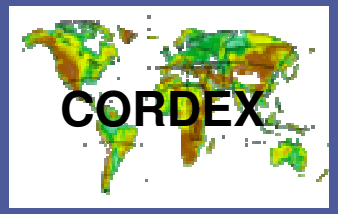

The international Med-CORDEX initiative:

A multi-component and multi-model approach to study the physical processes, the variability and the trends of the Mediterranean regional climate system

S. Somot (Météo-France / CNRM) & the Med-CORDEX team:

The Med-CORDEX team:
Paolo Ruti, Samuel Somot, Florence Sevault, Clotilde Dubois, Laurent Li, Philippe Drobinski, Sophie Bastin, Karine Béranger, Miguel Gaertner, Clemente Gallardo, Pedro Galán, Adriana Carillo, Gianmaria Sannino, Bodo Ahrens, Jennifer Brauch, Andreas Dobler, Vladimir Dj, Borivoj Rajkovic,Silvio Gualdi, Alberto Elizalde Arellano, Daniela Jacob, Baris Onol, Samiro Khodayar, Serge Planton, Piero Lionello, Filippo Giorgi

cnrs
dépasser les frontières

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CORDEX

Evaluating and Improving Regional Climate Projections

Outcomes of the Toulouse WCRP workshop – 11-13 February 2009

The main objectives of CORDEX:

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

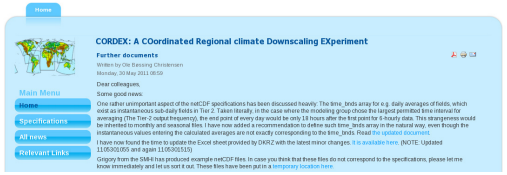
i) the evaluation and intercomparison of regional downscaling models and methods as well as the definition of standards for the preparation and dissemination of model data, and

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

- WCRP initiative for the Regional Climate Downscaling
  - Leaded by F. Giorgi (ICTP) and C. Jones (SHMI)
  - Participants from all over the world
  - Definition of several domains to be covered at 50 km,
  - Use of ERAInterim driven runs for evaluation
  - Priority to the Africa domain
  - Priority to RCP4.5 and RCP8.5 scenario
  - Endorsed by WCRP in Dec 2008 with the creation of the TFRCD (Task Force on Regional Climate Downscaling)
  - A suite of workshop: Toulouse (Feb. 2009), Lund (May 2009), Lille (June 2010), Trieste (Mar. 2011)

CORDEX climate data archive

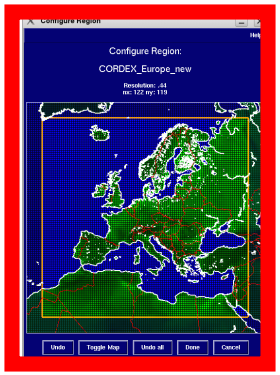


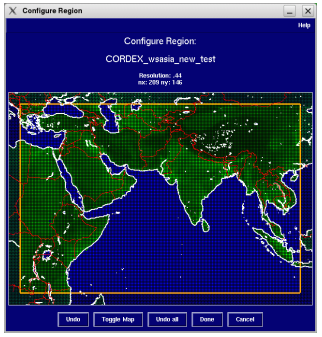
- Pratical details
  - A general set of instructions for the CORDEX runs
  - A web portal at DMI
  - Data format specifications
  - A dedicated EGU session
  - The coordination of the regional CORDEX domain definition
  - The submission of proposals (national, european) to get funded

