Euro – CORDEX IPSL Simulations using IPSL-CM + WRF/MM5 models & DRIAS

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Specific scientific issues using Euro-CORDEX

- Impacts of CC on regional air quality (and health)
- Costs and benefits from emission scenarios
- Evolution of cold and heat waves and other extremes with CC
- Heat wave development, regional processes and evapotranspiration regimes, early warnings and their evolution
- Evolution of wind energy resource
- Later: evolution of solar energy resource

Regional Europe simulations for several projects

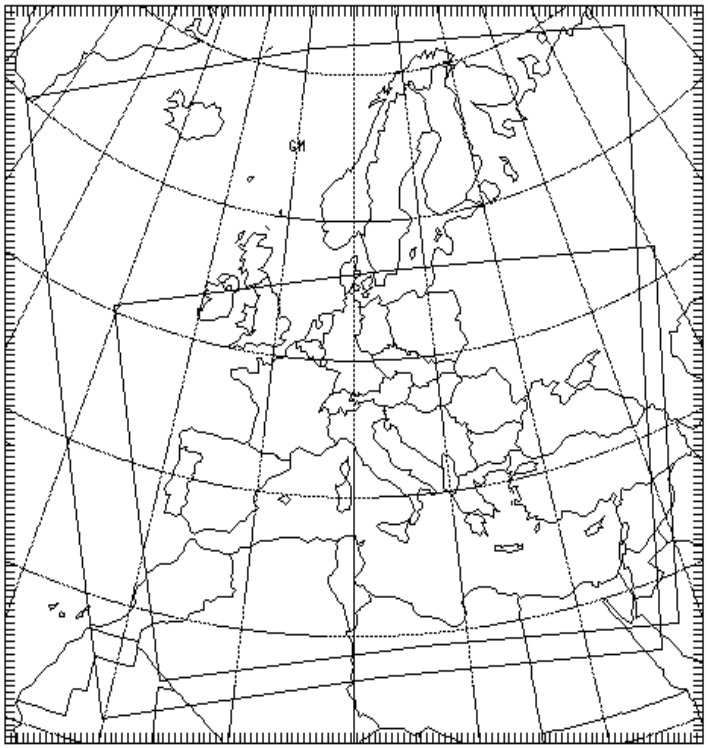
Salut'AIR	CityZEN	ATOPICA	IMPACT2C	DRIAS	Institutional	KiC E3P
•INERIS/IPSL •Primequal •Historical and projections (2050) •Emissions and climate	•INERIS •FP7 project •Reanalyses (past decade) •Projection (2030, emissions only)	•INERIS/IPSL •Env2011 •Historical and projections (2050) •Emissions projections and climate, focus on interactions with biosphere	•IPSL •FP7 •2°C Climate impacts on energy sector •2°C Climate impacts on water resource in the Med area •2°C Climate impacts on air quality	•IPSL •GICC / PNACC • National scale climate projections and dustribution	•INERIS •MED •supports French authorities for cost-benefits analyses of AQ/CC impacts •European Environment Agency •AQ reanalysis and projections	• IPSL lead •Extreme events (projections and diagnostics)

EURO-CORDEX

Modelling setup (base simulations)

WRF V3.2.1

- Domain
  - 50km, 120x117x32 pts
  - Includes CORDEX EURO and MED domains
- Physics
  - NOAH
  - Yonsei Univ. PBL
  - Kain-Fritsch convection
  - Rapid Radiative Transfer Model
  - 5-class micro physics (inc. mixed-phase & super-cooled water)
- Large-scale Forcing:
  - ERA-interim
  - IPSL-CM



