THEME [ENV.2013.6.1-1]
[Climate-related ocean processes and combined impacts of multiple stressors on the marine environment]

Grant agreement for: Collaborative project*

Annex I - "Description of Work"

Project acronym: PREFACE

Project full title: " Enhancing prediction of tropical Atlantic climate and its impacts "

Grant agreement no: 603521

Version date:

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Part A

Workplan Tables

A1:
Project summary

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per project

General information

Project title [3]	Enhancing prediction of tropical Atlantic climate and its impacts		
Starting date [4]	01/11/2013		
Duration in months [5]	48		
Call (part) identifier [6]	FP7-ENV-2013-two-stage		
Activity code(s) most relevant to your topic [7]	ENV.2013.6.1-1: Climate-related ocean processes and combined impacts of multiple stressors on the marine environment		
Free keywords [8]	Climate prediction, Tropical Atlantic, Climate change, Marine ecosystems, Climate impacts, fisheries, Tropical Atlantic bias, Model systematic error, climate models, Tropical Climate		

Abstract [9]

Tropical Atlantic climate recently experienced pronounced shifts of great socio-economic importance. The oceanic changes were largest in the eastern boundary upwelling systems. African countries bordering the Atlantic strongly depend upon their ocean - societal development, fisheries, and tourism. They were strongly affected by these climatic changes and will face important adaptation challenges associated with global warming. Furthermore, these upwelling regions are also of great climatic importance, playing a key role in regulating global climate.

Paradoxically, the Tropical Atlantic is a region of key uncertainty in earth-climate system: state-of-the-art climate models exhibit large systematic error, climate change projections are highly uncertain, and it is largely unknown how climate change will impact marine ecosystems. PREFACE aims to address these interconnected issues, and has the following goals:

• To reduce uncertainties in our knowledge of the functioning of Tropical Atlantic climate.
• To improve climate prediction and the quantification of climate change impacts in the region.
• To improve understanding of the cumulative effects of the multiple stressors of climate variability, greenhouse induced climate change, and fisheries on marine ecosystems, and ecosystem services (e.g., fisheries, coastal vulnerability).
• To assess the socio-economic vulnerabilities and evaluate the resilience of Atlantic African fishing communities to climate-driven ecosystem shifts and global markets.

To meet these goals we bring together European and African expertise to combine regional and global scale modelling capabilities, field experiments and observation systems. Our target region includes areas more affected by climate change and by its consequences, European outermost regions, and African countries bordering the Atlantic.

A2:
List of Beneficiaries

Project Number [1]	603521	Project Acronym [2]	PREFACE

List of Beneficiaries

No	Name	Short name	Country	Project entry month[10]	Project exit month
1	UNIVERSITETET I BERGEN	UiB	Norway	1	48
2	KOBENHAVNS UNIVERSITET	UCPH	Denmark	1	48
3	CENTRE EUROPEEN DE RECHERCHE ET DE FORMATION AVANCEE EN CALCUL SCIENTIFIQUE	CERFACS	France	1	48
4	INSTITUT DE RECHERCHE POUR LE DEVELOPPEMENT	IRD	France	1	48
5	METEO-FRANCE	MF-CNRM	France	1	48
6	UNIVERSITE PIERRE ET MARIE CURIE - PARIS 6	UPMC	France	1	48
7	HELMHOLTZ ZENTRUM FUR OZEANFORSCHUNG KIEL	GEOMAR	Germany	1	48
8	INSTITUT FUER OSTSEEFORSCHUNG WARNEMUENDE AN DER UNIVERSITAET ROSTOCK	IOW	Germany	1	48
9	JOHANN HEINRICH VON THUENEN-INSTITUT, BUNDESFORSCHUNGSINSTITUT FUER LAENDLICHE RAEUME, WALD UND FISCHEREI	TI	Germany	1	48
10	CHRISTIAN-ALBRECHTS-UNIVERSITAET ZU KIEL	CAU	Germany	1	48
11	UNIVERSITA CA' FOSCARI VENEZIA	UNIVE	Italy	1	48
12	WAGENINGEN UNIVERSITY	WU	Netherlands	1	48
13	HAVFORSKNINGSINSTITUTTET	IMR	Norway	1	48
14	UNI RESEARCH AS	UniRes	Norway	1	48
15	FUNDACIO INSTITUT CATALA DE CIENCIES DEL CLIMA	IC3	Spain	1	48
16	UNIVERSIDAD COMPLUTENSE DE MADRID	UCM	Spain	1	48
17	THE UNIVERSITY OF READING	UREAD	United Kingdom	1	48
18	INSTITUTO NACIONAL DE INVESTIGACAO PESQUEIRA	INIP	Angola	1	48
19	MINISTRY OF FISHERIES AND MARINE RESOURCES	MFMR	Namibia	1	48
20	UNIVERSITY OF CAPE TOWN	UCT	South Africa	1	48

A2:
List of Beneficiaries

No	Name	Short name	Country	Project entry month[10]	Project exit month
21	INSTITUTO NACIONAL DE DESENVOLVIMENTO DAS PESCAS	INDP	Cape Verde	1	48
22	INSTITUT NATIONAL DE RECHERCHE HALIEUTIQUE	INRH	Morocco	1	48
23	INSTITUT SENEGALAIS DE RECHERCHES AGRICOLES	ISRA	Senegal	1	48
24	UNIVERSITE CHEIKH ANTA DIOP DE DAKAR	UCAD	Senegal	1	48
25	UNIVERSITE D'ABOMEY-CALAVI	UAC	Benin	1	48
26	CENTRE DE RECHERCHES OCEANOLOGIQUES	CRO	Cote d'Ivoire	1	48
27	UNIVERSITY OF NIGERIA	UNN	Nigeria	1	48
28	UNIVERSITE LIBRE DE BRUXELLES	ULB	Belgium	1	48

A3:
Budget Breakdown

Project Number [1]	603521	Project Acronym [2]	PREFACE

One Form per Project

Participant number in this project [11]	Participant short name	Fund. % [12]	Ind. costs [13]	Estimated eligible costs (whole duration of the project)					Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D	
1	UiB	75.0	T	1,239,340.80	0.00	291,907.20	242,830.40	1,774,078.40	1,464,243.00
2	UCPH	75.0	T	375,529.60	0.00	0.00	0.00	375,529.60	281,646.00
3	CERFACS	50.0	A	643,200.00	0.00	0.00	0.00	643,200.00	321,600.00
4	IRD	75.0	T	1,297,212.80	0.00	0.00	0.00	1,297,212.80	972,908.00
5	MF-CNRM	75.0	F	497,976.00	0.00	0.00	0.00	497,976.00	355,172.00
6	UPMC	75.0	T	751,161.47	0.00	3,200.00	0.00	754,361.47	479,590.00
7	GEOMAR	75.0	T	1,238,273.60	0.00	6,000.00	0.00	1,244,273.60	934,704.00
8	IOW	75.0	T	667,120.00	0.00	2,000.00	0.00	669,120.00	502,340.00
9	TI	75.0	T	470,574.40	0.00	0.00	0.00	470,574.40	352,930.00
10	CAU	75.0	T	521,840.00	0.00	1,000.00	0.00	522,840.00	392,380.00
11	UNIVE	75.0	T	377,187.20	0.00	0.00	0.00	377,187.20	282,890.00
12	WU	75.0	A	470,150.00	0.00	0.00	0.00	470,150.00	352,612.00
13	IMR	75.0	A	667,697.00	0.00	9,000.00	0.00	676,697.00	509,772.00
14	UniRes	75.0	T	369,681.60	0.00	0.00	0.00	369,681.60	277,260.00
15	IC3	75.0	S	355,426.00	0.00	0.00	0.00	355,426.00	266,569.00
16	UCM	75.0	T	540,832.00	0.00	3,000.00	0.00	543,832.00	408,624.00
17	UREAD	75.0	T	119,324.80	0.00	0.00	0.00	119,324.80	89,493.00
18	INIP	75.0	F	96,367.00	0.00	0.00	0.00	96,367.00	72,275.00
19	MFMR	75.0	F	96,367.00	0.00	0.00	0.00	96,367.00	72,275.00
20	UCT	75.0	T	220,800.00	0.00	0.00	0.00	220,800.00	165,600.00
21	INDP	75.0	T	96,367.00	0.00	0.00	0.00	96,367.00	72,275.00

A3:
Budget Breakdown

Participant number in this project [11]	Participant short name	Fund. %[12]	Ind. costs[13]	Estimated eligible costs (whole duration of the project)					Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D	
22	INRH	75.0	F	96,367.00	0.00	0.00	0.00	96,367.00	72,275.00
23	ISRA	75.0	T	78,667.00	0.00	0.00	0.00	78,667.00	59,000.00
24	UCAD	75.0	T	78,667.20	0.00	0.00	0.00	78,667.20	59,000.00
25	UAC	75.0	T	78,667.00	0.00	0.00	0.00	78,667.00	59,000.00
26	CRO	75.0	T	78,667.00	0.00	0.00	0.00	78,667.00	59,000.00
27	UNN	75.0	T	78,667.00	0.00	0.00	0.00	78,667.00	59,000.00
28	ULB	75.0	T	9,276.80	0.00	0.00	0.00	9,276.80	5,000.00
Total				11,611,407.27	0.00	316,107.20	242,830.40	12,170,344.87	8,999,433.00

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

*** The following funding schemes are distinguished**

Collaborative Project (if a distinction is made in the call please state which type of Collaborative project is referred to: (i) Small of medium-scale focused research project, (ii) Large-scale integrating project, (iii) Project targeted to special groups such as SMEs and other smaller actors), Network of Excellence, Coordination Action, Support Action.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project, and it cannot be changed. The project number **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

2. Project acronym

Use the project acronym as indicated in the submitted proposal. It cannot be changed, unless agreed during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry info force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a detailed justification on a separate note.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Activity code

Select the activity code from the drop-down menu.

8. Free keywords

Use the free keywords from your original proposal; changes and additions are possible.

9. Abstract

10. The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

11. The number allocated by the Consortium to the participant for this project.

12. Include the funding % for RTD/Innovation – either 50% or 75%

13. Indirect cost model

A: Actual Costs
S: Actual Costs Simplified Method
T: Transitional Flat rate
F :Flat Rate

Workplan Tables

Project number

603521

Project title

PREFACE—Enhancing prediction of tropical Atlantic climate and its impacts

Call (part) identifier

FP7-ENV-2013-two-stage

Funding scheme

Collaborative project

WT1
List of work packages

Project Number [1]	603521	Project Acronym [2]	PREFACE

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Type of activity [54]	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Management	MGT	1	24.00	1	48
WP 2	Dissemination	OTHER	1	18.00	1	48
WP 3	Heat and freshwater budgets, air-sea interaction	RTD	4	172.00	1	48
WP 4	Circulation and wave response	RTD	7	234.00	1	48
WP 5	Joint observations – model comparison	RTD	6	177.50	1	48
WP 6	Coupled basin-wide processes determining the climatology	RTD	5	159.00	1	48
WP 7	Relation between the background state (error) and variability	RTD	3	146.00	1	48
WP 8	Influence of remote systematic errors	RTD	16	86.00	1	48
WP 9	Tropical Atlantic variability on seasonal and longer time scales and its global impacts	RTD	16	128.00	1	48
WP 10	Statistical methods to assess and improve forecast of Tropical Atlantic variability	RTD	11	66.50	1	48
WP 11	Impact of model improvement and systematic error reduction on climate prediction and projection	RTD	15	85.50	19	48
WP 12	Environmental and anthropogenic pressures on pelagic ecosystems and fisheries	RTD	9	503.00	1	48
WP 13	Evaluating environmental and socio-economic effects of climate change on small scale fisheries	RTD	10	255.00	1	48
WP 14	Data and information management	RTD	1	10.50	1	48
			Total	2,065.00		

WT2:
List of Deliverables

Project Number [1]	603521	Project Acronym [2]	PREFACE

List of Deliverables - to be submitted for review to EC

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	Kick off meeting report	1	1	2.00	R	CO	3
D1.2	First general assembly report	1	1	2.00	R	CO	15
D1.3	Second general assembly report	1	1	2.00	R	CO	27
D1.4	Third general assembly report	1	1	2.00	R	CO	39
D2.1	Project website	2	1	1.00	D	PU	3
D2.2	First project fact sheet	2	1	1.00	R	PU	4
D2.3	Second project fact sheet	2	1	1.00	R	PU	18
D2.4	Summer school and workshop	2	1	2.00	D	PU	24
D2.5	Third project fact sheet	2	1	1.00	R	PU	36
D2.6	Final project meeting in Africa, with dissemination workshop	2	1	3.00	D	PU	48
D2.7	Final project fact sheet	2	1	1.00	R	PU	48
D2.8	PREFACE summary scientific article	2	1	4.00	R	PU	48
D2.9	Policy brief	2	1	4.00	R	PU	48
D3.1	Object-Seasonal heat and fresh water ML-balance	3	7	62.00	O	PU	18
D3.2	Report air-sea interaction	3	4	51.00	R	PU	36
D3.3	Report on near-inertial waves	3	2	16.00	R	PU	42
D3.4	Report on interannual ML-balance	3	7	43.00	R	PU	48

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.1	Velocity, temperature, salinity variability in the equatorial Atlantic	4	7	40.00	R	PU	12
D4.2	Eastern Atlantic interannual to decadal variability	4	20	81.00	R	PU	30
D4.3	Remote and local forcing of warm and cold events	4	7	73.00	R	PU	42
D4.4	Suggestion for a sustainable long term monitoring system	4	4	40.00	R	PU	48
D5.1	Processes on seasonal to interannual variability in forced ocean models	5	4	90.50	R	PU	24
D5.2	Strategies to improve forced models	5	6	87.00	R	PU	36
D6.1	Assessment of bias development in s2d integrations	6	5	30.00	R	PU	24
D6.2	Diagnostic experiments of model drift	6	14	64.00	R	PU	36
D6.3	Report on best practices for simulating TAV	6	12	65.00	R	PU	48
D7.1	Assessment on the representation of s2d TAV by current model configurations	7	3	67.00	R	PU	24
D7.2	Report on model improvements on the representation of s2d TAV	7	6	79.00	R	PU	36

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.1	Interdependence between biases in the Tropical Atlantic and in other regions	8	27	68.00	R	PU	24
D8.2	Atlantic influence on ENSO and the impact of bias	8	16	18.00	R	PU	36
D9.1	Mechanisms for seasonal to interannual TAV and impacts	9	16	107.00	R	PU	36
D9.2	Mechanisms for long-term TAV	9	3	21.00	R	PU	24
D10.1	Assessment of s2d forecast skill in the TA	10	1	22.50	R	PU	24
D10.2	Bayesian hierarchical model	10	11	32.00	R	PU	36
D10.3	Statistical methods and Bayesian methods	10	11	12.00	R	PU	48
D11.1	Impact of model improvements on climate prediction	11	15	58.50	R	PU	48
D11.2	Impact of model improvements climate projections	11	1	27.00	R	PU	48
D12.1	Retrospective bioclimatic analysis	12	9	93.00	R	PU	36
D12.2	Bioclimatic modeling	12	9	97.00	R	PP	42
D12.3	Report on macrozooplankton distributions	12	4	158.50	R	PP	42
D12.4	Climate variability and pelagic fish	12	13	154.50	R	PU	48
D13.1	Report on models	13	10	73.00	R	PU	30

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D13.2	Report of survey results	13	10	95.00	R	PU	42
D13.3	Report of impact analysis	13	10	87.00	R	PU	48
D14.1	Communication system	14	1	1.00	O	CO	1
D14.2	Data and information management implementation plan	14	1	1.00	R	PP	2
D14.3	EAF Nansen data service	14	13	4.50	O	RE	3
D14.4	PREFACE model and observational database	14	1	4.00	O	RE	6
			Total	2,049.00			

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP1	Type of activity [54]	MGT
Work package title	Management		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

The main objective of this Work Package (WP) is to ensure an effective, smooth and high-quality implementation of the project, with respect to general administrative and management practices and financial management.

Specific objectives:

1. To establish and maintain effective administrative, financial and contractual management to achieve the project objectives on time, to cost and at the highest quality level

2. To ensure that the project submits all results and deliverables in due time and good quality

3. To act on unforeseen events and make the necessary changes to the work plans

4. To ensure an efficient interaction with the European Commission (EC), facilitate the consultation with the External Scientific Advisory Panel (ESAP) and affiliated partners representing commissions of African coastal areas of the Atlantic

5. To maintain contact with partners and core theme leaders, and ensure effective communication among the internal boards and internal governance panels, and the PREFACE partners

6. Organisation of the general assembly meetings

Description of work and role of partners

Task 1.1 Management (UiB)

This task aims at ensuring the smooth running of the project, supervising the progress and completion of each partner's tasks, in order to achieve the project objectives on time, to cost, and in the most efficient way. The Coordinator, supported by the Project Office (PO), located at UiB, will be in regular contact with the Scientific Steering and Executive Board and Management Board.

Management involves the following:

• Establishing planning mechanisms for detailed management including the management of the scheduling and the resources allocation, reporting tools, and maintenance of action and decision lists.

• Establishment of optimal communication channels between the different project bodies (Management Board, MB; SC; governance panels), the partners and the external bodies (ESAP, EC, affiliate partners). Promotion of web-based interaction and regular teleconferences to facilitate the exchanges between partners, especially on the progress of results.

• Preparing and post-processing of EC reviews from the consortium-side including support in the implementation of recommendations from the EC and reviewers.

• Scheduling, organisation of general assemblies, and preparing follow up reports.

• Organisation of management meetings.

• Assist partners in hosting internal project meetings and workshops

• Preparation and application of the quality control and documentation plan.

• Management of consortium-level legal and ethical issues.

• Implementation of the plans under knowledge and innovation-related activities, intellectual property issues and the Gender Action Plan.

• Management of the budget kept to develop collaborations with the stakeholder group

• Deliver the periodic reports and final report of the project.

• Provide the partners, through the intranet section of the project web site, with all the required documentation. The PO will use a web portal with a private section that will be used for internal project communication and document exchange and include a wiki for quick and efficient interaction.

Task 1.2 Reporting and interfacing with the EC (UiB)

Timely and good quality reports on the scientific and financial progress of the project and interfacing with the EC will be the responsibility of the Coordinator. The Coordinator will be the single contact point for the EC and for strategic issues outside the project. This task will ensure the appropriate follow-up of specific obligations deriving from the EC contract, in terms of reporting (financial and scientific results), communication and general management procedures. He will inform the EC of project achievements and any deviations from the agreed plans. In case of major difficulty, he will undertake a dialogue with the EC in order to find appropriate solutions.

Task 1.3 Managing external cooperation (UiB):

To make best use of project funds,

1. explore cooperation with other funded (national and international) projects working in the same geographic area, in relation to observational and modelling activites, and the organisation of summer schools and workshops. Relevant EU projects DACCIWA and HELIX.

2. develop and maintain links to groups with complementary/overlapping scientific interest/issues, these include for example the international AMMA program

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	24.00
	Total	24.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	Kick off meeting report	1	2.00	R	CO	3
D1.2	First general assembly report	1	2.00	R	CO	15
D1.3	Second general assembly report	1	2.00	R	CO	27
D1.4	Third general assembly report	1	2.00	R	CO	39
		Total	8.00			

WT3:
Work package description

Description of deliverables

D1.1) Kick off meeting report: Report on the kick off meeting, including an exectutive summary, the program, and an action list. The summary and program, including links to the presentation, will be made public on the project website. [month 3]

D1.2) First general assembly report: Report on the first general assembly, including an exectutive summary, the program, and an action list. The summary and program, including links to the presentation, will be made public on the project website. [month 15]

D1.3) Second general assembly report: Report on the second general assembly, including an exectutive summary, the program, and an action list. The summary and program, including links to the presentation, will be made public on the project website. [month 27]

D1.4) Third general assembly report: Report on the third general assembly, including an exectutive summary, the program, and an action list. The summary and program, including links to the presentation, will be made public on the project website. [month 39]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS1	Consortium agreement	1	1	Consortium agreement signed
MS2	Meeting on FP7 cooperation	1	3	Conference call to determine the level of cooperation between PREFACE and other projects funded to work in the region.

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP2	Type of activity [54]	OTHER
Work package title	Dissemination		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

This WP undertakes to ensure high-level dissemination of project results at a European and African level, and to the wider international community and to policy makers and stakeholders.

Specific objectives

1. To prepare and diseminate material for a various audiencs, including wider scientific community, stakeholders, and policy makers.

2. To organise a workshop and the final project conference to be hosted by one of the African partners, including a session directed at policy makers

Description of work and role of partners

While UiB will oversee the workpackage activities, all PREFACE partners will contribute actively to dissemination.

Specific tasks:

• Prepare informational factsheet at the start of the project as well as at each reporting period, including at the end of the project (UiB, all)

• Distribute fact sheets to stakeholders (HEIs, authorities, climate service providers, and policy sectors, funding agencies, other public bodies) in order to inform them about project results (UiB)

• Create the project website, and keep it up to date (UiB, all).

• Inform the broader scientific community of the project results through a longer article to Bulletin of the American Meteorological Society, or a similar journal. (UiB, all).

• Provide a set of reusable illustrations (300 dpi) for dissemination through the website, public lectures, and updating teaching material (all). Encourage the sharing of teaching material among PREFACE partners (UiB).

• Actively update Wikipedia pages relevant to PREFACE (UiB, all)

• Early in the project, organise in association with AWA (in the CCLME and GCLME) as well as the Nansen Tutu center and the BMBF SPACES program (in the BCLME) a joint meeting in Africa gathering interdisciplinary ocean and climate scientists (UiB, all)

• Organize at least one summer school to which African PhD students can join. The first summer school will be linked to the AWA, Nansen Tutu center, SPACES meeting and is planned for February 2015. The Norwegian Research School in climate dynamics (RESCLIM, http://www.resclim.no/), who organise yearly indisciplinary summer schools, will be involved, financially support, and help organise the summer school. We will also contact with the organisers of the Bergen Research Summer School (BRSS, UiB) to investigate whether they can organize and fund a second workshop in 2017 on a topic related to PREFACE. BSSR support research-based education for global development challenges. They organising summer schools each year and financially support participants from developing countries.

• Organise the final project meeting to be hosted by one of the African partners. The meeting will include a special session targeting policy makers and stakeholders from the region (UiB, all)

• Prepare policy briefs on the management of the marine environment, and potentially also on the development of climate prediction capability for the region.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	18.00
	Total	18.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.1	Project website	1	1.00	D	PU	3
D2.2	First project fact sheet	1	1.00	R	PU	4
D2.3	Second project fact sheet	1	1.00	R	PU	18
D2.4	Summer school and workshop	1	2.00	D	PU	24
D2.5	Third project fact sheet	1	1.00	R	PU	36
D2.6	Final project meeting in Africa, with dissemination workshop	1	3.00	D	PU	48
D2.7	Final project fact sheet	1	1.00	R	PU	48
D2.8	PREFACE summary scientific article	1	4.00	R	PU	48
D2.9	Policy brief	1	4.00	R	PU	48
		Total	18.00			

Description of deliverables

D2.1) Project website: A website for the PREFACE project for dissemination and to facilitate internal communication [month 3]

D2.2) First project fact sheet: Fact sheet introducing PREFACE to be distributed to stake holders, colleagues, and other interested partners, particularly in Africa and Europe [month 4]

D2.3) Second project fact sheet: Fact sheet to provide updated information on PREFACE to distribute to stake holders, colleagues, and other interested partners, particularly in Africa and Europe [month 18]

D2.4) Summer school and workshop: A summer school and workshop in Africa organised jointly with AWA, SPACES, RESCLIM and potentially also other EU project working in the region [month 24]

D2.5) Third project fact sheet: Fact sheet to provide updated information on PREFACE to distribute to stake holders, colleagues, and other interested partners, particularly in Africa and Europe [month 36]

D2.6) Final project meeting in Africa, with dissemination workshop: Organise the final project meeting to be hosted by an African partner, including a session directed at policy makers and stake holders in the region including specifically the outcome of WP13 [month 48]

D2.7) Final project fact sheet: Fact sheet to provide sumarry of PREFACE findings to distribute to stake holders, colleagues, and other interested partners, particularly in Africa and Europe [month 48]

D2.8) PREFACE summary scientific article: Longer article summarising key project findings to the broader scientific community [month 48]

D2.9) Policy brief: Prepare and distribute a policy brief on management of the marine environment in the Tropical Atlantic region [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS3	Decision on second summer school	1	18	Contact Bergen Research Summer School about potentially organising a second summer school in 2017 on a PREFACE related theme

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP3	Type of activity [54]	RTD
Work package title	Heat and freshwater budgets, air-sea interaction		
Start month	1		
End month	48		
Lead beneficiary number [55]	4		

Objectives

Main Objective:

WP 3 focuses on improving the understanding of the physical processes controlling the mixed layer heat and freshwater balances in the eastern boundary upwelling regions and in the Gulf of Guinea. Heat and freshwater budgets in coastal upwelling regions and surrounding areas will be estimated, as they are important to validate high-resolution ocean and coupled models.

Specific Objectives:

1. To determine seasonal and interannual variability of the mixed layer heat and fresh water budgets by quantifying air-sea fluxes and diapycnal, isopycnal and advective heat and freshwater fluxes in the eastern boundary upwelling systems and the Gulf of Guinea

2. To investigate local air-sea interaction and ocean feed-backs in frontal regions and the impact of short period wind fluctuations on Bjerknes and wind-evaporation-SST feedbacks controlling interannual and longer time scales

3. To analyze the impact of near-inertial oscillations on mixed layer depth and their contributions to the mixed layer heat budget

Description of work and role of partners

Mixed layer heat and freshwater balances within the eastern boundary upwelling systems and surrounding areas are key quantities for the validation of high-resolution ocean models and finally the development of improved simulations of coupled climate models (e.g. Hummels et al., 2013). In the tropical Atlantic, very shallow mixed layers are prominent features, particularly within the eastern boundary upwelling regions (Schafstall et al., 2011) and the Gulf of Guinea (Wade et al., 2011). In those regions, even moderate mixed layer heat and freshwater fluxes may significantly impact sea surface temperature and salinity (Rhein et al., 2010). Seasonal and interannual variability of heat and freshwater budgets will be derived from existing and new observations.

Task 3.1: Determine seasonal and interannual variability of heat and freshwater budgets in the upwelling regions of Benguela, Northwest Africa as well as in the Gulf of Guinea [IRD, MF-CNRM, UPMC, GEOMAR, IOW, IMR, INIP, UCAD, UAC, CRO]

Within the northeastern boundary upwelling system, seasonal and interannual variability of the heat and freshwater budgets will be quantified using data from numerous existing ship surveys (e.g. German SOPRAN and SFB754 programs) that include microstructure data for determining diapycnal fluxes, from floats, Gliders (PREFACE, AWA and SFB754 program), drifters, river run-offs and satellite data and climatologies [IRD, UPMC, GEOMAR]. Additionally, the role of vertical velocity will be analyzed from moorings deployed of Senegal [UPMC, UCAD]. Seasonal and interannual heat and freshwater budgets for the Gulf of Guinea will be determined from observations and modeling [IRD, MF-CNRM, GEOMAR, UAC, CRO]; observations include PIRATA buoys with an additional buoy at 6°S, 8°E, glider deployments, Argo floats (with increased vertical resolution in the upper 50 m), PIRATA and EGEE cruises that also included microstructure measurements, as well as ships of opportunity. Data from essentially the same observations will be used to analyze variability of barrier layers, the extent and variability of river plumes and variability of precipitation [IRD, UAC]. Efforts will also focus be on determining the

role of salinity in controlling diapycnal mixing and air-sea fluxes in the Gulf of Guinea [IRD, GEOMAR, UAC]. For the southeastern boundary upwelling system, variability of heat and freshwater budgets will be determined from hydrograhic and microstructure data collected during cruises carried out in the framework of the German national projects DECBU, GENUS and BENEFIT projects and by data sets collected within Angolan and Namibian projects as well as data from Norwegian cruises collected within the Nansen program [IOW, IMR, INIP]. The seasonal heat and freshwater balances will be derived in close cooperation with modeling studies performed in WP5 and will be delivered to WP5 and to CT3, WP6 and WP7 (D3.1). Once seasonal heat budgets in the individual regions are established, differences in the interannual variability in the northeastern upwelling system, the Gulf of Guinea and the southeastern upwelling system will be analyzed [IRD, MF-CNRM, UPMC, GEOMAR, IOW, IMR, INIP, UCAD, UAC, CRO].

Task 3.2: Advance understanding of local air-sea interaction and ocean feedback mechanisms in frontal regions and their impact on SST [IRD, UPMC, INIP, UCAD].

Local air-sea interaction is of particular importance for a better understanding of the role of short period wind-fluctuations for the evolution of the ocean mixed layer and their corresponding effect on precipitation, including processes like diapycnal mixing and near-inertial waves. Amplification of ocean feedback mechanisms in frontal regions like the Angola-Benguela front need to be better understood and the impact on SST needs to be quantified. Additionally, local intraseasonal variability, in particular of wind, may contribute or even trigger variability of the major climate modes associated with the large-scale feedback mechanisms controlling interannual and longer time scales. Tasks associated with local air-sea interaction include investigating the role of SST fronts and their variability and feedback mechanisms [IRD, UPMC, UCAD] and studying the Bi-weekly and intraseasonal coupled oscillations in the Gulf of Guinea and Benguela frontal zone [IRD, INIP]. An important task will also focus on determining the link between local processes and tropical Atlantic climate modes [IRD, UPMC]. The results from the observational studies will be compared to the results from the modelling studies performed in CT3, WP7.

Task 3.3: Determine strength of near-inertial waves and near-inertial energy flux in the mixed layer of the tropical Atlantic [UCPH, IRD, GEOMAR].

Inertial waves strongly contribute to shaping mixed layer depth distribution and thus SST in the ocean. Currently, this process is poorly simulated in climate models (Jochum et al., 2013). Near-inertial variability in the mixed layer, their energy flux into the deeper water and their impact on the mixed layer depth distribution will be investigated using velocity records from mooring and concurrently observed winds from the PIRATA network and the associated subsurface moorings [UCPH, IRD, GEOMAR].

Table of PREFACE observations

Existing observations:
- data from numerous ship surveys to the eastern boundary upwelling systems and the Gulf of Guinea that include hydrographic observations, turbulence profiles and shipboard velocity observations.
- PIRATA buoy array including subsurface temperature and salinity records.
- subsurface velocity records from the PIRATA locations (10°W-Eq, 23°W-Eq) and from 8°N and 5°N, 23°W (SFB754 moorings) as well as from 23°S at Walvis Bay (GENUS mooring).
- hydrographic and turbulence data from Glider observations within the Gulf of Guinea and the northeastern upwelling region of the tropical Atlantic.
- drifter, SST, mixed-layer depth and ocean-atmosphere flux climatologies.
- satellite SST, Argo float, sea surface height and wind stress observations.

New observations:
- PREFACE PIRATA buoy at 8°E, 6°S needed for mixed layer heat and freshwater budget analysis in the region of large SST bias of coupled climate models.
- Possible additional mixed-layer temperature, conductivity and velocity sensors along PIRATA buoy lines.
- ARGO floats with enhanced vertical resolution in the mixed layer provided by CORIOLIS, at no additional cost to PREFACE.
- Glider observations with attached turbulence sensors (2014, 2015 and 2016).
- PREFACE cruises in 2014, 2015 and 2016.

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
2	UCPH	6.00
4	IRD	27.00
5	MF-CNRM	5.00
6	UPMC	5.00
7	GEOMAR	18.00
8	IOW	3.00
13	IMR	2.00
18	INIP	40.00
24	UCAD	6.00
25	UAC	44.00
26	CRO	16.00
	Total	172.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D3.1	Object-Seasonal heat and fresh water ML-balance	7	62.00	O	PU	18
D3.2	Report air-sea interaction	4	51.00	R	PU	36
D3.3	Report on near-inertial waves	2	16.00	R	PU	42
D3.4	Report on interannual ML-balance	7	43.00	R	PU	48
		Total	172.00			

Description of deliverables

D3.1) Object-Seasonal heat and fresh water ML-balance: Dataset of the seasonal heat and fresh water mixed-layer fluxes (monthly-means) contributing to the mixed layer balances in the eastern boundary upwelling regions off northwestern and southwestern Africa and in the Gulf of Guinea. [month 18]

D3.2) Report air-sea interaction: Summary of observational data related studies of local air-sea feedback mechanisms in the eastern boundary upwelling regions and the Gulf of Guinea and their impact on interannual climate variability in the tropical Atlantic. [month 36]

D3.3) Report on near-inertial waves: Summary of the observational studies on the impact of near-inertial waves on shaping mixed layer depth and on energy fluxes at the air –sea interface as well as the fluxes from the mixed layer to the deeper ocean. [month 42]

D3.4) Report on interannual ML-balance: The report will summarise the results on interannual variability of the seasonal mixed layer heat and fresh-water balances in the eastern boundary upwelling regions and the Gulf of Guinea including the evolution of the dominant individual heat and salt fluxes controlling the respective budget. [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS4	PREFACE PIRATA buoy installation	4	12	The PREFACE PIRATA buoy measuring meteorological and oceanographic parameters will be installed at 6°S, 8°E. Real-time data availability will be set up through PIRATA web interfaces.
MS5	1st year-Glider/Turbulence measurements along southeastern boundary	7	12	Hydrographic and microstructure measurements will have been performed of southwest Africa to fill data gaps for seasonal mixed layer heat and freshwater flux estimates.
MS6	2nd year maintenance of the PREFACE PIRATA buoy	4	24	The PREFACE PIRATA buoy will be recovered and redeployed. High resolution data from the meteorological and oceanographic sensors from the 1st year will be available through PIRATA web interface.
MS7	2nd year-Glider/Turbulence measurements along southeastern boundary	7	24	2nd year hydrographic and microstructure measurements will have been performed of southwest Africa to contribute to estimates of interannual variability of mixed layer heat and freshwater fluxes.
MS8	3rd year maintenance of the PREFACE PIRATA buoy	4	36	The PREFACE PIRATA buoy will be recovered and redeployed. High resolution data from the 2nd year will be available through PIRATA web interface.
MS9	3rd year-Glider/Turbulence measurements along southeastern boundary	7	36	3rd year hydrographic and microstructure measurements will have been performed

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
				of southwest Africa to contribute to estimates of interannual variability of mixed layer heat and freshwater fluxes.

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP4	Type of activity [54]	RTD
Work package title	Circulation and wave response		
Start month	1		
End month	48		
Lead beneficiary number [55]	7		

Objectives

The main objective of WP4 is to improve our understanding of the role of local and remote forcings such as circulation variability or wave propagation along the equatorial and coastal wave-guide in setting mean SST pattern and in driving SST variability in eastern boundary coastal upwelling regions of both hemispheres. This WP is based mainly on observations performed partly together with WP3 and build on interaction with the synthesis WP5 that mainly focus on ocean modeling.

Specific Objectives:

1. Extend the existing observational network by installing new time series stations to allow evaluation of changes in the advection of anomalous water masses and wave propagation along the equatorial and coastal wave guides.

2. Using historical and new observational data to characterize the local circulation system near the coastal upwelling regions including the Gabon and Angola Currents, the upwelling undercurrents, and the Angola Dome.

3. Identify and understand differences in the connection of coastal upwelling systems of both hemispheres with the equatorial region.

4. Understand the generation and evolution of warm and cold events in the coastal upwelling regions of both hemispheres.

Description of work and role of partners

SST variability in the eastern equatorial Atlantic is forced by different processes. Interannual or year-to-year variations are associated with air-sea interactions (including the positive Bjerknes feedback) similar to processes resulting in the El Nino phenomenon of the equatorial Pacific (the so-called Atlantic Nino), by advection and wave dynamics as well as by internal variability associated with stochastic processes due to variations in the intensity of tropical instability waves or basin-mode oscillations associated with the generation of equatorial deep jets. The equatorial variability was found to be strongly related to the generation of Benguela Ninos, warm oceanic events in the southeastern tropical and subtropical Atlantic (Rouault 2012). However, local forcing of SST variability in the coastal upwelling regimes of both hemispheres might be as important. In the southern hemisphere south of about 13°S, coastal upwelling is strongly related to variations in along-shore winds, north of it upwelling also occurs during periods of calm winds possibly induced by coastal Kelvin wave propagation. Within WP4, we will concentrate on the connectivity between the equatorial and coastal regions to identify the role of remote versus local processes in forcing mean pattern and variability of key parameters such as SST, thermocline depths and subsurface current.

Task 4.1 Monitoring equatorial Atlantic variability [GEOMAR, IRD, UCT]

Advection of anomalous water masses as well as wave propagation along the equatorial wave guide will be analyzed using the existing PIRATA buoy array with buoys deployed at the equator 35°W, 23°W, 10°W, and 0°. Subsurface moorings with upper ocean velocity measurements are installed at 23°W and 10°W in the frame of the PIRATA [IRD] and SFB754 [GEOMAR] programs (Brandt et al. 2011, 2012). This observational program will be extended within PREFACE by an additional current meter mooring at 0°. Velocity time series and

temperature and salinity records from equatorial (and near-equatorial) moorings and buoys will be analyzed and corresponding time-series of integrated parameters like transport and heat content variations will be provided to other WPs of CT2 and other CTs for model validation and analysis of climate variability [GEOMAR, IRD]. The analysis of the equatorial dataset will particularly include the role of intraseasonal waves propagating along the equator. Intraseasonal Kelvin waves are known to affect the onset and mature phase of the Atlantic cold tongue and might have similar effects on the eastern boundary upwelling systems. The Gulf of Guinea is of particularly interest, as it might be most directly affected by equatorial processes. The maintenance of the PIRATA array will allow acquiring additional shipboard measurements within this region [GEOMAR, IRD]. At the project conclusion, a design for a sustainable long-term equatorial monitoring system will be recommended [GEOMAR, IRD, UCT]. The results of this task will be used in WP5 for model validation and analysis of simulated equatorial variability; results from zonal velocity observations regarding equatorial basin modes will feed into WP9.

Task 4.2 Monitoring variability along the southern hemisphere coastal wave guide [All partners]

This task focuses on the coastal upwelling region of the southern hemisphere and encompasses a region of particular strong climate variability and at the same time strongest SST bias in coupled climate models. An extensive dataset that will be analyzed within PREFACE are CTD and shipboard velocity data acquired in the entire coastal ocean off West Africa by the Norwegian R/V Nansen. This dataset is complemented by regional database of the partner countries such as the Southern African Data Centre for Oceanography (SADCO) that stores marine information from the areas around southern Africa. The entire region has received frequent coverage in the past and it will be the principal region of the ongoing survey work of R/V Nansen [IMR, INIP, MFMR, UCAD, UCT]. Oceanographic data collection by R/V Nansen is supplementary to the fisheries monitoring, but the station grid is quite dense. Some hydrographic data go as far back as to 1984. After 1994 there is typically about 1200-1500 CTD stations occupied per year. In the context of oceanographic process studies and/or model validation the most interesting period starts perhaps in 2005, after the ship was fitted with a robust underway instrumentation and commenced continuous recording of currents and surface salinity across the shelf. The analysis of this dataset will be performed to identify interannual to decadal variability in the circulation near the continental slope and in water mass characteristics. Obtained time series will be provided for model validation [IMR, INIP, MFMR, UCT].

Within the German BMBF SACUS SPACES project a current meter mooring array at the eastern boundary at 11°S was proposed for the observation of the southward flowing Angola current. The array consisting of three current meter moorings and a single mooring with hydrographic sensors will be deployed for the first time in July 2013 during a cruise with the German R/V Meteor [GEOMAR]. This mooring array is located near the Lobito oceanographic station (12° 22’S, 13° 32’E) that has been operated almost continuously since 1969. The depth at Lobito station is 40 m, and daily (5 times a week) observations of temperature and salinity at 4 standard depths are available. Additional parameters, as oxygen concentration, PH and nutrients are occasionally obtained. These observations will be continued and used to study seasonal, year-to-year and long-term variations on the shelf off Angola [INIP, UCT, UiB].
Since 2003 an oceanographic mooring on the central Namibian shelf off Walvis Bay (23°S) was operated to obtain long-term hydrographic data (Monteiro et al., 2006; Mohrholz et al., 2008) [IOW, MFMR]. Additionally, a series of ship expeditions, conducted in the frame of different projects, will provide a large set of hydrographic data of the Benguela system. The mooring work on the continental shelf off Namibia at 23°S together with an additional mooring at 18°S will be performed in the frame of BMBF SACUS SPACES. As we expect a transformation of the coastal trapped waves during its southward propagation in the different upwelling cells associated with significant water mass transformation, PREFACE will enhance the existing observational network by the establishment of a new oceanographic mooring near 20°S. This mooring that is located south of the Kunene upwelling cell will allows the observation of changes in the signal propagation from the near-equatorial region toward the coastal upwelling region off the coast of Namibia. Additionally, the mooring will deliver important information for the identification of the role of local versus remote forcing of the poleward undercurrent [IOW]. It would also be location for observing a Benguela Niño event, if it were to occur during the project (Appendix 1). Additional shipboard observations of the boundary current regime with meridional sections at different latitudes will be part of PREFACE as well [GEOMAR, IOW].

The common analysis of boundary current moorings and shipboard observations will be used to identify signal propagation along the coastal wave-guide and the interaction of the eastern boundary current regime and the Angola Dome. The goal will be a better understanding of factors determining the generation of cold and warm events (Benguela Ninos) along the southwestern African coast [GEOMAR, IMR, INIP, IOW, MFMR, UCT]. The results regarding observed variability in the Benguela upwelling region on seasonal and longer time scales will

be used for comparison with forced ocean simulations (WP5), coupled climate simulation (WP7) and for the interpretation of tropical Atlantic variability (WP9).

Task 4.3 Connectivity between equatorial and coastal variability, local versus remote forcing [All partners]

Additionally to data discussed in tasks 4.1 and 4.2, data from the northern hemisphere will be analyzed here. Among the datasets to be used are R/V Nansen data from the northern hemisphere particularly from coastal regions of Senegal [IMR, UCAD] as well as shipboard and glider data acquired in the coastal upwelling region off Mauritania in the frame of the German SFB754 [GEOMAR]. A trilateral project focussing on the northern hemisphere eastern boundary upwelling system that was recently funded by German and French research ministries, AWA, includes moored, and glider observations in the region between Cape Verde and Senegal. This project represents already cooperation between different project partners also involved in PREFACE [GEOMAR, IRD, UCAD]. The data acquired in the northern hemisphere will be analyzed in comparison to the acquired dataset from the southern hemisphere and by using equatorial time series as well as data from satellite remote sensing of wind stress, sea level anomaly, sea surface temperature and salinity to identify and understand differences in the connectivity of the coastal upwelling systems of both hemispheres with the equatorial region and the relative importance of local forcing [all partners]. Recent studies suggest differences between wind-driven upwelling regimes in higher latitudes and low-latitude regimes with active upwelling also under calm wind conditions. Using available data we will identify the respective role and regional differences of remote and local forcing for generating local SST variability in coastal upwelling regions [all partners]. This task that includes also updates of observed equatorial and coastal time series will be performed in close collaboration with WP5 and additionally contribute to WP7 and WP9.

Table of PREFACE observations

Existing observations:
- PIRATA buoy array with subsurface temperature and salinity observations
- Subsurface equatorial current meter moorings at 23°W and 10°W (PIRATA, SFB754)
- Boundary current mooring array at 11°S (SACUS)
- Oceanographic mooring on the continental shelf off Namibia at 18°S and 23°S (SACUS)
- Glider and moored observations of Senegal (AWA)

New PREFACE observations:
- Subsurface equatorial current meter mooring at 0°
- Oceanographic mooring on the Namibian shelf at 20°S
- Shipboard and glider observations in the eastern boundary current system including meridional sections at different latitudes in 2014, 2015, and 2016 (in cooperation with WP3)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	6.00
4	IRD	2.00
7	GEOMAR	12.00
8	IOW	26.00
13	IMR	15.00
18	INIP	40.00
19	MFMR	59.00
20	UCT	68.00
24	UCAD	6.00
	Total	234.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.1	Velocity, temperature, salinity variability in the equatorial Atlantic	7	40.00	R	PU	12
D4.2	Eastern Atlantic interannual to decadal variability	20	81.00	R	PU	30
D4.3	Remote and local forcing of warm and cold events	7	73.00	R	PU	42
D4.4	Suggestion for a sustainable long term monitoring system	4	40.00	R	PU	48
		Total	234.00			

Description of deliverables

D4.1) Velocity, temperature, salinity variability in the equatorial Atlantic: Analysis of available moored observations from equatorial subsurface and PIRATA moorings including data from 23°W, 10°W, and 0°E acquired within different programs before PREFACE: Report on velocity, temperature, and salinity variability in the equatorial Atlantic [month 12]

D4.2) Eastern Atlantic interannual to decadal variability: Analysis of historical in-situ (mainly temperature and salinity) and remote sensing data (sea surface temperature, sea level anomaly, Chl-a) with regard to the Eastern Atlantic interannual to decadal variability: Report on the interannual to decadal variability in the eastern Atlantic and Benguela Nino [month 30]

D4.3) Remote and local forcing of warm and cold events: Statistical analysis including lead-lag correlations, EOFs and POPs to identify remote and local forcing mechanisms of warm and cold events in the coastal upwelling regions of the eastern tropical Atlantic: Report on the remote and local forcing of warm and cold events in the coastal upwelling regions and on interhemispheric differences in the generation of such events [month 42]

D4.4) Suggestion for a sustainable long term monitoring system: Based on the analysis of data from the tropical observing system with regard to interannual to decadal variability and anomalous climate events, a design for a sustainable long-term monitoring system will be recommended: Report on requirements for a sustainable long term monitoring system [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS10	Mooring_1 0N 0E	4	12	Install equatorial subsurface mooring at 0E, report
MS11	Mooring 20S Shelf	8	12	Install mooring on the shelf at 20S, report
MS12	Cruise 2014	7	12	Perform first PREFACE southeastern boundary current cruise 2014, report

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS13	Mooring_2 0N 0E	4	24	Redeploy equatorial subsurface mooring at 0E, report
MS14	Cruise 2015	7	24	Perform second PREFACE southeastern boundary current cruise 2015, report
MS15	Mooring_3 0N 0E	4	36	Redeploy equatorial subsurface mooring at 0°, report
MS16	Cruise 2016	7	36	Perform third PREFACE southeastern boundary current cruise 2016, report

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP5	Type of activity [54]	RTD
Work package title	Joint observations – model comparison		
Start month	1		
End month	48		
Lead beneficiary number [55]	6		

Objectives

WP5 aims to evaluate to what degree forced medium to very-high-resolution ocean models are able to reproduce observed mean state and variability in the eastern tropical Atlantic Ocean, to identify causes of failure and ways of improvement and to produce control experiments to help interpret observations. Main ocean properties targeted are heat and freshwater budgets, velocity or transport time series, signal propagation along the equatorial and coastal waveguide and horizontal and vertical gradients within the upper ocean.

Specific Objectives:

1. Produce and validate an ensemble of reference forced simulations from various models and configurations, from regional, to basin scale and global.

2. Carry out model process studies aimed at isolating the effect of specific internal or external forcing, to quantify the role of specific processes on observed variability.

3. Conduct numerical experiments to test the sensitivity to model configurations, and to propose OGCM improvements to better simulate tropical Atlantic variability.

Description of work and role of partners

Forced global OGCM present qualitatively similar SST bias as global CGCM in the eastern tropical Atlantic, albeit with smaller amplitudes. Regional OGCM may share the same flaws, but since they generally are not studied with the same large scale climate perspective, synthetic results are missing. CT2 offers the opportunity to realize a common set of comparisons to the observation-derived quantities, to conduct a coordinated effort towards understanding and reducing the errors. Our working hypothesis is that high resolution regional simulations are more accurate, and enable us to identify processes missing or poorly represented in lower resolution global OGCMs used in climate models. Also regional models are adequate tools to design process studies that can help interpret observations. We will analyze a range of existing and planned simulations, from tropical-subtropical Atlantic simulations at medium (1/4°) resolution [UPMC, IRD, UAC] to very-high-resolution (less than 10 km) regional simulations focusing on the equatorial and Benguela upwelling system [UCT, IOW, GEOMAR, UCPH, IRD], the northern Gulf of Guinea [IRD, UAC, CRO] and the Senegal-Mauritania upwelling system [UPMC,UCAD]. The set of reference observations for validation will come from historical and new data collected in WP 3 and 4. Results from sensitivity experiments will help to propose improvements for OGCM that will be of benefit to climate models used in WP6 and population dynamics models used in 12. The proposed numerical experiments are listed in Appendix 4.

Task 5.1. Validated ocean simulations [all participants]

Set up an ensemble of benchmark validated ocean simulations, existing and new, and validate them against historical and new observations collected in WP3 and 4, based on selected ocean indices (a thread running through out the project).
Groups in PREFACE using modelling to study the tropical eastern Atlantic have already performed or obtained simulations of the climatological state and of past time periods. These existing runs have been partially validated against some observations, but largely on a non-coordinated basis. Furthermore many datasets were naturally not known or accessible to all groups.

As a first contribution, we will share analyses in order to complete the most extensive and comparative validation process of existing runs based in particular on the historical data collection carried out in WP 3 and 4. Based on this step, groups will propose a first list of strengths and deficiencies, specific to the model and configuration used. The most common and significant flaws emerging from this inter-comparison will form the target list of ocean indices for the groups, when carrying on sensitivity experiments aimed at understanding and reducing the main errors.

The second contribution of Task 5.1 is to provide new and improved simulations that include the most recent period, in order to take full advantage of the new dataset obtained in PREFACE. The key signals observed or derived from observations in WP3 and 4 will then benefit from specific attention during this phase. In particular, these simulations will be compared to observations from the new PIRATA mooring at 6S-8E planned in WP3, and will permit mixed layer heat/freshwater budget (Peter et al, 2006; Jouanno et al, 2011; Da-Allada et al, 2013) to quantify main processes at this location. As for the first phase we will ensure exchanges among the groups on their finding on model skills relative to these reference signals, and on hypotheses to increase them.

A third contribution to Task 5.1 is the compilation and distribution of a realistic reference atmosphere data set. Simulations with these forcing data may serve for direct model validation with field data from cruises. Numerical experiments of participating groups with these forcing data are starting point and reference for the work as described in Task 5.3.

Task 5.2. Process studies [GEOMAR, IRD, UAC, CRO, IOW, UPMC]

Carry out model process studies aimed at interpreting observation-derived analyses.
In a complex physical system, the number of controlling processes is large and they may all act at the same place and time. Simplified process studies , control experiments, are required to disentangle processes. This modeling strategy is useful to interpret observations and able to unveil mechanisms or contributions that were hidden to the observer of the full complex system.

This strategy is well adapted to regional models when a preliminary validated realistic simulation is used as a reference. In perturbed experiments, either equatorial or coastal waves [UPMC, UCAD], part of wind forcing [IOW, IRD, UAC] or runoff forcing [IRD, UAC] can be turned off. These experiments can isolate the effect of remotely forced equatorial and coastal waves on upwelling (Rouault et al, 2007), the role of different wind patterns and variations on air-sea interactions (Fennel et al, 2012), the contribution of runoff to freshwater budget. They will be useful tools to fulfill objectives of WP 3 and 4 [GEOMAR, IRD, UAC, CRO, IOW, UPMC].

Task 5.3. Sensitivity experiments [IOW, UCPH, UPMC, UCT, IRD]

Conduct coordinated numerical experiments to test the sensitivity to model configurations, including boundary forcing, parameterizations and grid specifications, to propose modifications for low-resolution ocean model in global CGCM that could lead to improvements of tropical Atlantic variability simulations.

This task focus on the realization of numerical experiments aimed at identifying the most effective configuration modifications for reducing SST biases and other model flaws identified in Task 5.1. All OGCM display a significant sensitivity to each of the following elements of configuration, and it will be studied in the first part of this task:

- horizontal and vertical grid resolution, type of vertical coordinate [UPMC, UCT, IRD]
- atmospheric forcing spatio-temporal resolution, and in particular for the coastal wind stress structure (Fennel et al, 2012), diurnal cycle [IOW, IRD] and near-inertial waves representation (Jochum et al, 2013) [UCPH].
- role of frontal submesoscale (~1 km) turbulence. The influence of near-surface horizontal scale processes has not been properly quantified in realistic situations. Doing so will improve parameterizations in the medium or low resolution ocean models. [UPMC]
- sub-grid scale processes parameterizations, in particular diapycnal mixing and near-inertial wave [UPMC]. Particular attention will be paid to the detrimental effects of spurious diapycnal mixing associated with advection schemes.

