Dome C for a GABLS4 experiment : a challenge ?

E. Bazile, O. Traullé (CNRM/GAME)
and H. Barral (LGGE, Grenoble)

Outline

- Summary of the previous GABLS case ?
- Topic for a GABLS4 case ?
- Possible dates :
  - Case1: 4th Dec 2009
  - Case2: 27th Nov 2009
  - Case3: 10-12 Dec 2009
- GABLS4 case at EMS 2013

GABLS1	GABLS2	GABLS3
		
LES as reference	Data (CASES99)	Data (CABAUW)
Academic set up	Idealized forcings	Realistic forcings
Prescribed T_s	Prescribed T_s	Full coupling *(SCM)* Prescribed T_s *(LES)*
No Radiation	No Radiation	Radiation included
Turbulent mixing	Diurnal cycle	Low levet jet + transitions

LES: Large Eddy Simulation; *SCM:* Single Column Model

B. Holtslag (Nl), G. Svenson (Se), J. Cuxart (Uib), F. Bosveld (KNMI), G.J. Steeneveld, S. Basu (US for LES), F. Vihma (FMI), A. Beljars (CEP), E. Bazile (MF), …

Conclusions from GABLS1-3

Diurnal cycles of temperature and wind continue to be a challenge for NWP and climate models

- inter-model scatter is large for all SBL variables

- sensitive processes in SBL include turbulent mixing, surface-interactions, and longwave radiation divergence

- GABLS experiments suggest that operational models typically overestimate mixing in SBL.

But ...

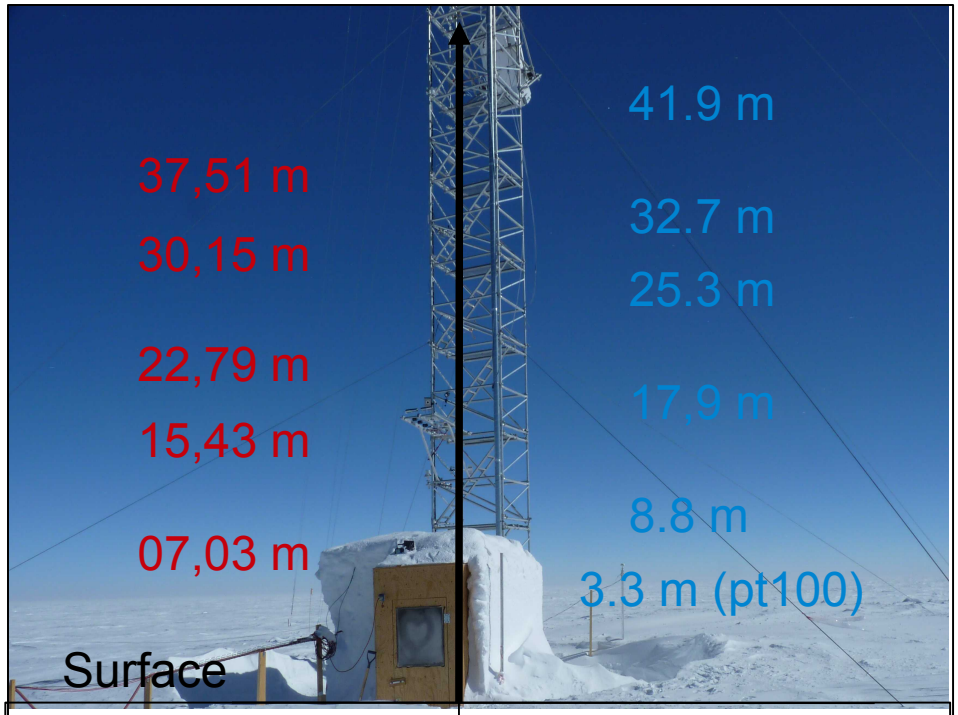
GABLS1: Prescribed ts with –0.25K/h completely dry Qv=0 (idealized case) (Cuxart et al 2006)

- **GABLS2:** diurnal cycle but problem with horizontal advection for the wind (Svensson et al 2011)
- **GABLS3:** Diurnal cycle based on the Cabauw site (Bosveld et al accepted ..) dificulties to initialize the soil moiture.

Critère pour un cas GABLS 4

- Vent faible < 8m/s
- Pas de nuage
- Mesure de température, vent, et humidité (mat)
- Flux turbulents, flux de surface, rayonnement en surface
- Température dans la neige
- 2 sondages
- Etudier la turbulence en couche limite stable, la transition diurne et l'interaction avec la surface
- Cycle diurne tres marqué en été, couche limite tres basse

Observations: Antarctic Plateau Dome C / Concordia



- High frequency parameters (10 Hz) from 6 ultra-sonic anemometers :
  3D Wind components and sonic temperature
- Low frequency parameters (30 min) : air temperature (ventilated and not ventilated), relative humidity, wind speed and direction (**Young**)
- 1 minute solar radiation components
- Sub and surface temperatures
- Radiometer HAMSTRAD (P. Ricaud)
- RS (1 or 2 per day)

**Thanks to Gert König Langlo (AWI for PMR, Bremerhaven, De)
Christian Lanconelli (ISAC, Bologna, It), Andrea Pellegrini (ENEA, Roma, It), Eric Fossat (LUAN, Nice, Fr)**

Numerical Experiment : 2.5km (100x100pts)

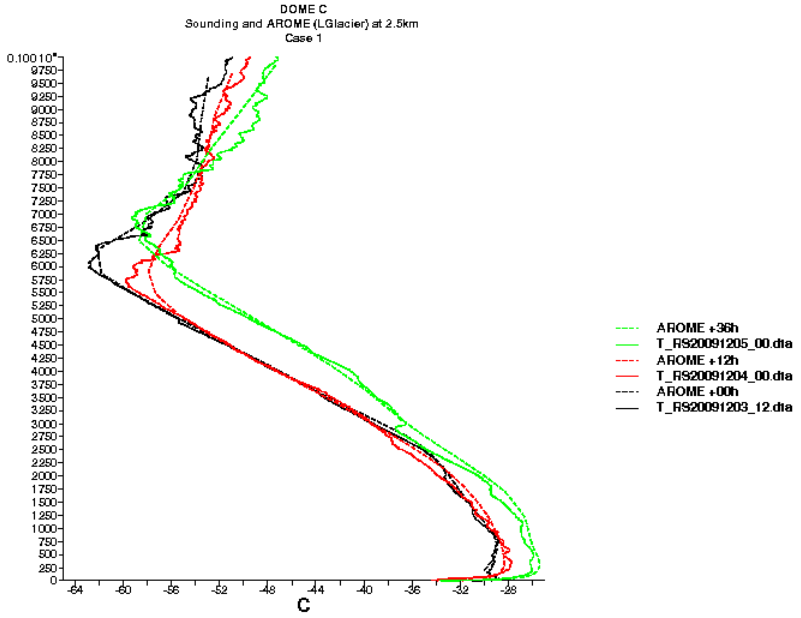
•**AROME** (Seity et al, 2011) : Nh model based on ARPEGE/ALADIN dynamical core with the Méso-Nh physical parametrization. AROME is included in the unified software ARPEGE/ALADIN/IFS and activated by namelist (logical switch)

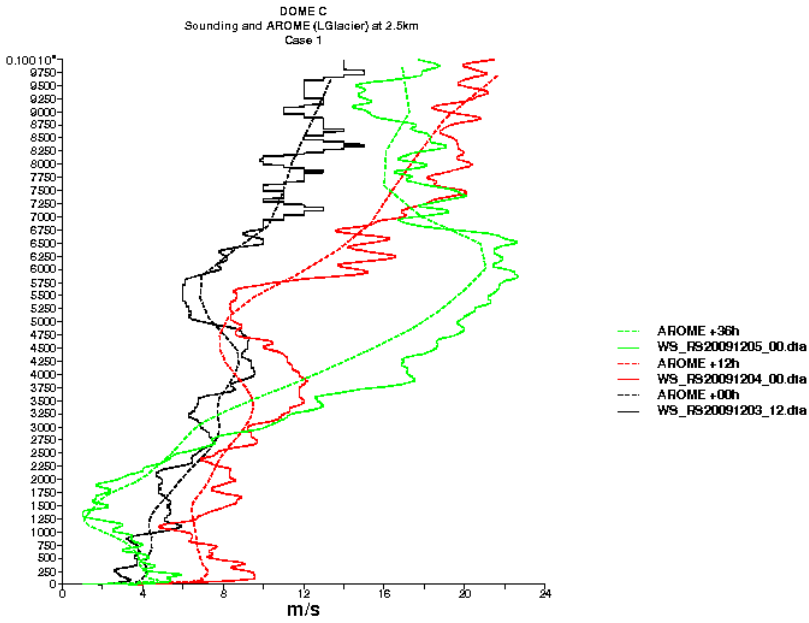
•Lateral boundary condition (LBC) from the operational ARPEGE analysis (4DVAR)
•Initial file (upper air and surface) from ARPEGE analysis

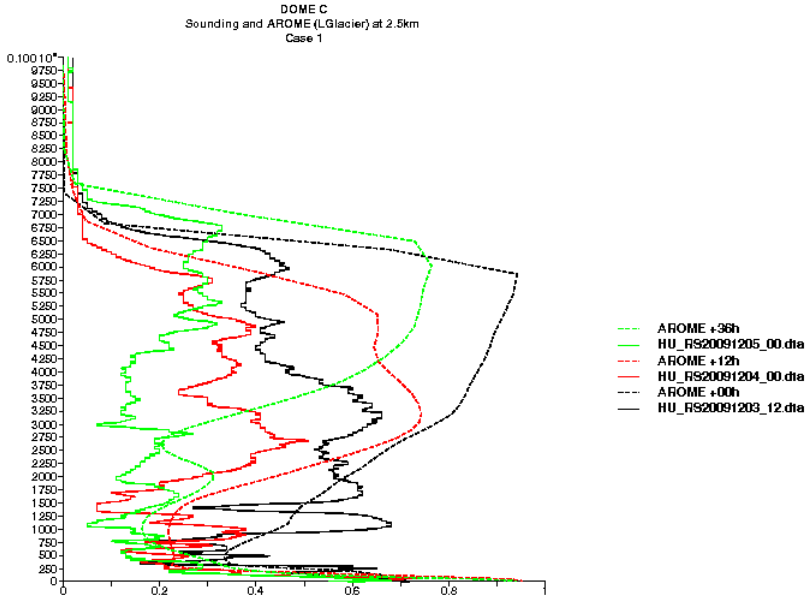
•Horizontal resolution: 2.5km , time step=60s (SL), preliminary test with 60 and then 90 vertical levels

