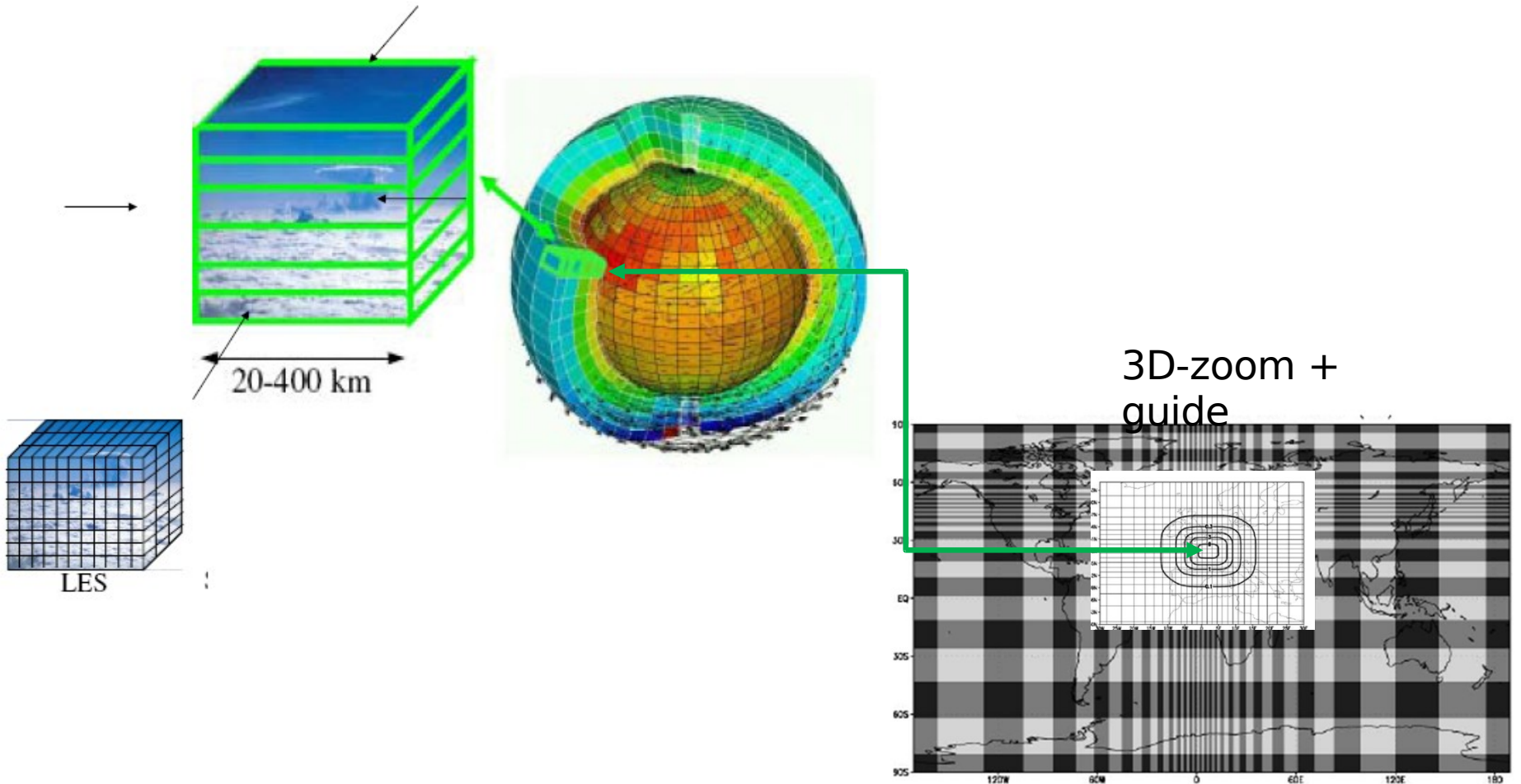


# Complémentarité des Approches 3D et 1D pour l'évaluation des paramétrisations dans LMDZ

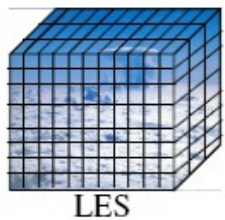
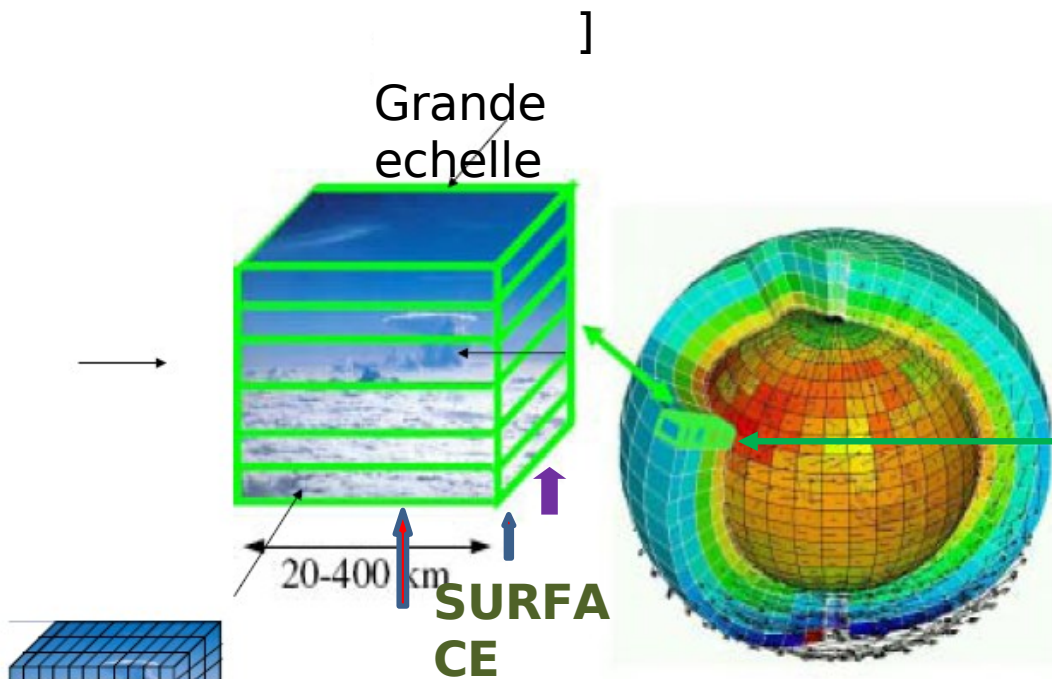
Modifiez le style des sous-titres du masque

- Les approches : 3D zoomé et guidé, 1D, simulations LES
- Les études de cas: Un exemple le cas RICO
- L'apport des sites d'observations: SIRTA et CABAUW

A. Campoy, A. Catarino, J.C Dupont, M. Haeffelin, F. Hourdin



$$\frac{\partial \phi}{\partial t} \equiv \left( \frac{\partial \phi}{\partial t} \right)_{\text{PHY}} + \left( \frac{\partial \phi}{\partial t} \right)_{\text{DYN}}$$

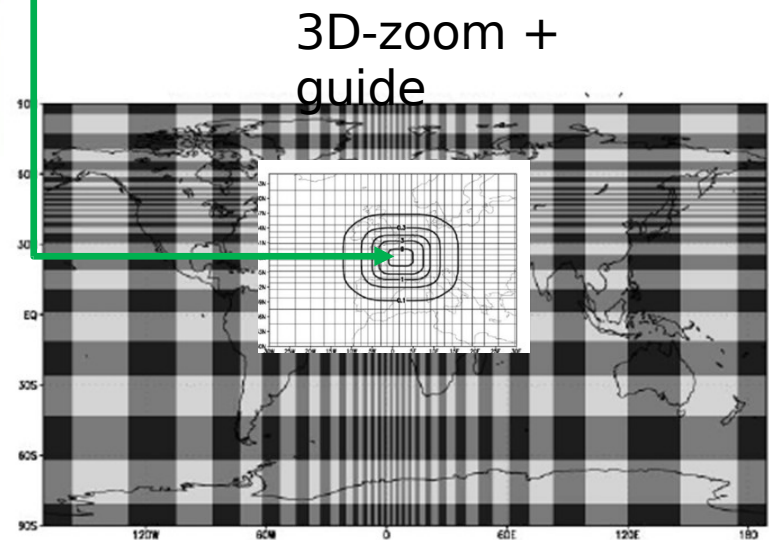


$$\left(\frac{\partial \phi}{\partial t}\right)_{LS} \equiv \left(\frac{\partial \phi}{\partial t}\right)_{DYN}$$

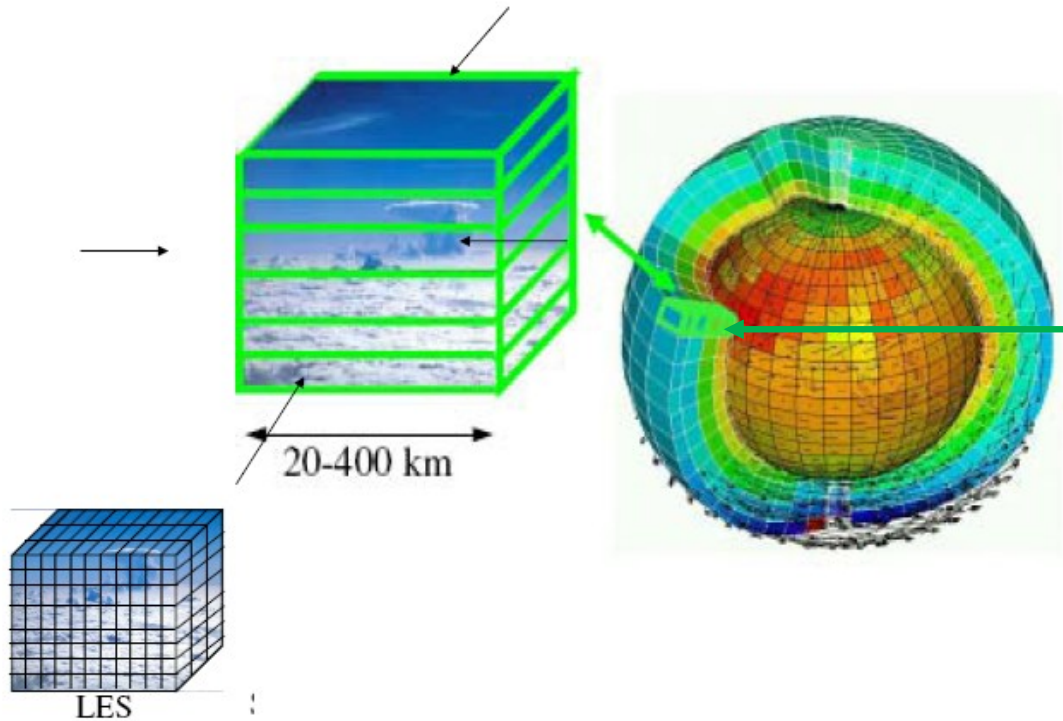
O  
U

$$\left(\frac{\partial \theta}{\partial t}\right)_{LS} = -\nabla_H \theta - w_{LS} \frac{\partial \theta}{\partial z}$$