In regions where models and observations diverge, process studies described in Task 5.2 will help identify sources of biases.

Once a common list of best practice for tropical eastern Atlantic upwelling systems is defined and tested in the regional models, the last step will consist in deriving recommendations for large scale OGCM used in climate models.

This WP contributes to the following common deliverables:

D9.1: Report on the mechanisms for seasonal to interannual variability in the Tropical Atlantic and its impacts, and potential to improve forecasts (with CT3 and CT4) (month 36)

D6.3: Forced ocean model section in common (with CT3 and CT4) report on best practices for the simulation of Tropical Atlantic Climate and Prediction, including improved understanding of key processes (month 48)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
2	UCPH	6.00
4	IRD	22.00
6	UPMC	19.50
7	GEOMAR	12.00
8	IOW	19.00
20	UCT	10.00
24	UCAD	3.00
25	UAC	74.00
26	CRO	12.00
	Total	177.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.1	Processes on seasonal to interannual variability in forced ocean models	4	90.50	R	PU	24
D5.2	Strategies to improve forced models	6	87.00	R	PU	36
		Total	177.50			

Description of deliverables

D5.1) Processes on seasonal to interannual variability in forced ocean models: Deliver a report on the role of various tested processes on seasonal to interannual variability of temperature and salinity in forced ocean models [month 24]

D5.2) Strategies to improve forced models: Final report on best practices and results of model/observations comparison, and proposed strategies to improve forced models [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS17	Annual WP5 meeting	6	6	Annual meeting with other CT2 partners to establish best practices for model/observations comparison, compare different model skills, and infer strategies to improve forced models. Months 6, 18, 30
MS18	Forced models reference experiments	8	12	Coordinate and produce interannual simulations of different models with yearly updated realistic atmospheric forcing. Month 12, 24, and 36.
MS19	Forced models test experiments	4	24	Conduct the necessary process study experiments to interpret WP3/4 observational and model analyses and evaluate the relative role of different tested processes
MS28	Seasonal to interannual TAV meeting	20	30	Meeting to discuss the mechanisms of seasonal to interannual variability among CT2, CT4, CT3

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP6	Type of activity [54]	RTD
Work package title	Coupled basin-wide processes determining the climatology		
Start month	1		
End month	48		
Lead beneficiary number [55]	5		

Objectives

The overarching goal of this WP is to reduce systematic error in the simulation of Tropical Atlantic climate. The focus of this WP will be on systematic biases that develop on time scales from hours to a year, as captured in ensemble integrations of the GCMs initialised from observational data of the global ocean and atmosphere.

Specific objectives:

1. Evaluate and characterise systematic biases present in the climatology of current ocean-atmosphere coupled models in the TA and of their emergence in hindcast integrations, including seasonal forecasting systems and PREFACE models, by which hypothesis will be formulated regarding the likely mechanisms for the development of such biases;

2. Develop partial and regional flux-correction, decoupling and nudging techniques for numerical sensitivity tests with coupled GCMs and perform coordinated experiments

3. Diagnose results from coordinated experiments to estimate the relative importance of different processes for TA bias development, and design targeted model-specific experiments to discriminate causes and triggers of bias development.

4. Design and test model modifications for the mitigation of model systematic errors.

Description of work and role of partners

This WP will identify leading-order mechanisms responsible for the development of systematic coupled model biases in GCMs affecting model integrations in the Tropical Atlantic, and develop strategies to correct the models in order to mitigate such biases. To achieve this, it will focus on the analysis of the systematic drift in integrations using full-field initialisation from observations (Toniazzo and Woolnough, 2013), using high-frequency diagnostic output in both oceanic and atmospheric components. Sensitivity experiments will then be conducted in hindcast mode to isolate relevant processes and model weaknesses. The main focus will be placed on the systematic SST biases that develop robustly within one year lead time and are also identifiable in the climatology. This WP benefits from a strong synergy and direct collaboration with activities in SPECS., in particular with regard to the interactions between the tropical Altantic, the tropical Info-Pacific and the mid-latitudes. It will take advantage of existing, large sets of seasonal forecast integrations, both operational and non-operational. It is expected that the proposed strategy will inform both our understanding of the climate dynamics of the Tropical Atlantic and GCM development. The proposed numerical experiments are listed in Appendix 4.

Task 6.1 Analysis of forecast to investigate the causes of systematic model error (UiB, UniRes, MF-CNRM, CERFACS, IC3)

The “fast” TA systematic biases will be characterised in terms of amplitude, pattern, and time development in the different observables (SST and 1.5m air temperature, MSLP, surface wind-stress, precipitation, ocean mixed-layer and thermocline temperatures and salinities, etc) from the hindcast carried out by the participating groups. A common minimum set of diagnostic output (to be agreed upon) will be made available by each modelling group. The analysis will be complemented by a similar analysis on the CMIP5 set of decadal hindcasts

from the updated ESG data-base (UiB), seasonal forecasts from EU-ENSEMBLES and DEMETER projects (UiB), and on the UKMO and ECMWF operational seasonal forecast systems in coordination with similar activities within SPECS (UniRes). Observational estimates derived from the AMMA-1 project will be used to compare with the ocean mixed-layer heat and freshwater budget from the simulations. Results provided by D4.2 (WP4) will complement these estimates to inform the design of sensitivity experiments in Task 6.3. The representation of the WAM onset and its impacts on the Equatorial and coastal ocean and specific mechanisms that have been proposed for the development of the coastal and equatorial SST biases (Richter et al, 2012; Tozuka et al. 2011; Toniazzo and Woolnough, 2013) will be assessed. In particular, the dependence of model drift on the season will be determined for each model. The impact of oceanic horizontal or vertical resolution on initial drift will be assessed from model integrations with varying configuration (IC3, CERFACS, MF-CNRM, UPMC, UiB). Participants will convene in a workshop to ensure a degree of consistency in the analysis of the different models and integrations and to exchange results that will inform the next stages.

Task 6.2 Coordinated sensitivity studies to identify robustness of various causes of model systematic error (UiB, UREAD, UniRes, MF-CNRM, WU, UPMC, CERFACS)

Errors in air-sea fluxes have long been recognised to play an important role in coupled-model bias development, and atmospheric, surface, and oceanic errors are known to strongly co-evolve in the Tropical Atlantic (e.g. Toniazzo and Woolnough, 2013). To discriminate between causative effects and coupled error-growth a useful diagnostic strategy (Vanniere et al., 2013) is to apply regionalised nudging/relaxation, flux-correction, or decoupling to surface fields in short (<9 months) initialised sensitivity experiments in hindcast (ensemble) mode. A coordinated set of such experiments across the modelling groups is planned that will allow to isolate sources of bias development and assess similarities and differences between different models. A common set of 4 experiments is proposed, consisting in a baseline experiment with Ocean-Atmosphere coupling limited to the Tropical Atlantic and SSTs constrained to observations outside, and three sensitivity tests where additionally inside the TA we will apply

- a total ocean-surface heat flux correction,
- a momentum flux (windstress) correction
- a solar heat flux correction.

The set-up of and the results from these experiments will be shared with Tasks 7.1 and 8.3 where modified integrations will be used for inter-annual variability and remote forcing studies.

Task 6.3 Further diagnostic sensitivity studies to understand causes of model systematic error (UiB, UREAD, UniRes, MF-CNRM, WU, UPMC, UCAD, CERFACS, GEOMAR)

Further, more targeted sensitivity experiments will be designed and carried out by each group informed both by existing literature and by the outcomes of the coordinated diagnostic studies. Such additional experiments may include regional decoupling (UPMC, UiB, UREAD, UniRes); localised restoring of ocean subsurface temperatures and/or salinities in the upwelling and equatorial areas (UniRes, UREAD, MF-CNRM, CERFACS); restoring atmospheric winds or PBL moisture (MF-CNRM, UiB, UPMC); applying implied atmospheric heating perturbations over nearby continental areas (UREAD, UniRes); correcting or imposing cloud-radiative fluxes (MF-CNRM, UiB). Where particular flux-corrections appear promising, their impact may be assessed on climate-mode simulations for WP6 (Task 6.2) and for WP11 in order to attempt to link bias reduction and TA internal variability (WU). GEOMAR will help informing this Task with results from sensitivity experiments in climate mode under WP7 and WP11 where the impact of specific ocean-model corrections (Greatbatch et al. 2004) and of enhanced horizontal resolution in specific (e.g. upwelling) areas are tested. UPMC and UCAD will perform simulations with both regional (OCATA) and global (CM5) coupled models. The regional configurations in particular will be used to study the sensitivity of the atmospheric PBL winds to local fluctuations in the SSTs. The diagnostic sensitivity studies in this Task will allow to formulate mechanistic models of bias development and thus permit to estimate potential performance improvements, in terms of bias reduction, resulting from specific changes in the GCM parametrisations.

Task 6.4 Towards improved models: Sensitivity studies involving specific model formulation, configurations, and parametrisations (UiB, UniRes, MF-CNRM, WU, UPMC, UCAD, UCPH)

Guided by the outcomes of Tasks 6.2 and 6.3, and in coordination with CT2 activities in Task 6.3, the modelling groups will test the impact of new or modified parametrisations and model configurations. Based on the evidence from current literature, areas of focus for sensitivity tests may include ocean vertical resolution, atmospheric

PBL stability and vertical tracer and momentum exchange, low-level marine stratiform cloud, and precipitating convection (MF-CNRM, UiB, UniRes, UPMC, WU). WU will implement, test and evaluate, in a suite of seasonal hindcasts, an ocean mixed-layer TKE parametrisation including surface-wave effects (Janssen 2012). Using the regional model OCATA and the GCM IPSL-CM5, UPMC and UCAD will focus on ocean-atmosphere coupling frequency, PBL parametrisations and the resulting representation of air-sea coupling (De Coetlogon et al., 2013) and compare from results of WP4 (D4.3). UiB will employ an EnKF technique for best-value estimation of a set of relevant physics parameters. UCPH will implement the recently developed parametrization for near-inertial waves (NIW; Jochum et al., 2013) into the ocean component of EC-Earth and NorESM, calibrate it with PIRATA observations of WP6, and evaluate the resulting hindcast drift (D4.4). Results of such tests, carried out in hindcast-mode integrations (possibly for case-studies) will be compared with flux-correction or nudging strategies to estimate the value of model configuration changes in terms of bias reduction. Model improvements in this Task will be further evaluated in extended integrations in WP7 and WP11.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	18.00
2	UCPH	12.00
3	CERFACS	22.00
5	MF-CNRM	20.00
6	UPMC	8.00
7	GEOMAR	18.00
12	WU	24.00
14	UniRes	16.00
15	IC3	6.00
17	UREAD	9.00
24	UCAD	6.00
	Total	159.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.1	Assessment of bias development in s2d integrations	5	30.00	R	PU	24
D6.2	Diagnostic experiments of model drift	14	64.00	R	PU	36
D6.3	Report on best practices for simulating TAV	12	65.00	R	PU	48
		Total	159.00			

Description of deliverables

D6.1) Assessment of bias development in s2d integrations: Report on the results for the initial model drift in existing s2d experiments, in terms of seasonality, timing and pattern. This synthesis will also take into account results from SPECS on processes acting in the Pacific. This deliverable will summarize activities for task 6.1. [month 24]

D6.2) Diagnostic experiments of model drift: Report on the analysis of diagnostics experiments performed for task 6.2. This will include the intercomparison of the initial drift phenomenology of s2d simulations within a homogeneous framework, including coordinated sensitivity tests with surface-flux correction. Additional experiments to test hypotheses and validate preliminary conclusions will be proposed for task 6.3. [month 36]

D6.3) Report on best practices for simulating TAV: This report will summarize key results obtained from WP5, WP6, WP7, WP8 and WP9 concerning modelling of tropical Atlantic variability (TAV) on s2d time-scales. It will assess current and new understanding of TAV key processes and include recommendations for ocean and ocean-atmosphere coupled climate models towards improving their representation of TAV. Common deliverable with WP5, WP7, WP8 and WP9. [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS20	Agreement on common methodology for initial drift analysis	3	1	Meeting to discuss diagnostics and analysis strategies to employ for analysing bias development (Task6.1); Document listing the agreed upon diagnostic model output to provide/analyse.
MS21	Results from initial-drift analysis	14	12	Workshop on bias development from existing s2d integrations, and for the design of common experiments, flux-correction and decoupling strategies. Minutes of meeting made available on the internal webs
MS22	Coordinated experiments	7	30	Task 6.2 coordinated experiments performed and shared with Tasks 7.1 and 8.3. Data and results made available to all CT3 and WP11 partners, data
MS23	Targeted sensitivty experiments	2	42	Task 6.3: shared document with short description of experiments under Tasks 6.3 by all participating groups, and first results, report
MS24	Model bias-correction methods	12	24	One-day workshop to discuss WP6 recommendations, and to determine

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
				model modifications for bias-correction experiments in Task 7.2. Minutes will be kept.
MS30	Existing s2d prediction data retrieved	11	6	Retrieval of selected experiments from existing datasets (e.g. CMIP5 decadal hindcasts, EUROSIP and SPECS seasonal predictions, ENSEMBLES, DEMETER) and preliminary assessment of simulated spatial-temp

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP7	Type of activity [54]	RTD
Work package title	Relation between the background state (error) and variability		
Start month	1		
End month	48		
Lead beneficiary number [55]	3		

Objectives

The main objective of this WP is to analyse the relationship between models mean biases and the representation of the Tropical Atlantic variability on seasonal to decadal (s2d) timescales.

Specific Objectives:

1. To make an assessment of the representation of Tropical Atlantic variability at s2d timescales by the state-of-the-art climate models (CMIP5 and other specific configurations).

2. To understand through statistical analysis and model experimentation the relationship between the model systematic error and the representation of Tropical Atlantic variability at s2d timescales.

3. To determine the optimal model configuration for the representation of s2d Tropical Atlantic variability and for the application in predictability studies (WP9 and WP11).

Description of work and role of partners

This WP considers the role of basin-wide ocean-atmosphere coupling for Tropical Atlantic variability on s2d timescales (TAV hereinafter). The first step is to use the existing simulations to evaluate the representation of the TAV in the state-of-the-art climate models. The SST Atlantic zonal mode (or equatorial mode, Xie and Carton 2004; Huang and Shukla 2005; Chang et al. 2006; Keenlyside and Latif 2007) and the development of Atlantic Niños have already been investigated for CMIP5 models by Richter et al. 2012a using the pre-industrial (piControl) experiments. They show, that in despite of the persistent mean biases already present in CMIP3, several models are able to reproduce observed equatorial variability to some extent, although they remain far from perfect. In this WP we extend this study by using CMIP5 runs (historical, full initialized) and new model configurations (High-resolution models, improved parameterisations and tuning, bias corrected methods).
In addition, we will also analyse the Atlantic Meridional Mode (AMM or inter-hemispheric gradient mode (Hastenrath and Heller 1977, Servain 1991, Nobre and Shukla 1996, Servain et al. 1999, Doi et al. 2010). To understand model differences, we will also perform a more detailed analysis of the representation of various feedbacks (e.g., Bjerknes positive and delayed negative feedbacks, and wind-evaporation SSTs (WES) positive feedback) by comparing models behaviour with the observational analysis carried out in WP4. To confirm numerically the statistical analysis, this WP will take advantage of some of the experimental strategy developed in WP6. For this purpose, those experiments exhibiting reduced model errors will be run longer to investigate if the model modifications, aimed at the bias reduction, impacts also the representation of TAV. The proposed numerical experiments are listed in Appendix 4.

Task 7.1 Relationships between model systematic biases and the representation of Tropical Atlantic s2d variability (UiB, CERFACS, MF-CNRM, GEOMAR, IC3, UCM, UNN)

In a first stage, we will perform an assessment on the representation of the intrinsic SST modes of variability in the TA by using the CMIP3/CMIP5 database (piControl simulation, historical and full-field initialized runs) by comparing with observations and reanalysis. The signature of s2d variability will be investigated for a reduced set of variables (upper ocean temperature and heat content, pressure, precipitation, winds, and surface heat-fluxes) (CERFACS, IC3, UNN, UiB, UCM). For this task, the use of a multi-model database allows for the identification of robust links among models. We will investigate the factors (regional air-sea

coupling, Bjerknes and WES feedbacks, SST gradients structure, latitudinal migration of ITCZ, wind forcing variability and SST response, ocean transport, mixed layer depth) responsible for the misrepresentation of these patterns (CERFACS, MF-CNRM, UNN, UiB, IC3). Our model analysis will be compared with the observational analysis on air-sea interactions and feedbacks mechanisms performed in WP4 (Tasks 4.2, 4.3). We will use the multi-model database to apply statistical methods in order to establish the relationships between the model mean biases and the representation of s2d variability within the Tropical Atlantic basin (CERFACS, UiB, IC3).

Apart from the CMIP5 database, other more specific model configurations at higher resolution will be used here. The impact of increasing the horizontal and vertical resolution within the Tropical Atlantic basin on the representation of TAV will be investigated (CERFACS, UiB, GEOMAR).

Task 7.2 Investigating the impact of PREFACE model modifications on the representation of Tropical Atlantic s2d variability (UiB, CERFACS, MF-CNRM, UPMC, GEOMAR, UniRes, IC3, UCAD,WU)

This part of the work will be carried out in synergy with WP5 and WP6, following the outcomes there on the role of specific processes controlling the development of model errors. We will test the most relevant changes in the parameterizations, partial flux correction, nudging and restoring techniques for bias mitigation from WP5 and WP6, in a few long-term integrations (at least 30 yrs) to assess their impacts on the modes of s2d variability.

UPMC will use both the global IPSL-CM5 model with a configuration in which the Tropical Atlantic region is zoomed, and the regional OCATA model with high-resolution oceanic and atmospheric zooms in frontal regions. They will also investigate the impact of increasing the temporal resolution (coupling model time-step) on the representation of TAV (Masson et al. 2012).

The impact of the more successful parameterisations developed in WP6 on Tropical Atlantic s2d variability will be investigated (WU, MF-CNRM, UPMC, UniRes, IC3, UCAD). WU and IC3 will concentrate on new parameterizations of vertical mixing in the ocean mixed layer as well as in the atmospheric marine boundary layer. UPMC and UCAD will study the impact of new parameterizations applied only on the atmospheric component on the representation of processes that have a crucial role on the TAV (wind response to SST gradients, PBL dynamics). The parameterizations will be tested first in atmospheric forced configuration and then in a coupled configuration.

We will also consider extending simulations with the best performing configurations for regionalised nudging, relaxation and flux corrected runs from WP6 to investigate the relation between bias development in different regions and the simulation of the TAV (Breugem et al. 2006, Hazeleger and Haarsma 2005) (CERFACS, WU, IC3, UniRes, UiB, MF-CNRM). WU will develop flux corrected runs for the historical period 1850-2000 over key regions in the Tropical Atlantic basin. These simulations will be analysed jointly with IC3. As in WP6, the flux correction will be applied fully as well as partially on the momentum and heat fluxes (windstress, sensible, latent heat fluxes) over the ocean. GEOMAR will investigate the origin of biases in Tropical Atlantic variability by prescribing to a coupled model observational SSTs and winds over different regions within the basin.

Richter et al. 2012b have shown that the development of warm events in the eastern equatorial Atlantic cannot be explained only by the identified ENSO-like dynamics mechanism. They pointed to a second mechanism associated to surface wind forcing north of equator and the induced SST anomalies. MF-CNRM will also analyse the capability of a climate model to reproduce the warm events development by imposing the adequate wind patterns identified as precursors in Richter et al. 2012b. This sensitivity test will be performed with the appropriate climatological partially flux correction.

The WP contributes to common deliverables:

D6.3 Report on best practices for simulating TAV (Month 48)

D9.1 Report on the mechanisms for seasonal to interannual variability in the Tropical Atlantic and its impacts, and potential to improve forecasts (Month 36)

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	12.00
3	CERFACS	22.00
5	MF-CNRM	15.00
6	UPMC	9.00
7	GEOMAR	15.00
12	WU	24.00
14	UniRes	3.00
15	IC3	6.00
16	UCM	6.00
24	UCAD	4.00
27	UNN	30.00
	Total	146.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.1	Assessment on the representation of s2d TAV by current model configurations	3	67.00	R	PU	24
D7.2	Report on model improvements on the representation of s2d TAV	6	79.00	R	PU	36
		Total	146.00			

Description of deliverables

D7.1) Assessment on the representation of s2d TAV by current model configurations: Report on the assessment of the representation of s2d TAV by the state-of-the-art coupled models and its relation to mean state errors based not only on existing simulations (CMIP5 and SPECS), but also on PREFACE models configurations. [month 24]

D7.2) Report on model improvements on the representation of s2d TAV: This report will summarize the main results from the experiments performed with the PREFACE model modifications (tasks 6.2, 6.3 and 7.2) with focus on the representation of s2d TAV. [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS21	Results from initial-drift analysis	14	12	Workshop on bias development from existing s2d integrations, and for the design of common experiments, flux-correction and decoupling strategies. Minutes of meeting made available on the internal webs
MS24	Model bias-correction methods	12	24	One-day workshop to discuss WP6 recommendations, and to determine model modifications for bias-correction experiments in Task 7.2. Minutes will be kept.
MS25	Basic set of bias-correction experiments	27	34	Completion of a basic, coordinated set of bias-correction experiments. Output data made available to all project participants.
MS28	Seasonal to interannual TAV meeting	20	30	Meeting to discuss the mechanisms of seasonal to interannual variability among CT2, CT4, CT3

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP8	Type of activity [54]	RTD
Work package title	Influence of remote systematic errors		
Start month	1		
End month	48		
Lead beneficiary number [55]	16		

Objectives

The main objective of this WP is to understand the interaction of model systematic errors among different regions, and to assess to what extent local systematic errors can be understood in isolation of remotes errors. We will focus on seasonal to decadal timescales and will address the dependence on the mean state of the teleconnections and planetary-scale feedbacks involving the Tropical Atlantic basin. The inter-basin teleconnections, land-ocean and tropical-extratropical interaction will be analyzed. To this aim, CMIP5 and SPECs simulations will be analyzed and partially coupled sensitivity experiments will be performed with different models in coordination across participating modeling groups.

The findings from analyzing the numerical experiments will be feedback to WP4.1 and WP4.3 in the form of a list of hypothesis for a correct representation of TA mean, variability and modulations.

Specific Objectives:

1. To assess the influence of systematic errors in regions remote from the Tropical Atlantic on the Tropical Atlantic mean state, and variability

2. To assess the influence of Tropical Atlantic systematic errors on remote regions, mean state, and variability

3. To assess the impact of the systematic error on the representation of the tropical interbasin tele-connections

Description of work and role of partners

WP8 will investigate the external sources of bias in the Tropical Atlantic basin and the corresponding impact on the representation of Tropical Atlantic bias and variability (UCM, UniRes, UREAD, UiB, GEOMAR, UNN). Also how the bias within the TA impacts the representation of the mean state and variability outside of the Tropical Atlantic (UCM, UiB, GEOMAR). Finally the impact of systematic error on representation of the connection between tropical ocean basins (Rodriguez-Fonseca et al., 2009; Martín del Rey, 2012; Losada et al, 2012; Ding et al., 2012;) will be determined (UCM,UiB), helping to understand the factors modulating this connection in observations (WP4.1). CMIP5 control runs and also SPECs initialized runs (UCM, UNN) will be analyzed to pose different hypothesis that will be tested by partially coupled simulations (UCM,UiB,UREAD,UniRes,GEOMAR, MF-CNRM,UPMC). A key element here is to investigate the link between processes in the Tropical Atlantic and Pacific. The proposed numerical experiments are listed in Appendix 4.

Task 8.1 Influence of systematic errors in regions remote from the Tropical Atlantic including land, on the Tropical Atlantic mean state, and variability (UCM, UiB, UniRes, UREAD, MF-CNRM, UPMC, GEOMAR, UNN)

In this task systematic errors refers to the mean state, and seasonal cycle, but also include errors in dominant modes of variability (as, for example: ENSO, AMO, PDO).

In a first stage, UCM will study the contribution of changes in the slowly varying background SST, as those imposed by multidecadal SST variability modes (AMO, PDO), on the Atlantic mean state. This will be determined using the CMIP5 picontrol and SPECS simulations analysing the sensitivity to different phases and amplitudes of these multidecadal modes. In a similar way, the sensitivity of Tropical Atlantic mean state and variability to the representation of the interannual modes (ENSO, NAO) will be determined.

In a second step, coordinated sensitivity experiments will be performed by partially coupled simulations to test the hypothesis derived from the CMIP5 analysis regarding the remote influence on the representation of Tropical Atlantic mean state and variability (UCM, UiB, MF-CNRM, UREAD, UPMC). The experiments performed in WP6.2 will be used as a reference case for these sensitivity experiments, in which remote SST regions influencing on the bias will be determined from the analysis of CMIP5/SPECS simulations and observations.

Apart from this, GEOMAR will study the impact of the North Atlantic SST bias on the Tropical Atlantic bias.

Also, the influence of subtropical south Atlantic SSTs on the representation of equatorial Atlantic anomalies will be analyzed. In this way, Nammchi. et al (2011) have shown how some Equatorial Atlantic warming/cooling anomalies co-occur with significant anomaly in the southern sub-tropics (SAOD), others are solitary. Using CMIP(3/-5) and SPECs simulations, UNN will investigate occurrence of errors during equatorial Atlantic warming/cooling concurrent with significant anomalies in the southern subtropics characteristic of the SAOD; also during solitary equatorial warming/cooling and comparing both cases to determine the sources of the errors.

UniRes and UREAD will investigate the effect of remote errors in the Indo-Pacific on the Atlantic via atmospheric teleconnections. Techniques will include atmospheric nudging (Jung et al., 2008) or applying heating terms in the atmosphere in certain areas (e.g. the West Pacific) in order to correct the source and propagation of planetary waves. The sensitivity tests will be carried out in initialized mode, for up to a few months lead-time, given that present evidence suggests that Indo-Pacific errors tend to develop and spread quickly, with influences in the global tropics.

Task 8.2 – Influence of TA systematic errors on remote regions, mean state, and variability (UCM, UiB, MF-CNRM, GEOMAR)

Following the same methodology as in Task 8.1, CMIP5 and SPECS simulations will be analyzed for different samples with enhanced and reduced bias in the Atlantic, with the aim of looking for possible influences on remote regions. UiB and UCM will contribute to assess the impact of Tropical Atlantic variability on Indo-Pacific variability performing partially coupled experiments in which the Tropical Atlantic will be restored to SST data along the observational period. The focus will be on assessing whether correcting biases in the Atlantic (variability and mean) improves the simulation of structure, skewness, and timing of ENSO variability and its teleconnections. The simulations will be done in coordination with different models (UCM, UiB, MF-CNRM).

GEOMAR will use ECHAM5-T213 for the atmosphere coupled to GCM NEMO3 to address the impact of the Tropical Atlantic SST bias on the mean state and the interannual variability outside the tropical Atlantic.

Task 8.3 – Understanding the factors modulating the connection between Tropical Ocean basins, and the impact of model systematic error (UCM, UiB, MF-CNRM)

Observations and coupled model studies have shown that Equatorial Atlantic Variability in boreal summer influence ENSO in the following seasons (Rodriguez-Fonseca et al. 2009; Ding et al; 2012). Nevertheless, a recent study of Ham et al. (2013) points to the North Tropical Atlantic as predictor of ENSO.

Rodriguez-Fonseca et al. (2009) and Martin del Rey et al. (2012) have pointed out that the relation between the Atlantic and Pacific Niños is not stationary, and became stronger since the 1970's. This relation has the potential to enhance ENSO prediction skill (Keenlyside et al. 2013). The representation of this link in climate models has not been examined extensively, but is found in some flux corrected models under certain circumstances (Svendsen et al. 2013).

In a first stage we will examine this relationship and its possible modulations in CMIP5 simulations (UCM). In a second stage we will analyse existing simulations (from Rodriguez-Fonseca et al., 2009; Ding et al., 2012; Martin-Rey et al., 2012 etc) and also the same experiments performed in Task 8.2 in which the Atlantic is restored to SST along the observational period (UiB,UCM, MF-CNRM). We will also address how mean state errors may affect the representation of the Tropical Pacific – Tropical Atlantic relation. This will inform analysis in WP4.1 on understanding the modulation of this relation in observations. We will assess two potential factors: the role of changes in local variability (Tokinaga and Xie 2012) or changes in the background atmospheric state.

Coordinated Experiments:
This WP will use the flux corrected experiments developed in WP6 and WP7 as a basis for the following guide.Specific coordinated:

1.Partially coupled simulations with prescribed SSTs outside the Tropical Atlantic and coupled inside the Tropical Atlantic. The experimental design will be similar to the baseline experiment in WP6.2, except that the prescribed SST will be chosen from an appropriate climatology, and specific anomalies will be applied in selected regions of the tropical Indo-Pacific or the North Atlantic, according to the outcomes of Task 8.1

2. Partially coupled simulations restoring the SSTs in the Atlantic to observations for the observational period, coupling in the Indo-Pacific region and prescribing climatological SSTs elsewhere (as in Rodriguez-Fonseca et al.,2009; Martin del Rey et al. (2012) and Ding et al., 2012). [UCM, UiB, MF-CNRM]. These coordinated experiment deal with Tasks 8.2 and 8.3

This WP contributes to common deliverables:

D6.3 Report on best practices for the simulation Tropical Atlantic Climate, including improved understanding of key processes. (Month 48)

D9.1 Report on the mechanisms for seasonal to interannual variability in the Tropical Atlantic and its impacts, and potential to improve forecasts (Month 36)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	9.00
5	MF-CNRM	5.00
6	UPMC	1.00
7	GEOMAR	9.00
14	UniRes	6.00
16	UCM	22.00
17	UREAD	4.00
27	UNN	30.00
	Total	86.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.1	Interdependence between biases in the Tropical Atlantic and in other regions	27	68.00	R	PU	24
D8.2	Atlantic influence on ENSO and the impact of bias	16	18.00	R	PU	36
		Total	86.00			

Description of deliverables

D8.1) Interdependence between biases in the Tropical Atlantic and in other regions: Report on results from the analysis of the CMIP5 s2d integrations and from new model sensitivity tests, targeting the influence of

remote biases on the Tropical Atlantic, and vice versa. Particular focus will be given on of interactions between processes in the tropical Atlantic and the tropical Pacific. [month 24]

D8.2) Atlantic influence on ENSO and the impact of bias: Report on the analysis of the mechanisms determining the Atlantic influence on ENSO, its modulation, and the impact of systematic biases. Common with WP9. [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS24	Model bias-correction methods	12	24	One-day workshop to discuss WP6 recommendations, and to determine model modifications for bias-correction experiments in Task 7.2. Minutes will be kept.
MS26	Remote biases in existing simulations, and proposed sensitivity experiments	27	12	Report on the analysis of CMIP5 simulations. List of major biases, together with possible decadal modulations.
MS27	Results from sensitivity experiments	12	42	Analysis of sensitivity tests and smiulations and list of conclusions. Data from sensitivity experiments made available.
MS28	Seasonal to interannual TAV meeting	20	30	Meeting to discuss the mechanisms of seasonal to interannual variability among CT2, CT4, CT3

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP9	Type of activity [54]	RTD
Work package title	Tropical Atlantic variability on seasonal and longer time scales and its global impacts		
Start month	1		
End month	48		
Lead beneficiary number [55]	16		

Objectives

The main goal of WP9 is to improve our understanding of Tropical Atlantic variability and its impacts through the analysis of observational data and climate model simulations.

Specific Objectives:

1. To analyze the origin, development and impacts of Atlantic interannual modes of variability, including the two-way Atlantic-Pacific relationship

2. To understand the long-term variations in the Tropical Atlantic addressing the relative roles of external forcings and internal variability

Description of work and role of partners

On seasonal and longer times scales, the Tropical Atlantic (TA) hosts several modes of variability. This WP aims at providing a further understanding of the origin, development and impacts of such modes. This WP will use results from the observational analysis performed in WP4. We will divide the study in different time scales. On the one hand, we will focus on interannual modes of variability, specifically we will address the Atlantic zonal (or equatorial) mode (Zebiak et al. 1996), for which we will further investigate its development and impacts; the South Atlantic Ocean Dipole (SAOD) (Nnamchi et al. 2011), for which we will analyze the processes involved in its origin and development; the two-way Atlantic-Pacific relationship; and the role of the equatorial deep jets in establishing equatorial regular basin-mode oscillations (Brandt et al. 2011). On the other hand, on longer time scales, we will address the role of the Atlantic sub-polar gyre in driving multi-decadal variations in the Tropical Atlantic and the relative roles of external forcings versus internal variability in the origin of the long-term changes in the Tropical Atlantic. The proposed numerical experiments are listed in Appendix 4.

Task 9.1 Understanding the representation of interannual Atlantic modes of variability (UCM, UNN, UCT, UiB, GEOMAR, IC3, UPMC)

Though some works point to the role of the Santa Helena anticyclone as crucial in setting up the ocean conditions for the development of the Atlantic equatorial mode (Richter et al. 2010; Lubbecke et al. 2010), recent studies suggest that the contribution of the north subtropical anticyclone is also relevant in the last decades (Martín-Rey et al. 2012). In this Task we will further investigate the roles of both subtropical anticyclones in the development of the Atlantic equatorial mode using an OGCM forced with appropriate wind fields (UCM, UPMC). In addition, we will evaluate the global atmospheric impacts of this equatorial mode and how these change depending on the background state and the particular characteristics of the mode by means of sensitivity experiments with AGCMs (UCM). Beyond the Equatorial Atlantic, the existence of a dipole mode in the South Atlantic SSTs was recently reported and named the South Atlantic Ocean Dipole (SAOD) (Nnamchi et al. 2011). To improve our knowledge of this mode, the relative roles of dynamical and thermodynamical air-sea interactions involved in the origin of the SAOD and the air-sea teleconnection processes associated to its life cycle will be evaluated. In addition, partially coupled GCM experiments will be conducted to determine the relative significance of the Gulf of Guinea and the South Atlantic Ocean extra-tropics in the evolution of the SAOD (UNN). To further investigate the atmospheric influence on the Tropical Atlantic ocean, we will study interannual variability of rainfall and climate in Central Africa and its impact on the Tropical Atlantic Ocean and

the Benguela current system by means of the analysis of ERA Interim and CFSR reanalysis, Reynolds and TRMM SSTs, as well as satellite derived precipitation data from TRMM and GPCP or other relevant products, including the observational results from WP4 (Task 4.2). Results from satellite remote sensing and reanalysis will be compared with coupled model output at the later stage of the project (UCT).

Observations indicate that equatorial Atlantic SST variations lead those in the Pacific by two seasons, with this dependence strengthening since the 1970's. Recent studies using observations and coupled models have clearly shown that the equatorial Atlantic SST impacts ENSO variability and predictability (Rodriguez-Fonseca et al., 2009; Ding et al. 2011, Polo et al., 2012; Keenlyside et al. 2013). Other works also suggest an impact from the Tropical North Atlantic region (Ham et al. 2013). Here we propose to clarify several details of this relation using partially coupled model experiments (UCM) and seasonal predictions (IC3), focusing on the periods in which this relationship is active. UiB and UCM will investigate the underlying dynamics explaining the possible role of the background state in explaining the observed modulation of the interaction between these basins; this work will be guided by results in WP8 where the impact of systematic model error on the representation of this link is studied. We will study the impact of the TAV leading mode on the initial development of ENSO (UCM).

The existence of regular oscillations in the equatorial Atlantic associated with the generation of equatorial deep jets became evident recently (Johnson and Zhang, 2003; Brandt et al., 2011). To better understand the role of these basin-mode oscillations in driving SST variability in the equatorial Atlantic, we will analyze remote-sensing data and observations from equatorial moorings in conjunction with idealized process-modeling describing the generation and upward energy propagation of equatorial deep jets (GEOMAR). This work will use results regarding the zonal velocity observations at the Equatorial Atlantic obtained under WP4 (Tasks 4.1)

Task 9.2 Understanding of long-term variability in the tropical Atlantic (UiB, CERFACS, UCM, IC3)

North Atlantic SST are dominated by multi-decadal variations that are most pronounced in the subpolar gyre. Extra-tropical SST variations have been shown to drive anomalies in the sub-tropics, particularly in boreal spring and summer (Smirnov and Vimont, 2012). We will investigate the influence of Atlantic subpolar gyre SST variations on Tropical Atlantic variability, decadal changes and modulation of interannual variability. We will analyse existing simulations, flux-corrected simulations from PREFACE, and targeted coupled model experiments. The later will include an active stratosphere, shown to better reproduce the atmospheric response to extra-tropical SST (Omrani et al. submitted) (UiB). CMIP5 historical and control simulations will also be used to evaluate the impact of these internal variations over the surrounding continents (UCM).

The understanding of long-term variability in the Tropical Atlantic is severely limited by biases in observations and climate models. Bias-corrected observations (Tokinaga and Xie 2011) indicate that sea surface temperature (SST) has increased across the tropical Atlantic basin during the past six decades. The pattern of regional changes shows stronger warming over the eastern equatorial Atlantic during boreal summer. This implies a weakening of the equatorial Atlantic cold tongue and a reduced seasonal cycle (SST-winds) and interannual variability. However, the causes for such a large change are still poorly understood. The recently performed CMIP5 attribution simulations (where different external forcings during the historical period are considered) and a range of detection and attribution techniques (Terray et al 2012; Ribes et al. 2012; Ribes and Terray 2012) will be used to gain a deeper understanding of the relative roles of external (both anthropogenic and natural) forcings versus internal variability. In particular, we would like to investigate the possible cooling influence of aerosols (anthropogenic and volcanic) and its projection upon the zonal and meridional Atlantic modes. (CERFACS). The System 4 seasonal predictions and CMIP5 decadal predictions will also be used for this purpose. (IC3).

Table of experiments

Existing simulations:

-CMIP5 simulations (preindustrial control, historical, attribution, decadal predictions)
-System 4, CFSv2, ENSEMBLES, SPECS and EC-Earth seasonal predictions

New experiments:

1. Subtropical anticyclones-Equatorial mode: Sensitivity experiments with OGCM (NEMO) using prescribed appropriate winds focusing on the Atlantic basin (UCM)

2. Impacts of the Equatorial Mode: Sensitivity experiments with AGCM (UCLA AGCM, Speedy AGCM) with appropriate prescribed SST boundary conditions in the Atlantic basin (UCM)

3.SAOD: Partially coupled AOGCM (ICTP Speedy + mixed layer ocean) simulations: Prescribed conditions in the Atlantic region, fully coupled elsewhere (UNN)

4. Two-way Atlantic-Pacific: Partially coupled AOGCM (ICTP Speedo and/or UCLA-MIT) sensitivity experiments (UCM)

5. Atlantic subpolar gyre-TAV: Coupled model (AGCM+Mixed Layer Ocean and AGCM+flux corrected OGCM) experiments with active stratosphere (UiB)

This WP also contributes to the following common deliverables:

D6.3 Report on best practices for the simulation Tropical Atlantic Climate and Prediction, including improved understanding of key processes (Month 48)

D8.2 The Atlantic influence on ENSO, mechanisms, modulation and the impact of bias (Month 36)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	9.00
3	CERFACS	6.00
6	UPMC	1.00
7	GEOMAR	6.00
15	IC3	6.00
16	UCM	20.00
20	UCT	50.00
27	UNN	30.00
	Total	128.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D9.1	Mechanisms for seasonal to interannual TAV and impacts	16	107.00	R	PU	36
D9.2	Mechanisms for long-term TAV	3	21.00	R	PU	24
		Total	128.00			

Description of deliverables

D9.1) Mechanisms for seasonal to interannual TAV and impacts: Report on the mechanisms driving different modes of variability within the Tropical Atlantic and their global impact, including the two-way Atlantic-Pacific relationship. The potential to improve forecasts will also be addressed. Common deliverable with WP5, WP6, WP7, and WP8 [month 36]

D9.2) Mechanisms for long-term TAV: Report on the relative roles of external forcings and internal variability in the long-term evolution of tropical Atlantic SSTs, including the possible impact of variations in the subpolar gyre [month 24]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS28	Seasonal to interannual TAV meeting	20	30	Meeting to discuss the mechanisms of seasonal to interannual variability among CT2, CT4, CT3
MS29	WP9 experiments completed	16	30	Conclusion of all the WP9 set of experiments

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP10	Type of activity [54]	RTD
Work package title	Statistical methods to assess and improve forecast of Tropical Atlantic variability		
Start month	1		
End month	48		
Lead beneficiary number [55]	11		

Objectives

Model systematic errors of both background state and variability strongly limit the predictive skills of state-of-the-art dynamical climate models in the Tropical Atlantic region (Stockdale et al., 2006). Sparseness of existing in situ data, together with limited model resolution often do not allow for an extraction of valuable information on state and variability of the ocean/atmosphere and related biogeochemical quantities.
WP10 main goal is to improve Tropical Atlantic climate prediction through the development of a unifying statistically-oriented framework.

Specific Objectives:

1. To develop a Bayesian hierarchical modeling strategy to re-calibrate forecasts and improve prediction of Tropical Atlantic variability and its impact

2. To develop a statistical scheme to predict SST anomalies in remote regions associated with Tropical Atlantic variability

3. To assess the ability of state-of-the-art climate models (CMIP5) to reproduce climate variations over the Tropical Atlantic Sector (including surrounding continents) over the 20th century

Description of work and role of partners

The main tasks of the WP are aimed at enhancing predictions of Tropical Atlantic climate on seasonal and decadal scale. Both observed data and simulated data will be considered. To achieve this goal we will use well established statistical methods as well recent advances in Bayesian analysis. The results will be also fed into CT5. There will be close cooperation between the impacts community in CT5, to ensure appropriate data are available for the impacts models.

In, particular:

- UCM and UCAD will develop a statistical seasonal prediction model with SST as main predictor. The originality of the model is to consider the non stationarity of the predictors (Rodriguez-Fonseca et , 2011; Losada et al., 2012). In the framework of PREFACE, UCM will further develop the model on the basis of previous findings related to Tropical Atlantic variability (Rodriguez-Fonseca et , 2011; Losada et al., 2012). The contribution of UCM in this WP will be fed by results of WP8 about the modulation of the teleconnections and its predictability.

- IC3 and UiB will contribute to the assessment of the current level of forecast skill on seasonal-to-decadal timescales. In addition, UiB will assess the ability of state-of-the-art climate models (CMIP5) to reproduce climate variations over the Tropical Atlantic Sector (including surrounding continents) over the 20th century. This will set a baseline for PREFACE model improvements on recent climate change timescales.

- Unive will develop and use Bayesian hierarchical modeling strategies to improve TAV predictions and re-calibrate simulated data for bringing them into line with measurements. The main theoretical advantage over "traditional" linear subspace-based (e.g. Empirical orthogonal functions) methods for inferring climate fields is that the Bayesian strategy encapsulates the uncertainties involved in the estimation of all model parameters and these uncertainties are properly taken into account in the predictions and re-calibrations.

Task 10.1 Development of a Bayesian hierarchical modeling strategy for improving prediction of Tropical Atlantic variability (Unive)

The goal is to develop a general methodology to obtain joint projections of climate indexes, based on ensembles of global climate model (GCM) output and historical observations and to re-calibrate simulated data to bring them into line with the measurements.
As an example, we consider sea surface temperature (SST) in the Tropical Atlantic. Given a representation of the SST spatio-temporal field in terms of a basis of orthogonal functions, we use a hierarchical Bayesian model for the function coefficients to estimate a baseline and a set of model discrepancies. The Bayesian hierarchical model will be used to synthesize the outputs from individual climate simulations and to quantify uncertainties of all unknowns conditional on the data. In this way we will be able to extract large-scale spatial features from the spatio-temporal fields to improve TAV prediction, identify sources of heterogeneity and non-stationarity of simulated TAV features, and to unify different spatial-temporal dependences, including fronts and shifts, into a unique statistical framework.

Task 10.2 Combining outputs from Climate Models (Unive)

This task uses the Bayesian hierarchical model developed in Task 10.1 to refine our understanding on local-to-regional scale TAV feature. The Bayesian hierarchical model is applied to a multi-model simulation ensemble in order to produce deeper statistical confidence by merging output distributions. Focus is on areas of sharp persistent gradients, which are expected to provide the biggest challenges to numerical models to jointly accurately represent spatial and temporal TAV variability.

Task 10.3 Extension of the Bayesian hierarchical model (Unive)

In this task an attempt is made to extend the use of the Bayesian hierarchical model to a simulation ensemble and to small-scale features. Several geophysical as well as biogeochemical parameters will be investigated. They will be used to make optimal predictions of the underlying climate processes and will yield valuable information to different investigators and users of the area.

Task 10.4 Optimized implementation of observational data in climate simulations (Unive)

This task tackles problems generated by the spatial misalignment between observational and model data, and by the scarceness/incompleteness of observations. A fully model-based strategy is proposed to optimize the rescaling between numerical climate model outputs, provided on the original model grid, and grid/point observations. This task focuses on a one-way model to observation rescaling. Moreover we will provide spatial and temporal predictions, coupled with an evaluation of their incertitude, of the oceanographic variables that may impact the stock abundance of key species of fishes. These predictions will be useful as inputs in the ecological-economic models developed in WP 13.

Task 10.5: Prediction of SST anomalies in remote regions due to Atlantic remote influence (UCM, UCAD)

An existing statistical tool will be adapted to predict SST anomalies in remote regions due to Atlantic remote influence. This tool considers the stationarity or absence of stationarity between the predictand and predictor fields.

Task 10.6: Forecast quality assessment using best existing dataset (IC3, UiB)

Using different state-of the art climate prediction datasets (e.g. the CMIP5 decadal hindcasts and the EUROSIP and SPECS seasonal predictions) the current levels of skill and reliability attained so far by simulations over the tropical Atlantic region will be investigated with a special focus on seasonal-to-decadal time scales (IC3). UiB will perform an analysis of variance of initial condition and structural uncertainties in forecast error, as function of lead-time for the Tropical Atlantic and surrounding continental regions. For this we will use existing databases for seasonal (ENSEMBLES, DEMETER) and decadal (CMIP5) timescales. Statistical analysis will be used to investigate sources of initial condition uncertainty, and which regions and variables lead to the largest forecast error. Similar analysis will also be performed to identify common elements of model error. Results of this analysis will be useful to identify possibilities to reduce forecast uncertainty and improve models.

Task 10.7: Model assessment of TAV over the 20th century (UiB)

The ability of simulations to reproduce climate variations over the Tropical Atlantic Sector (including surrounding continents) over the 20th century will be investigated in this task using state-of-the-art climate models (CMIP5).

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	6.00
11	UNIVE	48.00
15	IC3	4.50
16	UCM	6.00
24	UCAD	2.00
	Total	66.50

List of deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
D10.1	Assessment of s2d forecast skill in the TA	1	22.50	R	PU	24
D10.2	Bayesian hierarchical model	11	32.00	R	PU	36
D10.3	Statistical methods and Bayesian methods	11	12.00	R	PU	48
		Total	66.50			

Description of deliverables

D10.1) Assessment of s2d forecast skill in the TA: Report on the current forecast skill on s2d and performance of historical simulations in the Tropical Atlantic sector, and the performance of statistical forecasts of remote SST anomalies. [month 24]

D10.2) Bayesian hierarchical model: Report on the Bayesian hierarchical model developed in Task 10.1, including an assessment of previous hierarchical Bayesian approach-based work in the field of climatology, Software of the models developed in Task 10.4. [month 36]

D10.3) Statistical methods and Bayesian methods: Report and software of statistical methods and Bayesian methods for combining forecasts. [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS30	Existing s2d prediction data retrieved	11	6	Retrieval of selected experiments from existing datasets

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
				(e.g. CMIP5 decadal hindcasts, EUROSIP and SPECS seasonal predictions, ENSEMBLES, DEMETER) and preliminary assessment of simulated spatial-temp
MS31	Existing statistical tool adapted	11	6	An existing statistical tool will be adapted to predict SST anomalies in remote regions due to Atlantic remote influence
MS32	Initial analysis of skill meeting	11	19	SKYPE meeting to discuss initial analysis of skill of existing predictions/projections with WP11, meeting
MS33	Bayesian hierarchical model	11	24	Development of the Bayesian hierarchical model for describing space-time error dependences; Full-assessment of space-time error dependences based on the Bayesian hierarchical approach, model
MS34	Bayesian regression model	11	36	Development of the Bayesian regression model for optimal combination of ensemble forecasts and recalibration, model

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP11	Type of activity [54]	RTD
Work package title	Impact of model improvement and systematic error reduction on climate prediction and projection		
Start month	19		
End month	48		
Lead beneficiary number [55]	15		

Objectives

This WP will quantify the impact of the PREFACE model improvements (CT3) and bias correction techniques in climate predictions and long-term projections. The assessment will include an assessment of the reliability of the climate simulations to provide the most reliable information to CT5. The link between model error improvement and forecast quality of the West African monsoon will also be investigated.

Specific Objectives:

1. to quantify the impact of the both model improvement and bias correction techniques (CT3) on climate predictions and long-term projections;

2. to assess the reliability of the latest climate information available to PREFACE to provide the most reliable information to CT5;

3. to investigate the link between model error improvement and climate predictions of the West African monsoon.

Description of work and role of partners

Climate information is the product of a set of climate simulations that, after adequate post-processing, is provided to the users. A minimum requirement of the climate information is its trustworthiness, which is measured by the reliability of climate predictions and projections. We will investigate the impact of model bias on climate information at several time scales, using available climate predictions, historical simulations and projections. An evaluation of the skill of model-based decadal hindcasts from e.g. the CMIP5 database will be correlated with the error-growth analysis to be performed in CT3 to determine links between mean model errors and the quality of climate information, such as forecast quality and projection reliability. The findings from analysing the numerical experiments will be fed back to CT3 in the form of an assessment of the effects of improved models on impact-relevant predictions and projections, with a focus on the simulation of the climate of the Tropical Atlantic and its variability. The assessment will be based on climate predictions, as well as on baseline (historical or control) and greenhouse-forced (scenario or fixed-concentration) climate integrations modified or perturbed as described in CT3. The proposed numerical experiments are listed in Appendix 4.

The WP11 work will be carried out as part of two tasks.

Task 11.1 Impact of model improvement on climate predictions of the Tropical Atlantic and neighbouring regions (CERFACS, IC3, UCM, UCPH, UiB, WU)

Forecast quality assessment on seasonal-to-decadal time scales will be performed over the tropical Atlantic region using the best research and operational climate prediction datasets (e.g. the CMIP5 decadal hindcasts and the DEMETER, ENSEMBLES, EUROSIP and SPECS seasonal predictions) to estimate the current levels of skill and reliability and compare them with the new sets of predictions to be performed in PREFACE (IC3). Operational seasonal forecast systems (ECMWF System 4 and CFSv2) will be used to ensure an efficient transfer of the results to climate services. The relation between mean-state errors and different aspects of seasonal-to-decadal forecast quality will be explored. The forecast quality information will be, on one side, correlated with the error-growth analysis planned in CT3, and on the other side, linked to the

knowledge obtained on the main feedbacks acting in the Tropical Atlantic, to gain insight on the sources of the systematic error in long-term projections (IC3,UiB). In this framework, multi-year predictions can be used to investigate alternative ways to constrain the reliability of longer term projections, increasing our confidence in climate-change projections (IC3).

A limited set of climate prediction experiments case studies will be performed with the improved (in terms of new parameterizations), bias-corrected models developed in CT3, and with the standard forecast systems. The impact on forecast quality of improved parameterizations (e.g. stable boundary layer with improved moisture convergence and ocean boundary layer schemes) (WU,UCPH,UiB), different initialization methods that take into account the model drift (full versus anomaly initialization) (IC3), and bias corrected systems (CERFACS, UiB) will be assessed. A special focus will be on the Atlantic-Pacific interbasin connection and the prediction of ENSO linked to tropical Atlantic events (UCM).

