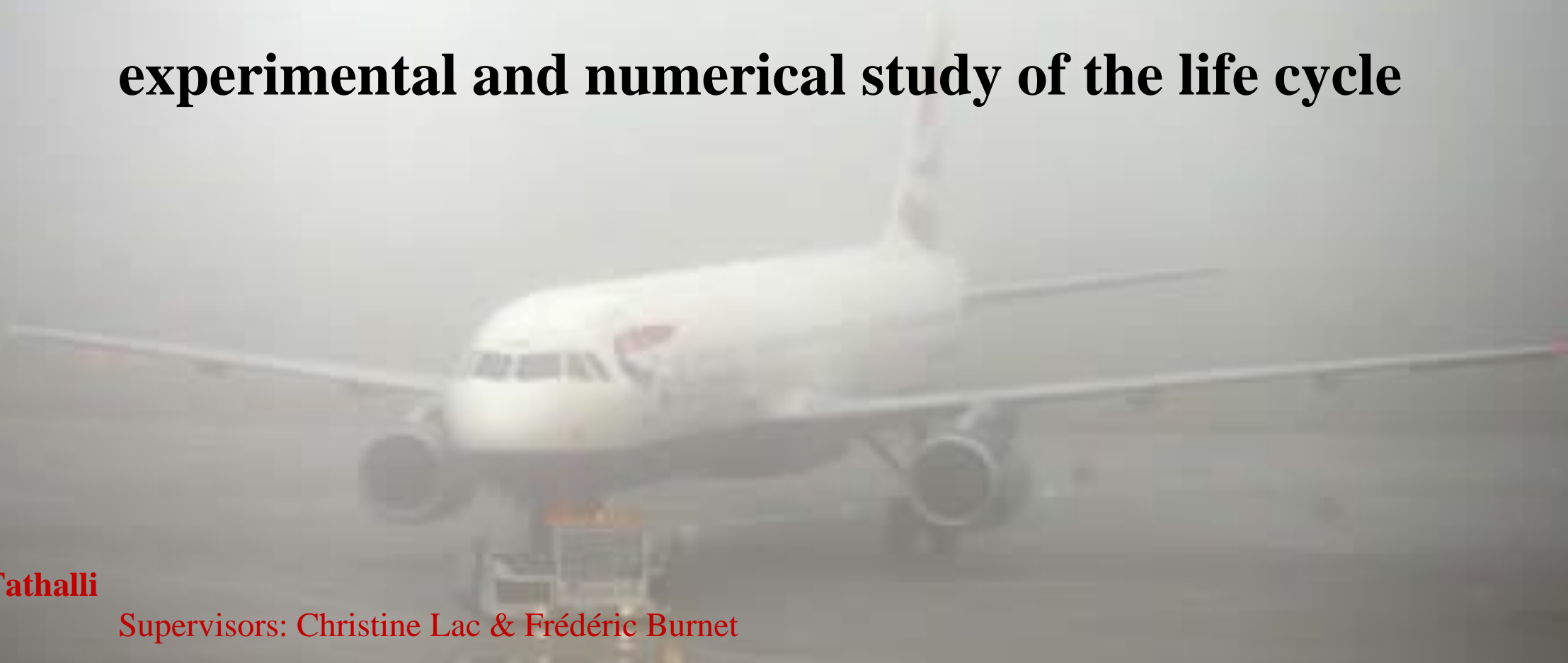


Stratus lowering Fog:

experimental and numerical study of the life cycle



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16/04/2019 – Kick-off meeting



GMEI/MNPCA & GMME/PHY-NH

Introduction

Context

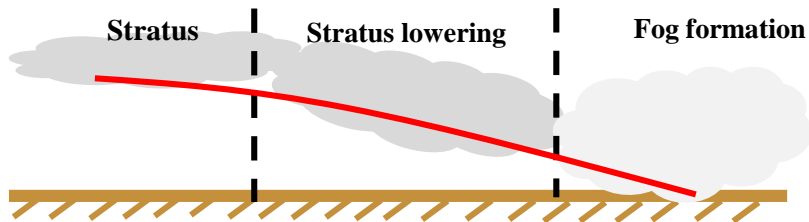
- ❑ Strong visibility reduction



Strong disruption of aviation



- Radiative fogs (RAD).
- Advection fogs (ADV).
- **Fogs due to stratus lowering (STL)** (Stratus Transition lowering).



