

Zoom / utilisation / climat régional

Etude de processus / evaluation

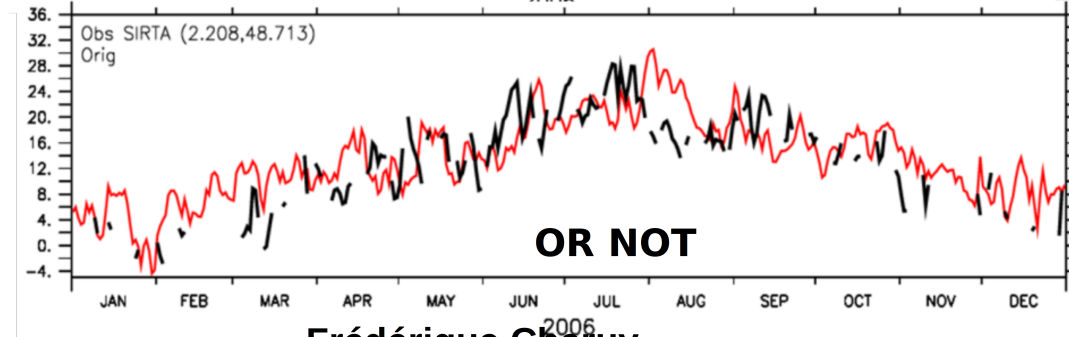
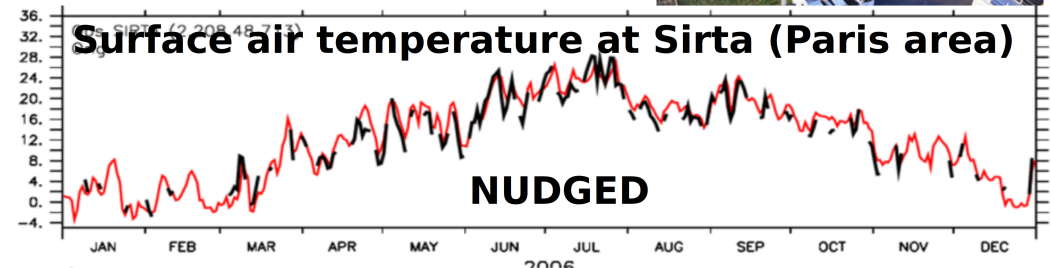
1. Operating modes : b) Zooming or/and nudging for climate

Nudging capability

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

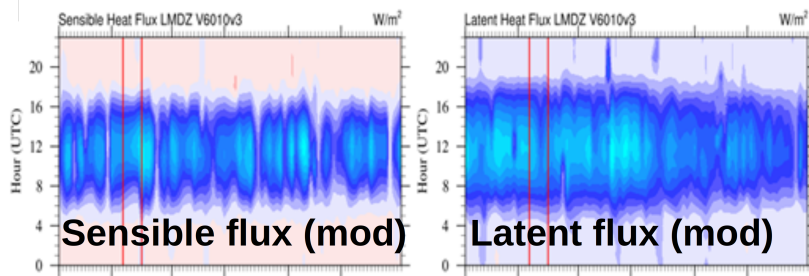
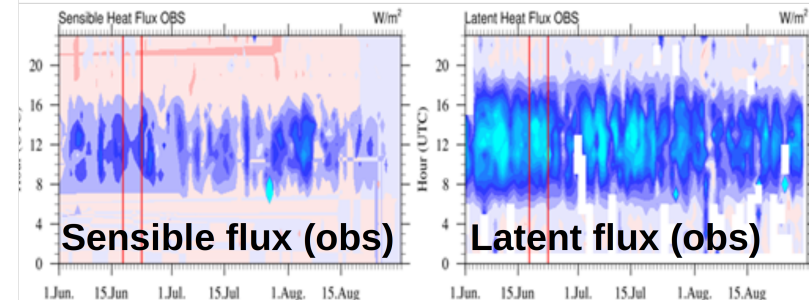
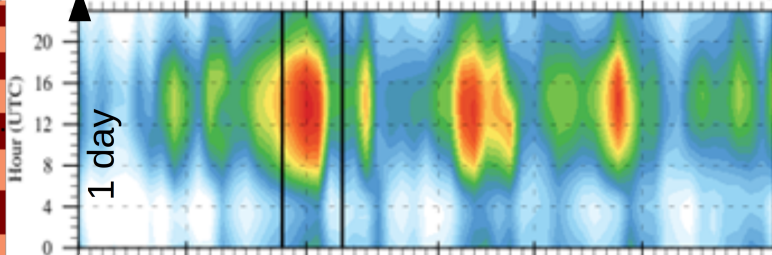
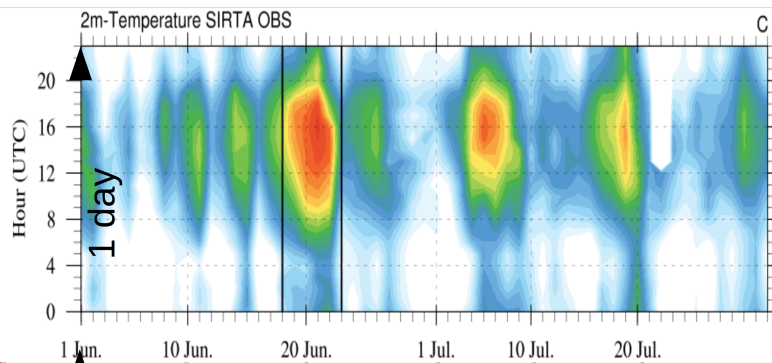
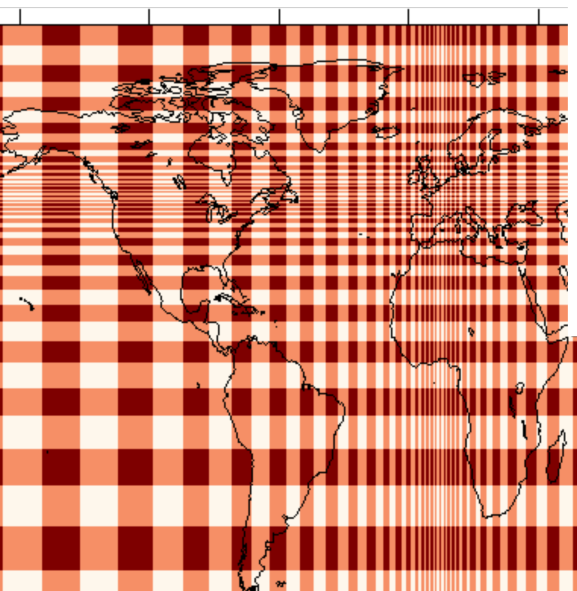
X : model state variables, u, v, T, q
X^a : X from (re)analysis regridded on the model grid
F(X) : state variables model tendencies
τ : time constant

Often using nudging in u and v only relying on the model physics for the thermodynamics (~ simulations with imposed large scale dynamics)