The role of the tropical Atlantic variability for the West African precipitation variability has been largely documented. However, there is less information about how relevant the Tropical Atlantic systematic error in climate predictions affects the skill of neighbouring land precipitation (Velinga et al., 2012). Recent results show that seasonal forecast systems have improved the representation of the tropical Atlantic SSTs, although a certain degree of drift, which depends on the specific start date within the year, is still present, limiting the forecast quality of these systems over land. The impact of the model improvements, particularly of the bias-corrected simulations, on the West African monsoon climate predictions will be assessed (IC3, UCM). The MCA-based statistical seasonal forecast system for West African rainfall based on SST predictors developed in WP10 will be used as a benchmark to compare the forecast quality of the dynamical forecast systems. The statistical system takes into account the nonstationarity of the predictors (Rodriguez-Fonseca et al., 2011; Losada et al., 2012) and the low-frequency modulations of the interanual teleconnections (UCM)

The impact of the start date within the year on the representation of the Atlantic Niño will be taken into account. Also, the impact on the ENSO seasonal predictions linked to the possible improvements in the reproduction and prediction of the Atlantic Niño events in the previous summer will be assessed (UCM)

Task 11.2 Impact of model improvement on climate projections of the Tropical Atlantic (CERFACS, MF-CNRM, UiB, UniRes, WU)

The relationship between model biases and their response to external forcing in the Tropical Atlantic will be investigated by using the CMIP5 model projections of the future climate (CERFACS).

Flux-corrected centennial simulations will be performed with the EC-Earth and NorESM models using the experience gained in CT3. The flux correction will be applied fully as well as partially on the momentum and heat fluxes (wind stress, sensible, latent heat fluxes), or variables that affect the fluxes such as albedo and soil moisture. The flux-correction approaches implemented in CT3 will allow diagnosing the dominant processes that are responsible for the Tropical Atlantic biases and their impact on the seasonal cycle (South-American and African monsoon systems), the modes of interannual variability (Atlantic Niños), and climate sensitivity in the climate projections (UiB, UniRes, WU).

As new parameterizations will be tested within PREFACE, the impact of these new parameterizations on the biases and the climate projections will be evaluated by including them in EC-Earth, CNRM-CM and HadGEM. The new parameterizations include relevant physical processes such as an updated vertical mixing in the ocean mixing layer as well as in the atmospheric marine boundary layer, which will be explored in EC-Earth. Centennial simulations (2005-2100) will be run with the standard and new versions of the models. The characteristics of these simulations will depend on the findings in CT3. If no mean-climate improvement is found for the Tropical Atlantic, only flux-corrected experiment will be performed. (CERFACS,MF-CNRM,UiB,UniRes,WU).

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	18.00
2	UCPH	12.00
3	CERFACS	12.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
5	MF-CNRM	3.00
12	WU	8.00
14	UniRes	2.00
15	IC3	24.50
16	UCM	6.00
	Total	85.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D11.1	Impact of model improvements on climate prediction	15	58.50	R	PU	48
D11.2	Impact of model improvements climate projections	1	27.00	R	PU	48
		Total	85.50			

Description of deliverables

D11.1) Impact of model improvements on climate prediction: Report on the impact of model improvements and interbasin teleconnections on the forecast quality of a range of climate predictions. [month 48]

D11.2) Impact of model improvements climate projections: Report on the impact of new parameterizations and flux-correction approaches on the tropical Atlantic climate projections for the rest of the XXI Century. [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS32	Initial analysis of skill meeting	11	19	SKYPE meeting to discuss initial analysis of skill of existing predictions/projections with WP11, meeting
MS35	New climate prediction experiments	15	42	New climate prediction experiments to assess improvements for the tropical Atlantic in terms of forecast quality
MS36	limate projections with new parameterizations and flux correction	1	42	Updated climate projections for the rest of the XXI Century.

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP12	Type of activity [54]	RTD
Work package title	Environmental and anthropogenic pressures on pelagic ecosystems and fisheries		
Start month	1		
End month	48		
Lead beneficiary number [55]	9		

Objectives

1. Disentangling environmental and anthropogenic pressures on pelagic fishes in the tropical Atlantic; stock development and spatial distribution (vertical and horizontal).

2. Analyse changes in total biomass and spatial (vertical and horizontal) distribution of major food web components.

Description of work and role of partners

We will investigate the relation of macrozooplankton distribution at various spatial scales to environmental parameters, mainly through a comparative analysis of the three Atlantic African Large Marine Ecosystems (LME) (Canary, Guinea, and Benguela). Exploited fish populations (Sardine, Sardinella, Horse Markel and Tuna) dynamics will be assessed in terms of prey availability and habitat variability. Then, taking advantage of the 30-year observation time series we will establish connections between large-scale oceanographic variability and changes in functional pelagic diversity. Particular attention will also be paid to the response (e.g. regime shift) of major exploited fish species to Tropical Atlantic climate. On the other side, habitat utilization patterns of tunas will be analysed around the Cape Verde islands applying catch statistics and new data gained through pop-up tagging experiments. We will test the hypothesis that changes in the oxygen minimum zone will differentially affect BET (bigeye tuna) and YFT (yellowfin tuna) population dynamics and thus impact the resilience of the two species against other stressors. We will further focus on large-scale changes in range and assemblage properties in the pelagic food web and analyze cumulative impacts on the fish compartment and associated ecosystem services.

Task 12.1 Disentangling hydroclimatic and anthropogenic effects on pelagic top predators and the impact of changes on sustainable harvest levels (TI, INDP, IRD)

Critical situations for stocks appear at times when severe environmental impacts coincide with impacts from fisheries. With fisheries mortality as density controlling factor, changes in the spatial distribution and utilization of habitat should be the effect of changing habitat quality, when at low densities key habitats should be preferred whereas at high densities also habitats of low quality should be utilized according to the ideal free distribution. First analyses on BET (Thunnus obesus) and YFT (Thunnus albacares) show no significant changes in range distributions (Worm and Tittensor, 2011), but both species have different habitat preferences with BET utilizing depths below the thermocline and tolerating low oxygen concentrations whereas YFT needs highly oxygenated waters above the thermocline, although occasional deep dives have been reported. Hence the analysis of habitat properties (including acoustic approach, see Bertrand et al., 2002) in the area is suggested a promising approach to track differential changes in horizontal and vertical habitat utilization. Methodically, pop-up tags that provide detailed behavioural data and allow for controlled experimental design without depending on uncertain fisheries tag return rates are applied (Weng et al., 2009). In time series analysis, amongst others partial moving time window analysis or analysis of residuals from population models may be applied to figure out the effects of different simultaneous impacts. Based on longline logbooks and catch statistics from the Cape Verde region and the eastern central Atlantic, shifts in the center of gravity of catches will be analyzed applying a stepwise climate envelope model including shifts in temperature, changes in OMZ, long-term fisheries data and ocean productivity. Strong cooperation with CECAF and ICCAT authorities is envisaged. Parallel to the analysis of predator dynamics, meso- and bathypelagic food web components will be analysed to obtain a description of the

prey field and quantify and model changes in vertical and horizontal distribution of these food web components. Differential responses may be expected with water depth, with higher rates of change in warmed surface waters vertically disconnecting food webs and thus effecting also mid-water and deep-sea habitats. Comparative data will be obtained along meridional transects resampling historical transects from the 1960' and 1970's to indicate both OMZ and climate related shifts in distribution and abundance. In line with the resampling, reanalysis data as input based on deliverables 5.2 and 9.1, and milestone M9.1 from WP5 and WP9 will be acquired to parameterize the bioclimatic envelope model. Output from centennial simulations (2005-2100) from WP11 will be acquired to develop scenarios for 2050 and 2100.

Task 12.2 Ocean climate variability effects on environmental conditions and small pelagic fish populations off West Africa during the last 30 years (IMR, IRD, INRH, ISRA, CRO, INIP, MFMR)

Although variations in pelagic fish populations are typically initiated by climate-induced changes in ocean forcing, the response in fish to this forcing tend to be a highly non-linear, as it is typically mediated through a myriad of trophic interactions with other ecosystem components. Accordingly, predictions of pelagic fisheries from climate variability must be based on local ecosystem structure (Drinkwater et al. 2010). There are cases, however, where a relatively good prediction of pelagic fish population changes responds, quite accurately, to large-scale indices of variability in the ocean climate. Off West Africa such a correspondence has been observed in the Benguela and northwest African upwelling regions. In both regions small pelagics play a central role in the ecosystem (Cury et al. 2000). This implies, among others, a good correspondence between pelagic population changes and large-scale indices on ocean climate; the agreement frequently observed in the eastern boundary upwelling systems (EBUS) systems (Alheit et al., 2009).

However, the strongest impact of Tropical Atlantic Variability on coastal fisheries will be "felt" not in the EBUS but in the low-latitude ecosystem, located within a 10-12 degree latitude band from the equator, on its both sides. Physical oceanographers refer to this region as the coastal waveguide (CW) because of the dominant physical forcing responsible for seasonal variability. Whether pelagic populations from the CW are tightly coupled to physical variability remains an open research question; firstly, because the principal physical mechanism that forces upwelling is not wind, but seasonal coastally trapped Kelvin waves (Verstraete, 1992) and, secondly, understanding the role of small pelagic fish in low-latitude ecosystems remains a major research challenge (Bakun, 2009).

The exploitation of an exceptional large database on the main exploited fish species (abundance, distribution and age structure: Sardina Pilchardus, Sardinella aurita, S. maderensis and Trachurus trecae) will provide solid basis to investigate the effect of environmental change on population's dynamics. Indeed IMR in cooperation with the partner institutions in Africa has been carried out annual or semiannual fish census surveys with RV Dr. Fridtjof Nansen off West Africa over 30 years. Moreover associated to fish census the RV Dr. Fridtjof Nansen has collected simultaneously data on oceanographic variability in the low-latitude ecosystem.

As one of the research topics within PREFACE project, we propose to investigate connections of large-scale variability of the Tropical Atlantic climate to the variability in oceanographic conditions and to the changes in the pelagic ecosystem observed over the low-latitude ecosystem of Gabon-Angola during the last 30 years. To our knowledge, this would be a first attempt to address such questions in this specific regional context. In particular, input from regional modeling undertaken in WP5 in terms of tropical-subtropical Atlantic simulations at medium (1/4°) resolution focusing on the equatorial and Gulf of Guinea as well as both east border upwelling system (Canaria and Bengula) will be acquired, referring to deliverables 5.2 and 9.1.

Task 12.3 Comparative analyses of spatiotemporal macrozooplankton distributions along three LMEs of the West coast of Africa related to environmental parameters and fish population dynamics and spatial structure (IRD, IMR, UMPC, INRH, ISRA, CRO, INIP, MFMR, ULB)

Zooplankton, and more specifically macrozooplankton (euphausiids -"krill" and jellyfish), are critical to the functioning of ocean foodwebs. Zooplanktons consume primary producers, microzooplankton and detritus, producing dissolved and particulate organic matter, thereby actively contributing to the remineralisation of nutrients. These biological cycles are key processes in the maintenance of the oxygen minimum zone (OMZ). Furthermore, zooplankton contributes to the export of matter to the ocean's interior with fast-sinking faecal pellets, via vertical migration (Carlotti and Poggiale, 2010). In turn, zooplankton is a main prey for a large variety of exploited and non-exploited fish. Zooplankton therefore performs a critical role in structuring higher and lower trophic levels, influencing the population dynamics of exploited species (Carlotti and Poggiale, 2010).

Zooplankton acts as beacons of climate change for a host of reasons. Firstly, zooplanktons are extremely sensitive to temperature (Mauchline, 1998). Secondly, most zooplankton species are short-lived (1 year), resulting in tight coupling of climate and population dynamics (Hays et al., 2005). In fact, plankton may be more sensitive indicators of change than environmental variables, because their non-linear responses can amplify subtle environmental signals (Taylor et al., 2002). Thirdly, zooplankton are generally not commercially exploited (except krill and jellyfish), so studies of long-term trends in response to environmental change are generally not confounded with trends in exploitation. Fourthly, the distribution of zooplankton can accurately reflect temperature and ocean currents because plankton are free floating, and most remain so for their entire life. Lastly, because almost all marine animals have a planktonic stage in their life cycles, alterations in the distribution of these groups are partially determined while floating in the zooplankton. Although some valuable zooplankton time-series exist, they are limited in spatial extent and mostly concern the mesozooplankton (Mackas and Beaugrand, 2009), excluding other important group such as macrozooplankton or gelatinous zooplankton, difficult to capture quantitatively with plankton nets (Mackas and Beaugrand, 2009). Zooplankton data is, in general, insufficient in quantity and quality (low resolution) for a mechanistic understanding of ecosystem dynamics (Mitra and Cabell, 2010). Acoustic surveys, however, offer continuous, high resolution, instantaneous observations of the ecosystem components, over large spatial and temporal data ranges (Brehmer, 2006). Acoustics, being properly integrated into interdisciplinary research programmes involving ecology and oceanography, as well as fisheries, can work as an integrator of the biotic and abiotic components of the ecosystem, leading to major advances in understanding marine ecosystem functioning (Koslow et al., 2009; Trenkel et al., 2011). A recent bi-frequency acoustic method developed in the Humboldt Current system by Ballón et al. (2011) and later applied in the Bay of Biscay (Lezama-Ochoa et al., 2011) allows for the extraction of continuous, high-resolution information on the biomass and distribution patterns of crustacean macrozooplankton, pelagic fish and other marine components.

In this context an important objective is to study the distribution of macrozooplankton in the tropical Atlantic and its further impact on exploited fish. For that purpose we need to have both a comparative and integrated approach. Comparative approach because climate variability, ecological processes and exploitation pressure is not similar in all ecosystems; integrated because the accessibility of information on macrozooplankton will help making the link between changes in physical conditions and the impact on fish and fisheries.

Macrozooplankton plays a key role in pelagic ecosystems at ecological and biogechemical levels more it is in close relation with lower trophic levels and fish populations. Their preys are highly sensitive to environmental variability and high resolution physical model should help to improve our knowledge on their dynamics. However, there is no information of the variability of the mid trophic compartment along the west coast of the African continent. We propose to work mainly on the acoustic data collected in the area using the same methodology device and vessel (RV Dr. F. Nansen) as well as on remote sensing data collected in West Africa since 1983.

The objective will be to get a broad knowledge on the macrozooplankton distribution at meso and macro scale according to comparative analysis on the three Large Marine Ecosystem (Canaria, Guinea, and Benguela), related to environmental parameters. Each of these Atlantic tropical regions has a unique set of climatic and oceanic conditions. However, they also share common characteristics, like the two EBUS. At the methodological level we will adapt a bi-frequency (for long data series) and multi-frequency (on single survey) acoustic analysis using previous model developed on the Humboldt Current system as well as geostatistical analysis. This method can be used to extract continuous and simultaneous high-resolution information on the spatiotemporal patterns of biomass distributions of macrozooplankton and pelagic fish throughout the diel cycle and one an annual basis. The dynamic of exploited fish population assessed each year will be then re-analyzed according to prey availability and environmental parameters. i) Apply the multi-frequency acoustic method and derivation of classification algorithms (Ballón et al., 2011, Lezama-Ochoa et al., 2011) to routine acoustic data from the three LMEs of West Africa, and a try to apply passive acoustics methodologies to improve description of oceangraphyic feature and set future development of acoustic observatory. ii) Describe the spatiotemporal patterns of macrozooplankton biomass distribution in the three West African LME iii) Synthesize the impact of macrozooplankton on fish exploited resources and iv) perform a comparative analysis between the three LME (Grados et al., 2012).

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
4	IRD	76.00
6	UPMC	4.50
9	TI	45.00
13	IMR	13.00
18	INIP	38.00
19	MFMR	59.00
21	INDP	59.00
22	INRH	59.00
23	ISRA	59.00
26	CRO	90.00
28	ULB	0.50
	Total	503.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D12.1	Retrospective bioclimatic analysis	9	93.00	R	PU	36
D12.2	Bioclimatic modeling	9	97.00	R	PP	42
D12.3	Report on macrozooplankton distributions	4	158.50	R	PP	42
D12.4	Climate variability and pelagic fish	13	154.50	R	PU	48
		Total	503.00			

Description of deliverables

D12.1) Retrospective bioclimatic analysis: Report describing retrospective bioclimatic analysis of food web components. [month 36]

D12.2) Bioclimatic modeling: Bioclimatic modeling tuna and prey field dynamics according to scenarios [month 42]

D12.3) Report on macrozooplankton distributions: Comparative analysis of spatiotemporal macrozooplankton distributions [month 42]

D12.4) Climate variability and pelagic fish: Report on oceanographic mechanisms and recent climate variability affecting small pelagic fish population changes equatorward of the Canary Current and Benguela Upwelling Systems. [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS28	Seasonal to interannual TAV meeting	20	30	Meeting to discuss the mechanisms of seasonal to interannual variability among CT2, CT4, CT3
MS37	EAF data extracted	13	12	Extraction and collation of data subsets relevant to the analyses from EAF-Nansen database, report
MS38	Meso and bathypelagic records	9	12	Completion of database on historical meso and bathypelagic records from tropical and sub-tropical Atlantic Ocean, data
MS39	Final methodology and data analysis	4	24	Analysis of time-series of Sardinella spp. and Trachurus spp. by length classes 1994-2014, based on distribution maps and geostatistical structural analysis, report
MS40	Tagging survey	9	30	Completion of field phase in tagging experiments, report
MS41	Bioclimatic modeling meso- and bathyplegaic food web	9	36	Completion of field phase meso- and bathyplegaic food web components and bioclimatic modelling, link with MS38, report
MS42	Bioclimatic modeling on tuna	9	48	Bioclimatic modeling tuna tagging experiments and prey field dynamics in combination with biotic and abiotic data of their habitat according to scenarios under WP10 and WP11, Synthesis, link MS40 & 41
MS43	Spatio-temporal distribution of fish and zooplankton	4	36	Acoustic and trawl sampling database analysis for macrozooplakton and small pelagic fish

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS44	Coastal waveguide and pelagic fish distribution	13	36	Analysis of impacts of El-Niño-like events on distribution of pelagic fish; based on acoustic-survey data, satellite imagery and process studies [Link with WP4 and MS39], report
MS45	Pelagic fish and prey field dynamics in their habitat	4	48	Synthesis pelagic fish and prey field dynamics in combination with abiotic and biotic data of their habitat [link with CT2 and MS42], report
MS46	Mid-term progress workshops	13	6	Workshops scheduled at months 6,18,30,42, mainly to coordinate analysis of EAF Nansen data in WP12, WP13

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP13	Type of activity [54]	RTD
Work package title	Evaluating environmental and socio-economic effects of climate change on small scale fisheries		
Start month	1		
End month	48		
Lead beneficiary number [55]	10		

Objectives

The main objective of WP13 is to understand the effect of climate change on small scale fisheries and coastal communities in selected West African countries and to derive an understanding of the effect of uncertainty in projections and possible implications for management.

Specific Objectives

1. Using historic oceanographic data like sea surface temperature or model hindcast data to identify the environmental effect on the stock development of key species and derive environmental sensitive single-stock models for those.

2. Compare the environmental effect on key species from different coupled climate-ocean models to understand the uncertainty of projections.

3. Understand the potential effect of different model projections on management of key species with focus on small scale fisheries.

4. Understand the perceived and realized threats to small scale fisheries communities.

Description of work and role of partners

The main objective of WP13 is to understand the effect of climate change on small scale fisheries and coastal communities and to derive an understanding of the effect of uncertainty in projections and possible implications for management and fishing communities. It will (i) develop coupled ecological-economic models for key species and (ii) investigate perceived and realised threats for coastal fishing communities.
In Africa, fisheries play an important economic, social and environmental role. Historically, in South Africa and other countries, research and data collection pertaining to the oceans mainly focused on exploited fish populations and their management. In recent years, however, uncertainty associated with effects of changing environmental conditions on marine ecosystems has prompted scientists to suggest the adoption of a precautionary approach with a shift in policy focus towards an ecosystem-based approach (Bottsford et al. 1997; Link, 2002; Pikitch et al. 2004). Although distant water fleets are currently a major pressure on stocks in West Africa and thus the local fisheries, global warming will be an important and likely irreversible additional pressure (Sumaila et al. 2011, Lam et al. 2012).

Task 13.1 Develop coupled ecological-economic models for key species (CAU, IRD, ISRA, UNN, INDP, INRH)

Environmentally sensitive single species models (Voss et al. 2011, Tahvonen et al. 2013) will be developed to simulate historic and future evolution of fish population dynamics using results and data from other PREFACE WPs: Generic age structured ecological-economic models will be parameterized for important commercial fish stocks using environmentally sensitive stock-recruitment models derived from WP12 (D12.1, 12.2, and 12.3). These will be used to simulate historic (using data from WP5) and future (using data from WP10 or directly from WP11) development of these stocks.

The economic-ecological models are age structured single and multispecies fish stock models. They include an environmentally sensitive stock-recruit relationship, age specific selectivity, natural mortality with explicit

predation mortality, fish price and cost of harvesting. As the influence of environmental variability for key parameters like growth or recruitment is modeled, the output of coupled climate-ocean models, e.g. upper ocean temperature, can be used directly. An example of an application with a more advanced age-structured model can be found in Voss et al. (2010) here the temperature influences the stock-recruit relationship and the development of the stock is investigated under different climate scenarios. The objective function of the models can be set to maximize harvest of biomass or maximize profit (or any other reasonable objective within the parameter set). The results are vectors of fishing mortality, biomass, harvest and profit. The key biological processes for key species should be obtained from WP12. The biological work should ideally identify the crucial environmentally sensitive processes in stock development to adjust the models accordingly. Thus if possible, the models should be species specific. Within WP13 we also aim on estimating costs of harvesting and prices for these key species. We are aware of the difficulty in obtaining sufficient data and plan to corporate closely with organizations in Africa involved with data collection and analysis (FAO/CECAF, Fishery Committee for the Eastern Central Atlantic; the Subregional Fisheries Commission (SRFC) and others).

Optimal harvest will be compared to realized harvest to assess possibilities for enhanced management. Given the dependence of adjacent countries on fish as an important source for food, the optimization goal might be maximum harvest. However runs with different objectives (maximal harvest, maximal profit) can be made. If data on interactions between key species is available, this can be included into the models to estimate optimal harvest under interaction constraints (multispecies models).

Task 13.2 Investigate perceived and realised threats for coastal fishing communities (CAU, IRD, ISRA, UNN, INDP, INRH)

West African Coastal communities, and in particular fishermen, face various risks in their everyday life (uncertainty about the success of fishing, uncertain prices for fish and inputs such as fuel, and many more). Climate change puts additional risks and threats on top of this. We will use (a) field survey and economic experiments among West African fishing communities to assess how fishermen and -women perceive these risks and how they cope with them. We will (b) combine this empirical approach with ecological-economic models (from Task 13.1) of the local fisheries to study the impact of these extra risks on the vulnerability and resilience of West African fishing communities. Two specific hypotheses are (i) that the current risks are already so large that the predicted extra risk has no effect at all or (ii) that the predicted extra risk could mean that a tipping point is crossed, i.e. local fishing communities might not be resilient against these extra threads.

To investigate the resilience of local fishing communities the following coping mechanisms will be included in the framework: credit and insurance markets, and outside options. Elicitation of small-scale fishers risk preferences helps to assign values to improve the understanding about future environmental change and to perform a descriptive socio-economic impact study. In addition, policy measures intended to improve coping mechanisms for small-scale fisheries (e.g. investing in education to improve outside options) benefit both from better predictions and knowledge about the current state of resilience.
The work shall encompass the difference between the different African regions with respect to work already accomplished in other projects or programmes. The close collaboration to the existing projects, LME programmes, the World Bank or other United Nations programmes should guarantee the efficient use of resources.

This WP also contributes to the following common deliverables:

D2.6) Final project meeting in Africa, with dissemination workshop: Organise the final project meeting to be hosted by an African partner, including a session directed at policy makers and stake holders in the region including specifically the outcome of WP13 [Month 48].

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
4	IRD	8.00
10	CAU	42.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
21	INDP	59.00
22	INRH	59.00
23	ISRA	59.00
27	UNN	28.00
	Total	255.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D13.1	Report on models	10	73.00	R	PU	30
D13.2	Report of survey results	10	95.00	R	PU	42
D13.3	Report of impact analysis	10	87.00	R	PU	48
		Total	255.00			

Description of deliverables

D13.1) Report on models: This report contains a description of the generic models, the data collected, and the species specific models with reference to an online repository if applicable [month 30]

D13.2) Report of survey results: This report contains a summary of all conducted questionnaire surveys and experiments and reference to an online repository with raw data if applicable (confidentiality rules applied) [month 42]

D13.3) Report of impact analysis: This report describes the methodology used and the results of the impact analysis, supported by one or more policy briefs if applicable [month 48]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS46	Mid-term progress workshops	13	6	Workshops scheduled at months 6,18,30,42, mainly to coordinate analysis of EAF Nansen data in WP12, WP13
MS47	Development of generic model framework	10	12	Based on a literature review and own data a generic model framework for ecological-economic models will be developed
MS48	Definition of data needs	10	12	Necessary biological and environmental data to

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
				parameterize the generic models for key species, provided from other work packages will be defined
MS49	Collection of data	10	20	The data for key species will be collected and collated in a data base
MS50	Model development	23	24	Species specific environmentally sensitive ecological-economic models for key commercial species will be developed
MS51	Questionnaire development	10	24	Field surveys and economic experiments to assess how fishermen and -women perceive risks and how they cope with them will be developed
MS52	Surveys conducted	10	36	The surveys performed in different countries will be collated in one database

WT3:
Work package description

Project Number [1]	603521	Project Acronym [2]	PREFACE

One form per Work Package

Work package number [53]	WP14	Type of activity [54]	RTD
Work package title	Data and information management		
Start month	1		
End month	48		
Lead beneficiary number [55]	1		

Objectives

This WP undertakes to facilitate high-level data management and efficient communication with in the project.

Specific objectives

1. To establish and maintain a platform for data server for sharing data generated in PREFACE

2. To implement and maintain software for disseminating results across the web, and for internal communication

Description of work and role of partners

Task 14.1 Management and dissemination of PREFACE data (UiB)

This will involve the management of both observational and modeling data generated within PREFACE, with the intention of facilitating effective internal data sharing, but also allow sharing of data with groups outside of PREFACE. These groups may include both endusers and external collaborators.
Observational data management implies (UiB):

• data actions: rescue; acquisition; harmonization; assimilation; formatting; processing; archival; integration; quality control; attribution to PI; documentation; sharing; online access; long-term preservation; synthesis; dissemination; visualization.

• management components: networking among the scientific and database partners; according to international standards and protocols (ISO, SOAP, WSDL, XML); structuring and organizing data flow between and among core themes, WPs, data centers, and with other EC funded projects (eg EU AMMA) according to intellectual property rights as stated in the PREFACE data policy; timely data exchange and collaboration with international partners/projects is strongly encouraged; feeding metadata and data streams into international programs (eg. GEO, GEOSS and GMES; NASA's GCMD; providing access (according to intellectual property rights) to all PREFACE data (observed and modelled data) while elaborating a comprehensive short term (data rescue) and long term (data preservation) data management plan; providing an appropriate data policy with respect to ESF and ICSU/CODATA "Good scientific practice in research", the WIPO copyright treaty 3, and the DOE-NIH Guidelines for Sharing Data and Resources 4 organizing and participating to regular data and information management meetings.

Model data management implies (UiB):

1. Although all modelling centres are responsible for archiving their own simulations, a data server will be maintained at UiB for the sharing of subsets of agreed data from various model simulations to facilitate joint analysis will be set up.

2. Access to all PREFACE partners will be provided to the server

3. The server will also be configured to enable part of the data to be shared with the wider scientific community

Task 14.2 Historic oceanographic and fisheries data from the EAF-Nansen program (IMR):

EAF Nansen (http://www.eaf-nansen.org) is a FAO-coordinated program performing regular fish monitoring surveys with the research vessel “Dr. Fridtjof Nansen” around Africa since 1980s. This is a development and capacity program with the objectives centered at providing survey-based information in aid of sustainable fisheries management to developing countries; the surveys in the framework of this program have covered practically all territorial waters of the West Africa’s coastal countries. During its 30 years in operation, this program has conducted well over 200 surveys, which covered the continental shelf to a depth 700-1000 m and provided core fisheries and supporting oceanographic data. This program does not assume ownership of the collected data. All collected data are immediately transferred to a country or organization over which territorial jurisdiction a survey has been conducted. It is up to that owner to decide how to use this data and whether to share it. In practice, it is exclusively the fisheries data, which has been used in post-survey analyses, mainly in the framework of FAO-led regional workshops supporting capacity building and regional stock assessment programs. In all these initiatives, the exclusive ownership of the data and equal participation of the countries has been strictly observed. PREFACE is perhaps the first continental-scale climate project of its size, which requests access to the entire EAF Nansen data collection, including oceanographic data. This poses the two main challenges. The first challenge is to conform to the FAO rules of the exclusive data ownership and equal participation for the African countries; the second challenge is to retrieve and consolidate a research quality archive from the data that are dispersed between 15 or so individual African partners.

The direct participation in the project tasks of a significant proportion of the African data owners, and the close collaboration with the other owners through parallel capacity building activities in the region (Section 3.1) is the PREFACE response on the first challenge. PREFACE will process only the data that are released explicitly to the project by the African data owners and will provide feedbacks to them on a purpose the released data has been used. The ownership of data used in publications will always be acknowledged. The progress in PREFACE will be regularly updated through participation in regional workshops or conferences organized by the FAO or West African LMEs.

Responding on the second challenge, PREFACE involves the Center for Development and Coordination in Fisheries (CDCF). The CDCF is a department at IMR (Partner 13) responsible for the coordination of the EAF Nansen surveys. The CDCF maintains a backup archive of all data collected with the program since 1985 but do not have the ownership rights to those data. However, the CDCF has a data management infrastructure networked to the owners of the EAF Nansen data. Throughout the PREFACE lifetime, the CDCF data manager will work closely with the EAF Nansen partners in Africa to request the necessary authorizations, and once those are obtained, will release the data from the local archive to a respective PREFACE requester. This activity is designed as a data service, and will be available to PREFACE from within the first two months of the project (Deliverable 2.6).

Task 14.3 Develop and maintain a communication platform (UiB):

The data manager will perform this task, which consists of two components

1. Supply a pivotal communication platform (e.g. project website, document server for internal and external sharing, electronic mailing lists for internal and external distribution).

2. Implement and maintain a sophisticated project management module to guarantee efficient and smooth flow of information. This module will be based on open source software, such as Redmine (http://www.redmine.org/) or ProjectPier (http://www.projectpier.org/) and these will be adapted by the data manager to fit the needs of the project. Redmine is already used at UiB for project management.

Task 14.4 Organise workshops for analysis of data (IMR)

Additional workshops/progress meetings for partners involved in the analysis of observational data, mainly from EAF Nansen data (MS46, WP12, WP13). These will aid data sharing among partners and ensure a close collaboration on the analysis of these data. It is envisaged these meetings will strengthen cooperation among African partners. These meetings will take part mid-term between general assemblies. Similar workshops will also be held as side events to general assemblies, but no additional costs are required for these.

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	UiB	6.00
13	IMR	4.50
	Total	10.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D14.1	Communication system	1	1.00	O	CO	1
D14.2	Data and information management implementation plan	1	1.00	R	PP	2
D14.3	EAF Nansen data service	13	4.50	O	RE	3
D14.4	PREFACE model and observational database	1	4.00	O	RE	6
		Total	10.50			

Description of deliverables

D14.1) Communication system: Set up of the projects communication system [month 1]

D14.2) Data and information management implementation plan: Define PREFACE data and information management implementation plan (short/long term) and data policy. Presented draft plan and policy during kick-off meeting and finalise thereafter. [month 2]

D14.3) EAF Nansen data service: Data service for the EAF Nansen surveys at CDCF operational, with information provided on the internal PREFACE website. [month 3]

D14.4) PREFACE model and observational database: Databases of observational data and selected model data: Databases of observational data; databases of selected model data (continuously updated, Month 6, 12, 24, 36) [month 6]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS46	Mid-term progress workshops	13	6	Workshops scheduled at months 6,18,30,42, mainly to coordinate analysis of EAF Nansen data in WP12, WP13
MS53	Data management	1	3	Data management in full operation

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS54	EAF data inventory	13	3	Create an inventory of EAF Nansen surveys off West Africa

WT4:
List of Milestones

Project Number [1]	603521	Project Acronym [2]	PREFACE

List and Schedule of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS1	Consortium agreement	WP1	1	1	Consortium agreement signed
MS2	Meeting on FP7 cooperation	WP1	1	3	Conference call to determine the level of cooperation between PREFACE and other projects funded to work in the region.
MS3	Decision on second summer school	WP2	1	18	Contact Bergen Research Summer School about potentially organising a second summer school in 2017 on a PREFACE related theme
MS4	PREFACE PIRATA buoy installation	WP3	4	12	The PREFACE PIRATA buoy measuring meteorological and oceanographic parameters will be installed at 6°S, 8°E. Real-time data availability will be set up through PIRATA web interfaces.
MS5	1st year-Glider/ Turbulence measurements along southeastern boundary	WP3	7	12	Hydrographic and microstructure measurements will have been performed of southwest Africa to fill data gaps for seasonal mixed layer heat and freshwater flux estimates.
MS6	2nd year maintenance of the PREFACE PIRATA buoy	WP3	4	24	The PREFACE PIRATA buoy will be recovered and redeployed. High resolution data from the meteorological and oceanographic sensors from the 1st year will be available through PIRATA web interface.
MS7	2nd year-Glider/ Turbulence measurements along southeastern boundary	WP3	7	24	2nd year hydrographic and microstructure measurements will have been performed of southwest Africa to contribute to estimates of interannual variability

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
					of mixed layer heat and freshwater fluxes.
MS8	3rd year maintenance of the PREFACE PIRATA buoy	WP3	4	36	The PREFACE PIRATA buoy will be recovered and redeployed. High resolution data from the 2nd year will be available through PIRATA web interface.
MS9	3rd year-Glider/ Turbulence measurements along southeastern boundary	WP3	7	36	3rd year hydrographic and microstructure measurements will have been performed of southwest Africa to contribute to estimates of interannual variability of mixed layer heat and freshwater fluxes.
MS10	Mooring_1 0N 0E	WP4	4	12	Install equatorial subsurface mooring at 0E, report
MS11	Mooring 20S Shelf	WP4	8	12	Install mooring on the shelf at 20S, report
MS12	Cruise 2014	WP4	7	12	Perform first PREFACE southeastern boundary current cruise 2014, report
MS13	Mooring_2 0N 0E	WP4	4	24	Redeploy equatorial subsurface mooring at 0E, report
MS14	Cruise 2015	WP4	7	24	Perform second PREFACE southeastern boundary current cruise 2015, report
MS15	Mooring_3 0N 0E	WP4	4	36	Redeploy equatorial subsurface mooring at 0°, report
MS16	Cruise 2016	WP4	7	36	Perform third PREFACE southeastern boundary current cruise 2016, report
MS17	Annual WP5 meeting	WP5	6	6	Annual meeting with other CT2 partners to establish best practices for model/observations comparison, compare different model skills, and infer strategies to improve forced models. Months 6, 18, 30

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS18	Forced models reference experiments	WP5	8	12	Coordinate and produce interannual simulations of different models with yearly updated realistic atmospheric forcing. Month 12, 24, and 36.
MS19	Forced models test experiments	WP5	4	24	Conduct the necessary process study experiments to interpret WP3/4 observational and model analyses and evaluate the relative role of different tested processes
MS20	Agreement on common methodology for initial drift analysis	WP6	3	1	Meeting to discuss diagnostics and analysis strategies to employ for analysing bias development (Task6.1); Document listing the agreed upon diagnostic model output to provide/analyse.
MS21	Results from initial-drift analysis	WP6, WP7	14	12	Workshop on bias development from existing s2d integrations, and for the design of common experiments, flux-correction and decoupling strategies. Minutes of meeting made available on the internal webs
MS22	Coordinated experiments	WP6	7	30	Task 6.2 coordinated experiments performed and shared with Tasks 7.1 and 8.3. Data and results made available to all CT3 and WP11 partners, data
MS23	Targeted sensitivty experiments	WP6	2	42	Task 6.3: shared document with short description of experiments under Tasks 6.3 by all participating groups, and first results, report
MS24	Model bias-correction methods	WP6, WP7, WP8	12	24	One-day workshop to discuss WP6 recommendations, and to determine model modifications for bias-correction

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
					experiments in Task 7.2. Minutes will be kept.
MS25	Basic set of bias-correction experiments	WP7	27	34	Completion of a basic, coordinated set of bias-correction experiments. Output data made available to all project participants.
MS26	Remote biases in existing simulations, and proposed sensitivity experiments	WP8	27	12	Report on the analysis of CMIP5 simulations. List of major biases, together with possible decadal modulations.
MS27	Results from sensitivity experiments	WP8	12	42	Analysis of sensitivity tests and smiulations and list of conclusions. Data from sensitivity experiments made available.
MS28	Seasonal to interannual TAV meeting	WP5, WP7, WP8, WP9, WP12	20	30	Meeting to discuss the mechanisms of seasonal to interannual variability among CT2, CT4, CT3
MS29	WP9 experiments completed	WP9	16	30	Conclusion of all the WP9 set of experiments
MS30	Existing s2d prediction data retrieved	WP6, WP10	11	6	Retrieval of selected experiments from existing datasets (e.g. CMIP5 decadal hindcasts, EUROSIP and SPECS seasonal predictions, ENSEMBLES, DEMETER) and preliminary assessment of simulated spatial-temp
MS31	Existing statistical tool adapted	WP10	11	6	An existing statistical tool will be adapted to predict SST anomalies in remote regions due to Atlantic remote influence
MS32	Initial analysis of skill meeting	WP10, WP11	11	19	SKYPE meeting to discuss initial analysis of skill of existing predictions/projections with WP11, meeting
MS33	Bayesian hierarchical model	WP10	11	24	Development of the Bayesian hierarchical model for describing space-time error dependences; Full-assessment

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
					of space-time error dependences based on the Bayesian hierarchical approach, model
MS34	Bayesian regression model	WP10	11	36	Development of the Bayesian regression model for optimal combination of ensemble forecasts and recalibration, model
MS35	New climate prediction experiments	WP11	15	42	New climate prediction experiments to assess improvements for the tropical Atlantic in terms of forecast quality
MS36	limate projections with new parameterizations and flux correction	WP11	1	42	Updated climate projections for the rest of the XXI Century.
MS37	EAF data extracted	WP12	13	12	Extraction and collation of data subsets relevant to the analyses from EAF-Nansen database, report
MS38	Meso and bathypelagic records	WP12	9	12	Completion of database on historical meso and bathypelagic records from tropical and sub-tropical Atlantic Ocean, data
MS39	Final methodology and data analysis	WP12	4	24	Analysis of time-series of Sardinella spp. and Trachurus spp. by length classes 1994-2014, based on distribution maps and geostatistical structural analysis, report
MS40	Tagging survey	WP12	9	30	Completion of field phase in tagging experiments, report
MS41	Bioclimatic modeling meso- and bathyplegaic food web	WP12	9	36	Completion of field phase meso- and bathyplegaic food web components and bioclimatic modelling, link with MS38, report
MS42	Bioclimatic modeling on tuna	WP12	9	48	Bioclimatic modeling tuna tagging experiments and prey field dynamics in combination with biotic and abiotic data of their habitat according to

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
					scenarios under WP10 and WP11, Synthesis, link MS40 & 41
MS43	Spatio-temporal distribution of fish and zooplankton	WP12	4	36	Acoustic and trawl sampling database analysis for macrozooplakton and small pelagic fish
MS44	Coastal waveguide and pelagic fish distribution	WP12	13	36	Analysis of impacts of El-Niño-like events on distribution of pelagic fish; based on acoustic-survey data, satellite imagery and process studies [Link with WP4 and MS39], report
MS45	Pelagic fish and prey field dynamics in their habitat	WP12	4	48	Synthesis pelagic fish and prey field dynamics in combination with abiotic and biotic data of their habitat [link with CT2 and MS42], report
MS46	Mid-term progress workshops	WP12, WP13, WP14	13	6	Workshops scheduled at months 6,18,30,42, mainly to coordinate analysis of EAF Nansen data in WP12, WP13
MS47	Development of generic model framework	WP13	10	12	Based on a literature review and own data a generic model framework for ecological-economic models will be developed
MS48	Definition of data needs	WP13	10	12	Necessary biological and environmental data to parameterize the generic models for key species, provided from other work packages will be defined
MS49	Collection of data	WP13	10	20	The data for key species will be collected and collated in a data base
MS50	Model development	WP13	23	24	Species specific environmentally sensitive ecological-economic models for key commercial species will be developed
MS51	Questionnaire development	WP13	10	24	Field surveys and economic experiments to assess how fishermen and -women perceive risks and

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
					how they cope with them will be developed
MS52	Surveys conducted	WP13	10	36	The surveys performed in different countries will be collated in one database
MS53	Data management	WP14	1	3	Data management in full operation
MS54	EAF data inventory	WP14	13	3	Create an inventory of EAF Nansen surveys off West Africa

WT5:
Tentative schedule of Project Reviews

Project Number [1]	603521	Project Acronym [2]	PREFACE

Tentative schedule of Project Reviews

Review number [65]	Tentative timing	Planned venue of review	Comments, if any

WT6:
Project Effort by Beneficiary and Work Package

Project Number [1]	603521	Project Acronym [2]	PREFACE

Indicative efforts (man-months) per Beneficiary per Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	WP 9	WP 10	WP 11	WP 12	WP 13	WP 14	Total per Beneficiary
1 - UiB	24.00	18.00	0.00	6.00	0.00	18.00	12.00	9.00	9.00	6.00	18.00	0.00	0.00	6.00	126.00
2 - UCPH	0.00	0.00	6.00	0.00	6.00	12.00	0.00	0.00	0.00	0.00	12.00	0.00	0.00	0.00	36.00
3 - CERFACS	0.00	0.00	0.00	0.00	0.00	22.00	22.00	0.00	6.00	0.00	12.00	0.00	0.00	0.00	62.00
4 - IRD	0.00	0.00	27.00	2.00	22.00	0.00	0.00	0.00	0.00	0.00	0.00	76.00	8.00	0.00	135.00
5 - MF-CNRM	0.00	0.00	5.00	0.00	0.00	20.00	15.00	5.00	0.00	0.00	3.00	0.00	0.00	0.00	48.00
6 - UPMC	0.00	0.00	5.00	0.00	19.50	8.00	9.00	1.00	1.00	0.00	0.00	4.50	0.00	0.00	48.00
7 - GEOMAR	0.00	0.00	18.00	12.00	12.00	18.00	15.00	9.00	6.00	0.00	0.00	0.00	0.00	0.00	90.00
8 - IOW	0.00	0.00	3.00	26.00	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00
9 - TI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.00	0.00	0.00	45.00
10 - CAU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.00	0.00	42.00
11 - UNIVE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	0.00	0.00	0.00	0.00	48.00
12 - WU	0.00	0.00	0.00	0.00	0.00	24.00	24.00	0.00	0.00	0.00	8.00	0.00	0.00	0.00	56.00
13 - IMR	0.00	0.00	2.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	0.00	4.50	34.50
14 - UniRes	0.00	0.00	0.00	0.00	0.00	16.00	3.00	6.00	0.00	0.00	2.00	0.00	0.00	0.00	27.00
15 - IC3	0.00	0.00	0.00	0.00	0.00	6.00	6.00	0.00	6.00	4.50	24.50	0.00	0.00	0.00	47.00
16 - UCM	0.00	0.00	0.00	0.00	0.00	0.00	6.00	22.00	20.00	6.00	6.00	0.00	0.00	0.00	60.00
17 - UREAD	0.00	0.00	0.00	0.00	0.00	9.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00
18 - INIP	0.00	0.00	40.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.00	0.00	0.00	118.00
19 - MFMR	0.00	0.00	0.00	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	0.00	0.00	118.00
20 - UCT	0.00	0.00	0.00	68.00	10.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00	128.00
21 - INDP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	59.00	0.00	118.00

WT6:
Project Effort by Beneficiary and Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	WP 9	WP 10	WP 11	WP 12	WP 13	WP 14	Total per Beneficiary
22 - INRH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	59.00	0.00	118.00
23 - ISRA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.00	59.00	0.00	118.00
24 - UCAD	0.00	0.00	6.00	6.00	3.00	6.00	4.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	27.00
25 - UAC	0.00	0.00	44.00	0.00	74.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	118.00
26 - CRO	0.00	0.00	16.00	0.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00	90.00	0.00	0.00	118.00
27 - UNN	0.00	0.00	0.00	0.00	0.00	0.00	30.00	30.00	30.00	0.00	0.00	0.00	28.00	0.00	118.00
28 - ULB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50
Total	24.00	18.00	172.00	234.00	177.50	159.00	146.00	86.00	128.00	66.50	85.50	503.00	255.00	10.50	2,065.00

WT7:
Project Effort by Activity type per Beneficiary

Project Number [1]	603521	Project Acronym [2]	PREFACE

Indicative efforts per Activity Type per Beneficiary

Activity type	Part. 1 UiB	Part. 2 UCPH	Part. 3 CERFACS	Part. 4 IRD	Part. 5 MF-CNRM	Part. 6 UPMC	Part. 7 GEOMAR	Part. 8 IOW	Part. 9 TI	Part. 10 CAU	Part. 11 UNIVE	Part. 12 WU	Part. 13 IMR	Part. 14 UniRes
1. RTD/Innovation activities														
WP 3	0.00	6.00	0.00	27.00	5.00	5.00	18.00	3.00	0.00	0.00	0.00	0.00	2.00	0.00
WP 4	6.00	0.00	0.00	2.00	0.00	0.00	12.00	26.00	0.00	0.00	0.00	0.00	15.00	0.00
WP 5	0.00	6.00	0.00	22.00	0.00	19.50	12.00	19.00	0.00	0.00	0.00	0.00	0.00	0.00
WP 6	18.00	12.00	22.00	0.00	20.00	8.00	18.00	0.00	0.00	0.00	0.00	24.00	0.00	16.00
WP 7	12.00	0.00	22.00	0.00	15.00	9.00	15.00	0.00	0.00	0.00	0.00	24.00	0.00	3.00
WP 8	9.00	0.00	0.00	0.00	5.00	1.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
WP 9	9.00	0.00	6.00	0.00	0.00	1.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WP 10	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.00	0.00	0.00	0.00
WP 11	18.00	12.00	12.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00	2.00
WP 12	0.00	0.00	0.00	76.00	0.00	4.50	0.00	0.00	45.00	0.00	0.00	0.00	13.00	0.00
WP 13	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	0.00	42.00	0.00	0.00	0.00	0.00
WP 14	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.50	0.00
Total Research	84.00	36.00	62.00	135.00	48.00	48.00	90.00	48.00	45.00	42.00	48.00	56.00	34.50	27.00
2. Demonstration activities														
Total Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Consortium Management activities														
WP 1	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Management	24.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

WT7:
Project Effort by Activity type per Beneficiary

4. Other activities														
WP 2	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total other	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Total	126.00	36.00	62.00	135.00	48.00	48.00	90.00	48.00	45.00	42.00	48.00	56.00	34.50	27.00

WT7:
Project Effort by Activity type per Beneficiary

Activity type	Part. 15 IC3	Part. 16 UCM	Part. 17 UREAD	Part. 18 INIP	Part. 19 MFMR	Part. 20 UCT	Part. 21 INDP	Part. 22 INRH	Part. 23 ISRA	Part. 24 UCAD	Part. 25 UAC	Part. 26 CRO	Part. 27 UNN	Part. 28 ULB	Total
1. RTD/Innovation activities															
WP 3	0.00	0.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00	6.00	44.00	16.00	0.00	0.00	172.00
WP 4	0.00	0.00	0.00	40.00	59.00	68.00	0.00	0.00	0.00	6.00	0.00	0.00	0.00	0.00	234.00
WP 5	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	3.00	74.00	12.00	0.00	0.00	177.50
WP 6	6.00	0.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	0.00	0.00	159.00
WP 7	6.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00	30.00	0.00	146.00
WP 8	0.00	22.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	0.00	86.00
WP 9	6.00	20.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00	0.00	128.00
WP 10	4.50	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	66.50
WP 11	24.50	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	85.50
WP 12	0.00	0.00	0.00	38.00	59.00	0.00	59.00	59.00	59.00	0.00	0.00	90.00	0.00	0.50	503.00
WP 13	0.00	0.00	0.00	0.00	0.00	0.00	59.00	59.00	59.00	0.00	0.00	0.00	28.00	0.00	255.00
WP 14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.50
Total Research	47.00	60.00	13.00	118.00	118.00	128.00	118.00	118.00	118.00	27.00	118.00	118.00	118.00	0.50	2,023.00
2. Demonstration activities															
Total Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Consortium Management activities															
WP 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00
Total Management	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.00
4. Other activities															
WP 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00
Total other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00

WT7:
Project Effort by Activity type per Beneficiary

Total	47.00	60.00	13.00	118.00	118.00	128.00	118.00	118.00	118.00	27.00	118.00	118.00	118.00	0.50	2,065.00

WT8:
Project Effort and costs

Project Number [1]	603521	Project Acronym [2]	PREFACE

Project efforts and costs

Beneficiary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs	
1	UiB	126.00	919,739.00	6,000.00	185,310.00	663,029.40	1,774,078.40	1,464,243.00
2	UCPH	36.00	180,706.00	0.00	54,000.00	140,823.60	375,529.60	281,646.00
3	CERFACS	62.00	372,000.00	0.00	30,000.00	241,200.00	643,200.00	321,600.00
4	IRD	135.00	473,743.00	0.00	337,015.00	486,454.80	1,297,212.80	972,908.00
5	MF-CNRM	48.00	359,980.00	0.00	55,000.00	82,996.00	497,976.00	355,172.00
6	UPMC	48.00	264,483.92	0.00	206,992.00	282,885.55	754,361.47	479,590.00
7	GEOMAR	90.00	549,921.00	6,000.00	224,000.00	464,352.60	1,244,273.60	934,704.00
8	IOW	48.00	251,950.00	98,000.00	105,000.00	214,170.00	669,120.00	502,340.00
9	TI	45.00	259,109.00	0.00	35,000.00	176,465.40	470,574.40	352,930.00
10	CAU	42.00	250,400.00	23,000.00	62,000.00	187,440.00	522,840.00	392,380.00
11	UNIVE	48.00	207,142.00	0.00	28,600.00	141,445.20	377,187.20	282,890.00
12	WU	56.00	249,428.00	0.00	28,663.00	192,059.00	470,150.00	352,612.00
13	IMR	34.50	413,603.00	9,000.00	30,748.00	223,346.00	676,697.00	509,772.00
14	UniRes	27.00	213,579.00	0.00	17,472.00	138,630.60	369,681.60	277,260.00
15	IC3	47.00	178,269.00	0.00	47,500.00	129,657.00	355,426.00	266,569.00
16	UCM	60.00	262,520.00	3,000.00	75,500.00	202,812.00	543,832.00	408,624.00
17	UREAD	13.00	67,578.00	0.00	7,000.00	44,746.80	119,324.80	89,493.00
18	INIP	118.00	0.00	0.00	0.00	96,367.00	96,367.00	72,275.00
19	MFMR	118.00	0.00	0.00	0.00	96,367.00	96,367.00	72,275.00
20	UCT	128.00	0.00	0.00	0.00	220,800.00	220,800.00	165,600.00
21	INDP	118.00	0.00	0.00	0.00	96,367.00	96,367.00	72,275.00

WT8:
Project Effort and costs

Beneficiary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs	
22	INRH	118.00	0.00	0.00	0.00	96,367.00	96,367.00	72,275.00
23	ISRA	118.00	0.00	0.00	0.00	78,667.00	78,667.00	59,000.00
24	UCAD	27.00	35,118.00	0.00	14,049.00	29,500.20	78,667.20	59,000.00
25	UAC	118.00	0.00	0.00	0.00	78,667.00	78,667.00	59,000.00
26	CRO	118.00	0.00	0.00	0.00	78,667.00	78,667.00	59,000.00
27	UNN	118.00	0.00	0.00	0.00	78,667.00	78,667.00	59,000.00
28	ULB	0.50	5,798.00	0.00	0.00	3,478.80	9,276.80	5,000.00
Total		2,065.00	5,515,066.92	145,000.00	1,543,849.00	4,045,492.95	12,170,344.87	8,999,433.00

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It cannot be changed unless agreed so during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

53. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

54. Type of activity

For all FP7 projects each work package must relate to one (and only one) of the following possible types of activity (only if applicable for the chosen funding scheme – must correspond to the GPF Form Ax.v):

• **RTD/INNO =** Research and technological development including scientific coordination - applicable for Collaborative Projects and Networks of Excellence

• **DEM =** Demonstration - applicable for collaborative projects and Research for the Benefit of Specific Groups

• **MGT =** Management of the consortium - applicable for all funding schemes

• **OTHER =** Other specific activities, applicable for all funding schemes

• **COORD =** Coordination activities – applicable only for CAs

• **SUPP =** Support activities – applicable only for SAs

55. Lead beneficiary number

Number of the beneficiary leading the work in this work package.

