CORDEX simulations at CNRM

S. Somot (Météo-France / CNRM-GAME),
M. Déqué, A. Braun, A. Alias, F. Sevault, I. Beau, C. Dubois, Ph. Lucas-Picher, B. Decharme (J. Colin, M. Herrmann)

CORDEX: a coordinated international activity, under the WCRP umbrella that would develop a framework for:

i) the evaluation and intercomparison of regional downscaling models and methods as well as the definition of standards for the preparation and dissemination of model data, and

ii) the production of a multi-model ensemble of regional climate downscaling simulations for regions worldwide, which would significantly enhance the contribution of regional dynamical and statistical downscaling tools to future IPCC assessments.
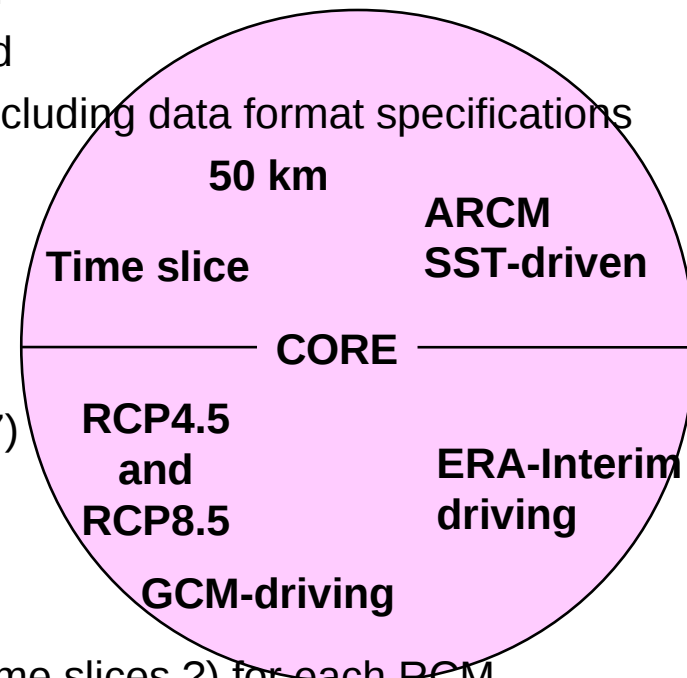
CORDEX

CnrS

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CNRS
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DE LA RECHERCHE
SCIENTIFIQUE

CORDEX

- **WCRP initiative for the Regional Climate Downscaling**
    - Leaded by F. Giorgi (ICTP) and C. Jones (SHMI)
    - Endorsed by WCRP in Dec 2008 with the creation of the TFRCD (Task Force on Regional Climate Downscaling) + a suite of workshops: Toulouse (Feb. 2009), Lund (May 2009), Lille (June 2010), Trieste (Mar. 2011)
    - Definition of several domains to be covered at 50 km
    - Participation from modelling groups all over the world
    - A general set of instructions for the CORDEX runs including data format specifications
    - A web portal and central database archive at DMI
    - A dedicated EGU session

- **CORE simulations**
    - Resolution: 50 km, Africa domain mandatory
    - ERA-Interim lateral forcing for validation (1989-2007)
    - Simulation: historical (1950-2005)
    - Simulation: scenario RCP4.5 (2005-2100)
    - Simulation: scenario RCP8.5 (2005-2100)
    - One driving GCM and one transient simulation (or time slices ?) for each RCM
    - Options: multiple GCMs for driving the RCD (uncertainty)
    - Options: other domains