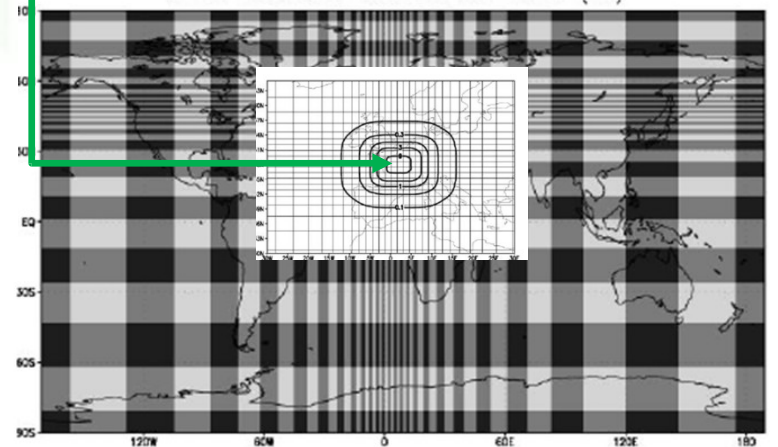
$$\left(\frac{\partial q_t}{\partial t}\right)_{LS} = -\nabla_H q_t - w_{LS} \frac{\partial q_t}{\partial z}$$



d



3D-zoom +  
guide



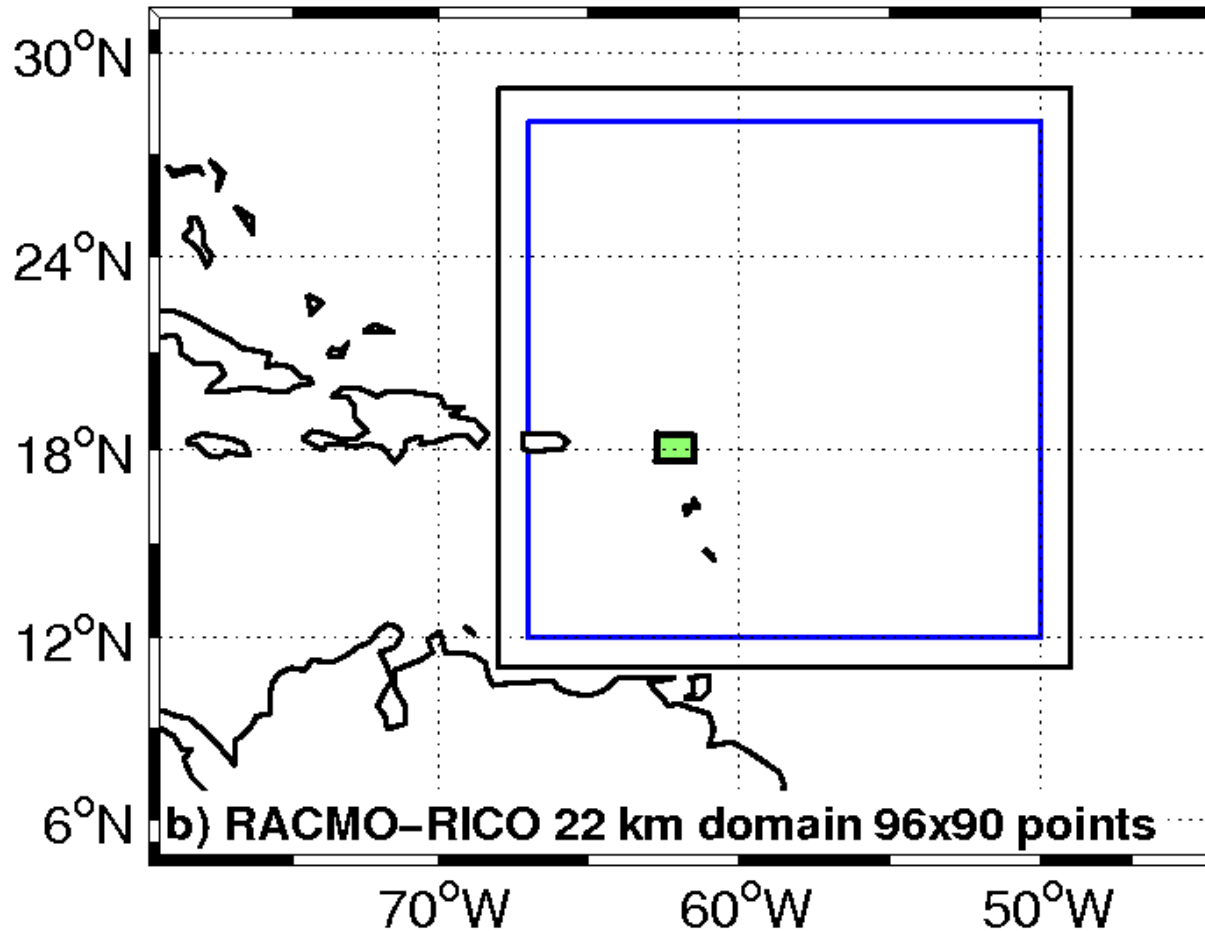
$$\frac{\partial T}{\partial t} + [\vec{V}_H \cdot \vec{\nabla} T] + \left[ \omega \frac{\partial T}{\partial p} \right] = \left[ \omega \frac{\alpha}{c_p} \right] + P_T$$

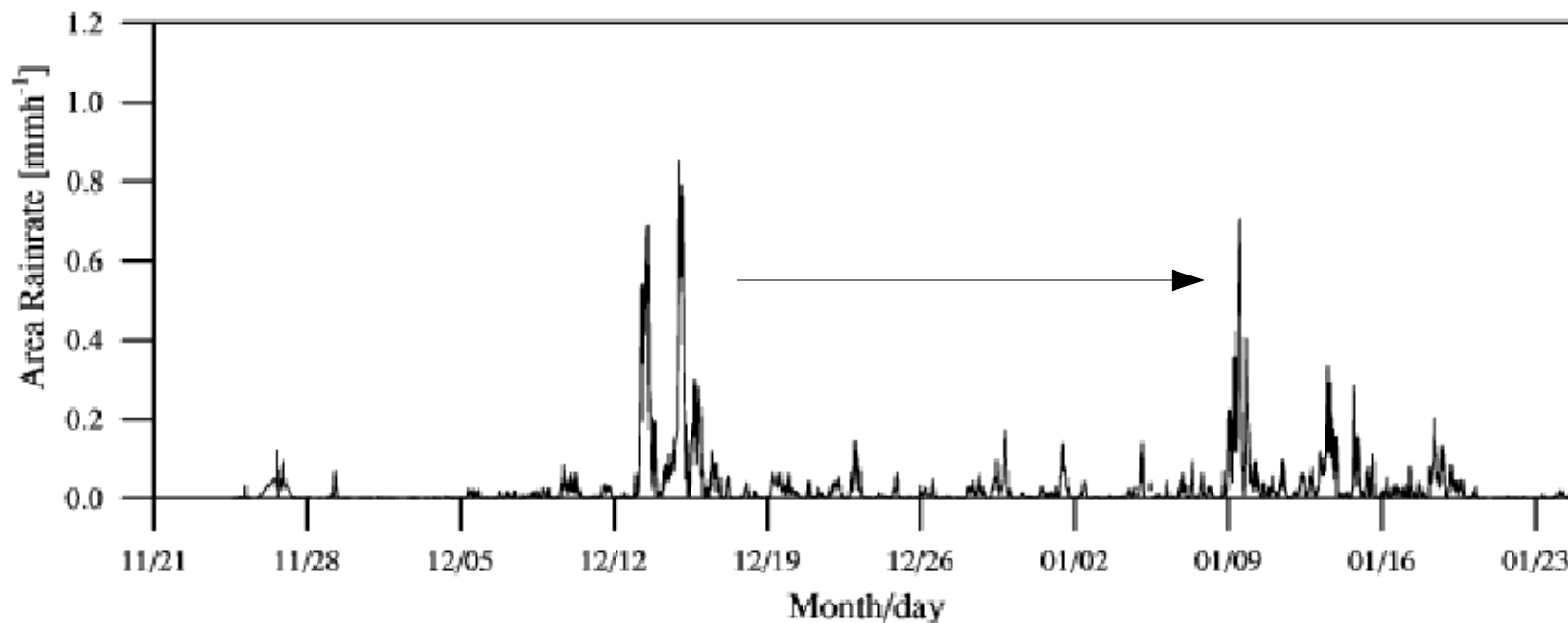
$$\frac{\partial q}{\partial t} + [\vec{V}_H \cdot \nabla q] + \left[ \omega \frac{\partial q}{\partial p} \right] = P_q$$

$$\frac{\partial X}{\partial t} = F(X) + \frac{X^a - X}{\tau}$$

# RICO

idéalisé: Petits cumulus précipitants  
sur les océans tropicaux ( cas composite, forçages constants).