Frédérique Cheruy

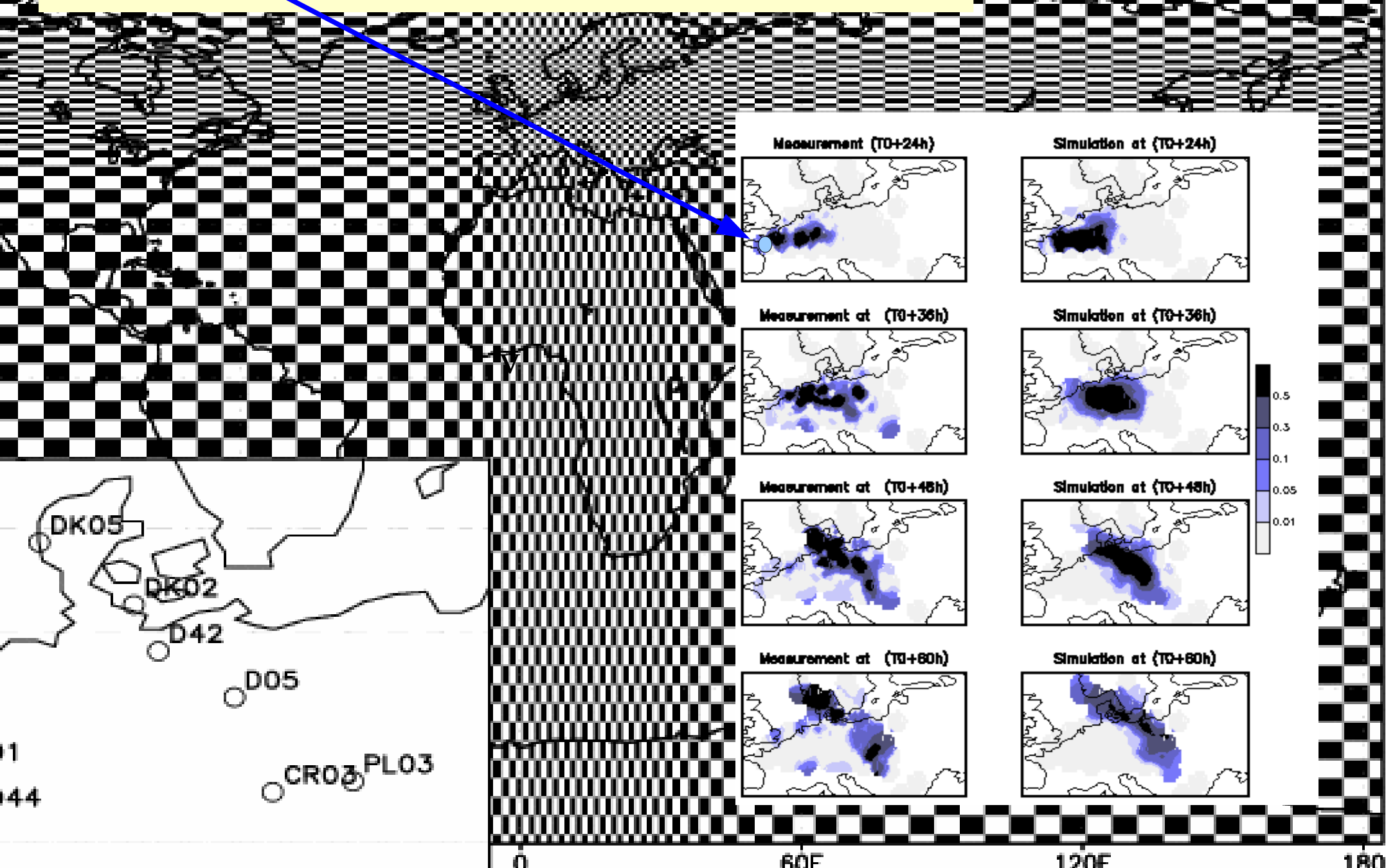
HEAT-WAVE SUMMER 2017



Transport de traceurs

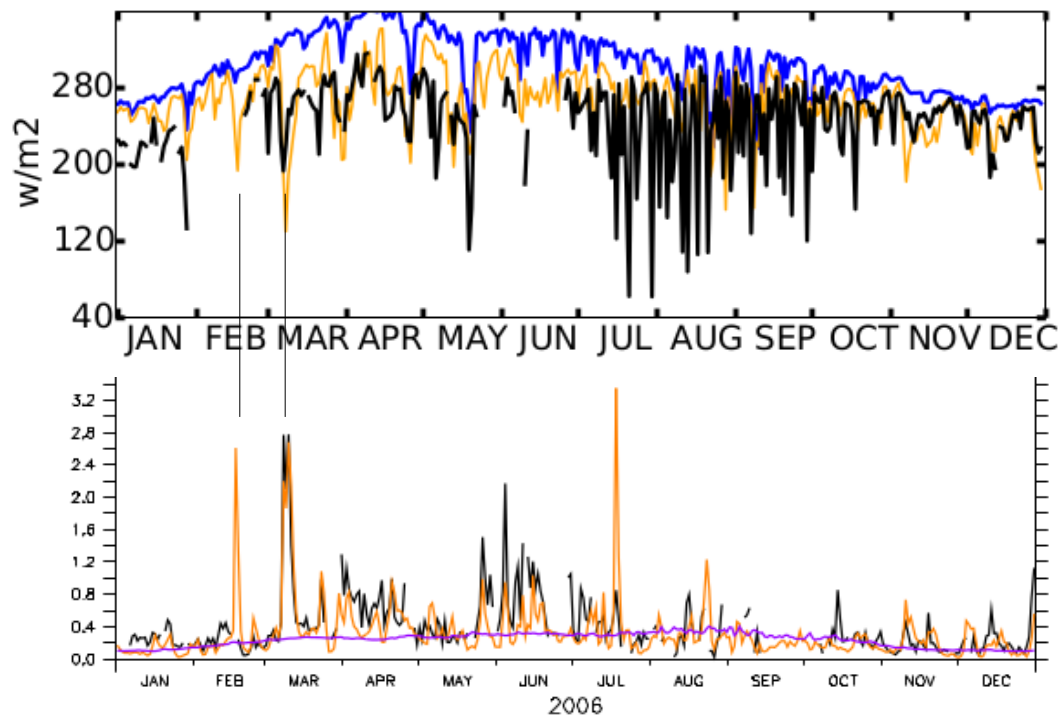
1. Operating modes : c) Tracer transport

Numerical simulation with LMDZ
Chemical tracer (PMCH) emitted in French Brittany (ETEX)