50 km

Time slice

ARCM SST-driven

CORE

RCP4.5 and RCP8.5

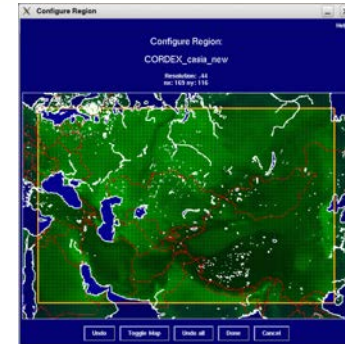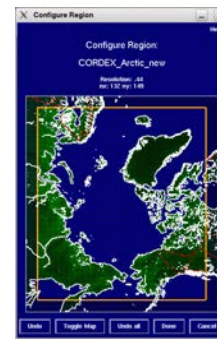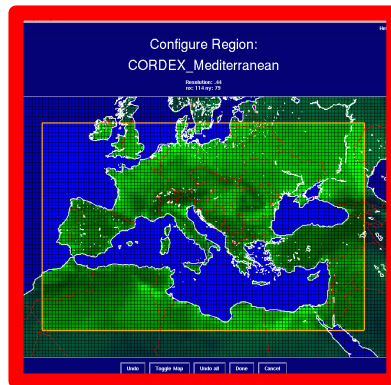**ERA-Interim driving**

GCM-driving

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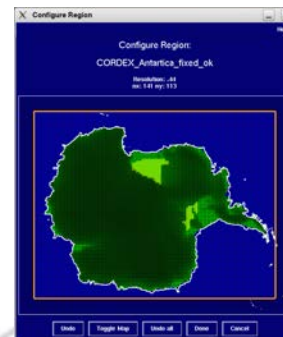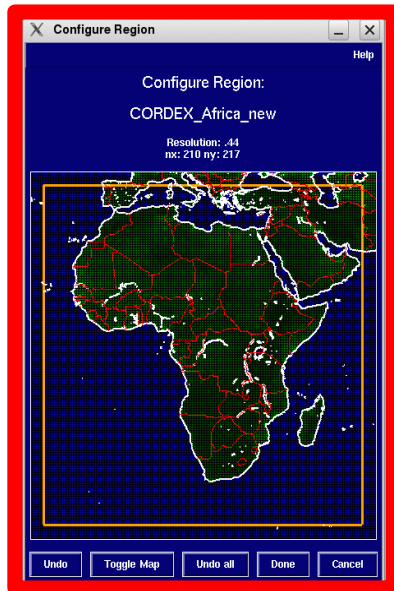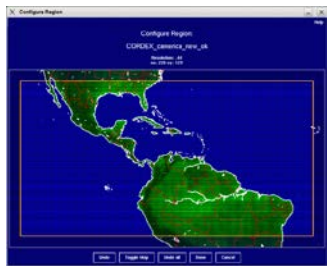# CORDEX: 12 domains at 0.44° or 50 km

NARCCAP OURANOS-UQAM

CORDEX@CNRM

PRUDENCE ENSEMBLES IMPACT2C

**HyMeX-ChArMex-MerMex MedCLIVAR CIRCE CLIMRUN**

AMMA ENSEMBLES

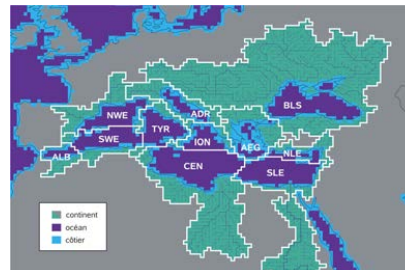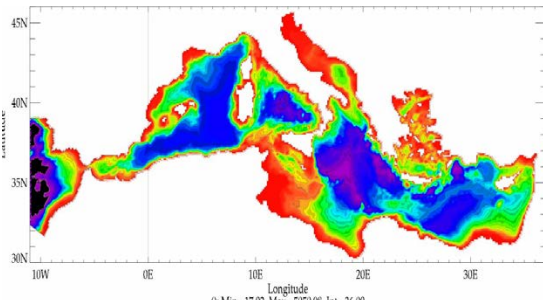# The Mediterranean domain in CORDEX: Med-CORDEX