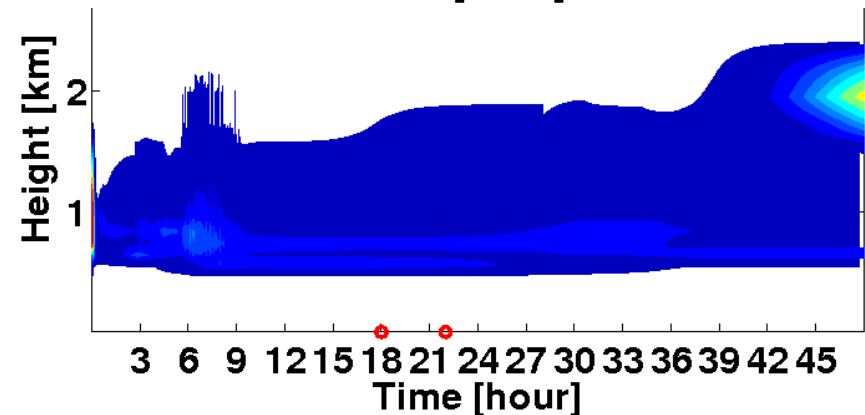
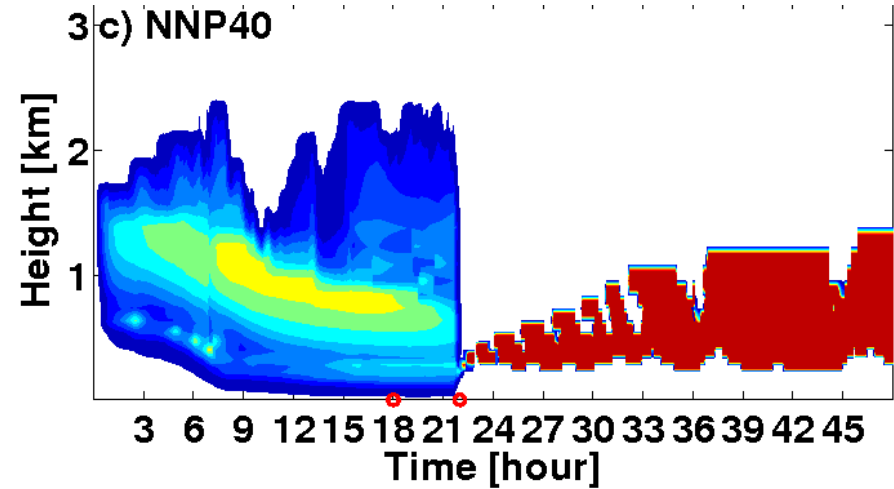
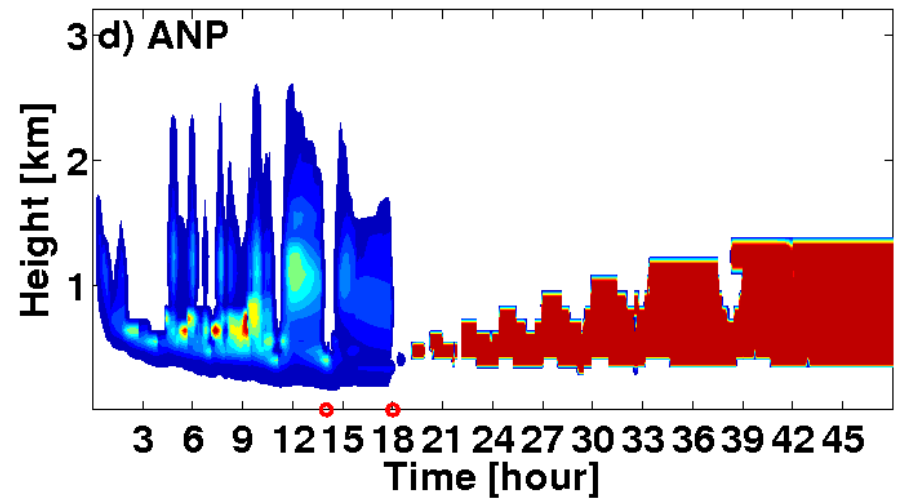
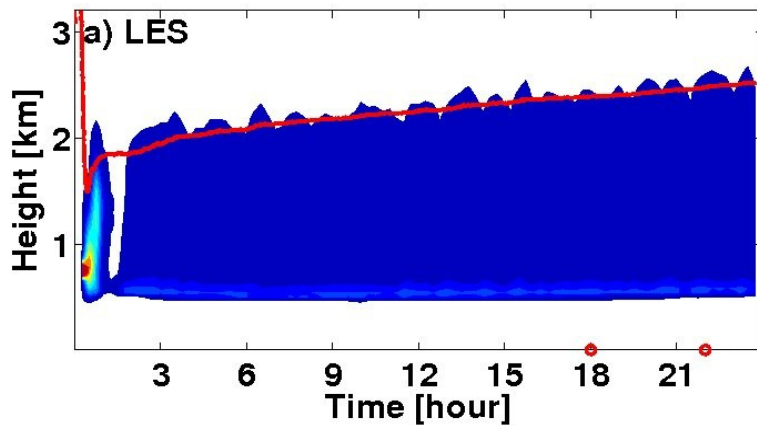




## Précipitations pendant RICO sur la zone

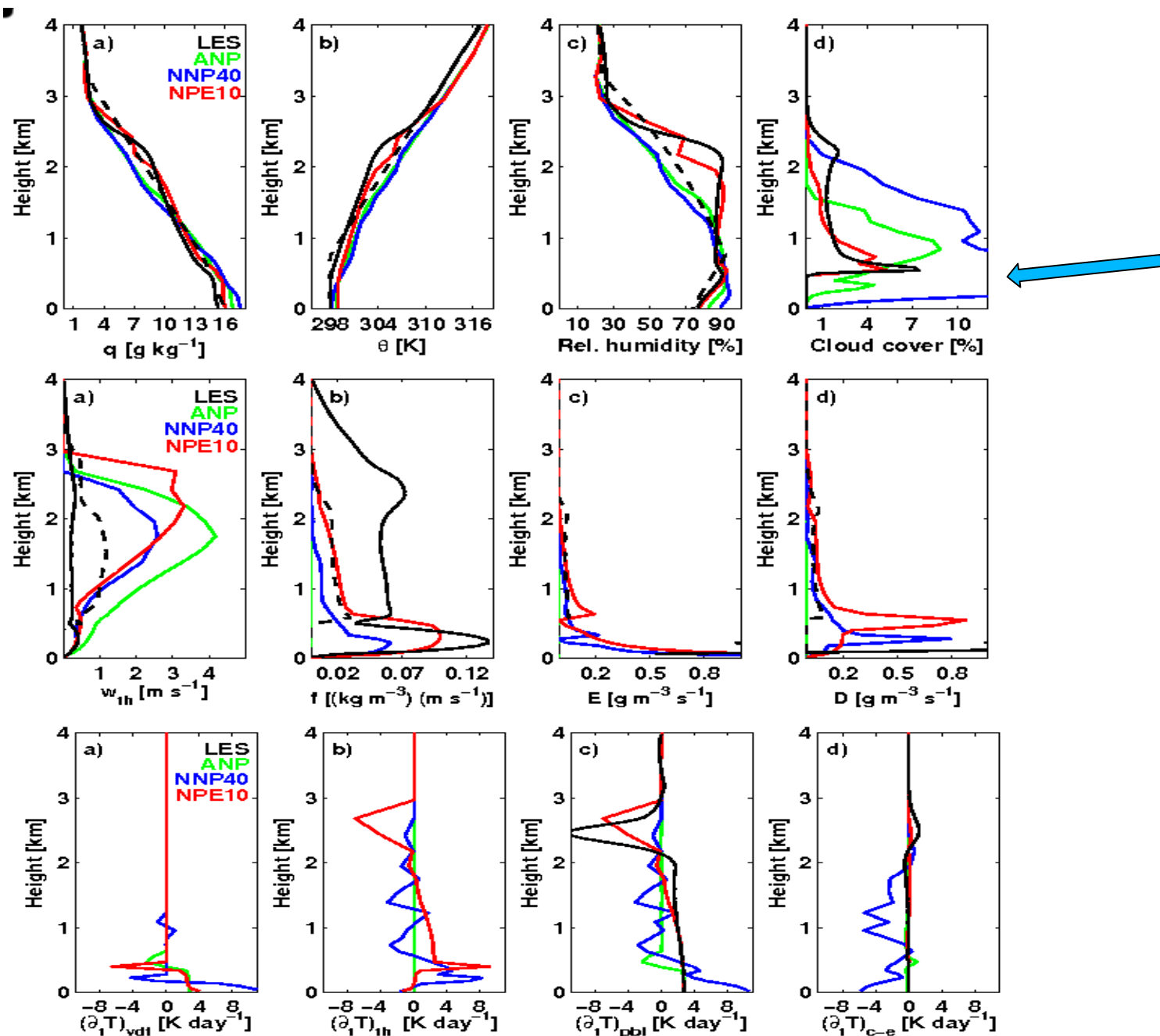
2 journées avec la quasi-totalité des obs.  
Simulations difficiles à interpreter  
Choix: Cas composite idéalisé

3 versions de la « nouvelle physique » pour un cas non utilisé pour le développement des paramétrisations



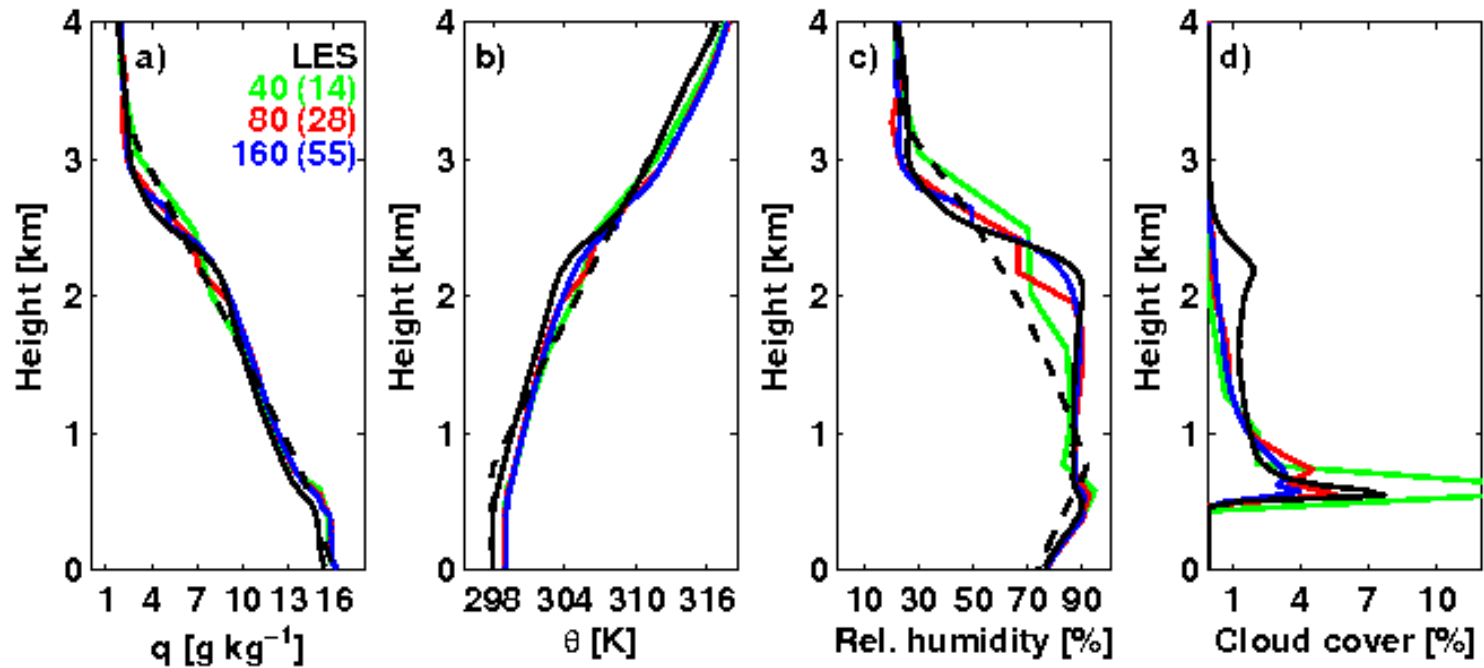
Issu thèse A. Catarino

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# Sensibilité résolution verticale