56. Person-months per work package

The total number of person-months allocated to each work package.

57. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

58. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

59. Milestone number

Milestone number:MS1, MS2, …, MSn

60. Delivery date for Milestone

Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

61. Deliverable number

Deliverable numbers in order of delivery dates: D1 – Dn

62. Nature

Please indicate the nature of the deliverable using one of the following codes

R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

63. Dissemination level

Please indicate the dissemination level using one of the following codes:

• **PU =** Public

• **PP =** Restricted to other programme participants (including the Commission Services)

• **RE =** Restricted to a group specified by the consortium (including the Commission Services)

• **CO =** Confidential, only for members of the consortium (including the Commission Services)

• **Restreint UE =** Classified with the classification level "Restreint UE" according to Commission Decision 2001/844 and amendments

• **Confidentiel UE =** Classified with the mention of the classification level "Confidentiel UE" according to Commission Decision 2001/844 and amendments

• **Secret UE =** Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

64. Delivery date for Deliverable

Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date

65. Review number

Review number: RV1, RV2, ..., RVn

66. Tentative timing of reviews

Month after which the review will take place. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

67. Person-months per Deliverable

The total number of person-month allocated to each deliverable.

PART B

COLLABORATIVE PROJECT

Table of Contents

B1. CONCEPT AND OBJECTIVES, PROGRESS BEYOND STATE-OF-THE-ART, S/T METHODOLOGY AND WORK PLAN

B1.1 Concept and project objective(s)

The Tropical Atlantic experienced persistent climate change during the last century together with pronounced multi-decadal shifts. The largest oceanic changes were in the eastern boundary upwelling systems. African countries bordering the Atlantic depend strongly upon their ocean - societal development, fisheries, and tourism. They were strongly affected by these climatic changes and will face important adaptations associated with future global change. Fisheries in the region are crucially important for the livelihoods of these countries and experience additional pressure through foreign, including EU, fishing fleets. These upwelling regions, the most productive around the world, are also of great climatic importance, as here cloud feedbacks involving marine stratocumulus are key to regulating global climate. Furthermore, Tropical Atlantic sea surface temperature (SST) variations have been linked to climatic extremes, including droughts in Africa, Europe, America, and Asia, as well as changes in Atlantic Hurricanes. They may also influence the El Niño Southern Oscillation (ENSO).

At the same time, the Tropical Atlantic is a region of ***key uncertainty in the earth-climate system*****:** state-of-the-art climate models exhibit large systematic error; large uncertainties exists in the relative roles of internal and external factors – such as aerosol forcing – in shaping climate change; and it is largely unknown how ***marine ecosystems*** respond to climate variability and how ***climate change will impact*** them. As a consequence, model based prediction of Tropical Atlantic climate and its global ***socio-economic impacts*** are highly uncertain on all timescales. The magnitude of the problem and the need to resolve it is internationally recognised. PREFACE takes on the challenge to redress this situation through the first comprehensive assessment of the Tropical Atlantic. Together European and African expertise will combine ***regional and global scale modelling capabilities, field experiments and observation systems*** (Fig. 1) to address the following**:**

Objectives

- To ***reduce uncertainties*** in our knowledge of the functioning of Tropical Atlantic climate, particularly of ***climate-related ocean processes*** (including stratification) and dynamics, coupled ocean, atmosphere, and land interactions; and internal and externally forced climate variability.
- To better understand the impact of model systematic error and its reduction on seasonal-to-decadal climate predictions and on climate change projections.
- To ***improve*** the simulation and ***prediction*** of Tropical Atlantic ***climate*** on seasonal, and longer time scales, and contribute to better ***quantification of climate change impacts*** in the region.
- To improve understanding of the cumulative effects of the ***multiple stressors*** of ***climate variability***, greenhouse induced ***climate change*** (including warming and deoxygenation), and ***fisheries on marine ecosystems***, functional diversity, and ecosystem services (e.g., fisheries) in the Tropical Atlantic.
- To assess the ***socio-economic vulnerabilities*** and evaluate the resilience of the welfare of West African fishing communities to climate-driven ecosystem shifts and global markets.

The target region includes areas more affected by climate change and by its consequences: African countries bordering the Atlantic (including Cape Verde), and several European outermost regions (Saint-Martin, Martinique, Canaries, Guadeloupe, French Guyana, Madeira). Better observing capabilities will be integrated with coordinating action by the Integrating Themes panels (Appendix 1) to enable PREFACE to take advantage of potential high-impact case studies, in case the

opportunity arises during the projects duration. PREFACE also aims to strengthen cooperation between European and African researchers working on Tropical Atlantic climate and its impacts.

B1.2 Progress beyond the state of the art

At a global level, our ability to simulate and predict climate and its impacts has improved substantially over the last decades. In the tropics much of the focus has been on the Pacific, and on intra-seasonal and interannual variability. It was implicitly assumed that these efforts would lead to similar improvements in the Tropical Atlantic. It is, however, now obvious that this is not the case and that improvements in the Tropical Atlantic require a focused and concerted effort. PREFACE aims to be a first and major step in this direction. PREFACE will go beyond the state-of-the-art by bringing together expertise in climate modelling and prediction, oceanography, and fisheries and its management, from Europe and countries of the region. To close key knowledge gaps we will enhance observations and analyse underutilized observations, and use advanced ocean and climate modelling capabilities (Appendix 1). PREFACE scientific activities are distributed over four core themes (CTS). These key elements and their relation to PREFACE are schematized below. The following summarizes how PREFACE will progress beyond the state of the art, with links to the CTs

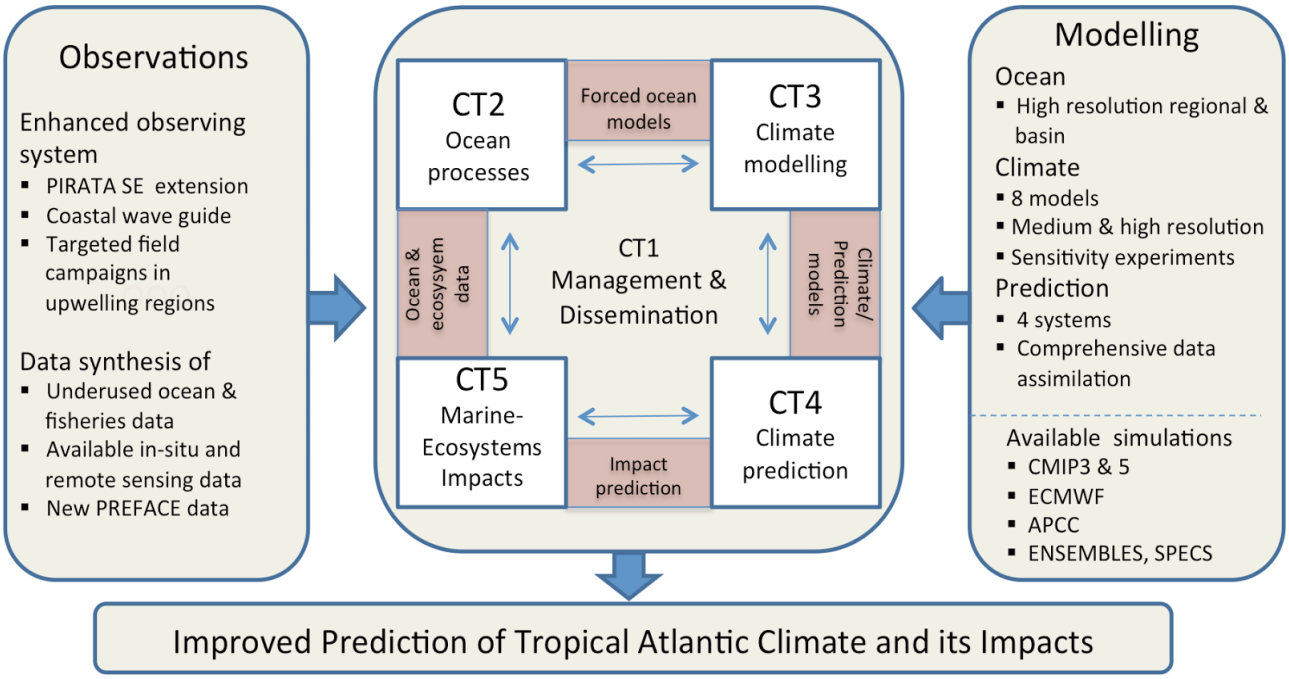


Figure 1 PREFACE combines new and underused observations with state-of-the-art ocean and climate models to improve understanding, simulation, and prediction of Tropical Atlantic Climate and its impacts. This will be achieved through four research Core Themes (CTs), and one for management and dissemination. Common aspects linking CTs are indicated.

Key oceanic processes in the eastern Tropical Atlantic (CT2)

PREFACE will focus on coastal upwelling regions of both hemispheres off West Africa (including in the Gulf of Guinea) that show the largest climate and ocean-only model error in the tropics, and are most poorly understood. Similar processes influence both: local ocean-atmosphere interaction (Richter et al., 2010), remotely forced coastal waves (Polo et al., 2008), intense meridional water

mass advection from the equatorial region as well as the mid-latitudes (Florenchie et al., 2003; Lübbecke et al., 2010). However, important differences also exist: The southeastern Atlantic supports Benguela Niños (Gammelsrod et al., 1998) and the bias is larger in climate models.

During recent years the focus of research on tropical Atlantic climate variability was on the equatorial Atlantic cold tongue region. Within the CLIVAR TACE program (2006-2011) that was aimed at enhancing climate predictions in the Tropical Atlantic region, several process studies were conducted to study the role of ocean dynamics on the seasonal to interannual SST variability in the eastern equatorial Atlantic. Using the enhanced observational network during the TACE period as well as forced high-resolution ocean modeling, the role of different processes affecting the evolution of the equatorial cold tongue could be identified. This regards particularly the role of wind forcing for the generation of equatorial Kelvin waves, the establishment of the equatorial thermocline slope and vertical velocities in the equatorial upwelling region (Hormann and Brandt, 2009; Marin et al., 2009). A particular focus was on the equatorial mixed layer heat budget. During the onset of cold tongue, diapycnal mixing becomes the strongest cooling term as evidenced from microstructure measurements as well as high-resolution modeling (Wade et al., 2011; Giordani et al., 2013; Hummels et al., 2013). However, besides the improved process understanding, the strong SST bias in coupled climate simulations that is largest in the Benguela upwelling region persists. On the other hand, until now no similar coordinated effort was performed to study the mixed layer heat budget and the role of ocean dynamics for SST variability in the coastal upwelling regions of both hemispheres. Different studies are performed that are mainly based on regional programs including a diapycnal mixing study at the Mauritanian continental slope and shelf (Schafstall et al., 2010), moored and shipboard observations on the Namibian shelf (Mohrholz et al., 2008), or analysis of remote-sensing data (Polo et al., 2008). These studies together with high-resolution ocean and coupled modeling suggest that the variability in the coastal upwelling regions is linked to both local wind forcing as well as wave propagation and advection from the equatorial and mid-latitude regions (Richter et al., 2010; Lübbecke et al., 2010; Rouault, 2012).

Some recent efforts on understanding better the role of these coastal upwelling zones in biases in AGCM (Large and Danabasoglu, 2006) to high-resolution ocean models (Xu et al., 2013), suggest that their proper representation could improve drastically the SST distribution and its time-evolution. Hence recent developments in numerical techniques and physical parameterizations will be incorporated in PREFACE numerical models so to evaluate their beneficial effects in helping reduce biases. Particular attention will be paid to the detrimental effects of spurious diapycnal mixing associated with advection schemes (Lemarié et al., 2012), and horizontal and vertical resolution. Also, the fine-scale turbulence and wave-activity will be progressively included, starting from kilometre-scale frontal dynamics, the so-called submesoscale turbulence regime. High-resolution ocean models will allow for the first time a direct comparison between in situ observation and models on small spatial scales of these coastal waveguide and upwelling zones. Based on the detailed model validation, model simulations will be performed with different model types in order to gain knowledge to improve parameterizations or simulations strategies of those processes in coupled climate models that are relevant for tropical Atlantic variability and potentially for the establishment of biases.

Climate modelling and Tropical Atlantic biases (CT3)

Current model simulations of the Tropical Atlantic are affected by severe biases, which are identical in character and show very little improvement compared to those in GCMs of previous generations (Toniazzo and Woolnough, 2013; Davey et al., 2002, Richter et al. 2012a). These systematic errors can be broadly summarised as a negative bias in the meridional SST gradient and a positive bias in the zonal SST gradient, linked with surface wind and precipitation errors including a southward shift of the ITCZ. The SST biases, which are most pronounced in boreal summer, have a

detrimental impact on the simulated TA variability (Ding et al., submitted) and they distort the representation of high-impact regional circulation systems, e.g. the continental monsoons (Caminade and Terray, 2010; Robertson and Mechoso, 2000), and of inter-basin teleconnections (Joly and Voldoire, 2010). Analysis and sensitivity tests with climate integrations have yielded a number of possible origins for the bias, including springtime Equatorial and coastal wind biases linked with errors in tropical precipitation (Richter and Xie, 2008; Tozuka et al., 2011, Richter et al. 2012b), errors in the surface radiation and freshwater budget (Wahl et al., 2011), misrepresentation of ocean vertical mixing (Hazeleger and Haarsma, 2005) or dynamics (Large and Danabasoglu, 2006), missing processes such as unresolved ocean near-inertial waves (Jochum et al, 2013) and deep jets (Brandt et al., 2011). A number of recent studies show promise from increased model resolution (Seo et al., 2006; Seo et al. 2008; Doi et al. 2012; P. Chang and B. Kirtman, priv comm.; I. Richter, priv comm.).

Although a link between the climatological biases in simulations and their reliability as prediction tools is expected (Stockdale et al. 2006), it has not been firmly established, since recent seasonal and decadal hindcasts experiments performed in a multi-model framework have been insufficiently analysed in the Tropical Atlantic region. To make progress in the knowledge of how the Tropical Atlantic biases affect the predictability on the surrounding regions, an understanding of the processes responsible for bias development and of those responsible for variability in the Tropical Atlantic needs to be achieved. First, the aspects that depend on the representation of local processes and those that depend on the adjustment of the global circulation to remote errors and to air-sea coupling need to be separated, which may be accomplished by the analysis and experimentation by using initialised hindcast integrations (Jakob, 2003). Second, the ubiquity of SST biases with the same sign across very different GCMs suggests seeking for common potential source of error in a multi-model approach. Third, the links with model background state and their representation of seasonal to decadal (s2d) variability in the Tropical Atlantic must be established by means of a consistent approach. PREFACE will address these three issues with the first coordinated coupled model assessment of the causes of model systematic error in the Tropical Atlantic on time-scales ranging from synoptic to decadal, to understand how the representation of key oceanic and coupled ocean-land-atmosphere processes affect model biases, including their dependence on resolution and parameterizations.

PREFACE will perform an exhaustive analysis of existing state-of-the-art seasonal-to-decadal prediction systems (UKMO, ECMWF, ENSEMBLES, CMIP5, SPECS), as well as control, historical and scenario integrations (CMIP5). PREFACE will also develop additional multi-model experiments in a coordinated way aimed at identifying strategies for bias mitigation and key areas for improving the representation of Tropical Atlantic climate, increasing the reliability of model predictions and future climate projections.

Predicting Tropical Atlantic climate and its impacts (CT4)

Bias-corrected observations indicate SST increased across the Tropical Atlantic basin during the past six decades, and the equatorial Atlantic cold tongue weakened and reduced annual and interannual variability (Tokinaga and Xie, 2011). The causes for such large changes are poorly understood, because of observational uncertainties and model biases. Although model biases significantly limit seasonal predictions (Stockdale et al. 2006) their impact on regional Atlantic climate sensitivity are unknown. Tropical Atlantic variability (TAV) has also global impacts, and may also enhance predictability of ENSO (Rodriguez-Fonseca et al. 2009; Ding et al. 2011, Keenlyside et al. 2013) However, the connection between Pacific and Atlantic variability, particularly its decadal modulation, remains to be properly understood.

PREFACE will assess the roles of external forcing (including aerosol effects) versus internal variability, using detection and attribution techniques (Terray et al. 2012). Some recent promising results have shown that model improvement can enhance seasonal prediction in the equatorial

Atlantic [p. comm., T. Stockdale]. We will build on this and improve understanding of TAV predictability and impacts, and assess the impacts of model improvements and model error on seasonal and climate change projections.

PREFACE shall also investigate advanced statistical methods to enhancing forecasts in the region. Bayesian Hierarchical Models are emerging as powerful new methods for inferring, e.g., spatially complete climate fields from sparse/noisy time series. One of the most appreciated advantages over traditional theoretical approaches like, e.g., linear subspace-based methods (see, for instance, empirical orthogonal functions) for inferring climate fields, is that Bayesian posterior distribution of reconstructed climates, once estimated, can be directly sampled to yield complete uncertainty estimates of the reconstructions, along with a point estimate of the expected value. Thus Bayesian estimates of climate fields encapsulate the uncertainties involved in the estimation of all model parameters, which cannot readily be done using traditional linear subspace methods. While much work has been devoted to develop statistical models for univariate spatial as well as spatial-temporal processes, statistical modeling for multivariate processes like the one proposed here is a relatively unexplored area of investigation. We shall apply these methods to recalibrate climate forecasts.

Marine ecosystems, fisheries and climate change (CT5)

Whether pelagic populations in the Tropical Atlantic coastal waveguide (CW) are tightly coupled to physical variability is an open question, whose answer has critical implications in terms of resource management and preservation. PREFACE will investigate connections of large-scale oceanographic conditions to changes in the pelagic ecosystem in the CW region during the last 30 years. To our knowledge, we will be the first to address this question over this specific region. We will adopt the precautionary integrated and ecosystem-based approach (Botsford et al. 1997) given the large degree of uncertainty. Non-exploited biological components play an important role in the structure and functioning of marine ecosystems. There is increasing consensus that this role must be recognized and understood to enhance our knowledge of how climate change and anthropogenic forcing are likely to impact marine systems. This point has been underlined by the Joint Research Council in the framework of Surplus estimation available in the fishing agreement negotiation between West African nations and the European Commission (STECF, 2012). PREFACE is in line with these recommendations. Specifically, we will investigate the combined effect of ***multiple stressors (increasing temperatures, acidification, deoxygenation and overexploitation)***, most of them connected to climate change, on several key species of the West African ecosystems functioning: (i) zooplankton, which acts as beacons of climate change for a host of reasons (sensitivity to temperature (Mauchline et al. 1998) tight coupling of climate and population dynamics (Hays et al. 2005) and tendency to respond nonlinearly to subtle environmental signals (Taylor et al. 2002)) and whose dynamics is generally not directly affected by exploitation; (ii) small pelagic fish, which are an essential resource for African fisheries (source of animal protein and fishing quota for foreign fleets); (iii) two top predators with distinct physiological sensitivities; which are expected to respond differently to habitat modification. We expect underwater acoustics tools to work as an integrator of the biotic and abiotic components of the ecosystem, leading to major advances in understanding marine ecosystem functioning (Koslow et al. 2009, Trenkel et al. 2011). Ecological-economic modeling will be applied to investigate the economic effect of environmental variability on the respective African fisheries, with focus on small scale fisheries.

Ocean and ecosystem data (CT2, CT5)

Comprehensive observational networks, such as the Pacific TOGA/TAO buoy array, have contributed significantly to the advances of tropical climate simulations and predictions. In the Tropical Atlantic, the buoy array PIRATA was established in the late 1990's (Bourles et al. 2008).

PREFACE will build on PIRATA data and other achievements and data sources including CLIVAR TACE (Tropical Atlantic Climate Experiment, 2006-2011) that focused on the eastern equatorial Atlantic. Nowadays data are available to study the heat and freshwater budget in the equatorial region. Current meter moorings observing the signal propagation along the equator are established. However, with TACE it became evident that Tropical Atlantic variability is strongly linked to the coastal upwelling regions off Africa. Particularly the observing system in the tropical southeast Atlantic suffers from the lack of long time series: PIRATA does not include a southeast extension. Argo floats and surface drifter coverage is exceptionally low in these upwelling regions, and continuous moored observations along the coastal waveguide are non-existent. A German initiative BMBF SACUS was proposed with moored observations at 11°S and 18°S aimed at identifying the connection between the equatorial region and the Benguela upwelling region. Another trilateral (French-German-African) initiative, AWA, focuses on the Northwest African upwelling regime. Both programs in place take advantage from a close cooperation with African partners along the West African coast. PREFACE will contribute ***new elements to the existing observing system***, consisting of moored observations along the equatorial and coastal waveguide from the equatorial region into the eastern coastal upwelling regions, a PIRATA southeast extension, and enhanced shipboard and glider measurements particularly including microstructure measurements in the Benguela upwelling region. PREFACE aims at providing a synopsis of historical shipboard data, including hydrographic, current, and fisheries data from FRV Fridtjof Nansen since 1985 along the continental margin of West Africa; remote sensing data of different parameter as well as data from ongoing international and national research programs. The resulting array of fine temporal and spatial resolution data sets are required to validate and improve high-resolution ocean and coupled climate models. The regular fish census surveys by the FRV F. Nansen provide a large database allowing to address variability in abundance, spatial distribution and age structure of the principal pelagic stocks of commercial interest e.g. Sardinella and horse mackerel. This data together with in-situ data provided by African partners and IRD, and historical satellite remote sensing data offer an exceptional opportunity to investigate the environmental impact of climate variability and change on exploited small pelagic fish dynamics.

Socio-economic vulnerabilities and resilience of African Atlantic countries fishing communities (CT5)

In many West African countries, fisheries play an important economic, social and environmental role. Although small-scale fisheries might not contribute much to the gross domestic product on a national scale (with some exceptions like Senegal), it is important on a local scale and many coastal communities rely on fisheries as their major source of income and food provision (Lam *et al.* 2012). Based on global assessments of marine exploited ecosystems, Bundy et al. (2012) argue that it is now necessary to study the human infrastructure that marine ecosystems support and the services they produce. West African fishing communities face various risks in their everyday life including uncertainty about the success of fishing, uncertain prices for fish and inputs such as fuel. Thus any external shock, anthropogenic or environmental, might pose an extra threat on these communities. Foreign fleets are currently the major threat to local fisheries but global warming will likely have a cumulative effect and regulating distant water fleets even more urgently needed to dampen this effect (Sumaila *et al.* 2011). Two major differences are interesting: the changes are likely irreversible and projections uncertain, i.e. the actual changes to be expected. We will specifically analyze if the vulnerability and adaptive capacity of fishing communities to theses shocks is high or low, to correctly estimate potential risks related to climate change (Allison et al. 2009). This might not only include the direct effect on the capture sector through potential changes in the resource, but also dependant sectors, in particular processing and trade. In Senegal for instance, traditional/artisanal fishing is usually destined at local processing and consumption whereas almost all industrial catch goes to the export sector (Stillwell et al., 2010). In addition adaptation behaviour is likely to affect other resources (such as bushmeat in Brashares et al., 2004).

Currently the majority of studies analyse vulnerability and adaptive capacity on a relative broad scale, i.e. national scale, taking into account also relative rough measures of changes in the environment, e.g. average air temperature or sea surface temperature. Although some researchers have tried to measure adaptive behaviour at the local level (e.g. migration in Njock and Westlund (2010) and others), cause and effect relationships are very hard to assess (are they migrating because of lower fish stocks or changing markets or new opportunities in other sectors or worse agricultural conditions?). In PREFACE, by assessing resilience we are able to find the deeper factors that explain adaptive behaviour that are needed for both cost assessments and vulnerability reducing/adaptation policies (for a similar example see e.g., de Pinto et al., 2012). This work focuses on the local level since local institutional, cultural and economic conditions may differ even in similar environmental conditions and because communities and social networks (factors that can hardly be measured on national level) are assumed to be decisive conditioning factors. In addition, within group inequalities/dynamics can only be studied using micro level data.

PREFACE will also analyse the potential future development of key commercial species with bio-economic models (Tahvonen et al. 2013, Voss et al. 2011) and use the results as potential future scenarios within the interviews and experiments. PREFACE will use both survey methods and field experiments to elicit information about risk and time preferences and cooperation behaviour within social groups (families, fishing communities) under various risk scenarios and under shocks to the common pool resource. We will use the elicited information for empirical analysis to study adaptive behaviour under specific consideration of the following factors, which have been identified as important: outside options in the agricultural sector, in the off-farm sector and through migration and insurance and credit constraints.

Using both experimental and behavioural economics methods and linking them to theory, we are thus working in the field of the future agenda for development economics (Duflo, 2011). Using the elicited risk and time preferences and combining it with the forecasts from the improved climate models, we will study in what way more precise information about future development affects small-scale fishers' adaptive behaviour.

Performance metrics

- Completion of planned observational campaigns and implementation of enhancements of the observational network
- Increased knowledge of processes controlling upper ocean temperature variations in the eastern equatorial Atlantic and upwelling zones
- Use of observational analysis to improve the representation of key processes in ocean models for simulating variability in these regions
- Robust identification of key systematic errors in coupled climate models for the Tropical Atlantic region, through model experimentation
- Development of improved and bias corrected coupled models, taking into account observational and forced ocean model simulation
- Increased understanding of the mechanisms for predictability of Tropical Atlantic climate
- Enhanced knowledge of the impacts of model error on seasonal and climate change projections, and demonstration of improved prediction through its reduction.
- Development of advanced statistical methods for to enhancing forecasts in the region
- Increased understanding of environmental and anthropogenic pressures on pelagic fish stocks in the Tropical Atlantic, through analysis of historic data
- Increased understanding of the economic effect of environmental variability on the respective African fisheries, through economic-ecological modelling
- Integration of African and European marine and climate science, as measured through participation in joint research campaigns, research stays in Europe and Africa, joint supervision of students, and joint publications, including those led by African scientists
- Number of completed Doctoral and Master degrees of students from African partners, and from European partners that arise from PREFACE, particularly those related to the analysis of oceanographic and marine ecosystem data
- Transfer of information to stakeholders and policy makers, as gauged by distribution of fact sheets and policy briefs, participation in a targeted information session, and follow up inquires about the project
- Dissemination of PREFACE results, as measured through the number of conference presentation, number of publications, number of hits on the website, and email inquiries about the project

B1.3 S/T Methodology and associated work plan

B1.3.1 Overall strategy and general description

PREFACE is divided into five Core Themes (CT): four for research and one for management and dissemination (CT1) (Fig. 1). Each CT is divided into work packages (WP), with 14 in total and their relationships are shown in Fig. 2. To focus PREFACE on its goals, three integrating themes (IT) that encompass several WP tie the project together: ocean processes, ocean-atmosphere-land interaction, and predicting Tropical Atlantic Climate and its impacts; these will be overseen by an internal panel (Sec. 2.1). An external scientific advisory panel of four eminent scientists (Sec. 2.1) has been formed to provide scientific guidance in each of these scientific CT and help place the project internationally. PREFACE makes use of observational data (summarized above), as well as existing seasonal and decadal predictions, and long-term climate change projections (Appendix 2), and will perform a suite of experiments with state-of-the-art climate models (Appendix 3 & 4).

CT1 Project management and dissemination: The complexity of this large project requires considerable attention to the management structure (see also Section 2.1) and full time human resources are budgeted. WP1 deals with all management and financial administrative issues, carefully monitoring project progress, and ensure timely preparation of scientific reports, financial statement, and deliverables, and arranging management and general assembly meetings. WP2 handles all dissemination issues, including organising summer schools, workshops, and the final project meeting in Africa. WP14 undertakes project data and information management, and will maintain internal data servers and project management software, and facilitate internal communication. CT1 will communicate regularly with the Commission about the development of the project.

CT2 Role of ocean processes in climate variability will increase understanding of ocean processes key to Tropical Atlantic climate through the combined use of observations and high-resolution ocean modeling (as described above). CT2 is composed of three WPs. **WP3** *Heat and freshwater budgets, air-sea interaction* aims to improving the understanding of the physical processes controlling the mixed layer heat and freshwater balances in the eastern boundary upwelling regions and in the Gulf of Guinea. **WP4** *Circulation and wave response* investigates the role of local and remote forcings along the equatorial and coastal wave-guide in setting mean SST pattern and in driving SST variability in eastern boundary coastal upwelling regions of both hemispheres. With input from these two WPs, **WP5** *Joint observations – model comparison* will using forced medium to very-high-resolution ocean models to identify causes of systematic error in these regions and ways of improvement ocean models; informing work in CT3 and CT5.

CT3 Evaluation of current climate models and bias reduction will provide a robust assessment of various systematic errors in coupled ocean-atmosphere-land processes, and develop improved and bias corrected coupled models. **WP6** *Coupled basin-wide processes determining the climatology aims* focuses on understanding and reducing systematic biases that develop on time scales from hours to a year, as captured in climate predictions. WP6 informs work in two other WPs. **WP7**, *relation between the background state (error) and variability* investigates the relationship between models mean biases and the representation of the Tropical Atlantic variability on seasonal to decadal (s2d) timescales. **WP8** *Influence of remote systematic errors* assess to what extent Tropical Atlantic systematic errors can be understood in isolation of remotes errors, including land interaction.

CT4 Climate prediction in the Tropical Atlantic will increase understanding of climate predictability in the region and evaluate the impact of model systematic error on climate prediction, through experiments incorporating model improvements (CT2&CT3) and bias correction techniques. **WP9** *improved understanding of Tropical Atlantic variability on seasonal and longer*

time scales and its global impacts shall investigate mechanisms for seasonal variability, and assess the contribution of external forced climate change in the region. **WP10** *statistical methods to assess and improve forecast of Tropical Atlantic variability* focuses on advanced statistical methods for enhancing prediction in the region. **WP11** *Impact of model improvement and systematic model error reduction on climate prediction and projection* will quantify the impact of the PREFACE model improvements (CT3) and bias correction techniques in climate predictions and long-term projections, and provide the most reliable information to CT5.

CT5 Impacts of climate change on pelagic functional diversity in the Tropical Atlantic with effects on western African fisheries economies aims to disentangle environmental and anthropogenic pressures on pelagic fish stocks in the Tropical Atlantic. CT5 will (i) couple retrospective environmental data from PREFACE CT2 to investigate changes in biomass, spatial distribution of and interaction disturbances between major food web components, in shelf areas and the high seas and (ii) develop stock projections based on output of PREFACE CT4 and using historical data, dynamic bioclimatic envelope models and single species population dynamic models (both in **WP12**). CT5 will further (iii) develop coupled ecological-economic models for key species and (iv) investigate perceived and realised threats for coastal fishing communities (both in **WP13**).

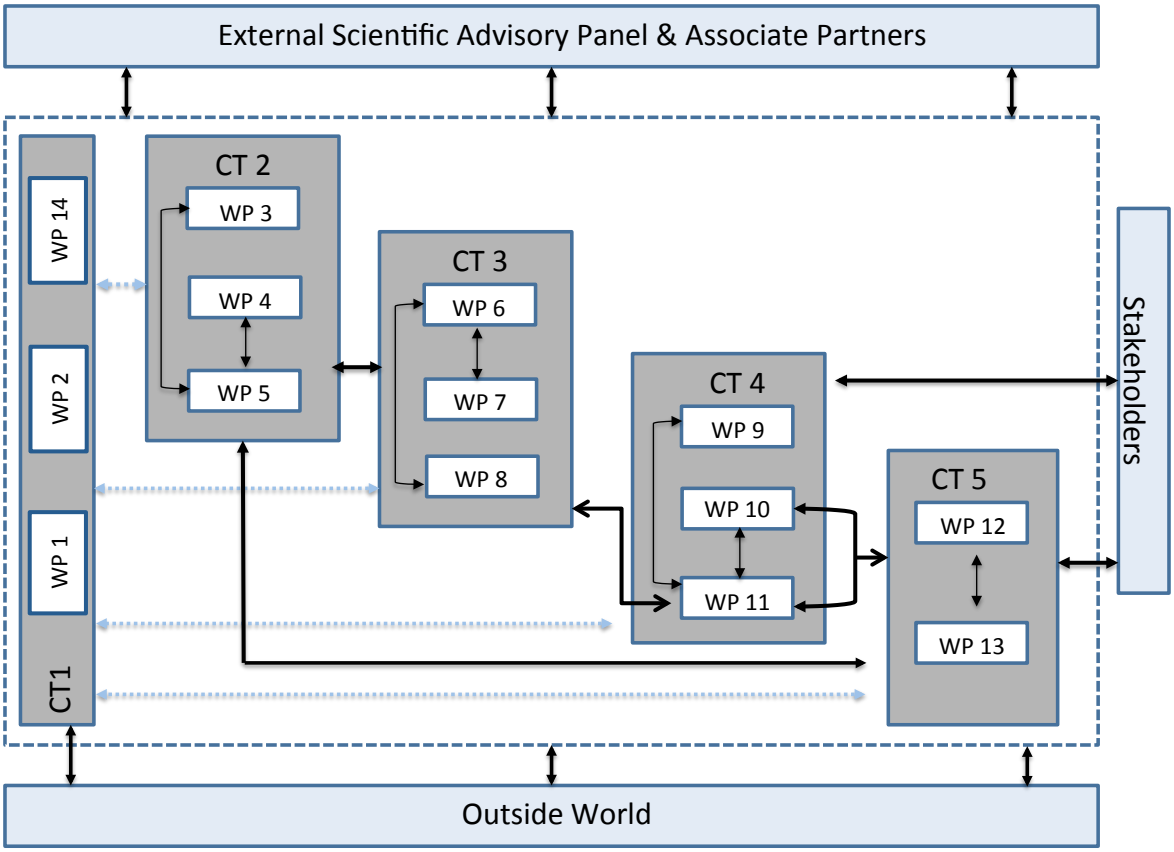


Figure 2: The interaction among the project core themes (CT) and work packages (WP) is sketched. The key dependencies are shown by arrows inside the dashed box, which delineates the project. Interaction with external bodies to different parts of the project is shown

Risks and contingency plans

A project of this size and ambition faces many challenges. There are a number of foreseen risks that could impede PREFACE reaching its goals. The following are our contingency plans to address these:

- Data issues related to new observations: There is a risk of cancelled ship time, mooring losses, or glider failures. The contingency plan is to exchange ship time and instrumentation between partners to optimize the observational efforts. This will be achieved by a close coordination among observational groups. Cruises in the Benguela upwelling region with German research vessels as well as PIRATA cruises for 2014 are already scheduled. Further cruise proposals will be prepared commonly between different WPs. Additionally there will be access to research vessels from African partners that can be used e.g. for glider rescue operations. A large part of the planned work is based on historical observations, data from the global observing system including satellite remote sensing, Argo float and surface drifter data, and PIRATA buoy data. A delay in delivery will only cause small deviation from the program.
- Climate modelling: PREFACE aims to both gain insight into the causes of systematic model error in the Tropical Atlantic and in turn improve models in the region (CT3). As described above, recent studies that have provided a deeper insight into the causes of systematic error, proposed strategies for further investigation, and identified approaches to improve models in this region (including those from PIs: Wahl et al. 2009, Tozuka et al. 2011; Toniazzo and Woolnough 2013). PREFACE aims to test the robustness of previously identified mechanisms through coordinate experimentation. There is little risk that we will not manage this, as all the modelling groups involved have extensive experience with this type of work. While recent studies have identified improvements in the mean state and variability in the Tropical Atlantic (e.g. Richter et al. 2012), there is a significant risk that PREFACE won't lead to substantial model improvement in this region. However, we apply a variety of approaches here from insight driven experimentation to optimal parameter detection methods, based on Ensemble Kalman Filter data assimilation.
- Climate modelling and prediction: PREFACE also aims to assess the impact of model bias on simulated and predicted Tropical Atlantic variability and its impacts. The use of flux-corrected models provides an appropriate contingency plan in the unlikely event that all experimentation fails to produce any reduction of systematic error in the region.
- Questionnaire surveys in African countries: In some parts of Africa, there is the possibility of encountering difficulties when conducting the interviews in fishing communities. These potential factors can include poor infrastructure, political conflict, corruption or political or legal limitations to conducting interviews or the content of questionnaires, difficulties in the coordination with African partners and enumerators during surveys or even finding dedicated and qualified enumerators. In addition we might fail to detect meaningful adaptive behaviour. However we have African partners in each of the countries where surveys are planned, ensuring proper communication with enumerators and fishing communities. If surveys are completely impossible in one country we can shift to another country as we have several countries in each of the LME regions. If quantitative analysis will not be possible due to unforeseen difficulties in the surveys we can still perform a descriptive analysis of the

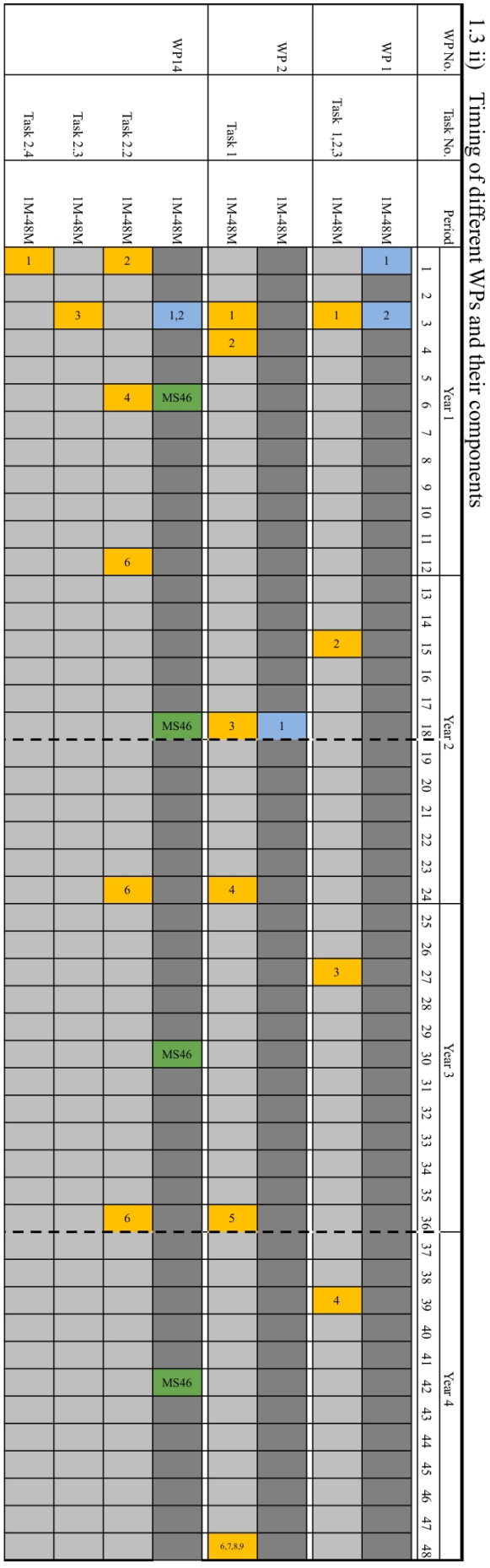
collected data from the surveys, which is even more than what is currently available in some areas.

- Integration of African partners: While African and European scientists are united in their common interests, distance and in some case poor internet infrastructure pose a problem to the full integration of African partners into PREFACE. However, there is established already a close cooperation between different European and African partners. This includes several French IRD activities in Africa (LEGOS-IRD cooperational program on education and research, UPMC-IRD "International laboratory" ECLAIR), the Nansen-Tutu Centre at UCT coordinated by Norway and South Africa, the GEOMAR - Cape Verde cooperation as well as ongoing projects like e.g. AWA, SACUS, and EAF Nansen. The successful preparation of this proposal demonstrates a successful cooperation between European and African partners, and that internet problems can be overcome to a certain extent. African and European partner have travel budgets to enable project coordination and knowledge exchange during regular visits, meetings, and conferences.
- Running of complex computer models: Resources are distributed over many computing centres around Europe and all modelling partners have extensive experience in working with their own models. Thus, the risk of any set of planned experiments not being complete is extremely low. And any essential experiments could be performed by alternative partners if required.
- Personnel: The project requires recruitment of early career scientists. Currently there are many new graduates in the areas of the project. The scientific calibre and extensive personal networks of the PREFACE team will help to identify and attract early career scientists to fill these positions. The management structure is robust, with all key personnel having deputies/co-leaders. The management team also includes many with substantial experience in the coordination of large National and EU projects.

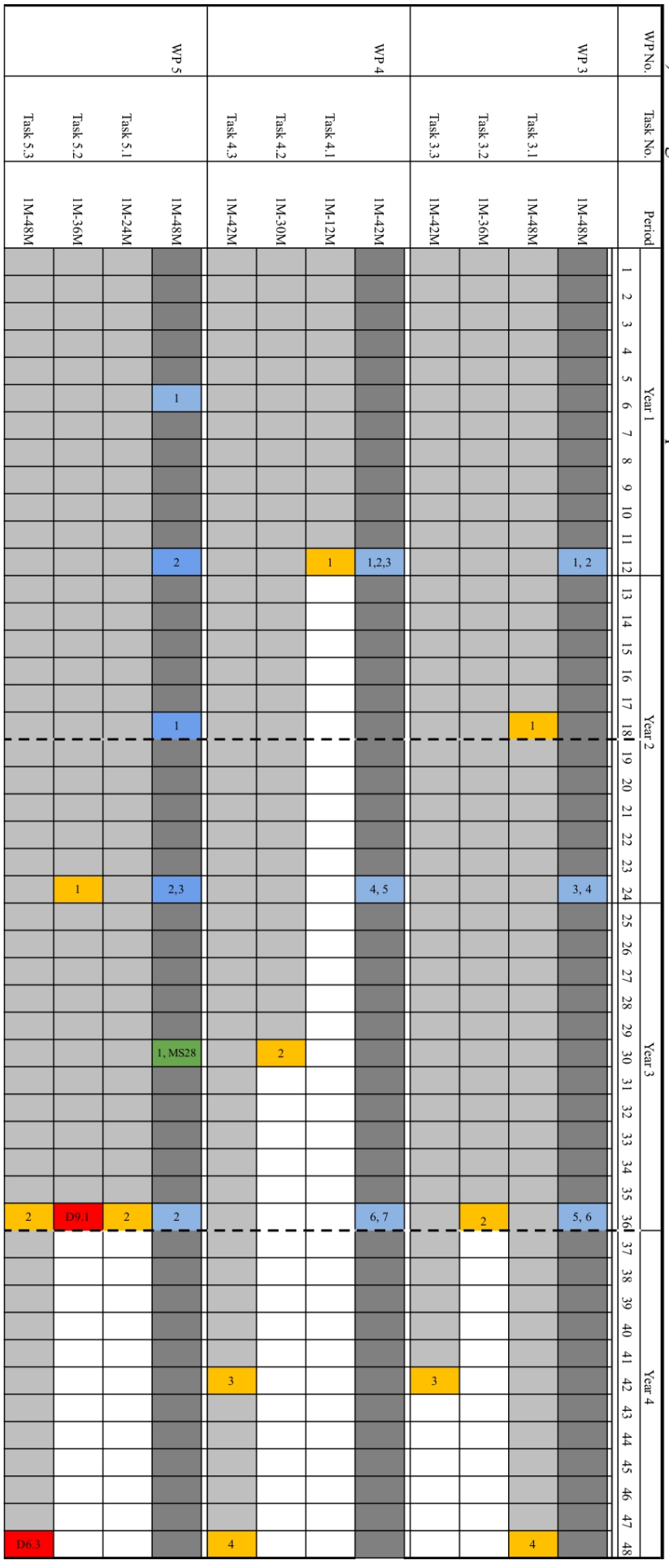
Regarding unforeseen risks, we are confident that we will be able to develop speedy and appropriate contingency plans for the following key reasons:

- PREFACE multidisciplinary team has extensive experience in all areas addressed by the project,
- PREFACE team have already worked together in many different projects; this encompasses both European and African scientists. IRD, IMR, and UMPC have particularly strong connections with partners from Africa
- PREFACE management structure allows fast information flow, allowing speedy identification of risks; Risk identification will be on the agenda of our quarterly SKYPE meetings of the the SSEC
- PREFACE encompasses a number of advisory panels that will help identify risks and develop appropriate contingency plans. Internal panels deal with issues of project integration, arbitration, gender, dissemination, and data. We can also draw input from an external scientific advisory panel and affiliated partners, including commissions of the key African marine ecosystems.

B1.3.2 Timing of work packages and their components (Note, Gantt chart ordered by CT)



1.3 ii) Timing of different WPs and their components



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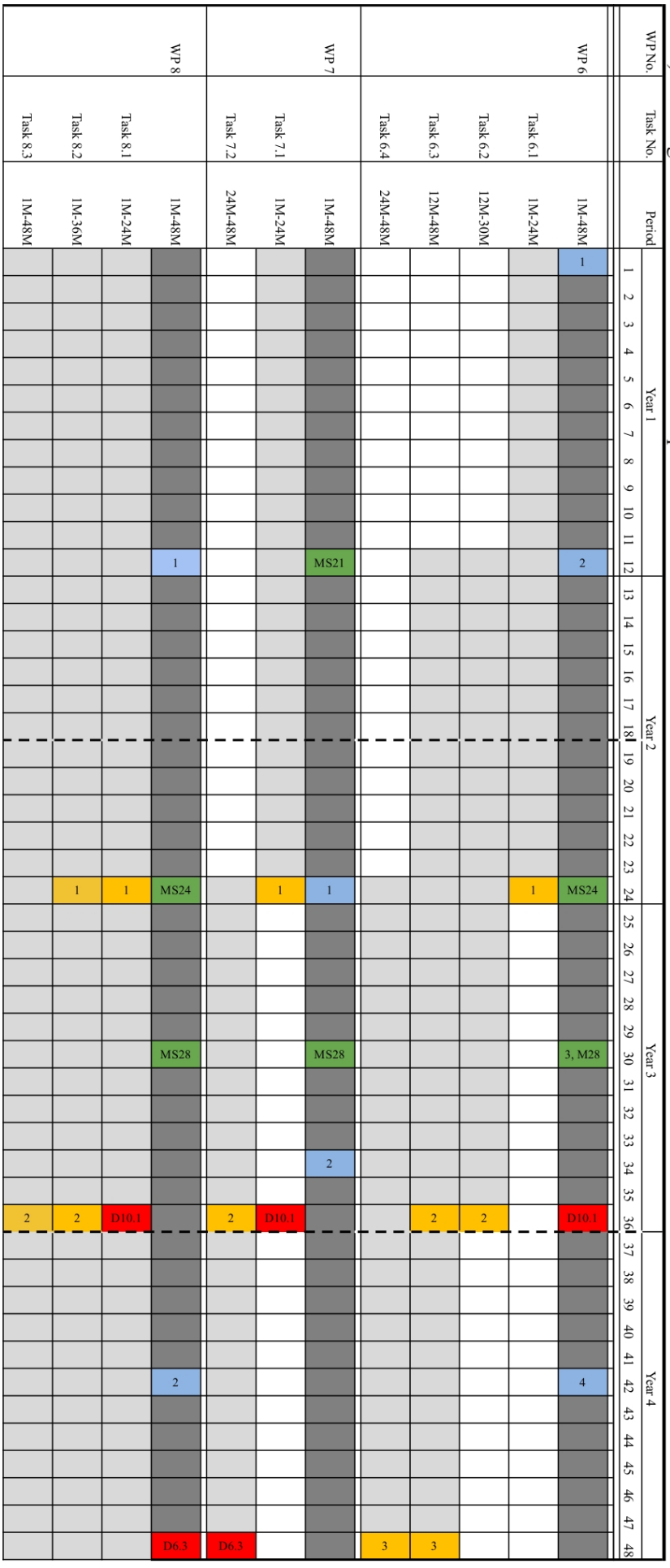

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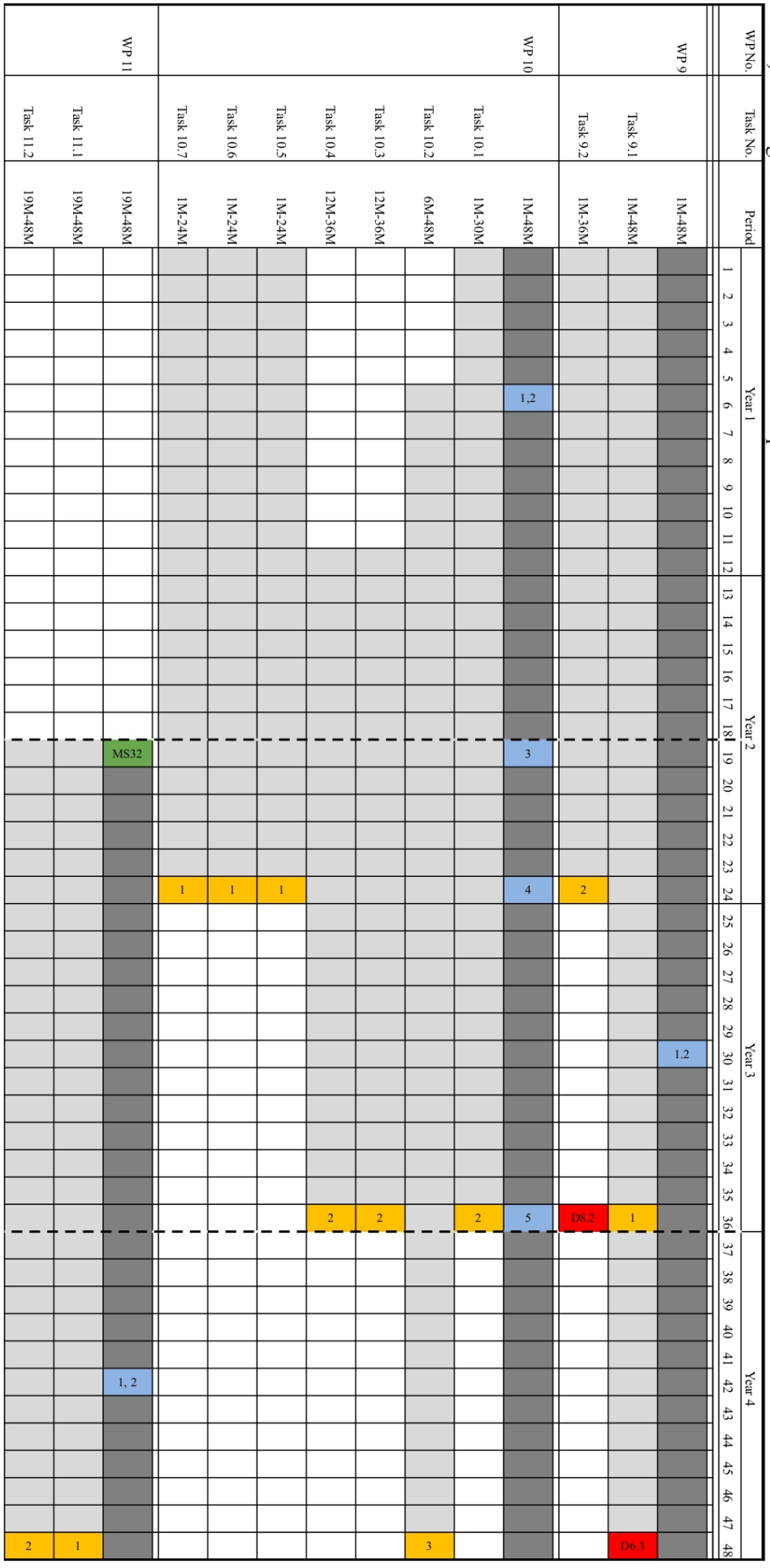

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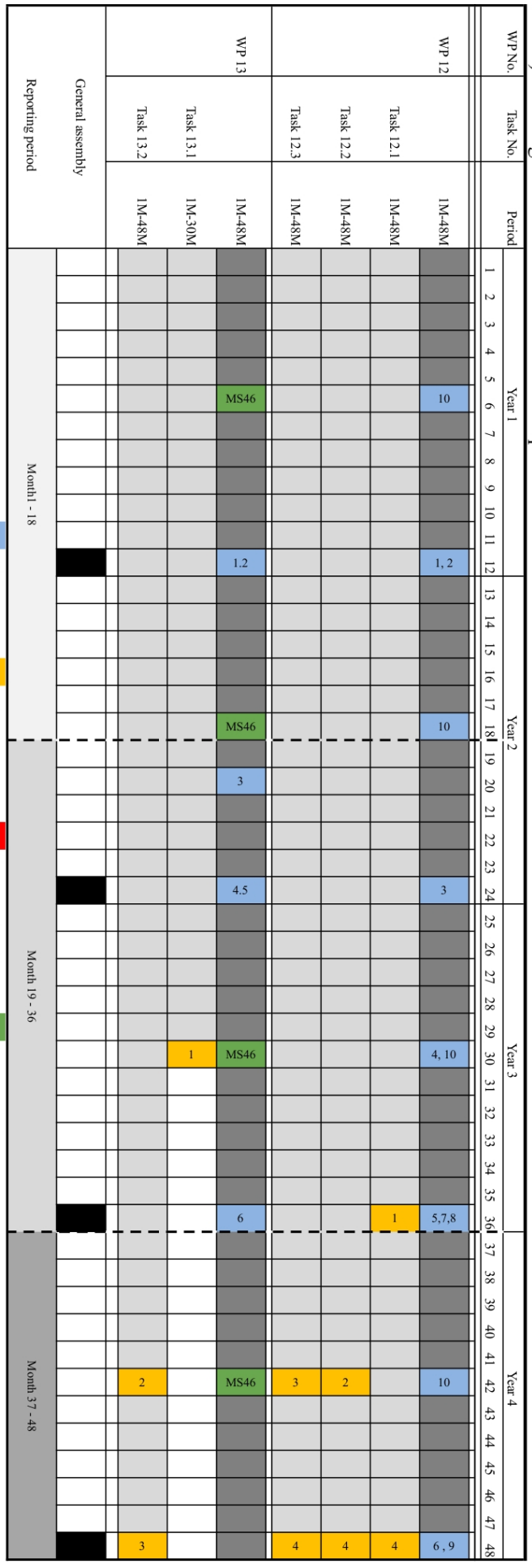
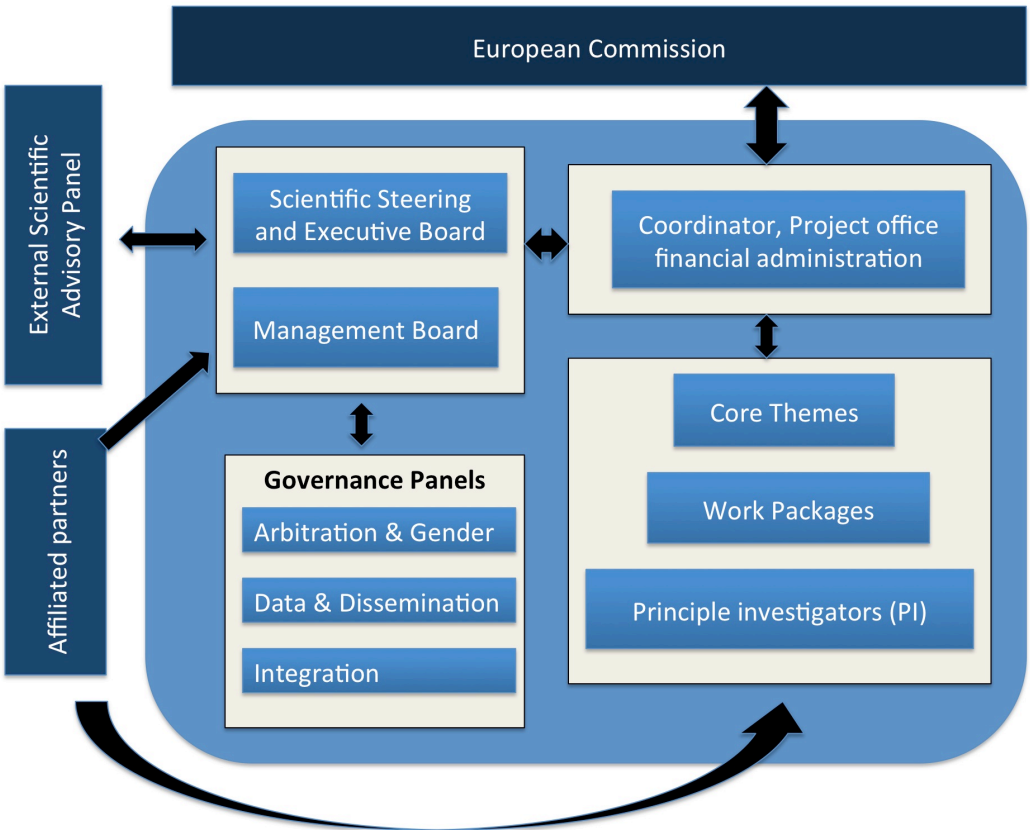


B2. IMPLEMENTATION

B 2.1 Management structure and procedures

Management is a keystone of PREFACE. Efficient and effective management is of paramount importance, as PREFACE is a large consortium with 28 beneficiaries (individual participants) spread over Europe and Africa. To meet this challenge, PREFACE has a streamlined, but appropriately resourced management, with an entire work package (WP1) devoted to project management. Professor Noel Keenlyside, Geophysical Institute and Bjerknes Centre, University of Bergen, will coordinate PREFACE and lead the Consortium in its implementation. The project office (**PO**) will support him, with a fulltime project manager, and experienced project administrators at the University of Bergen's divisions of finance and research administration will handle all practical administration of FP7 instruments, financial, reporting and contractual matters.