- **Why do we propose a specific CORDEX Mediterranean sub-domain ?**
  - Climate change hot-spot, very strong regional features
  - Need for high-resolution RCM (Gibelin and Déqué, 2003; Gao et al. 2006; Herrmann et al. 2011)
  - Need for air-sea-land-hydrology coupling (Somot et al. 2008; Artale et al. 2010)
  - Already-existing Mediterranean climate modelling community: MedCLIVAR, HyMeX, CIRCE
  - RCSM: Regional Climate System Model (atmosphere, ocean, land surface, hydrology, river)
  - Very High resolution RCM (up to 10 km for the same domain)
  - Ocean model scenarios, Land surface model scenarios

  - Specific design for the RCSM, land surf and ocean runs (task force in HyMeX)
  - Main goals: sharing good practices, enhance the communication between the various communities (ocean, atmo, land, hydrology), create new evaluation methods for the multi-component RCSM
  - Best use of the new satellite products and new in-situ dataset for model evaluation
  - Best use of the HyMeX synergy (in-situ field campaign, physical process community)
  - Work togather to the improvement of the RCSM and of their components
  - Deliver quality-checked regional climate products to the climate community and the impact community
  - Deliver improved messages about the climate change in the Mediterranean area for the next IPCC report (IPCC-AR5)
  - hymex-ttm3@cnrm.meteo.fr, P. Ruti (ENEA), S. Somot (CNRM), EOS paper
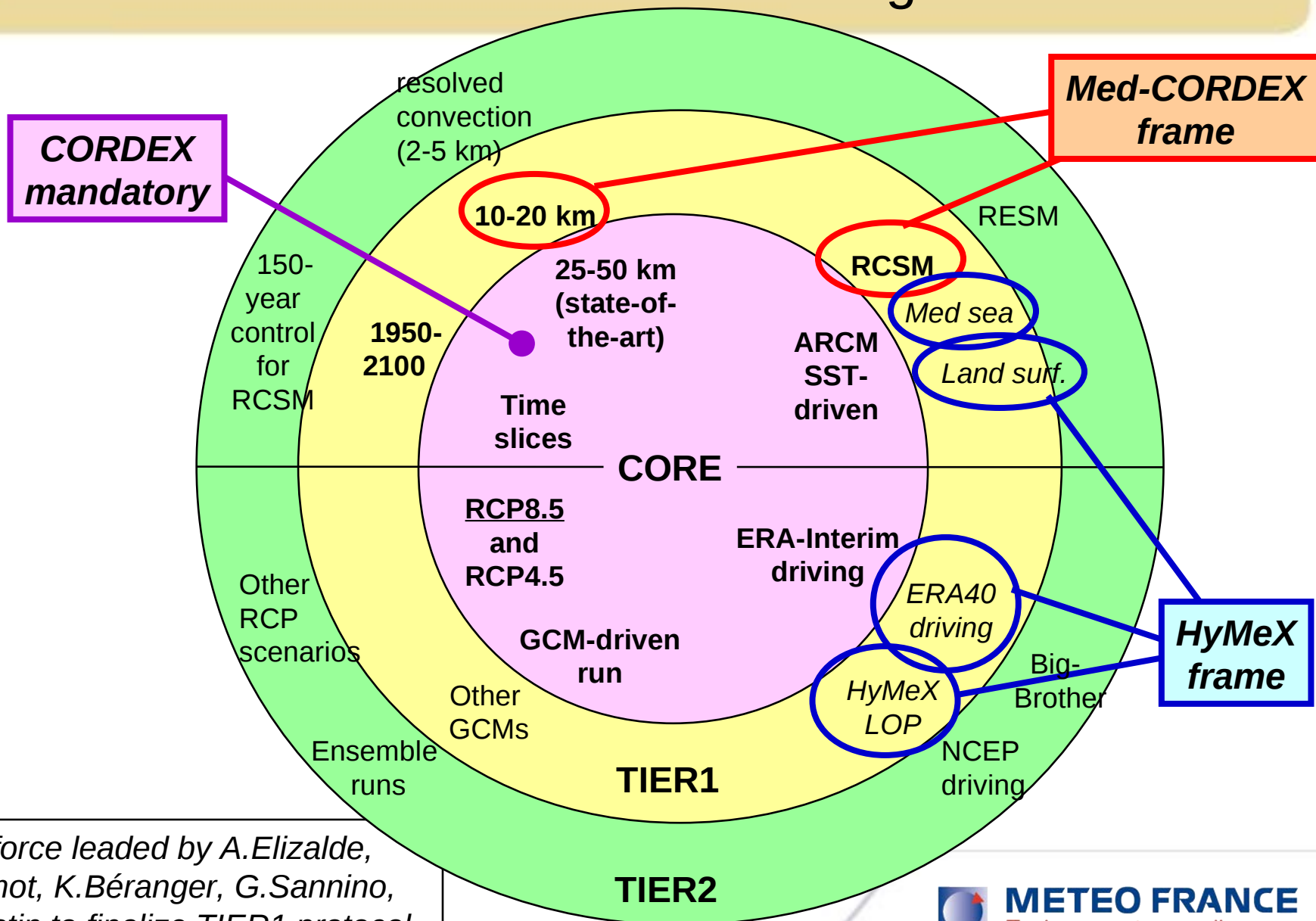
Med-CORDEX minimal domain
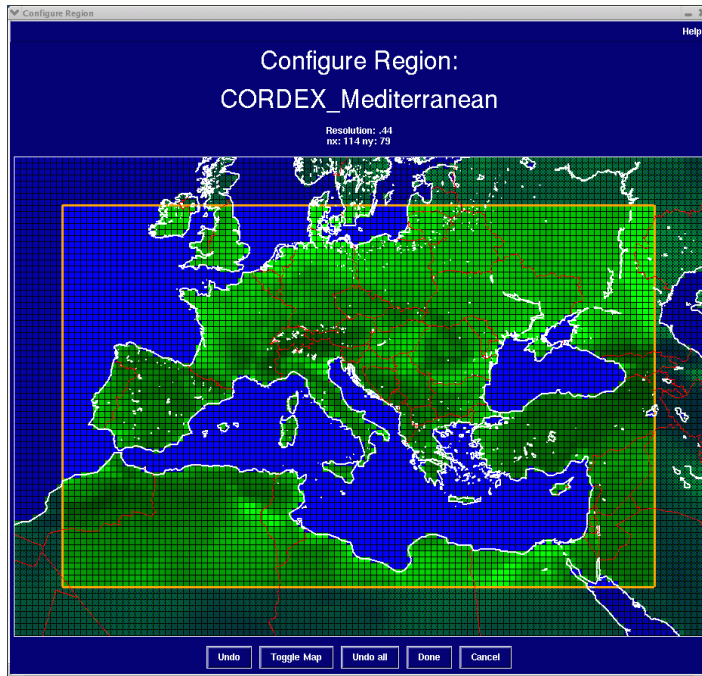
Definition:

- The domain covers the whole Mediterranean and Black Seas as well as their catchment basins plus the ocean model buffer zone

- It could be extended to cover the Sahara (aerosols), the near Atlantic (cyclones), the Middle-East

Med-CORDEX run design

CORDEX mandatory

Med-CORDEX frame

HyMeX frame

resolved convection (2-5 km)

10-20 km

RESM

150-year control for RCSM

1950-2100

25-50 km (state-of-the-art)

RCSM

Med sea

Land surf.

ARCM SST-driven

Time slices

CORE

RCP8.5 and RCP4.5

ERA-Interim driving

Other RCP scenarios

GCM-driven run

ERA40 driving

Other GCMs

HyMeX LOP

Big-Brother

Ensemble runs

NCEP driving

TIER1

TIER2

Task force leaded by A.Elizalde, S.Somot, K.Béranger, G.Sannino, S. Bastin to finalize TIER1 protocol

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Med-CORDEX modelling participant list

Regional Climate System Model

ENEA
MPI
CNRM
LMD
Univ. Belgrade
MORCE-MED
UCLM/UPM
COSMO-CLM (GUF)
INSTM
IC3

atm-ocean-land-river

atm-ocean-land

in development

Atmosphere RCM

Same ARCM as in RCSM (25-50km)
RegCM, ALADIN, WRF, ETA, LMD, PROMES, REMO, COSMO-CLM
+ other ARCM (50 km)
TAU, IIBR, Univ. Istanbul (RegCM)
+ very high-resolution ARCM (10km)
WRF, ALADIN, RegCM, COSMO-CLM (KIT)

Still open to new "players"

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Med-CORDEX scenario: the GCM/RCSM matrix

CIRCE - A1B

| RCM/GCM		GCM			
		CNRM	MPI	IPSL	INGV
RCM	ENEA	X	X		
	MPI				X
	LMD			X	

Med-CORDEX – RCP8.5 (RCP4.5)

RCM/GCM		CNRM	MPI	IPSL	INGV	HadGEM	EC-Earth
RCSM	ENEA	?	?				
	MPI		X				
	CNRM	X					
	LMD			X			
	U. Belgrade				X		
	MORCE-MED			X			
	UCLM/UPM					?	
	COSMO-CLM		?				

The CNRM Regional Climate System Model (RCSM) including atmosphere-land surface-river-ocean
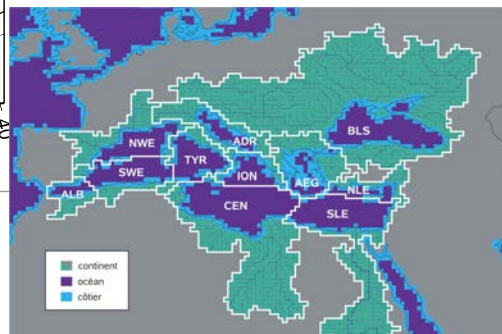
ALADIN-Climat v5 + ISBA (ERA40, ERAInterim, GCM forcing) 50 km
(Déqué and Somot, 2008; Colin et al. 2010)
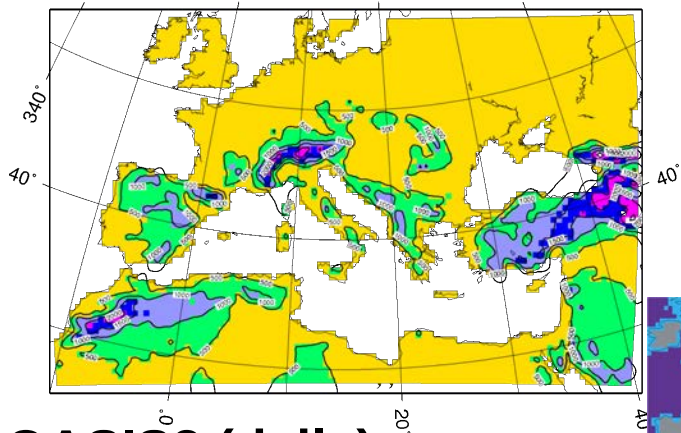
OASIS3 (daily)
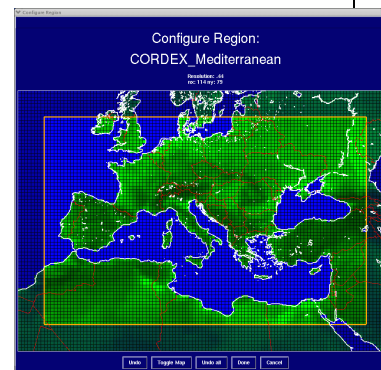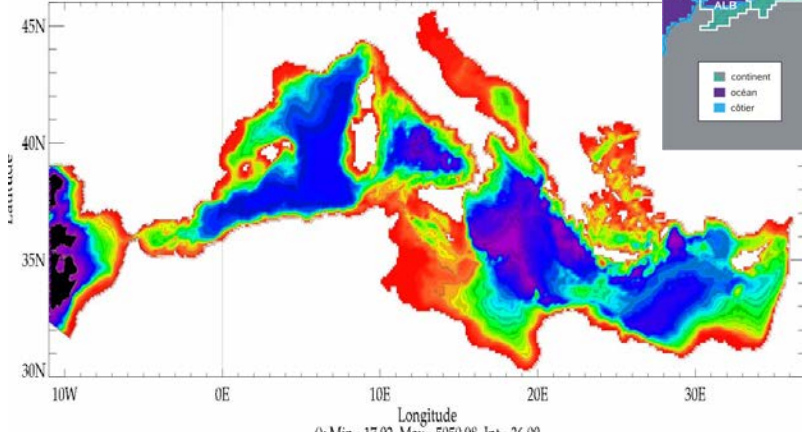
Med-CORDEX domain and frame: ERA-Interim period (1989-2008)