## Leçons de l'exercice 1D idéalisé

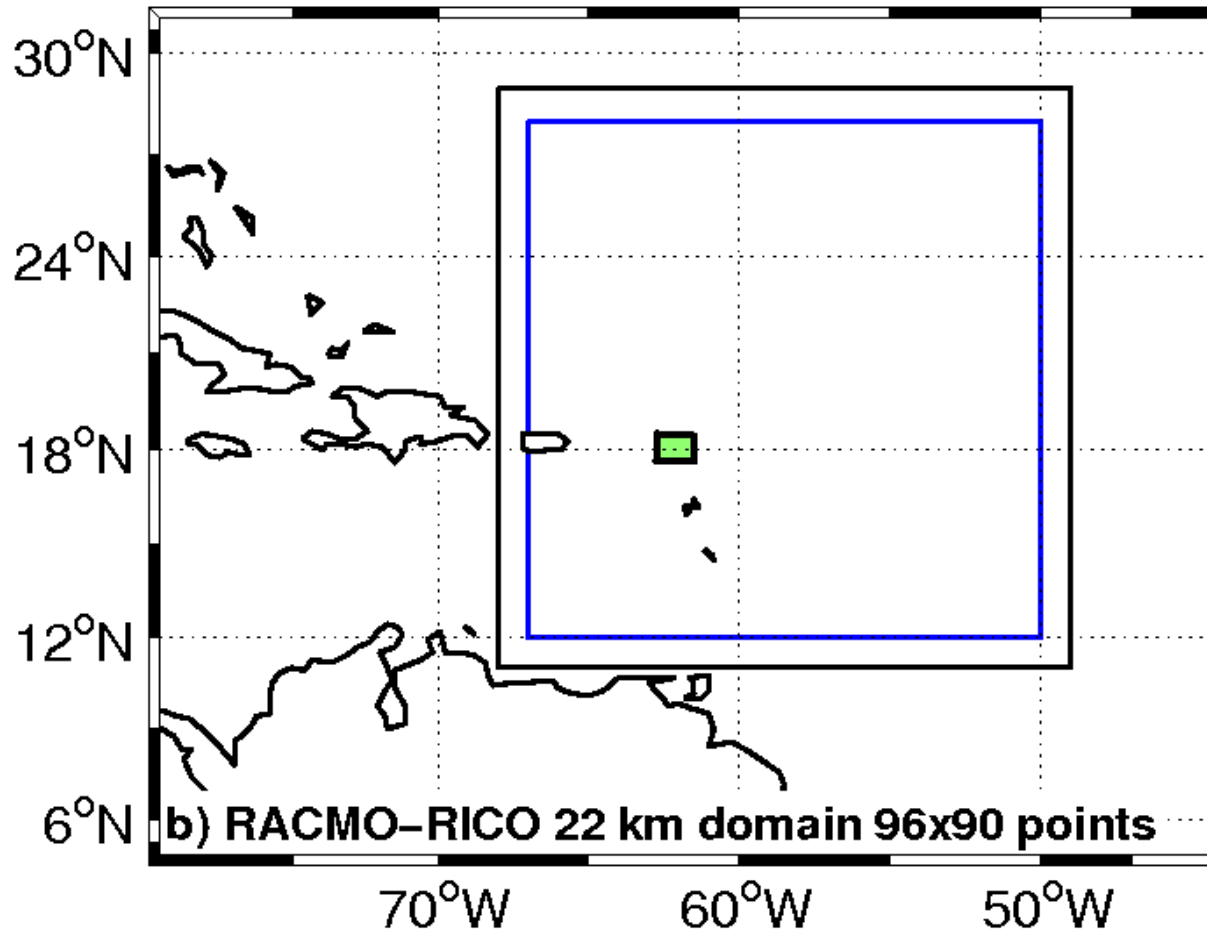
Npv2.0 plus en accord avec la LES: représentation plus réaliste de  
L'interaction entre la couche limite et le nuage (JAM 2011+ Rio et al. 2010)

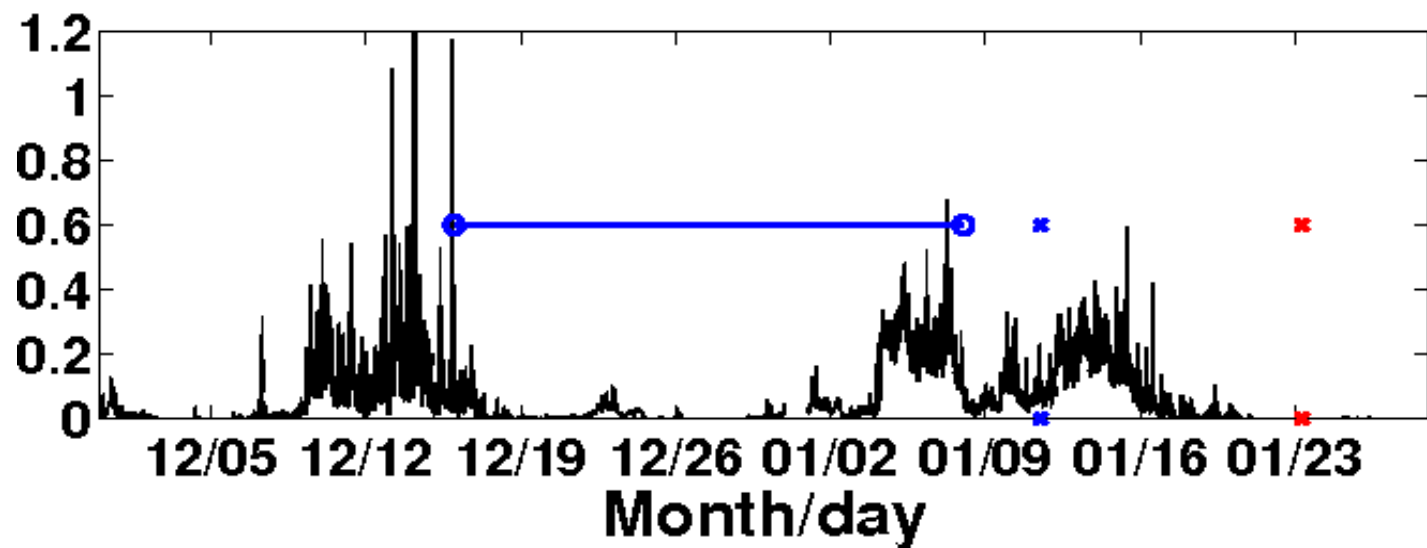
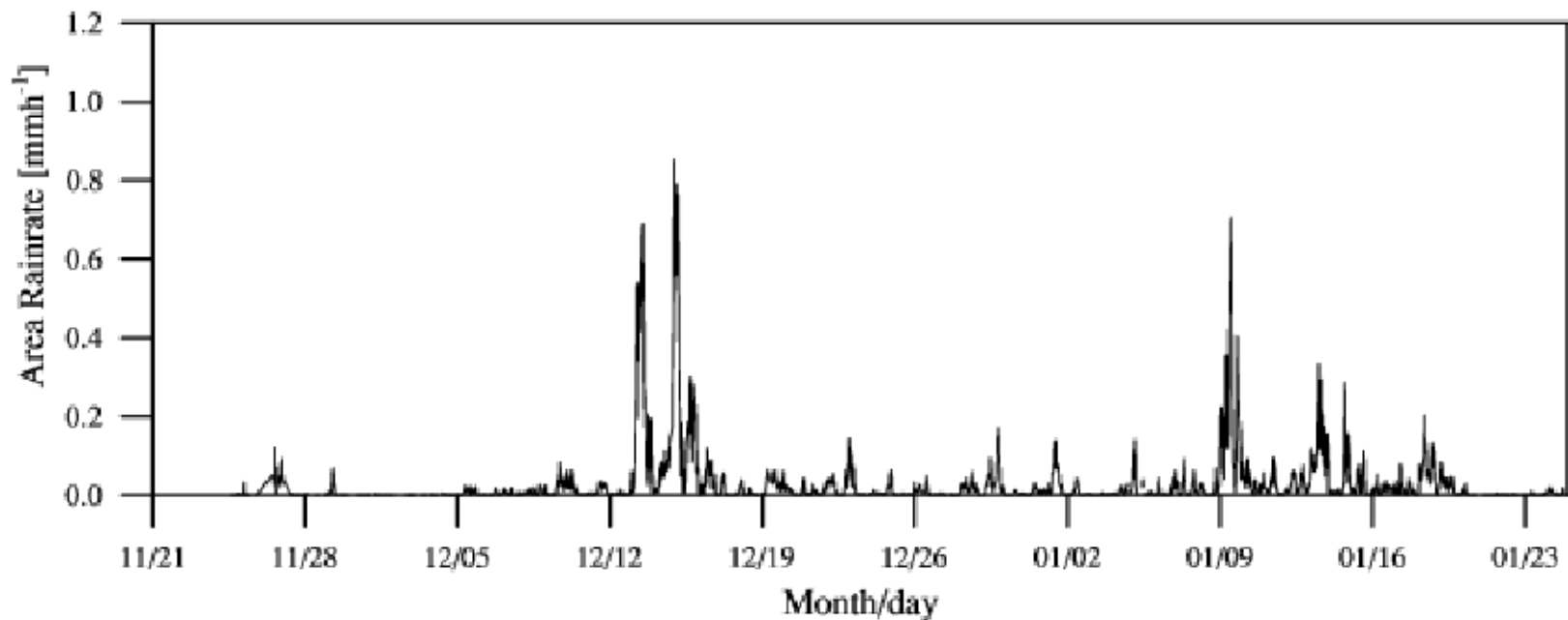
Résolution verticale : 40 niveaux = bon compromis