❑ AROME

- ➔ Difficulties to correctly forecast stratus lowering.

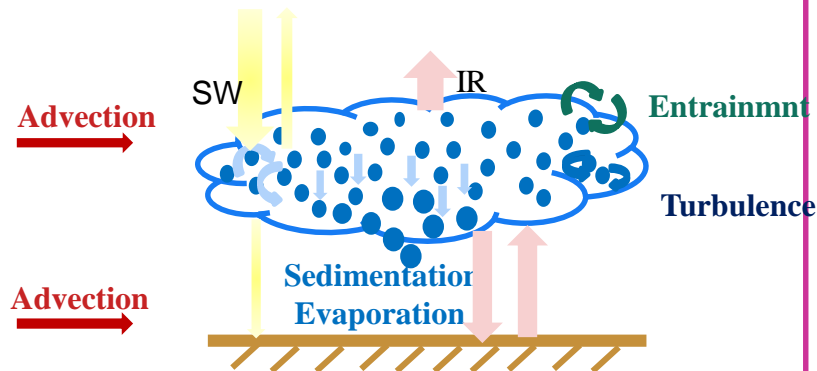
In winter 2011 at Paris- CDG :

AROME simulates about 70 % RAD fogs but only **30 % STL** (Philip, 2016).

Objectives of the thesis

- Better understand the processes leading to (or not) the stratus lowering.

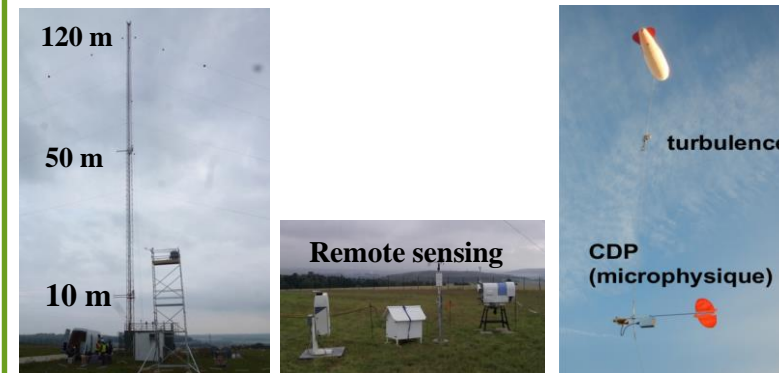
What are the **processes leading to stratus lowering** ?



- Evaluation of the 2-moment microphysical scheme LIMA (Vié et al., 2016) in stratus and fog.
- Characterize the necessary elements to improve the forecast with **AROME**.

Methods

- Analysis of data collected during the **OPE** field campaign in the North-East of France.



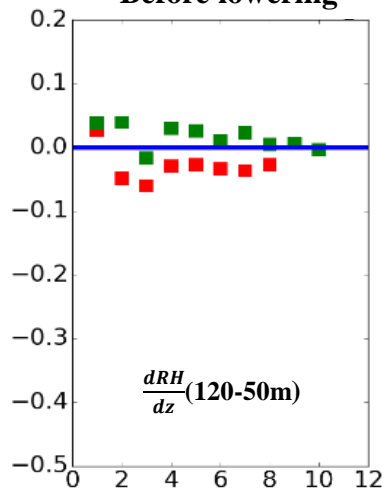
- Analysis of the numerical simulation of **an STL event of OPE** with **Meso-NH** model and LIMA scheme at high resolution, then an idealized simulation.
- Contribution to **SOFOG3D** experimental network.

