LMDZ-régional, jusqu'où iras-tu?

(quelques exemples d'utilisation du LMDZ pour étudier le climat régional)

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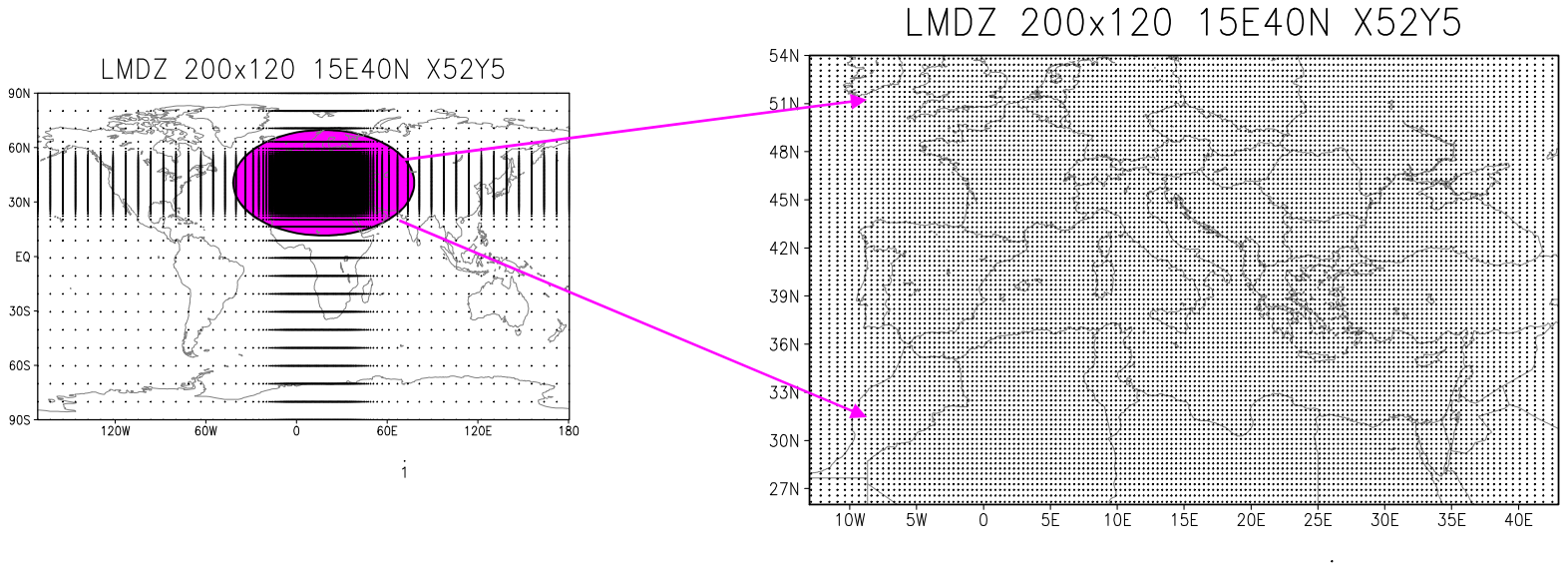
- CLAVIER: a downscaling for eastern Europe (CLARIS: South America)
- SCAMPEI: a downscaling for France
- CIRCE: a downscaling for the Mediterranean
- Perspectives: A two-way nesting test in East China

LMDZ-regional: Med version



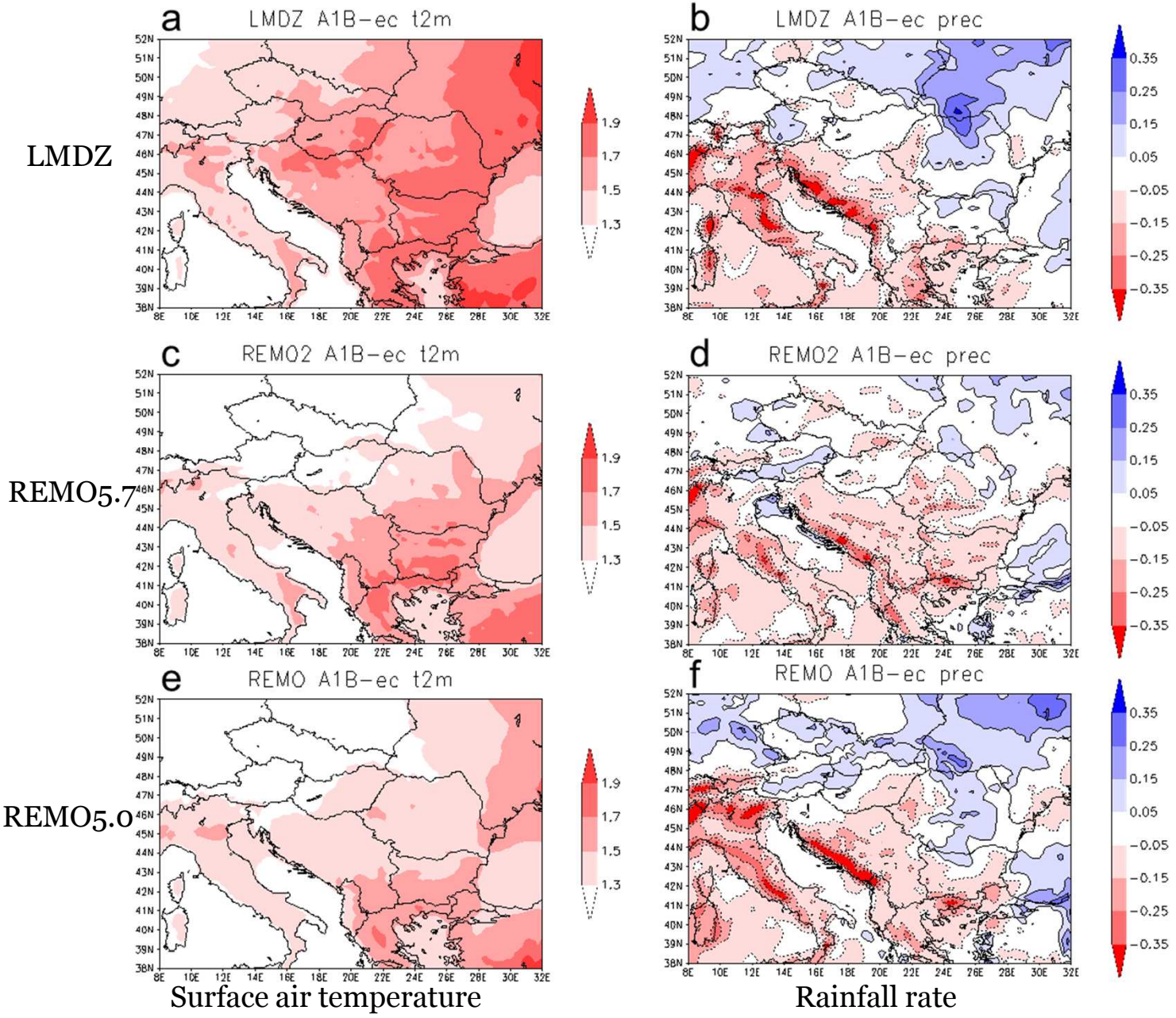
- LMDZ-Med is a global atmospheric GCM with variable grid and a zoom over the Mediterranean basin. Local resolution: 30 km.
- It is run as a regional climate model, with nudging conditions (every 6 hours) from a global model (LMDZ-g, ERA40, IPCC, etc.) at low resolution outside the zoom. The model is free to have its own behaviours inside the zoom.