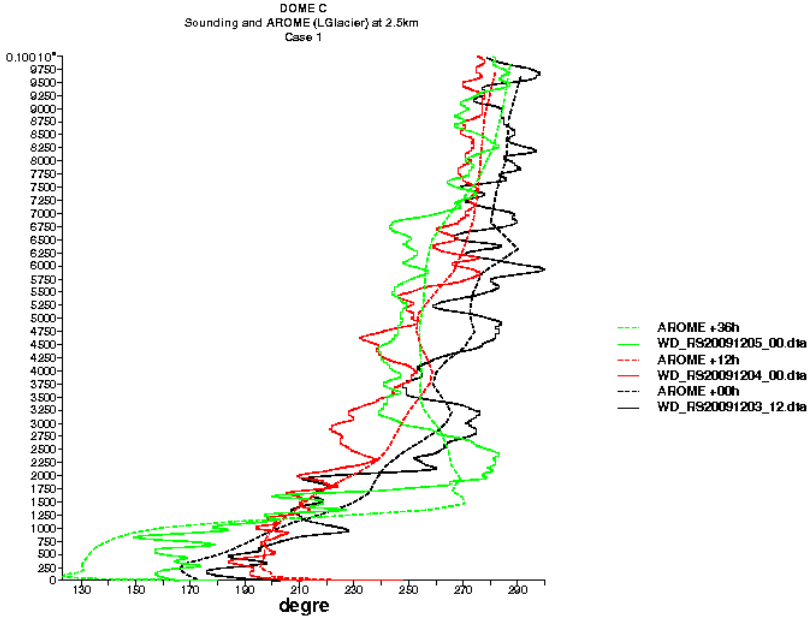
•Two types of experiment with AROME and ARPEGE physics:
  •36h forecast on 3 "optimum " dates chosen with low winds, observation available, almost no clouds etc … → create 1D cases
  •"climate mode" the model is driven only by the LBC every 6h no reinitialization in the domain and for the surface fields

Case 1





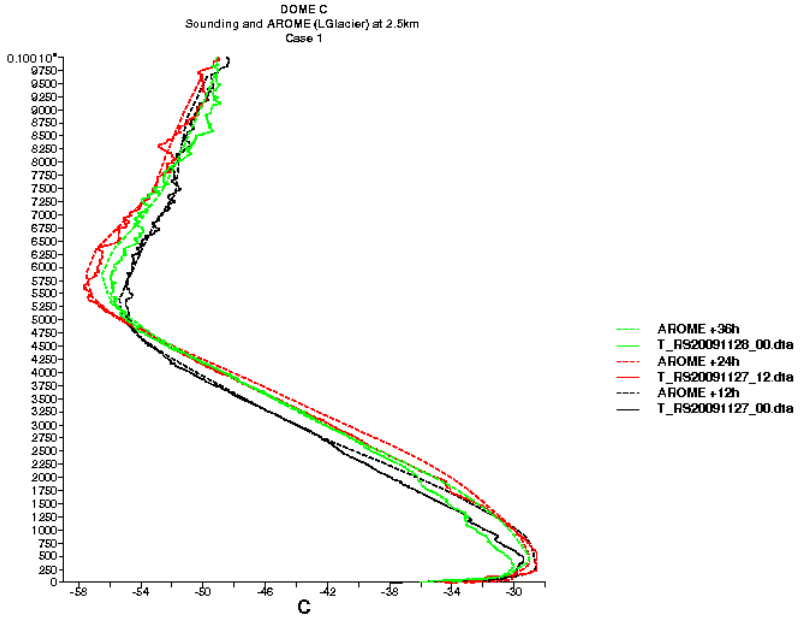


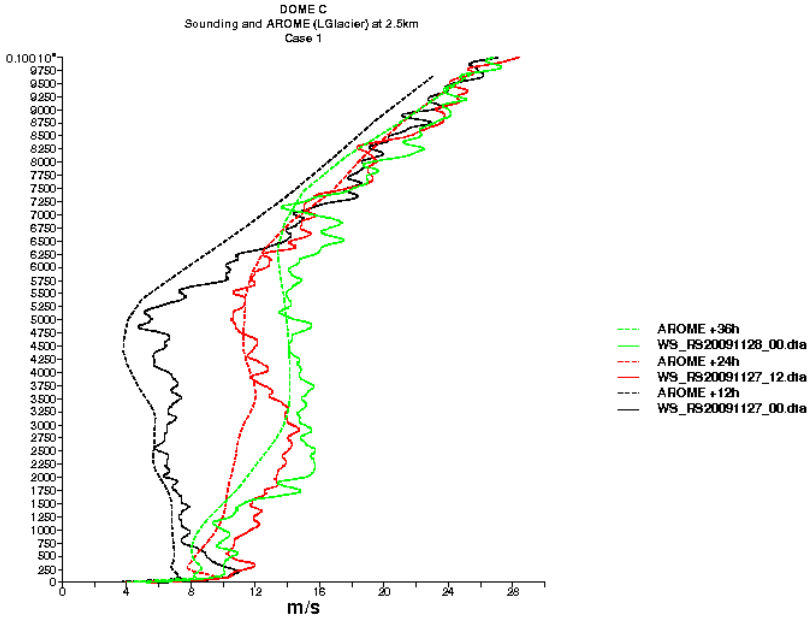


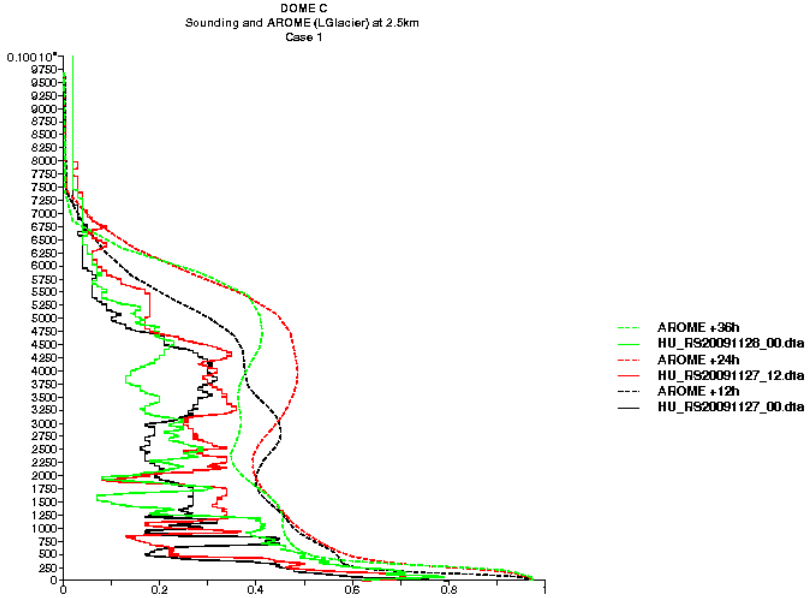
ome C

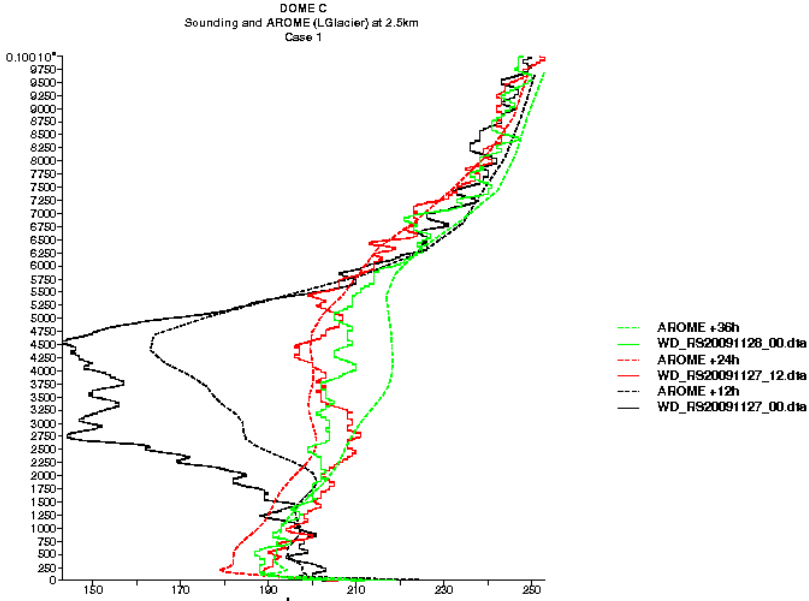
Toulouse

Case 2


DOME C
Sounding and AROME (LGlacier) at 2.5km
Case 1
C
AROME +36h
T_RS20091128_00.dta
AROME +24h
T_RS20091127_12.dta
AROME +12h
T_RS20091127_00.dta

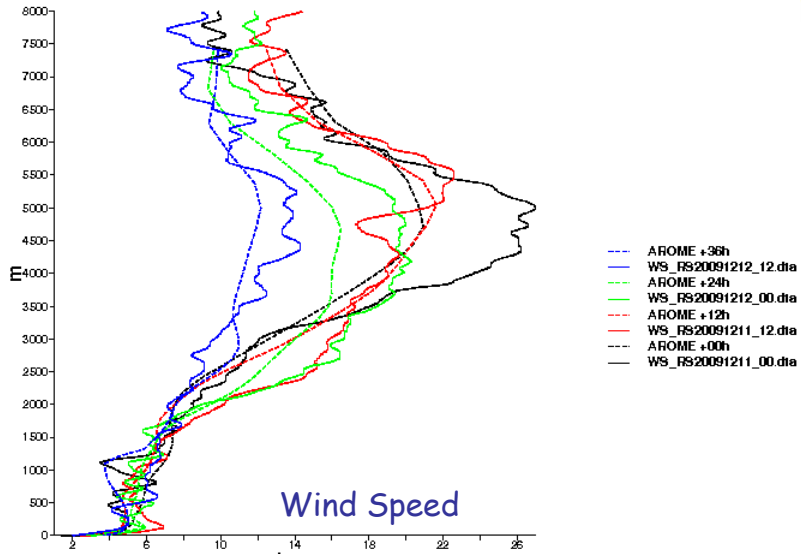

DOME C
Sounding and AROME (LGlacier) at 2.5km
Case 1
m/s
AROME +36h
WS_RS20091128_00.dta
AROME +24h
WS_RS20091127_12.dta
AROME +12h
WS_RS20091127_00.dta

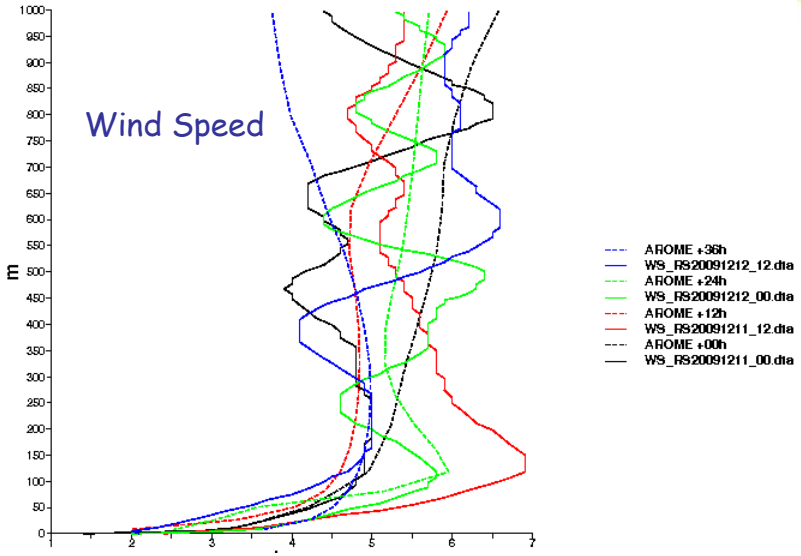

DOME C
Sounding and AROME (LGlacier) at 2.5km
Case 1
AROME +36h
HU_RS20091128_00.dta
AROME +24h
HU_RS20091127_12.dta
AROME +12h
HU_RS20091127_00.dta