Chimere v2009-185

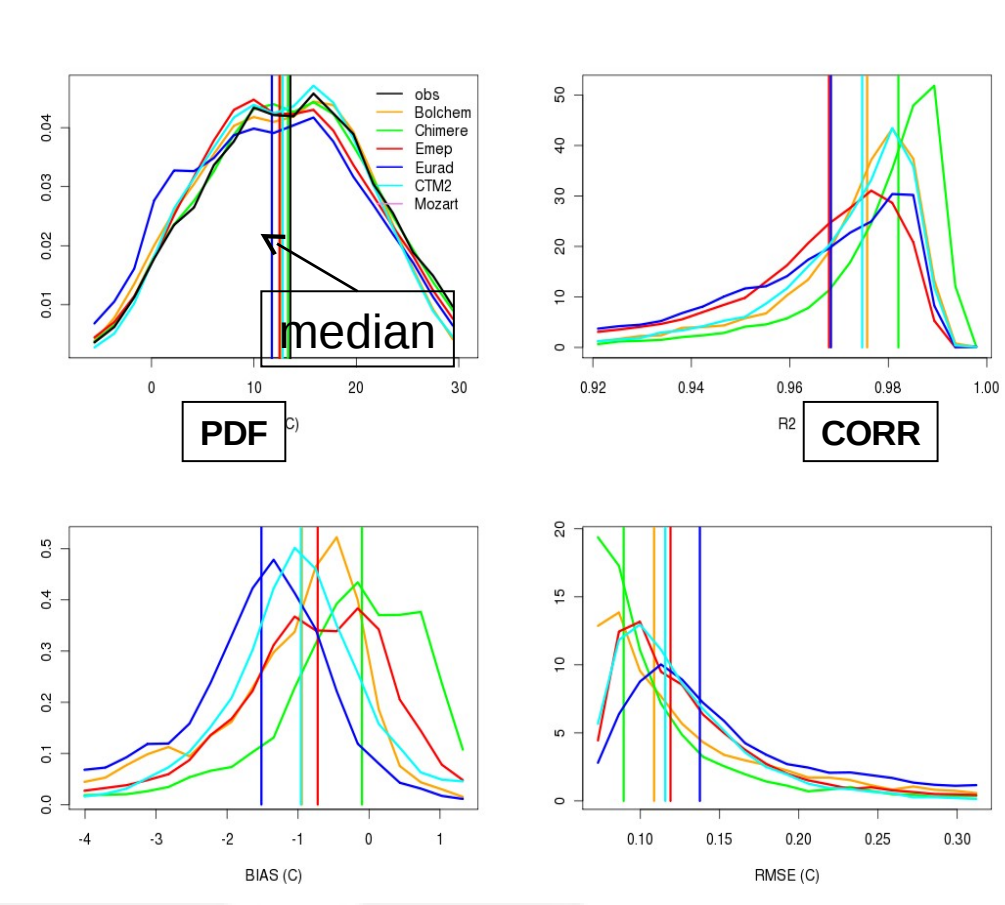
- Domain 0.5deg
- Boundary Conditions: INCA

Simulation schedule:

Large-scale Forcing	WRF 50km	WRF 18km (IMPACT2C)
ERA-Interim 1989-2008	Done (NOAH)	Planned Oct 2011
LMDz v3.3 1960-2005	Done (NOAH) +shorter period with diffusion scheme	Planned Oct 2011
LMDz v3.3 2005 - 2065	Planned Sep 2011	Planned Mar 2012

Model evaluation: scores 1998-2007: T2 daily max

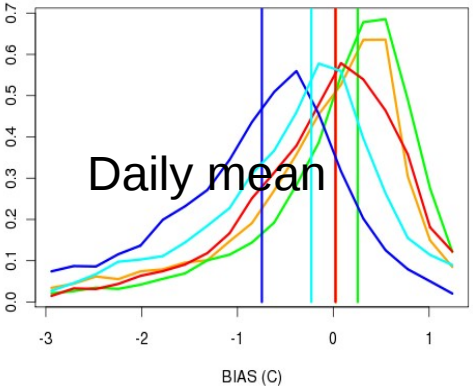
obs
Bolchem
Chimere / WRF
Emep
Eurad



WRF captures well daily max of surface temperature

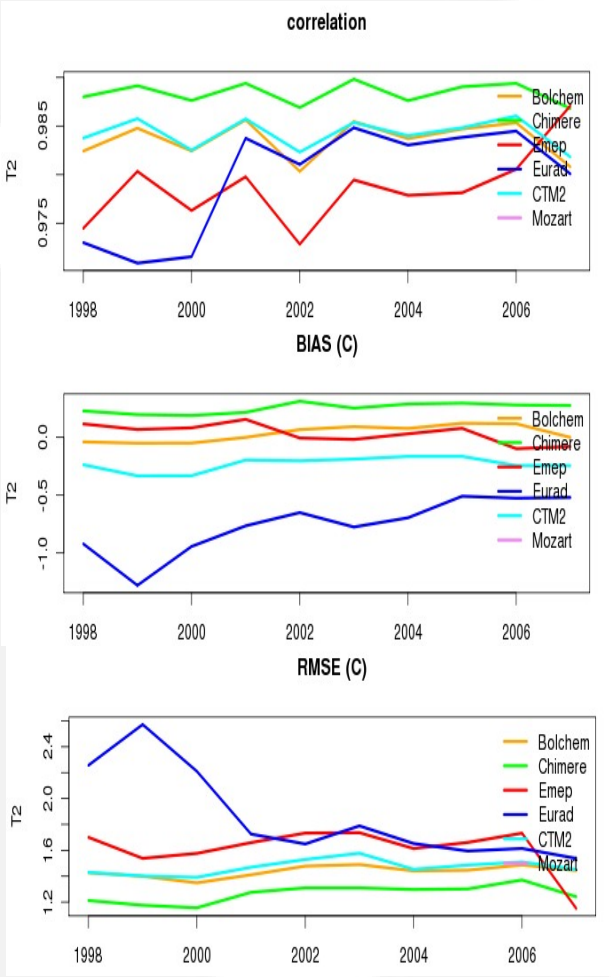
Performs better than any other model involved

Slight warm bias for daily mean (below)