Data analysis

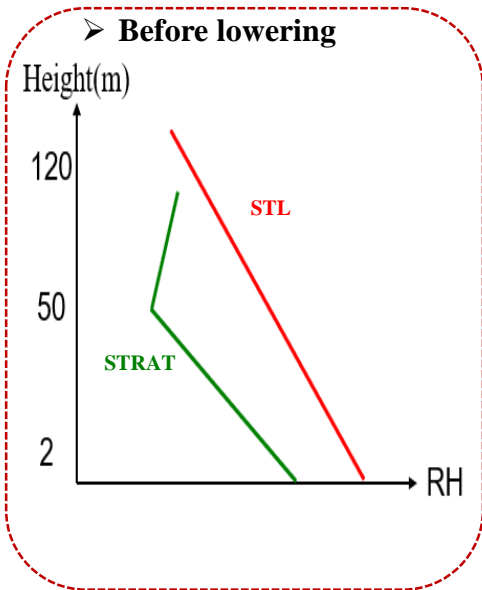
Statistical analysis of OPE events to characterize **large scale conditions** associated with STL.

- ✓ 10 cases of STL
- ✓ 10 cases of stratus lowering without fog (STRAT).
- ✓ 10 cases of radiative fogs (RAD).

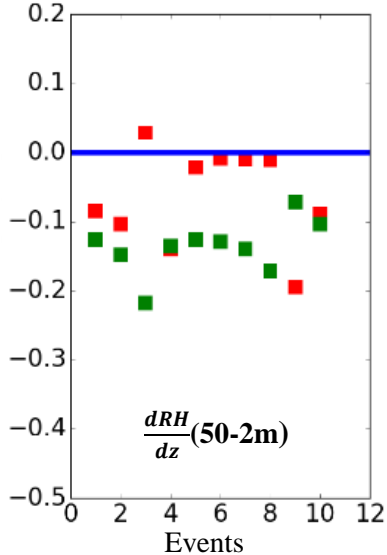
Before lowering



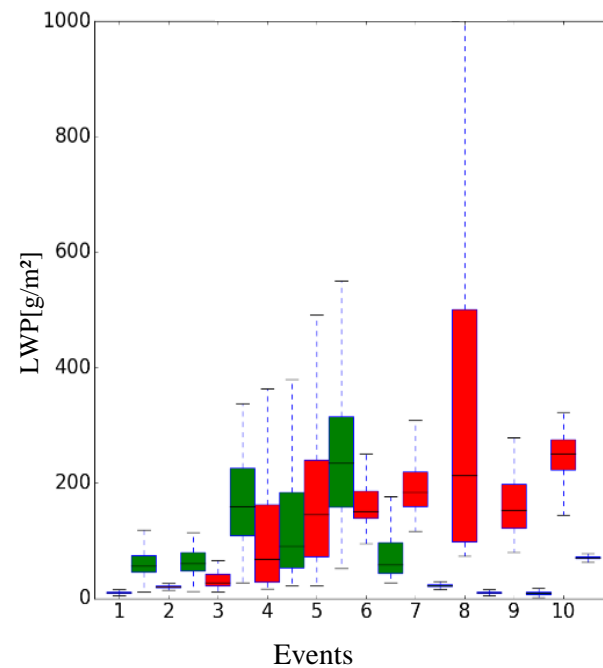
— STL
— STRAT



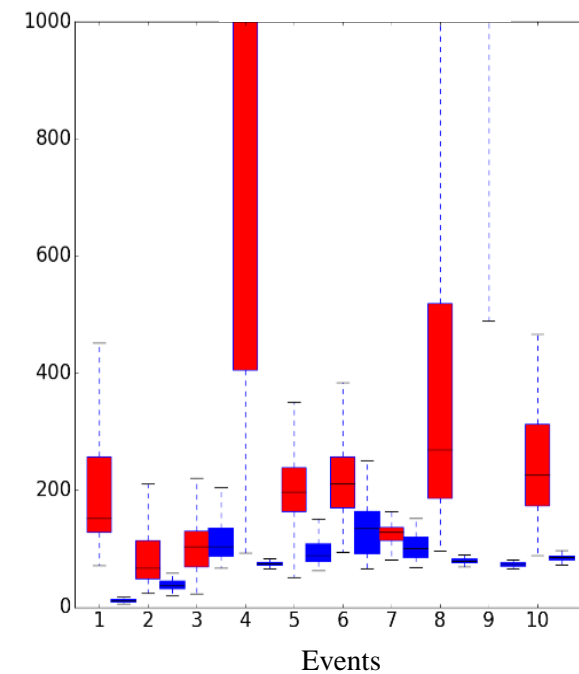
Vertical gradient of relative humidity for STL and STRAT.