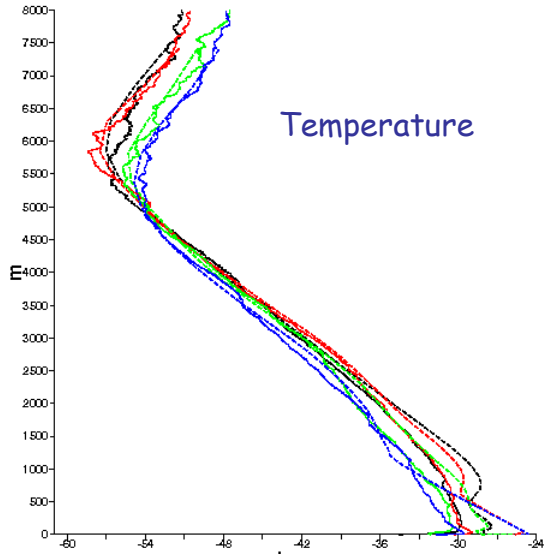

DOME C
Sounding and AROME (LGlacier) at 2.5km
Case 1
degre
AROME +36h
WD_RS20091128_00.dta
AROME +24h
WD_RS20091127_12.dta
AROME +12h
WD_RS20091127_00.dta

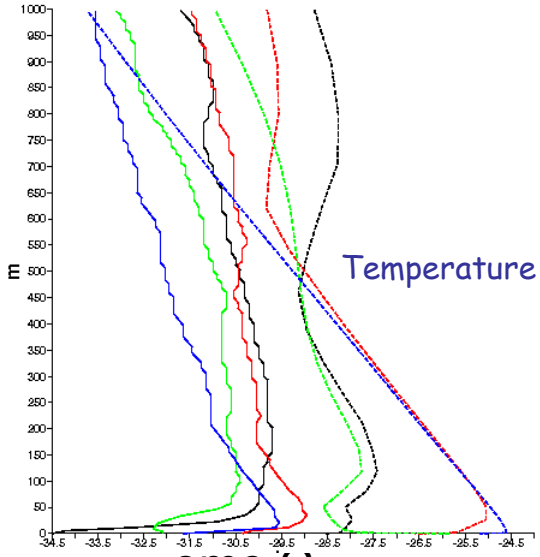
ome C

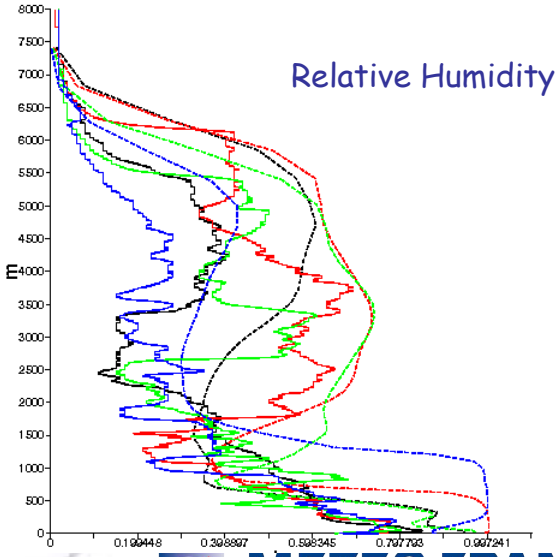
Case 3









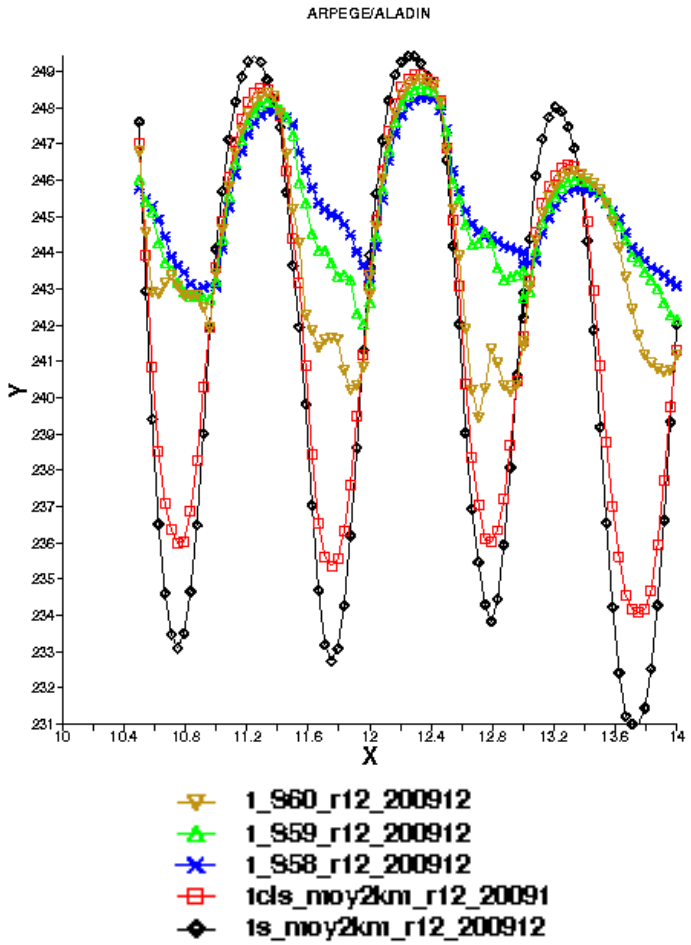


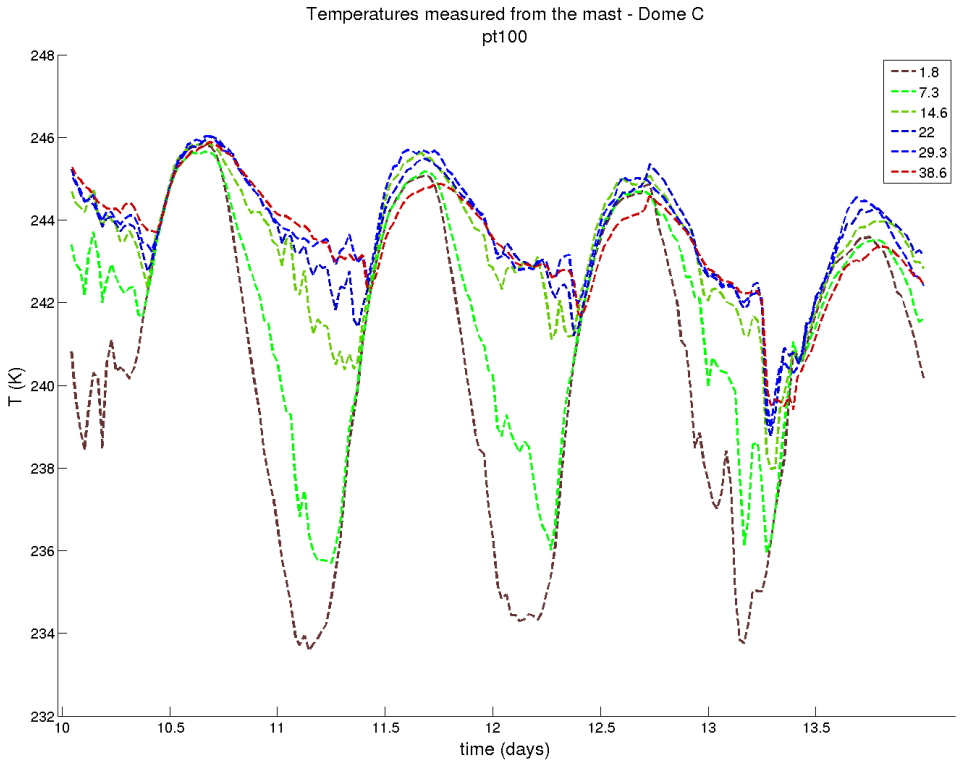
Réunion Dome C

Toulouse

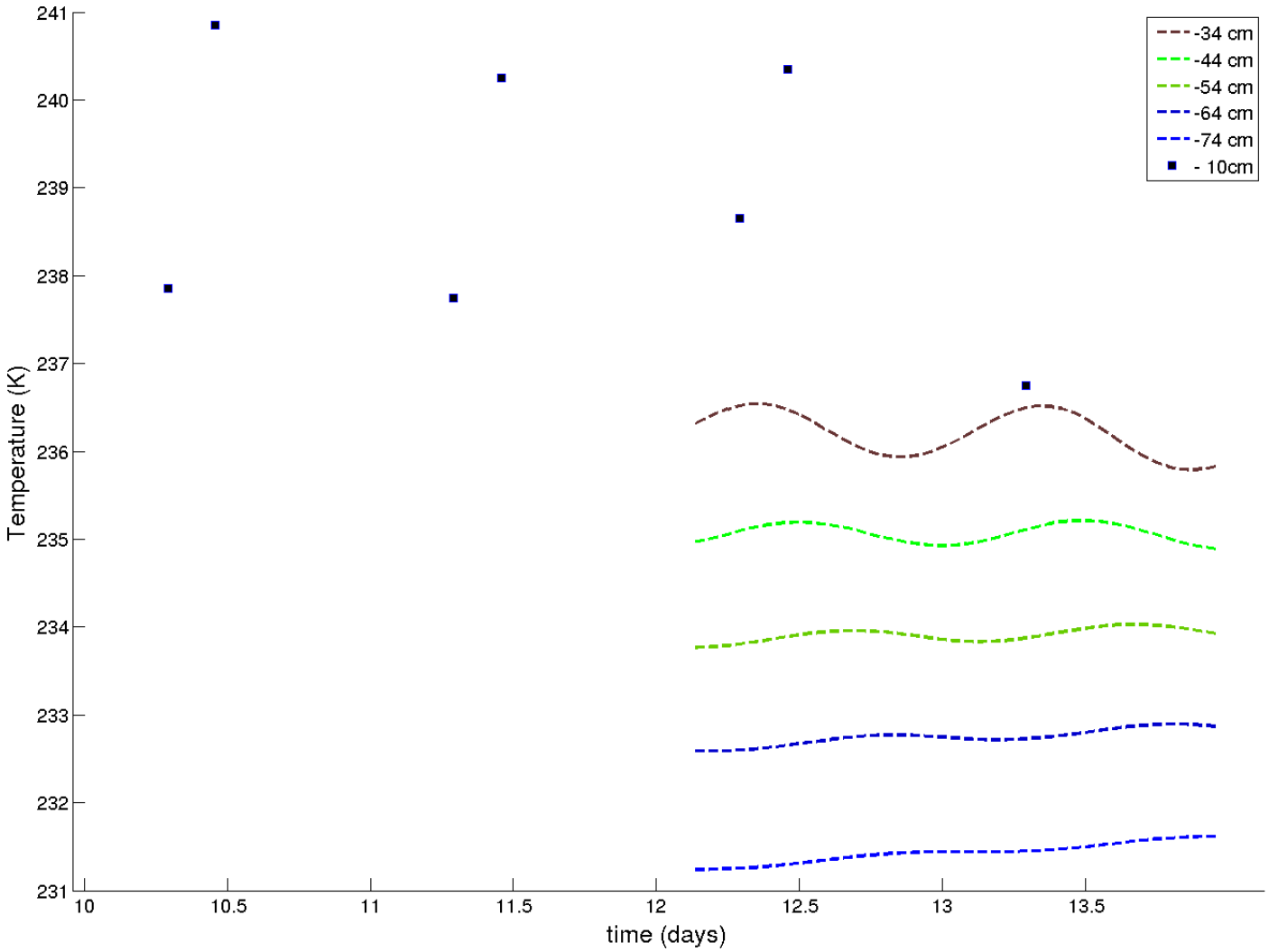
METEO FRANCE
Toujours un temps d'avance

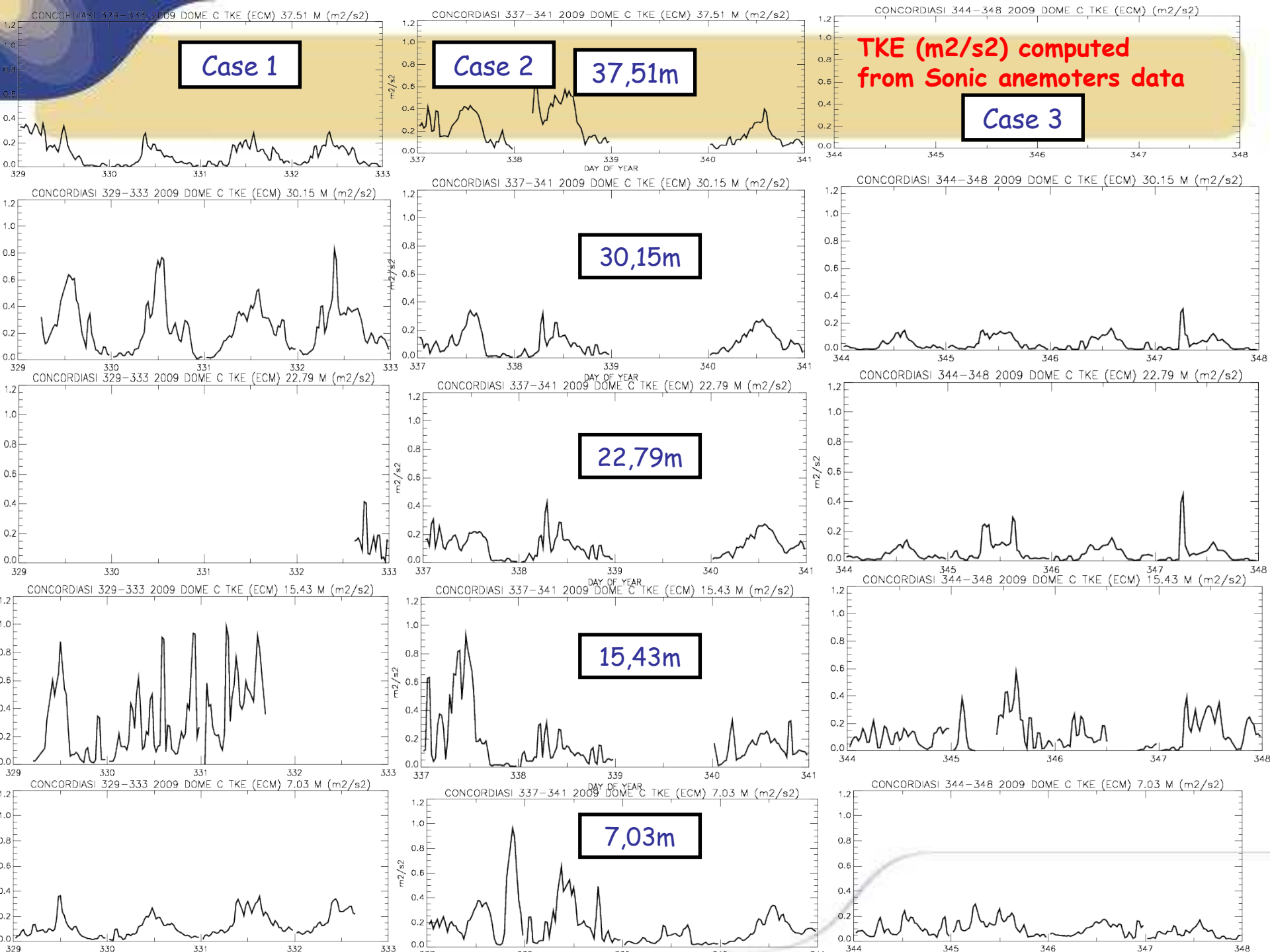
December, 10-13th 2009 (Case3)





December, 10-13th 2009 (Case3)

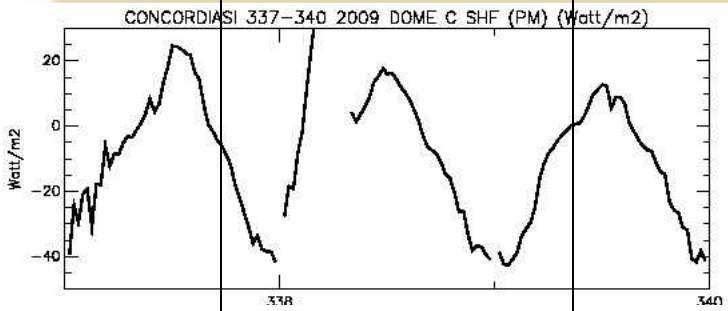


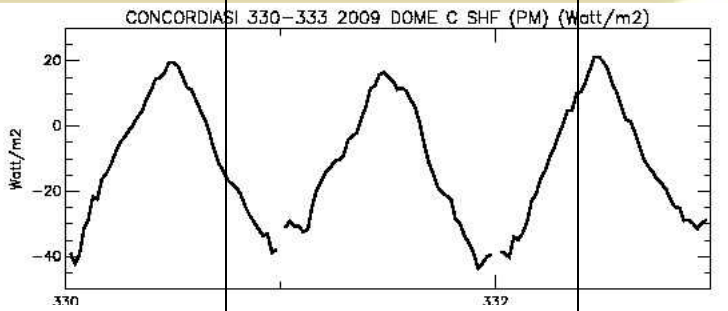

TKE (m2/s2) computed from Sonic anemoters data
Case 1
Case 2
Case 3
37,51m
30,15m
22,79m
15,43m
7,03m
CONCORDIASI 329–333 2009 DOME C TKE (ECM) 37.51 M (m2/s2)