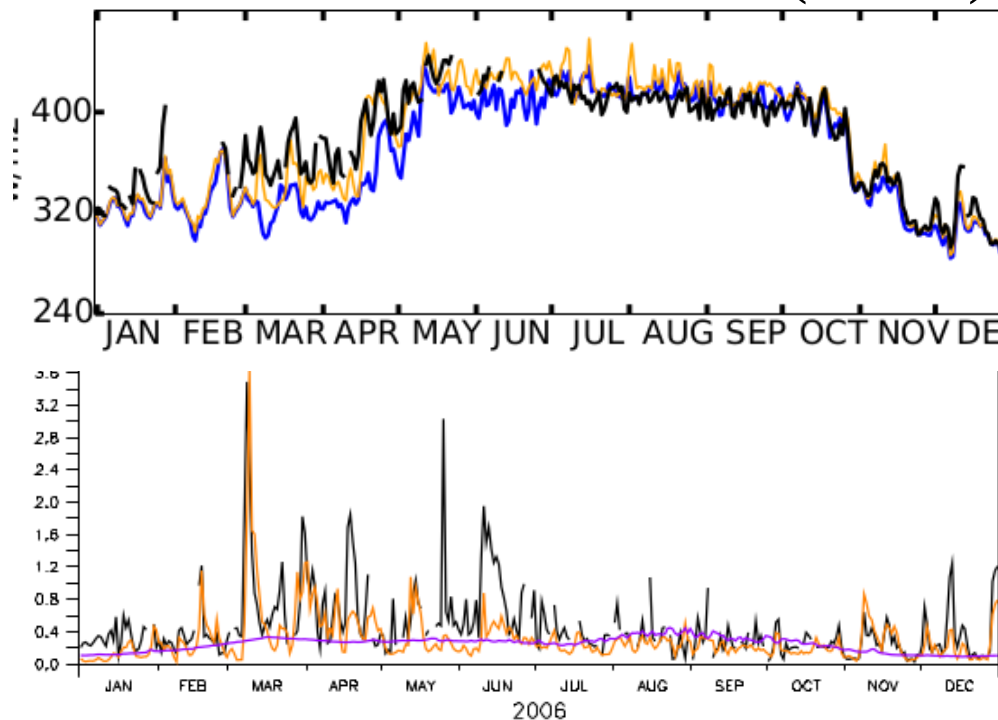


1. Operating modes : c) Tracer transport

SW downward flux surf. (W/m²)

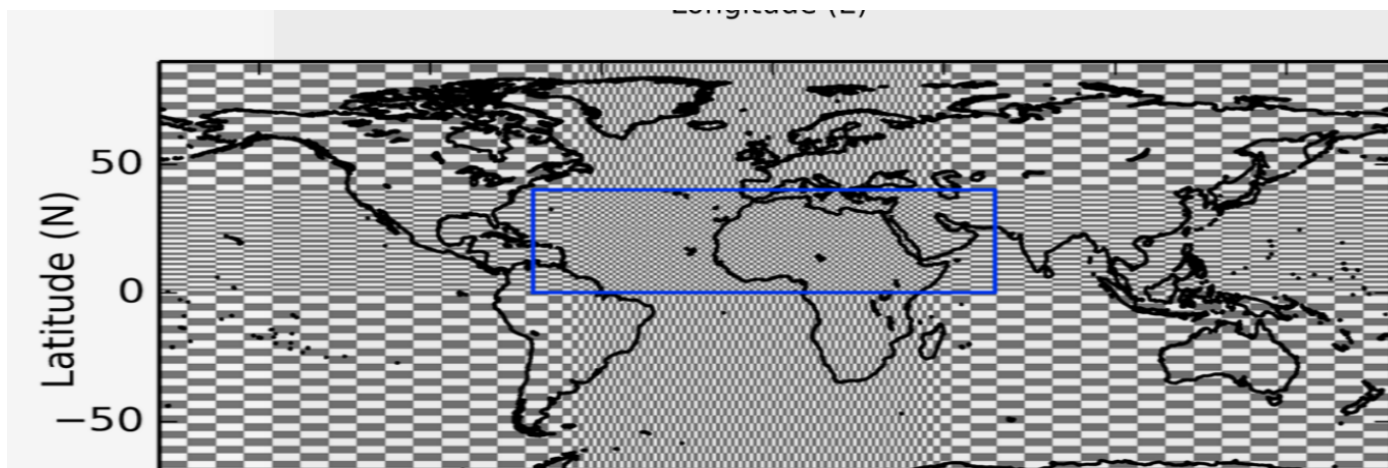


LW downward flux surf. (W/m²)



Coupled simulations with interactive aerosols (Dialo et al., 2017)

Tracer concentrations in $\mu\text{g} / \text{kg}$, 2006

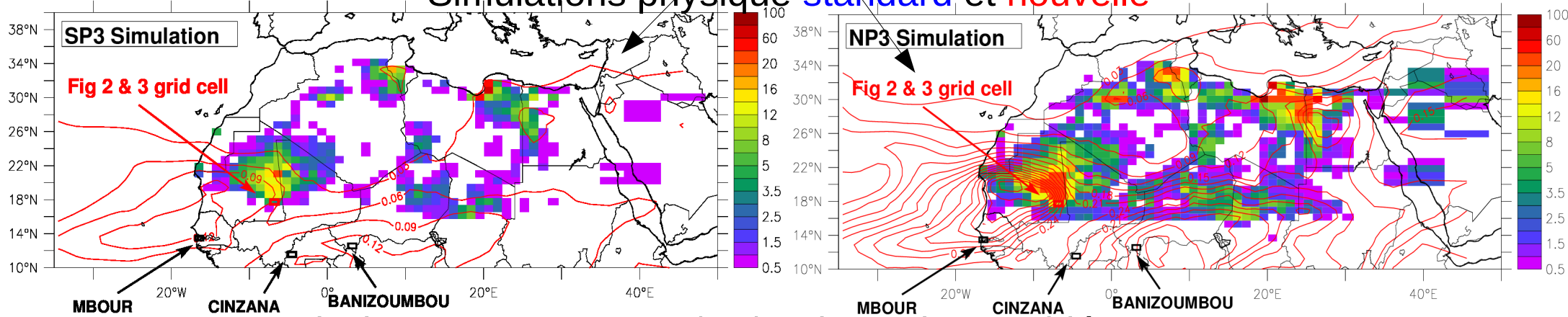


— Observations
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—

II. Impact sur le 3D : vent et soulèvement des poussières

Impact de la représentation de la couche limite sur l'émission de poussières

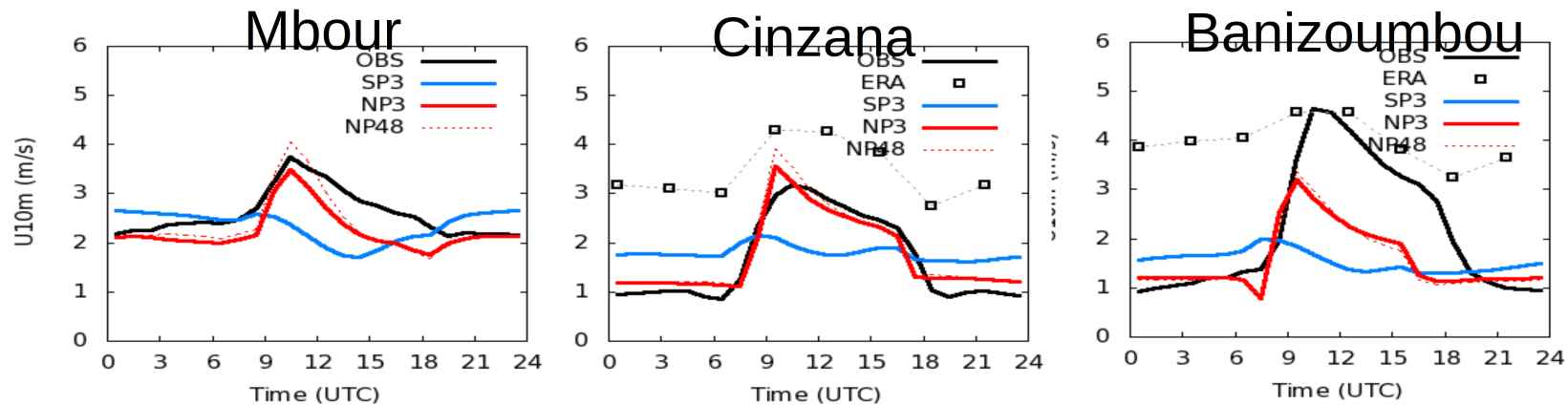
Simulations physique **standard** et **nouvelle**