The PREFACE management structure (above) pays particular attention to information flow, resource transfer, and decision-making. These are critical elements for a project of this complexity. A simple as possible design is adopted to allow fast flow of information and resources between partners, project administration, the European Commission (EC), as well as information flow between PREFACE and the outside world. The project office is the interface between the European Commission and the PREFACE consortium.

We adopt a hierarchical but flexible decision-making structure that involves the Coordinator, the PO, Scientific Steering and Executive Board **(SSEB)**, management board **(MB)**, and a number of panels. The SSEB and MB are the main decision making bodies. They are advised by a number of governance panels, which deal with gender and arbitration issues, data management within the project and dissemination to the outside world, and on integrating different elements of the project. These panels are designed to ensure smooth and effective internal running of the project. An External Scientific Advisory Panel (**ESAP**) is charged with providing input on improving the project work and will assist in embedding the project in the global scientific network. A number of

associate partners represent commissions of African coastal areas of the Atlantic will play a key role in ensuring PREFACE meets expectations of the countries of this region.

The main ways of communication between partners are the internet (e-mail, web-based tools), teleconferences and workshops, including general assemblies and task-specific, targeted workshops. Web-based interaction will be promoted to save travel time, costs, and the environment. We will also adopt a web-based management tool.

General Coordination, decision making and associated bodies

PREFACE leadership overview

Coordinator, deputy	Noel Keenlyside (UiB), Peter Brandt (GEOMAR)
CT1, WP1, WP2	Noel Keenlyside (UiB), Project Manager (UiB), Project Office
Core Theme 2	Peter Brandt (GEOMAR), Alban Lazar (UPMC)
Core Theme 3	Thomas Toniazzo (UniRes), Emilia Sanchez-Gomez (CERFACS)
Core Theme 4	Belén Rodríguez-Fonseca (UCM), Francisco Doblas-Reyes (IC3)
Core Theme 5	Patrice Brehmer (IRD), Jörn Schmidt (CAU)
WP3	Marcus Dengler (GEOMAR), Bernard Bourlès (IRD)
WP4	Peter Brandt (GEOMAR), Mathieu Rouault (UCT)
WP5	Gael Alory (IRD), Alban Lazar (UPMC)
WP6	Thomas Toniazzo (UniRes), Aurore Voldoire (MF-CNRM)
WP7	Emilia Sanchez-Gomez (CERFACS)
WP8	Belén Rodríguez-Fonseca (UCM)
WP9	Elsa Mohino (UCM)
WP10	Angelo Rubino (Unive)
WP11	Francisco Doblas-Reyes (IC3)
WP12	Heino Fock (TI) and Marek Ostrowski (IMR)
WP13	Jörn Schmidt (CAU)
WP14	Benjamin Pfeil

Coordinator and Project office

UiB will coordinate the project in financial, administrative and managerial aspects, and host the Project Office (PO). Prof. Noel Keenlyside will coordinate the project and head the PO. Peter

Brandt (GEOMAR) will act as Deputy Coordinator to fill in for the Project Coordinator when under exceptional circumstances he may be absent. The coordinator is responsible for the overall scientific coordination and day-to-day management of the project, and is the principle contact for the European Commission and for the financial administration at UiB. The coordinator is assisted by his deputy, the administrative PM and the DM, both at the PO. His tasks include the following:

- Liaising with the EC on behalf of the consortium and communication of all information in connection with the project to the EC
- Collecting project deliverables and submitting them to the EC, after validation by the SSEB
- Day-to-day coordination of the project, monitoring the project planning and progress, communicating deadlines, detecting bottlenecks and designing contingency plans
- Overall administrative and financial management, and management of Consortium-level legal, gender, and ethical issues
- Decision making, risk assessment (including contingency planning) and conflict solving
- Preparation and application of the quality control and documentation plan
- Preparation and delivery of the reporting for the EC, after validation by the SSEB
- Organization of project meetings, including SSEC meetings, and internal and external panel reviews
- Communication within the project, to users, and to the general public and coordination with other EU – funded or other international projects
- Communication with affiliated partners and other relevant international organizations
- Coordination with relevant EU-funded and international projects and initiatives
- Preparing and post-processing of EC mid-term reviews that will follow the project reporting
- Implementation of the plans under knowledge and innovation-related activities, intellectual property issues and Gender Action Plan

The administrative PM assists the Coordinator in the daily monitoring of progress of the project and in all issues listed above. In addition to this, the PM identifies promptly and anticipates problems, and proposes remedy action. The DM, Dr. Benjamin Pfeil (**UiB**), maintains the data server ensuring the rapid exchange of data between the partners, and maintains the web service communication module, and project management software (WP14). He/she is responsible for management of the data, keeping contact with European and international data centers, and will assist partners in obtaining external data. He/she will assist partners in using the project management software (e.g., Redmine or ProjectPier). This software will provide a clear view of the projects progress, keeping track of milestones and deliverables. The DM ensures proper archival (including meta-data) and dissemination of data created by PREFACE, and that intellectual property rights are obeyed.

Financial administration

The financial/administrative manager at the University of Bergen takes care of the correct distribution of funds, coordinates the financial reporting of the consortium, and provides assistance in legal issues. The financial/administrative manager of PREFACE will be hired from experienced staff at UiBs division of Finance. This division administers many of the UiBs FP7 projects and has vast experience. The responsibilities of the finance manager will include:

- receiving the entire financial contribution from the EC and, with advice from the Coordinator, manage this contribution by allocating it to the Beneficiaries pursuant to the work plan and the decisions taken by the appropriate bodies;
- ensuring the overall smooth financial management of the Consortuim, keeping track of budgets, requesting interim reports from the Consortium as appropriate
- Coordinating the financial annual report in line with the FP7 financial rules;
- Clarifying any issues with the budgets raised by the Consortium and the EC

Scientific steering and executive board (SSEB)

The SSEB will consist of the coordinator and the four research Core Theme leaders (or their substitutes). The SSEB will assist the coordinator in overseeing project progress, identifying potential risks and fallbacks and taking measures to prevent or minimize risks. The SSEB will have quaterly telephone/SKYPE conferences to discuss all important matters. The SSEB will ensure the timely preparation of the deliverables for the EC; propose changes of the project budget to the MB as well as the reallocation of funding between the Contractors; make proposals to the MB for changes in Consortium membership; prepare the content and timing of press releases and joint publications by the Consortium or proposed by the EC

Management board

The MB is the overall decisive body of the Consortium, and is the arbitration body for all decisions proposed by the SSEB. The management board will consist of one representative from each partner institution. Each partner will appoint one member for the management board and one substitute. Each partners representative will be directly responsible to the respective core theme leader concerning scientific and management related issues for their partner's tasks. The tasks of the management board members are:

- To participate in management board meetings; if unable to participate, to ensure a substituting person attends on their behalf, and inform he coordinator in writing about this beforehand.
- To ensure that the financial statements for the partner are submitted to the coordinator in time and comply with the guidelines.
- To ensure an effective communication within the project, a MB member must inform the other MB members by email if he/she cannot be contacted by email for more than 14 days. In case of prolonged absence the coordinator can request that a replacement is appointed.

The management board will meet annually half a day before or after the annual project meeting. The Coordinator will act as chairperson of the MB at the first meeting. The chairman of the following MB will be elected from the members for periods of 12 months.

Good governance panels

These panels help oversee running of the project, and will report at 6 month intervals to the MB and SSEB.

(1) Arbitration and Gender: The members will make recommendations on relevant arbitration and gender issues and will report to the to the SSEB on minor issues and to the MB on major issues. Typical tasks in gender related issues could be related to recruitment of PREFACE staff and monitoring of how special needs for female researchers are being taken into account in the various training and research activities (sec. 5). Arbitration issues could be to resolve conflicts among partners in relation to the project. Typical examples could be conflicts on authorship of publications based on results obtained during the project period. The panel will review the conflicts together with the involved partners and propose solutions. This process will be laid out in the consortium agreement. Three panel members will be nominated by email and assigned by online vote before the kick-off meeting.

(2) Integration of science and partners: PREFACE has defined three integrating themes (Sec 1.3, Appendix 1) that tie work across the project and are key to reaching the projects objectives, and three IT Panels will be formed at the Kick Off meeting. The panel will monitor the project wide

progress in these themes, and suggest methods to improve scientific integration; their tasks a summarized in Appendix 1.

The consortium will consist of ten partners from different African countries. To work towards the best possible integration of these partners in PREFACE, a partner integration panel will be formed to assist African and European partners. Typical tasks could include capacity building in the African states, student education and help with administrative procedures. The panel will consist of four members, two from African, two from European partners who will be elected at the kick-off meeting.

(3) Data and dissemination (Data policies): This panel will deal with all issues of data collection, data use and distribution. PREFACE makes use of historic data belonging to African partners, collected under the FAO Nansen program. The panel is charged to ensure European partners respect ownership of these data, while promoting its use in PREFACE. The panel will consist of three members, including the DM and an African partner representative. The panel will consult the associated partner commissions of African coastal areas of the Atlantic (Sec 2.3). The panel members will be elected at the kick-off meeting. The panel will also be charged with overseeing project dissemination.

The three panels will give recommendation to MB and SSEB on project integration.

External scientific advisory panel (ESAP)

The ESAP will provide PREFACE with high-level advice on the scientific directions of the project. It will consist of the following distinguished scientists:

- Prof. William Johns (University of Miami) is an observational oceanographer who has conducted numerous field programs studying the Tropical Atlantic circulation and variability. He was one of the lead scientists who helped to develop the CLIVAR TACE (Tropical Atlantic Climate Experiment) program. Dr. Johns served on the CLIVAR Atlantic Implementation panel from 2003-2009 and is presently the chair of the Science Steering Group for the U.S. Atlantic Meridional Overturning Circulation (U.S. AMOC) program. *His expertise is particularly relevant for **CT2***.
- Prof. Carlos R. Mechoso (Uni. California, LA) is an expert on climate simulation by general circulation models of the coupled atmosphere-ocean system. He chairs VOCALS, an international research program sponsored by WCRP/CLIVAR, which has focused on the climate system of the eastern tropical Pacific. He is also co-chair of a US CLIVAR group that aims to better understand the coupled atmosphere-ocean dynamics in the eastern part of the tropical oceans. *He brings important expertise to **CT3 and CT4***.
- Prof. Ping Chang (Texas A&M Uni.) is an expert on high-resolution regional climate modeling in the Tropical Atlantic sector, and on ocean-atmosphere interactions and predictable dynamics of the region. He is a current member of the International CLIVAR Atlantic Implementation Panel. He was a committee member of the U.S. CLIVAR/Atlantic Panel, U.S. CLIVAR-Seasonal-to-Interannual Modeling and Prediction Panel, the Scientific Working Group for the Pilot Research Moored Array in the Tropical Atlantic (PIRATA). *His expertise are particular relevant to **CT3 and CT4***.
- Prof. U. Rashid Sumaila (Uni. British Columbia) is deeply interested in how economics, through integration with ecology and other disciplines, can be used to help ensure that environmental resources are sustainably managed for the benefit of all generations. Sumaila has authored over 130 journal articles, including appearances in Science, Nature and the Journal of Environmental Economics and Management. He has given talks at the UN, the White House,

the U.S. Congress, the Canadian Parliament, the House of Lord, UK and the WTO. *His expertise is particularly relevant to* ***CT5.***

Other management issues

Consortium agreement

The consortium agreement will be based on the Commissions DESCA model and will be prepared by the coordinator together with the legal adviser at UiBs division of Research management. It will form the base for the consortium's collaborative work.

Management of knowledge

Knowledge management will be described in the consortium agreement. It is envisioned that project results shall be freely accessible to all consortium members. Project results will be shared at annual meetings and partners are encouraged to create teaching materials and materials for public outreach from project results. The project will also publish a newsletter that partners can use to share knowledge.

Project meetings

PREFACE will have annual meetings of the whole consortium. They will be announced in time so that all partners can make the necessary reservations. Meetings will include presentations of scientific results as well as a meeting of the Scientific Steering and Executive Board to discuss relevant matters. As described the management board will also convene either before or after the annual meeting. The meetings will be planned by the project office together with one of the partners as local host.

Internal communication

As the PREFACE consortium consists of 28 partners, good and efficient communication is important to reach the goals set out by the project plan. The coordinator will talk to the four core theme leaders in a quarterly teleconference, but will also set up ad-hoc teleconferences/videoconferences if necessary. The core theme leaders will set up communication plans for their theme with the relevant work package leaders, it is envisioned that such interactions will take place at least quarterly. Daily communication will also take place by email and telephone. The coordinator will create an internal site at the projects website that is only accessible for consortium members.

Risk management

As laid out in section 2.3 many members of the consortium already have worked together on numerous occasions, so that the conflict potential is low. The coordinator and his deputy have experience in leading projects. If conflicts arise that the arbitration and gender panel cannot solve or if the project plan cannot be followed the coordinator will contact the commission as soon as possible.

B 2.2 Beneficiaries

Beneficiary 1 UiB

University of Bergen (UiB)/Geophysical Institute is the primary academic marine research organisation in Norway with key expertise in physical oceanography, climate research, biogeochemistry, and meteorology. UiB has coordinated a series of EU projects in the field of climate research, among others TRACTOR, PACLIVA, CYCLOPS, CARBOOCEAN and currently EU FP7 CARBOCHANGE. The Geophysical Institute (GFI) is an internationally acknowledged contributor in the areas of marine and climate research. GFI and UiB are key participants in the Bjerknes Centre for Climate Research in Bergen, a nationally funded Center of Excellence, and the Center for Climate Dynamics. GFI also coordinates the Norwegian Research School in Climate Dynamics (ResClim). The institute's research strategy rests upon use of own cutting - edge measurement techniques developed in collaboration with technology partners in combination with theoretical studies and modelling in geophysics. GFI has a leading role in the development of the Norwegian Earth System Model (NorESM), and climate prediction system.

Tasks assigned

UiB will be the coordinating institution of PREFACE. It will host the project office including the project director, the project manager, and the data manager, and perform and support project dissemination (WP1, 2, & 14). UiB will analyse wave-guide processes (WP4). In addition, UiB will analyse observations and existing climate and prediction experiments, as well as perform experiments with NorESM and ECHAM5 to advance understanding of the causes of model bias in the Tropical Atlantic (WP6) and its impacts on variability (WP7 & 8) and climate prediction (WP11), but also to understand the mechanisms for Tropical Atlantic variability (WP9) and assessing current levels of forecast skill in the region (WP10).

Qualification of the key personnel

Prof. Noel Keenlyside works on climate variability, predictability, and change. He has contributed to understanding Tropical Atlantic variability and its impacts, and its representation in climate models, with 13 publications on this topic. He has 49-refereed publications in total, including in the high-ranking Nature and PNAS journals that have been cited a total of 1846 times, with an average citation rate of 34, and an h-index of 21 (ISI Web of Knowledge). Keenlyside has worked extensively with climate models and in seasonal-to-decadal prediction. His significant management skills include leading a research group funded under the prestigious Emmy-Noether Programme of German Science Council (DFG), and leadership roles in several relevant EU projects (DEMETER, ENSEMBLES, DYNAMITE, and SUMO). He currently plays a leading role in developing a Norwegian climate prediction system, based on NorESM with an Ensemble Kalman Filter data assimilation scheme. Keenlyside is active in the international community, and been on advisory committees for the US CLIVAR AMOC program, and EU funded ECOPAS project. He has supervised 3 Postdoctoral Scientists, 10 PhD students, and 4 Masters students.
Prof. Tor Gammelsød has more than 30 years of research and teaching experience in the area of physical oceanography, including making observations. The Atlantic Ocean, including the Tropical Atlantic, is a focus of his work. He is cooperates extensively with African scientists, and is active in capacity building, leading a NorAD funded education program in physical oceanographers in Mozambique.
Dr. Benjamin Pfeil, data manager, has successfully carried/carries out the data management for EU CARBOOCEAN, EU CARBOCHANGE, EU COCOS, EU GEOCARBON, NFR CO2Base, SOCAT (Surface Ocean CO2 Atlas) and is leading the ocean part for the ESFRI ICOS.

Relevant publications

Keenlyside, N.S., H. Ding, and M. Latif (2012), Potential of Equatorial Atlantic Variability to Enhance El Niño Prediction, GRL, in revision

Keenlyside, N.S., M. Latif, J. Jungclaus, L. Kornblueh, and E. Roeckner, 2008: Advancing Decadal-Scale Climate Prediction in the North Atlantic Sector. *Nature*, 453, 84-88

Gammelsrød, T., C. H. Bartholomae, D. C. Boyer, V. L. L. Filipe, and M. J. O'Toole, 1998: Intrusion of warm surface water along the Angolan-Namibian coast in February-March 1995: The 1995 Benguela Nino. *South African Journal of Marine Science-Suid-Afrikaanse Tydskrif Vir Seewetenskap*, 19, 41-56.

Beneficiary 2 UCPH

Centre for Ice and Climate (CIC) is a centre of excellence funded by the Danish National Research Foundation and located at the Niels Bohr Institute, University of Copenhagen (UCPH). The centre opened in 2007 and is a 10-year effort building upon a long tradition of ice-core research in Copenhagen.
CIC is led by Professor Dorthe Dahl-Jensen, who is widely recognized for her work (*e.g.* recipient of the EU Descartes Prize 2008 and EU ERC Advanced Investigator's Grant for the project WATERundertheICE). Dahl-Jensen has created a diverse team, in gender as well as nationality, focused on past climate and ice-core science. Since its inception, CIC has produced 14 PhDs and 20+ M.Scs. Currently, the centre employs 40 persons, incl. 15 postdocs and senior level scientific staff.
CIC works in close collaboration with Danish and international partners on projects, shared PhD scholarships, and exchange of students and research fellows. International collaborators include Oeschger Centre for Climate Change Research (Switzerland), Ice Core and Quaternary Geochemistry Lab (Oregon, USA), Institute of Arctic and Alpine Research (Colorado, USA), Center for Remote Sensing of Ice Sheets (Kansas, USA), Institute of Low Temperature Science (Japan), Alfred-Wegener Institute for Polar and Marine Research (Germany), Laboratoire des Sciences du Climat et de l'Environnement (France), Bjerknes Centre for Climate Research (Norway), Geo-Biosphere Science Centre (Sweden), and British Antarctic Survey (UK).

Tasks assigned

Together with his PhD student Prof. Jochum will analyse the strength of near-inertial waves (NIW) in the PIRATA and the German mooring array (WP3), and compare it to their strength in NorESM and EC Earth (WP5). They will then implement the NIW parameterization that has been developed for CESM (Jochum et al 2013) into these 2 ESMs and assess the impact with a series of hindcast runs (WP6). Finally, after optimizing the setup, the impact of the parameterizations will be tested for their impact on seasonal to decadal forecasts (WP11).

Qualification of key personnel

Markus Jochum: Professor in Physical Oceanography with longstanding experience in the numerical simulation of the equatorial ocean and tropical climate. Of particular importance is his work on tropical mixed layer processes and their connection to atmospheric convection. He is member of several international CLIVAR panels and the NASA SST panel, and played a key role in the development of the latest Community Earth System Model (CESM). Professor Jochum will focus on the analysis and parameterization of near-inertial waves in the tropical Atlantic and their impact on European climate and its variability.

Relevant publications

Jochum et al. 2013: On the impact of near-inertial waves on climate, Journal of Climate, in press

Jochum et al. 2010: Quantification of the feedback between phytoplankton and ENSO in the Community Climate System Model, Journal of Climate, 23, 2916-2925

Jochum and Potemra, 2008: Sensitivity of tropical rainfall to Banda Sea diffusivity, Journal of Climate, 21, 6445-6454

Beneficiary 3 CERFACS

The Centre Européen de Recherche et Formation Avancée en Calcul Scientifique (CERFACS, France) is a leading research institute on algorithms for solving large scale scientific problems. The CERFACS Climate Modeling and Global Change team conducts basic scientific research and high-level technical developments for climate studies. It develops the OASIS coupler software, currently used by more than 25 climate modeling groups. It has been involved in many European projects dealing with global and regional studies of climate variability, and related predictability (SIDDACLICH, DEMETER, PREDICATE, DYNAMITE, ENSEMBLES, COMBINE, SPECS) and also in the international project AMMA. It also develops end-to-end downscaling approaches to provide climate data in impact studies (EU projects IS-ENES, EUDAT).

Tasks assigned

CERFACS will participate actively to the Core Theme 3 (co-leader) in the evaluation of climate models and bias reduction in the Tropical Atlantic. Besides its contribution to the analysis of the CMIP5 database, CERFACS will focus on the added value of increasing horizontal and vertical model resolution, using the high-resolution version of the ARPEGE-OASIS-NEMO coupled GCM, in the representation of the Tropical Atlantic climate. CERFACS will contribute to the analysis of initial model drift (participant WP6), to the study of the interaction between mean state and Tropical Atlantic variability (WP7, leader) and will participate to the coordinated experiments to explore bias reduction and related processes from seasonal to interannual timescales (WP6 and WP7 (leader)). CERFACS will also contribute to the assessment of the different roles of external forcings versus the internal climate variability in the Tropical Atlantic region, using detection/attribution techniques (participant WP9). Finally, CERFACS is involved in WP11 and will analyze the impact of model improvements proposed in WP6,WP7 and WP8 on climate projections and decadal forecasts.

Qualification of key personnel

Laurent Terray is a research director at CERFACS and is active in the field of climate modeling for more than 20 years, working on ENSO as well as on climate variability over the North Atlantic and Europe. He is also studying the detection and attribution of anthropogenic climate change and related impacts at regional scales. He has also been involved in many European projects (e.g. PREDICATE, DYNAMITE, ENSEMBLES, COMBINE and SPECS). L. Terray is the current co-chair of the WCRP/CLIVAR Atlantic Implementation Panel).

Dr. Emilia Sanchez-Gomez is a senior research scientist with more than 10 years of experience in climate research including tropical and midlatitude variability and predictability studies, regional climate modelling, links between the large scale circulation and extreme events and downscaling techniques, improvement of the initialization techniques to deal with climate drift. She has been strongly involved in several European projects (e.g DYNAMITE, ENSEMBLES, COMBINE and SPECS).

Dr Sophie Valcke holds a "highly qualified" research engineer position at CERFACS. She is currently leading a team for the developments of the OASIS coupler. She is CERFACS Principal Investigator for the current IS-ENES, METAFOR and IS-ENES2 projects, funded by the European Commission 7th framework program. Dr Valcke is also interacting with other groups developing coupling framework internationally, such as the USA-led ESMF and CESM projects.

Mr. Eric Maisonnave is a senior research engineer with more than 10 years of experience in the field of climate modelling. He has been involved in several EU projects like DEMETER, PREDICATE or DYNAMITE, and has developed abilities to configure, use and facilitate access to several OASIS coupler based coupled models. He is deeply involved in the European projects IS-ENES and IS-ENES2 where he works on Earth System Model assembling.

Relevant publications

SanchezGomez, E., C. Cassou, D. L. R. Hodson, N. Keenlyside, Y. Okumura and T. Zhou, 2008 : North Atlantic weather regimes response to Indian-western Pacific Ocean warming: A multi-model study. Geophys. Res. Lett., 35, L15706, doi:10.1029/ 2008GL034345.

Cassou C., L. Terray and A. S. Phillips, 2005: Tropical Atlantic influence on European Heatwaves J.Climate, 18, 2805-2811.

Terray L. and Cassou C. Tropical Atlantic sea surface temperature forcing of quasi-decadal variability over the North Atlantic European region J. Climate, (2002), 22, pp. 3170-3187

Beneficiary 4 IRD (NB hosting two groups)

The Institute of Research for Development (IRD) is a non-profit government-funded public organisation created in 1944 and whose general missions are to conduct research and training with a view to promoting economic, social and cultural development in the Southern Countries. Research performed in IRD covers a wide range of areas and disciplines and addresses major development challenges such as human health, food security, climate change, water resources, vulnerability and social inequality. IRD consists of about 56 research laboratories, operating jointly with academic partners in France, in the French overseas territories and in 35 countries in Africa, Asia, Latin America and the Mediterranean Basin. About 40% of the 2200 IRD's staff is based in Southern countries. Several joint research units (UMR) and one own service unit (US) are including in the Preface project, they have key expertises in fisheries acoustics and ecology, skills in geostatistics and marine observational system. Each UMR Joint Research unit was involved or has coordinated EU projects. Lastly IRD operate two FRV, the Antea could be deployed in tropical Atlantic.

UMR EME (IRD, Ifremer, University of Montpellier 2). Since the 1st January 2009, the CRH evolved towards an UMR (joint labs). UMR 212 EME associating the IRD, the University of Montpellier II and Ifremer by the 1st January 2011, its objectives being to study the impact of global change on marine ecosystems, their governance and their exploitation and plan out evolution scenarios with the help of patterns and empirical analysis. More information on the Web site: http://www.umr-eme.org/

UMR LEGOS (CNES, CNRS, IRD, University Paul Sabatier Toulouse III). LEGOS is a multi-disciplinary research laboratory concerned with environmental research. Researches conducted at LEGOS concern key environmental issues related to ocean health and its response to climatic forcing. They associate physical oceanography, marine geochemistry and biogeochemistry. Theses researches themes are linked by an observational approach using remote sensing from satellites. Research in oceanography covers a wide range of spatial and temporal time scales. The relationship between these phenomena and climate is investigated as well as the interactions between dynamics, primary production and the chemical state of the ocean. LEGOS specificities are the development of original algorithms for oceanography and the acquisition of in situ data. LEGOS is also leader in the development of sensors and development of new generation numerical models for both open end regional oceans. IRD team of LEGOS coordinates PIRATA in France and is strongly involved in West Africa through its team in Cotonou/Benin (regional actions in research - PROPAO & ALOC-GG- and capacity building -regional Master & PhD-).Web http://www.legos.obs-mip.fr/

UMR LEMAR (IRD, Université de Bretagne Occidentale, CNRS, Ifremer). The LEMAR "Laboratoire des sciences de l'environnement marin" (Science Laboratory of the Marine Environment) has gathered biologists, chemists and physicists with the aim of studying, understanding and modelling marine systems within the biosphere, of defining the characteristics of this medium and its organisms, and of specifying their interactions. This UMR has gathered more than 66 researchers and around 47 engineers and technicians (39 PhD and 22 PostDoc and limited-term employees). The unit pursues a resolutely interdisciplinary policy, inside which it has carried out methodological research in the use of underwater acoustic technologies, and applying these methods on fishery resources. It works particularly on the studies and observations of marine populations in coastal environments. West Africa is a priority area for the unit.

UMR LOCEAN (IRD, CNRS, University Pierre et Marie Curie, IRD, MNHN). LOCEAN is a joint research laboratory. Its personnel includes 111 permanent employees, about 55 graduate students and 30 post-docs. The research done at LOCEAN is mainly devoted both to the study of the variability of the ocean and the role of the ocean on climate. Another topic is biogeochemistry for ocean. For the first topic of research, the focus is on the role of the ocean on climate variability on seasonal to centennial time scale for past, present and future periods. For the second topic, the focus is on improving our understanding of ocean dynamics and its impact on major chemical compounds in relation to the investigation of some bio-geochemical processes and cycles and their impact on climate. The regions investigated include the Arctic, the Austral Ocean, tropical regions with specific field experiments/studies West Africa, as well as global ocean circulation and biogeochemical model developments.

UMR LPO (IRD, CNRS, Ifremer, Université de Bretagne Occidentale). LPO (Laboratoire de Physique des Océans, Physics Laboratory Oceans) covers three main scientific themes: (1) Mechanisms of ocean dynamics, from sub-mesoscale to basin scale; (2) Climate change: Role of the ocean and impacts on the thermohaline circulation; and (3) Understanding the exchange from the coast to the open ocean to study the effects of climate change on regional oceanic margins and their ecosystems. More information on Web site : http ://wwz.ifremer.fr/lpo

US IMAGO is an IRD Technical Unit competent in the following fields: (i) Marine Chemical analysis: (ii) Physical oceanography instrumentation (iii) management of observational networks: TAO mooring array in the tropical Atlantic Ocean (PIRATA program); (iv) software developpement; (v) use of satellite data: The unit provide data (SST, CHLa, Wind, altimeter, atmospheric fluxes etc.) either on Delayed Time (historical series) or in Near Real Time. Technicians and engineers of the unit are able to deliver formation, in marine chemistry, instrumentation, ship of opportunity program, use of satellite data either in laboratory or at sea. The unit is ISO 9001 certified since 2009.

Tasks assigned

IRD will contribute to CT2 mainly through i) in situ observations analysis and the monitoring of yearly *Pirata* cruises for the maintenance of the *Pirata* Atlas buoys and ADCP moorings in the Gulf of Guinea, along with the additional Atlas buoy at 6°S-8°E and ADCP mooring at 0-0 (WP3 and 4); ii) numerical experiments, by using ROMS & NEMO, mostly dedicated to the Gulf of Guinea and the south-east tropical Atlantic upwelling area, (WP5). In CT5, IRD will work mainly on WP12 on the Nansen data base (acoustics, fisheries etc.) to analysis change in spatial structure of small pelagic fish and mid trophic layer (macro and meso zooplankton) along the three African LMEs, related to environmental change studied in other Preface CT and observed in historical data base (e.g. Satellite data). IRD will also play a role in tuna habitat description. Lastly IRD will contribute to the WP 13.

Qualification of key personnel (among 19 IRD agents see appendix 6)

Dr Patrice Brehmer (UMR Lemar) work in fisheries and fisheries acoustics, PI of the international consortium AWA project (14 countries and 40 laboratories) associated to preface. He will be based in Dakar Senegal during the project duration and is PI of Preface CT5 with Joern Schmidt.
Dr Anne Lebourges-Dhaussy (UMR Lemar), associate director of the Lemar she is an expert in zooplankton studies using multifrequency methodologies.
Dr Bernard Bourlès (UMR Legos) work in physical oceanography, observations & data analysis. Co-Chair of the PIRATA ISSG and coordinator of PIRATA France, coordination of oceanographic & coastal environment regional programs in West Africa (EGEE/AMMA, PROPAO, ALOC-GG), Co-head of the regional Master 2 & PhD program in West Africa and member of the TACE/CLIVAR.
Dr Yves du Penhoat (UMR Legos) based in Benin he works in physical oceanography, data & numerical simulations analysis, former head of the LEGOS, specialist in tropical Ocean circulation.
Dr Serge Janicot (UMR Locean) senior scientist, atmosphericist, expert in African climate and monsoon in particular. He is one of the head of the AMMA international program.
Dr Arnaud Bertrand (UMR EME), Fisheries ecology, head of the joint international laboratory Discoh (LMI Discoh). Specialist of pelagic habitat description using acoustics methodology.
Dr. Nicolas Bez, (UMR EME). Research in geostatistics applied to fisheries.

Relevant publications

Bourlès, B., R. Lumpkin, M.J. McPhaden, F. Hernandez, P. Nobre, E. Campos, L.Yu, S. Planton, A.J. Busalacchi, A.D. Moura, J. Servain, and J. Trotte, The PIRATA program: history, accomplishments and future directions, *Bulletin of the American Meteorological Society*, 89(8), 1111-1125.

Demarcq H., Reygondeau G., Alvain S., Vantrepotte V., 2012. Marine phytoplankton seasonality from space. *Remote sensing of Environment*. In press

Lebourges-Dhaussy, **A**., Coetzee, J., Hutchings, L., Roudaut, G., and Nieuwenhuys, C. 2009. Zooplankton spatial distribution along the South African coast studied by multifrequency acoustics, and its relationships with environmental parameters and anchovy distribution. *ICES Journal of Marine Science*, 66, 1055-1062.

Machu, E., O. Ettahiri, S. Kifani, A. Benazzouz, A. Makaoui and **H. Demarcq**. 2009. Environmental control of the recruitment of sardines (*Sardina pilchardus*) over the western Saharan shelf between 1995 and 2002: a coupled physical/biogeochemical modelling experiment. *Fisheries Oceanography*, 18, 287-300.

Bertrand A., Ballón M., Chaigneau A. 2010. Acoustic observation of living organisms reveals the oxygen minimum zone. PLoS ONE 5(4): e10330. doi:10.1371/journal.pone.0010330. (Editor's choice, Science 2010, 328:793).

Beneficiary 5 MF-CNRM

Météo-France is the French weather service. In PREFACE, Météo-France is represented by its research centre, the «Centre National des Recherches Météorologiques» (CNRM). The CNRM is the department responsible for conducting the largest part of the meteorological research activities, and for coordinating research/development undertakings conducted within other departments. To carry out its missions, CNRM hosts approximately 275 permanent positions (one third being research scientists), and about 60 students and visitors, working in specialised divisions. The climate group «GMGEC» is one of these divisions in charge of the studies of present climate variability and of the impact of human activities on climate. Its main specific research activities concern the development of climate models, the studies of climate variability, of the projection of climate at global and regional scales, of seasonal and long-range forecasting, of atmospheric chemistry and of air-sea interactions. MF-CNRM has played an important role in the FP6 AMMA project, which has settled the network on the Tropical Atlantic in the EU scientific community and with African partners. MF-CNRM is currently involved in several EU FP7 projects (EUCLIPSE, CLIM-RUN).

Tasks assigned

The activities MF-CNRM will conduct within PREFACE mostly rely on the use of the CNRM-CM global coupled model (http://www.cnrm-game.fr/spip.php?article126&lang=en). The most recent versions of this model are derived from CNRM-CM5, which was developed in close collaboration with CERFACS in order to participate to the CMIP5 project (http://www.cnrm.meteo.fr/cmip5/). MF-CNRM will contribute in providing an estimation of the inter-annual variability of the heat budget in the tropical Atlantic (WP3). The main goal of MF-CNRM participation in PREFACE will be to improve the realism of the simulated climate in the tropical Atlantic in CNRM-CM5. This will be achieve by running sensitivity experiments with CNRM-CM in order to improve the understanding of the sources of model biases and characterise their impacts on variability (WP7 & 8). Finally, we will assess if the model improvements made during the project have an impact on climate projections (WP11),

Qualification of key personnel

Dr. Aurore Voldoire, scientist, is in the climate division since 2001 and is mainly in charge of the development of CNRM-CM. Her main research activities concern the ocean-atmosphere coupled interactions and their impact on climate variability.
Dr Guy Caniaux and **Hervé Giordani**, scientists, are in the climate division since 1986 and 1995 respectively. They are specialists of ocean-atmosphere interactions from the meso-scale to the large-scale. They have played an important role during the AMMA project in describing the processes at work in the Equatorial Atlantic Cold Tongue.
Dr Romain Roehrig, junior scientist, is in the climate division since 2008. He is specialist of the African monsoon, its variability and atmospheric processes at work in the region.

Publications

Giordani, H., and G. Caniaux, 2011: Diagnosing vertical motion in the equatorial Atlantic. Ocean Dynamics, 61, 1995-2018, doi :10.1007/s10236-011-0467-7

Giordani, H., G. Caniaux, and A. Voldoire, 2013: Intraseasonal mixed layer heat budget in the Equatorial Atlantic during the cold tongue development in 2006. J. Geophys. Res., in revision.

Joly M. and A. Voldoire, 2010: Role of the Gulf of Guinea in the interannual variability of the West African monsoon : what do we learn from CMIP3 coupled simulations ? Int. J. of Clim., 30(12) : 1843-1856, DOI:10.1002/joc.2026.

Roehrig, R., D. Bouniol, F. Guichard, F. Hourdin and J.-L. Redelsperger, 2013: The present and future of the West African monsoon: a process-oriented assessment of CMIP5 simulations along the AMMA transect, J. of Climate, in revision.

Beneficiary 6 UPMC

Université Pierre et Marie Curie (UPMC) represents 5.000 permanent staff members and 20.000 students. The team gathered for PREFACE is formed by researchers from three laboratories, LOCEAN, LATMOS and LMD, all belonging to the Institute Pierre Simon Laplace (IPSL), which plays a leading role in climate research : the LOCEAN for studying world general oceanic circulation and physical oceanic processes based on observations and numerical modeling (with a lot of PIs and/or coordinators in many programs: TOGA, WOCE, JGOFS and IGBP, European Union projects from the 3rd to the 7th framework programs, etc.); the LATMOS in the field of air-sea interactions; and the LMD for linking experimental approaches and theories with numerical modeling, developing for more than 30 years an atmospheric general circulation model, LMDZ, which is the atmospheric component of the IPSL coupled model involved in the CMIP and IPCC reports.

Tasks assigned

UPMC will be involved in all research WP2, 3, 4 and 5. Most researchers are well versed into basin scale ocean or atmosphere physical processes, but several of them have been focusing particularly on the north-eastern tropical area of the Atlantic, or on the equatorial band. In the Senegalese upwelling, the team will conduct measurements of hydrology, circulation, and surface atmosphere characteristics, for their mean and variability (WP3). It will model the Senegalese regional upwelling with ROMS at sub-mesoscale, as well as the whole tropical Atlantic ocean circulation with a NEMO OGCM basin configuration, focusing on WP3 and 4 key quantities (WP5) simulation. In the eastern equatorial basin, ocean-atmosphere coupling processes will be studied using observations and 2 models coupling NEMO OGCM with atmosphere WRF atmosphere model and with global LMDZ (IPSL-CM5) AGCM, for the climatological mean state and seasonal cycle (WP6), as well as for the interannual variability (WP7) and remote influences on the bias (WP8). In close collaboration with UCM, UPMC will participate to the analysis of numerical process studies using the same NEMO basin model (WP9). Finally, UPMC will carry out modeling studies aimed at identifying the environmental marine forcings of the coastal upwelling ecosystem (WP12).

Qualification of key personnel

Alban Lazar, assistant professor, is specialist of tropical Atlantic ocean circulation and air-sea coupling, and Atlantic basin modeler. Convener of an EGU session on tropical circulation, and member of the US CLIVAR working group on Eastern tropical Biases, he has been living in Senegal for the past 4 years, studying and measuring the coastal upwelling with young researchers from UCAD.
Xavier Capet, researcher, specialist of meso-scale ocean processes and coastal upwellings modeling, focuses also on couplings with marine biogeochemistry as well as with local atmosphere.
Gaëlle de Coëtlogon, assistant professor, has a long experience on the analysis of the air-sea coupling and the investigation of the physical processes involved in the Eastern Tropical Atlantic basin.
Catherine Rio, researcher, is specialist of the marine atmosphere boundary layer. She had a major role in the recent implementation of a new physics in LMDZ.
Frédéric Hourdin, senior scientist, is the co-director of LMD and head of the LMDZ modeling team.

Selected references

De Coëtlogon, G.; S. Janicot; A. Lazar, 2010: Intraseasonal variability of the ocean-atmosphere coupling in the Gulf of Guinea during boreal spring and summer. *Quat. J. of Roy. Meteor. Society,* 136, 426-441.

Hourdin, F., J.-Y. Grandpeix, C. Rio, and co-authors, 2012: LMDZ5B: the atmospheric component of the IPSL climate model with revisited parameterizations for clouds and convection. *Climate Dynamics*, DOI 10.1007/s00382-012-1343-y.

Peter, A.C.; Le Hénaff, M.; Du Penhoat, Y.; Menkes, C.E.; Marin, F.; Vialard, J.; Caniaux, G.; Lazar, A., 2006: A model study of the seasonal mixed layer heat budget in the equatorial Atlantic, *Journal of geophysical research*, 111, C6,C06014,2006, cit. 16(24).

Beneficiary 7 GEOMAR (NB hosting two groups)

Helmholtz Centre for Ocean Research Kiel (GEOMAR) is the successor of the Leibniz Institute of Marine Sciences (IFM-GEOMAR). The institute employs more than 750 people; its mandate is the interdisciplinary investigation of all relevant aspects of modern marine sciences, from sea floor geology to marine meteorology. Research is conducted worldwide. Our major research divisions are: Ocean Circulation and Climate Dynamics, Marine Biogeochemistry, Marine Ecology, and Dynamics of the Ocean Floor. We cooperate closely with national and international universities, and with SMEs active in marine technology and science. The core activities of the Physical Oceanography research unit are observational programs addressing the role of the ocean in the climate system with a focus on the Atlantic. We have a significant experience in the whole range of sea-going observational work, including recent technologies like autonomous instrumentation (glider, floats), and multi-year, multi disciplinary deep-sea ocean moorings (including development of real-time data access technologies). The Climate modelling group of the research unit Meteorology employs a hierarchy of models to understand ocean and climate variability. This includes ocean, coupled ocean-atmosphere-sea ice, and biogeochemical modelling. Modelling is aimed at understanding the mean ocean circulation and climate, the mechanisms behind their variability on seasonal to millennial timescales, and to assess the predictability of these fluctuations.

Tasks assigned

GEOMAR will contribute to all core themes with enhanced contributions to CT2 and CT3. In CT2, GEOMAR will focus on the heat, freshwater, and nutrient budgets in upwelling regions of the tropical Atlantic as well as on circulation in and connectivity between the equatorial region and coastal upwelling regions. During recent years, the mixed layer heat and nutrient budgets in different regions of the tropical Atlantic were particularly studied by estimating diapycnal fluxes at the base of the mixed layer from microstructure measurements. By using an extensive shipboard dataset, remote sensing and other in-situ data, the seasonal mixed layer heat budget in the equatorial cold tongue region could be closed (Hummels et al. 2013) and the nutrient supply to the mixed layer in the Mauritanian upwelling region could be estimated (Schafstall et al. 2010). These data together with data from different shipboard campaigns and glider swarm experiments in the tropical Atlantic not analysed so far will be available to PREFACE and will be further analysed together with data to be acquired within PREFACE. Current meter moorings in the central equatorial Atlantic are installed since 2004 and will be continued within different programs until 2016. With this equatorial velocity time series the interannual variability of the upper ocean could be linked to internal deep ocean fluctuations having an impact on the climate of surrounding continents (Brandt et al. 2011a, 2011b). A new mooring array at the Angolan coast will be installed by GEOMAR in July 2013 for two years within the BMBF SPACES program to infer the connectivity between the equatorial region and the Benguela upwelling region. The overall dataset of equatorial and coastal circulation variability will be available to PREFACE and studied together with new observations in the eastern equatorial Atlantic and the Benguela upwelling region acquired within PREFACE. GEOMAR will as well contribute to the synthesis of these data with high-resolution and climate modelling within PREFACE.
In CT3, we shall investigate the nature of the SST bias in the equatorial Atlantic and the southeastern tropical Atlantic, a common problem in global climate models. We shall do this with a hierarchy of numerical models, ranging from uncoupled simulations with both ocean and atmosphere models to integrations of coupled ocean-atmosphere general circulation models (CGCMs). Finally, we shall also employ CGCMs with regionally enhanced resolution in the ocean. The research aims at identifying the main causes of the equatorial/southeastern tropical Atlantic sea surface temperature (SST) bias, which are largely unknown at this stage of research. One question is as to whether the bias along the Equator and along the west coast of Africa are strongly linked to each other or mostly reflect two independent biases, the former originating from deficiencies in the representation of atmospheric processes and the latter from shortcomings in the representation of ocean processes. The work will also address the impact of the SST bias on the mean state and the interannual variability outside the tropical Atlantic. The modelling work is embedded into research conducted under the auspices of the Climate Variability and Predictability (CLIVAR) programme of the World Climate Research Programme (WCRP)

Qualification of key Personnel

Dr. Peter Brandt is a Professor of Oceanography in the research unit Physical Oceanography. His main interests are: The role of the ocean in interannual to centennial climate variability, variability of regional ocean circulation, tropical circulation and equatorial wave processes, lateral exchanges by mesoscale eddy processes and diapycnal mixing. He is involved in several international and national committees: 2010-present CLIVAR Atlantic Sector Implementation Panel (chair); 2008-present PIRATA Scientific Steering Group (member); 2010-2013 Vice-President and starting in April 2013 President of the Ocean Science Division of EGU; Brandt has a long-standing experience in sea-going observations as well as model interpretations.

Dr. Mojib Latif is a Professor of Meteorology, chairman of Research Division Ocean Circulation and Climate Dynamics and head of the Meteorology research unit. His main research interests are climate variability and predictability on seasonal to centennial timescales and anthropogenic climate change. In the last 15 years he took part in several European Research Projects. In 2000 he was awarded the Sverdrup Gold Medal by the American Meteorological Society.

Dr. Richard Greatbatch is Professor of Theoretical Oceanography. His interests cover a wide range, focusing on the dynamics of the ocean and the atmosphere on time scales from days to interdecadal, including climate variability and climate change, and transport and mixing by mesoscale eddies in the ocean. He is an Emeritus member of the CLIVAR Working Group for Ocean Model Development and has almost 140 refereed publications in scientific journals. In 1998 he was awarded the President's Prize of the Canadian Meteorological and Oceanographic Society.

Dr. Marcus Dengler is a Senior Scientist in the research unit Physical Oceanography. His scientific interests include the large-scale ocean circulation with particular emphasis on upper ocean processes, diapycnal mixing and on the interaction between physical processes and biogeochemical cycling. Since 2006 and within the framework of a DFG-Emmy Noether fellowship, he is leading a junior research group that investigates mixing processes in the equatorial and coastal upwelling regions of the tropical Atlantic using microstructure and finescale observation. He is an expert in observing turbulence in the ocean.

Relevant publications

Brandt, P., A. Funk, V. Hormann, M. Dengler, R. J. Greatbatch, J. M. Toole (2011a): Interannual atmospheric variability forced by the deep equatorial Atlantic Ocean, Nature, 473, 497-500, doi: 10.1038/nature10013.

Brandt, P., G. Caniaux, B. Bourlès, A. Lazar, M. Dengler, A. Funk, V. Hormann, H. Giordani, and F. Marin (2011b): Equatorial upper-ocean dynamics and their interaction with the West African monsoon, Atmospheric Science Letters, 12, 24–30, doi: 10.1002/asl.287.

Ding, H., N. S. Keenlyside, and M. Latif (2012): Impact of the Equatorial Atlantic on the El Niño Southern Oscillation. Climate Dynamics, DOI: 10.1007/s00382-011-1097-y.

Hummels, R., M. Dengler, B. Bourlès (2013): Seasonal and regional variability of upper ocean diapycnal heat flux in the Atlantic cold tongue, Progress in Oceanography, ISSN 0079-6611, 10.1016/j.pocean.2012.11.001.

Keenlyside, N. S., H. Ding, and M. Latif (2013): Potential of Equatorial Atlantic Variability to Enhance El Niño Prediction. Geophys. Res. Lett., subm.

Mehta, V., G. Meehl, L. Goddard, J. Knight, A. Kumar, M. Latif, T. Lee, A. Rosati , and D. Stammer (2011): Decadal climate predictability and prediction. Where are we? Bull. Amer. Meteor. Soc., 92, 637-640, DOI:10.1175/2010BAMS3025.1.

Schafstall, J., M. Dengler, P. Brandt, and H. Bange (2010): Tidal-induced mixing and diapycnal nutrient fluxes in the Mauritanian upwelling region, J. Geophys. Res., 115, C10014, doi:10.1029/2009JC005940.

Beneficiary 8 IOW

The Leibniz Institute for Baltic Sea Research (IOW) studies marine ecosystems of marginal seas and ocean margins with special emphasis on the Baltic Sea. Since the mid-1990s a major research focus has been on the Benguela upwelling region and oxygen minimum zones at low latitudes (Angola dome). The studies usually combined state of the art field investigations and numerical ecosystem modelling. The major goal is the identification and quantification of fundamental process interactions, which determine the function and dynamics of the entire ecosystem. Sound experience of the specific dynamics of the Benguela upwelling system was gained from former expeditions and model studies. In the course of former research and capacity building projects IOW scientists established a strong collaboration with regional partners in southern Africa.