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

CLAVIER: a climate downscaling study for Eastern Europe

- LMDZ
- REMO5.0
- REMO5.7

LMDZ-regional and REMO for climate change downscaling (ECHAM A1B) in Eastern Europe (2021/2050 – 1961/1990)



LMDZ

REMO5.7

REMO5.0

Surface air temperature

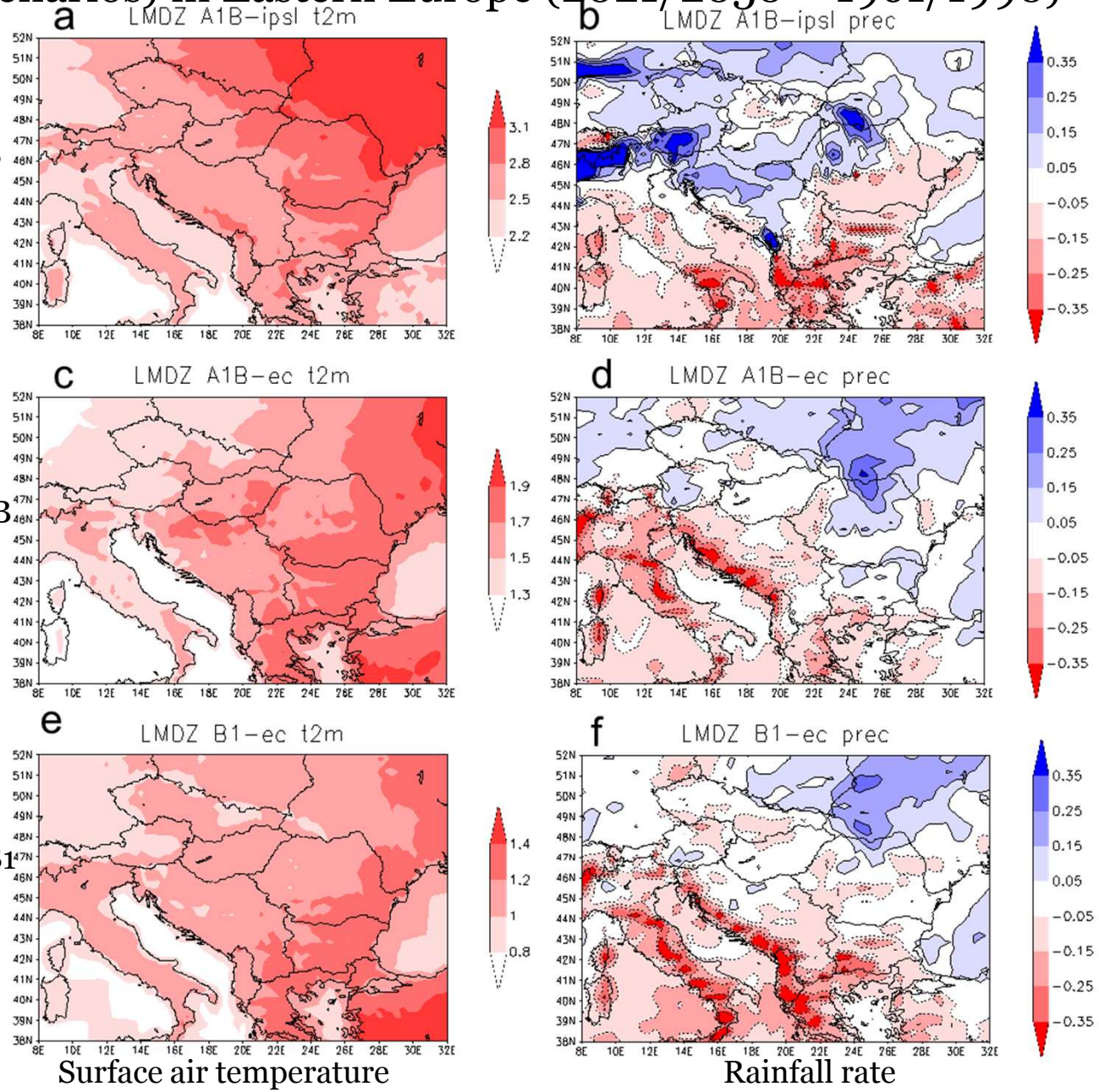
Rainfall rate

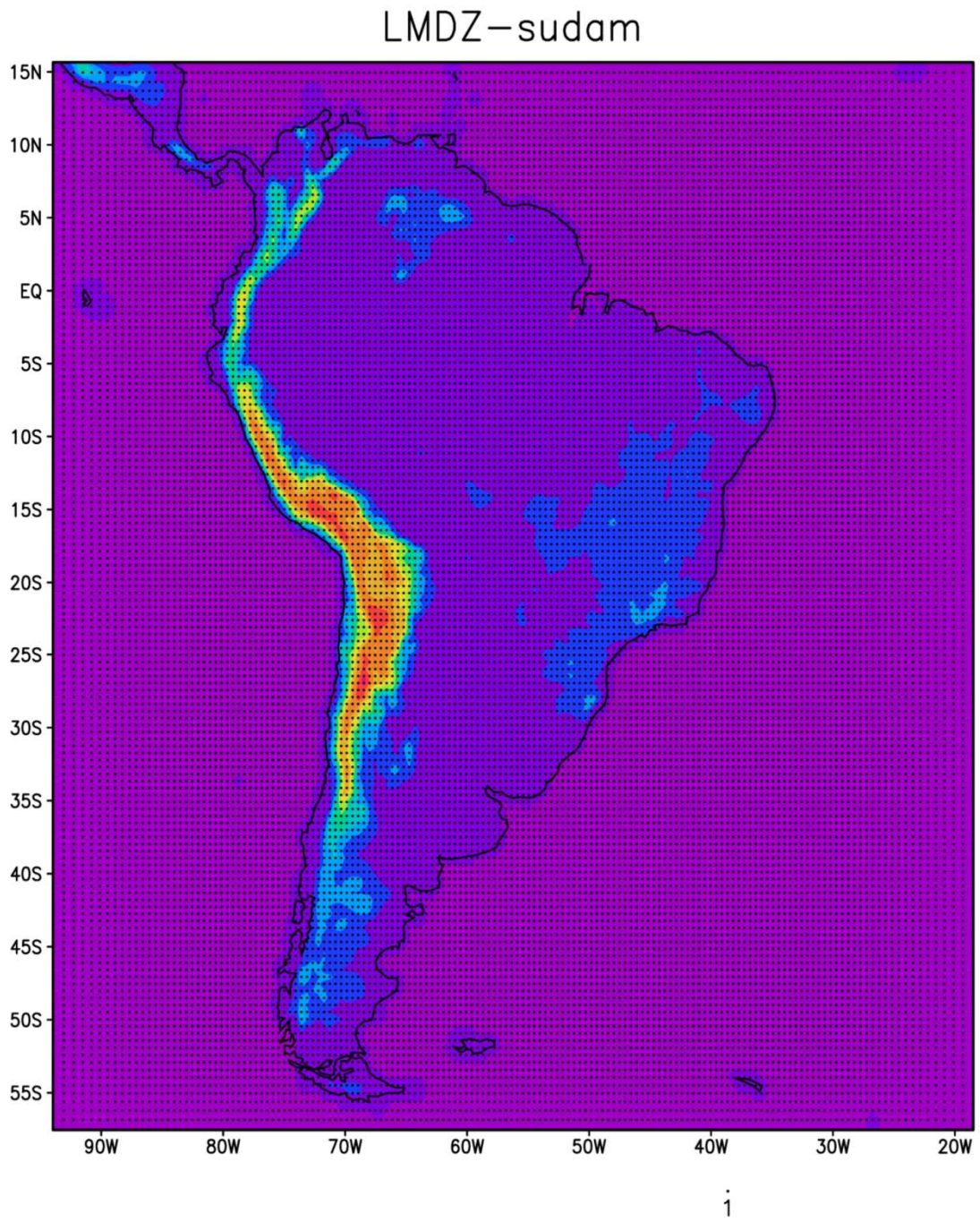