Before lowering



During fog



■ STL
■ STRAT
■ RAD

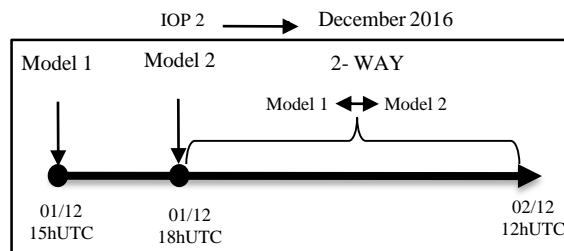
➤ Before lowering:

LWP (STL) > LWP (STRAT)

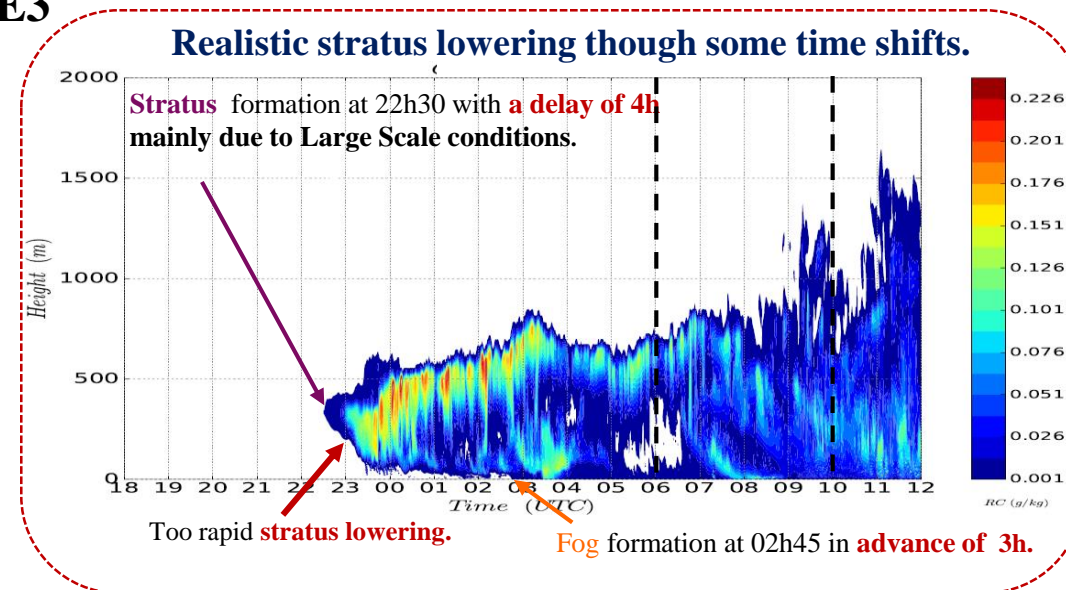
➤ During fog:

LWP (STL) > LWP (RAD)

- Horizontal grid resolution: 500 m et 100 m with two-way nested grids.
- 150 vertical levels : 0 to 3250 m (from 1.5 to 50 m de resolution).
- Microphysics **ICE 3** then **LIMA**.
- Initial/coupling: **Arome** analysis.