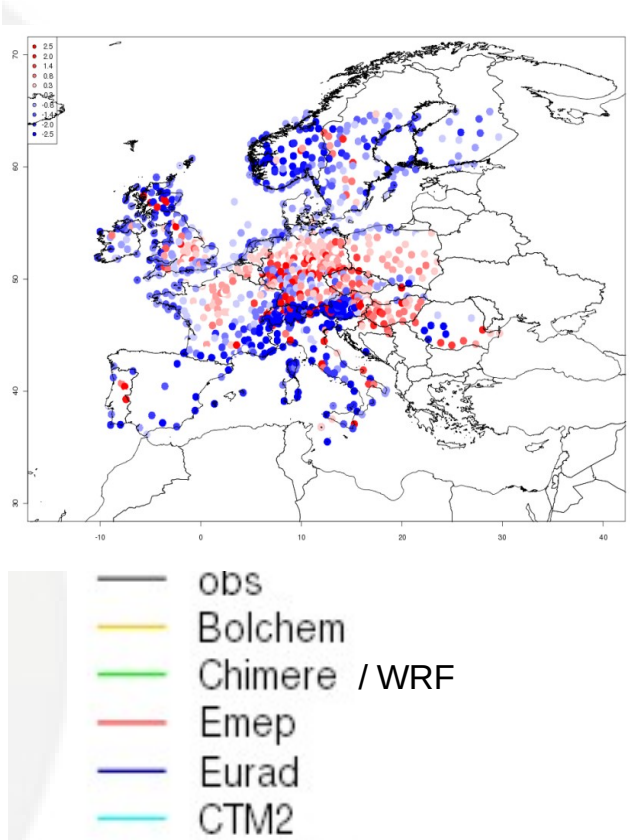


BIAS

Model evaluation: temporal and spatial variability of T2 scores



WRF/Chimere: Average bias / T2 daily means

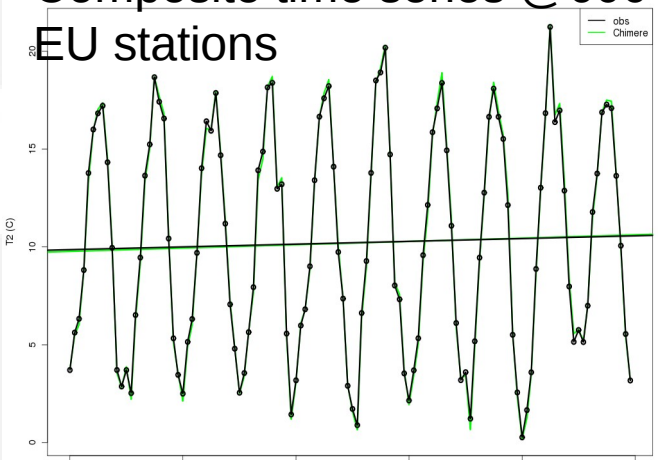


Consistent response in time (performances not impaired by outstanding years)

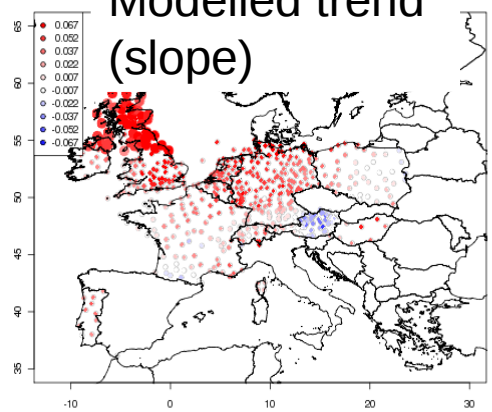
Negative biases along coastlines and over mountains, small or positive elsewhere

T2 trend (1998-2007)

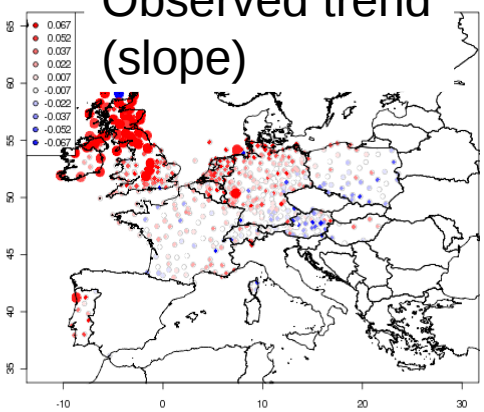
Composite time series @600 EU stations



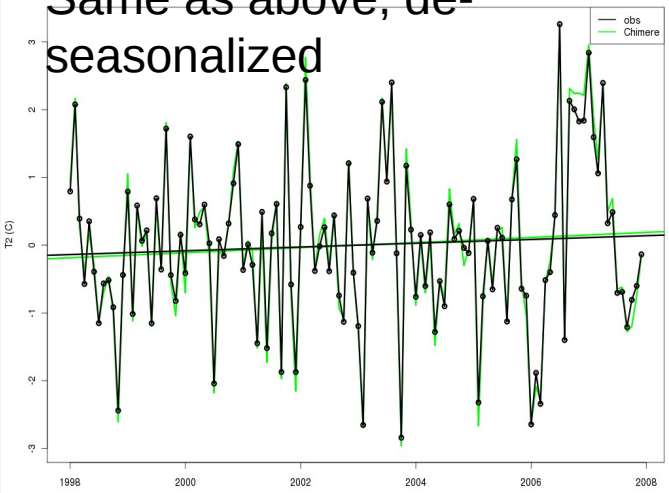
Modelled trend (slope)