Emmissions Mars 2006, $\mu\text{g}/\text{m}^2/\text{s}$, simulations guidées en vent

$$F_h = \frac{K \rho_a}{g} U^{*3} \left(1 - \frac{U^* Th}{U^*} \right) \left(1 + \frac{U^* Th}{U^*} \right)^2$$

Cycle diurne moyen du vent à 10m, m/s

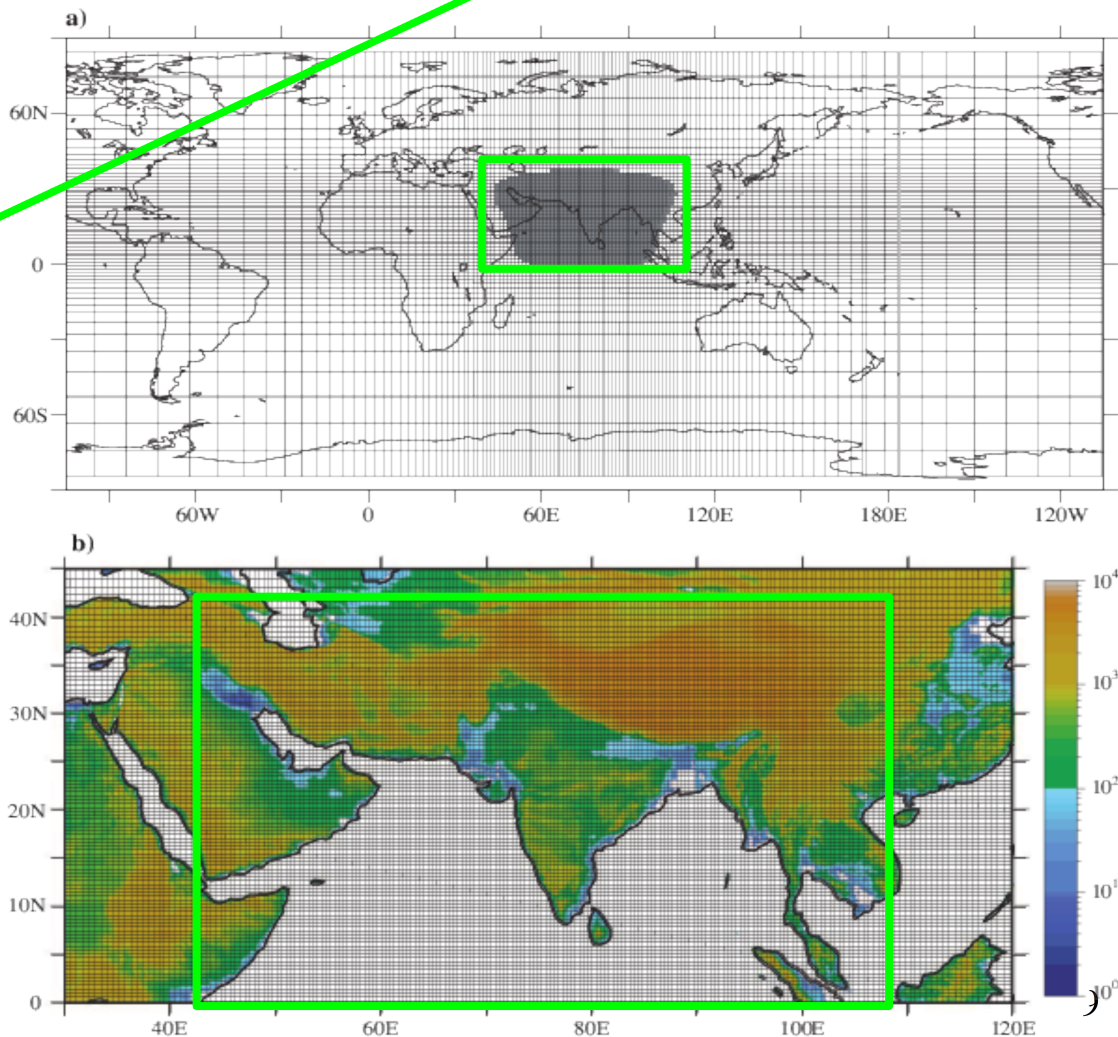
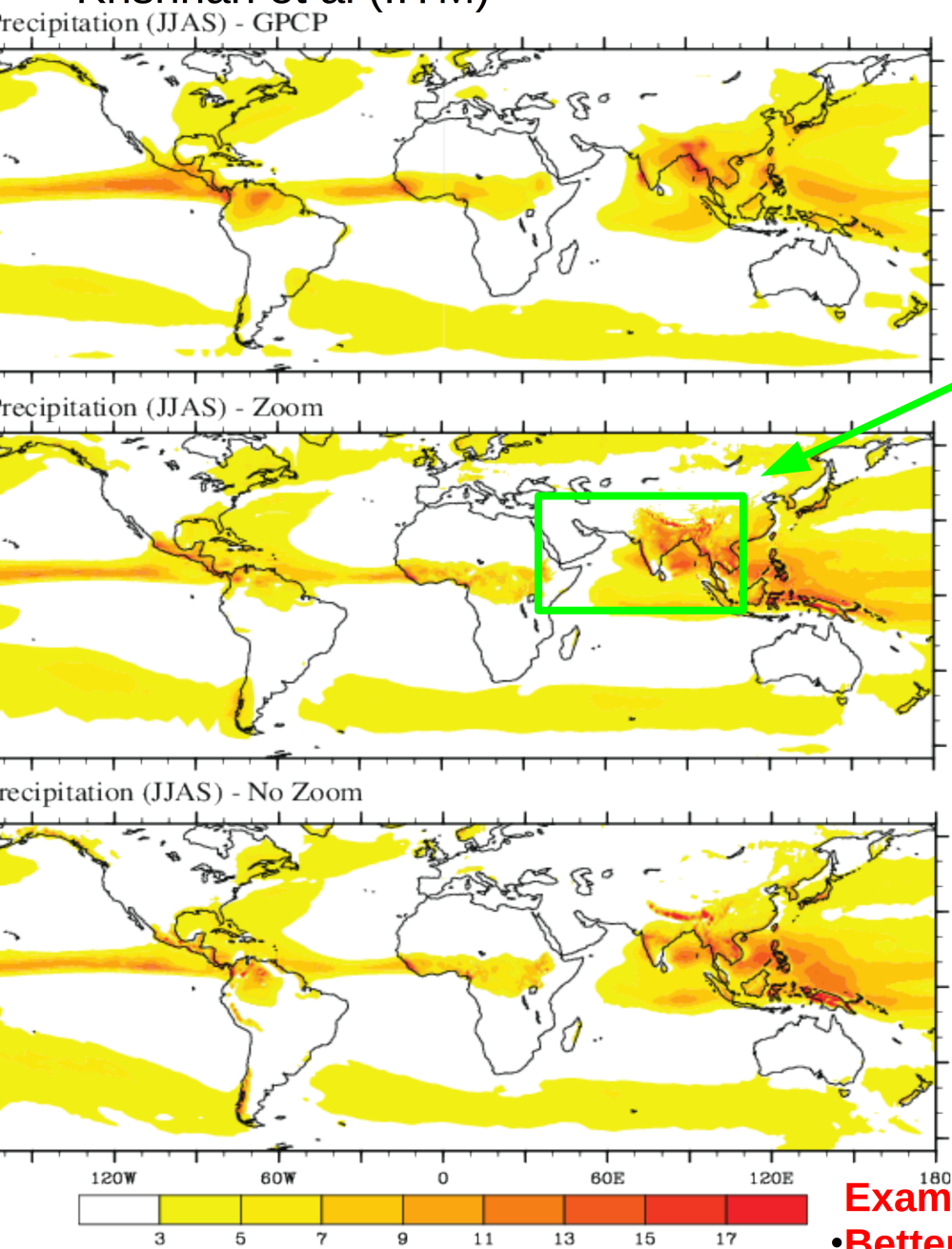