TRIP river routine scheme at 50 km
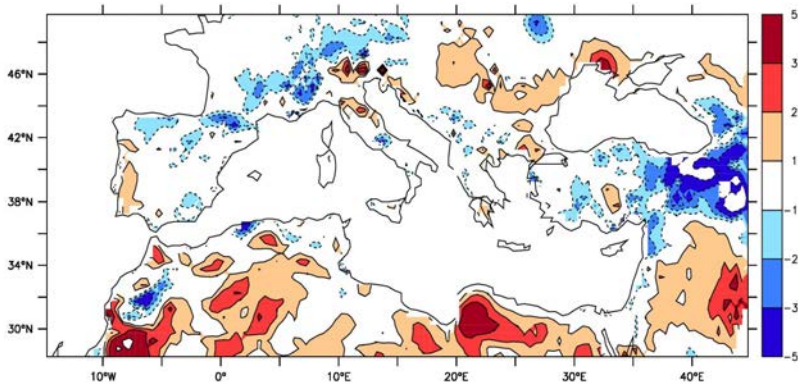(CNRM modified version, Decharme et al. 2010)

NEMOv2-MED8 (10 km)
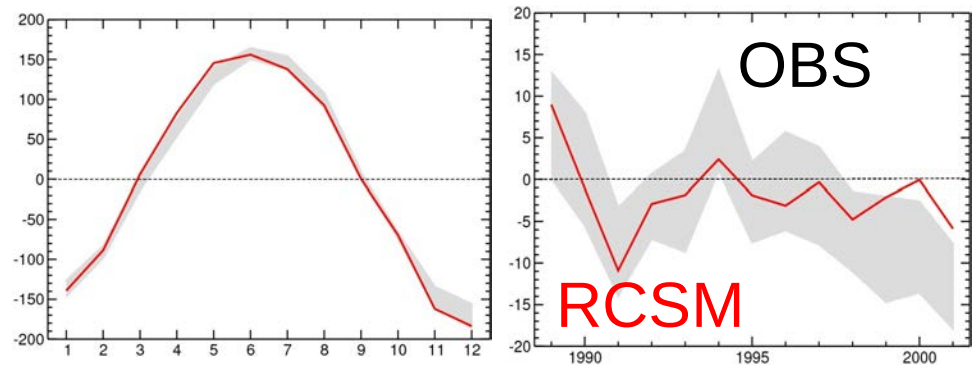(Sevault et al. 2009, Beuvier et al. 2010, Herrmann et al. 2010)

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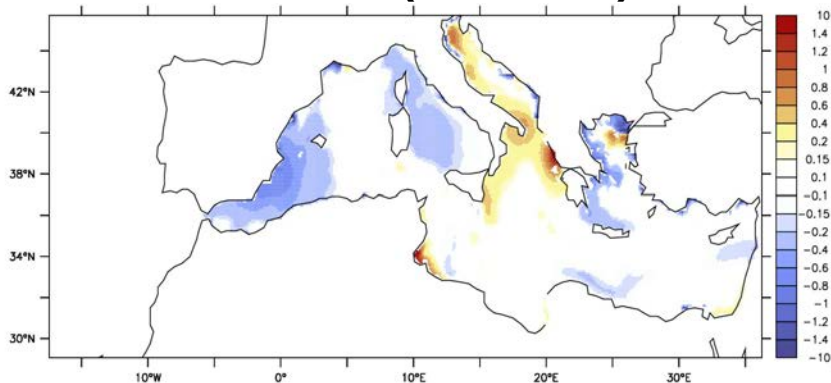Toujours un temps d'avance