Tasks assigned

The focus of IOW's contribution to the project will be on the interactions between the tropical Atlantic and the Angola Gyre and Benguela ecosystem. Field observations and numerical simulations with an ecosystem model of the SE Atlantic will be used. The obtained long term data from moorings is used for time series analysis, and for validation and refinement of the IOW ecosystem model of the eastern tropical and subtropical Atlantic.
The overall goals are 1) to clarify the connectivity between the tropical Atlantic and the Benguela upwelling system, 2) to estimate time scales of signal propagation in the Southeast Atlantic, 3) to understand SST variability as result of upwelling variability and local the heat fluxes, and 4) to enhance predictive capability of ecosystem models.

Qualification of key personnel

Dr. Volker Mohrholz is involved since 1999 in physical studies of the dynamics of the ABFZ and exchange processes between shelf and adjacent ocean (Mohrholz et al. 2001). The dynamics of the oxygen budget in the northern Benguela through the interplay of local and remotely forced processes was studied in the frame of the NAMIBGAS project (Lass and Mohrholz, 2008). He operated a mooring on the shelf off Walvis Bay that provided the first highly resolved oceanographic time series of the pole-ward undercurrent and proved the direct coupling of the shelf oxygen conditions with the distribution of central water masses (Mohrholz et al. 2008). Since 2005 V. Mohrholz is working also on the field of marine turbulence in several marine environments, with main focus on turbulent boundary layers.
Dr. Martin Schmidt is working since 1997 in several projects investigating the dynamics of the ABFZ and the northern Benguela upwelling system. (Lass et al. 2000, Mohrholz et al. 2001, Fennel et al. 2012) As chief scientist he was responsible for cruises POS-250 and MSM 18-4. For projects NAMIBGAS and GENUS he has extended the ecosystem model ERGOM for the special conditions within the Benguela upwelling system. He is co-developer of MOM4 and is experienced in the application of high performance computers for numerical ocean modelling. The results gained with a regional Atlantic model (M. Schmidt, in: Herzfeld et al. 2011) are basis of numerical modeling in the GENUS project.

Publications

Fennel, W., Junker, T., Schmidt, M., Mohrholz, V., 2012, Response of the Benguela Upwelling Systems to spatial variations in the wind stress, Continental Shelf Res. (http://dx.doi.org/10.1016/j.csr.2012.06.004).

Herzfeld, M., M. Schmidt, S. M. Griffies, Z. Liang (2011), Realistic test cases for limited area ocean modeling. Ocean Modelling. 37, 1–34, doi:10.1016/j.ocemod.2010.12.008.

Lass, H.U. and V. Mohrholz (2008), On the interaction between the subtropical gyre and the subtropical cell on the shelf of the SE Atlantic. J. Mar. Sys., 74, 1-43.

Lass, H.U., M. Schmidt, V. Mohrholz and G. Nausch, 2000. Hydrographic and Current Measurements in the Area of the Angola-Benguela Front. J. Phys. Oceanogr. 30: 2589-2609

Mohrholz, V., C. H. Bartholomae, A. K. van der Plas and H. U. Lass (2008). The seasonal variability of the northern Benguela undercurrent and its relation to the oxygen budget on the shelf. Cont. Shelf Res., 28, 424-441.

Mohrholz, V., M. Schmidt and J.R.E Lutjeharms, 2001. The hydrography and dynamics of the Angola-Benguela frontal zone and environment in April 1999. South Afr. J. Sci. 97: 199-208

Stramma, L., Gregory C. Johnson, G.C., Sprintall, J., Mohrholz, V., 2008. Expanding Oxygen-Minimum Zones in the Tropical Oceans. Science 320: 655-658

Beneficiary 9 TI

The Thünen-Institute of Sea Fisheries (TI) provides the scientific basis to guide the sustainable use of natural marine resources and evaluates the ecological and economic conditions required to achieve this goal. TI-SF prepares decision support for the German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) with respect to the Common Fisheries Policy of the EU (CFP) and international marine conventions (i.a. NEAFC, NAFO, CCAMLR, OSPAR, IWC, ASCOBANS) of which Germany is a member. Through its scientific monitoring programmes and research activities, the institute contributes to a general increase in knowledge about marine systems for the benefit of the international community.
The institute takes part in international research projects funded by EU and other agencies in order to evaluate and resolve specific questions regarding the management of marine living resources and to further improve the scientific basis of its advice (FP6 projects COEXIST, VECTORS). In line with the ecosystem approach to fisheries management, the institute's ecosystem studies have been conducted since the 1960's yielding a wealth of background data in low latitude Atlantic waters as well as in Arctic and sub-Arctic regions.

Tasks assigned

TI will lead 12 and contribute to WP 13. Tasks comprise building up a data base on meso- and bathypelagic food web data, tuna tagging experiment and bioclimate envelope modelling.

Qualification of key personnel

Dr. G. Kraus is director of the vTI Institute of Sea Fisheries and has a long record of publications in fisheries research and biological oceanography and is one of the promoters of the German cooperation with Cape Verde institutions in the field of oceanography.
Dr. Fock will be in charge of 12 as co-chair. Dr. Heino O. Fock has been involved with marine ecosystem research for many years dealing benthic invertebrate communities, plankton and fisheries ecology at the Univ. Of Kiel, Biologische Anstalt Helgoland, Univ. Hamburg and the Alfred-Wegener Inst. Since 2005 he is employed at TI where he is responsible for the assessment of demersal stocks and the adoption of the ecosystem approach to fisheries management in the NW Atlantic. He has published on midwater ecology, deep-sea diversity and seamount ecology, has supervised 4 master students and 1 PhD.

Relevant publications

Fock, H.O., 2009. Deep-sea pelagic ichthyonekton diversity in the Atlantic Ocean and the adjacent sector of the Southern Ocean. Global Ecology and Biogeography 18, 178-191.

Fock, H.O., Pusch, C., Ehrich, S., 2004. Structure of deep-sea pelagic fish assemblages in relation to the Mid-Atlantic Ridge (45°N to 50°N). Deep Sea Res. I 51, 953-978.

Kraus, G., Pelletier, D., Dubreuil, J., Möllmann, C., Hinrichsen, H.H., Bastardie, F., Vermad, Y., and Mahevas, S. 2009. A model-based evaluation of the performance of Marine Protected Areas as a fishery management measure for a stock facing strong environmental variability - the example of Eastern Baltic cod (*Gadus morhua callarias* L.). ICES J. Mar. Sci., 66: 109-121.

Kraus, G., and Köster F.W. 2004. Estimating sprat population sizes from egg production. Fish. Res., 69: 313-329.

Beneficiary 10 CAU

Christian-Albrechts-Universität zu Kiel (CAU) is a full university owned by the German State of Schleswig-Holstein. At its eight faculties it currently teaches about 23.000 students, with 1.165 scientific staff involved both in teaching and research. In research, CAU is well-profiled; e.g. it currently holds 3 projects funded by the German "Excellence Initiative" and has participated in over 40 projects funded by EU's 6th Framework Programme and is currently involved in 30 projects and successful proposals under the EU's 7th Framework Programme. The Department of Economics has a long tradition in the field of environmental and resource economics. Several major research projects have been coordinated.

Task assigned

CAU will lead WP13 on socio-economic effects of climate change on small-scale coastal fisheries and coastal communities. It will develop environmental sensitive bio-economic models for key species and will use output from WP11 to produce alternate future scenarios as basic storylines for interviews and questionnaires. Major tasks will be interviews, questionnaires and economic experiments within small scale fishing communities in key countries along the West African coast.

Qualification of key personnel

Prof. Dr. Katrin Rehdanz is associate professor for environmental and resource economics at the Christian-Albrechts University of Kiel associated with the Kiel Institute for the World Economy. She holds a diploma and a PhD in economics from the University of Hamburg. She has a strong background in environmental valuation and environmental-economy modeling. Her main areas of research are environmental impact assessment and climate policy analysis. She has published various articles in international journals and has been principle investigator to a number of international and national third-party funded projects including the cluster of excellence initiative "The Future Ocean" funded by the German government.
Dr. Linda Kleemann is an environment and development economist with focus on rural development in Africa. She has experience in microeconometric methods, in particular impact evaluation methods and measuring the adoption and dissemination of agricultural technologies, as well as value chain analysis. She has recently worked on impacts of sustainability standards and certifications in agriculture. She has experience in preparing, managing and executing surveys in rural areas in Africa and India. She is managing director of the Poverty Reduction, Equity and Growth Network (PEGNet).
Dr. Jörn Schmidt is a specialist in multidisciplinary work, currently research fellow within the Cluster of Excellence "Future Ocean" in the Department of Economics, University Kiel. He is experienced in zooplankton ecology, fish larvae ecology and fisheries assessment and ecological-economic modelling. Jörn is co-chair of the ICES "Study Group on Integration of Economics, Stock Assessment and Fisheries Management" (SGIMM) and German member of the Science Committee (SCICOM). He was main contributor to an EU Study on European Fisheries and Climate Change.

Recent Publications

Abdulai A, Kleemann L (Forthcoming). The Impact of Trade and Economic Growth on the Environment: Revisiting the Cross-Country Evidence. Journal of International Development

Kleemann L (2011) Pineapple Faming in Ghana - A Good Choice for Smallholders?. In: D. Neuhoff, N. Halberg, I.A. Rasmussen, J. Hermansen, C. Ssekyewa, and S.M. Sohn (eds), Organic is Life - Knowledge for Tomorrow (2):137-140

Maddison D, Rehdanz K (2011) The Impact of Climate on Happiness and Life- Satisfaction, Ecological Economics, 70(12):2437-2445

Papaioannou EA, Vafeidis AT, Quaas MF, Schmidt JO (2012) The development and use of a spatial database for the determination and characterization of the state of the German Baltic small-scale fishery sector. ICES Journal of Marine Science, 69(8):1480-1490

Rehdanz K, Maddison D (2009) The Amenity Value of Climate to German Households, Oxford Economic Papers, 61:150-167

Schmidt JO, Zeller M. (2012) Climate change in the North and Baltic Seas. In (eds.) Narberhaus I, Krause J, Bernitt U, Threatened Biodiversity in the German North and Baltic Seas - Sensitivities towards Human Activities and the Effects of Climate Change. ISBN 978-3-7843-4017-3, pp. 628

Beneficiary 11 UNIVE

The "Dipartimento di Scienze Ambientali, Informatica e Statistica" (DAIS) was established in January 2011, aimed at merging expertise from Environmental Sciences, Computer Science and Statistics. Strong interactions among DAIS scientists ensure that many research activities carried out by DAIS are based on a truly multidisciplinary approach. Within the DAIS different researchers are particularly active and well recognized in international projects concerning climate issues and anthropogenic stressors. So, for instance, our department contributes to deepen our knowledge on early human impacts on climate (IDEAS-ERC-2010AdG) or policies for sustainable energy investments (FP7-PEOPLE-2010-IRSES), while an attempt is being performed to establish and improve a global mercury observation system (FP7-ENV-2010). Since long time, researchers of our department actively contribute, within national and international projects, to explore past climates in Antarctic regions (for detailed information see, e.g., http://www.csna.it/).

Tasks assigned

With regard to the call, a multidisciplinary approach is applied, in particular, to merge the experiences gained by the group of Climatology and Physical Oceanography of Angelo Rubino and that of Statistics of Carlo Gaetan in order to produce new knowledge on trend variability, extrems recognition, and common behavior of different climate descriptors in the Tropical Atlantic. In PREFACE we will develop a statistical methodology to improve Tropical Atlantic climate predictions (WP10, leader). As a prerequisite, an assessment of state-of-the art climate model to reproduce climate variations over the Tropical Atlantic will be performed.

Qualification of key personnel

Prof. Angelo Rubino has a large experience in theoretical and experimental physical oceanography, remote sensing of the ocean, and climatology. He has participated to many national and international research projects in leading positions for several of them.
Prof. Carlo Gaetan is a statistician and his principal areas of research are spatial statistics and extreme values. In these fields he has given both theoretical and applied contributions, especially for the solution of environmental problems.

Relevant publications

Alpers, W., P. Brandt, A. Lazar, D. Dagorne, B. Sow, A. Rubino, and P. Brehmer: A sub-mesoscale eddy off the coast of West Africa studied by multi-sensor satellite and surface drifter data and by numerical modeling, *Rem. Sens. Environ*, 129, 132-143, 2013.

Zanchettin, D., A. Rubino, D. Matei, O. Bothe, and J. H. Jungclaus: Multidecadal-to centennial SST variability in the MPI-ESM simulation ensemble for the last millennium. Clim. Dyn., DOI:10.1007/s00382-011-1361-9, 2012.

Zanchettin, D., C. Timmreck, H.-F. Graf, A. Rubino, S. Lorenz, K. Lohmann, K. Krueger, and J. H. Jungclaus: Bi-decadal variability excited in the coupled ocean–atmosphere system by strong tropical volcanic eruptions. Clim. Dyn., DOI:10.1007/s00382-011-1167-1, 2012.

Fabbri, P., Gaetan C., Zangheri, P.: Transfer function-noise modeling of an aquifer system in NE Italy, Hydrological Processes, 25, 194-206, 2011.

Chiogna M., Gaetan, C.: An interchangeable approach for modelling spatio-temporal count data. Environmetrics, 7, 849-867, 2010.

Beneficiary 12 WU

Wageningen University (WU) is one of Europe's and the World's leading institutes in the field of Earth and Life sciences. The Meteorology and Air Quality group is specialised in large-scale meteorology, boundary layer turbulence and meso-scale meteorology. As part of Wageningen University, it has naturally become qualified to describe the interactions between the Earth's surface and the atmosphere. WU-MAQ coordinates GEWEX atmospheric boundary layer research program and works with the national meteorological institute, KNMI, on the development of seamless prediction systems. WU-MAQ contributes to the development of Earth system models with new near surface parameterizations and diagnostics.

Tasks assigned

WU contributes with novel boundary layer parameterizations for the advanced Earth System model EC-Earth in WP6. WU will perform specific flux-corrected simulations in WP7 in order to analyze the impact of remote biases. In WP11 new simulations of near-term climate variability and future climate change will be analyzed. WU will work together with KNMI (Prof.Hazeleger, Dr.Haarsma) on the PREFACE tasks.

Qualification of key personnel

Prof. dr. Wilco Hazeleger (M.Sc. in Meteorology 1994, Wageningen University; PhD in Physical Oceanography 1999, Utrecht University) leads the Global Climate Division of KNMI and has a chair in Climate Dynamics at Wageningen University. He initiated and leads the EC-Earth project in which a European consortium of 22 partners develops an Earth system prediction system, based on ECMWF seasonal forecast system. He led the CLIVAR-Atlantic panel and he is involved in many national and European projects on oceanography, climate modelling, prediction and climate services. He co-authored over 80 articles on climate variability and modelling, predictability on seasonal to decadal time scales and on climate scenarios, intended to inform climate adaptation strategies.
Prof. dr. Bert Holtslag is a Senior Professor of Meteorology and Chair of the Meteorology and Air Quality Section at Wageningen University. He has a large track record in research and leadership of national and international projects and programs dealing with modeling and process representation (parameterization) studies for weather, air quality and climate as well as modeling and conceptual analysis of observations dealing with atmosphere-land interaction, urban meteorology and boundary layer processes. He is (co-) author of more than 250 scientific publications, including about 120 well cited papers in the international reviewed atmospheric science literature. His H index is 29 to ISI WEB of Science.
Dr.ReindertHaarsma, (MSc in Physics Utrecht University, PhD Physics 1989, Free University of Amsterdam) is a Senior Scientist at KNMI. He specializes in dynamical meteorology and climate dynamics. He has worked on the development of coupled climate models, coupled ocean-atmosphere processes and teleconnections from the tropics.

Relevant publications

Breugem, W.P., W. Hazeleger and R.J. Haarsma, Multimodel study of tropical Atlantic variability and change Geophys. Res. Lett., 2006, 33, doi:10.1029/2006GL027831

Clim. Dyn., 2011, 36, 5, 989-1003, doi:10.1007/s00382-009-0692-7.

Haarsma, R.J., E.J.D. Campos, W. Hazeleger and C.A. Severijns, Influence of the Meridional Overturning Circulation on Tropical Atlantic Climate and Variability. J. Climate, 2008, 21, 1403-1416, doi:10.1175/JCLI1930.1.

Hazeleger, W. and R.J. Haarsma, Sensitivity of tropical Atlantic climate to mixing in a coupled ocean-atmosphere model Clim.Dyn., 2005, 25, 4, 387-399, doi:10.1007/s00382-005-0047-y.

Hazeleger, W. et al, 2010. "EC-Earth: seamless earth system prediction in action." Bull. AmericanMet. Soc., 91, 1351-1356.

Holtslag, B.; 2006. GEWEX Atmospheric Boundary-layer Study (GABLS) on Stable Boundary Layers. Boundary-Layer Meteorology 118, 243 – 246

Beneficiary 13 IMR

The Institute of Marine Research (IMR) undertakes research on marine resources, the marine environment and aquaculture. The principal objective of IMR is to provide scientific advice in the above areas to the authorities, industry and society. It is the largest marine research institution in Norway. The work primarily concentrates on the ecosystems of the Barents Sea, the Norwegian Sea and the North Sea, and the Norwegian coastal zone. IMR currently executes 38 research projects in the framework of FP7, and coordinates three of them. The Centre for Development Cooperation in Fisheries (CDCF) at IMR is a Norwegian government agency providing capacity building in fisheries and marine environment to developing countries. The CDCF operates the research vessel "Dr. Fridtj of Nansen" monitoring fisheries resources and environment around tropical oceans in the framework of the FAO EAF-Nansen Project.

Tasks assigned

IMR will coordinate access and retrieval of the historic data collected with RV Dr. Fridtjof Nansen (WP2) and will contribute to core themes CT2 and CT5. In CT2, IMR will concentrate on analyses of seasonal and interannual variability of the mixed layer characterizing low-latitude shelf of Gabon-Angola region, based on the historic time series. In CT5, IMR co-coordinates 12 focusing on the implementation of Task 12.2, in cooperation with INIP and MFMR.

Qualifications of the key personnel

Marek Ostrowski is a senior scientist at the Oceanography Section of IMR. He has 15 years of experience in building capacity in oceanography and marine data management around Africa. He initiated and led the creation of the historic data archive from the RV Dr. Fridtjof Nansen surveys comprising meteorological, oceanographic and digital echogram data. His research activities contribute to understanding oceanography and ecology at the coastal boundary of the southeastern Atlantic.
Jens-Otto Krakstad is a senior scientist working at the Centre for Development Cooperation at IMR. He has been working in the Benguela region since 2000 beginning with a three year assignment at Namibia's MFMR. He is currently working with the Nansen program and with several bilateral research cooperation programs around Africa. Krakstad has participated and been cruise leader on more than 30 demersal and pelagic research surveys along the west coast of Africa.
Dr. Erling Kåre Stenevik is a senior scientist working at the Pelagic Fish section at IMR. He has been working in the Benguela region since 1998. He has participated on 15 surveys in the region and currently co-coordinates a Norway funded research project in cooperation Angola, Namibia and South Africa, addressing impact of climate change on marine biodiversity. His research activities are focused on recruitment mechanisms of fish in the Northern and southern Benguela region.

Relevant publications

T. Pripp, T. Gammelsrød and J.-O. Krakstad (accepted). Physical influence on the biological production along the western shelf of Madagascar. In " The Mozambique Channel: Mesoscale Dynamics and Biological Production" Deep Sea research II xxxxx

Garavelli, L., Grüss, A., Grote, B., Chang, N., Smith, M., Verley, P., Stenevik, E.K., Kaplan, D.M. and Lett, C. 2012. Modeling the dispersal of Cape hake ichthyoplankton. Journal of Plankton Research, 34(8): 655-669.

Hutchings, L., van der Lingen, C.D., Shannon, L.J., Crawford, R.J.M., Verheye, H.M.S., Bartholomae, C.H., van der Plas, A.K., Louw, D., Kreiner, A., Ostrowski, M., Fidel, Q., Barlow, R.G., Lamont, T., Coetzee, J., Shillington, F., Veitch, J., Currie, J.C., Monteiro, P.M.S., 2009. The Benguela Current: An ecosystem of four components. *Progress in Oceanography*, 83, 15-32.

Ostrowski, M., J. C. B. da Silva, and B. Bazik-Sangolay (2009), The response of sound scatterers to El Nino- and La Nina-like oceanographic regimes in the southeastern Atlantic, *ICES J. Mar. Sci.*, *66*(6), 1063-1072.

Stenevik, E.K., Verheye, H.M., Lipinski, M.R., Ostrowski, M. and Strømme, T. 2008. Drift routes of Cape hake eggs and larvae in the southern Benguela Current system. Journal of Plankton Research, 30(10): 1147-1156.

Beneficiary 14 UniRes

Uni Research AS is a non-profit research company in which the University of Bergen owns 85% of the shares. Uni Research runs its climate research through the department Uni Climate, and is one of four partners in the Bjerknes Centre for Climate Research (BCCR). BCCR is the largest climate research centre in the Nordic countries with a focus on the natural science aspects of climate change and established expertise in complex research projects (e.g. BCCR Centre of Excellence; NorClim, The National Norwegian Earth System Modelling project; CarboOcean, the multi-institutional EU-IP on the marine carbon cycle). It is guaranteed a continuation of 12 year funding directly from the Government, with the mandate to continue as a leading international centre. Uni Climate has a leading role in Norway for the use and further development of the new Norwegian Earth System Model (NorESM), with expertise in global climate modelling and climate dynamics.

Tasks assigned

UniRes will participate in CT3 and CT4 to support the process-based evaluation and development of the NorESM model towards consistent performance on time-scales from seasons to millennia. It will use a common configuration of NorESM with UiB for seasonal-to-decadal forecasting and climate-mode integrations. In WP6.1,, it will analyse initial-error development in seasonal hindcast systems GloSEA (UKMO) and System-4 (ECWMF) for ocean-atmosphere biases in the TA, complementing existing analysis of CMIP5 integrations (Toniazzo and Woolnough, 2013), and in coordination with parallel SPECS project activity at UREAD. In WP6.2, it will support UiB participation with NorESM in coordinated experiments. In WP6.3 it will employ partial fluxcorrection and decoupling, nudging and forcing techniques (Toniazzo 2010; Vanniere et al. 2013), for sensitivity experiments targeted at the role of specific processes for model bias development, in particular the impact of the Equatorial ocean dynamics on the coastal upwelling regions. A similar strategy will be used in WP8.1 to study the remote impacts on TA bias development of precipitation biases over land areas and in the subtropical Indo-Pacific. These studies have strong links and will be co-ordinated with SPECS and PREFACE activities at UREAD. In WP6.4 it will inform and support current model development efforts with NorESM, and the UiB PREFACE activity with EnKF-based parameter estimation, using the outcomes of the sensitivity experiments in. In WP7.3 it will test the sensitivity to the presence of TA SST biases and the impact of specific corrections on the seasonal cycle (especially monsoon systems), on modes of inter-annual variability; and in WP11.2 on climate sensitivity.

Qualification of the key personnel

Dr Thomas Toniazzo has been a member of the NCAS-Climate Tropical Group for 7 years, and is currently in the process of moving to UniResearch. His research interests are in understanding and modelling of the tropical climate system, including interactions between resolved and unresolved scales, air-sea coupling, and the use of initialized hindcasts to evaluate numerical simulations of the tropical climate with GCMs. Since joining the UK Met Office Hadley Centre in 2000 he has accumulated extensive experience in and made contributions to the coupled GCM modelling. He has actively participated in international climate research programmes s.a. DYNAMITE and VOCALS, and he will be co-supervising a SPECS position on the evolution of Tropical Pacific biases in the ECWMF and Met Office seasonal forecasting systems with **Steve Woolnough** (NCAS-Climate, Reading) and Eric Guilyardi (IPSL/NCAS-Climate).

Relevant publications

Toniazzo, T., 2010: Climate variability in the south-eastern tropical Pacific and its relation with ENSO: a GCM study. Clim. Dyn.34, 1093-1114.

Toniazzo, T., S.J. Abel, R. Wood, C.R. Mechoso, G. Allen, and L.C. Shaffrey, 2011: Large-scale and synoptic meteorology in the south-east Pacific during the observations campaign VOCALS-REx in Spring 2008. Atmos. Chem. Phys. 11: 4977-5009.

Toniazzo, T. and S. Woolnough, 2013: Development of warm SST errors in the southern tropical Atlantic in CMIP5 decadal hindcasts. Clim. Dyn. in press.

Vanniere B., E. Guilyardi, T. Toniazzo, G. Madec and S. Woolnough, (in prep): A hindcast and partially coupled strategy to identify the source of tropical SST errors in coupled GCMs

Beneficiary 15 IC3

The Institut Català de Ciències del Clima (Catalan Institute of Climate Sciences, IC3, Spain) is funded by the Catalan government and aims at developing high-quality research on climate variability and prediction, and its impacts. The Climate Forecasting Unit (CFU, http://ic3cfu.wikispot.org), the research unit involved in this project strong of 15 scientists and technicians, undertakes research on the development of dynamical and statistical methods for the prediction of global and regional climate on time scales ranging from a few weeks to several years. The formulation of the predictions includes the development and implementation of techniques to statistically downscale, calibrate and combine dynamical ensemble and empirical forecasts to satisfy specific user needs in the framework of the development of a climate service. Making progress in dynamical global climate modelling with a focus on monthly-to-decadal climate prediction is one of the main objectives of the CFU, for which it uses the EC- Earth and develops initialization methods that allow improving different aspects of the forecast quality. The assessment of the sources of predictability and the limitations of current climate prediction systems to exploit them, especially over Europe, Africa and South America, inspires many of the publications of the unit. The CFU is currently involved in five FP7 projects, QWeCI, DENFREE, CLIM-RUN, IS-ENES2 and EUPORIAS, several nationally- and privately-funded projects, and coordinates the FP7 project SPECS.

Tasks assigned

IC3 will contribute to WP6 and WP7, where it will analyze the links between the mean state and the variability in EC-Earth and multi-model climate prediction experiments, using a process-based approach. In WP9 it will further our understanding of the processes behind the tropical Atlantic variability, while in WP10 IC3 will use the existing climate informations to combine them statistically, a way to reduce the impact of the systematic error on climate predictions. IC3 will lead WP11, where all the knowledge generated in CTs 3 and 4 will be put together to assess how the improvements in the climate models benefit the tropical Atlantic climate information, comprising both predictions and projections.

Qualification of the key personnel

Prof. Francisco J. Doblas-Reyes is a worldwide expert in the development of seasonal-to-decadal climate prediction systems and the head of the CFU. He is involved in the development of the EC-Earth ESM since its inception. He is an IPCC lead author (Fifth Assessment Report), serves in several WCRP and WWRP scientific panels, has participated in a number of FP4 to FP7 projects, is coordinator of the FP7 collaborative project SPECS and is author of more than 60 peer-reviewed papers. He is shaping IC3's plans for the development of European climate services.
Dr. Isabel Andreu-Burillo is a senior scientist with more than 15 years of experience in operational and research oceanography, including the development of data assimilation codes, in institutions of France, United Kingdom and Australia.

Relevant publications

Vannière, B., E. Guilyardi, G. Madec, F.J. Doblas-Reyes and S. Woolnough (2013). Using seasonal hindcasts to understand the origin of the equatorial cold tongue bias in CGCMs and its impact on ENSO. Climate Dyn, 40, 963-981, doi:10.1007/s00382-012-1429-6.

Guémas, V., F.J. Doblas-Reyes, F. Lienert, Y. Soufflet and H. Du (2012). Identifying the causes of the poor decadal climate prediction skill over the North Pacific. J. Geophys. Res., 117, D20111, doi:10.1029/2012JD018004.

Du, H., F.J. Doblas-Reyes, J. García-Serrano, V. Guemas, Y. Soufflet and B. Wouters (2012). Sensitivity of decadal predictions to the initial atmospheric and oceanic perturbations. Climate Dyn., 39, 2013-2023, doi:10.1007/s00382-011-1285-9.

Doblas-Reyes, F.J., M.A. Balmaseda, A. Weisheimer and T.N. Palmer (2011). Decadal climate prediction with the ECMWF coupled forecast system: Impact of ocean observations. J. Geophys. Res. A, 116, D19111, doi:10.1029/2010JD015394.

Beneficiary 16 UCM

The University Complutense of Madrid (UCM), is one of the oldest universities in Spain and one of biggest one in Europe (80000 students). UCM is Campus of International Excelence, with one cluster in "Global Change and New Energies". PREFACE will be executed TROPA research group founded in 2002 and with a dynamic research activity: more than 23 peer reviewed papers in the last 5 years, experience in climate variability studies under different national and international projects, collaborations with external institutions (ICTP, UPMC, IRD, MPI, UCLA),and a reference group in TAV studies (e.g. Polo et al., 2008; Rodríguez-Fonseca et al., 2009, 2011; Losada et al., 2010,2012; Mohino et al. 2011; Martín-Rey et al. 2012). TROPA has developed skills in numerical simulations with GCMs(Speedy, UCLA-AGCM-MIT-OGCM, running at UCM). http://tropa.fis.ucm.es/web

Tasks assigned

Reliability of CMIP5 models in reproducing the TAV SST modes (WP7); coordination of WP8 and WP9; remote influence, impacts and modulations of/on the TA bias (WP8); understanding of the Equatorial Mode and impacts, including the two-way Atlantic-Pacific relationship (WP9); statistical modelling of SSTs and WAM (WP10); analysis decadal predictions on the WAM (WP11).

Qualification of the key personnel

Belen Rodriguez-Fonseca is Full Professor at UCM and PI of TROPA. She has more than 20 papers in SCI journals, extensive experience in tropical and extratropical climate variability and a record of national research projects dealing with TAV and teleconnections, cooperational projects with Senegal, and participation in EU projects. She is first author of a referenced paper about the influence of the Atlantic Niño on the triggering of ENSO and she is convener of an EGU session about Tropical Teleconnections. 4 PhD Thesis supervised, 12 Masters and she is currently advising 6 PhD Theses.
Elsa Mohino is Assistant Professor at UCM. She received her B.Sc. degree in Physics in 2000 and her Ph.D. in 2005 both at UCM. She also obtained a two-year post-doctoral grant to work at LOCEAN (Paris, France) in West African variability from intra-seasonal to multi-decadal timescales. She works in TROPA group since 2007.

Relevant publications

Losada T., Rodríguez-Fonseca B., Polo I., Janicot S., Gervois S., Chauvin F., Ruti P. 2010b. Tropical response to the Atlantic Equatorial mode: AGCM multimodel approach,Clim. Dyn., 35: 45-52. DOI 10.1007/s00382-009-0624-6.

Losada T., B. Rodriguez-Fonseca, E. Mohino, J. Bader, S. Janicot and C.R. Mechoso 2012: Tropical SST and Sahel rainfall: A non-stationary relationship, Geophysical Researh Letters, Vol. 39, L12705, doi:10.1029/2012GL052423

Martín-Rey M, I.Polo, B.Rodríguez-Fonseca, F.Kucharski 2012. Changes in the Interannual Variability of the Tropical Pacific as a response to an equatorial Atlantic forcing. Sci. Mar. Vol. 76, No. S1, 2012. (in press)

Mohino E., Janicot S. and Bader J. 2011a. Sahel rainfall and decadal to multi-decadal sea surface variability. Clim. Dyn. 37: 419-440. DOI: 10.1007/s00382-010-0867-2

Polo I., B. Rodríguez-Fonseca, T. Losada, J. García-Serrano 2008a: Tropical Atlantic Variability modes (1979-2001). Part I: time-evolving SST modes related to West African rainfall, J.Clim. 21:6457-6475.

Rodríguez-Fonseca B., Polo I., García-Serrano J., Losada T., Mohino E., Mechoso C.R. and Kucharski F. 2009. Are Atlantic Niños enhancing Pacific ENSO events in recent decades? Geophys. Res. Lett. 36. L20705. DOI:10.1029/2009GL04004

Rodríguez-Fonseca B., Janicot S., Mohino E., Losada T., Bader J., Caminade C., Chauvin F., Fontaine B., García-Serrano J., Gervois S., Joly M., Polo I., Ruti P., Roucou P and Voldoire A. 2011. Interannual and decadal SST-forced responses of the West African monsoon. Atmos. Sci. Lett. DOI 10.1002/asl.308

Beneficiary 17 UREAD

The University of Reading and is a leading centre in modelling and understanding the climate system. The climate directorate of the National Centre for Atmospheric Science (NCAS) at Reading and the Meteorology Department within which it sits, have over 70 research staff and about 45 research students working across atmospheric and climate science as well as hosting staff from the UK Met Office. In the 2008 Research Assessment Exercise 75% of its research was graded as world leading or internationally excellent. NCAS-Climate and the Department of Meteorology are playing a leading role in the development of earth-system models and high-resolution climate models. NCAS-Climate includes an internationally leading group focused on the weather and climate of the tropics. These groups have been partners in a number of previous and ongoing EU funded projects including ENSEMBLES, THOR, SPECS of relevance to this proposal.

Tasks assigned

UREAD's participation in PREFACE will provide a link with ongoing activities in the SPECS project involving the UKMO seasonal forecasting system GloSEA4 (UM v8, HadGA3 N96L85 + NEMO/ORCA 025L75). Specifically, these links are with research planned for WP6 and WP8. In WP6.2 it will participate in coordinated experiments with GloSea5 for WP6. In WP6.3 it will employ partial or regional fluxcorrection and decoupling techniques (Toniazzo 2010), nudging and forcing techniques (Vanniere et al. 2013), for additional sensitivity experiments targeted at the role of specific processes for the development of model biases, in particular the impact of biases in the Equatorial thermocline on the Benguela and Canary upwelling regions. A similar strategy will be used in WP8.1 to study the remote impacts of mean-state precipitation biases over adjacient continental areas and in the subtropical Indo-Pacific on TA bias development. These studies have strong links and will be co-ordinated with SPECS activities at UREAD and PREFACE activities at UniRes.

Qualification of the key personnel

Dr Steven Woolnough is the head of the NCAS-Climate Tropical Group, his research interests are in understanding and modeling of the tropical climate system, including interactions between convection and the large-scale dynamics, air-sea coupling, and in the use of initialized hindcasts to understand the sensitivity of the simulation of the tropical climate to the representation of physical processes. He will be co-supervising a SPECS position on the evolution of Tropical Pacific biases in the ECWMF and Met Office seasonal forecasting systems with Thomas Toniazzo (UniReserach, Bergen) and Eric Guilyardi (NCAS-Climate). He has strong links with the Met Office through involvement in their Working Groups on the Madden-Julian Oscillation and the Asian Monsoon. He is a leading a component of a joint GASS/YoTC-MJO-TF international project on the Madden-Julian Oscillation and is member of the Planning Group for the WWRP/WCRP Subseasonal to Seasonal Prediction Project.

Relevant publications

Vanniere B., E. Guilyardi, T. Toniazzo, G. Madec and S. Woolnough, (in prep): A hindcast and partially coupled strategy to identify the source of tropical SST errors in coupled GCMs

Toniazzo, T. and S. Woolnough, 2013: Development of warm SST errors in the southern tropical Atlantic in CMIP5 decadal hindcasts. *Clim. Dyn. in press*.

Vanniere B., E. Guilyardi, G. Madec, F. J. Doblas-Reyes and S. Woolnough, 2013: Using seasonal hindcasts to understand the origin of the equatorial cold tongue bias in CGCMs and its impact on ENSO. *Clim. Dyn.*, 40, 963-981.

Klingaman, N. P., S. J. Woolnough, H. Weller and J. M. Slingo, 2011: The impact of finer-resolution air-sea coupling on the intra-seasonal oscillation of the Indian monsoon. *J. Climate*, 24, 2451-2468.

Woolnough, S. J., F. Vitart and M. A. Balmaseda, 2007: The role of the ocean in the Madden-Julian Oscillation: Implications for MJO prediction. *Quart. J. Roy. Meteor. Soc.,* 133, 117-128.

Beneficiary 18 INIP

The Instituto Nacional de Investigação Pesqueira (INIP) undertakes research primarily concentrated along the Angola coastal line in whole region of on marine resources, the marine and continental environment. The principal objective of INIP is to provide scientific advice in the above areas to the authorities, industry and society as a whole. The INIP is answerable to the Ministry of Fisheries, and its duties are to: monitor and carry out research on life, the environment and interactions among living organisms in coastal waters and the ocean. Also the INIP take part on the research in whole Benguela Current Large Marine Ecossystem (BCLME) and Guinea Current Large Marine Ecossystem (GCLME). With a staff that include researchers, technicians and administrative, INIP is the main institution that deal with marine environment. INIP has historical experience in marine research. Since 1968 was stated the Lobito Fixed Station, with daily record, beside the INIP two fisheries researcher centre are located in Central (Benguela) and South (Namibe) part of Angola. Researchers of INIP are involved in many currents projects national, regional and international, with countries as South Africa, Namibia, Norway, Germany and others.
More than 30 years data of resources and environment were collected by different researcher vessels (mainly Dr. Fridtjof Nansen) and can be a useful tool for the PREFACE.

Tasks assigned
The INIP will involve in task of packages WP3, WP4, WP12. For this, the data set of collected with RV Dr. Fridtj of Nansen and others vessels, from fixed station and others sources will be available to contribute to core themes CT2 and CT5. The INIP participation will be opportunity for improvement of capacity building of the own staff and improve the partnership with international experienced researchers agencies.

Qualifications of key personnel
Pedro Tchipalanga is a senior researcher at the INIP. He has more than 10 years of experience in work in oceanography Department and involved in many researcher projects mainly at national and regional level. His research activities contribute to understanding oceanography along the coastal zone of Angola.
Antonio da Silva is General Director and a senior researcher at the INIP. He has more than 5 years of experience in work in oceanography Department and involved in many researcher projects mainly at national and regional level. His research activities contribute to understanding Biological oceanography along the coastal zone of Angola.

Relevant Publications
Dias, C.A,1983 - Preliminary report on the physical oceanography off southern Angola, March and July 1971. Collection of Scientific Papers International Commission for the Southeast Atlantic Fisheries, 10. pp. 103-116

Dias C.A., 1983 - Preliminary report on the physical oceanography off southern Angola, March and July 1971. Collection of scientific papers. ICSEAF. pp 103-116

Dias C.A., 1983 - Note on the evidence of a permanent southward flow of upper oceanic tropospheric waters off Angola at 12º S. Collection of scientific papers.. ICSEAF. pp 99-102

Gammelsrød, T., C.H. Bartholomae, D.C. Boyer, V.L.L. Filipe and M.J. O´Toole, 1998: Intrusion of warm Surface Water along the Angolan-Namibian Coastal in February_march 1995: The Benguela Niño. S. Afr.J. Mar. Sci., 19: 41-56

Hutchings, L., van der Lingen, C.D., Shannon, L.J., Crawford, R.J.M., Verheye, H.M.S., Bartholomae, C.H., van der Plas, A.K., Louw, D., Kreiner, A., Ostrowski, M., Fidel, Q., Barlow, R.G., Lamont, T., Coetzee, J., Shillington, F., Veitch, J., Currie, J.C., Monteiro, P.M.S., 2009. The Benguela Current: An ecosystem of four components. Progress in Oceanography, 83, 15-32.

Ostrowski, M., J. C. B. da Silva, and B. Bazik-Sangolay (2009), The response of sound scatterers to El Nino- and La Nina-like oceanographic regimes in the southeastern Atlantic, ICES J. Mar. Sci., 66(6), 1063-1072.

Pedro Tchipalanga, 2003 - Sea Level Anomalies Associated with Warm and Cold Events along the Angolan Coastal Zone. Submitted, University of Cape Town.

Quilanda Fidel, 2001- Spatial and temporal variability of coastal temperature and salinity on Angola waters. MSc Thesis. Submitted, University of Cape Town

Fidel,Q ; Filipe,V; Gammelsrod, T; Hansen,E; Lien, V.S, Tchipalanga,P, 2004 - Oceanographic features off Angola (in press)

Beneficiary 19 MFMR

The Ministry of Fisheries and Marine Resources (MFMR) was established shortly after independence in 1990 to manage Namibia's living marine resources. The Directorate of Resource Management (DRM) is responsible for providing scientific management advice. To perform this duty DRM is divided into three subdivisions: Pelagic, Demersal & Environment which are running several research and monitoring programmes, focusing mainly on the commercially important fish species such as hake, monk, orange roughy, deep sea red crab and rock lobster, sardine, anchovy, horse mackerel and tunas. Research activities include biomass assessment (based on surveys), ageing, ecosystem research and stock assessment. The Subdivision Environment assesses the state of the marine environment through research and regular monitoring of key parameters such as sea temperature, salinity, dissolved oxygen, nutrients, phyto-, zoo- and ichthyoplankton species composition and abundance.

Tasks assigned

MFMR will contribute to WP4 mainly, as well as WP3 through its existing hydrographic observation network. These observations will be used to investigate the interaction of the eastern boundary current regime and the Angola Dome for a better understanding of factors determining the generation of cold and warm events in the Benguela. MFMR will also participate in WP12.

Qualification of key personnel

Mrs Anja van der Plas has been working in the physical and chemical oceanography section since 1995, her work particularly focussing on the low oxygen dynamics of northern Benguela shelf region.

Mr Chris Bartholomae has worked on the physical oceanography of the northern Benguela since 1992.

Mr Uatjavi Uanivi has been a fisheries biologist with the institute since 2005 doing research on horse mackerel, and currently heading the Horse mackerel Research section.
Mrs Nadine Moroff has been a fisheries biologist at the institute since 2003 in the Small Pelagic Section, dealing mainly with sardine, but also with red eye round herring, anchovy and sardinella.

Relevant publications

Mohrholz, V., Bartholomae, C.H., van der Plas, A.K., Lass, H.U., 2008. The seasonal variability of the northern Benguela undercurrent and its relation to the oxygen budget on the shelf. CSR 28: 424-441

Monteiro, P.M.S., van der Plas, A.K., Mélice, J.-L., Florenchie, P., 2008. Dynamical characteristics of interannual hypoxia variability in a coastal upwelling system: climate and ecosystem state implications, DSR I 55:435-450.

Bartholomae, C.H., van der Plas, A.K., 2007. Towards the development of environmental indices for the Namibian shelf, with particular reference to fisheries management. AJMS 29: 25-35.

Monteiro PMS, van der Plas AK, Mohrholz V, Mabille E, Pascall A, Joubert W 2006. The variability of natural hypoxia and methane in a coastal upwelling system: oceanic physics or shelf biology? GRL 33: L16614, doi:10.1029/2006GL026234

Rouault, M., S. Illig, C Bartholomae, C.J.C. Reason and A. Bentamy , 2007. Propagation and origin of warm anomalies in the Angola Benguela upwelling system in 2001. J Mar. Sys. 68:473-488.

Gammelsrød T, Bartholomae CH, Boyer DC, Filipe VLL, O'Toole MJ (1998) Intrusion of warm surface water along the Angolan-Namibian coast in February–March 1995: the 1995 Benguela Niño. In: Pillar SC, Moloney CL, Payne AIL, Shillington FA (eds) Benguela Dynamics: Impacts of Variability on Shelf-Sea Environments and their Living Resources. SA J Mar. Sci. 19: 41–56

K. L. Cochrane, C. J. Augustyn, T. Fairweather, D. Japp, K. Kilongo, J. Iitembu, N. Moroff, J.-P. Roux, L. Shannon, B. van Zyl, and F. Vaz Velho. Benguela Current Large Marine Ecosystem-Governance and Management for an Ecosystem Approach to Fisheries in the Region. Coastal Management 37:235-254, 2009.

Beneficiary 20 UCT

The University of Cape Town (UCT) is a public research university located in Cape Town in the Western Cape province of South Africa. UCT was founded in 1829. As of 2011, 24,773 students were enrolled. UCT employs approximately 4500 staff members of whom 44% are academic staff; the rest are administrative and support staff. Between 85% and 90% of academic staff hold doctoral or masters qualifications. The Department of Oceanography, the only one of its kind in sub-Saran Africa, is the major focus for teaching and research in physical oceanography, atmospheric science and climatology in South Africa and elsewhere in Africa. The Department has 5 academic and 2 research and 3 support staff.

Tasks assigned

The Nansen-Tutu Center and the Department of Oceanography will coordinate the effort which should include 2 PHD, a junior lecturer in the Department of Oceanography and the Nansen-Tutu Center and, Jenny Veicht who does not need funding and Mathieu Rouault. Funding will be used to pay the 2 PHD and 1/3 of Mathieu Rouault cost of employment and travel to workshop. We will also host researcher and students from Namibia, Angola and Europe to foster collaboration between researchers.
UCT will contribute to:
WP4: Circulation and wave response
Tiago Queiroz (Angola) will do a PHD at UCT on Benguela Niños using model output from ORCA05 and observation and will do some experiment using ROMS (2014). He is advised by Mathieu Rouault, Jenny Veitch and Chris Reason. Mathieu Rouault (UCT) will work on the variability of ocean circulation in the Tropical South East Atlantic inferred from altimetry and satellite remote sensing of wind stress, sea surface temperature and salinity and model. He will advise and host PHD students from Angola and Namibia. Dr Mathieu Rouault will oversee the implementation of the PIRATA South East extension with relevant people and analyse the results.
WP5: Joint observations – model comparison
Mathieu Rouault jenny Veitch and Tiago Queiroz are using models as well as observation and will be able to contribute to WP5. Dr Jenny Veitch, junior lecturer at UCT is fully funded and will participate to the project and co-advise students. She is doing ROMS regional modelling of the Benguela upwelling.
WP9: Understanding of TAV on seasonal and longer time scales and its global impacts
George Noel TiersMondo (advisor Mathieu Rouault) will do a PHD within the program George Noel TiersMondo will look at ERA Interim and CFSR reanalysis, Reynolds and TRMM SST as well as satellite derived precipitation data from TRMM and GPCP due to the lack of data in Central Africa. Results from satellite and remote sensing could be compared with coupled model output at some stage. Scale will range from seasonal to the diurnal cycle.

Qualification of key personnel

Dr Mathieu Rouault is a researcher in the Dept. of Oceanography of University of Cape and is also affiliated to the Nansen-Tutu Center. He has a PhD (1989) in Fluid Mechanics. He has published about 60 peer review papers. He is president of South African Society for Atmospheric Science, chairman of the international PIRATA South East extension program, member of CLIVAR Atlantic and CLIVAR Africa panels
Tiago Queiroz is a lecturer at University of Luanda
George-Noel Tiersmondo is a lecturer at Institut de Technology de Kinshasas

Relevant publications

Rouault, M. (2012), Bi-annual intrusion of tropical water in the northern Benguela upwelling, Geophys. Res. Lett., 39, L12606, doi:10.1029/2012GL052099.7.
Rouault, M., B. Pohl and P. Penven, (2010) Coastal Oceanic climate change and variability from 1982 to 2009 around South Africa, African Journal of Marine Science 32(2): 237–246
Rouault, M., Servain J., Reason C.J.R., Bourles B., Rouault M.J., Fauchereau N., (2009): Extension of PIRATA in the tropical South-East Atlantic: an initial one-year experiment. African Journal of Marine Science 2009, 31(1): 63–71

Beneficiary 21 INDP

The National Institute for Fisheries Development (INDP) created in 1992, is a public institution, with legal personality and with administrative, scientific and technical autonomy. The INDP is the scientific support of the government in fisheries development, management, policy and planning, as well as in marine biodiversity conservation and marine environment issues. The Institute has a research vessel, "Islandia" as well as a laboratory and a times-series oceanographic site, the Cape Verde Oceanic Observatory (CVOO – www.cvoo.de), which measures temperature, salinity, biological parameters, nutrients, dissolved carbon and oxygen, and include an oceanographic long-term mooring for in-situ observations. The observatory is a result of cooperation between the INDP, and GEOMAR in Kiel, Germany, and it became a very important logistic base on the international oceanographic scientific context and it highly welcomes international investigators to conduct field work in the West African region. In addition to the long-term measurements of oceanographic parameters the CVOO has been used to develop different research related to climate change, namely the importance of natural aerosol in marine environments, the interaction between the ocean and the desert, the breathing of the ocean, interplay of small-scale physical and biogeochemical processes near the Cape Verde Islands, diversity and activity of marine N2 fixers in oligotrophic waters of the North Atlantic, etc. The lab offers several equipment, including spectrophotometer, fluorometer, homogenizer, centrifuge, automatic titration (Winkler Method) autoanalyzer (nutrients), freezers (-20 and -80ºC), generator/producer of liquid nitrogen, among others. The observatory is a member of the network for ocean observatories (EuroSITES). In order to increment CVOO's activities and developing ocean research in Cape Verde and give greater support to the international scientific community working in this region, Cape Verde, with support from Germany will soon build the Ocean Science Centre Mindelo (OSCM). Recently, areas like remote sensing, data processing and analysis of satellite and in situ data are being addressed by the Institute. Web site: www.indp.cv. Nonetheless, INDP's main focus is fisheries research and marine biodiversity management, where daily biologic samplings of species are done in order to serve as a basis for studies of population dynamics and assessments to determine the behavior and abundance of the commercial important species and based on that, propose management measures for sustainable fisheries.

Tasks assigned

In the PREFACE project INDP will have a major role in CT5/WP12, particularly for the tagging experiment that will be carried out off Cape Verde archipelago, in collaboration with TI and IRD. In the CT5/WP13 issues related to the assessment of the impacts of climate change on the fishery INDP we actively participated to data analysis and they will responsible to set the interview in Cape Verde, which is the only island state of PREFACE.

Qualification of key personnel

Dr., Carlos Ferreira Santos is a shipbuilding engineer, he is director of the Fisheries Development and Promotion Department, board member, and PI of the WP2 of the AWA project.
Dr. Oliveira Monteiro, Ivanice is a marine biologist, responsible of laboratory analyses at CVOO.
Mr. Melo Ramos, Vito de Deus is a biologist and PhD candidate on Oceanography.
Dr. Neves Silva, Péricles is a Marine biologist, post graduate in marine resources and fisheries management and CVOO manager.
Dr. Brito Vieira, Nuno is a marine biologist, CTD technician on CVOO.
Mr. Costa V., Márcia is a Fisheries Engineer, master on Biologic Oceanography.

Relevant publications

Bartley D. M., Subasinghe R. and Santos C. F.*Tilapia and tuna risk analysis of introducing tilapia into Cape Verde*. FAO Aquaculture Newsletter 49. 2012.

Fiedler, B., P. Fietzek, N.Vieira, P. Silva, H. Bittig, and A. Kortzinger (2013). *In situ CO2 and O2 measurments on a profiling float*, J.Atmos. Ocean Tech., doi:10.1175/JTECH-D-12-00043.1, in press.

Ramos, V., Pérez-Marrero, J., Llinás, O., Cianca, A. and Morales, J. 2008. *Variation of the Chlorophyll a concentration in the Cape Verde region related to SST, wind and geostrophic currents from satellite data*. Progress in Oceanography. (in publication)

Ramos, V.D.M., Fujiwara, S. 2004. *Possibility of Acoustic Biomass Estimation by the Ordinary Echo sounder for Cavala Preta, Decapterus macarellus, in Cape Verde waters.* In: Relatório final do Projecto de Cooperação Científica sobre Recursos Haliêuticos na ZEE da Republica de Cabo Verde, Março 2004, INDP, Mindelo, Cabo Verde. Anexo 6-1.

Beneficiary 22 INRH

The "Institut National de Recherche Halieutique" (INRH) of Morocco is a public entity granted with a moral and financial autonomy since 1996. Dedicated to Research and technological development in fisheries science, INRH is an indispensable tool for decision making in the maritime sector in Morocco. Through its research programs and expertise, INRH contributes to scientific knowledge on marine environment and biodiversity in order to develop responsible and sustainable exploitation of marine resources. The institute's role is conducting an ongoing assessment of the state of fishery resources, monitoring ecosystem indicators and ensuring the quality and safety of the marine and coastal environment in Morocco. In addition, INRH undertakes various research activities and experiments at sea or ashore such as aquaculture studies, monitoring of artificial reefs and marine protected areas in order to develop and rationalize the management of fisheries resources.

The INRH is composed of about 440 people working in multidisciplinary research areas and organized into three scientific departments: (i) the Department of Fisheries Resources provides diagnostics on the status of exploited stocks and on their variability facing fishing pressure and environmental dynamics. Through its scientific advices, this department contributes efficiently to the development of national fisheries, (ii) the Department of Oceanography and Aquaculture analyses and follows the evolution of marine and coastal ecosystems, evaluates the aquacultural potentialities and ensures the monitoring of coastal algal and shellfish areas potentialities, (iii) The Department of Quality and Safety of the Marine Environment aims to preserve the health of marine and coastal ecosystems and the protection of consumer health through the monitoring of chemical and microbiological contamination.