LMDZ-regional climate change downscaling (3 different scenarios) in Eastern Europe (2021/2050 – 1961/1990)

IPSL-A1B

ECHAM-A1B

ECHAM-B1





Configuration of LMDZ-sudam:
-irregular rectangular lat/lon grid
-152x150 points in the domain
-about 0.48°
-very week relaxation inside

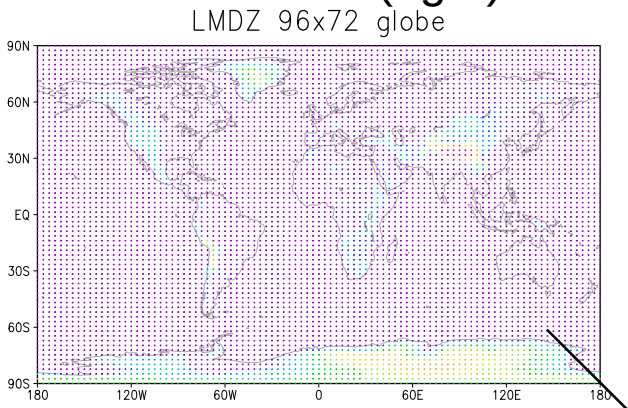
ERAinterim: Global 0.75° 4xdaily. Finished and post-processed (1989/2008, 20 years)