CONCORDIASI 337–341 2009 DOME C TKE (ECM) 37.51 M (m2/s2)
CONCORDIASI 344–348 2009 DOME C TKE (ECM) (m2/s2)
CONCORDIASI 329–333 2009 DOME C TKE (ECM) 30.15 M (m2/s2)
CONCORDIASI 337–341 2009 DOME C TKE (ECM) 30.15 M (m2/s2)
CONCORDIASI 344–348 2009 DOME C TKE (ECM) 30.15 M (m2/s2)
CONCORDIASI 329–333 2009 DOME C TKE (ECM) 22.79 M (m2/s2)
CONCORDIASI 337–341 2009 DOME C TKE (ECM) 22.79 M (m2/s2)
CONCORDIASI 344–348 2009 DOME C TKE (ECM) 22.79 M (m2/s2)
CONCORDIASI 329–333 2009 DOME C TKE (ECM) 15.43 M (m2/s2)
CONCORDIASI 337–341 2009 DOME C TKE (ECM) 15.43 M (m2/s2)
CONCORDIASI 344–348 2009 DOME C TKE (ECM) 15.43 M (m2/s2)
CONCORDIASI 329–333 2009 DOME C TKE (ECM) 7.03 M (m2/s2)
CONCORDIASI 337–341 2009 DOME C TKE (ECM) 7.03 M (m2/s2)
CONCORDIASI 344–348 2009 DOME C TKE (ECM) 7.03 M (m2/s2)
m2/s2
DAY OF YEAR