Tasks assigned

The PREFACE project addresses key scientific issues to the Department of Fisheries Resources and represents a major concern for the National authorities and the fishing industry in Morocco. From its experience in acoustic and oceanographic surveys, INRH will actively intervene in CT5/WP12, in order to analyse the impacts of environmental factors on small pelagic species, especially small pelagic *e.g.* sardines. Moreover, due to the strong interactions between pelagic fisheries and hydroclimatic conditions, the CT5/WP13 issues related to the assessment of the impacts of climate change on the development of the small pelagic fishery will be crucial for INRH.

Qualification of key personnel

Dr. Najib Charouki, Head of the URD "Direct Monitoring and Observation of Stocks"
Mr. El Salahdine Ayoubi, Head of the Laboratory of Acoustics
Dr Abdelmalek Faraj, Head of the Department of Fisheries Resources
Mr Abdelkabir Kamili, socio-economist at the INRH.

Relevant publications

Charouki N., Raïssi N., Auger P., Mchich R., and Atmani H., 2011. A management oriented competitive model with two time scales: The case of sardine fishery along the Atlantic coast between Cantin Cape and Blanc Cape. ECOMOD-6083; 9p.

Mchich R., **Charouki N**., Auger P., Raissi N. and Ettahiri O., 2006. Optimal spatial distribution of the fishing effort in a multi fishing zone model. Ecological Modelling, 197(3/4), 274-280.

Faraj A., and Bez N. 2007. Spatial considerations for the Dakhla stock of Octopus vulgaris: indicators, patterns, and fisheries interactions. ICES Journal of Marine Science, 64,1820-1828.

Robert M., **Faraj A**., McAllister M. and Rivot E. 2010. Bayesian state-space modeling of the De Lury depletion model: strengths and limitations of the method and application to the Moroccan octopus fishery. ICES Journal of Marine Science, 67, 1272-1290.

Kifani S., Masski H. and **Faraj A**., 2008: The need of an ecosystem approach to fisheries: The Moroccan upwelling-related resources case, Fisheries Research 94, 36-42.

S. EL AYOUBI, 2012. Evaluations des stocks des petits pélagiques en Méditerranée et Atlantique marocains en saison du printemps/ Assessement of small pelagics stocks in the Mediterranean and Atlantic Moroccan spring season. 29 p.

Beneficiary 23 ISRA

Founded in 1974, the Senegalese Institute for Agricultural Research (ISRA), which became in 1997 a Public Scientific and Technological Entity, develops and conducts research on crops, livestock, fisheries, forestry and rural socio-economics in order to contribute to the growth of agricultural production. Its main objectives are i)the design and execution of research program on crop production, forestry, animal and fishery and rural economy, ii)the creation of scientific knowledge, the generation of technological innovations and the development of tools for decision support to improve the agricultural sector, iii)the development and transfer of research results, iv) the promotion and research training through research and v)the development of scientific cooperation as well as with African and international research institutions and universities in Senegal. The Centre for Oceanographic Research of Dakar-Thiaroye (CRODT), is the ISRA's department responsible for fishery research in Senegal. Composed of 87 researchers, engineers and technicians, the CRODT is based in Hann (Dakar), with offices in St Louis, Kayar, Mbour, Joal and Ziguinchor and an oceanographic research vessel « Itaf DEME ». The main missions of the CRODT are i) the evaluation of the fishery resources, ii) the monitoring of the fishery resources and operating systems, iii)providing technical basis of fishery management measures for the sustainable exploitations of fishery resources.
In addition to its main research program " Resources and Environment ", " Dynamics of operating systems " and " Management and development of fisheries and their environments », CRODT is strongly involved in the CECAF/FAO working groups on the "assessment of coastal pelagic resources of the North-West Africa area" and the "assessment of demersal resources" and in the evaluation panels within the International Commission for the Conservation of Atlantic Tunas (ICCAT). A last point according to preface proposal, ISRA/CRODT is the owner institution for EAF-Nasen data along Senegalese coastline.
Scientific contact: **Dr Hamet Diaw Diadhiou,** Fishery Biologist, Head of the ISRA CRODT

Tasks assigned

ISRA also participates in WP12. ISRA will contribute to the CT5 and is the Senegalese institution owner of the Nansen data. ISRA will play a key role in West African animation of WP13 in PREFACE on social and economical issues. IRSA have also an expertise in fisheries acoustics at sub regional level that will be used in WP12 through a local PhD thesis.

Qualification of key personnel

Adama Mabaye is a sociologist researcher with a solid background in small scale fisheries. He is a member of the « Association Française d'Halieumétrie » as well as of the « Association Euro-africaine Pour l'Anthropologie du changement social et du Développement ». He will play a key role in West African animation of WP13 of CT5 and is already in contact with the PREFACE partner of the Guinea Gulf.
Abdoulaye Sarré is a fisheries acoustics engineer in charge of small pelagic fish stock assessment in Senegal. Since 1988 he has participated to numerous surveys at sea and training in acoustics (e.g. SIMRAD). He was the head of the acoustic group of FAO in the CCLME. He will apply for a PhD in PREFACE CT5 (WP12), with CT5 PI and have regular experience of common survey with IMR leader of WP5112.
Djiga Thiao is a fisheries economist, with a solid background in fisheries sciences and statistical approach, he is as Mbaye A and Sarré A involved in the AWA project associated to PREFACE. He will mainly work on CT52 inside PREFACE.

Relevant publications

CEPIA, P., une gestion des Pêches, C. E., les Amp, I., Thiaw, D., Déme, M., **Diadhiou, H. D., & Mbaye, A**. 2011. Etats des lieux nationaux-Projet CEPIA: dynamiques halieutiques et systèmes de gestion des pêches.

Charles-Dominique, E., **& Mbaye, A.** 1999. Les usages de l'espace dans la pêche artisanale sénégalaise. In Communication au 4ème forum halieumétrique, Rennes (Vol. 29).

Mbaye Adama, 2010, Différenciation sociale dans la pêche maritime artisanale sénégalaise : implications pour la gestion des ressources halieutiques, Editions Universitaires européennes, Schaltungsdienst Langue o.H.G, Berlin, ISBN : 978-613-1-54265-7, 307p.

Sarré A., N. Charouki, E. M. Mahmoud, M. A. O.Taleb, E. Mbye, J. Jallow, S. El Ayoubi, J.-O. Krakstad and O. Alvheim. 2010. Towards coordinated acoustic surveys in North West Africa: Results of Parallel surveys and Intercalibrations. Report on the Workshop on the North West African Small Pelagic Resources, Casablanca, Morocco.

Thiao D. and Laloë F. 2012. A System of Indicators for Sustainability: an example from the Senegalese Fisheries. *Marine Resource Economics*, 27, 267-282.

Beneficiary 24 UCAD

UCAD is a public organization that has the mission to do research and training. More than 40 African nationalities are represented in UCAD. Expertises have been developed in the field of atmospheric sciences, oceanography, climate studies, hydrology, land productivity, food production including fisheries, water resources management. UCAD is used to advise national services and involved in national committees coodinating development issues. UCAD is usually involved in many research projects and international programs. UCAD had very significant contribution in AMMA project funded through FP6. The experience and work gained particularly on AMMA have been the basis of further investigations in QWECI FP7 funded project.

Tasks assigned

UCAD will contribute to analysis of heat and freshwater budgets air-sea interaction particularly determination of vertical velocities with moorings deployed of Senegal (WP3 and 4). UCAD will also investigate local air-sea interaction and the role of SST fronts and their variability. In WP4 UCAD will also contribute to analysing simulations of the Tropical Atlantic at Medium to very high resolution in the Senegal-Mauritania upwelling system. This will include analysis and validation of global and regional coupled models (WP6 and WP7). The resulting air-sea coupling will be compared with results of WP3. UCAD will cooperate with UCM on further development and validation of the statistical seasonal prediction model of upwelings considering non stationarity of predictors (SST). (WP10)

Qualification of key personnel

Amadou GAYE is full Professor at UCAD and Director of the Laboratoire de Physique de l'Atmosphere et de l'Ocean Siméon Fongang (LPAO-SF) at UCAD is specialised in rainfall variability related to the African monsoon. He is very much active on diagnostic studies, analysis and validation of climate simulation for climate change and variability issues. He is involved in coordination of African scientists working on Climate and is involved in international programs. He was PI of several research projects. He is member of Senegal national climate change committee.
Abdoulaye Deme is a researcher working in LPAOSF. He is also cooperating in a national project with the Ministry of environment on integration of Climate change Adaptation in national policies.

Other LPAOSF members who will be involved are Saidou M. Sall (senior lecturer) on intraseasonal air-sea interaction processes (convection over TA and cyclogenis), Dr Malick Wade (non permanent staff), and assistant professor Bamol Sow (University of Ziguinchor, associate researcher of the LPAOSF/UCAD).Finally several PhD students currently co-advised with UPMC will participate in the tasks.

Relevant Publications

Salack S, Giannini A, **Diakhaté M, Gaye AT**, Muller B (2012) Oceanic influence on the sub-seasonal to interannual timing and frequency of extreme dry spells over the West African Sahel. Climate Dynamics, DOI 10.1007/s00382-013-1673-4

Wade, M., Caniaux, G; duPenhoat, Y (*2011)*: Variability of the mixed layer heat budget in the Eastern Equatorial Atlantic as inferred from Argo floats. Accepté au Journal Geophysical Research Ocean. J. Geophys. Res., doi:10.1029/2010JC006683.

Wade, M., G. Caniaux, Y. DuPenhoat, M. Dengler, H. Giordani, and R. Hummels *(2010)*: A one dimensional modelling study of the diurnal cycle in the tropical Atlantic at the PIRATA buoys during the EGEE-3 campaign. Ocean Dynamics, DOI: 10.1007/s10236-010-0337-8.

Sylla, B., **A.T. Gaye**, J. Pal, G. Jenkins, BI, 2009: High-resolution simulations of West African climate using regional climate model (RegCM3) with different lateral boundary conditions, *Theor Appl Climatol* DOI 10.1007/s00704-009-0110-4

Estrade, P., A. Lazar, X. Capet, ***Wade M***, F. Colas, **S. Ndoye, B. Sow, S. Faye**, D. Dausse (2012): Observing vertical velocities in the Senegalese upwelling. Geophysical Research Letter, submitted.

Beneficiary 25 UAC

The International Chair in Mathematical Physics and Applications (ICMPA) of the University of Abomey-Calavi (UAC), created in 2001, is a supranational and permanent structure to contribute to the development of Mathematical Physics and Applications in Africa. The ICMPA became the UNESCO Chair of Mathematical Physics and Applications (ICMPA-UNESCO Chair) in April 2006.

The objectives of the International Chair in Mathematical Physics and Applications (ICMPA) are defined as follows: (1) To work out and spread the knowledge and the know-how in Mathematical Physics and Applications; (2) To promote and support young people and women in the area of Mathematical Physics and Applications; (3) To look for active partnerships between the Chair and companies as well as industries for concrete applications of Mathematical Physics to problems of development in society at large.

These objectives, in the many fields encompassed by Mathematical Physics and their Applications, notably entail: (i) The promotion and support of young researchers; (ii) The organization of Master degree and PhD programmes. ICMPA-UNESCO Chair's activities derive from the pre-cited objectives, among which the following initiatives deserve specific mention: (a) The organization every two years of the International Conference on Contemporary Problems in Mathematical Physics (COPROMAPH), with the publication of dedicated Proceedings; (b) the organization of five training programs for M.Sc. and PhD degrees including Physical Oceanography and Applications (regional Master 2 created in 2008 with IRD).

The ICMPA-UNESCO Chair is involved in several programs related to regional climate and oceanography and established in close relation with IRD: i) the AIRD PROPAO coastal network and the ALOC-GG program ;ii) the AIRD LMI (International Laboratory) "ECLAIR-SPLASH" project, iii) the AWA program (Ecosystem **A**pproach to the management of fisheries and the marine environment in **W**est **A**frican waters), launched by a trilateral German-French-African consortium).

Tasks assigned

The ICMPA-UNESCO Chair will contribute to CT2 through: i) the evaluation of numerical models performance though the development of statistical tools and analysis and comparisons with in situ observations and products; ii) as part of EAMNET (Europe-Africa Marine earth observation Network), collecting and providing satellite products dedicated for studies related to the Gulf of Guinea circulation and surface conditions.

Qualification of the key personnel

1. ICMPA-UNESCO Chair President : **Pr Norbert Hounkonnou** (20%): Main contact. Awarded by TWAS and UNESCO. PhD supervisor. Expertise in Mathematical Physics focusing on Non-commutative and Nonlinear Mathematics);
2. ICMPA-UNESCO Chair Scientific Secretary: **Pr Ezinvi Baloitcha** (20%) : Expertise in Dynamics of Complex Systems, Numerical Simulations and Satellite Products Analysis;
3. One PhD (100%) : Statistical modeling of air-see interactions in the tropical Atlantic;
4. One Post doc: Physical processes controlling the mixed layer heat and freshwater balance (100%)
5. One engineer (100%): Management of the EAMNET station and products.

Relevant publications:

Da-Allada, C. Y., G. Alory, Y. du Penhoat, E. Kestenare, F. Durand, and N. Hounkonnou, Seasonal mixed-layer salinity balance in the tropical Atlantic Ocean: Mean state and seasonal cycle, J. Geophys. Res., doi:10.1029/2012JC008357, in press, (2013)

M. N. Hounkonnou and Mahaman Kabir Mahaman, Some exact solutions of a nonlinear Boussinesq system of equations, International Journal of Pure and Applied Mathematics Vol.45, no. 1, 45 - 65 (2008).

E. Baloïtcha and G. G. Balint-Kurti , Theory of the Photodissociation of Ozone in the Hartley continuum; effect of vibrational excitation and $O(^1D)$ atom velocity distribution. Phys. Chem. Phys. (2005), 7,3829– 3833

D. Lauvergnat, E. Baloïtcha, G. Dive and M. Desouter-Lecomte, Dynamics of complex molecular systems with numerical kinetic energy operators in generalized coordinates. Chemical Physics 326 (2006) 500–508.

Beneficiary 26 CRO

The CRO (national Oceanography Research Center in Côte d'Ivoire) has been created in 1958. The CRO mission is to do the necessary research for the knowledge of the aquatic environment for its preservation and protection, for the implementation of an operation and sound management of natural aquatic resources, those which may be renewable or non-living or mineral. It consists in three research departments: fish farming, environment, and living aquatic resources, along with one department dedicated to scientific publications (edition, library). Its main research fields are: oceanography and coastal area management, quality and ecological functioning of aquatic ecosystems, biodiversity, biology and ecology of aquatic ecosystems, management and exploitation of aquatic resources, fish farming. It also welcomes the National Center of Oceanographic Data and is thus involved in the UNESCO/IOC ODINAFRICA program. The CRO is involved in several programs established in close relation with IRD: i) the AIRD PROPAO coastal network (monitoring of coastal Sea Surface Temperature sensors) and the AIRD ALOC-GG program : "Analyse Littorales, Océaniques et Côtières au nord du Golfe de Guinée" ; ii) the AWA program (Ecosystem **A**pproach to the management of fisheries and the marine environment in **W**est **A**frican waters), launched by a trilateral German-French-African consortium); iii) the AIRD LMI "ECLAIR-SPLASH" project.

Tasks assigned

CRO will contribute to CT5 and CT2 (WP3 & WP5) through numerical experiments (ROMS-PISCES) and providing numerical results for physic and biogeochemical parameters. CRO will gather and digitalize historical and recent data on biological & physical parameters along with fishery statistics concerning the Côte d'Ivoire oceanic area, and do data statistical analysis.

Qualification of the key personnel (4 ETP for PREFACE)

Dr Aka Marcel Kouassi, researcher (50%) : Main contact & data processing : co-head of CRO research dpt.
Dr Vamara Koné, researcher (50%): numerical experiments (ROMS-PISCES) adapted to the north of the Gulf of Guinea. CT2. Will also provide physic and biogeochemical parameters for CT5.
Dr Amandé Justin, researcher (100%) : Data gathering and digitalization of historical recent data on biological parameters and fishery. Data treatment & statistical analysis. CT5
Dr Konan Justin, researcher (100%): Data gathering and digitalization of historical recent data on biological parameters and fishery. Data treatment & statistical analysis. CT5
Mr. N'Guessan Kouadio Benjamin, technician/student (PhD: 100%). Data gathering and digitalization of historical recent data on physical and chemical. Data treatment & statistical analysis. Research on pelagic ecosystem functioning and biomass. CT5 & CT2.

Relevant publications:

Adingra, A.A., Kouadio, A.N., Blé, M.C. et **Kouassi,A.M.** 2012. Bacteriological analysis of surface water collected from the Grand-Lahou lagoon, Côte d'Ivoire. African Journal of Microbiology Research vol. 6 (13) pp. 3097 -3105.

Koné, V., C. Lett and P. Fréon (2012): Modeling the effect of food availability on recruitment success of Cape anchovy ichthyoplankton in the southern Benguela upwelling system. African Journal of Marine Science (in press).

Amandè M.J., Chassot E., Chavance P., Murua H., A. Delgado de Molina, Bez N. 2012. Precision in bycatch estimates : the case of tuna purse-seine fisheries of the Indian Ocean. 2012. ICES Journal of Marine Science, 69(8) :1501-1510.

Konan K.J., Atse B.C. & Kouassi N.J., 2011. Food and feeding ecology of Tylochromis jentinki (Teleostei: Cichlidae) in Ebrié Lagoon, Ivory Coast, with emphasis on spatial, size and temporal variation in fish diet. African Journal of Aquatic Sciences, 36 (1): 75-82.

Beneficiary 27 UNN

University of Nigeria (UNN) is the first full-fledged university in Nigeria and one of the five elite universities in the country. With established research in basic climate science, change and adaptation, UNN hosts national level research centers in Basic Space Science, Environmental Management and Control, and Oceanography and Marine Studies. At the present, there is an ongoing multi-disciplinary project on Climate Change Adaptation funded by the Open Society Foundation.

Tasks assigned

UNN will participate in Core Themes 3, 4 and 5 encompassing both the physical and human dimensions of PREFACE. Contributions will involve equatorial–subtropical extratropical South Atlantic Ocean (SAO) partially coupled experiments (WP9); Basic state versus models' representation of SAO dipole (SAOD) using CMIP3-5 and SPECS database (WP8), diagnosis of a reduced set of variables in these models and observations (WP7); and Field surveys of climate-related risks along the Nigerian coasts (WP 13).

Qualification of key personnel

Dr. Hyacinth C. Nnamchi
Dr. Nnamchi holds is a Lecturer in the Department of Geography, where he teaches courses on Climatology and Statistical/Computer Methods. He holds a PhD degree in Meteorology from the Institute of Atmospheric Physics, Chinese Academy of Sciences. Dr. Nnamchi's research interests centre on equatorial–subtropical South Atlantic Ocean air-sea interactions and their impacts of climates, especially over African and the Americas.

Dr. Nnaemeka A. Chukwuone
Dr Nnaemeka Chukwuone is currently a Senior Research Fellow at the Centre for Entrepreneurship and Development Research (CEDR) and a Senior Lecturer at the Department of Agricultural Economics, University of Nigeria, Nsukka where he teaches course in production economics and resource and environmental economics. He holds a PhD in Resource and Environmental Economics from the University of Nigeria, Nsukka. Dr Chukwuone's research interest include a range of agricultural, environment and economic policy issues especially agricultural finance, gender and development, poverty issues, resource conservation, environmental resource valuation, climate change and macroeconomic development.

Relevant Publications

Nnamchi, H.C., Li, J.P., Kang, I-S and Kucharski, F. (2012), Simulated impacts of the South Atlantic Ocean Dipole on summer precipitation at the Guinea Coast. Clim. Dyn. doi: 10.1007/s00382-012-1629-0.

Nzeadibe T.C., Egbule, C.L., Chukwuone, N.A., Agwu, A.E and Agu, V.C (2012), Indigenous innovations for climate change adaptation in the Niger Delta region of Nigeria. Environment,Development and Sustainability, 14(6), 901-914. doi: 10.1007/s10668-012-9359-3.

Nnamchi, H.C., Li, J.P. and Anyadike, R.N.C. (2011), Does a Dipole Mode Really Exist in the South Atlantic Ocean? J. Geophys. Res., doi: 10.1029/2010JD015579.

Nnamchi, H.C. and Li, J.P. (2011), Influence of the South Atlantic Ocean Dipole on West African Summer Precipitation. J. Clim., 24, pp.1184-1197.

Chukwuone N.A, C.N. Ukwe, A Onugu and C.A. Ibe (2009) Valuing the Guinea current large marine ecosystem: estimates of direct output impact of relevant marine sectors, Ocean & Coastal Management, 54, 189-196.

Beneficiary 28 ULB

The Université libre de Bruxelles (ULB: http://www.ulb.ac.be) is one of the largest and best Research Universities in Belgium. Founded in 1834, the ULB has a long tradition of excellence in Research with three scientific Nobel Prizes, one Fields Medal, three Wolf Prizes and two Marie Curie Excellence Awards. The ULB is an active participant in the 7th European Framework Program. Up to now, ULB has hosted 14 FP7 individual Marie Curie fellows, 8 ERC Starting and 2 Advanced Grantees and is currently managing 80 projects form the FP7 cooperation program. The Environmental hydroacoustics lab (EHL: http://ehl.ulb.ac.be) specialises in the characterisation of marine and aquatic environments and ecosystems primarily by active and passive acoustic means, covering a wide range of applications, e.g., acoustic tomography in coastal waters, monitoring of productivity in marine habitats, ultrasonic and optical imaging of plankton, and ocean observatories. EHL designs experimental techniques, signal processing and inversion algorithms for the remote sensing of ocean to very shallow freshwater environments, using sparse arrays of acoustic and environmental sensors, broadband sound sources or opportunity sources. This together with the design and planning of experiments and operations at sea represent EHL core of activities and the principal source of funding since its creation in 2001. The lab participated in FP6 and FP7 EC projects including Integrated Project AQUATERRA, European Seas Observatory Network of Excellence (ESONET), and Ocean Acoustic Exploration IRSES (OAEx), and is supported by international (incl. US funding agency ONR) and national institutions (incl. FNRS).

Tasks assigned

ULB will contribute to WP12. During PREFACE fieldwork, ULB will deploy a pilot passive system that will capture every detail of a LME underwater soundscape. The soundscape, due to biotic, natural abiotic and anthropogenic sources, will be selectively analyzed to gain insight of these sources and of the environment and ecosystem dynamical features which are attributable for the observed patterns in time and space of measured sound scalar and vector quantities. One of the objectives is to exploit the long-term passive recordings to infer coastal upwelling features in combination with existing oceanographic moorings. The variations in propagation conditions as evidenced by sensed sounds of opportunity such as those of distant fishing boats as well as of the wind and wave sounds dominant in shallow waters will be studied. Another primary objective is to assess the feasibility of acoustic detection and identification of fish through various sound productions. The detection and identification of fish shoals will also be investigated through swim bladder resonance characteristics as revealed by naturally occurring sources such as due to wind and waves or anthropogenic activity such as ship noise. Interpretation of the passive acoustic data will rely on archival data and concomitant survey conducted by IRD partner with multi-frequency echo sounders.

Qualification of key personnel

Jean-Pierre Hermand, PhD, is Research Director at the U.L.B. since 2001, where he founded the Environmental Hydroacoustics Laboratory. He has held several positions at the SACLANT Undersea Research Centre, La Spezia, Italy, where he was appointed Principal Scientist to the Environmental Research Division to lead the research and development of acoustic remote sensing techniques and inversion methods. He has been Chief Scientist of many experiments at sea. Since 2001, he has coordinated interdisciplinary research on acoustic observatories in the framework of international and European Framework Programme projects. He was recently awarded grants from Australian National Network in Marine Science and ONR Global. His current research interests lie in adjoint modeling, sequential Bayesian estimation, data assimilation and the use of active and passive acoustics to e.g. remotely sense dynamics of coastal fronts, productivity in marine habitats. He is a Fellow of the IEEE and a Fellow of the Acoustical Society of America. He is currently the Chair of the Oceanic Engineering Society (OES) Technical Committee on "Ocean Signal and Image Processing" and Elected Member of OES Administrative Committee.

Relevant Publications

O. Carrière, J.-P. Hermand, and Y. Stéphan, "Passive tomography in coastal areas: A feasibility of the Ushant front monitoring," in PASSIVE '08 OCEANS IEEE/OES Eur. Conf. - New Trends for Environmental Monitoring using Passive Systems, pp. 1–6, Oct. 2008.
O. Carrière, J.-P. Hermand, L. Calado, A. C. de Paula, and I. C. A. da Silveira, "Feature-oriented acoustic tomography: Upwelling at Cabo Frio (Brazil)," in Proc. OCEANS '09 MTS/IEEE Conf., pp. 1–8, Oct. 2009.

B 2.3 Consortium as a whole

PREFACE overarching goal is to improve the prediction of Tropical Atlantic climate and its impacts, through reducing uncertainties in our knowledge of the functioning climate system, particularly climate-related ocean processes, and coupled ocean-atmosphere-land processes. We aim to improve understanding of the impact of multiple stressors of climate variability, climate change, and fisheries on marine ecosystems in the region, as well as assess the socio-economic vulnerabilities and resilience of West African fishing communities to climate-driven ecosystem shifts and global markets.

To achieve these goals PREFACE has drawn on key expertise in the areas of oceanography, modelling, prediction, fisheries, and marine ecosystem impacts. The EU funding mechanism allows us to bring together leading researchers in these fields from 28 institutes in both Europe and Africa. It is composed of, 18 partners from 8 European countries, and 10 partners from 9 African countries/states. The European partners are geographically well distributed: 3 Norwegian, 4 French, 4 German, 2 Spanish, 1 UK, 1 Italian, 1 Danish, and 1 Belgian. The African partners are well distributed along the Atlantic coast of Africa: 2 partners from Senegal, and one each from Angola, Namibia, South Africa, Cape Verde, Morocco, Benin, Ivory Coast, and Nigeria.

Key and complementarity skills relevant to the projects goals

PREFACE team will achieve its goals due to its composition of researchers with complementary skills. Our team has the skills to reduce uncertainties in our knowledge of key climate-related ocean processes (including stratification) and dynamics. Observational data from new campaigns as well from underutilized sources, and the skills to analyze them are key elements of PREFACE. The team consists of leading oceanographic centers, with expertise in observational work (CRO, GEOMAR, IMR, IRD, INIP, MFMR, UCAD, UPMC, UAC, UCT) and additional experience in ocean modeling (IOW, UPCH, UPMC, UCT). These European and African partners have been involved in making observations in this region for decades. In particular, under the EAF Nansen program, African (INIP, MFMR) and Norwegian partners have been regular hydrographic measurements in the region for more than 30 years. During the CLIVAR TACE (Tropical Atlantic Climate Experiment) program (2006-2011), GEOMAR, IRD, UPMC, and UCT substantially contributed to the observational program with process studies, experiments at sea, and analysis of in-situ and remote sensing data regarding i) equatorial circulation variability in the central and eastern equatorial Atlantic, ii) heat and freshwater budgets in the equatorial cold tongue and the Gulf of Guinea, iii) equatorial and coastal wave propagation. Members of the PREFACE consortium were also member of the TACE observing working group (Brandt, Dengler, GEOMAR; Bourlès, IRD; Reason, Rouault, UCT).

IRD has a longstanding experience in West Africa with strong regional partnership, including CRO, UCAD, and UAC, and has contributed significantly to Tropical Atlantic research during WOCE and CLIVAR (Cither, Etambot, Equalant) and was in charge of the oceanographic component of AMMA in France (through the EGEE program). IRD is responsible in the PIRATA consortium for the PIRATA array in the eastern Tropical Atlantic. The yearly PIRATA buoy service cruises are regularly capitalized by different working groups worldwide for experiments at sea including diapycnal mixing studies, glider swarm experiments (e.g., in cooperation with GEOMAR), atmospheric observations, or biogeochemical measurements. Besides TACE, GEOMAR has a longstanding tradition in Tropical Atlantic research including western boundary circulation studies during WOCE and CLIVAR, studies regarding the air-sea gas exchange in tropical upwelling regions (BMBF SOPRAN) as well as the physical, biogeochemical studies in the frame of the DFG Collaborative Research Centre SFB 754 “Climate Biogeochemistry interactions in the tropical Ocean” running since 2008. The latter project focuses with enhanced shipboard, moored, glider

observations, and tracer release experiments on the oxygen minimum zone of the tropical North Atlantic located between Cape Verde and the equator. INDP is a strategic partner for GEOMAR as a base for reaserch vessels and glider experiments in the centre of the tropical Atlantic. As a major step towards a modern, multipurpose research infrastructure, GEOMAR will invest approx. 2.5 M€ to build the "Ocean Science Centre Mindelo" (OSCM), which will house a state-of-the-art laboratory, workshop, office, meeting, and storage facilities for marine research. Plans for the OSCM started in 2012 and construction will begin in 2013. The OSCM infrastructure will be available to the national and international research community and will foster collaboration and development of joint research projects. Further funding was provided by GEOMAR for the Cape Verde Ocean Observatory (CVOO) as well as the Cape Verdean RV Islandia. African scientists in PREFACE also play a central in the observational work, as they are the holders of expert local knowledge on physical oceanography, and fisheries. This information can be crucial to the planning of making new observations in this region.

A strong ocean modeller team complements the observational oceanographers to form a complete group of ocean processes experts. The modeller team has at its disposal three comparable albeit differents ocean models that form a continous suite of numerical tools permitting either a transfer of basin model improvments directly to climate model (MOM-4 and particularly NEMO, the pivotal ocean module in PREFACE, being shared by a number of climate models) or the transfer of very high resolution regional model (ROMS) improvements to the two former basin models. In particular LOCEAN-UPMC and IOW, will run and optimize NEMO and MOM-4 configuration for the whole PREFACE domain of interest, while UCT, IRD and UPMC will run WRF regional configurations for the three coastal upwellings and optimize them. The resulting key skill of the CT2 team will be to coordinate, for the first time in the field, two ensembles of up to-date analyses of the whole eastern tropical Atlantic Ocean: the observed and the simulated analyses. Both ensembles will be as compatible, physically coherent and geographically continuous as it could be, thanks to the coordination, through the choice of common standards, of new measurements, of analysis of historical datasets, and of corresponding numerical simulations. The derived OGCM improvements and resulting recommendations for climate model improvements should be unprecedented.

PREFACE has also the skills to improve the physical understanding of coupled ocean, atmosphere, and land interactions; to model internal and externally forced climate variability; and to reduce model errors and associated uncertainties in climate predictions for the region of the Tropical Atlantic and adjacent land areas. PREFACE particularly seeks to bring together different areas of competence to bear synergistically on the Tropical Atlantic problem, and an important part of its modelling strategy is to bridge operational forecasting (initial-condition problem) and coupled climate modelling on long time horizons (description of the mean attractor). These aspects are integrated across CT2-4, with expertise drawn in from both areas. Some of the centres involved (CERFACS, IC3, MF-CNRM, UREAD, UiB, UPMC-IPSL, WU) are leading seasonal to decadal climate forecasting institution, and are familiar with state-of-the-art climate-modelling tools and the scientific, technical and operational methodologies of seasonal forecasting, with an either direct involvement (MF-CNRM, IC3) or close collaborative links with operational centres (UREAD, WU). Others are transferring this knowledge to the development of new state-of-the-art prediction systems, using advanced data assimilation techniques (UiB, UniRes). All participating climate modelling groups (CERFACS, GEOMAR, IC3, MF-CNRM, UCM, UiB, UniRes, UPMC, UREAD, WU) have demonstrated strong expertise in utilising coupled and uncoupled GCMs for studies of tropical climate variability and specifically in African climate, variability and change, and the skills to assess the contributions of external and internal influences on the region (CERFACS). Beyond this a number of groups have strong skills in understanding the mechanisms for climate variability, including ocean-atmosphere interaction, teleconnections, and predictability (GEOMAR, UiB, UMPC, UCM, WU). Unive brings to PREFACE advanced statistical schemes to enhance climate

predictions through optimal recalibration of ensemble forecasts. This combined expertise will be critical in diagnosing the robust sources of error in the region, how they affect climate variability and teleconnections. This will enable them to ***improve*** the simulation and ***prediction*** of Tropical Atlantic ***climate*** on seasonal, and longer time scales, and contribute to better ***quantification of climate change impacts***

Fisheries is a key economic sector in African countries with a high socioeconomic impact in particular in coastal communities. The consortium of African partners with local management expertise and four European institutes with extended background in regional fisheries research, management and economics (IRD, IMR, TI, CAU) allows to pursue a diversified approach through analysis of available long-term and large scale data sets as contributed to PREFACE by the African partners, TI, and IMR both for oceanic and coastal environments in combination with experimental studies on key processes and new monitoring activities as coming from the AWA project in West-African waters. This will reveal the cumulative effects of the multiple stressors of climate variability, of climate change (including warming and deoxygenation), and of fisheries on marine ecosystem services (within PREFACE e.g., fisheries yields, biodiversity) in the Tropical Atlantic. . The consortium has experience in performing questionnaire and interview surveys in African countries and in the area of climate change effects on socio-economics (CAU). Surveys have been performed in Ghana on small-scale farmers and CAU is co-organizing the Poverty Reduction, Equity and Growth Network (PEGNet) with yearly conferences also in Africa (e.g. 2012 in Dakar, Senegal). Including African partners, PREFACE has the ideal set up to perform the surveys in the best possible way.

The data collected under the EAF Nansen program will also play a particularly important role in understanding long-term oceanographic, and climate variability in the of Tropical Atlantic. In this respect the African partners play an essential role in PREFACE, many being funded in the project to analyse these data. Many of these will be junior researchers and PhD students. This particularly important in the context of these data, which have been collected with funding from the FAO directed towards capcity building. The team of European scientists have long tack records with working with scientists from the African partner institutes, and in training young researchers (IMR, IRD, UMPC, UiB). This will help ensure PREFACE contributes to capacity building in the region, and to strengthening European – African scientific cooperation.

All partners are familiar with large consortium projects and coordinated activities including model sensitivity tests. The exchange of knowledge between partners with different backgrounds and expertise (forecasting, process studies, climate modelling, observations, and impact studies) is a cornerstone of PREFACE and continued interaction, as planned in the common milestones and deliverables, and facilitated by the Integrating Themes panels, will ensure progress in the understanding of the specific character of the coupled climate of the Tropical Atlantic, its impacts and its predictability.

The consortium is well-balanced in relation to the objectives

The following table summarizes the distribution of PM in the different CTs, and in terms of expertise. There is approximately 44% of PM are directed at observational based work, and 34% towards modelling. Observations effort is almost equally split between hydrographic and marine ecosystems. Given the large uncertainties in this region, the largest focus of the work is on improving understanding. However, a significant amount of effort (21%) is directed towards climate prediction, and economic and societal impacts.

Core Theme Breakdown	PM	%
CT1	52.5	3
CT2	583.5	28
CT3	391	19
CT4	280	14
CT5	758	37
Total	**2065**	**100**

Activity Breakdown	PM	%
Climate and ocean modelling	696.5	34
Climate prediction	152	7
Observations		
Obs. Physical oceanography	406	20
Obs. Marine ecosystems	503	24
Economic and societal impacts	255	12
Dissemination	18	1
Management	24	1
Information and data management	10.5	1
Total	**2065**	**100**

Table 2.1: Summary of PM distribution over the project

Ability to work as a team, commitment to tasks assigned

PREFACE's success will lie also in our ability to work together, as there are many dependencies among WPs (Fig. 2). The team has a long history of cooperation in EU (*e.g.*, DEMETER, ENSEMBLES, AMMA) national (*e.g.*, German SACUS), and tripartite French-German-African (*e.g.*, AWA) projects. Connections of IRD, IMR, and UiB with African partners is particularly strong, resulting from long-term initiatives such the FAO-Nansen program, Nansen-Tutu centre, LMI ICEMASA (South Africa), LMI Eclair-Splash (Senegal). The IRD have also a representation in several of the African PREFACE partner countries i.e. Morocco, Senegal (including Cape Verde), Benin (including Nigeria) and South Africa. IRD also provide tools to improve capacity building in Africa e.g. JEAI progammes for young African team associated to IRD), MLD for French scientists who want to work several months in missions over Africa. The strength of the cooperation is reflected in many joint publications (see partner descriptions). Most of the PREFACE team also has a long record of data sharing through previous EU projects, such as THOR, and also in performing coordinated sets of experiments, and joint analysis.

There is a strong commitment among all partners to achieve the task assigned. All partners, European and African, were involved in the preparation of the proposal. Much of the preparation was managed using online document sharing provided by Google, and also through SKYPE, email, and telephone calls. Despite the challenges, the quality of this proposal reflects a commitment of all partners to work together. The African partners are particularly interest to achieve the project goals, as they have the potential to lead to improved climate predictions in the region. Tropical Atlantic variability has global impacts, which also include Europe. Thus European scientist also has a direct interest in this topic. Apart from this the many years of experience and scientific output on this region by both European and African scientists shows there deep interest in the region that will ensure tasks assigned are completed in a timely manner.

Sub-contracting

Subcontracting has been limited to a minimum, and is slight more than 1% of the total budget (Table 2.2). The subcontractors will be selected according to the rules for subcontracting laid down in FP7 Grant Agreement Annex II - General Conditions Article II.7 and in the recent guide to financial issues relating to FP7 indirect actions from 18th of March 2013.

IOW plan to subcontract ship time since IOW will not get for each mooring maintenance a research vessel, funded by a project partner. Thus, IOW expects that they will have to do the mooring maintenance partially with chartered local ships. This will also provide the possibility for fast reaction in case of accidental events with the moorings. As the charted vessels will come from Namibia or Angola, this activity will also contribute to capacity building.

CAU will subcontract work in WP13 related to the questionnaires, which will be performed in up to three African countries. These costs include 1) translation of the surveys from English into French and Portuguese 2) contracting enumerators (interviewers) in up to three countries (including their travel costs) 3) data entry and cleaning. Subcontracting for the translation is required given the extent and nature of the region chosen and the content of the questionnaire and the experimental part (games), and also due to lack of literacy in French and Portuguese. It is crucial to ensure an exact translation. Enumerators will be contracted, either from a professional firm or among the students of the partner institutions. Since the survey will require a larger number of people to work very intensively during a period of up to 2 months this needs to be contracted out. We and the lead researchers from the partner institutions will supervise throughout the whole survey period. High frequency/Bi-weekly data on fishing and social network related questions will be collected from a subgroup of the whole sample by mobile phone. This can be done by the project team.

Data entry and first data cleaning will be done by the enumerators simultaneously with the surveys (using handheld survey computers, preferred) or in the evenings during the survey (when pen and paper based, not preferred). In case of pen and paper based survey we will use double entry. Detailed data cleaning is done by student assistants after the survey.

Partner	Cost items	Cost
		EURO
1 UiB	Audit	6000
7 GEOMAR	Audit	6000
8 IOW	Shiptime	96000
8 IOW	Audit	2000
10 CAU	Survey	22000
10 CAU	Audit	1000
13 IMR	Audit	9000
16 UCM	Audit	3000
	Total	145000

Table 2.2: Summary of subcontracting

Third parties (other than subcontractors)

IRD (Partner 4) third party: Université Paul Sabatier– Toulouse III (UPS)

Since its creation in 1969, UPS has been expanding its offer of multidisciplinary education in the fields of science, health, engineering, technology and sports, developing one of the most important scientific research clusters in France. Centred on Toulouse, European space and aeronautics capital, UPS is a renowned European university with a global outlook. In PREFACE, UPS will co-lead CT2/WP5, and will perform numerical simulations and analysis dedicated on heat/salt budgets and mixed layer processes. UPS contact is Gaël Alory. The budget distribution between IRD and UPS should be as follows:

UPS	**RTD**
Personnel costs (1Homme-mois)	4 718,00
Subcontracting	0,00
Other direct costs	0,00
Indirect costs	2 830,80
Total costs	7 548,80
Maximum allowable EU contribution	5 661,60
Requested EU contribution	5 661,60

IRD	**RTD**
Personnel costs	469 025,00
Subcontracting	0,00
Other direct costs	337 015,00
Indirect costs	483 624,00
Total costs	1 289 664,00
Maximum allowable EU contribution	967 248,00
Requested EU contribution	967 247,00

UPMC (Partner 6) third party: The National Centre for Scientific Research (CNRS)

CNRS is a government-funded research organization under the administrative authority of French Ministry in charge of research. CNRS is the main fundamental research organization in Europe and is largely involved in national, European, and international projects covering all fields of knowledge. CNRS is organized in 1211 laboratories, either intramural or in partnership with universities, other research organizations or industry. In PREFACE, CNRS will perform the following tasks attributed to Catherine Rio and Frédéric Hourdin: Realization, validation, and analysis of coupled simulations using NEMO OGCM and LMDZ (IPSL-CM5) atmosphere model (Task 6.2 and Task 6.3); as well as attributed to Xavier Capet: Participation to the mooring

measurements and analysis off Senegal (Task 3.1), and realization, validation, and analysis of simulations with ROMS ocean model (Task 5.1, 5.2 and 5.3).

The salary and person months of CNRS staff working in PREFACE are listed in the table below. It is worth mentioning that these costs will be considered as complimentary in kind resources listed in section B2.4. There will be no other costs to PREFACE from CNRS.

CNRS	**RTD**
Personnel costs	72,483.92
Subcontracting	
Other direct costs	
Indirect costs	43,490.35
Total costs	115.974,24
Maximum allowable EU contribution	86,980.70
Requested EU contribution	0.00

UPMC	**RTD**
Personnel costs	192 000,00
Subcontracting	
Other direct costs	206 992,00
Indirect costs	239 395,20
Total costs	638 387,20
Maximum allowable EU contribution	479 590,40
Requested EU contribution	479 590,00

IC3 (partner 15) third party: Institut Català de Recerca i Estudis Avançats (ICREA)

IC3 applies a Third Party modality where the third party is making its resources available to the beneficiary. According to this situation, the third party, the ICREA will not carry out any part of the work and just lends resources to the beneficiary. These resources are directly used by the beneficiary, the work is performed in its premises and there is no reimbursement by the beneficiary to the third party. The third party makes available some of its resources to the beneficiary, which does not reimburse the cost to the third party, but which charges the costs of the third party as an eligible cost of the project. Its costs will be declared by the beneficiary in its Form C but must be recorded in the accounts of the third party. In that context, ICREA resources corresponding to dedicated time of Prof. Francisco J. Doblas-Reyes (ICREA personnel) will be available for the whole duration of the project for RTD activities.

Other countries

All participants requesting EU funding that are outside the EU belong to International Cooperation Partner Countries.

B 2.4 Resources to be committed

Overall distribution of resources

PREFACE has a large total budget of around 12 million Euros, with approximately 9 million Euros requested from the EU. The break down into major costs is summarized in Table 2.3. Focusing on research, the RTD activities constitute 95.4% of the PREFACE total budget. The remaining part is dedicated to management (2.6%) and dissemination (2.0%); amounts necessary to ensure the smooth running of a large, diverse, and geographically widely distributed consortium and high-level dissemination of project results.

PREFACE aims to increasing our understanding of key ocean processes for climate in the Tropical Atlantic. Thus a large fraction of the total budget has been allocated to enhancing observing systems. The budget is around 781k€, and approximately 9% of the EU requested budget.

African partners play a key role in PREFACE, and have accordingly been allocated 8.2% of the total budget (this includes the Integration Fund described below). They are directly affected by the impacts of climate change in this region, and so they may benefit the most of PREFACE outcomes. This also means that they are the holders of key knowledge in the region, related to the oceans and its impacts. Thus, their inclusion will ensure PREFACE will be better targeted. The African partners are also the owners of the historic hydrographic and fisheries data, collected under the EAF Nansen program. The data plays a central role in PREFACE. With PREFACE funding, African partners will analyze this data.

	Cost (€)	% of total cost
RTD	11,611,407.27	95.4%
MGT	316,107.20	2.6%
OTHER	242,830.40	2.0%
European partners	11,1170,741.67	91.8%
African partners (incl. integration fund)	999,603.20	8.2%

Table 2.3: Summary of major costs in PREFACE

Financial plan for the project is adequate

The use of financial resources has been carefully planned to ensure PREFACE will reach its goals, within the EU fixed budget. Firstly we identified the key expertise required to reach our goals. Each of these centres was allocated around 48 person months (PM) for European Partners, and between 27-128 PM for African partners. Nine ICPC partners adopted Lump Sum payments (see below). Due to the importance of personnel in RTD, the largest part of the PREFACE budget is allocated to personnel costs, and amounts to 2065 PM; for EU partners the personnel costs are over 70 % of the total European budget.

In terms of PM (table 1.3e, table 2.1), PREFACE activities are split between work focused on observations (~65%, CT2&5) and work using complex oceanographic and climate models (~33%, CT3&4). This reflects the importance of both in the project. It is a key underpinning that observations should play a central role in improving models. The observational based work is split in turn almost equally between physical oceanography and marine ecosystems/fisheries, reflecting an equal need to understand both physical and biological systems and their interaction. For more details justification of the break down of the consortium see summary in Sec 2.3 (Table 2.1).

Due to the underpinning role of observation in our project, we also identified partners needed to enhance the key elements of our observing system, many of which bring a substantial in kind contribution. We have budgeted accordingly for observations (see section above).

Lump sum payments

Partner	**Country**	**# PM**	**WP Involvement**	***Lump sum****	**Total (€)**	**EU req. (€)**
18, INIP	Angola	118	WP3, 4, 12,	9800 (LM)	96,367	72,275
19, MFMR	Namibia	118	WP4, 12	9800 (LM)	96,367	72,275
20, UCT	South Africa	128	WP4, 5, 9	20700 (UM)	220,800	165,600
21, INDP	Cape Verde	118	WP12, 13	9800 (LM)	96,367	72,275
22, INRH	Morocco	118	WP12, 13	9800 (LM)	96,367	72,275
23, ISRA	Senegal	118	WP12, 13	8000 (L)	78,667	59,000
25, UAC	Benin	118	WP3, 5	8000 (L)	78,667	59,000
26, CRO	Cote d'Ivoire	118	WP3, 5, 12,	8000 (L)	78,667	59,000
27, UNN	Nigeria	118	WP7, 8, 9, 13	8000 (L)	78,667	59,000
Total		**1072**			**920,933**	**690,700**

* based on one researcher/year

Management costs (WP1)

- Project Office (PO) has 24 PM allocated for the Project Manager (PM)
- Travel for management personnel to attend annual meetings is 7,748€
- Auditing costs equal 27,000€ (Table. 2.2)

Dissemination costs (WP2)

- PO has 18 PM dedicated to dissemination tasks; these are envisaged for the PM who will also perform these tasks
- Contribution of 20,000€ towards a summer school planned for February 2015, to be organized jointly with AWA, SPACES, Nansen Tutu center, and RESCLIM.
- A final conference is planned as dissemination activity to be held in Africa; 20,000€ are budgeted for the meeting, including invite several internationally renowned speakers to give keynote lectures.
- We budget 6,000€ for dissemination (i.e., preparation of project flyers, and pamphlets)

Data and information management costs (WP14)

- PO has 6PM for the employment of a data and information manager
- UiB budget includes 10,000€ for setting up an project data server
- Work in CT2 and CT5 make use of historic oceanographic and fisheries data collected under the EAF Nansen program. Partner IMR hosts these data, and to ensure they are available to PREFACE, 4.5 PM are budget for a technician at IMR
- We budget 20,000€ for holding additional workshops for analysis of data

Webpage and project management software is open source and hosted by UiB, and thus incurs no additional costs.

Other major costs, including equipment

Each partner maintains a small budget necessary for travel to attend project meetings, and also for disseminating results at international conferences and meetings. They also have some minor costs for consumables (e.g., hard disks, etc.).

PREFACE budgets 19,500€ to cover the attendance of the four member external scientific advisory panel at the annual general assemblies.

PREFACE will enhance the observing system in the Tropical Atlantic as follows:

- CT2,WP3
  - PREFACE PIRATA buoy at 8°E, 6°S needed for mixed layer heat and freshwater budget analysis in the Angola-Benguela frontal region.
  - Mooring off Senegal for vertical velocity estimates
  - Glider observations partly with attached turbulence sensors (2014, 2015 and 2016).
  - PREFACE cruises in the Benguela upwelling region in 2014, 2015 and 2016; other cruise
- CT2,WP4
  - Current meter mooring at 0°E, 0°N; mooring on the Namibian shelf at 20°S; mooring on the Senegalese shelf
  - PREFACE cruises in the Benguela upwelling region in 2014, 2015 and 2016; other cruise
- CT5,WP12
  - Pop-up tags, diverse cruises

The budget for these activities is summarized in the table below:

	Cost (Euro)	Description
GEOMAR		
Travel, subsistence, &	46583	Funds required for participation in PREFACE research cruises (container transport, travel, daily allowance)(WP3, WP4)
Transportation of equipment	43417	Cost for one container from Germany to Namibia and back to Germany equals 7236.20€. Two containers required per cruise, i.e 14472.40€ in 2014, 2015 and 2016
Consumables	70000	Glider (batteries, communication), research cruise (WP3)
IOW		
Travel & subsistence	25600	Funds required for particpating in research cruises (WP3, WP4)
Consumables	8000	Batteries, etc for mooring (WP4)
Equipment	58600	Mooring at 20S (WP4)
Shiptime	96000	Charter for mooring maintenance (WP4)
UPMC		
Equipment	49000	currentmeters+ hydrological censors (WP3)
Consumables	85000	4x15,000 consumables for yearly deployment of current/hydrology censors in Senegal + 2x12,500€ for glider batteries/communication (WP3)
Travel	12000	4x2000 travel for measurements in Senegal + 2x2000 glider travel (WP3)

IRD		
Equipment	150000	ATLAS Bouy (WP3)
Consumables	50000	Mooring consumables (wire, anchor, batteries, etc.) (WP4)
Travel & subsistence	35333	Funds required for participating in PREFACE research cruises(WP3, WP4)
Travel & subsistence	16250	Fund required for participation in PREFACE research cruises (WP12)
TI		
Equipment	30000	Pop-up tags and operational costs (WP12)
Travel & subsistence	5000	Costs of participating in research cruises (WP12)
Total	**780783**	

Complementary resources

PREFACE is an ambitious project and its real cost is actually much higher than the amount indicated as total costs in the budget tables. We have listed below an explanation of the resources that will complement the PREFACE project: these complementary resources will be brought into the project by the participation institutions, thanks to own funds and funds provided by national science foundations. The complementary resources listed below cannot be pinned down to an exact value, but the order of the estimates provided is believed to be right. Resources of the proposed project complementing the EU contribution are the following (listed per partner institution):

- PP1 University of Bergen: resources amounting to 655.000€ will complement the PREFACE consortium. These include in kind personnel resources for the coordinator (12pm, 170.000€), a university postdoctoral research (12pm, 110.000€) working on atmospheric convection related issues CT3, and researcher employed at the center for climate dynamics (6pm, 55.000€) providing assistance with data assimilation and climate prediction. All climate model simulations will be performed at Norwegian supercomputing facilities (6m CPUhrs, 320.000€).
- PP3 CERFACS, will contribute complimentary resources amounting to 321600 Euro to PREFACE. These include 306000 for in kind personnel, who will contribute to WP6, WP7, WP9 and WP11. And additional equipment (disk storage) to value of 15000 Euro will be additionally contributed for the stockage of simulations performed in in WP6, WP7, WP9 and WP11.
- PP4 Institut de Recherche pour le Développement (IRD): resources amounting to 3.325.000€ will complement the PREFACE consortium as a contribution for WPs 3 and 4. These include resources for the Pirata buoy array for instrumentation and research vessel time. Funding of about 100k€/year is provided by IRD, Météo-France, Observatoire Midi-Pyrénées, for regular functioning (missions at sea, transportation, material maintenance, coordination, etc.) and of 700.000€/year by IRD for research vessel time. Also, two ADCPs are installed (100k€, with buoyancy) at Pirata subsurface moorings at 23W-Eq and 10W-Eq, along with one new tide gauge for Sao Tome (25k€) that will be installed in 2013.
- PP5 MF-CNRM, will contribute complimentary resources amounting to 118500 Euro to PREFACE. These include 118500 for in kind personnel, who will contribute to WPs 3,6,7,8 and 11.
- PP6 Université Pierre et Marie Curie (UPMC): resource amounting to 300.000€ will complement the PREFACE consortium. These resources include 216.000€ for in kind personnel (7 scientists), who will contribute to all WP tasks where UPMC is involved, 4.000€ for computing resources for tasks in WP5, 6, 7 and 9, and 80.000€ for three yearly 2-month stay in

LPAOSF-UCAD laboratory (Senegal).