Difficulté à reproduire la partie supérieure du nuage

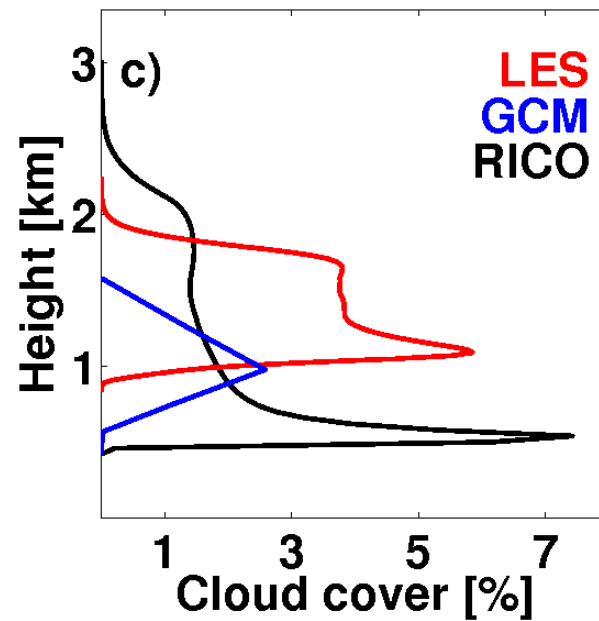
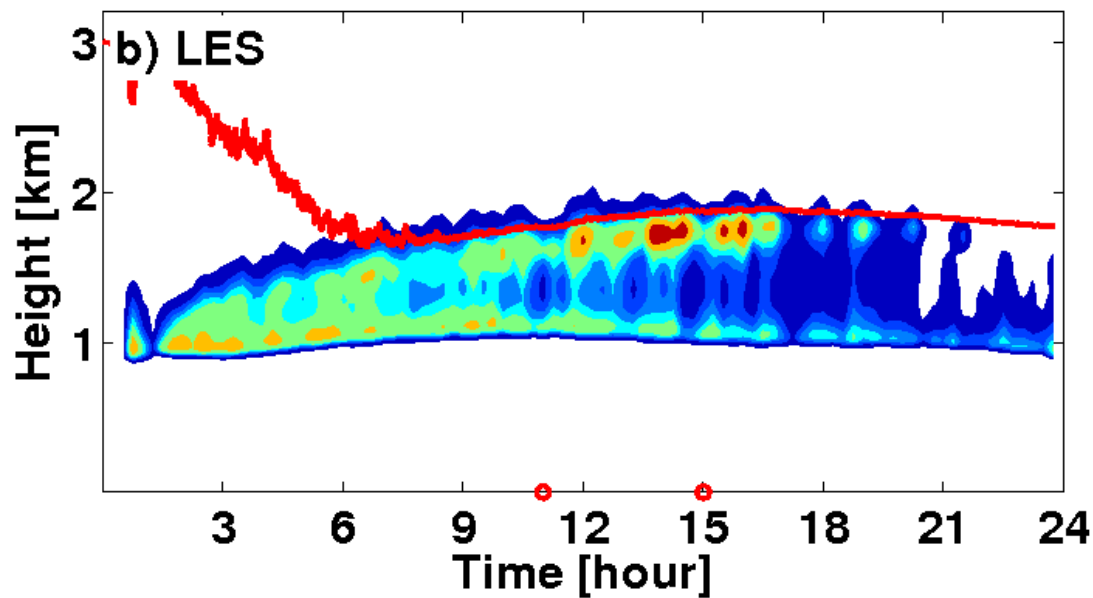
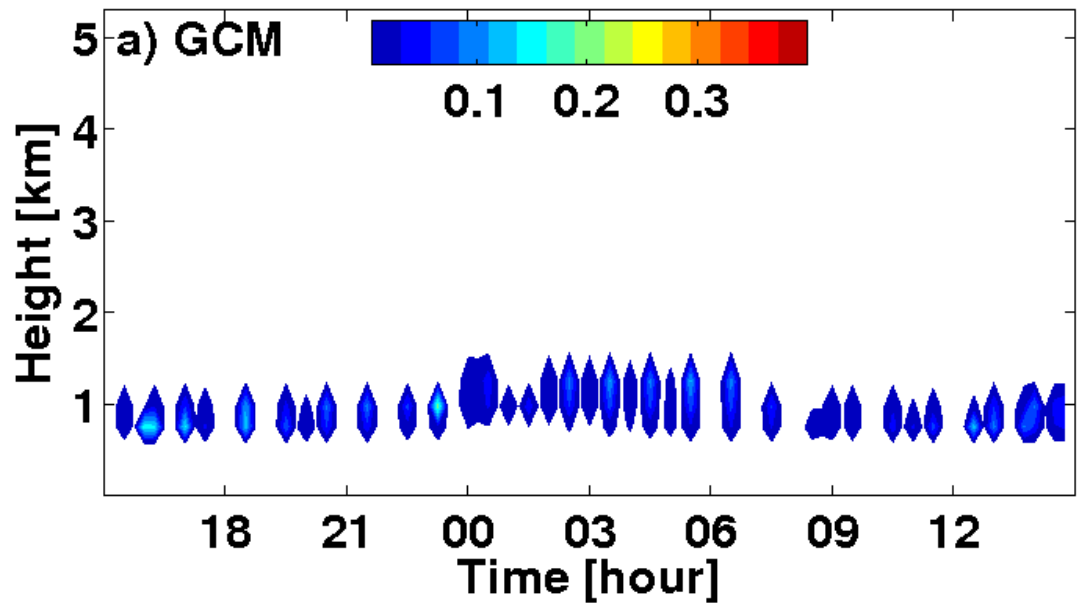
Quid dans la réalité du GCM-3D?

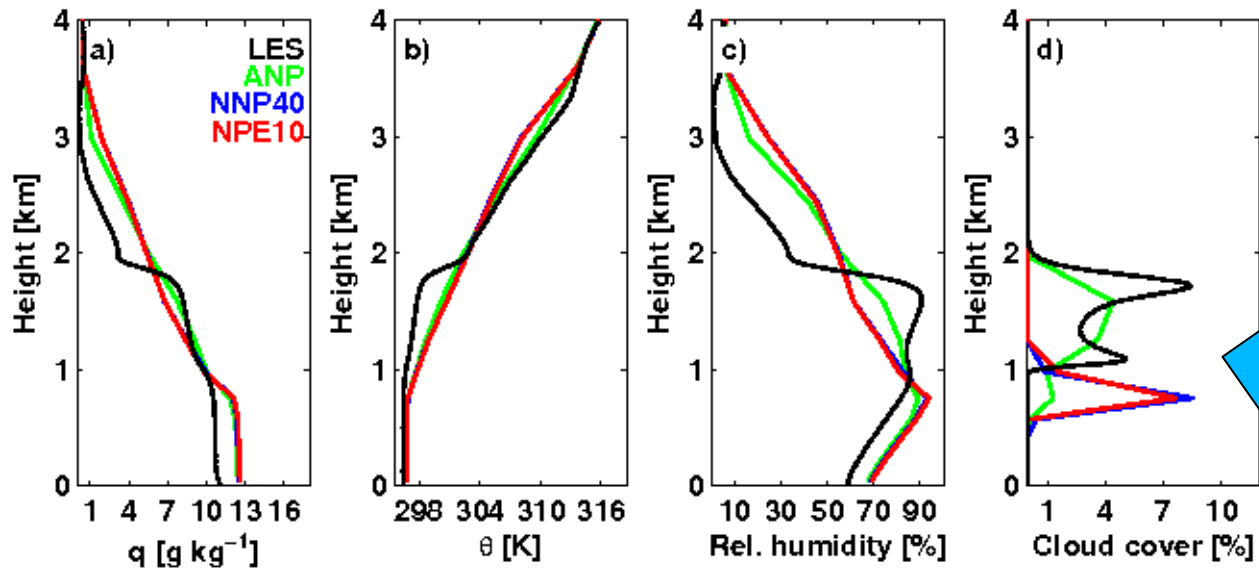
# RICO issu de LMDZ

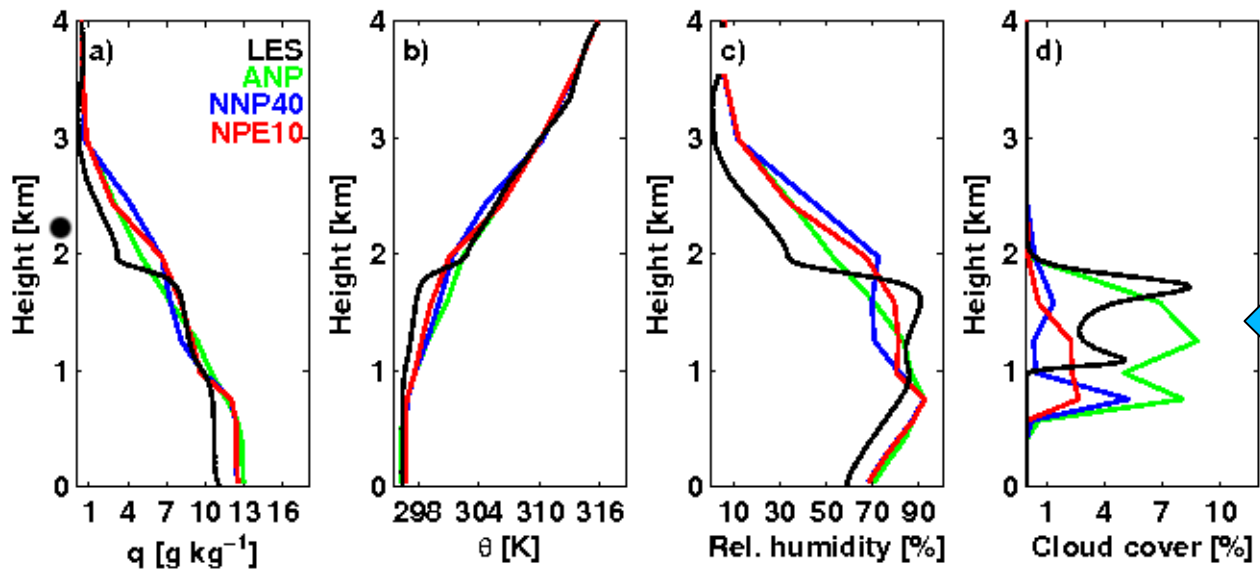
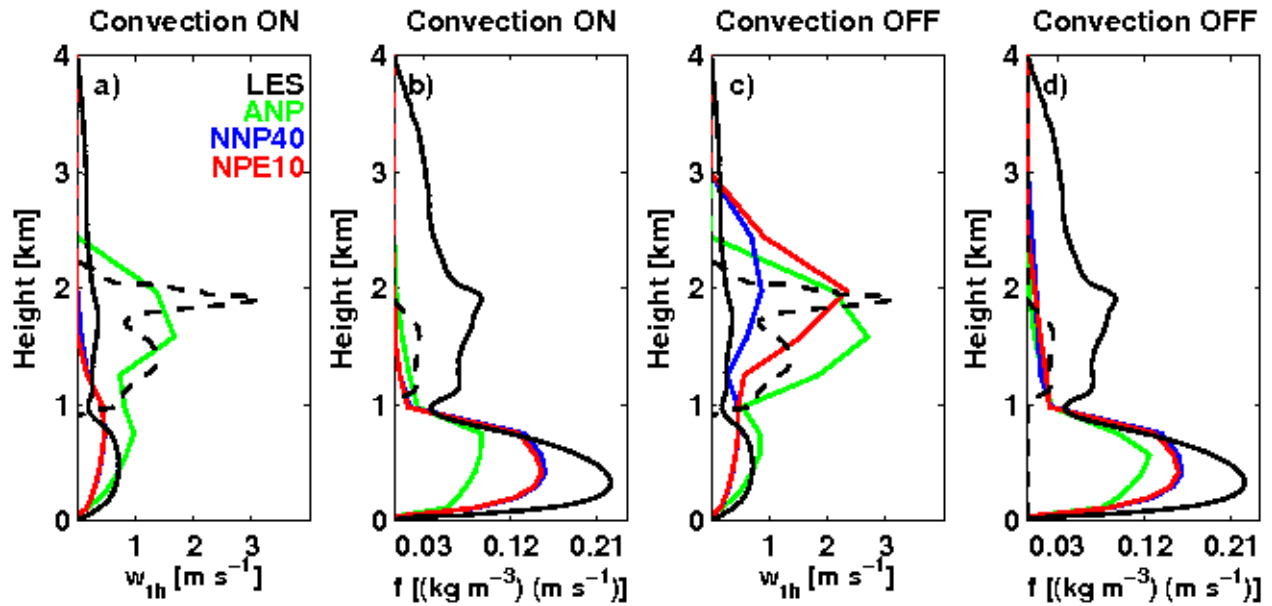




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- CAS Rico idéalisé: Comparaison 1D-LES (2 j)
- Confronter comportement de 3 versions des nouvelles paramétrisations physiques en développement, identifications des processus actifs dans un cas très contraint.
- Expériences de sensibilité

RICO dans LMDZ: conditions 3D similaires mais moins contraint.