SURFACE OBS

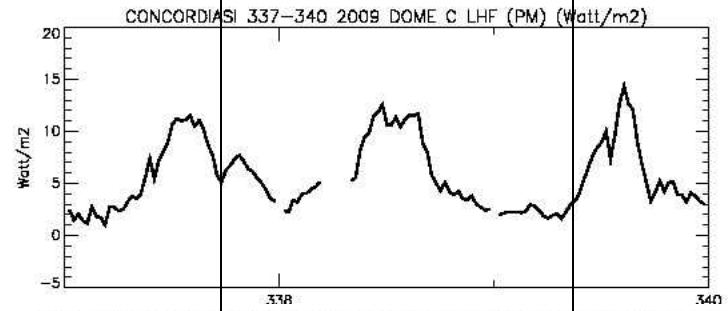
Case 1

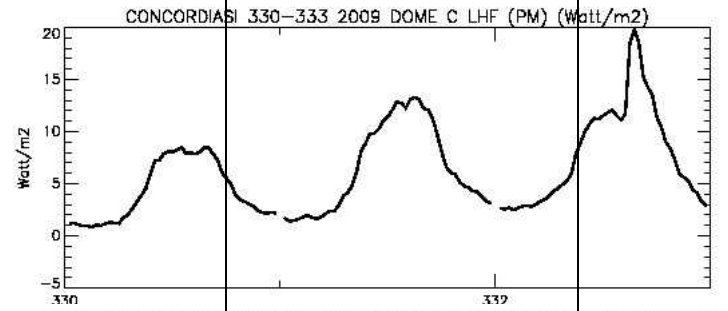
Case 2



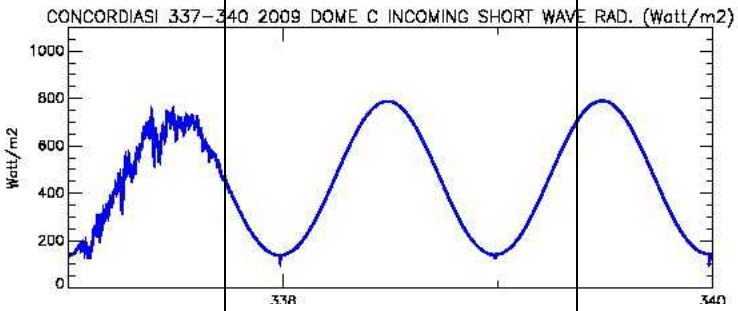


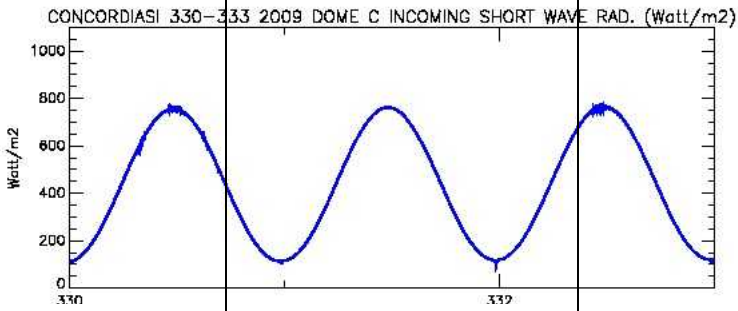
Hs W/m2



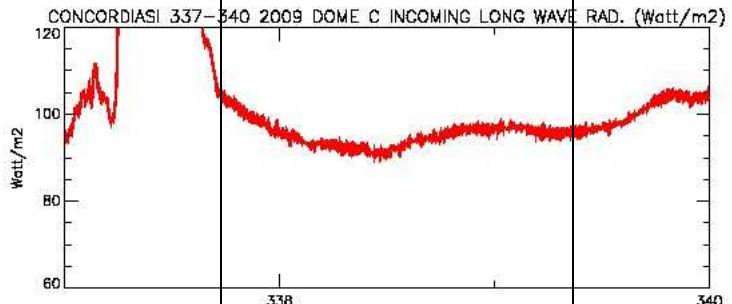


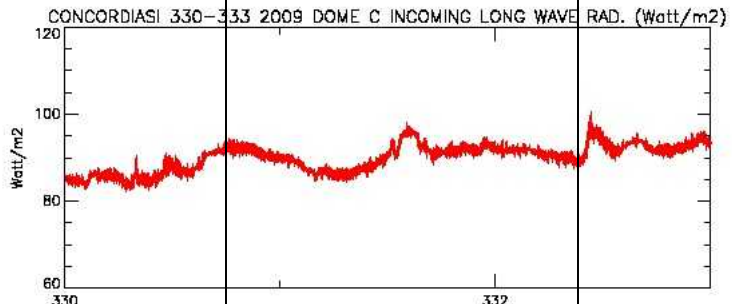
Lat. Heat W/m2





SWD W/m2





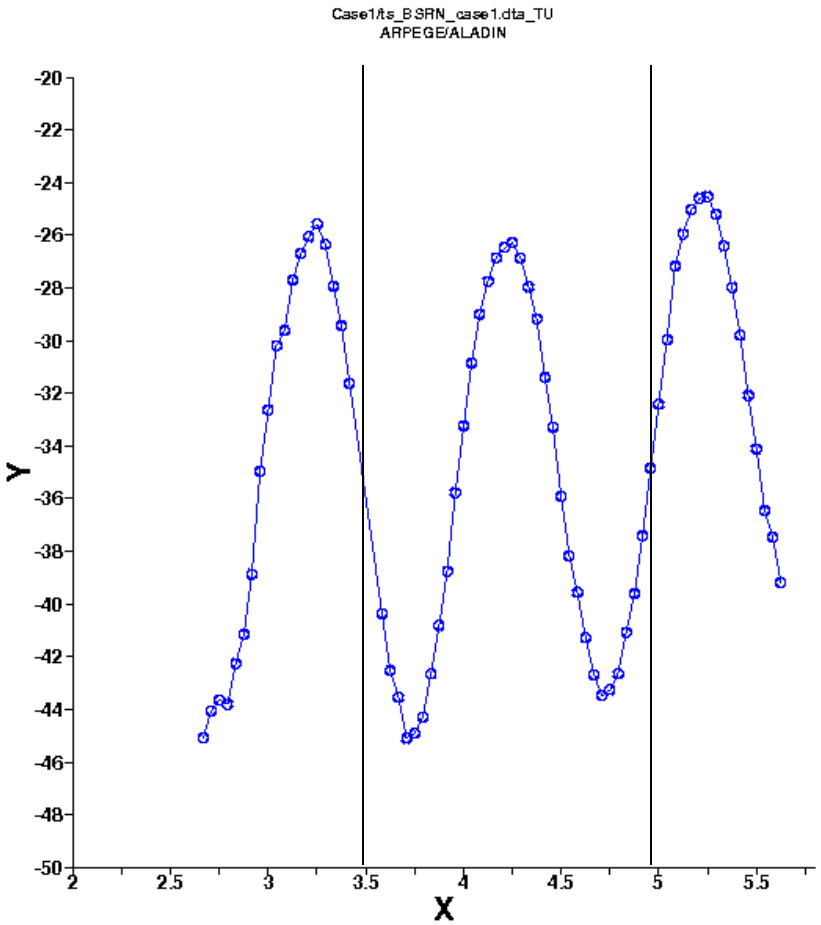
LWD W/m2

n Dome C

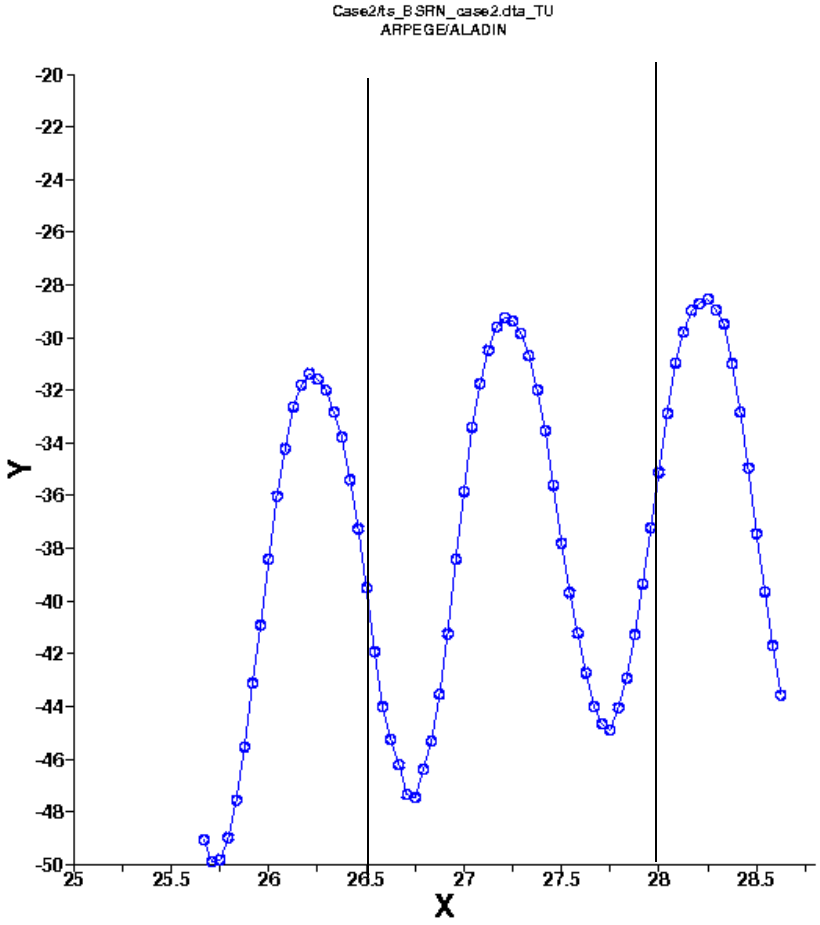
se

SURFACE Temperature

Case 1



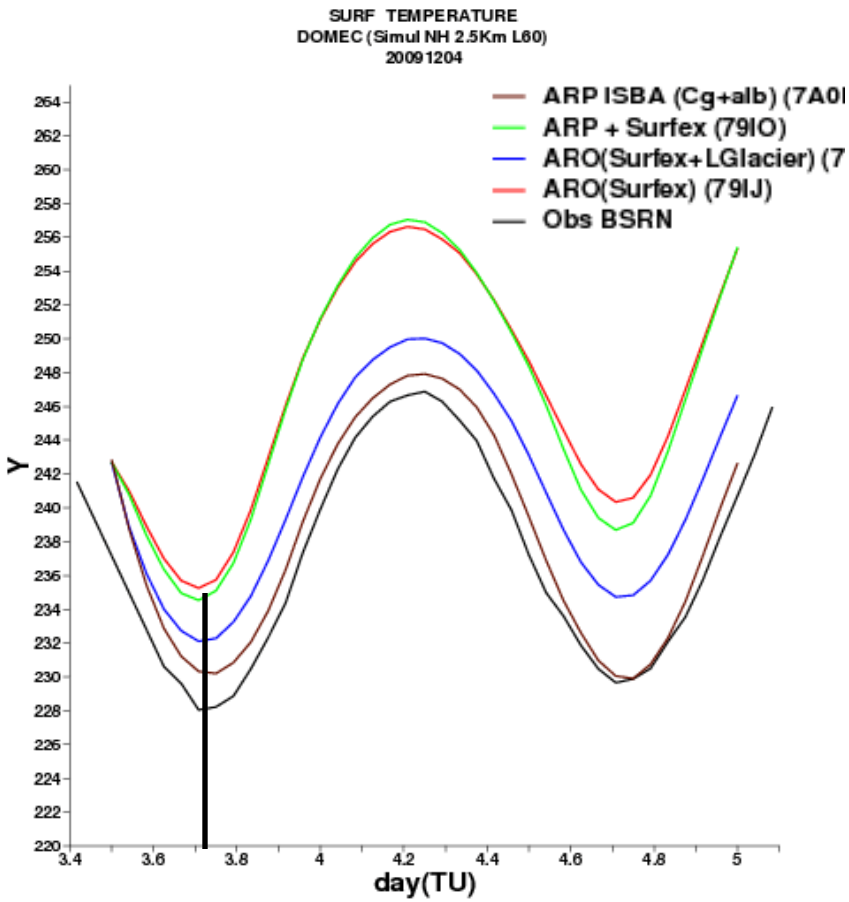
Case 2