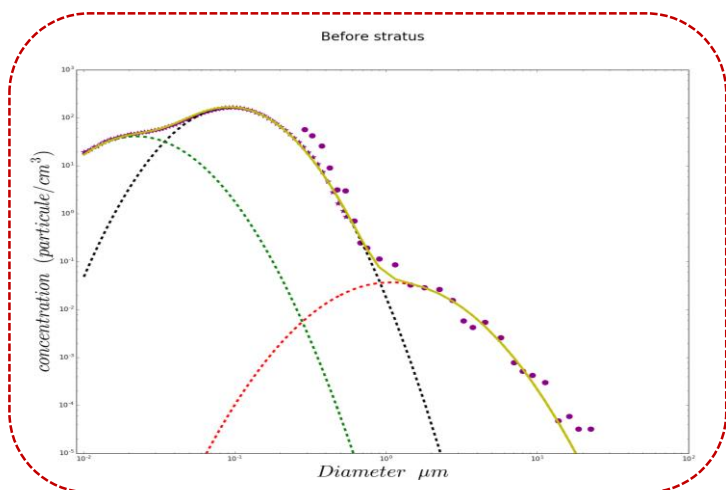


ICE3



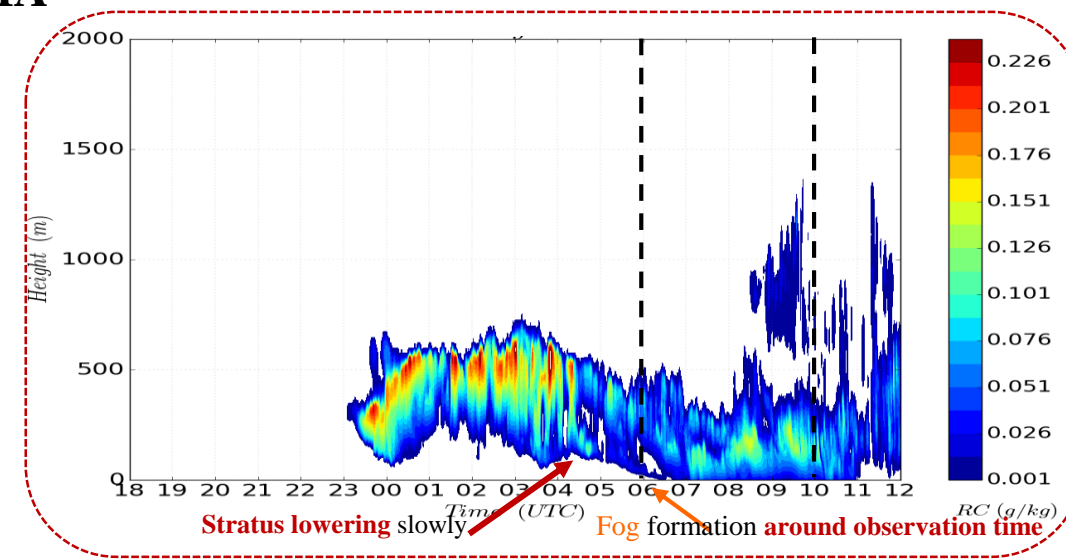
Two-moment microphysical scheme : LIMA (Vié et al., 2016)

- Ground realistic initialization of aerosols from OPC and SMPS



Concentration of the aerosols measured by SMPC and OPC

LIMA

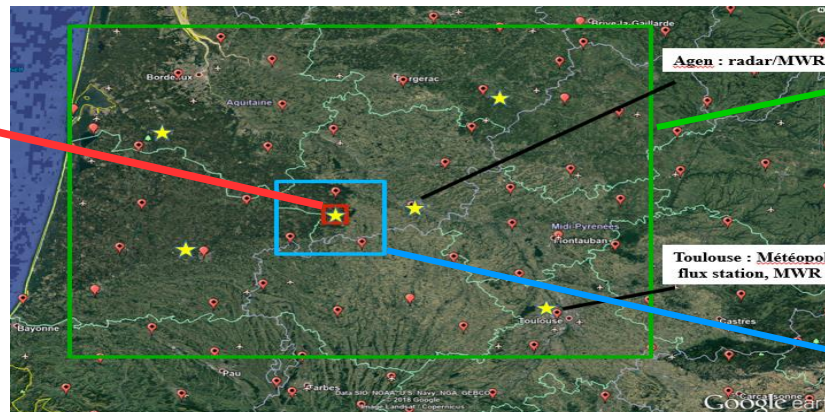


Temporal evolution of simulated vertical profile of cloud mixing ratio(g/kg)

Perspectives

- Validation of the 2-moment microphysical scheme LIMA with numerous microphysical measurements (Droplet Size distribution ...) for stratus and fog.
- Budget analysis to characterize the main processes leading to STL.
- LES simulation (about ten meters).
- Sensitivity tests with an idealized case (profiles of large-scale conditions, microphysics ,vertical resolution) → Towards improvements of **AROME**
- Contribution to the experimental strategy of **international campaign SOFOG3D** with **CDP** under tethered balloon.

Super site 10 x 10 km



Larger domain 300 x 200 km

Surrounding Area 50 x 50 km



Thank you for your attention