Descente d'échelle

1. Operating modes : b) Zooming or/and nudging for climate

Free climate simulation with zoom

Zoomed free climate simulation for Cordex South Asia, Krishnan et al (IITM)

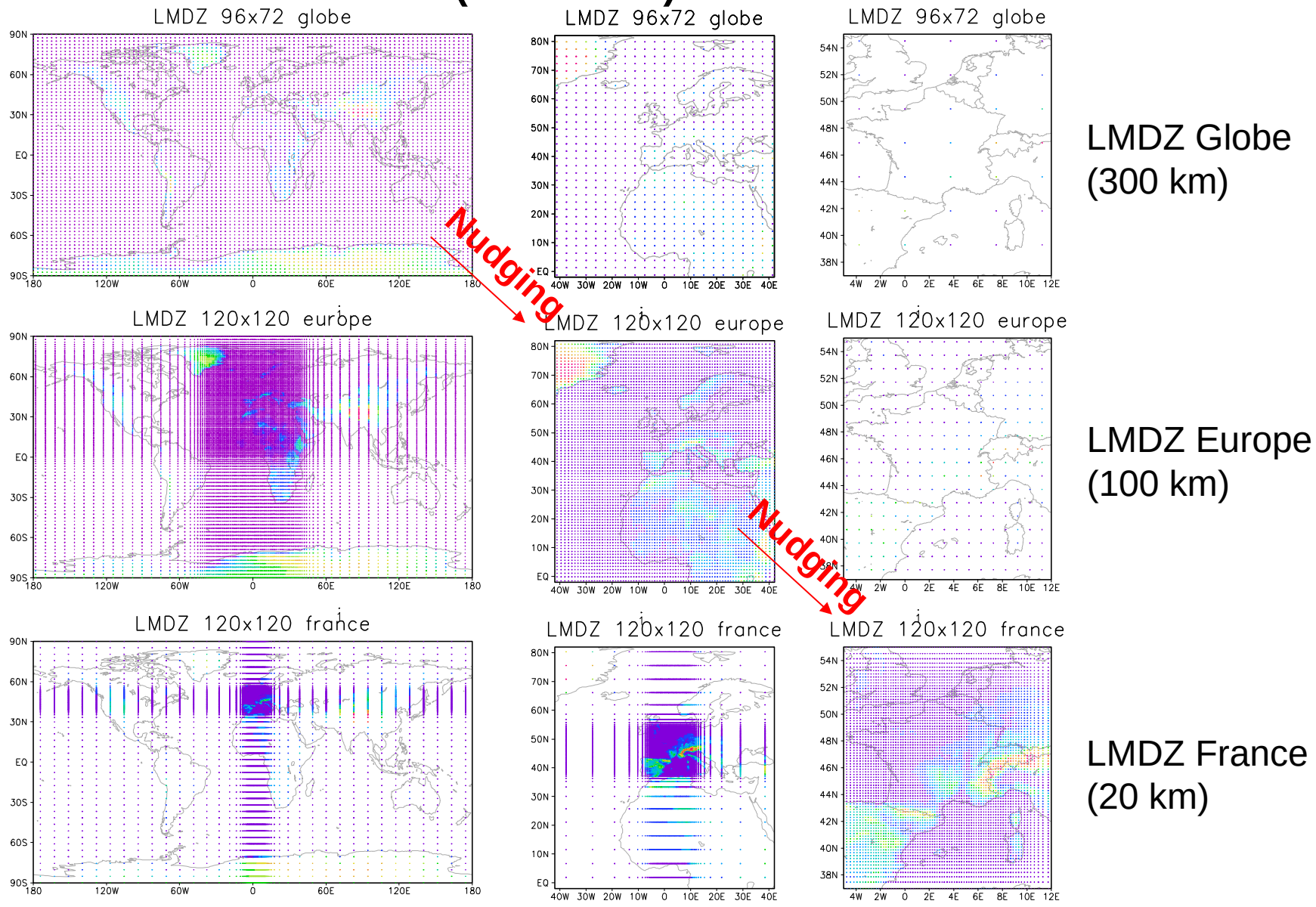


Example of improvement due to increased resolution
• **Better representation of depressions coming from Bay of Bengal**

1. Operating modes : b) Zooming or/and nudging for climate

Use for climate downscaling

LMDZ - Grid Cascade - (Laurent Li)



Similar to what is done with limited area models (like WRF)

Importance du tuning

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ESSP DIVERSITAS IGBP IHDP WCRP

WCRP

World Climate Research Programme

WCRP Regional Climate Workshop: Facilitating the production of climate information and its use in impact and adaptation work

Lille (France), 14-16 June 2010

- About the Workshop
- The Venue
- Meeting Agenda
- Presentations
- Organising Committees
- Sponsors
- Contact us

WCRP Regional Climate Workshop: Facilitating the production of climate information and its use in impact and adaptation work

The workshop will focus on the research priorities for facilitating the production and use of regional to local climate change information in adaptation and risk management.

The three main objectives of the workshop are:

- 1) To facilitate and promote a unifying vision and approach at regional climate research as a mean for more interaction between IPCC WGI and WGII in this area of investigation,
- 2) To find a common ground between the providers of regional climate information and the user of this information for impacts studies,
- 3) To provide a unique opportunity for WCRP to advance science for regional downscaling and climate information: methods and validation.