- Compétition entre la convection peu profonde et la convection profonde
- Dans la LES la convection profonde n'est pas prise en compte.



# Evaluation en continu à l'aide des observations des sites instrumentés

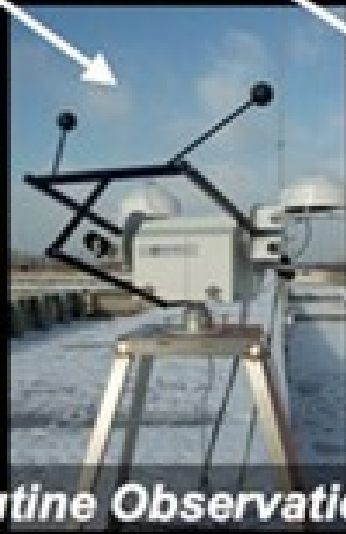
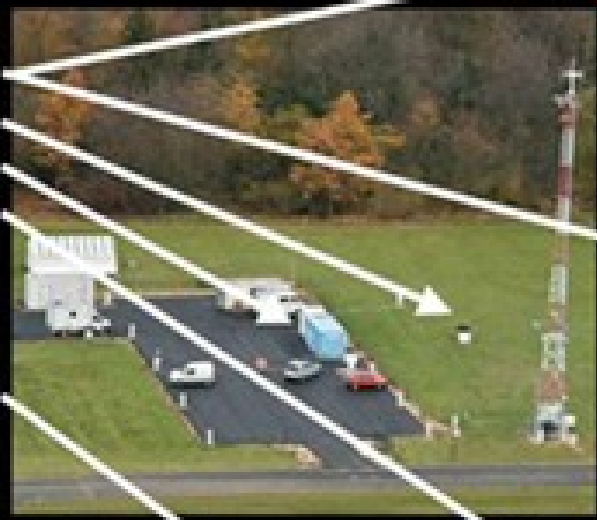


**Dynamics - Turbulence :**

- X-band Radar
- T, H 2m & gnd Sodar
- Doppler lidar
- Sonic anemometers

**Clouds and aerosols :**

- Depol/backsc. Lidar
- UV-VIS-NIR Sunphotometer
- SW and LW radiometers
- 95 GHz Doppler Radar
- Microwave radiometer



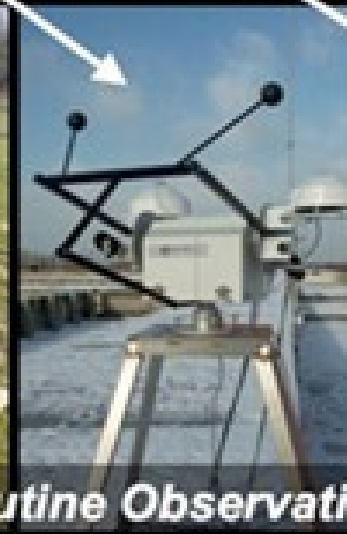
# 10 ans disponibles

## Dynamics - Turbulence :

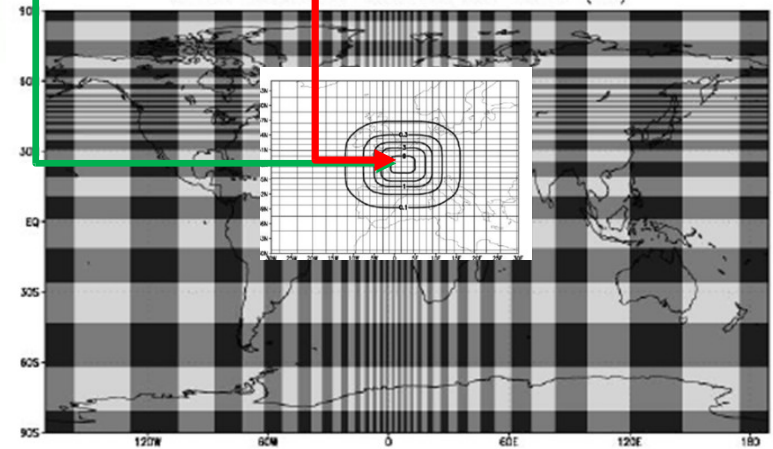
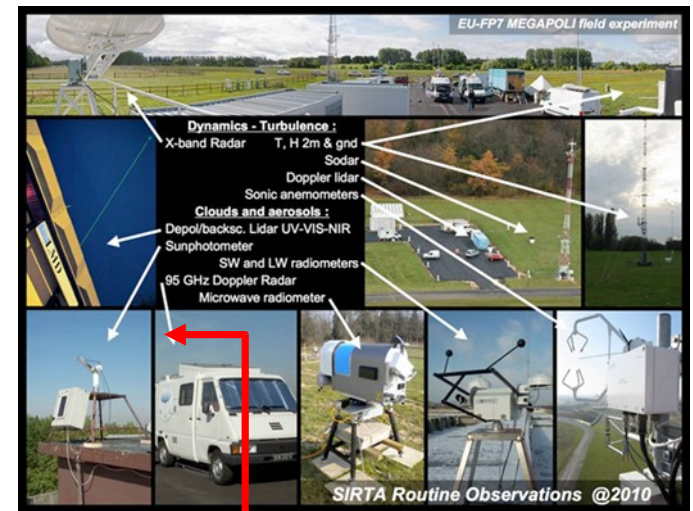
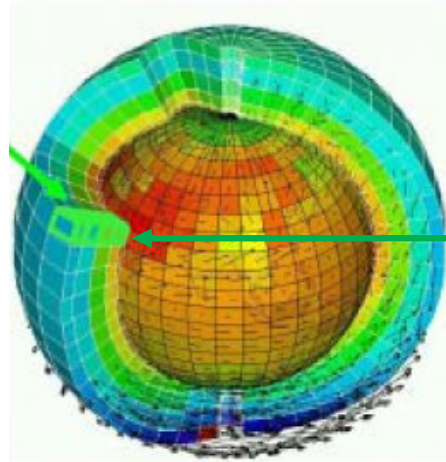
- X-band Radar
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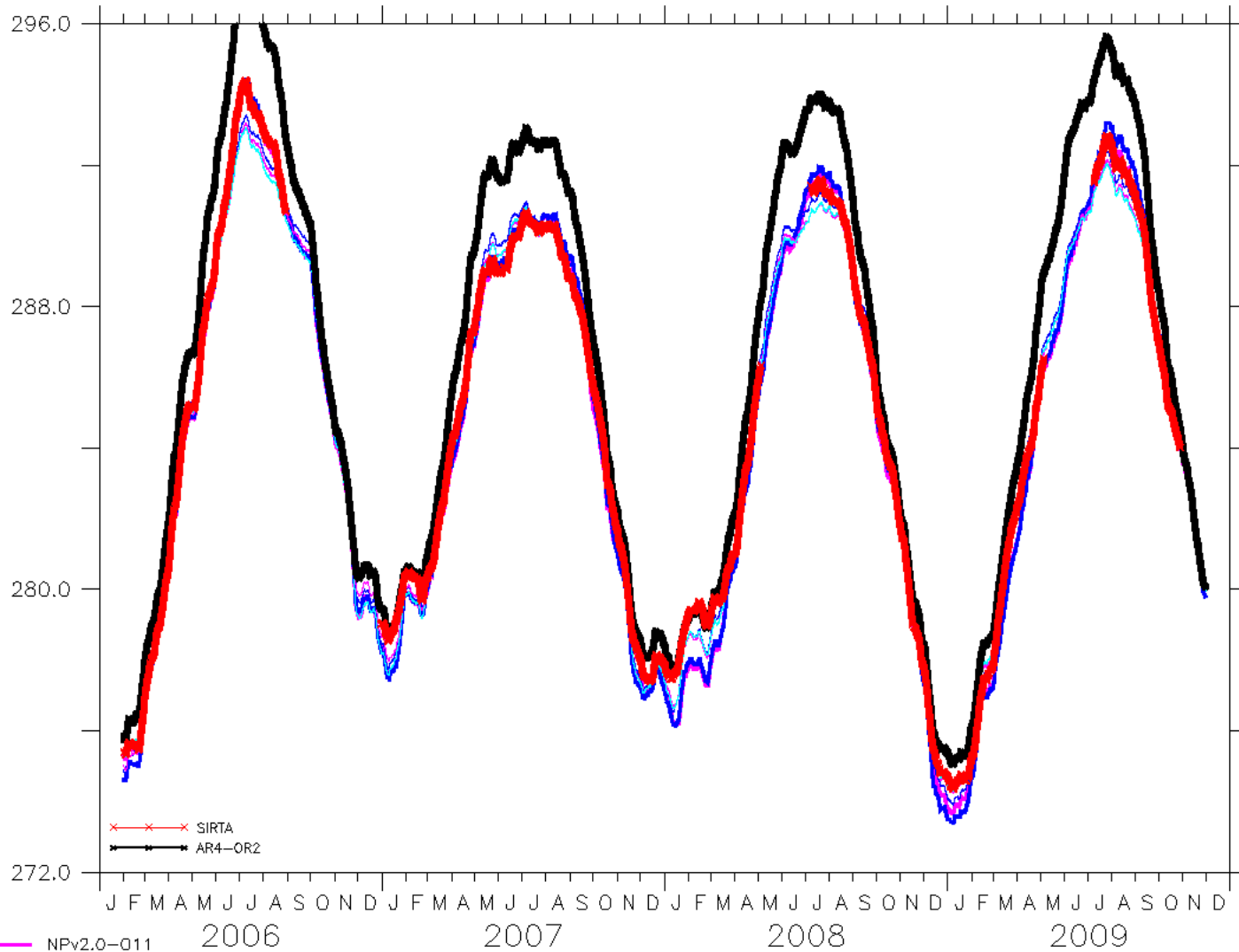
3D-zoom +  
guide