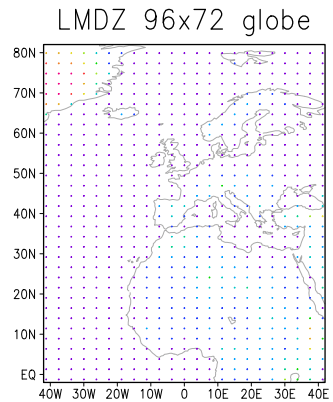
Scenario run: Driven by IPSL-CM4 and ECHAM5 global models with the scenario A1B (1951/2100, 150 years).

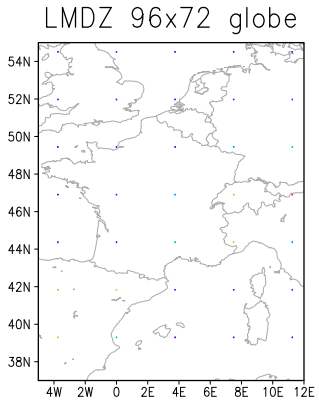
A downscaling study for France:

- Three versions: Global / Europe / France
- Two-way nesting between Global/Europe
- One-way nesting from Europe to France

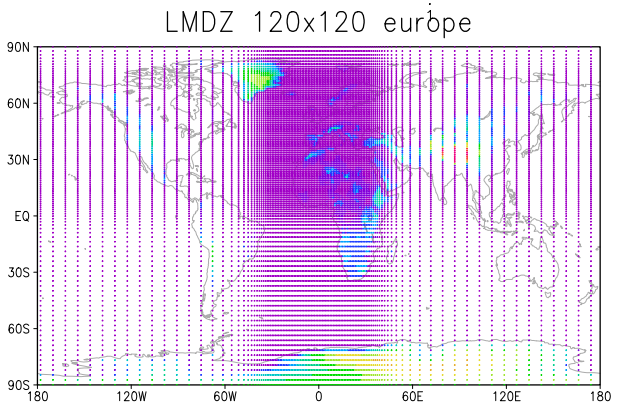
LMDZ grid schemes for the whole earth (left), for Europe (middle) and for France (right) in three versions

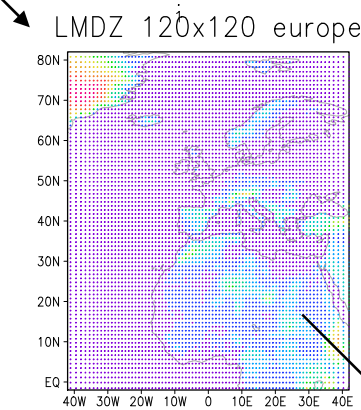


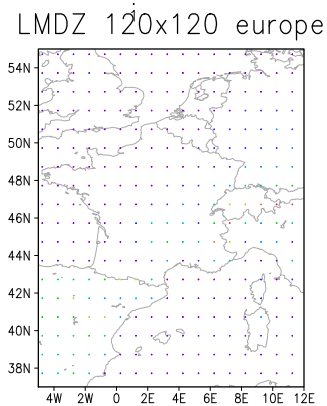




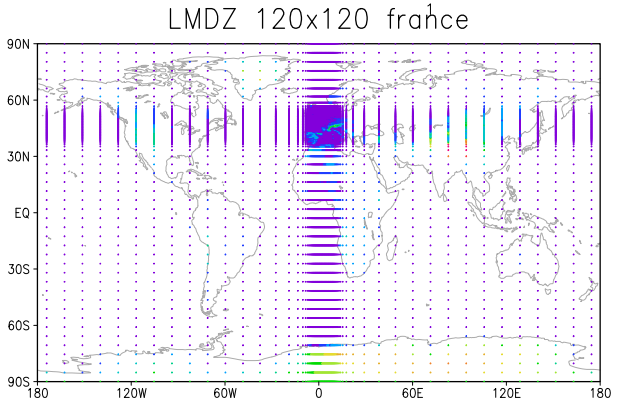
LMDZ Globe
(300 km)