Med-CORDEX ERA-Interim RCSM run at CNRM

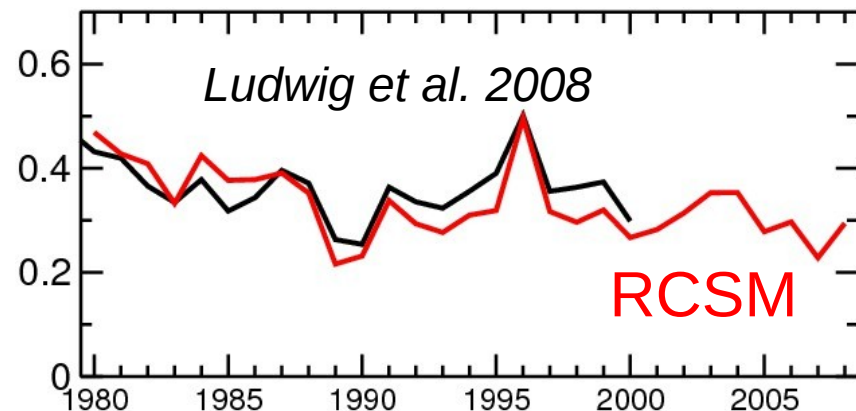**2m Temperature bias wrt CRU (°C)
in Summer (JJA) 1980-2001**