The programme of the workshop includes the following 5 themes:

- 1) Simulations of regional climate variability and change: Present and future prospects for delivering information to support impact and adaptation work
- 2) Regional climate change : Requirements and ability to deliver
- 3) Generation and use of regional/local climate information
- 4) Representation and interpretation of uncertainties in regional climate projections/predictions
- 5) Key information gaps: research needs to close such gaps

In order to facilitate in depth discussions to identify key research topics and due to limitation in size of conference facilities, this workshop is **by invitation** only.

WMO IOC ICSU

At that meeting :

Could the non tuning of regional models lead to overestimate the dispersion of climate projections downscalling for bad reasons ?

Idea of tuning strongly rejected by the regional climate modelers?

What I understood :

« Global models need tuning because they are not good enough »

I realized how few people did know what we were doing in our models, and in particular concerning the configuration setup and tuning.

Starting to wondering :

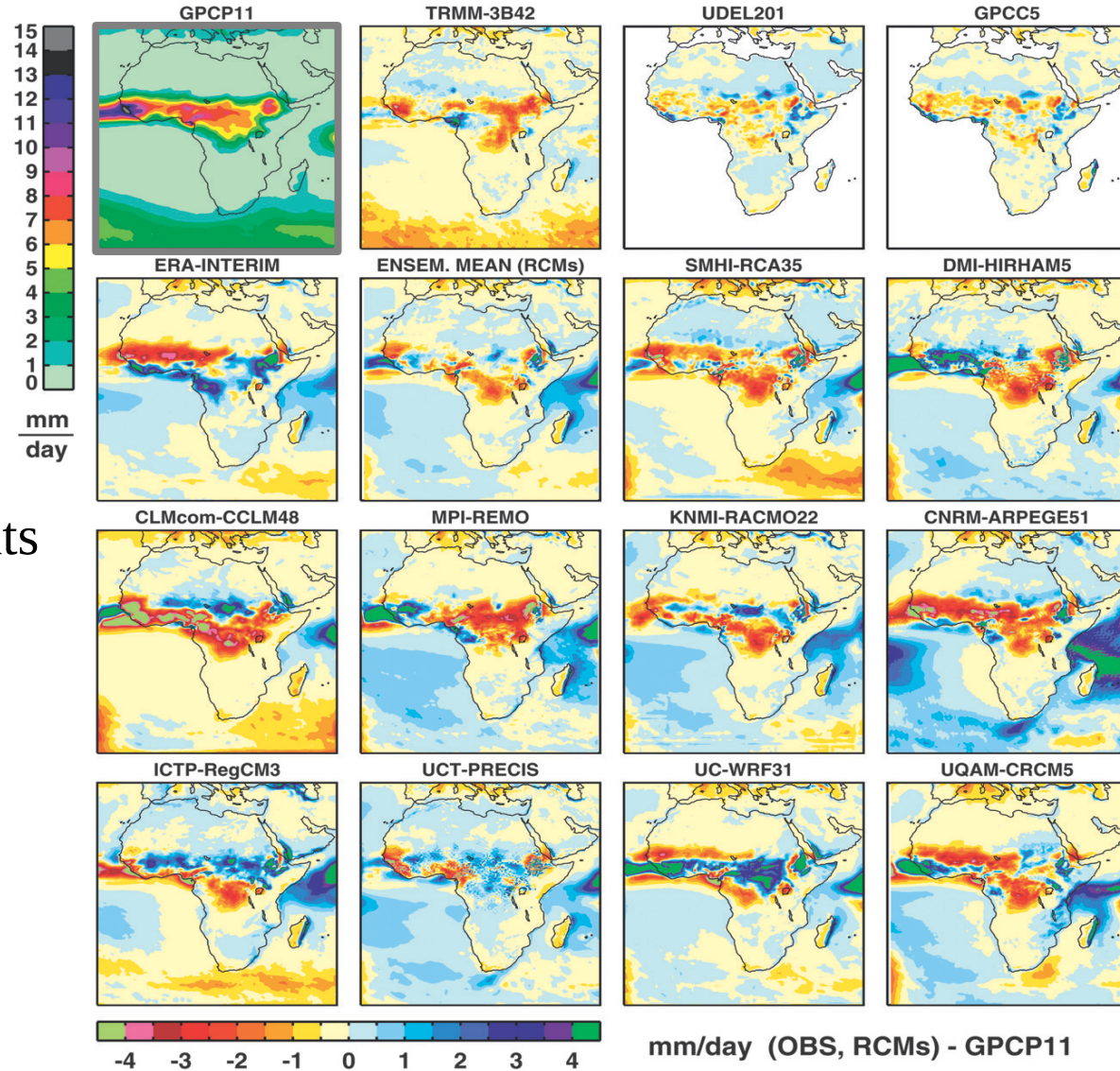
Do we know what we are doing ?

And who knows outside dev teams ?