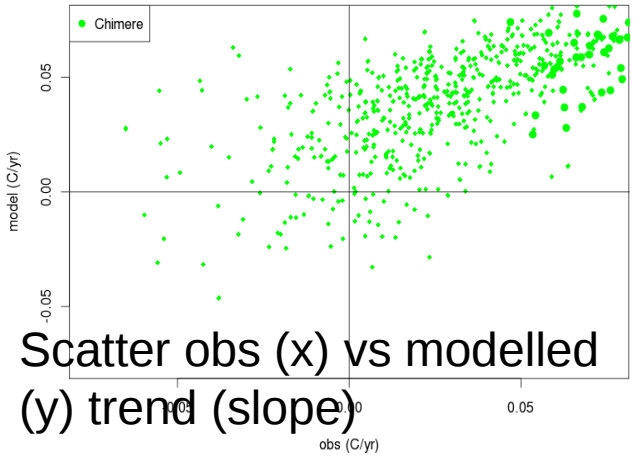


Observed trend (slope)



Same as above, de-seasonalized





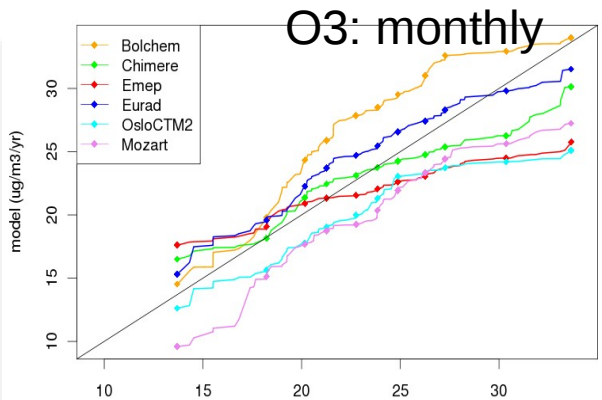
Scatter obs (x) vs modelled (y) trend (slope)

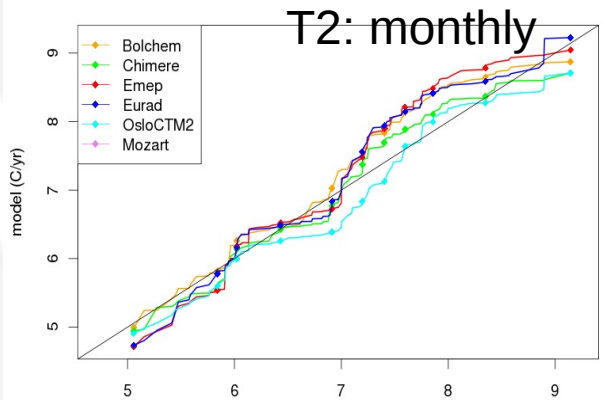
Slight positive trend, few locations where the trend is significant

Model captures well the T2 trend, mismatches limited to non-significant points

Interannual variability

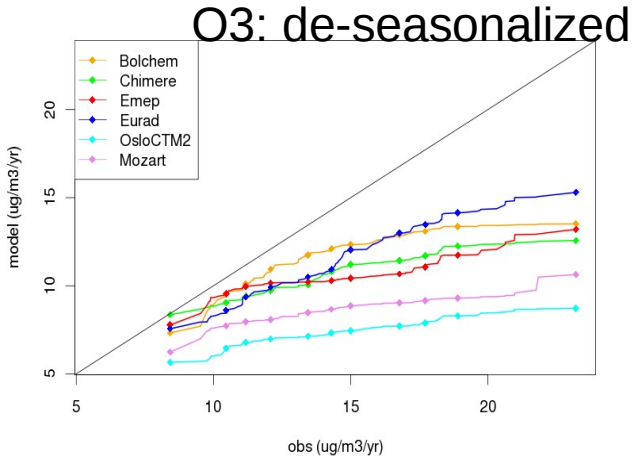
Quantile-quantile plots of the distribution (all stations) of the residuals of the linear fit of the monthly time series at all EU stations