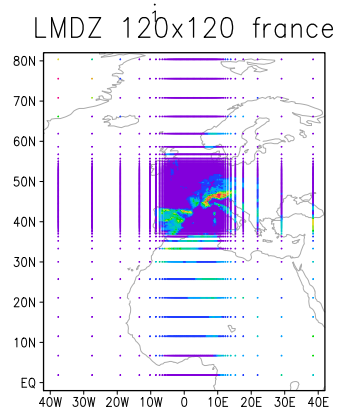


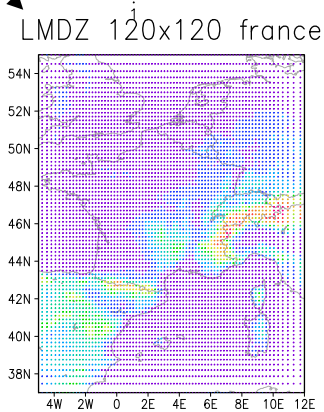




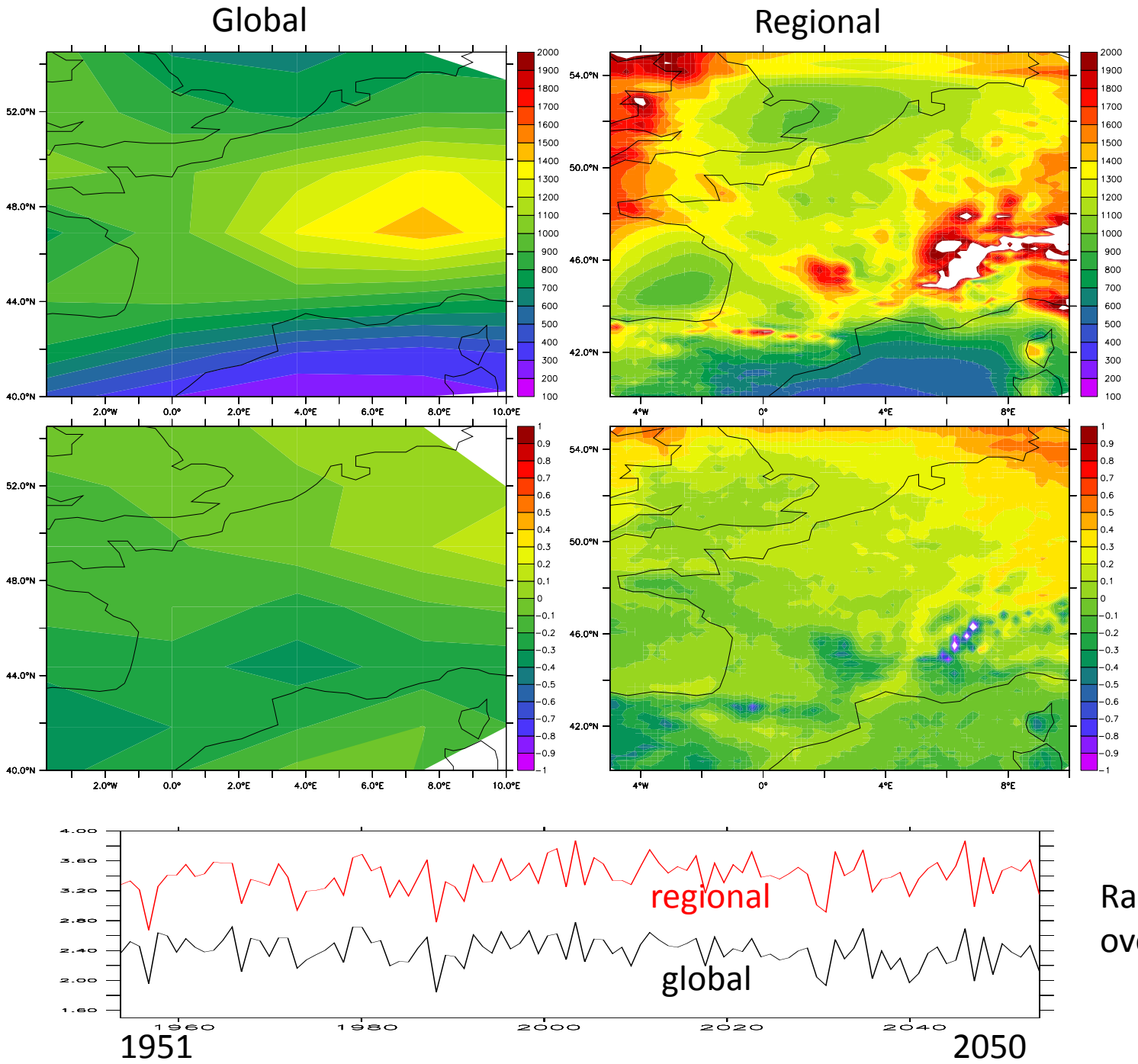
LMDZ Europe
(100 km)







LMDZ France
(20 km)


Global
Regional
Annual rainfall (mm/yr)
Changes of annual-mean rainfall (mm/day) (2050 – 2000)
regional
global
Rainfall averaged over France (mm/d)
1951
2050

Pr (mm/jour), Tx(° C) et Tn (° C) pour un niveau de retour à 50 ans, à Marseille, observation et trois résolutions du LMDZ

Pr	Obs	300km	100km	20km
1961/1990	**145**	**43**	**42**	**62**
2021/2050	**?**	**38**	**56**	**93**

Tx	Obs	300km	100km	20km
1961/1990	**38.9**	**32.2**	**34.7**	**35.6**
2021/2050	**?**	**36.0**	**36.9**	**37.5**