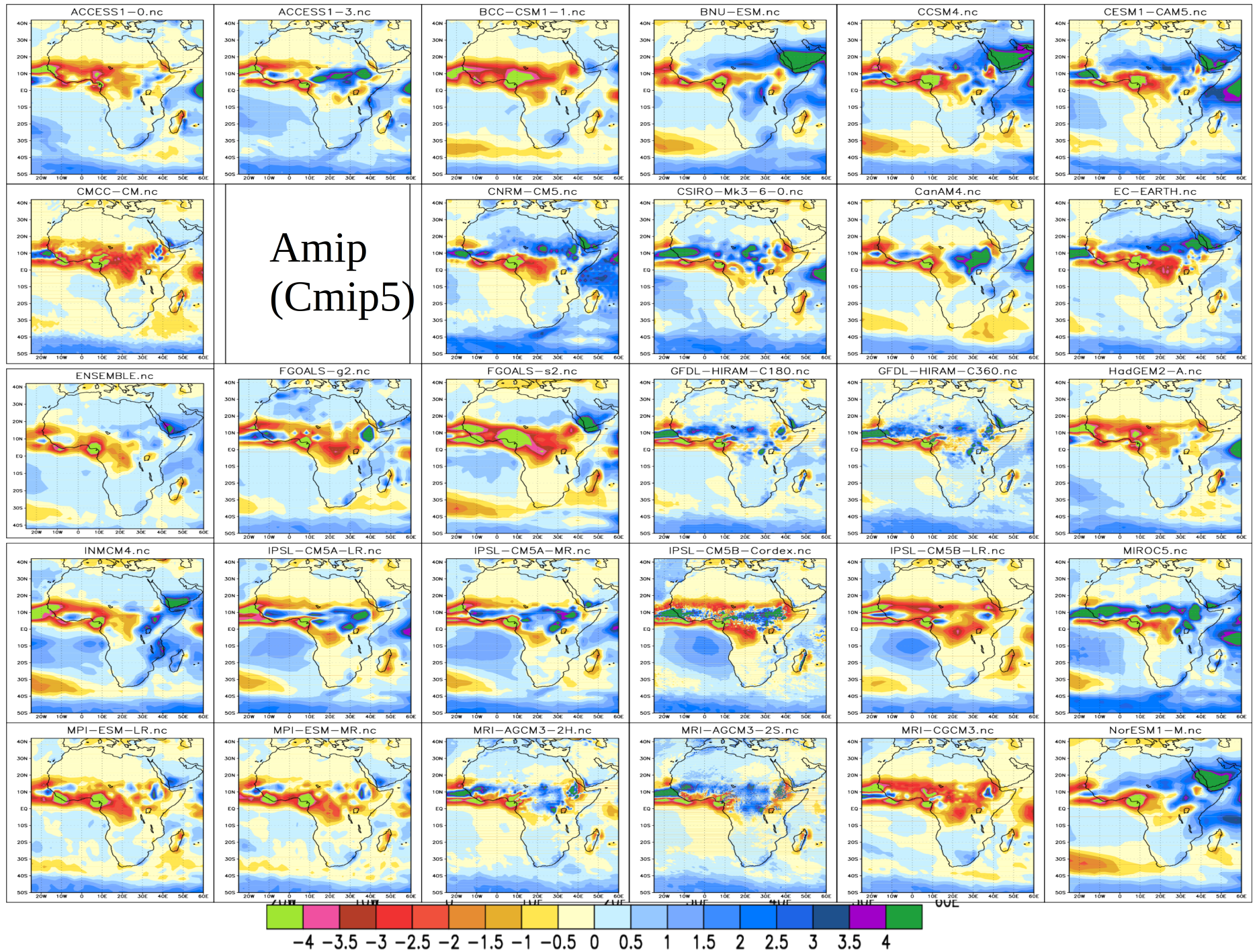
Rainfall biases, JAS

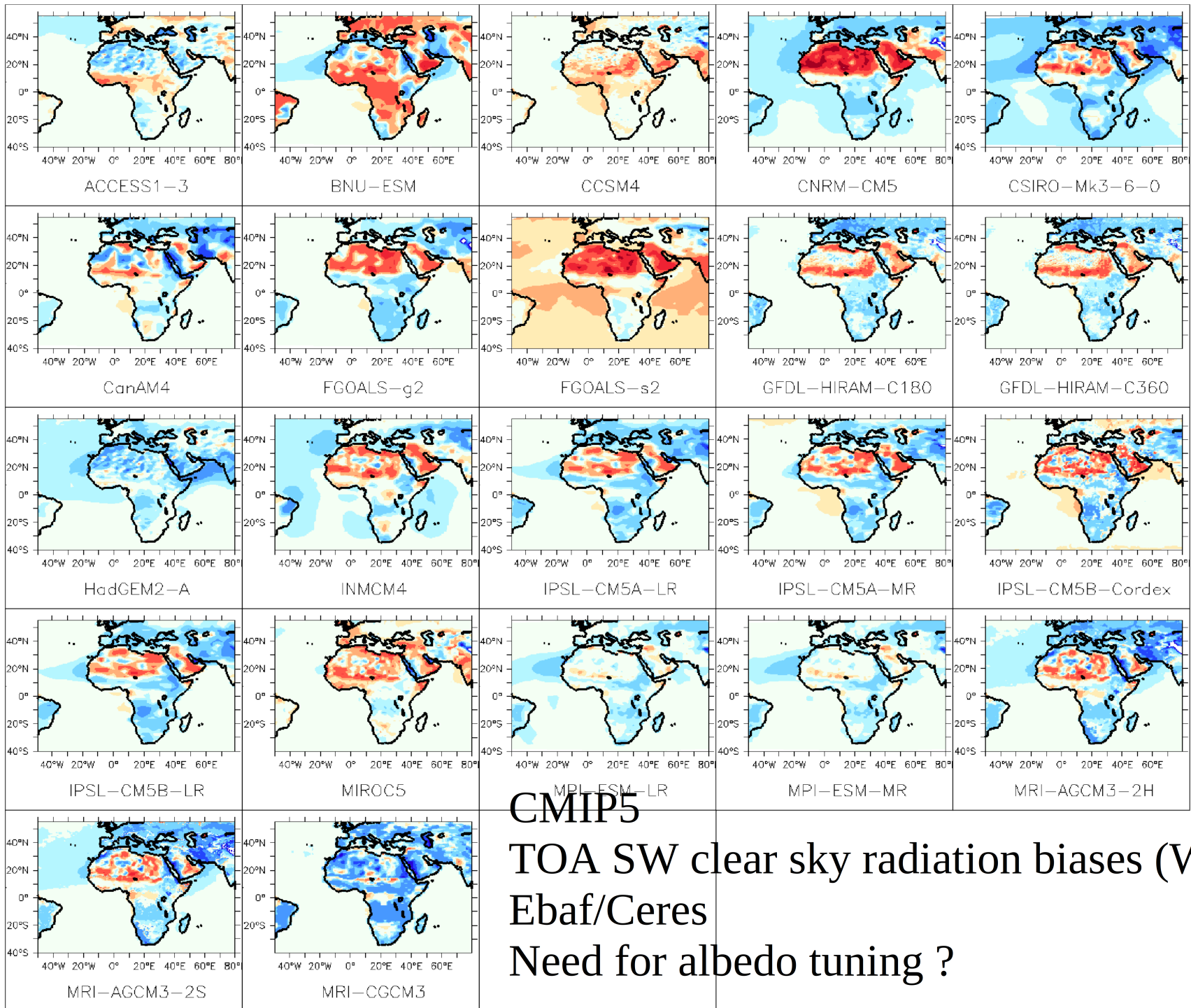
Precipitation Climatology in an Ensemble of CORDEX-Africa Regional Climate Simulations, Nikulin et al., 2012, J. Clim.

Precipitation (pr) | JAS | 1998-2008



Cordex :
Not downscaling but
Regional climate experiments





CMIP5

TOA SW clear sky radiation biases (W/m^2)

Eba/Ceres

Need for albedo tuning ?

Combination of parametrizations without retuning.

Typical example of multi-configuration simulation with WRF (Pohl et al., 2011)

Selection of 1 or a few configurations on a few criteria

Fig. 5 a MAM seasonal rainfall amounts averaged spatially over the Kenya rainfall index (mm) according to GPCP, ERA-Interim and the 27 WRF experiments in Set #1. Except for GPCP, the *smallest bar* indicates the convective rainfall seasonal amounts. b As a but for the continental part of the Kenya rainfall index (35°E–40°E). c As a but for the Lake Victoria Basin (32°E–35°E)