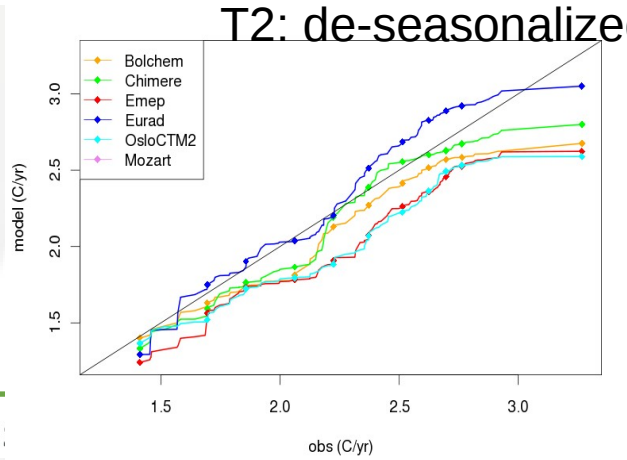




O3 interannual variability (besides the trend) is underestimated if we remove the seasonal cycle.

It is not the case for T2&W10





Part 2: Historical Climate free runs (in progress)

Scientific issues

- Model suite skill ?
- What information brought by the regional models ?

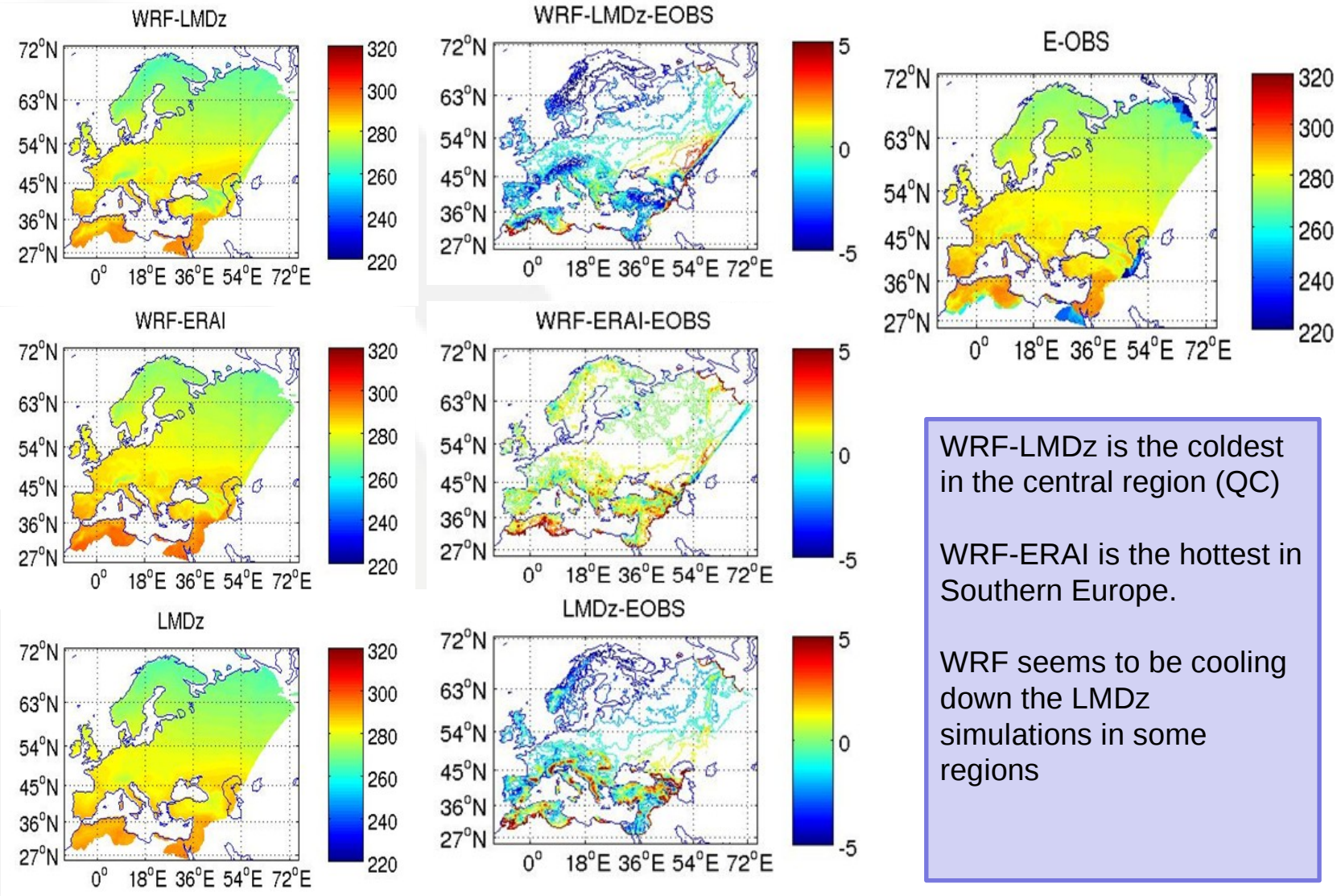
Time frame:

- 45yrs: 1960-2005

Evaluation with “observations”

- E-OBS gridded homogenized data

T2: average 1989-2005 (preliminary results)



WRF-LMDz is the coldest in the central region (QC)

WRF-ERAI is the hottest in Southern Europe.