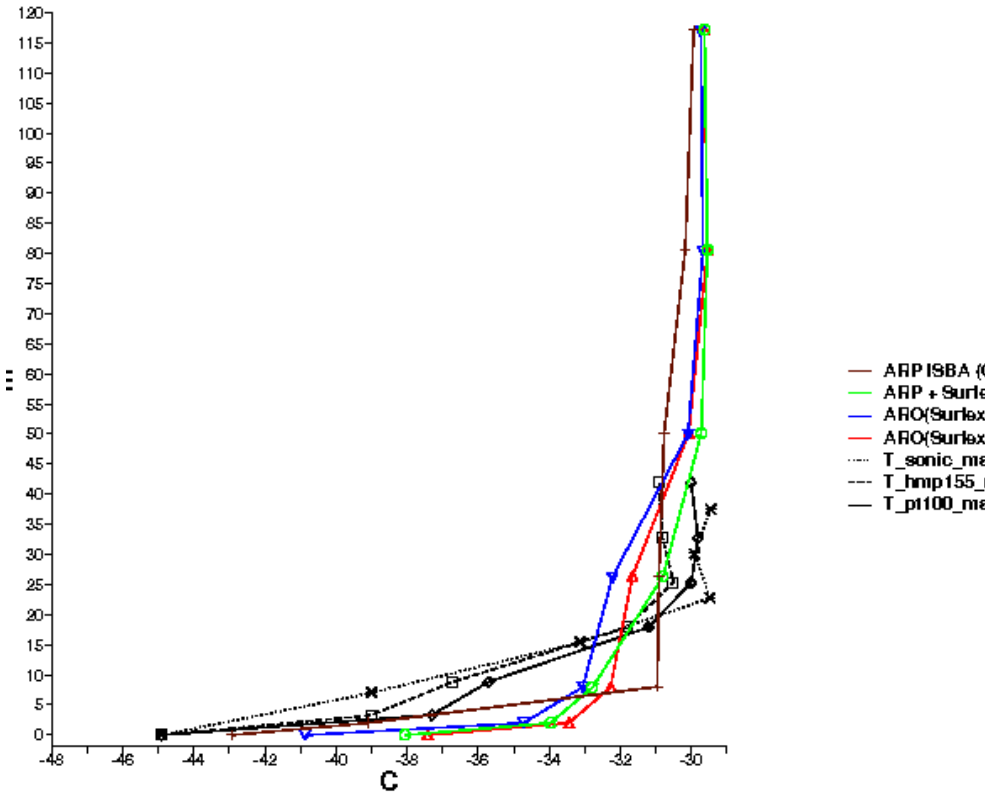
Réunion Dome C
Toulouse

METEO FRANCE
Toujours un temps d'avance

December, 4th 2009 (Case1) Init:03/12/09 at 12UTC



03/12/09 at 18UTC



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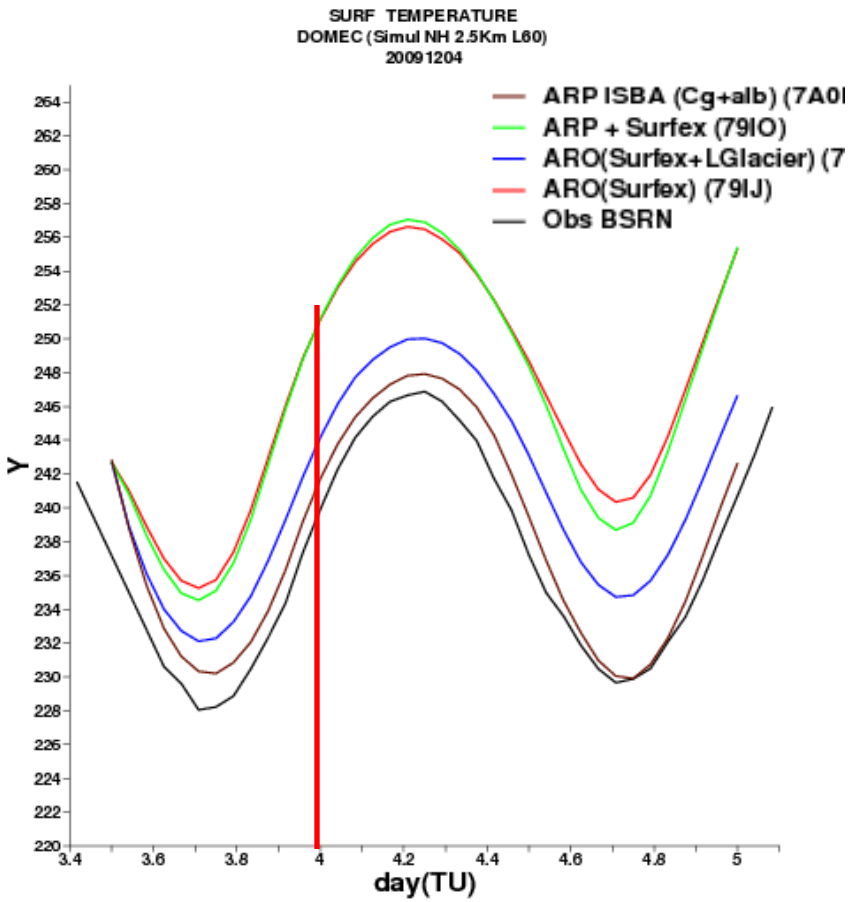
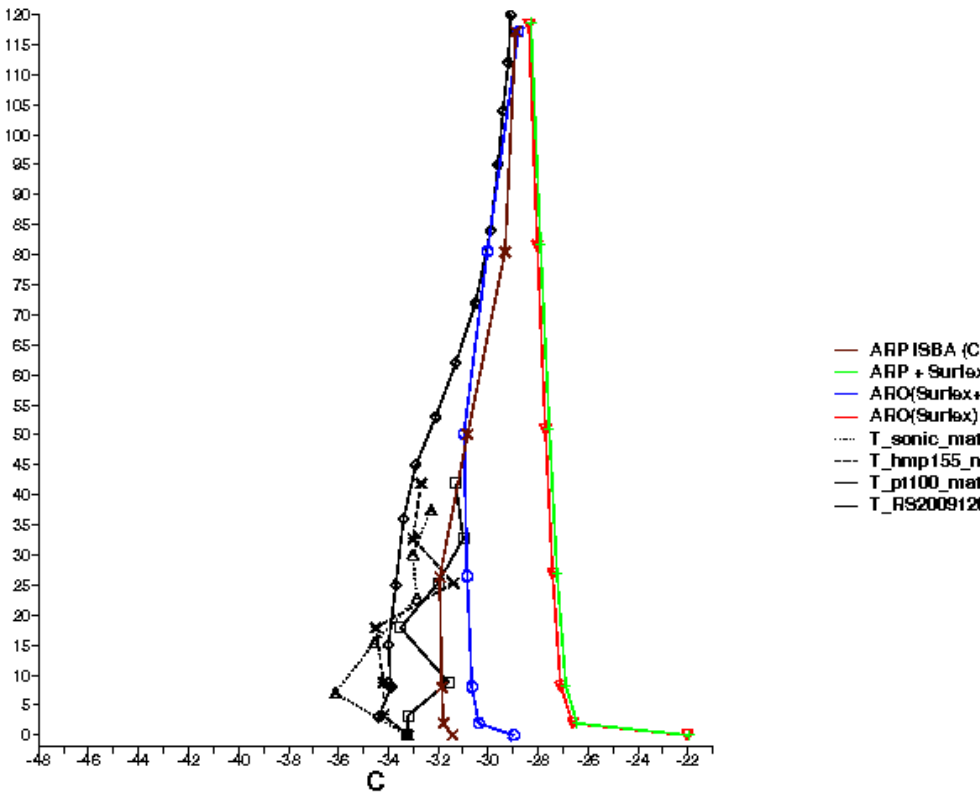


04/12/09 at 00UTC



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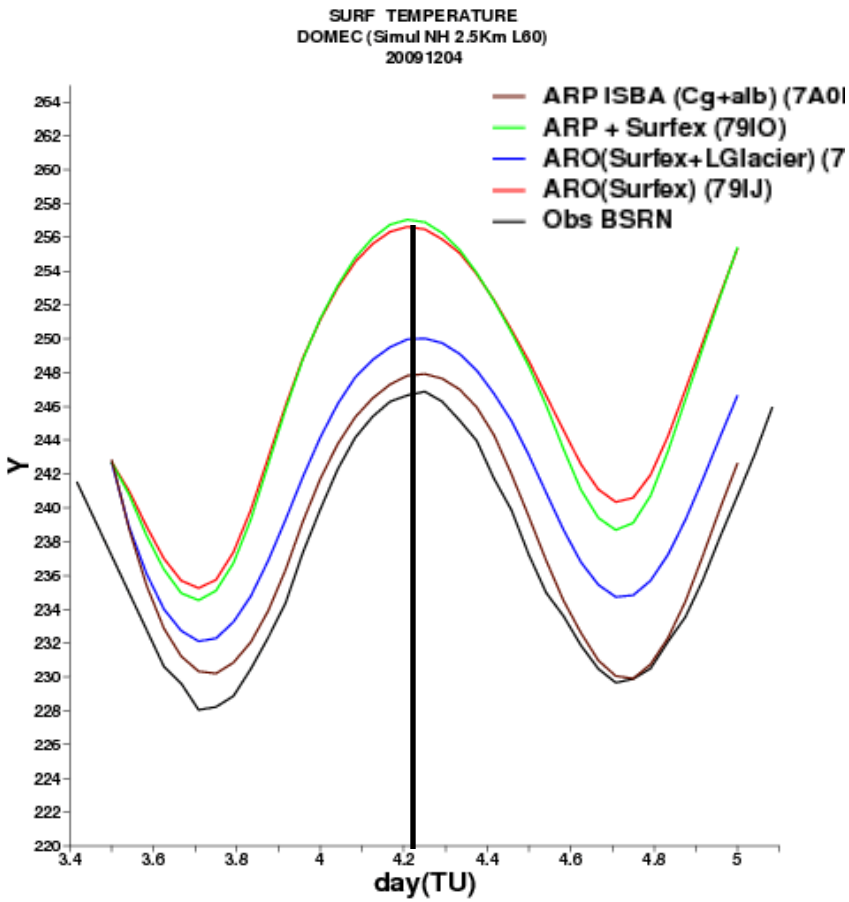

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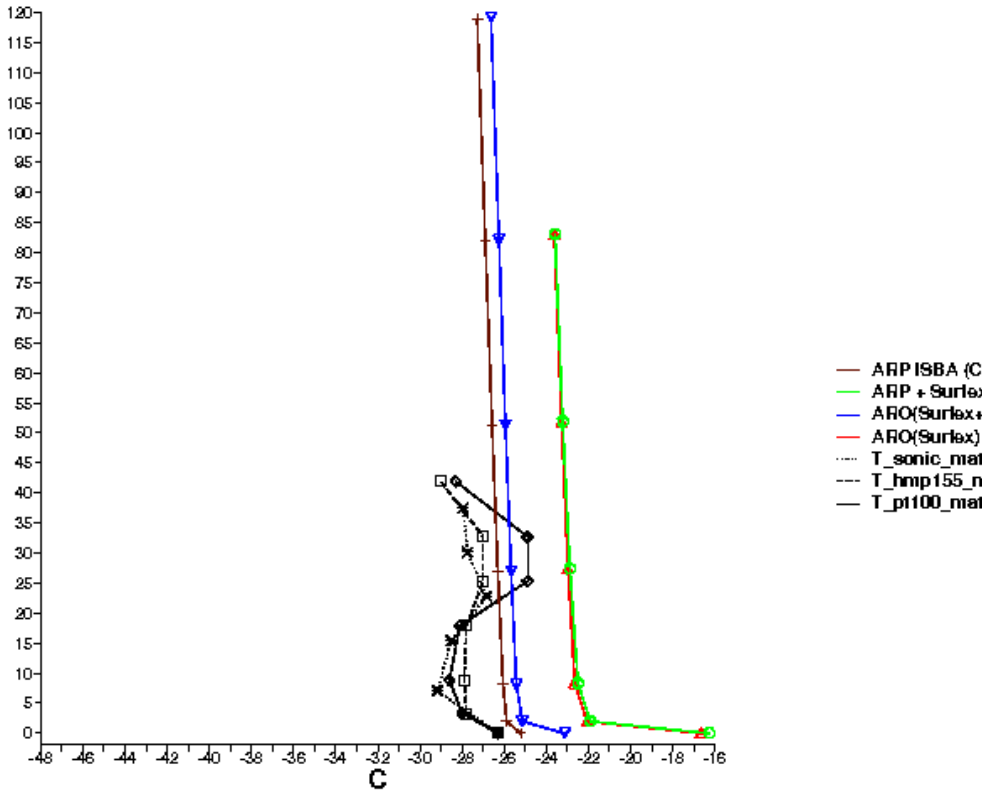