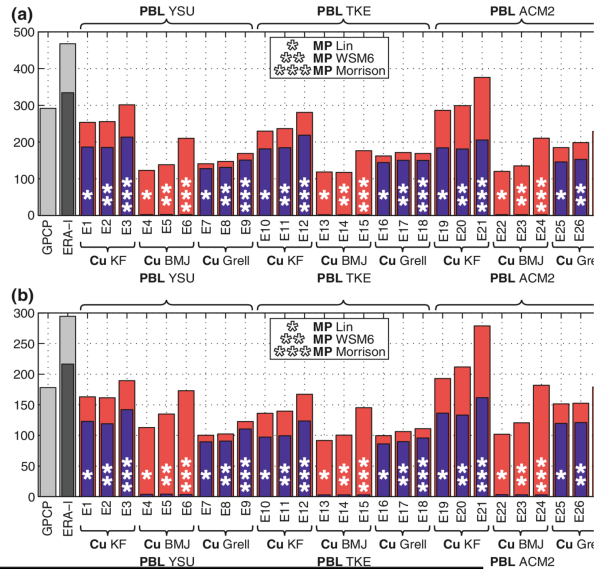
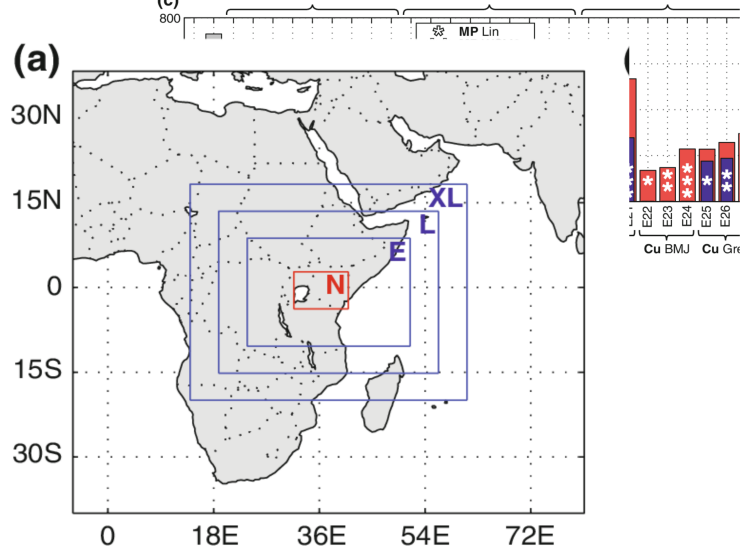
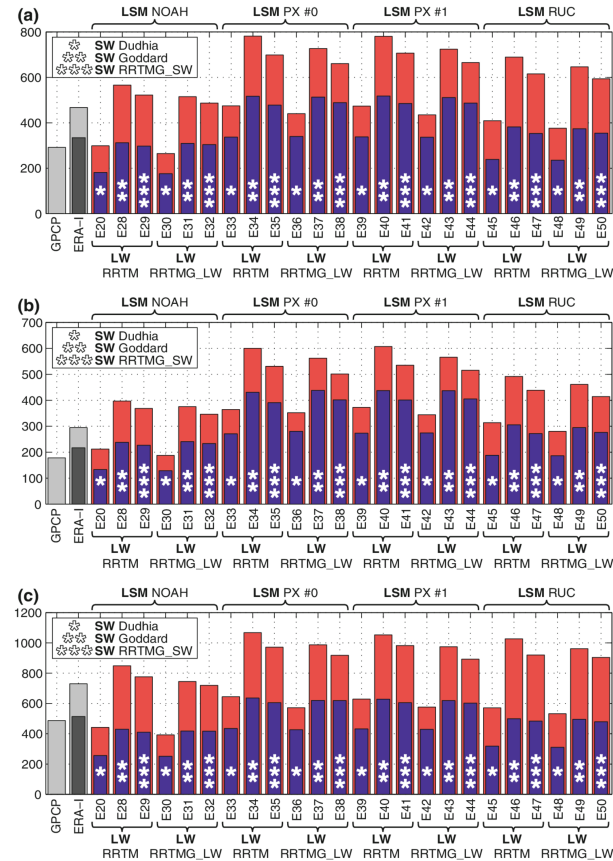
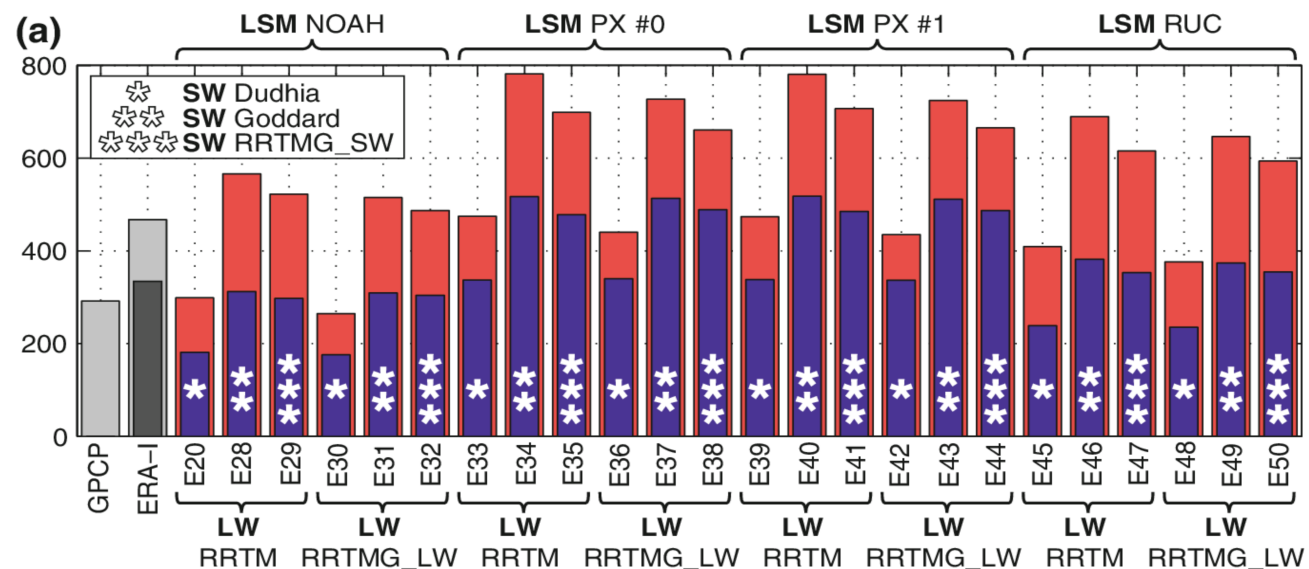


Fig. 8 As Fig. 5 but for the 24 WRF experiments in Set #2



Average rainfall over Kenya
Convective in blue, total red + blue

Changing rainfall by a factor of 2 by changing radiative code But no control of radiative fluxes in the study



Questions de recherche autour de la descente d'échelle dynamique pour les questions relatives au changement climatique

- Que gagne-t-on (c'est souvent fait) mais aussi que perd-on (c'est beaucoup moins fait, je crois) lors de la descente d'échelle ?
- Quelles sont les configurations les plus adaptées à un problème de descente d'échelle ?
- Importance ou non du tuning énergétique (pratiquement jamais regardé dans les exercices multi-physiques de WRF) dans les simulations en modèle à aire limitée pour les anticipations des changements climatiques futurs.
- Les rétroactions propres au modèle à aire limitée, et leur degré de cohérence / incohérence avec celles du modèle global ; les incohérences peuvent-elles pas surpasser le gain par descente d'échelle ?
- Apport possible du « two way nesting » et grilles en cascade sur ces questions.
- Pour les études d'impact, qu'est-ce qui est réductible ou non dans l'empilement des incertitudes provenant de l'empilement des modèles (global, aire limitée, modèle d'impact). Est-ce que des stratégies davantage intégrées permettraient de réduire ces incertitudes ?

questions qui peuvent dépendre fortement du problème considéré → Elargir la communauté
Mais ça ne se fera pas sans investissement de recherche sur ces questions de notre côté.