WRF seems to be cooling down the LMDz simulations in some regions

Next studies

In the paper

- Improvement of variability at various time scales?
- Future vs. Historical period

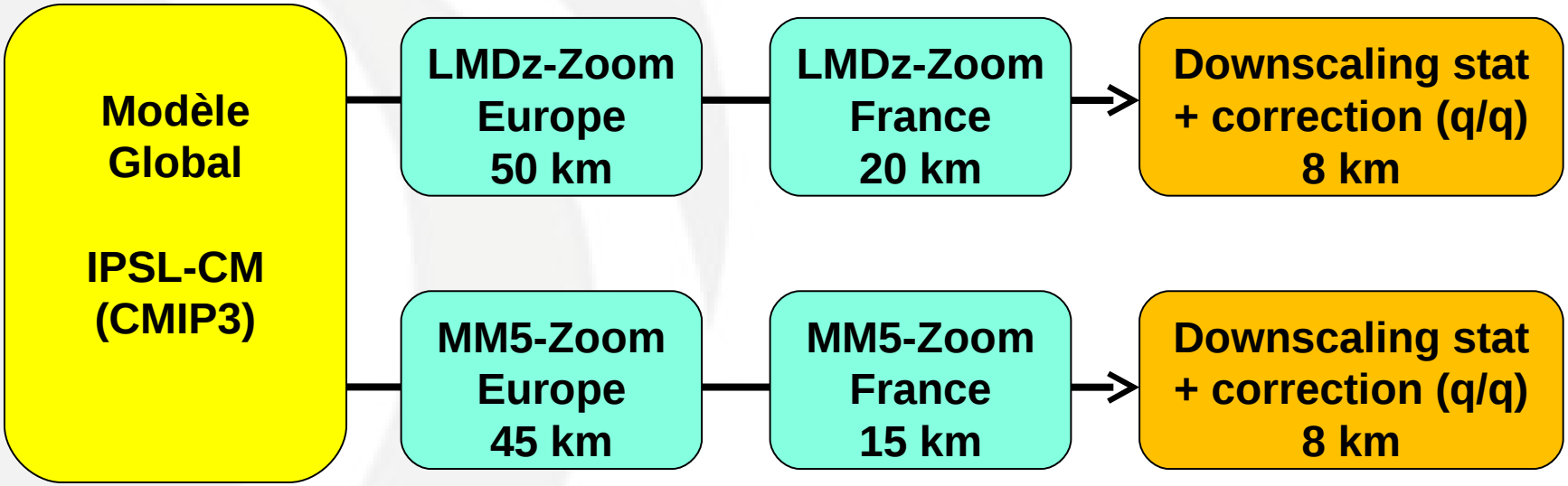
Later (soon)

- Extreme events (heat/cold waves), extreme precipitations, wind storms [improvement from large scale?), drought
- Higher resolution [expected Nov 2011]: 18 km resolution
- Downscaling at national level (8 km): DRIAS project