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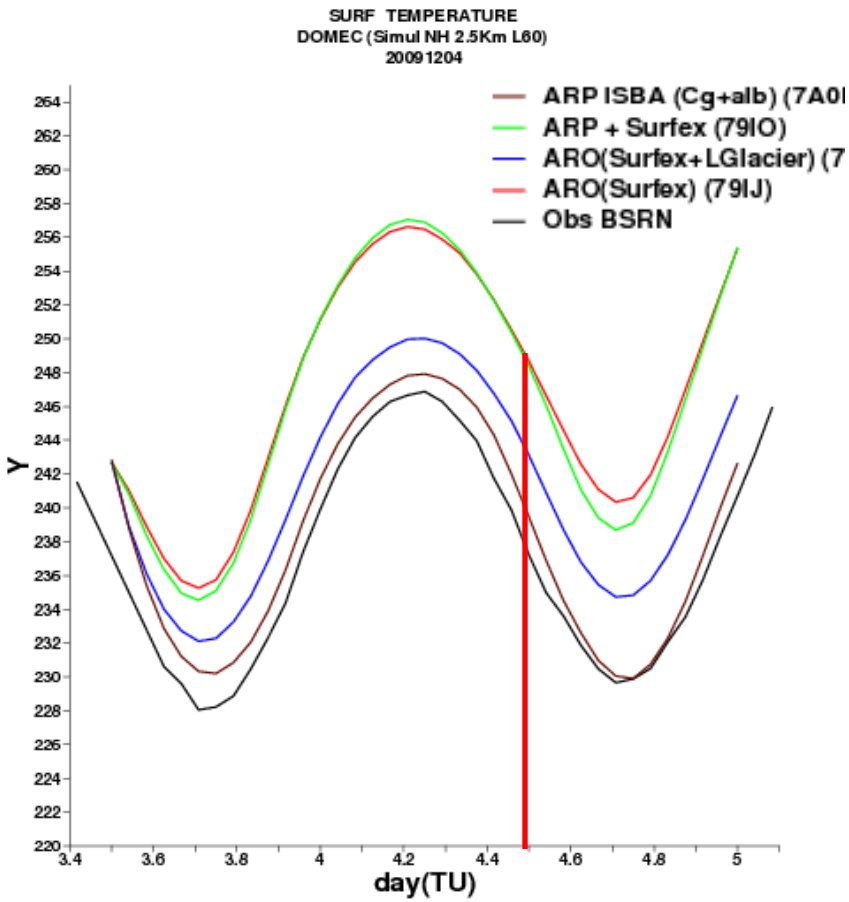

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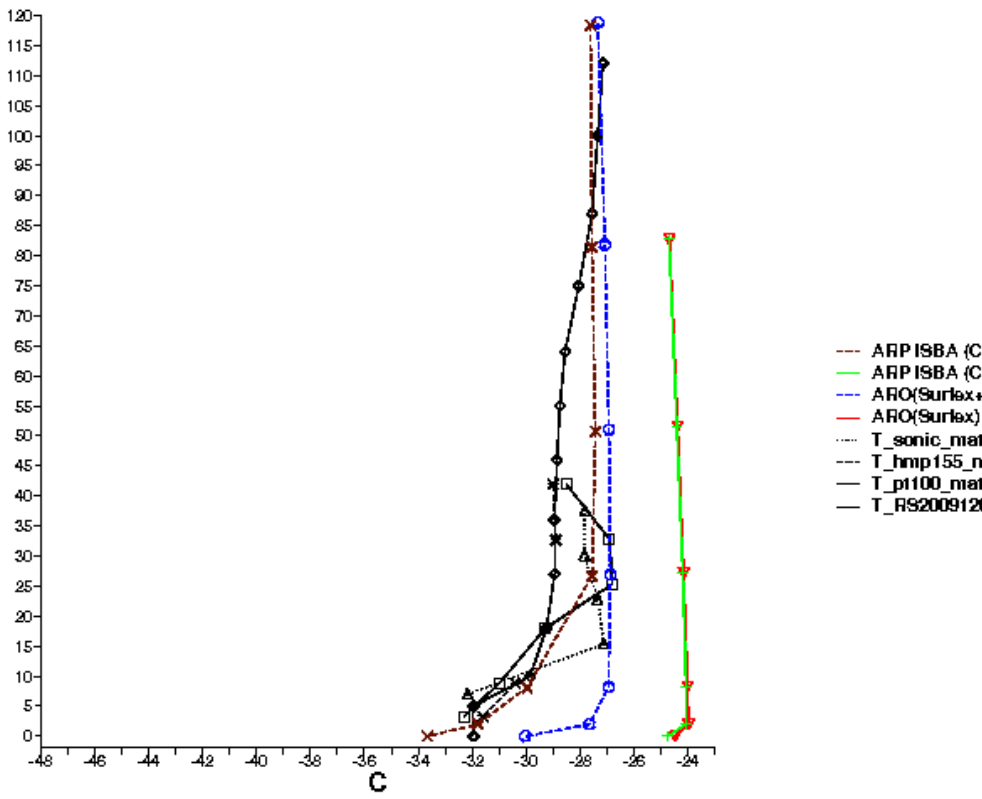

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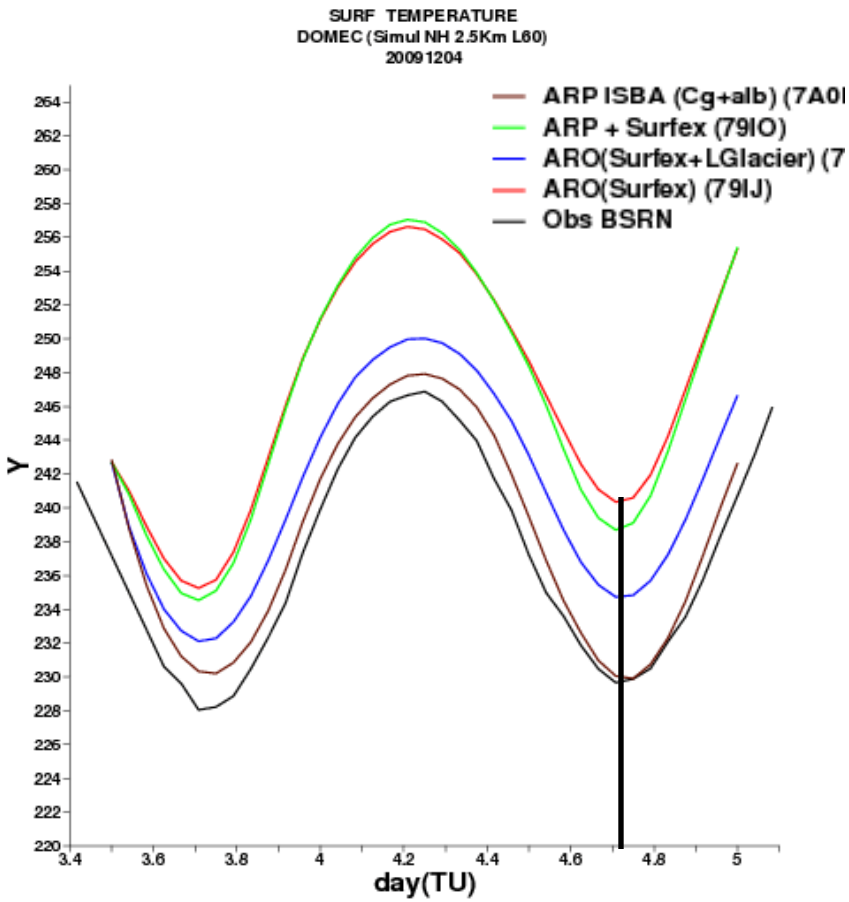