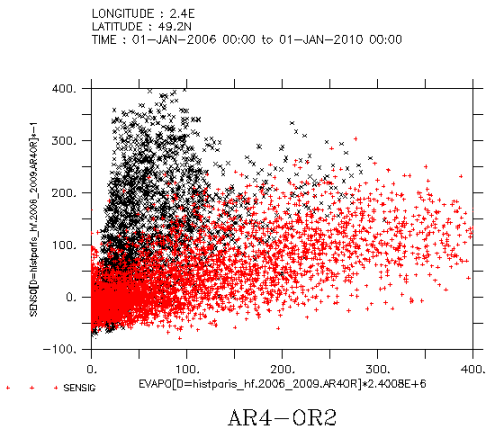
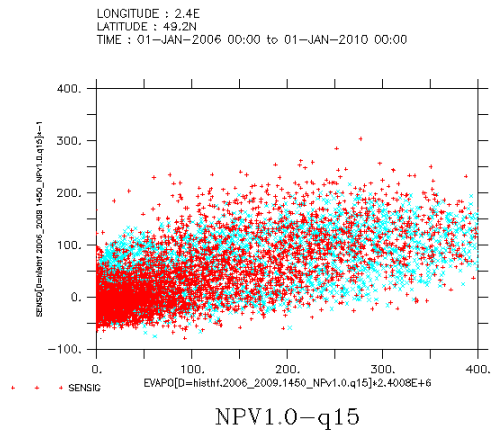
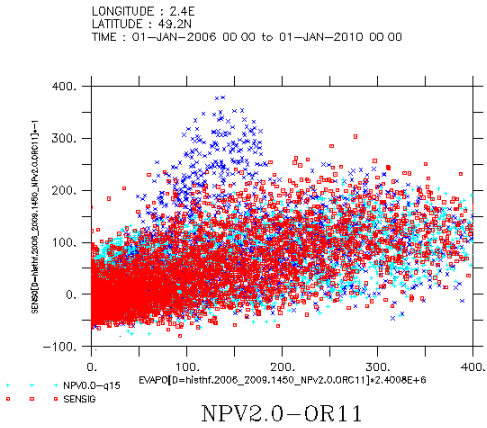
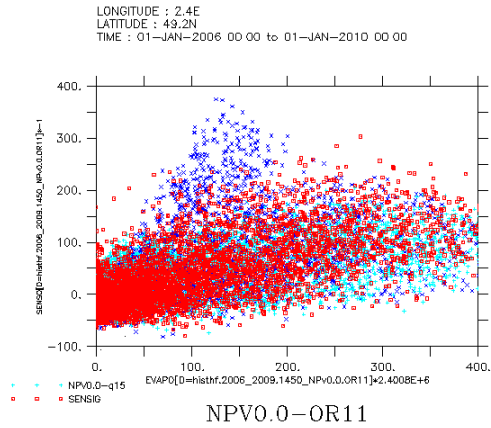
$$\frac{\partial X}{\partial t} = F(X) + (X_a - X)/\tau$$

LONGITUDE : 2.4E  
LATITUDE : 49.2N

DATA SET: histhf.2006\_2009.1450\_NPv2.0.0RC11

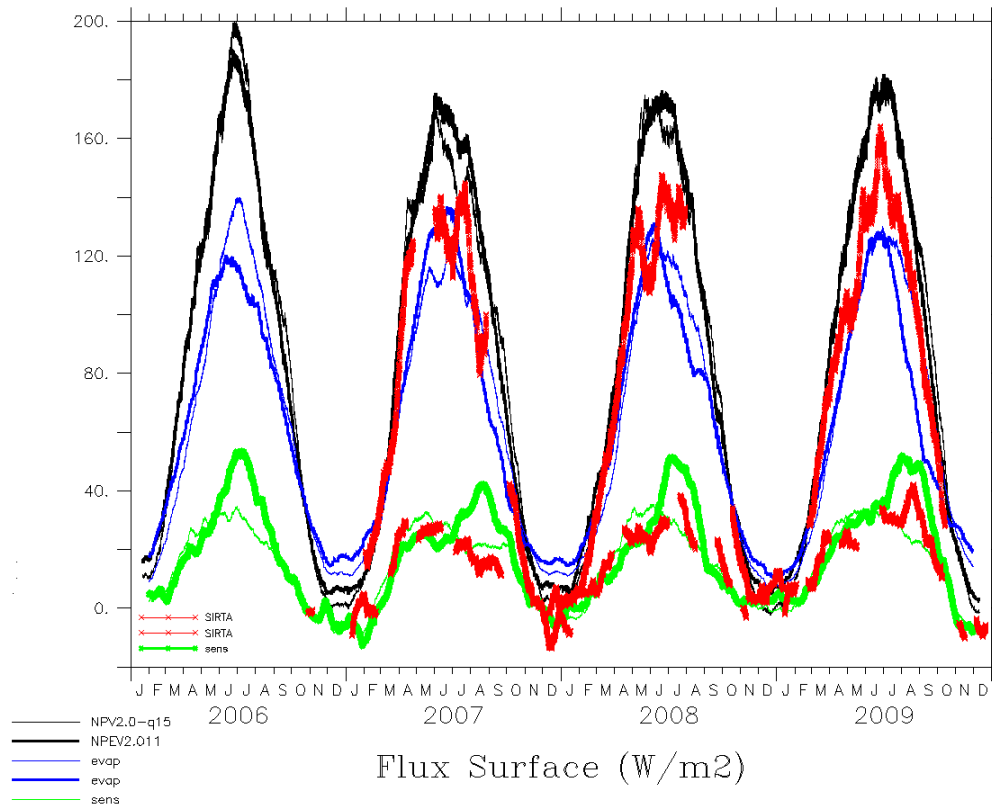


FLUX SENSIBLE



FLUX  
LATENT

LONGITUDE : 2.4E  
LATITUDE : 49.2N



3/17/11

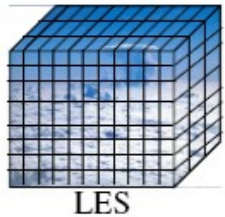
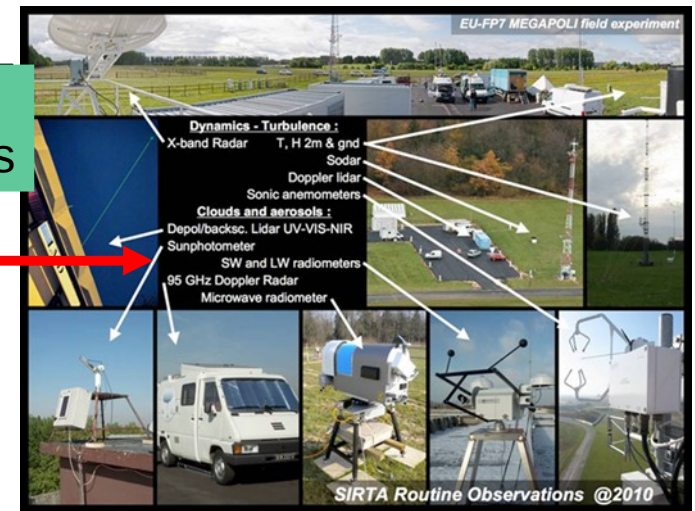
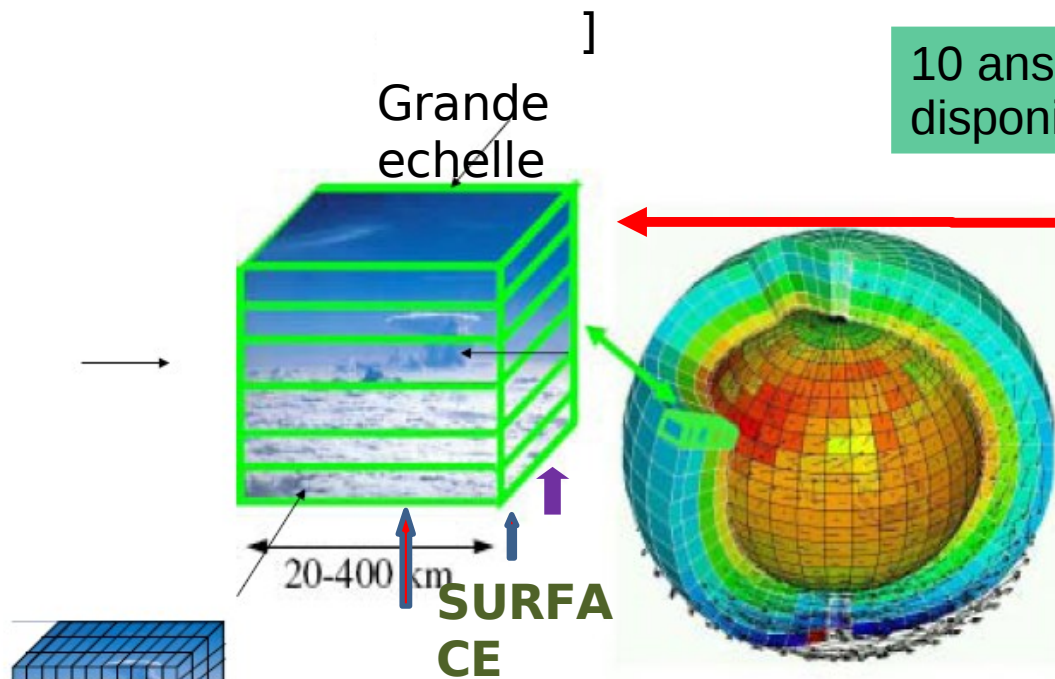
## Evaluation a l'aide de longues series

- Biais chaud et sec en été lié à une sous-estimation de l'évaporation. Corrigé avec ORC11. Les nouvelles paramétrisations ont peu d'impact (à ce niveau).

**MAIS RAYONNEMENT NET SUR-ESTIME  
COUVERTURE NUAGEUSE SOUS-  
ESTIMEE?**

**COMPENSATION D'ERREUR?**





$$\left(\frac{\partial \phi}{\partial t}\right)_{LS} \equiv \left(\frac{\partial \phi}{\partial t}\right)_{DYN}$$

O  
U

$$\left(\frac{\partial \theta}{\partial t}\right)_{LS} = -\nabla_H \theta - w_{LS} \frac{\partial \theta}{\partial z}$$

$$\left(\frac{\partial q_t}{\partial t}\right)_{LS} = -\nabla_H q_t - w_{LS} \frac{\partial q_t}{\partial z}$$