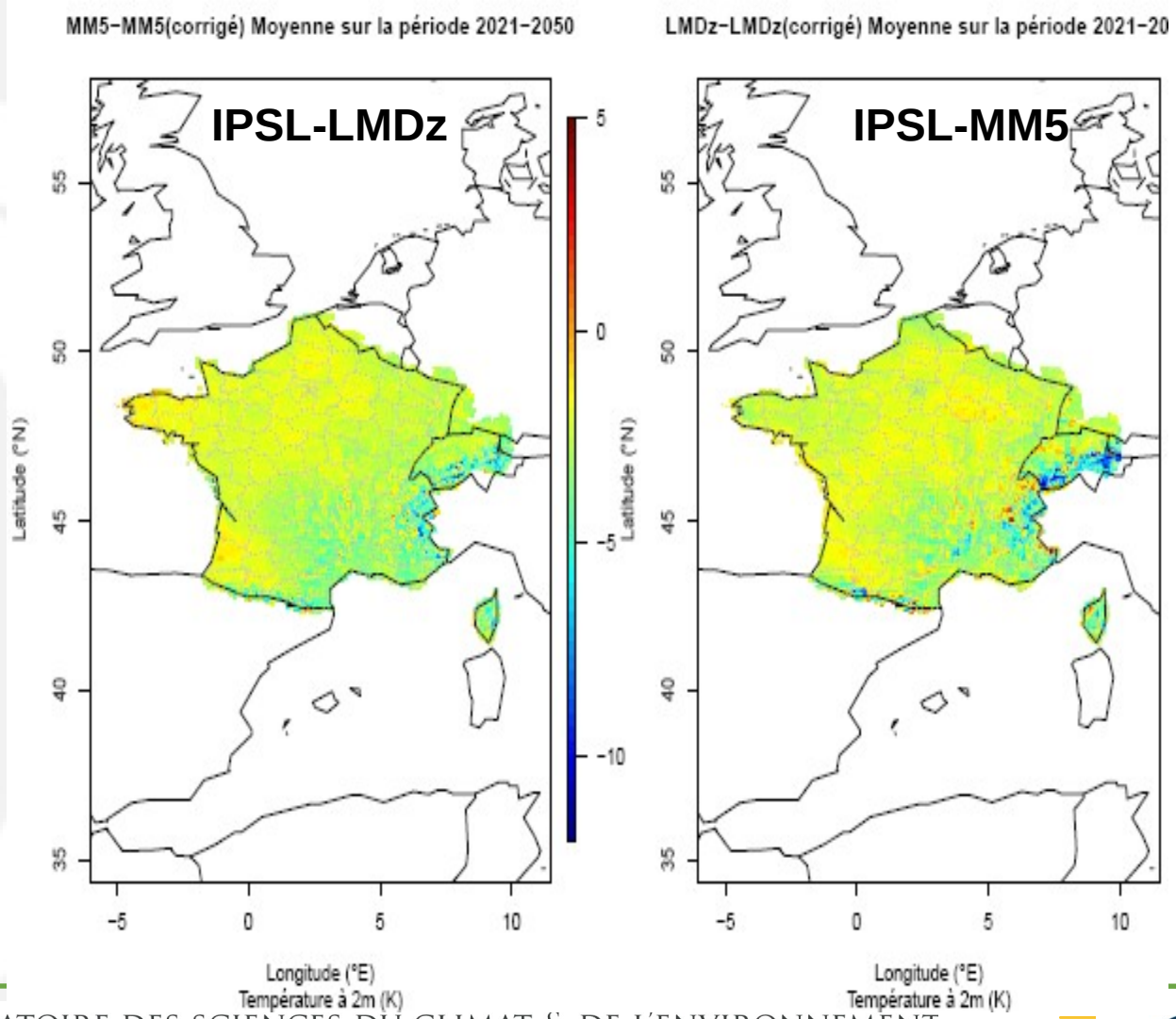
DRIAS - IPSL

2 chaînes de descente d'échelle issues du modèle de climat global de l'IPSL et utilisation des analyses SAFRAN de Météo-France

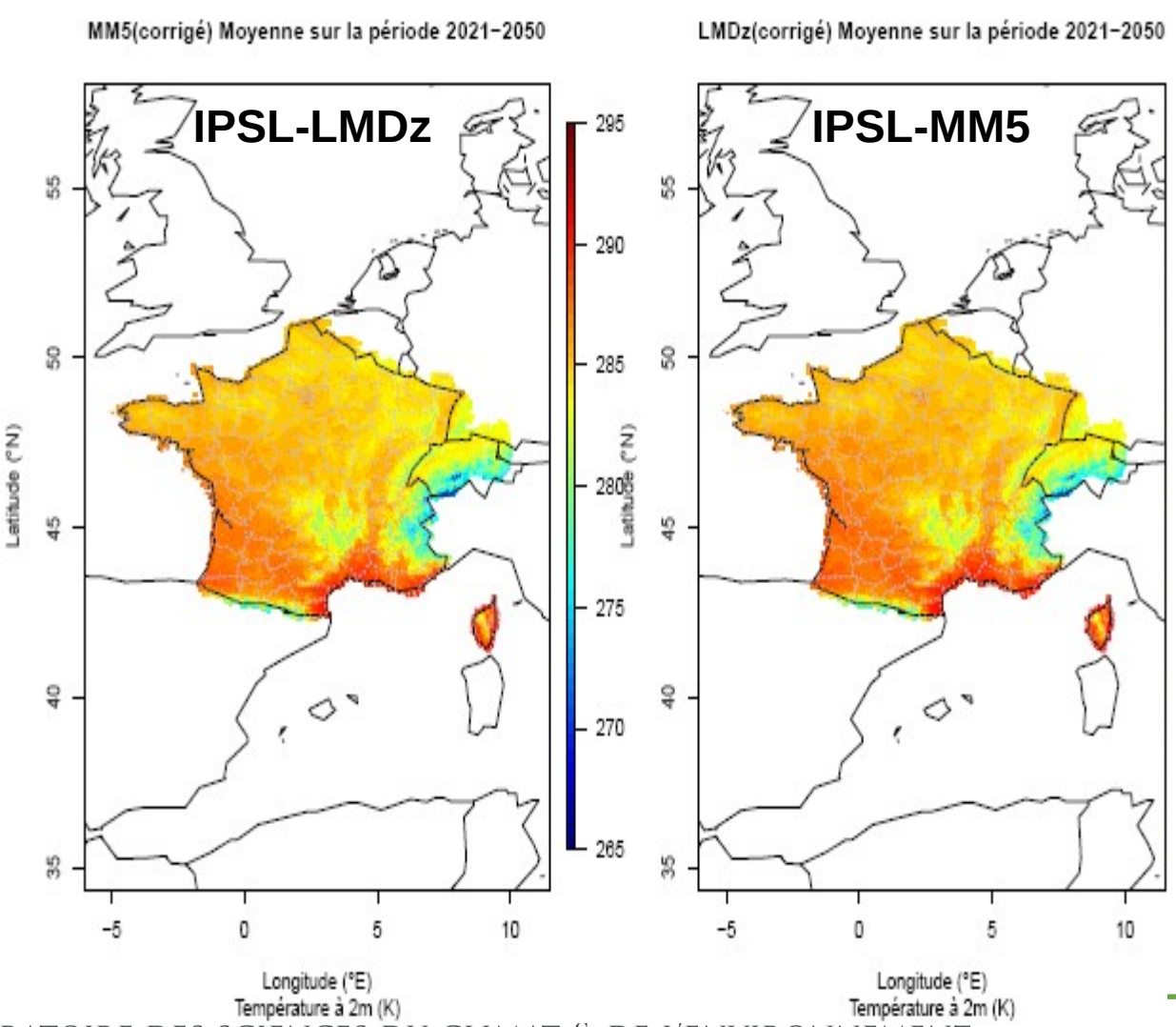
(avec Thomas Noël, Laurent Li, Mathieu Vrac, Julien Cattiaux, Sébastien Denvil)