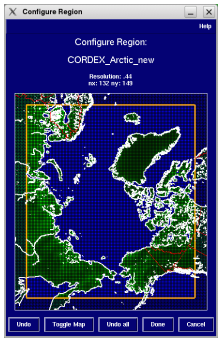
CORDEX: 12 domains at 0.44° or 50 km

NARCCAP

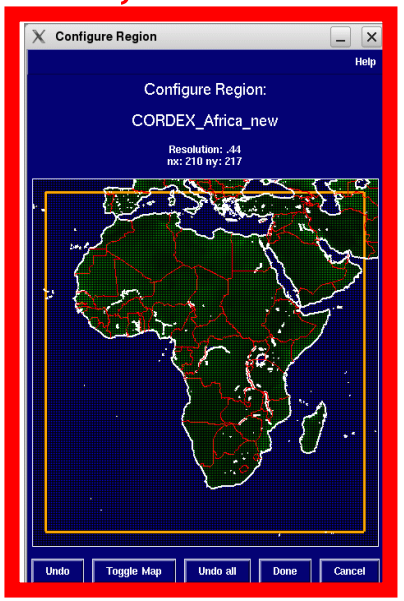
ENSEMBLES
IMPACT2C

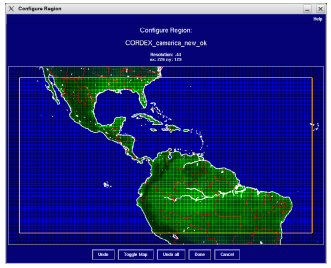


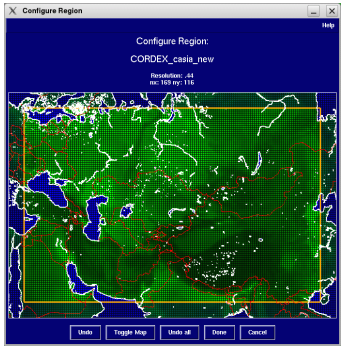


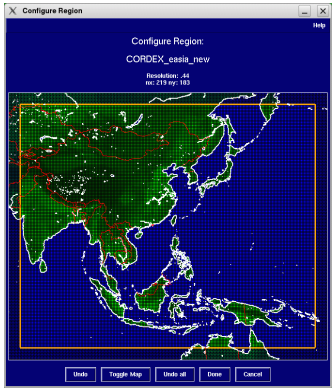


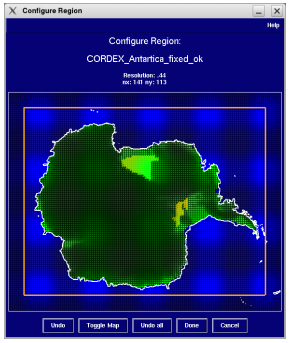
Mandatory domain
AMMA, ENSEMBLES



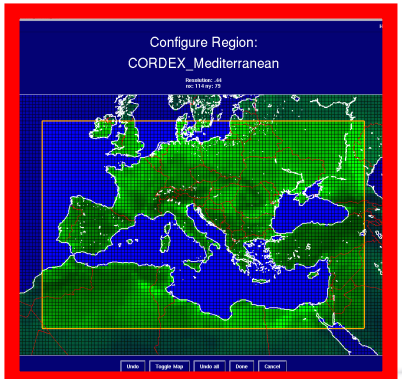




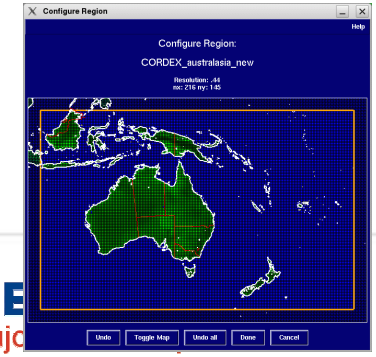




CLARIS-LPB

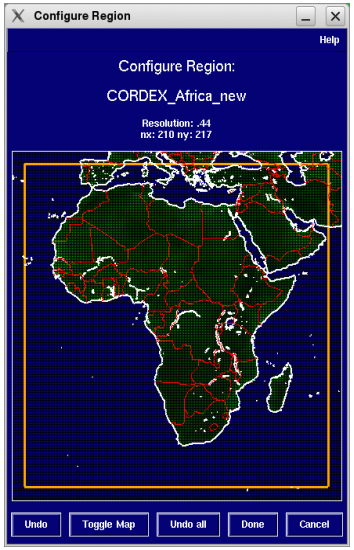


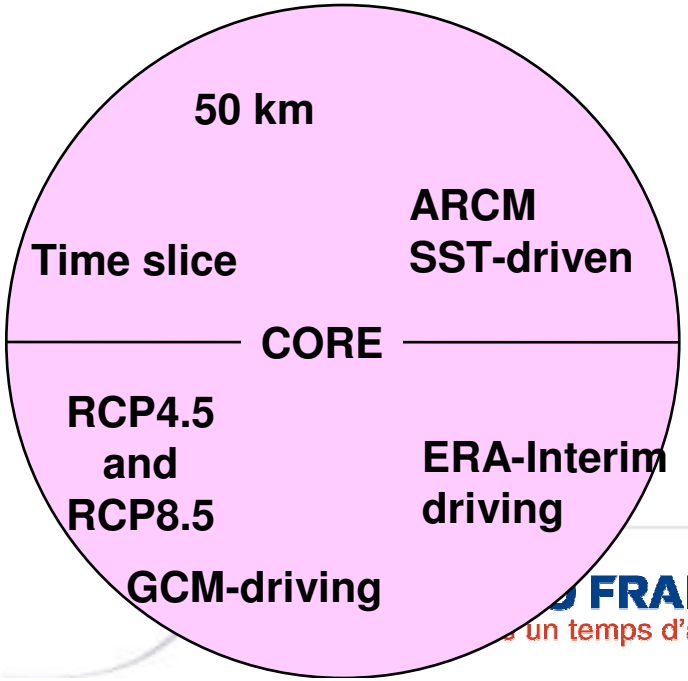
HyMeX
MedCLIVAR
CIRCE
CLIMRUN



CORDEX: 4 runs per chosen domain

- 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 in order to capture the inter-model uncertainty
  - Options: other domains





The Mediterranean domain in CORDEX: Med-CORDEX

- Why do we need a specific Mediterranean sub-domain ?
  - A specific area: climate change hot-spot, very strong regional features