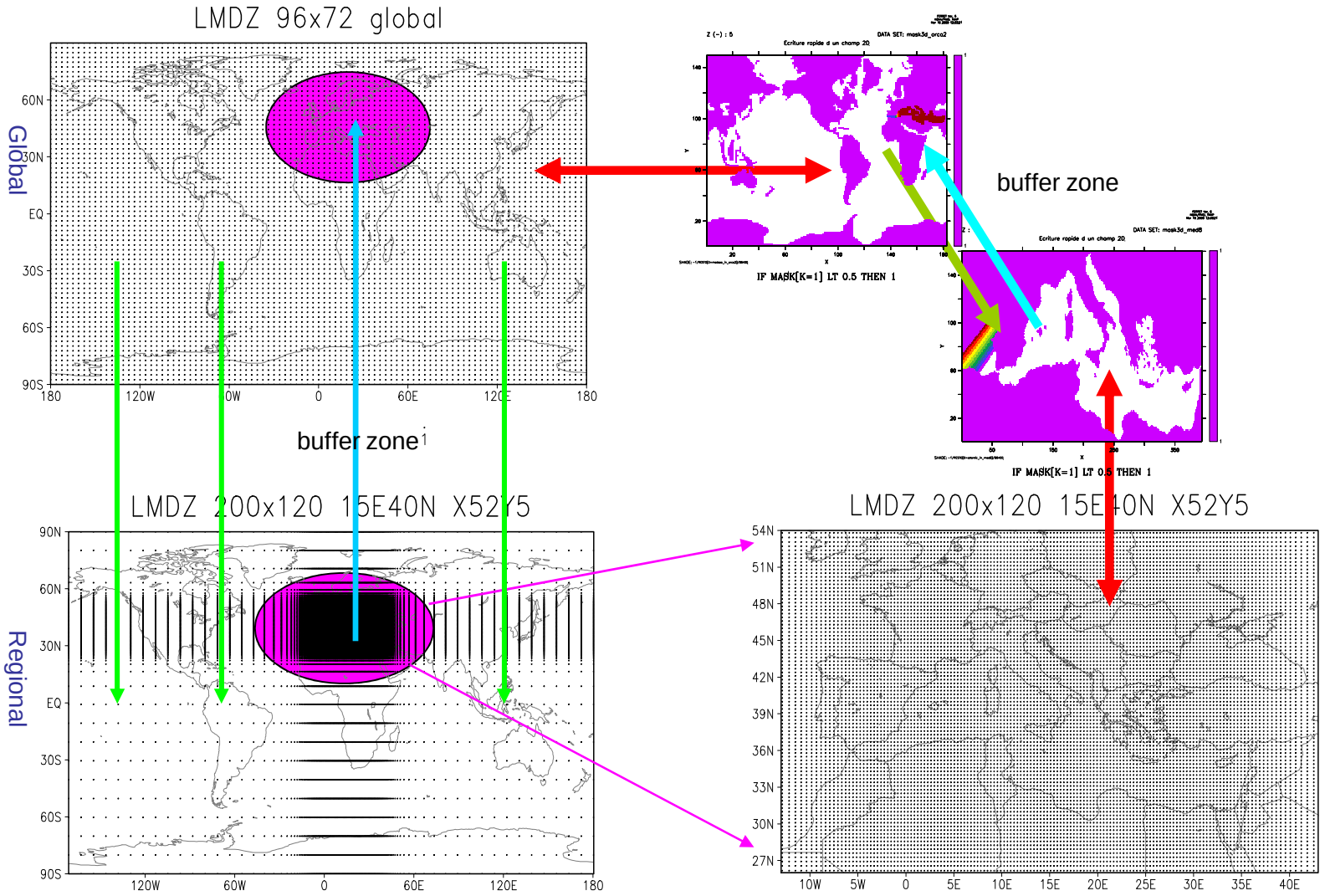
Tn	Obs	300km	100km	20km
1961/1990	**26.2**	**21.7**	**24.8**	**25.6**
2021/2050	**?**	**24.0**	**27.0**	**27.8**