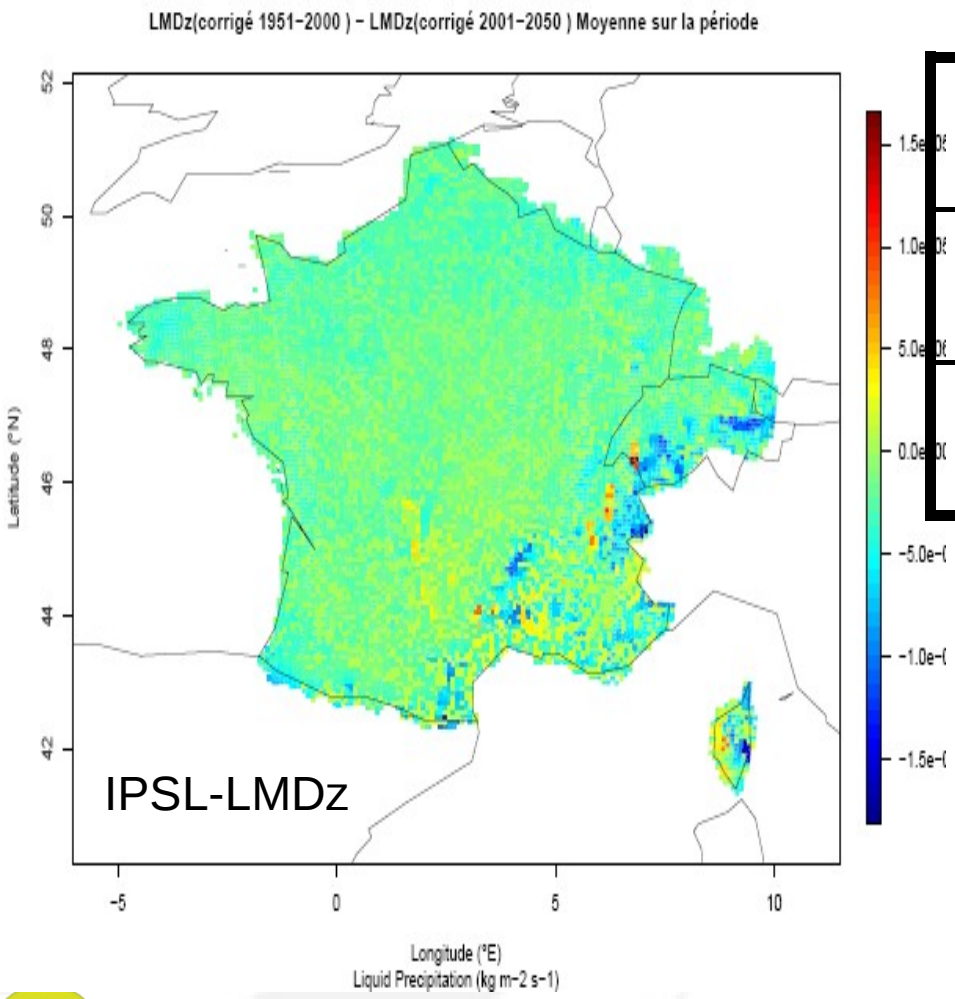
Correction statistique des données



Exemple de résultats : valeurs pour la période future, scénario A1B



Précipitation: un bon exemple pour illustrer l'indispensable expertise



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

Courtesy of Laurent Li

Conclusion générale sur les simulations

- Simulations période ERA-interim effectuées
- Simulations forçage IPSL-CM période historique effectuées
- Simulations « futur » d'ici septembre 2011
- Analyses « légères » en cours → juillet 2011
- Vérification des résultats effectuée sur ERAI