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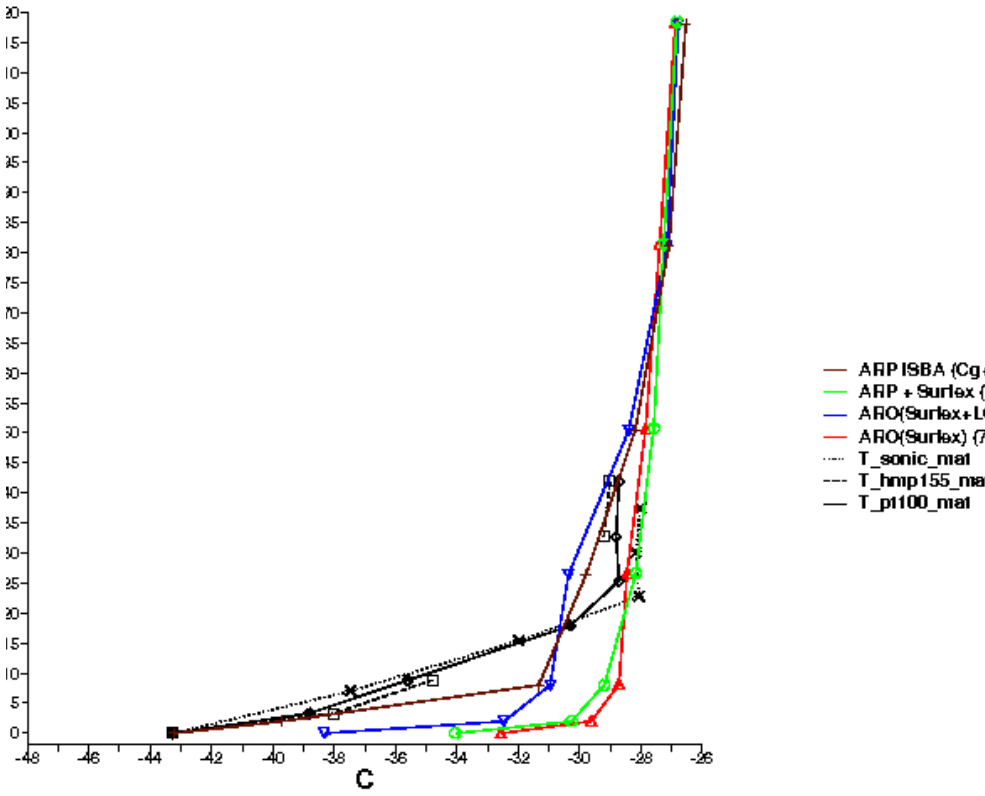
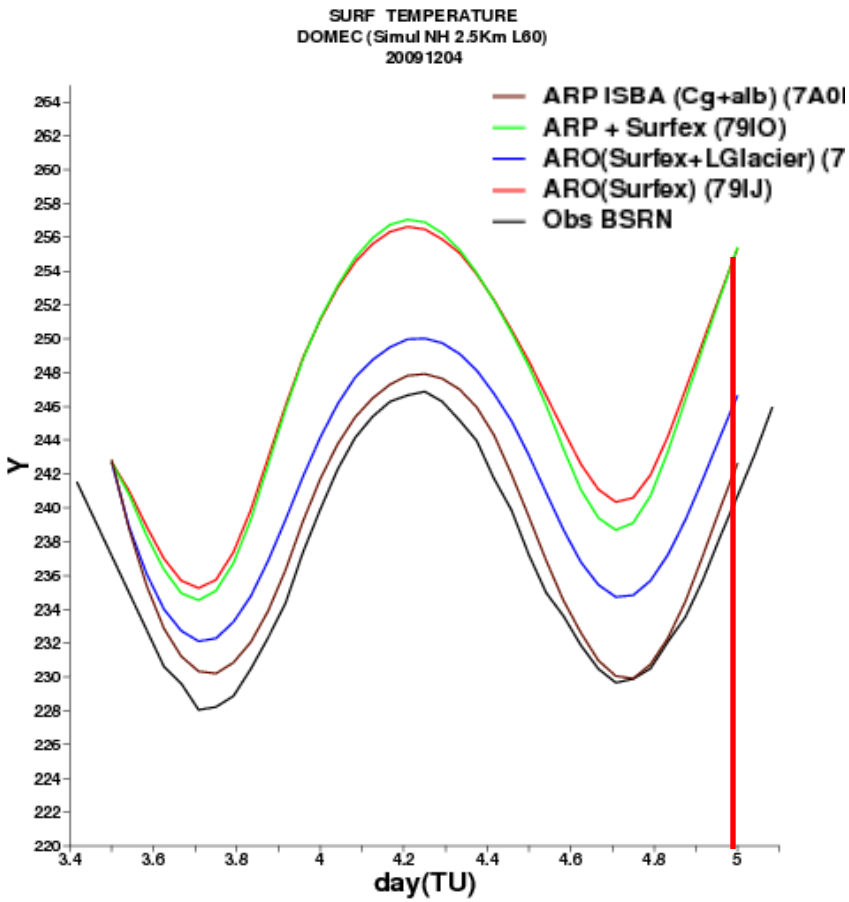


Réunion Dome C
Toulouse

INSU Observer & comprendre

METEO FRANCE Toujours un temps d'avance

December, 4th 2009 (Case1) Init: 03/12/09 at 12UTC



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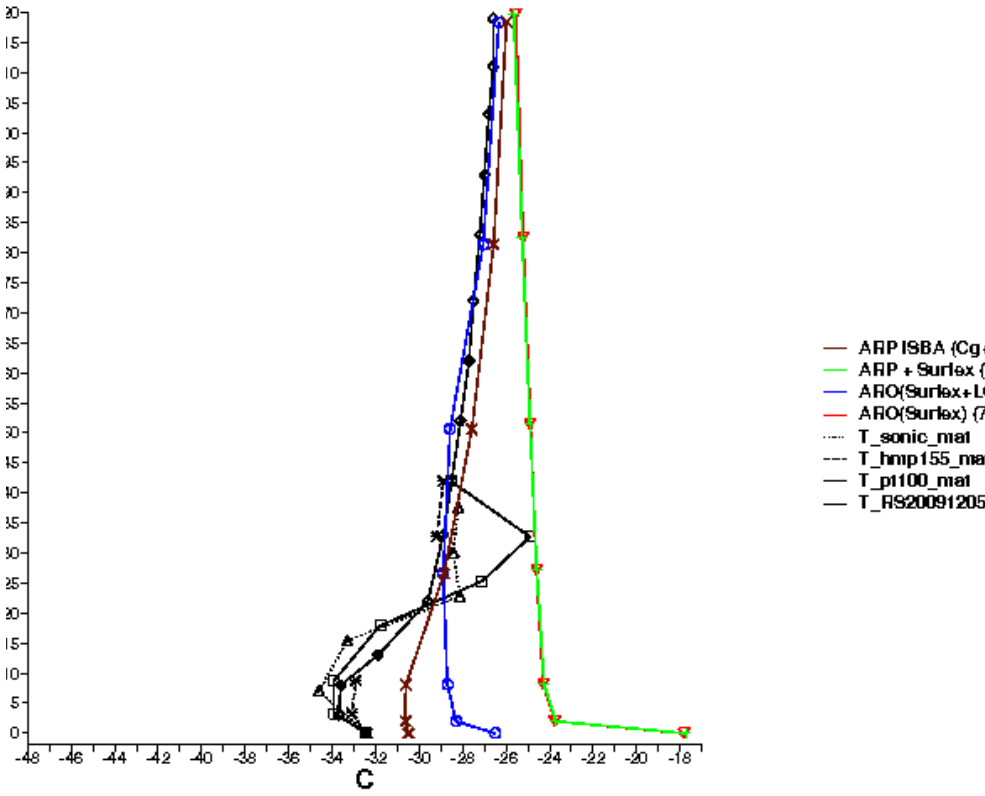
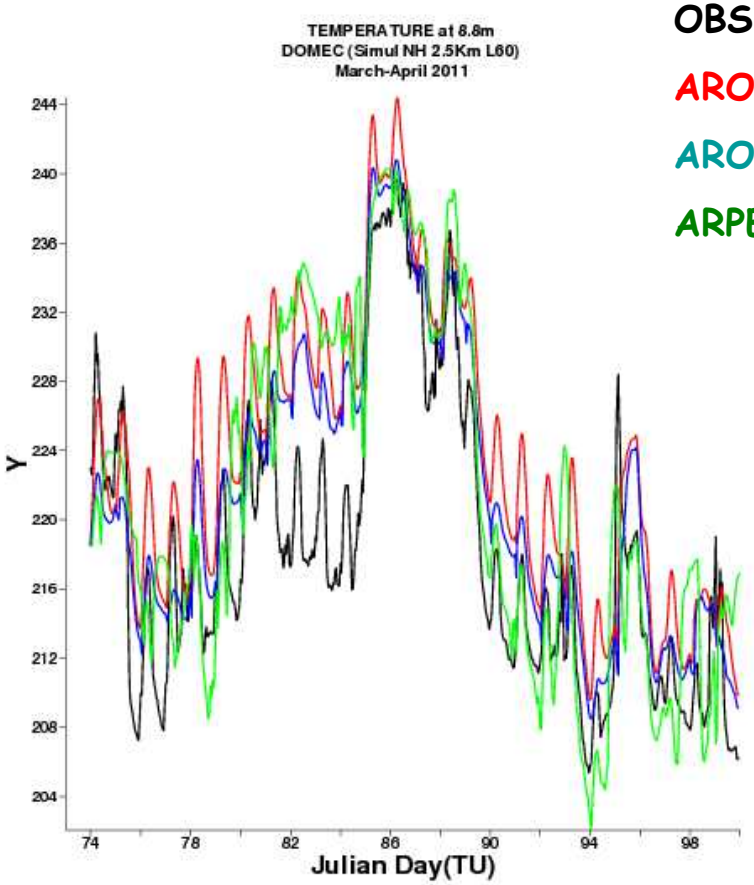


Experiment in “Climate” mode
2011/03/14 → 2011/04/08 with 2 physics package



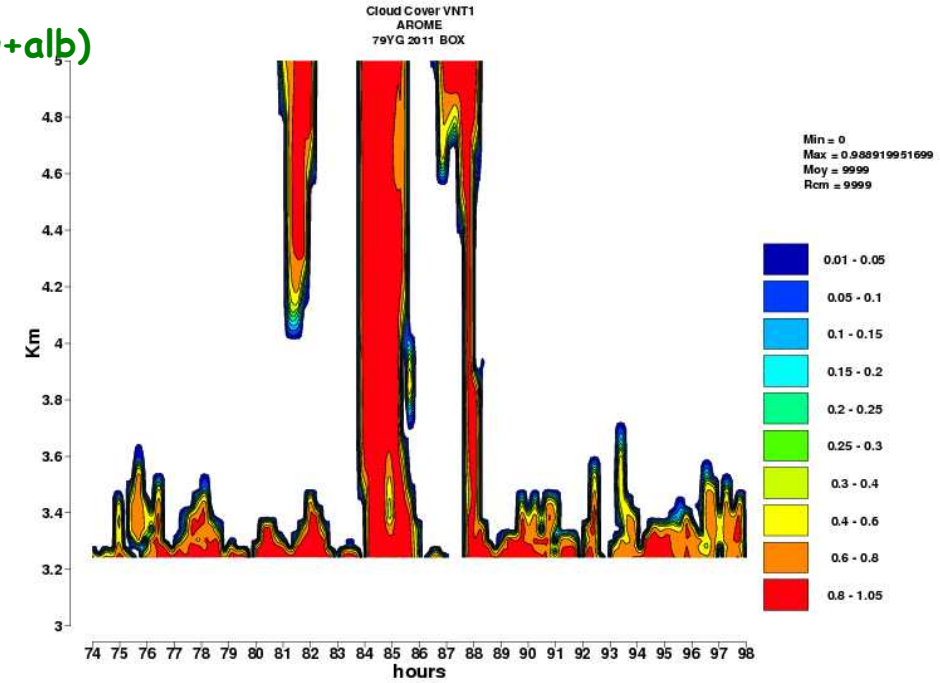
OBS

AROME

AROME Lglacier

ARPEGE (Cg+alb)

Cloud Cover



Conclusions & Perspectives

· Calculer les forçages pour la période du 10-12 décembre 2009 pour le modèle 1D

• Vérifier le comportement du modèle 1D voir en particulier ce problème de nuage dans le modèle 1D. Corriger l'état initial pour l'humidité et la température

•Fin juin: arrêter le choix de la date entre 3-4 Dec, 27 Nov ou 11-12 Déc 2009

•Simplifier les forçages atmosphériques sans trop dégrader la simulation 1D

•2 expériences demandées: en mode libre avec une surface interactive et une avec le Ts forcé

•Envoi des forçages à I. Sandu pour un test avec le modèle 1D du CEP avant annonce officielle prévue à l'EMS de septembre 2013