**Med Sea net surface Heat Budget:
SW+LW+LH+SH (W/m2, 1989-2001)**
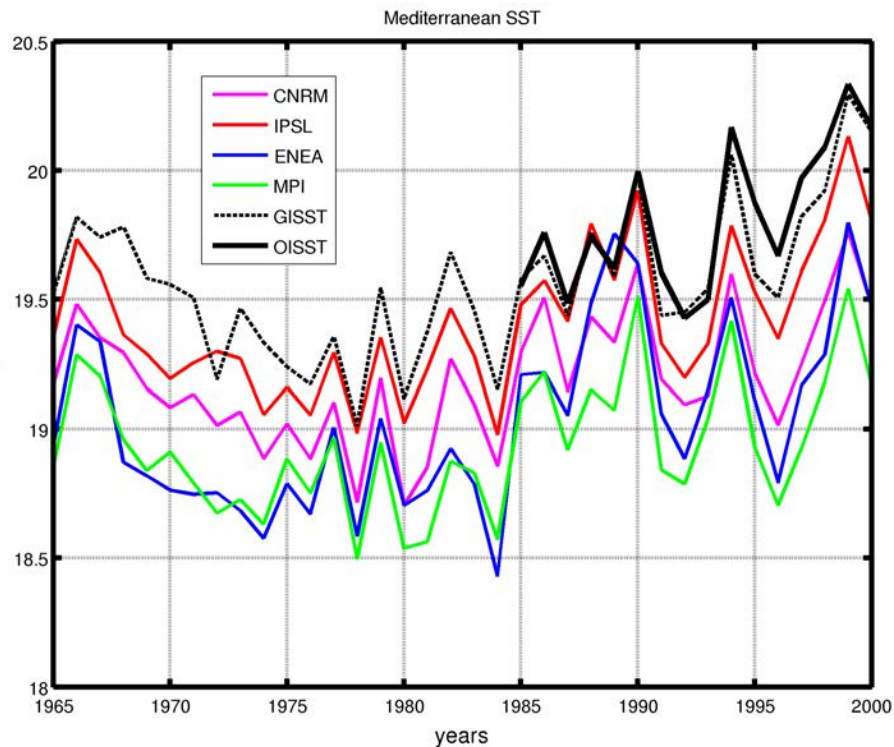

OBS

RCSM

**SSS bias wrt MedAtlas-II (psu)
in Winter (1989-2008)**
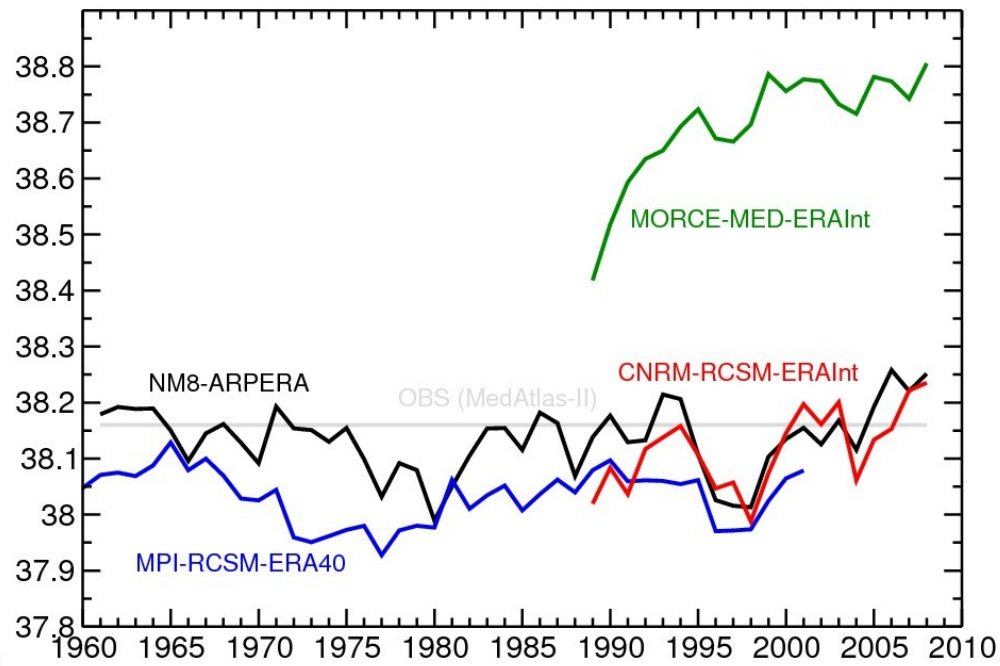

Mediterranean Sea river flux (mm/d)

Ludwig et al. 2008

RCSM

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First Med-CORDEX intercomparison

SST interannual time series
RCSM driven by ERA40, 1965-2000

SST interannual time series
RCSM driven by ERA40, 1965-2000

Li et al. (2011), MedCLIVAR book, Chap. 7 (figure made by P. Ruti)

Ruti et al. (in prep.), MedCORDEX , (figure made by C. Dubois)

Conclusion: CORDEX at CNRM

- ALADIN-Climat, version 5 (Colin et al. 2010; Herrmann et al. 2011)
- Configuration: 50km and 12km resolution, ARCM and RCSM
- Domain: Africa, North America, Mediterranean (CNRM)
- Domain: Europe (50km: Hungarian met service; 10km: CHMI)
- Open to scientific collaborations for other domains
- ERAInterim runs (1989-2008): first runs ok for Africa (50km), North America (50km), Mediterranean (50km, 12km, RCSM).
- RCP driven runs: ready to be launched
- MedCORDEX (official domain in CORDEX):
CNRM shares the co-leadership with ENEA

more than 10 modelling centers (ARCM, RCSM and 10km runs), regular meetings, a Med-CORDEX database at ENEA, first ERAInterim runs ok, a dedicated evaluation team, synergy Med-CLIVAR/Med-CORDEX/HyMeX, first EOS paper (Ruti et al., in prep.), no coordinated SDS effort in Med-CORDEX yet