Pr: précipitations intenses

Tx: température maxi de jour

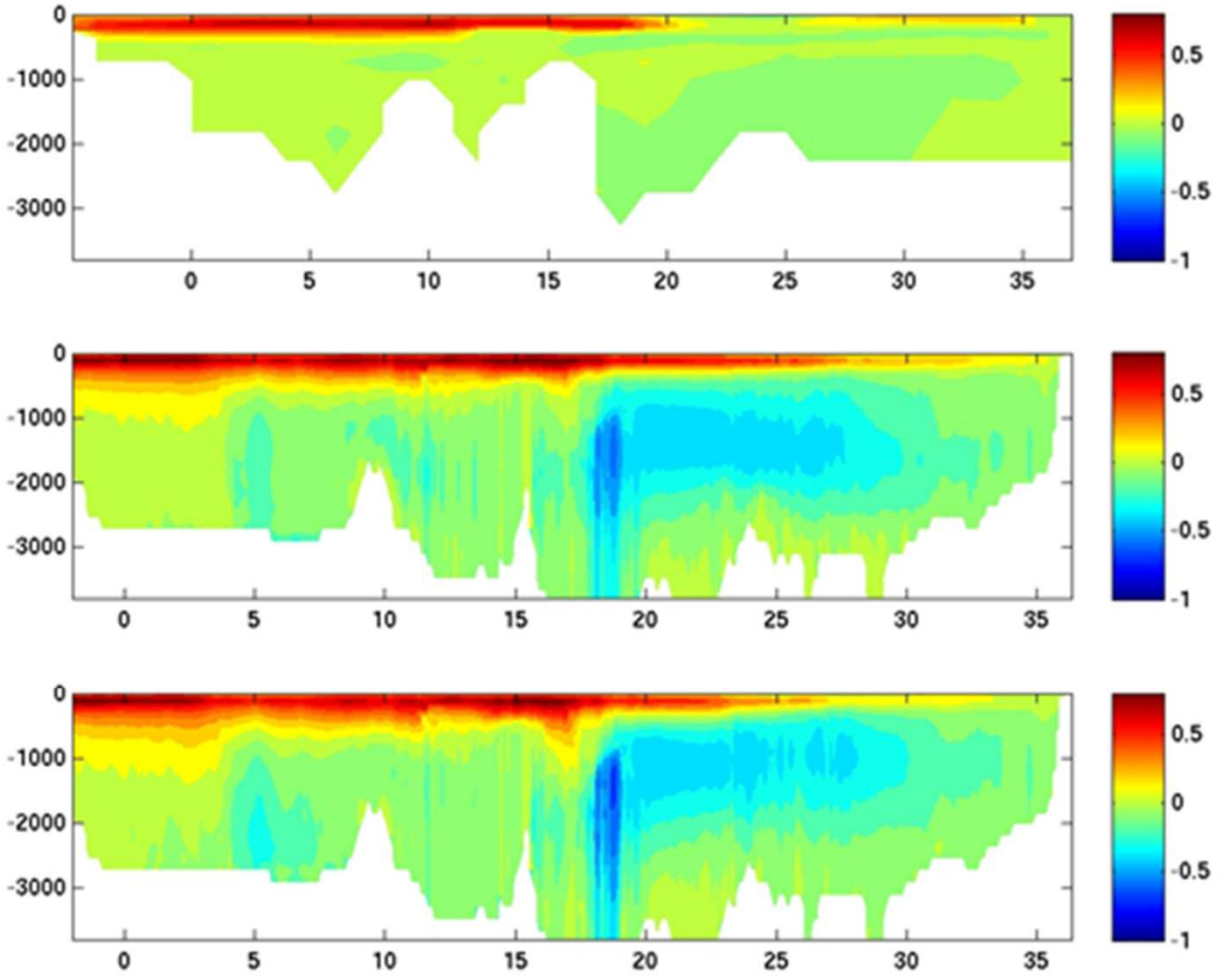
Tn: température de nuit chaude

CIRCE: Build a regional coupled model for the Mediterranean

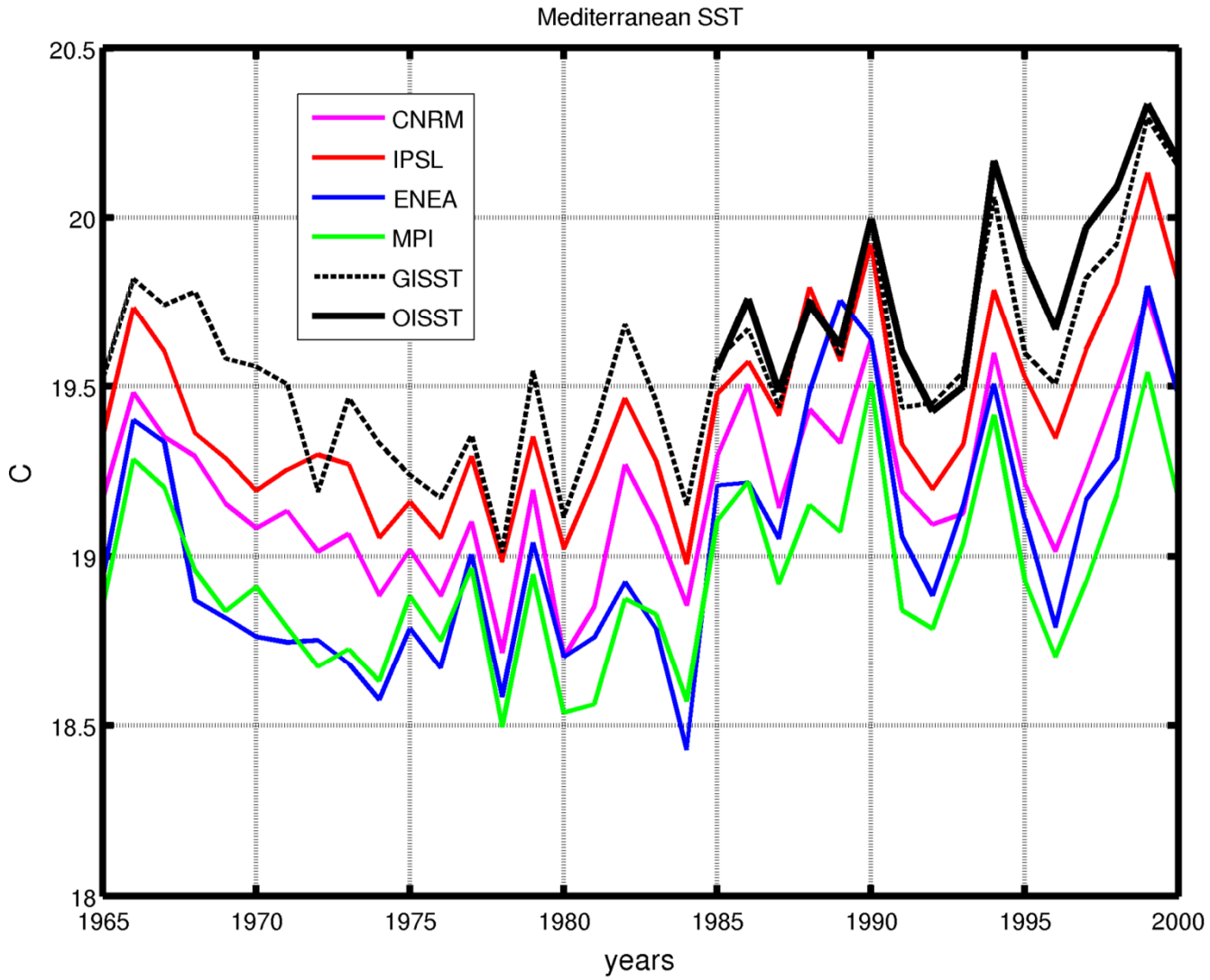


- **Global O-A coupled model: LMDZ-global / ORCA2**
- **Regional O-A coupled model: LMDZ-regional / MED8**
- **Two atmospheric models are coupled through buffer zones**
- **Two oceanic models are also coupled through buffer zones**