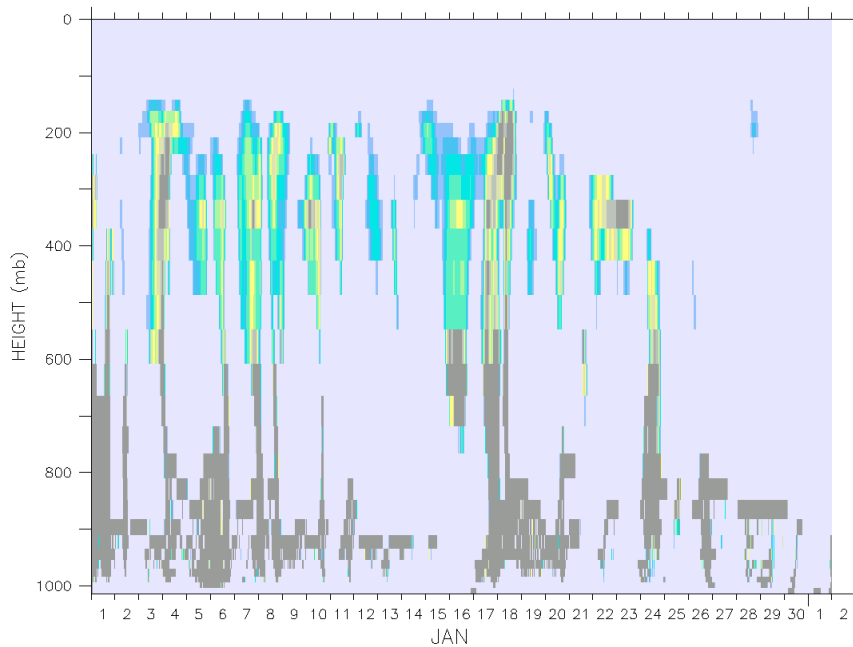
# Approche 1D

# Modele 1D forcé par des forçages et conditions aux limites issus de LMDZ

LONGITUDE : 2.4E  
LATITUDE : 49.2N  
YEAR : 2007  
CALENDAR: 360\_DAY

FERRET V.  
NOM/PS4  
Feb. 9 2011

DATA SET: input.scm

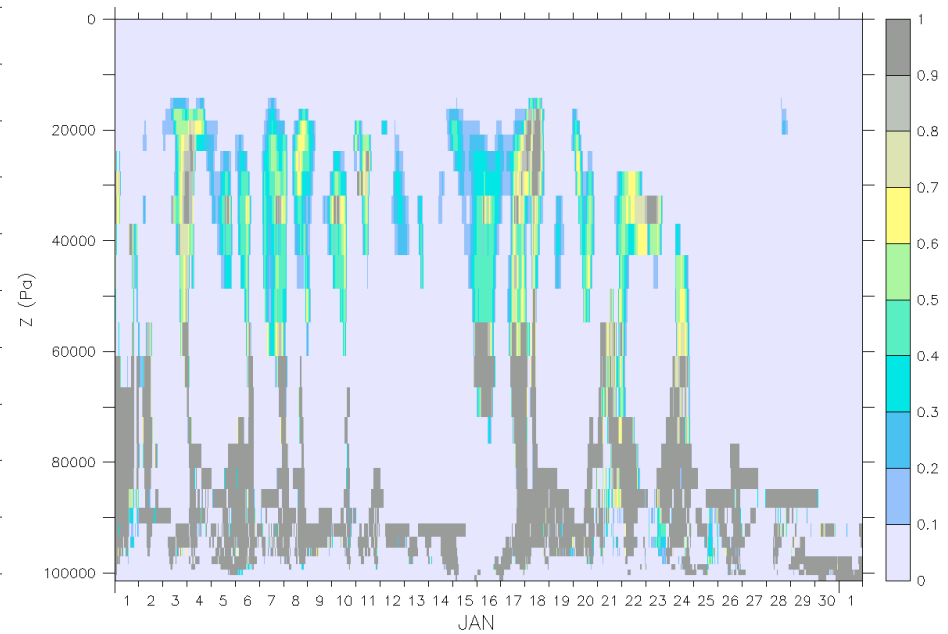


cld cover SIRTALMDZ3D

LONGITUDE : 0E  
LATITUDE : 49.2N  
YEAR : 2007  
CALENDAR: 360\_DAY

FERRET Ver: 6.08  
NOM/PS4  
Feb. 9 2011 08:14:20

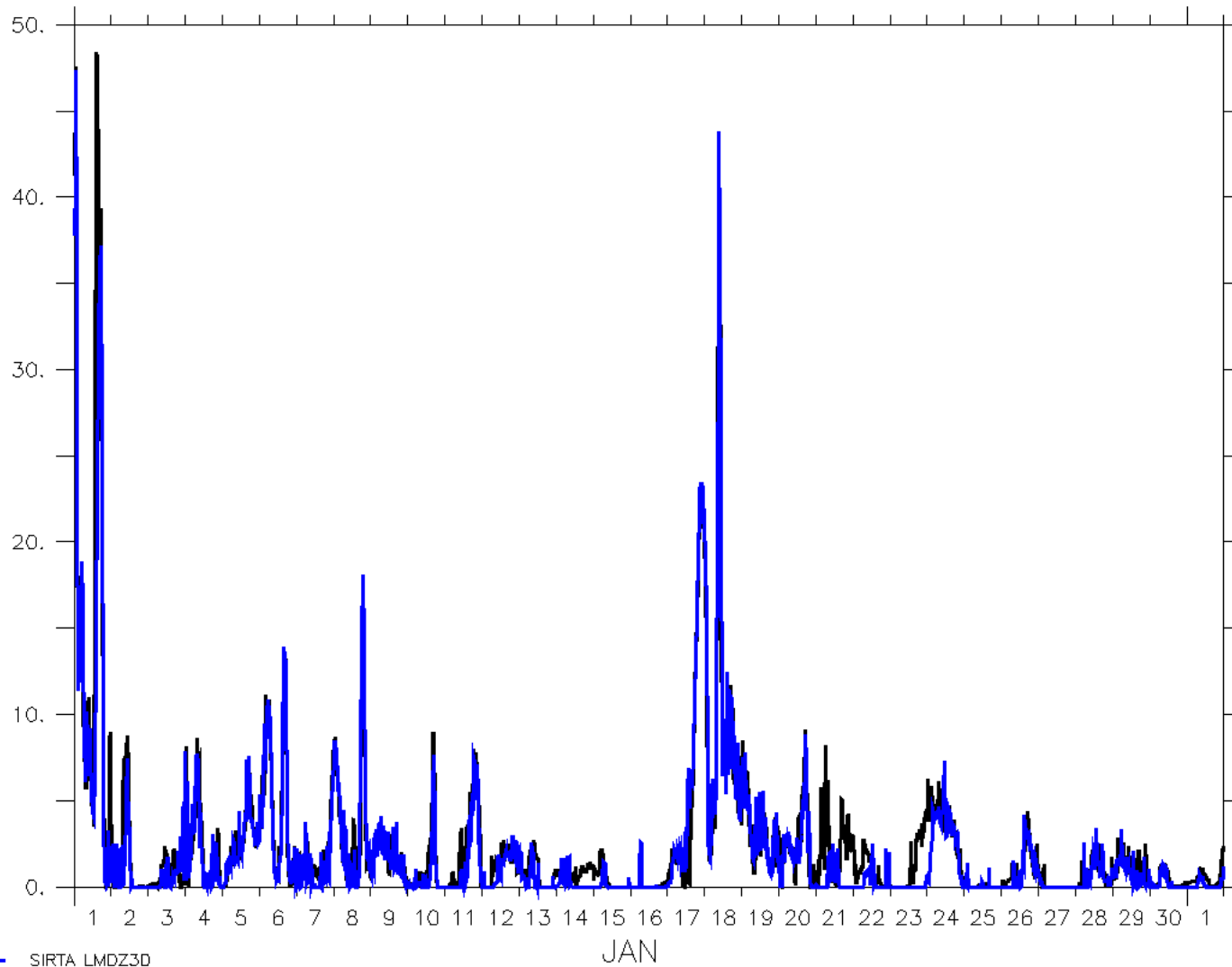
DATA SET: histins.NPv2.RF0.39.1.0



cld cover SIRTALMDZ1D

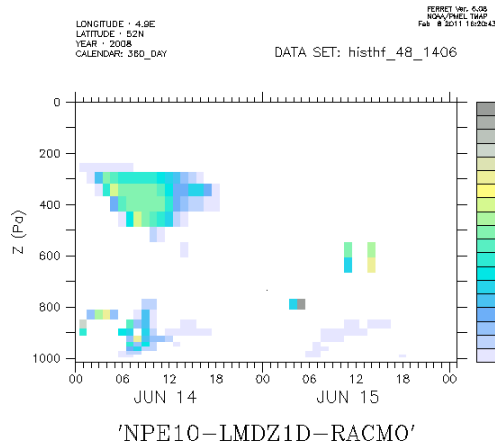
LONGITUDE : 0E  
LATITUDE : 49.2N  
YEAR : 2007  
CALENDAR: 360\_DAY

FERRET Ver. 6 08  
NOAA/PMEL TMAP  
Feb 9 2011 06:18:14

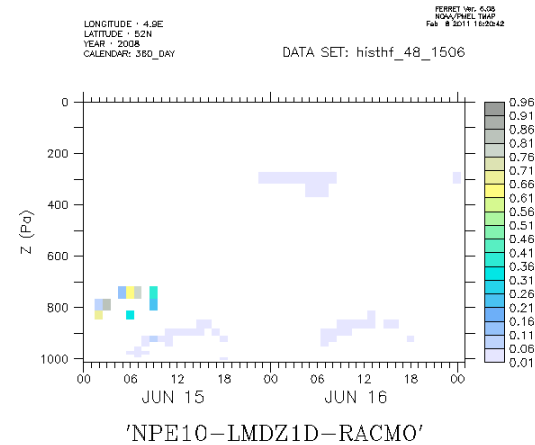


# Forçages RACMO (petits cumulus Cabauw)

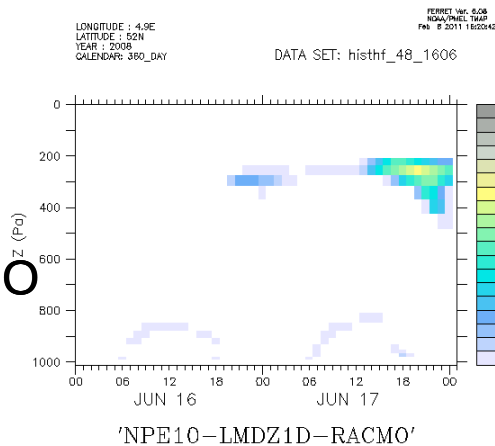
1D RACMO



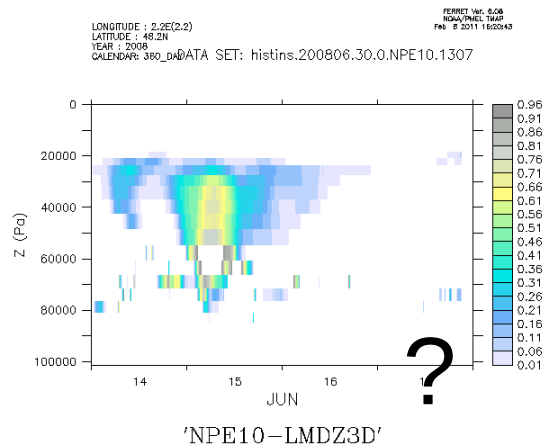
1D-RACMO



1D-RACMO



3D-zoomé



# 3D zoomé guidé /1D sur sites instrumentés

- 3D tous les couplages sont activés
- Expériences de sensibilités un peu lourde à mettre en œuvre
- Difficile avec les GCM qui n'ont pas le zoom

# 3Dzoomé guidé /1D

- 1D: certains couplages sont totalement ou partiellement coupés
- Expériences de sensibilité très faciles à mettre en œuvre
- Permet d'inter-comparer différents modules de physiques ( testbed )
- Réfléchir à un modèle sol-atmosphère 1D.