- PP7 Helmoltz Centre for Ocean Research Kiel (GEOMAR): resources amounting to 800.000€ will complement the PREFACE consortium. These resources are provided by the Helmholtz-Association and the German Ministry of Science. These correspond to 1 person-year (glider scientists, engineers, and technicians for ship cruises: 70.000€), 2 gliders (240.000€), 2 microrider (85.000€), underway CTD (90.000€), CTD system + altimeter (160.000€), contribution to research cruises in 2014 and 2015 (BMBF SACUS, 55.000€). Ship time will be provided by the German research council (DFG), cruise proposal for 2014 is already accepted, computer time and resources will be contributed (100.000€) to perform simulations in CT3 including staff making available know-how, data, and materials. Additionally, GEOMAR invest about 3.500.000€ via the Helmholtz society into the Cape Verde Ocean Observatory in Mindelo through major improvements of the local infrastructure, most importantly through construction of a research station with modern laboratories, workshops, offices and meeting facilities and improvements of the Cape Verdean R/V Islandia.
- PP8 Baltic Sea Research Institute Warnemünde (IOW): resources amounting to 530.000€ will complement the PREFACE consortium. These resources include 190.000€ for in kind personnel (scientist and technician), who will contribute to WPs 3, 4 and 5. Additional equipment to value of 260.0000€ (moored devices, equipment for shipboard measurements) will be additionally contributed for work in WP4. Computing resources at the German HLRN cluster to the value of 80.000€ will be contributed to perform simulations in WPs 5.
- PP9 TI will contribute complimentary resources amounting to 950000 Euro to PREFACE. These include 65000 for in kind personnel, who will contribute to WPs 12.1 and 12.2. The bulk of the commitment will be 1320 many hours of ship time for a survey in West-African waters on small pelagics to be undertaken in 2014 within the German-French-African AWA project.
- PP14 Universidad Complutense de Madrid (UCM): resources amounting to 140.000€ will complement the PREFACE consortium. These resources include 90.000€ for in kind personnel, who will contribute to WPs 6, 10, 11 and 9. Computing resources at UCM to the value of 50.000€ will be contributed to perform simulations in WPs 8, 9 and 10
- PP20 University of Cape Town (UCT): resources amounting to 240.000€ will complement the PREFACE consortium. These resources include 90.000€ for in kind personnel, who will contribute to WPs 4, 5 and 9. Additional equipment to value of 100.0000€ (one Atlas Mooring) will be additionally contributed for work in WPs 3 and 4. Computing resources at UCT to the value of 50.000€ will be contributed to perform simulations in WPs 5.

B3. IMPACT

B 3.1 Strategic impact

PREFACE will lead ***to improved climate predictions*** on seasonal to centennial timescales in the Tropical Atlantic sector, but also on a global scale: Model systematic error is a major cause of poor prediction in this region. It is highly likely that our concerted observational and modelling effort will lead to a reduction of the bias (CT2&3). Our confidence stems from various individual studies that have identified factors leading to some model improvements in this region. PREFACE will also improve understanding of the factors – external and internal – in driving climate change in the region (CT3). We will also apply artificially 'bias correct' models in predictions (CT4). As the feedbacks in the Tropical Atlantic are strongly coupled to the background state, this approach should also lead to enhanced climate prediction. Tropical Atlantic variability has global consequences, affecting extremes in the region, but also variability in the Indo-Pacific sector. Thus, improving predictions in the Tropical Atlantic will also enhance skill in other regions. PREFACE will also improve understanding of these global impacts (CT4).

PREFACE will lead to better understanding of environmental and anthropogenic factors on the marine environment in the Tropical Atlantic through the reduction of uncertainties: We will improve understanding of the relation of marine ecosystems – higher, middle, and lower trophic levels – to environmental parameters in three major Large Marine Ecosystems (Canary Current, Guinea Current, and Benguela Current, CT5). We will better understand the impact of hydroclimatic and anthropogenic effects (including fisheries) on pelagic top predators and lower trophic levels and the impact of climate changes on sustainable harvest levels (CT5). PREFACE will develop ecological-economics models for key commercial species in the region and combine these with the improved climate projections (optimally combined using advanced statistical methods, WP10) to provide ***more accurate quantification of climate change impacts on oceans, marine ecosystems and services*** in the Tropical Atlantic (CT4&CT5). This will also improve climate services in the surrounding continental areas.

PREFACE will lead to improved EU and international policies aimed at protecting the marine environment and safeguarding it as a living resource for human communities: we will provide increased understanding of the mechanisms governing changes in the marine ecosystem, by disentangling effects of environmental and anthropogenic pressures on key components of the pelagic ecosystems and fisheries (CT5); we will deliver improved capabilities to predict climate change impacts on the marine environment (CT4). Together with our ecological-economics model (WP13) these will lead to a more robust assessment of potential threats to marine ecosystems that can lead to more effective policy and management options for societal responses to climate change in the region. Results may be also relevant with respect to the external dimension of the Common Fisheries Policy due to the need to further control the fishing effort of distant water fleets to dampen the possible detrimental effect of climate change on fisheries in West African countries. A number of PREFACE partners are in close contact with European (ICES, EC/JRC), and international (e.g. SRFC, UN/FAO) bodies related to policy makers for marine environment and fisheries management, helping to ensure our impact in this respect.

In particular, a key element in the development of African coastal countries striving after economic welfare will be the preservation of sufficient marine resources in terms of food sources for growing populations and as basis for a maritime economic sector providing employment and local income, given that expansion of land-based economies will be limited due to arid conditions and other constraints. For this purpose, a fair allocation scheme between national utilization and licensing of resources to third parties will be essential, and for this allocation scheme a precise understanding of production in the ecosystem will be required. Given the particular socioeconomic conditions in each

of the African coastal countries, data from PREFACE participating countries can be understood as case studies exemplifying possible solutions in well-defined surroundings. However, taking into account specific differences between countries, results from PREFACE can also be applied in a wider sense. Predictions from theoretical studies indicate a decline in diversity and productivity in pelagic communities off West Africa, and PREFACE will be the first project to provide actual data for offshore pelagic fisheries, and in cooperation with AWA for the inshore areas where upwelling and associated coastal processes provide specific conditions for richer marine productivity.

European and African dimensions

The Tropical Atlantic is a region of key uncertainty in the climate system: This is most clearly emphasized by the systematic error of state-of-the-art models in this region that has shown little improvement during the last two decades. Even less is known about the impacts of TAV on marine ecosystems. A concerted effort at an international level is required to reduce uncertainties in the region, as has been expressed at a number of recent international meetings (e.g., TAV meetings in Miami, 2010, and Kiel, 2012 as well as the 4th AMMA (African Monsoon Multidisciplinary Analyses) International Conference in Toulouse, 2012). One main conclusion of the international AMMA program running since 2002 with strong involvement of the West African countries was that there would be no major improvement in predicting TAV without reducing systematic model error. PREFACE will take this forward by targeted observations in the Tropical Atlantic upwelling zones and along the coastal waveguide, in-depth analysis and experimentation with state-of-the-art climate and prediction models, and detailed analysis of marine ecosystem data. These efforts cannot be achieved at a national level.

African partners from the region are a key element of the PREFACE team. Firstly, they are the specialists of their region. Their input on regions to make observations (i.e, avoiding problems of mooring with fisheries activities) can be pivotal to the success of PREFACE. Recognizing this importance we include two associate partners (unfunded) that lead commissions for the two of the Large Marine Ecosystems regions of the African Atlantic coast. Secondly, they are owners of a wealth of oceanographic and fisheries data (Sec B1.2). There is already an intensive training task lead in Africa initiated by the AMMA project (regional Master, PhDs). PREFACE will reinforce this initiative in capacity building and fund Masters and PhD students from the region to analyze these data, in collaboration with European scientists (primarily in CT2 and CT5). PREFACE budgets for African students to pay extended visits to European labs (Integration fund, B2.4). In addition a summer school and workshops are planned to promote cooperation in the region and aid analysis (WP2, B3.2). This analysis will be invaluable to our understanding of the region, and its analysis will be of direct benefit to these African countries. This model follows partly that of the Nansen-Tutu center PREFACE partner. The education of young African scientists, and increasing their contact with the international community is a long-term contribution to these African societies. Results from the project, especially the outcome of the interviews and questionnaire surveys, will be disseminated to the communities where they have been performed to inform local communities and governments.

PREFACE will contribute to the development of the observational network needed for monitoring and predicting Tropical Atlantic climate. In the long-term, regional players should lead in the maintenance and continued development of the observational network. PREFACE will contribute to enhancing the required expertise in the region. In particular, African partners will be involved in the maintenance of the PIRATA network, and in the deployment and service of the mooring at 20S. In the latter case, a ship will be charted from Angola or Namibia to service the mooring.

Links to coordinated international and national activities

The importance of PREFACE is recognized and supported at international level, and we have obtained support letters from the following groups (Appendix 5):

1. international scientific steering committees on climate: (Climate community: World Climate Research Programme; International CLIVAR Project Office; U.S. CLIVAR Working Group on the Eastern Tropical Ocean Synthesis);
2. impacts community (African Monsoon and Multidisciplinary Analyses international; West African Science Service Center on Climate Change and Adapted Land Use; Ecosystem Approach to the management of fisheries and the marine environment in West African waters; The International Research Institute for Climate and Society);
3. seasonal prediction and modeling community (European Centre for Medium Range Weather Forecasts; Center for Ocean-Land-Atmosphere Studies; APEC Climate Centre(APCC));
4. Global observations network (PIRATA International Scientific Steering Group);
5. Local regional centers (commissions/projects for three Large Marine Ecosystems (GCLME, CCLME, BCC); IRD regional for Sénégal, Cap-Vert, Gambia, Guinée-Bissau et Mauritania), Angolan Meteorological Service.

This level of support also reflects the high calibre of the PREFACE team.

PREFACE observational activities are also coordinated within the Tropical Atlantic Climate Experiment (TACE) network, and will contribute to observations in the region and enhancement of the existing PIRATA array through partly funding a SE extension mooring, one of our key regions. This activity will help determine if observations in this region should continue.

PREFACE is linked to a number of other national and international projects on prediction of climate and its impacts (e.g. SPECS, NACLIM, SFB754, AWA, SPACES). PREFACE will also explore the possibility of coordinating activities with two other EU FP7 projects funded under ENV.2013.6.1 (WP1, task 1.3, MS2):

1. DACCIWA, which aims to advance our understanding of the West African Monsoon system and impacts of increased anthropogenic emissions on the regional climate and weather. It will organise a major field campaign in Southern West Africa involving three aircrafts and a wide range of surface-based instrumentation at two supersites in Ghana and Benin. DACCIWA will also work closely with operational satellite and modelling centres to ultimately reduce uncertainties in predictions on weather, seasonal and climate timescales. There is potential to coordinate DACCIWA and PREFACE observational campaigns, and to share modelling and future prediction results. This may lead to improved understanding, models, and predictions, as model error over the Tropical Atlantic and in the West African Monsoon are linked to a certain degree.
2. HELIX, which aims to develop and deliver coherent, internally-consistent global scenarios for 2°C, 4°C, and 6°C warming levels. While the scenarios are global, the project has three focus regions, one including West Africa. It will provide high-resolution scenarios for this region to aid adaptation policies. PREFACE and HELIX may potentially coordinate activities on the scenarios for the West African region. In particular, PREFACE (and DACCIWA) aims to improve models in this region and reduce uncertainty in future prediction, and thus may contribute directly to HELIX work in this region; while HELIX can provide input on the impact of different warming scenarios in the region.

PREFACE will promote trans-Atlantic cooperation on Tropical Atlantic research, contributing to the Galway Statement on Atlantic Ocean Cooperation, signed May 24th, 2013. In particular, we

envisage cooperation between PREFACE and an NSF project (1334707) entitled " Understanding Causes of Climate Model Biases in the Southeastern Tropical Atlantic" that was recently selected to be awarded. The project shares some similar goals with PREFACE and is lead by Prof Ping Chang, Texas A&M, who also serves on the PREFACE scientific advisory board. Cooperation will be formalised on commencement of both projects.

Associate partners

Below we list two key associated, no cost partners and describe their roles in PREFACE. During the course of the project, the MB will decide whether any other associate partners may join PREFACE.

1. The Benguela Current Commission (BCC)

Established in 2007, the Benguela Current Commission has a mandate from Angola, Namibia and South Africa to promote the integrated management, sustainable development and protection of the Benguela Current Large Marine Ecosystem (BCLME). The BCLME spans some 30 degrees of latitude, extending from Angola's Cabinda Provide in the north, to just east of Port Elizabeth in South Africa. It is one of the richest marine ecosystems on earth and supports an abundance of life. The Benguela Current Commission provides a vehicle for the three SADC countries to introduce an ecosystem approach to the management of the BCLME. The Commission is focused on the management of shared fish stocks, the assessment and monitoring of the physical environment, the establishment of an ecosystem information system, and the cooperative management of biodiversity and ecosystem health.

The activities of the Benguela Current Commission are supported by the governments of Angola, Namibia and South Africa; the Global Environment Facility; and the United Nations Development Programme. The government of Norway provides generous funding for the BCC Science Programme and Iceland is supporting a comprehensive Training and Capacity Building initiative. The PREFACE project will allow an enforcement of capacity building in this LME. On the other side the BCC (as the SRFC in CCLME for Mauritania, Senegal, Cape Verde, Gambia, Guinea and Guinea Bissau) will allow to transfer PREFACE results toward stakeholders and decision makers from Angola, Namibia and South Africa.

2. The Guinea Current Large Marine Ecosystem (GCLME) Project

The Guinea Current Large Marine Ecosystem (GCLME) Project is an ecosystem–based effort to assist countries adjacent to the Guinea Current Ecosystem to achieve environmental and resource sustainability. This would be accomplished by shifting from short-term sector by sector driven management objectives to a longer-term perspective and from managing commodities to sustaining the production potential for ecosystem-wide goods and services. The GEF pilot phase included a six country Gulf of Guinea Large Marine Ecosystem project that ended in November, 1999. This new phase extended the Gulf of Guinea Project from six to sixteen countries, all of which are influenced by the Guinea Current. This new Project will assist these sixteen countries in making changes in the ways that human activities are conducted in the different sectors of national life to ensure that the GCLME and its multi-country drainage basins can sustainably support the socio-economic development of the region. The four overall development goals of this project are to: 1) Decline in GCLME fish stock and unsustainable harvesting of living resources; 2) Recover depleted fish stocks; 3) Reduce land and ship-based pollution, and 4) Create an ecosystem-wide assessment and management framework for sustainable use of living and non-living resources in the GCLME. Priority action areas rely heavily on regional capacity building. Sustainability will derive from this improved capacity, strengthening of national and regional institutions and improvement in policy/legislative frameworks. The preface project will allow an enforcement of capacity building

in this LME project (16 countries). On the other side the GCLME will allow to transfer PREFACE results toward fisheries managers and decision makers from this African region.

Other steps towards achieving impacts

The Scientific Steering and Executive Board will direct science within the project. Important input on scientific directions will also be provided by the External Scientific Advisory Board. Advice will also be sought from two associate partners representing commissions of African coastal areas of the Atlantic on the use of EAF Nansen data, and the integration of African scientists in the project. Internal good governance panels will be formed to deal with issues related to arbitration, gender, data, dissemination, and project integration. These will help to make the project run smoothly. The integration panel will also evaluate progress within PREFACE on three scientific Integrating Themes (or project overarching themes, Appendix 1), ensuring continued interaction and scientific exchange among activities in the Core Themes. This will further help PREFACE achieve its objectives.

Annual meetings will facilitate scientific exchange across the project to help ensure smooth running of the project towards its goals. PREFACE will also make active use of web conferencing facilities and online collaborative software; both were used extensively in the planning of the project. They will be important for linking our activities in Europe and Africa. A data server will be purchased and maintained by the PREFACE management to ensure data exchange. Lastly, PREFACE management will have full control of the budget, and can ensure all partners, inside and outside of Europe, are meeting their obligations.

Assumptions and external factors

Observations play a critical role in PREFACE. Our team has significant expertise in making measurements in the region, and beyond that we will heavily use of existing networks. The analysis of oceanographic and fisheries data collected by the research vessel (FRV Dr. F. Nansen) is central of importance. African and Norwegian scientists jointly collect the data. We have involved these partners in PREFACE and have provided funding for the analysis of the data. All African institutes are fully integrated into the proposal. The availability of model data, models, and computing facilities is also of central importance. PREFACE involves partners with extensive experience in this area. Simulations required for the proposal are open access to PREFACE participants.

Innovation

PREFACE aims to enhance climate prediction. This will be of use to climate services in the region, and PREFACE will engage appropriate centres, such as the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) and The International Research Institute for Climate and Society (IRI); both of which have signed letters of support.

B 3.2 Plan for the use and dissemination of foreground

1 Researchers and climate service providers in the focus region through the education of young researchers and the involvement of senior scientists from African partner institutes, which include universities and centers for fisheries, oceanographic, marine, and agriculture. Several PREFACE European partners already work closely with the PREFACE African partners. Their on-going common project/program lead, in these countries (e.g. Germany: Cape Verde Ocean Observatory (CVOO) with construction of a research station at INDP, Mindelo, with modern laboratories, workshops, offices and meeting facilities, DFG SFB754, BMBF SPACES, BMBF AWA; France: Pirata, AWA; Norway: EAF-Nansen, Nansen-Tutu center) will be a key mechanism for dissemination of project results and clustering activities.

2 We plan to have a final project meeting in the Benguela region, to which we invite regional climate service providers and local researchers. We will also invite a number of international scientists, and organize a public lecture (with funding budgeted). In addition, to foster collaborations between north/south partners and promote south/south ones, PREFACE will also organize in association with AWA (in the CCLME and GCLME) as well as the Nansen Tutu center and the BMBF SPACES program (in the BCLME) a joint meeting in Africa gathering interdisciplinary ocean and climate scientist from Europe and Africa. Moreover, such joint meeting that will occur early in the project will strengthen work on PREFACE related topics in Africa, and will allow inviting stakeholders and decision makers from Africa, NGO and members of the European commission. Such common meeting could have a significant impact in Africa (for scientist and the larger public) as well as in Europe where we need programs such as PREFACE to coordinate national and European initiatives directed toward the development of African scientific institutions and universities.

3 International scientific community: we will publish in international peer reviewed journals and actively present work at international conferences and focused workshops; PREFACE aims to follow European commission's policy on open access for research articles; PREFACE partners are very active in organizing workshops and sessions at conferences on Tropical Atlantic Climate research. The strong international networks of PREFACE partners and the scientific advisory board will also be an important means for dissemination. Annual meetings provide a dissemination circle extending to Africa and North America (SSC). We will address the broader scientific community through reports in for example, Clivar exchanges, BAMS, EOS.

4 PREFACE will engage impacts, and climate service providers through information fact sheets. We will target the scientific bodies and organisations related to our area, as listed above: i.e., international scientific steering committees on climate, impacts community, seasonal prediction and climate service providers, programs for global observations network; and local centers of the region. In the latter case, the commissions and programs for the two Large Marine Ecosystems of the region are associated PREFACE partners (confirmation on a third pending). PREFACE partners are also members of a number of international panels (CLIVAR Atlantic panel, AMMA international), and involved in other related projects (SPECS, AWA, NACLIM).

5 PREFACE will target policy makers at National and EU levels, and in Atlantic Africa in two ways: policy briefs and in special information session. The information will be attached to the final project meeting in Africa and directed at local policy makers. As outlined above, PREFACE is well placed to inform policy related to the management of the marine environment, and on the development of climate prediction systems for the region. PREFACE is also active in the area of capacity building, and thus may also be able to contribute towards related National and EU initiatives.

6 Media and the public at large will be reached through several methods: Project website will host press releases and have a comprehensive section describing the activities and results of the project for the general public. PREFACE scientists will be encouraged to lecture publicly; PREFACE includes a number of senior scientists that are active in the media and frequently contribute to popular scientific articles in their respective countries. The PREFACE coordinator will be in contact with the UiB division of communication. This division has skilled scientific journalists who will help the researchers to disseminate project results to national and international media by preparing press releases, articles and also films.

7 Wikipedia is becoming an increasingly important and widespread source of information. PREFACE will use Wikipedia to disseminate PREFACE results, and to raise awareness of the Tropical Atlantic climate, marine ecosystems, and fisheries research, and to the potential impacts of climate change on the region, and the economies of Atlantic African countries. The PO will work with PREFACE scientists to update relevant Wikipedia sites. The involvement of expert scientists will help ensure the veracity of information on Wikipedia.

8 Education of young researchers will be an important element of PREFACE. Many PREFACE partners are active in the supervision of PhD and masters students, and also in lecturing. UiB hosts the Bergen Summer Research School since 2008. This Summer School for international students has the goal to produce and disseminate research-based education to address key global challenges. The PREFACE project management will be in contact with the organisers to teach and to invite young scientists from the ICPC countries to participate actively in the research school. The coordinator will also encourage partners to engage in other national and international programs that fund student mobility and education, for example the NOMA program by the Norwegian Centre for International Cooperation in Education (SIU).

9 PREFACE will put importance on maintaining a webpage for posting news, results, project reports, brochures, educational material, and general information for the media and public.

PREFACE will use a significant portion of management budget for this activity, which will be hosted through the UiB web system. PREFACE will also have a project logo for presentations.

Exploitation

The outcome from PREFACE will primarily impact two areas. First, improvements in modelling and prediction of climate and its impacts from PREFACE can benefit other European and International activities in this area, and can lead to improved climate services. Second, improved knowledge on marine ecosystem functioning and reduced uncertainties in its response will be of benefit to policy and marine managements, including e.g. exploited fish stock dynamics, coastal vulnerability. These sectors are targeted for dissemination.

Management of knowledge and intellectual property

A data dissemination protocol will be discussed with the external scientific advisory panel, and defined in the Consortium Agreement (CA). The PREFACE data dissemination protocol will aim at promoting the access to the data (common Internet workspace), data sharing (e.g. Ordinafrica, United Nations) and the publication in the scientific literature, while protecting the intellectual property rights of the project partners. All measurements and model experiments performed within PREFACE will be freely distributed within the consortium. The CA will spell out and identify background and the provisions for intellectual property safeguards to both background brought to the project and the foreground generated by the project.

B4. ETHICAL ISSUES

Survey data on fishing communities

During the field work study participants will participate in questionnaire surveys and behavioural games. Participation is entirely voluntary. Participants will be selected randomly based solely on their role in fishing communities. Before interviewers obtain basic demographic and socio-economic information we will explain the goal of our study and asked each participant for their consent to participate in the survey. Written informed consent will be obtained from all participants prior to the experiments. The experiments will consist of simple games that allow us to measure certain social constructs such as propensity to cooperate, time preferences and risk aversion. Both the treatment and the experiments pose no risk to the participants. All experiments will be performed according to the declaration of Helsinki (http://www.wma.net/e/policy/b3.htm).

Copies of ethical approvals by the competent legal local/national Ethics Boards/Bodies/administrations will be submitted to the European Commission prior to the commencement of the proposed field work.

When submitting the application for scrutiny to the competent local/national ethical boards/bodies for authorization detailed information will be provided on:

The procedures that will be used for the recruitment of participants (e.g. number of participants, inclusion/exclusion criteria, direct/indirect incentives for participation, the risks and benefits for the participants etc) and the nature of the material that will be collected (e.g. sensitive or personal data etc).

The informed consent procedures that will be implemented. Copies of examples of Informed Consent Forms and Information Sheets will be included. These will be in language and terms understandable to the participants. Participants will be informed about their rights:

- To know that participation is voluntary
- To ask questions and receive understandable answers before making a decision
- To know the degree of risk and burden involved in participation
- To know who will benefit from participation
- To know the procedures that will be implemented in the case of incidental findings
- To receive assurances that appropriate insurance cover is in place
- To know how their data will be collected, protected during the project and either destroyed or reused at the end of the research.
- To withdraw their data from the project at any time
- To know of any potential commercial exploitation of the research.

Privacy/confidentiality and the procedures that will be implemented for data collection, storage, protection, retention and destruction and confirmation that they comply with national and EU legislation.

The applicant will obtain from the data controller of their institution, written approvals for the technical data protection procedures that will be implemented in the project. These approvals demonstrate compliance of the data protection processes with the European legal framework. Copies of these approvals will be forwarded to the European Commission prior to the commencement of the related studies.

If requested by their institution's data controller, the applicant will consider obtaining approvals/opinions/authorizations from their national data protection authorities for the intended data collection and processing (http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/others/2006-07-03-vademecum.doc). If requested, copies of these documents will also be provided to the European Commission. The applicant will design and implement all relevant capacity-building and benefit-sharing arrangements for the protection and development of the local communities.

The ethical standards and guidelines of FP7 will be rigorously applied, regardless of the country in which the research is carried out.

ETHICS ISSUES TABLE

All FP7 funded research shall comply with the relevant national, EU and international ethics-related rules and professional codes of conduct. Where necessary, the beneficiary(ies) shall provide the responsible Commission/Agency services with a written confirmation that it has received (a) favourable opinion(s) of the relevant ethics committee(s) and, if applicable, the regulatory approval(s) of the competent national, regional or local authority(ies) in the country in which the research is to be carried out, before beginning any Commission approved research requiring such opinions or approvals. The copy of the official approval from the relevant national, regional or local ethics committees must also be provided to the responsible Commission services.

Guidance notes on informed consent, dual use, animal welfare, data protection and cooperation with non-EU countries are available at : http://cordis.europa.eu/fp7/ethics_en.html#ethics_sd For real time updated information on Data Protection also see: http://ec.europa.eu/justice/data-protection/index_en.htm

	Research on Human Embryo/ Foetus	YES	Page
	Does the proposed research involve human Embryos?		
	Does the proposed research involve human Foetal Tissues/ Cells?		
	Does the proposed research involve human Embryonic Stem Cells (hESCs)?		
	Does the proposed research on human Embryonic Stem Cells involve cells in culture?		
	Does the proposed research on Human Embryonic Stem Cells involve the derivation of cells from Embryos?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	**X**	

	Research on Humans	YES	Page
	Does the proposed research involve children?		
	Does the proposed research involve patients?		
	Does the proposed research involve persons not able to give consent?		
	Does the proposed research involve adult healthy volunteers?		
	Does the proposed research involve Human genetic material?		
	Does the proposed research involve Human biological samples?		
	Does the proposed research involve Human data collection?	**X**	**WP13**
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL		

	Privacy	YES	Page
	Does the proposed research involve processing of genetic information or personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	**X**	**WP13**
	Does the proposed research involve tracking the location or observation of people?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL		

	Research on Animals	YES	Page
	Does the proposed research involve research on animals?		
	Are those animals transgenic small laboratory animals?		
	Are those animals transgenic farm animals?		
	Are those animals non-human primates?		
	Are those animals cloned farm animals?		

	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	**X**	

	Research Involving non-EU Countries (ICPC Countries[19])	YES	Page
	Is the proposed research (or parts of it) going to take place in one or more of the ICPC Countries?	**X**	**WP13**
	Is any material used in the research (e.g. personal data, animal and/or human tissue samples, genetic material, live animals, etc) : a) Collected and processed in any of the ICPC countries?	**X**	**WP13**
	b) Exported to any other country (including ICPC and EU Member States)?	**X**	**WP13**
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL		

	Dual Use	YES	Page
	Research having direct military use		
	Research having the potential for terrorist abuse		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL	**X**	

[19] In accordance with Article 12(1) of the Rules for Participation in FP7, 'International Cooperation Partner Country (ICPC) means a third country which the Commission classifies as a low-income (L), lower-middle-income (LM) or upper-middle-income (UM) country. Countries associated to the Seventh EC Framework Programme do not qualify as ICP Countries and therefore do not appear in this list.

B5. GENDER ASPECTS

The gender balance in the PREFACE project involves 4 women among the 13 different work package (WP) leaders: Dr. Aurore Voldoire in WP6, Dr. Emilia Sanchez-Gomez in WP7, Dr. Belen Rodriguez-Fonseca in WP8 and Dr. Elsa Mohino in WP9. This corresponds to about 25% of women in the leadership team. Dr. Emilia Sanchez-Gomez and Dr. Belen Rodriguez-Fonseca are also co-leading the Core Themes (CTs) CT3 and CT4 respectively. This is a very good score when compared to the overall balance within all the project partners (see 2.2 participant description), which shows a proportion of ~23% among the 92 participants to the project. It is noteworthy that the leading women are in charge of some of the most innovative and central WPs of the project. Also, two of the women involved in this leadership comes from the UCM in Spain, a country that, according to Bettio and Verashchagina (2009), have experienced a segregation trend in university education (graduate and PhD degrees) over the last decade, contrary to most of the European countries and to the fact that Spain is a new active country with more women in higher education research. Moreover, all the women who are work packages leaders have children and have demonstrated to be able of organizing child care and work with success. This is an irrefutable proof of the equality gender politic of PREFACE.

From the 21 women participating in PREFACE the gender rates for women participation is ~31% for European countries, whereas only 10% for African countries. PREFACE will promote to balance this ratio, following the EU recommendation to support the basic principle of equality between women and men. Gender issues will be considered and promoted in every WP.

The PREFACE Gender Action Plan will:

- Encourage and help women in African countries to conduct scientific careers in the fields of climate variability and predictability, by promoting the exchange and collaboration between EU and African countries (regular visits, postdocs, PhDs).
- Encourage the recruitment of women at equal scientific or technical merit, especially in the field of climate variability, prediction and impacts. All job announcements will encourage women to apply by including a statement that demonstrates an “equal opportunities policy”.
- Help the participation of the women involved in the project: developing e-conference tools (teleconferences, Skype meetings) to limit travel, which is more difficult for staff with young children, encouraging a family-friendly organisation of the work; organize child care at meetings if requested, in particular for the workshops and general assemblies.
- Create a good working environment by encouraging working-time flexibility.
- Raise awareness in the consortium due to the involvement of women in the management team, through workshops and training.
- Communicate within the consortium, impacts, users and stakeholder communities regarding the current EU gender Legislation.
- Advertise on gender equality on the project website: links to relevant European web pages, and highlighting FP7 initiatives.

Bettio F. and A. Verashchagina (2009). Gender segregation in the labour market: Root causes,implications and policy responses in the EU, Luxembourg: Publications Office of the European Union.

APPENDICES

Appendix 1: Integrating themes

Three integrating themes (ITs) represent a mechanism that facilitates and ensures continued interaction and scientific exchange between activities in the Core Themes. They are broadly defined in terms of three overarching science themes that are of interest to all PREFACE partners:

1. Ocean processes
2. Ocean-atmosphere-land interactions
3. Predicting Tropical Atlantic climate and its impacts

It is expected that activities in most WPs will generate scientific results of pertinence to at least one of these ITs. The activity of each IT will consist in collating and disseminating within the project such results as they become available, regardless of specific PREFACE goals or tasks. Additionally, IT sessions will be held at each plenary meeting. Of particular interest to the efficacy of PREFACE, experience with data processing, data analysis and interpretation, whether observational or model-based, will be shared. Outside direct interaction, participating groups will make contributions to PREFACE wiki page for the three themes. The task of the IT Panels (Sec 2.1) will be to periodically summarise results to date and to make recommendations, where appropriate, to all PREFACE participants with regard to best practice for data processing, observations analysis and model diagnosing and testing. In particular, for each IT, the panels will attempt to ensure that

a) geographical focus for the analysis of specific processes is consistent across PREFACE
b) where possible and appropriate, similar periods of time (in observations, historical climate integrations, hindcasts) are covered
c) opportunities for case studies are recognised and highlighted;
d) diagnostics from different model integrations are comparable, or specifically documented
e) analysis carried out by different groups are consistent and that alternative methods and interpretations are clearly identified and, where opportune, advice with regard to specific issues is made available
f) relevant PREFACE deliverables are listed together, with a short description of their relevance for each IT and links to the documents

Particularly with regard to point c), it will be a special role of the IT panel to respond to potentially interesting case-study opportunity (e.g. a Benguela Niño falling within the observing period), make PREFACE participants aware of them, and facilitate and coordinate data analysis or modelling work intended to take advantage of them. The IT Panels will be nominated in the kick-off meeting at the project start.

Appendix 2: Existing simulations and climate predictions to be used in PREFACE

Timescale	Source	Description	WPs,Tasks requring this data
Seasonal			
	ENSEMBLES	Ensemble predictions made with 5 European climate models and covering the period 1960-2005	WP6, WP9, WP10, WP11
	DEMETER	Ensemble predictions made with early versions of the ENSMBLES models	WP6, WP10, WP11
	ECMWF	Ensemble predictions started once a month up to seven months in the future, plus forecasts up to 13 months in the future once every four months: System 3 and System 4; 1981-2010	WP6, WP7, WP9, WP10, WP11
	CFS	Ensemble predictions started once a month up to nine months in the future; 1981-2012	WP6, WP7, WP9, WP10, WP11
	SPECS	Multi-model ensemble predictions started once every six months with high resolution (around 50 km global); 1993-2009	WP6, WP7, WP9, WP11
	SPRUCE	Ensemble predictions started twice a year (every 6 months), with high resolution and using GLORYS ocean reanalysis as initial conditions (1993-2007)	WP6,WP7,WP11
	GloSEA4-5	Ensemble prediction system (42 members) run once a month to lead time of 7 months from bias -corrected EN3 ocean initialisation; hindcasts for the period 1960-present available. GloSea5 will be run at higher ocean resolution.	WP6, WP8
	EC-EARTH	The seasonal forecasts are initialized from the GLORYS2v1 ocean-sea ice reanalysis and from the ERAinterim atmospheric reanalysis every 1st November and 1st May over the 1993-2009 period.	WP9
Near-term			
	CMIP5	Multi-model ensemble of 10 year predictions with start dates at least every 5 years	WP6, WP7, WP9, WP11
	SPECS	Multi-model ensemble of 5-year long predictions with start dates every year; 1960-2012	WP6, WP7, WP11
Projections			
	CMIP5	Multi-model set of centennial scale climate change projections (historical, including attribution set, and control simulations also available)	WP6,WP7,WP8, WP9, WP10,WP11

Appendix 3: Models to be used in PREFACE Climate model

Model name	Partner	WPs	Resolutions	References
NorESM	UiB, UniRes	6,7, 8, 11	Ocean 1x1 deg ; Atmos: 2x2 deg; higher and lower resolution versions will be tested in preface	Bentsen et al. 2012; Counillon et al. 2013
EC-EARTH (IFS-NEMO)	WU, IC3	6,7, 8, 11	Ocean: 1x1 deg and 0.25x0.25 deg setups. Atmos: T255; Vertical resolution can be modified.	Hazeleger et al., 2010
CNRM-CM (ARPEGE-NEMO)	MF-CNRM	6, 7, 8, 11	Ocean 1°-0.3°	Voldoire et al., 2013
HadGEM3 (HadGA3-NEMO)	UREAD	6, 8	Ocean 1°-1/3° L75 (GloSea4) or 1/4° L75 (GloSea5); Atmos. N96L85 (85km lid)	Arribas et al. 2011
ARPEGE-NEMO (HighRes)	CERFACS	6, 7, 11	Ocean: 0.25°L75 Atmos: T359 (50km)	
ARPEGE-NEMO (LowRes)	CERFACS	6, 7, 11	Ocean 1° L42 Atmos T127 L31	
IPSL-CM5 (LMDZ-NEMO)	UPMC	6, 7, 8	Ocean 0.25° L75 Atmos N130L39. In zoomed config. 50 km x 50 km over 30S-30N, 60W-40E.	Dufresne et al. 2013
OCATA (WRF-NEMO)	UPMC	6, 7	Regional 60W-50E 30S-30N: WRF3.3 (~25 km, L35) + NEMO_025 (0.25°, L75)	
UCLA AGCM+MIT OGCM	UCM/IGEO	8, 9	MITgcm (0.3º-1º) + UCLA (2.5ºx2ºxL29) + SsIB	Cazes-Boezio et al., 2008; Stammer et al., 2011
SPEEDO	UCM/IGEO	8, 9	Ocean 1.5-layer reduced-gravity model (2ºx1º) Atmos T30xL8	Rodriguez-Fonseca et al., 2009
KCM	GEOMAR	6,7, 8	Low (2º /T31) and high (0.5º/ T213) atmosphere/ocean resolutions	Park et al., 2009

Ocean model

Model name	Partner	WPs	Resolutions	References
NEMO/ORCA 25	UCT, IRD, UPMC, GEOMAR, UCM	3, 4, 5, 9	0.25x0.25	Barnier et a. 2006
ROMS	UCT, IRD, UPMC, CRO	3, 4, 5	0.2x0.2 to 1kmx1km	Debreuet al. 2012
MOM-4/CFSR	UCT	3, 4, 5	0.33x0.33	Saha, et al 2010
NEMO "MERCATOR "	UCT, IRD, UPMC	3, 4, 5	0.08x0.08	Drévillon et al. 2008
NEMO/ORCA 12 "DRAKKAR"	UCT,UPMC	3, 4, 5	0.125x0.125	Barnier et al. 2006
MOM-4	IOW	3, 4, 5	0.075°x0.075°	Herzfeld et al. 2011
analytical upwelling model	IOW	4, 5		Fennel et al. 2012
Atmosphere model				
ECHAM5	UiB	WP9	T63L47; stratosphere resolving version	Roeckner et al. 2003
ICTP-AGCM	UNN, UCM-IGEO	WP9	T30	Molteni 2003
HadGA3	UREAD	6, 8	N96L85 (85km lid)	Arribas et al. 2011
WRF 3.3.1	GEOMAR		10 km horizontal, 51 vertical level	Skamarock et al. 2008
UCLA	UCM-IGEO	WP9	2.5ºx2ºxL29	Mechosoet al. 1990
Fisheries/economic model				
Bioclimate envelope model	TI	WP 12	0.5° x 0.5°	Cheung et al. 2008

Appendix 4: New experiments

Table 1: Overview of experiment classes planned in PREFACE, and in which WP they will be performed (i.e., forced ocean models, forced atmosphere, coupled, s2d predictions, climate change projections)

Class	Configurations	Activity
Forced Ocean	Regional	WP5
Forced Atmosphere	Global, Regional	WP6, WP7, WP8, WP9
Coupled s2d hindcasts	Global ensemble	WP6, WP7, WP8, WP11
Coupled control or historical	Global	WP7, WP8, WP9
Coupled scenario	Global	WP11

Table 2: Non-exhaustive list, ordered by type, of the experiments that will be performed.

Forced Ocean				
Experiment	**Description**	**Model(s)**	**Partner(s)**	**WP**
ATLTROP025	1990-2016; 1/4° 40L, with grid refinement in upwellings	NEMO	UPMC	5
Eastern Tropical Atlantic	1999-2016; 10°W-18°E, 34°S-8°N; 8km, 89L; open boundaries	MOM-4	IOW	5
Northern Gulf of Guinea	2000-2016; 66W-15E, 10S-14N; 2-way nesting with 1/5° -> 1/15°, 45L	ROMS	IRD, CRO	5
Canary Upwelling	2000-2016;1-way nesting with 1/15° -> 1/45° at coast	ROMS	UPMC, UCAD	5

Benguela upwelling	2000-2016; Angola-Benguela upwelling, 1/15	ROMS	UCT	5
Subtropical anticyclones-Equatorial mode	prescribed winds in the Atlantic basin, 1/4°	NEMO	UCM,UPMC	9
Forced Atmosphere				
Experiment	**Description**	**Model(s)**	**Partner(s)**	**WP**
PBL-SST coupling	Parametrisation tests	OCATA (WRF/NEMO)	UPCM, UCAD	6, 7
Impacts of the Equatorial Mode	Prescribed SST boundary conditions in the Atlantic basin	UCLA AGCM, Speedy AGCM	UCM	WP9
Teleconnected Indo-Pacific biases	Regional atmospheric nudging or heating	NorESM HadGEM3	UniRes UREAD	WP8
Coupled s2d hindcasts				
Experiment	**Description**	**Model(s)**	**Partner(s)**	**WP**
S2D hindcasts	Coupled initialised (e.g. EnKF)	NorESM, EC-Earth	UiB, UniRes, IC3	WP6, WP7, WP8, WP11
Seasonal hindcasts	Coupled initialised, regional and global	IPSL-CM5 (LMDZ/NEMO), OCATA (WRF/NEMO)	UPMC	WP6, WP7
AOGA	Coupled initialised, Atlantic-only coupling, observed SST	HadGEM3, NorESM, CNRM-CM, EC-Earth,	CERFACS, MF-CNRM, UiB, UniRes, UPMC, UREAD, WU	WP6,WP7WP8

	elsewhere	IPSL-CM, ARPEGE-NEMO ARPEGE		
AOGAHEAT	TOGA + total surface heat flux correction	HadGEM3, NorESM, CNRM-CM, EC-Earth, IPSL-CM, ARPEGE-NEMO ARPEGE	CERFACS, MF-CNRM, UiB, UniRes, UPMC, UREAD, WU	WP6,WP7
AOGAWIND	TOGA + windstress correction	HadGEM3, NorESM, CNRM-CM, EC-Earth, IPSL-CM, ARPEGE-NEMO ARPEGE	CERFACS, MF-CNRM, UiB, UniRes, UPMC, UREAD, WU	WP6,WP7
AOGASOL	TOGA + solar flux correction	HadGEM3, NorESM, CNRM-CM, EC-Earth, IPSL-CM, ARPEGE-NEMO ARPEGE	CERFACS, MF-CNRM, UiB, UniRes, UPMC, UREAD, WU	WP6,WP7
Various diagnostic	localised flux corrections; regional O-A decoupling and boundary forcing; regional 3-D	HadGEM3, NorESM, CNRM-CM, EC-Earth, IPSL-CM,	CERFACS, MF-CNRM, UiB, UniRes, UPMC,UREAD, GEOMAR, UCAD	WP6,WP7, WP8

	nudging in ocean and/or atmosphere	LMDZ/WRF, ARPEGE-NEMO ARPEGE		
Various physics	perturbed parameters or modified/new parameterisations	NorESM, CNRM-CM, LMDZ/WRF, ARPEGE, EC-Earth	MF-CNRM, UiB, UniRes, WU, UPMC, UCAD, UCPH	WP6,WP7, WP11

Coupled control or historical				
Experiment	**Description**	**Model(s)**	**Partner(s)**	**WP**
Various diagnostic	localised flux corrections;	EC-Earth, ARPEGE-NEMO	CERFACS WU	WP7
Various physics	perturbed parameters or modified/new parameterisations	EC-Earth	WU	WP7
Influence of remote errors on the Tropical Atlantic	regional SSTs restoring to observed anomaly patterns outside TA	UCLA+MIT NorESM CNRM-CM ARPEGE	UCM UiB MF-CNRM UPCM	WP8
Influence of Tropical Atlantic bias on remote regions	Coupled Indo-Pacific, SSTs restored to historical observations in TA and to climatology	UCLA+MIT NorESM CNRM-CM, ECHAM5-NEMO	UCM, UiB, MF-CNRM, GEOMAR	WP8 WP9

	elsewhere			
SAOD	Prescribed SSTs and/or winds in TA	ICTP Speedy + mixed layer ocean	UNN	WP9
Two-way Atlantic-Pacific	Observed Equatorial SST anomaly patterns in the Atlantic (Pacific) coupled elsewhere	ICTP Speedo and/or UCLA-MIT	UCM	WP9
Atlantic subpolar gyre-TAV	Active stratosphere; AGCM+Mixed Layer and AGCM+flux corrected OGCM	NorESM	UiB	WP9
Coupled scenario				
Experiment	**Description**	**Model(s)**	**Partner(s)**	**WP**
Updated historical and scenario simulations	Historical and scenario integrations with flux-corrections AND/OR updated physics, depending on the results of the previous WPs	NorESM, CNRM-CM, HadGEM, EC-Earth ARPEGE-NEMO	CERFACS, UiB, MF-CNRM, UniRES	WP11

Appendix 5: Letters of support

Outcomes of our proposal are of direct relevance to several international and national programs, and of interest to centres involved in prediction of climate and its impacts, as well as a number of institutions doing research in the region. The following have provided letters of support for the proposal.

Organisation	Contact person	Weblink
African Monsoon and Multidisciplinary Analyses (AMMA) international	Jean-Luc Redelsperger Jean.Luc.Redelsperger@ifremer.fr, Chris Thorncroft cthorncroft@albany.edu	www.amma-international.org
West African Science Service Center on Climate Change and Adapted Land Use (WASCAL)	Prof. Paul L. G. Vlek Dr. Manfred Denich (m.denich(at)uni-bonn.de) Dr. Harald Kunstmann (harald.kunstmann@kit.edu)	www.wascal.org
AWA	Dr. Aboubacar SIDIBE	www.awa-project.org
The International Research Institute for Climate and Society (IRI)	Lisa Goddard (goddard@iri.columbia.edu)	iri.columbia.edu
European Centre for Medium Range Weather Forecasts (ECMWF)	Tim Stockdale (T.Stockdale@ecmwf.int)	www.ecmwf.int
Center for Ocean-Land-Atmosphere Studies (COLA)	Jim Kinter (kinter@ @cola.iges.org) and Bohua Huang (huangb@cola.iges.org)	www.iges.org/cola.html
APEC Climate Centre (APCC)	Dr. Chin-Seung Chung (cschung@apcc21.org) Dr. Soo-Jin Sohn (jeenie7@apcc21.org)	www.apcc21.net Data: http://cis.apcc21.net/index.php
World Climate Research Programme (WCRP)	Antonio Busalacchi Chair, WCRP Joint Scientific Committee Ghassem R. Asrar Director, WCRP Joint Planning Staff	
International CLIVAR Project Office	Roger G. Barry Director,	
U.S. CLIVAR Working Group on the Eastern Tropical Ocean Synthesis	Prof. Carlos R. Mechoso, University of California, Los Angeles	

IRD regional (Sénégal, Cap-Vert, Gambia, Guinée-Bissau et Mauritania)	Georges De Noni, Director and sub regional IRD coordinator (Senegal,Cape Verde, Gambia, Guinea Bissau, Mauritania)	http://senegal.ird.fr/
Sub-regional Fisheries commission	Hamady Diop, head of Research and information systems	http://spcsrp.org/
PIRATA International Scientific Steering Group (ISSG)	Dr. Rick Lumpkin NOAA/AOML/Physical Oceanography Division Co-chair of the PIRATA International Science Steering Group	
LASG, Institute of Atmospheric Physics (IAP),	Jianping Li (ljp@lasg.iap.ac.cn) Professor and Deputy Director	http://web.lasg.ac.cn/staff/ljp/Eindex.html
U. Tokyo	Tomoki Tozuka (tozuka@eps.s.u-tokyo.ac.jp)	
Universidade Federal do Paraná Departamento de Física	Prof. Alice Grim	
Angola Meteorological service	Francisco Osvaldo, technical director	

Appendix 6: Full IRD partners list for PREFACE

IRD contribution in Preface CT2 and CT5

UMRs (joint research units) Lemar, Legos, Eme, Lpo and US Imago are involved inside Preface. Additional support i.e. not funded by preface are marked "*".

List of the key IRD agent involved in Preface with PM in percentage per year

1) Patrice Brehmer : IRD/LEMAR, CT5 (25%)

Qualification: researcher in fisheries and fisheries acoustics, Chair of the international consortium AWA a tripartite project (Germany, France, Africa, including 14 countries and 40 laboratories) associated to preface. He will be based in Dakar Senegal during the project duration.

Task assigned: PI of the CT5 with Joern Schmidt (CAU).

2) Bernard Bourlès: IRD/LEGOS, CT2 (30%)

Qualification: director of research, physical oceanography, observations & data analysis. Co-Chair of the PIRATA ISSG and coordinator of PIRATA in France, coordination of oceanographic & coastal environment regional programs in West Africa (PROPAO 2007-2010, ALOC-GG 2011-2014), Co-head of the regional Master 2 & PhD program in West Africa (at UAC/CIPMA, Cotonou, Benin), member of the TACE/CLIVAR team (2007-2011).

Task assigned: co-head of the CT2/WP3. PIRATA ATLAS moorings maintenance in the eastern tropical Atlantic and dedicated cruises. Additional measurements. Data analysis.

3) Yves du Penhoat, IRD/LEGOS, CT2 (20%)

Qualification: director of research, physical oceanography, data & numerical simulations analysis, former head of the LEGOS, specialist in tropical Ocean circulation, contribution to PIRATA, TACE/CLIVAR, ALOC-GG and the doctoral formation in West Africa.

Task assigned: PhD supervisor. Analysis on mixed layer processes and air-sea coupling in the tropical Atlantic.

4) Arnaud Bertrand, IRD/EME, CT5 (10%)*

Qualification: director of research, Fisheries ecology, head of the joint international laboratory Discoh (LMI Discoh).

Task assigned: acoustic data analysis postdoc co-supervision.

5) Hervé Demarcq, IRD/EME, CT5 (10%)*

Qualification: research, remote sensing.

Task assigned: environmental variability according satellite historical data and in situ observations.

6) Nicolas Bez, IRD/EME, CT5 (10%)*

Qualification: director of research, specialist in geostatistics applied to fisheries.

Task assigned: PhD supervision with INRH and analysis of trawl and acoustics Nansen data.

7) Erwan Josse, IRD/LEMAR, CT5 (10%)*

Qualification: director of research, Fisheries acoustics, ex-head of the IRD acoustic unit.

Task assigned: Tuna Habitat description by multifrequency acoustic observation during field study.

8) Raymond Lae, IRD/LEMAR, CT5 (5%)*
Qualification: director of researcher, fisheries. He will be based in Morocco during the project duration.
Task assigned: Support INRH locally.

9) Eric Machu, IRD/LPO, CT5 (20 %)*
Qualification: researcher, biogeochemistry, numerical simulations,
Task assigned: Role of biogeochemical cycles in the variability of small pelagic biomass.

10) Olivier Aumont, IRD/LPO, CT5 (5 %)*
Qualification: researcher, biogeochemistry, numerical simulations,
Task assigned: Role of meso and macrozooplankton in the biogeochemical cycles.

11) Gaël Alory, UPS-CNAP/LEGOS, CT2 (25%)*
Qualification: Researcher, climate and ocean-atmosphere interactions, mixed layer, numerical simulations analysis. Third party of IRD.
Task assigned: co-head of the CT2/WP5. Numerical simulations analysis dedicated on heat/salt budgets and mixed layer processes.

12) Frédéric Marin, IRD/LEGOS, CT2 (from 2015) (25%)
Qualification: researcher, physical oceanography, data & numerical simulations analysis,
Task assigned: Data and numerical simulations analysis in the Gulf of Guinea

13) Anne Lebourges-Dhaussy, IRD/LEMAR, CT5 (15%)
Qualification: engineer of research, Fisheries acoustics, associate director of the Lemar.
Task assigned: Small pelagic habitat description by multifrequency acoustic observation according to the Nasen data base.

14) Jacques Grelet, IRD/US IMAGO, CT2 (20%)*
Qualification: engineer, electronic, data acquisition & treatment (PIRATA cruises).
Task assigned: ATLAS buoys management (logistics, cruises) and cruises hydrological and current data management.

15) Dominique Dagorne, IRD/Imago, CT5 (15 %)*
Qualification: Engineer of research.
Task assigned: Satellite historical data treatment, studies on upwelling indicator.

16) Yannick Perrot, IRD/LEMAR, CT5 (15 %)
Qualification: Engineer of research, Fisheries acoustics, head of the IUEM Pole Image.
Task assigned: Acoustics data treatment and Intercalibration of acoustic data.

17) Rémy Chuchla, IRD/LEGOS, CT2 (20%)
Qualification: Engineer, data acquisition & treatment (PIRATA cruises and regional coastal data sets).
Task assigned: Hydrological & current cruises data treatment and analysis.

18) Gildas Roudaut, IRD/LEMAR, CT5 (15%)
Qualification: Engineer, Fisheries acoustics, head of the IUEM Pole Image.
Task assigned: Acoustics data treatment and set of portable acoustic system used during acoustics tuna surveys and opportunistic ones (Nansen and AWA projects).

19) Fabrice Roubaud, IRD/US IMAGO, CT2 (20%)*
Qualification: engineer, electronic & data acquisition.
Task assigned: ATLAS buoys management (logistics, cruises) and cruises hydrological data.

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