Schematic of the quardruple coupling in IPSL: M4

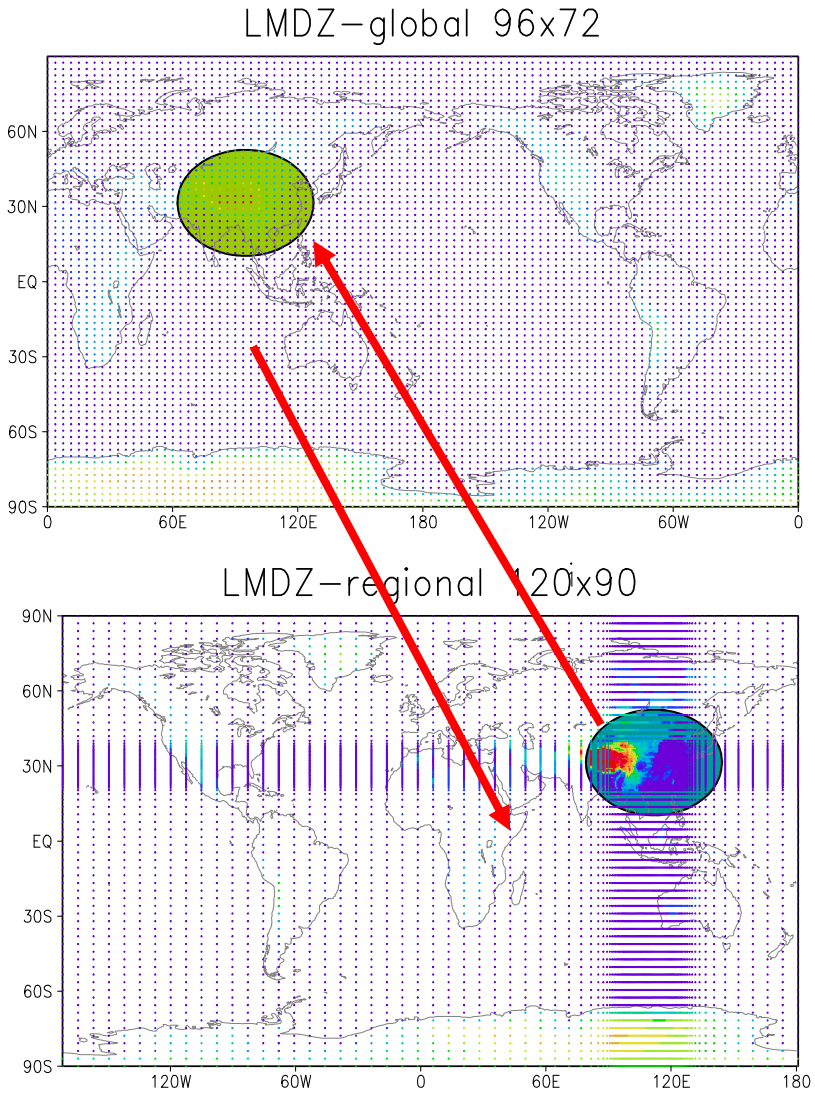


Zonal overturning stream function (Sv) for the whole Mediterranean Sea in IPSL-CM4, ERA40 and GR simulations respectively.

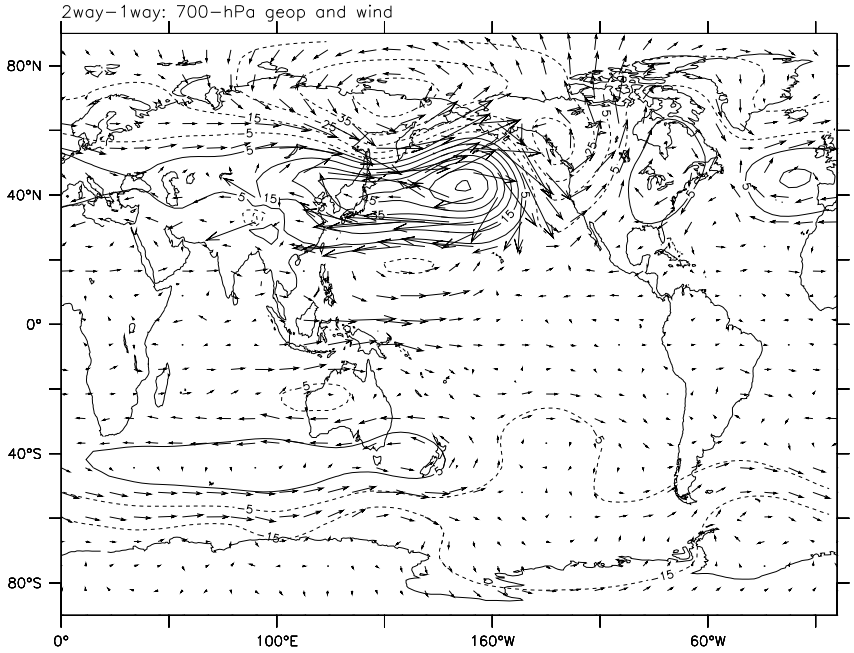


Time evolution of the annual-mean SST averaged for the whole Mediterranean Sea. Black curves are from regional coupled models, driven by ERA40, realized in CNRM, LMD, ENEA and MPI respectively.

Added values of high resolution and two-way nesting



Feedbacks from LMDZ-regional to LMDZ-global: vers une super-paramétrisation?



2way – 1way in LMDZ-global:
700-hPa height and wind

[Two-way nesting between LMDZ-regional and LMDZ-global]

Added values of LMDZ-regional: extremes

Spectral distribution of rainfall in southeast China, comparison between the observation, LMDZ/CTRL, LMDZ/CTRL2, and a few other corse-resolution global models. Added values of high-resolution models can be clearly identified.