  - Need for very high-resolution RCM (Gibelin and Déqué, 2003; Gao et al. 2006)
  - Need for air-sea-land-hydrology coupling (Somot et al. 2008; Artale et al. 2010)
  - To serve the scientific objectives of MedCLIVAR and HyMex
  - Natural follow-on of the CIRCE project (modelling community)
  - Financial support: HyMex context ? EU call ? CIRCE-2 ?

- Mediterranean specific scientific goals
  - Share expertise in multi-component regional climate modelling (good pratices)
  - Prepare clean model intercomparison for ARCM and RCSM
  - 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 with the in-situ field campaign (2012-2014)
  - 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)

The Med-CORDEX domain

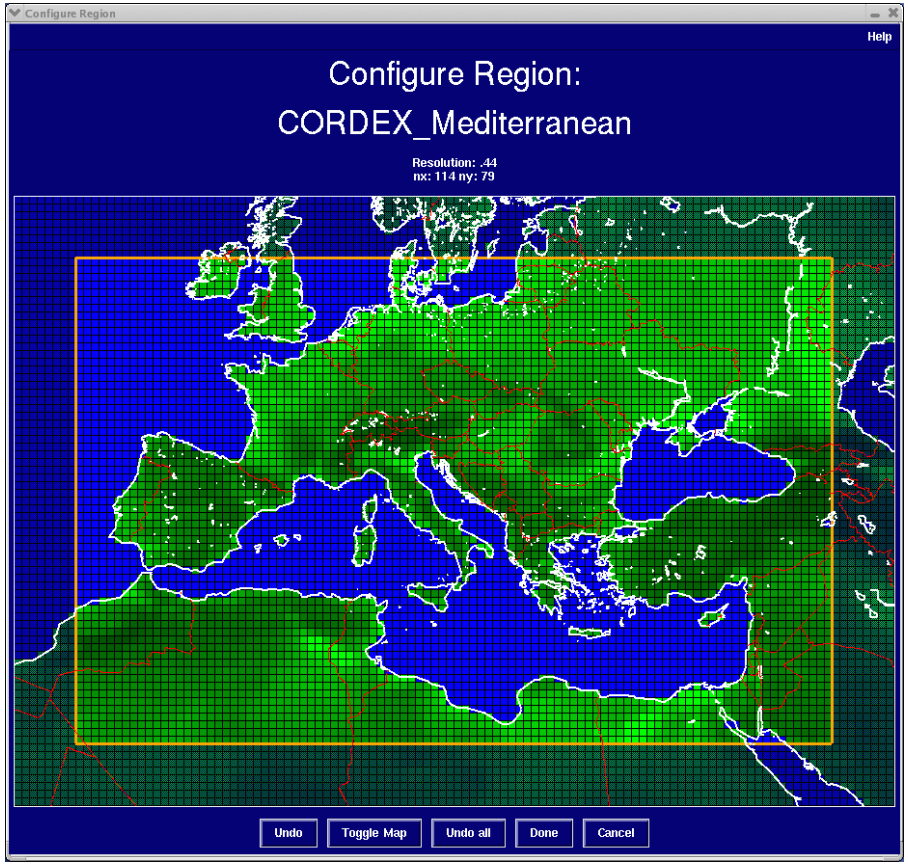
- CORE simulations (same as all the other CORDEX domains)
  - One common Mediterranean domain (Med and Black Seas + catchment basin excluding the Nile)
  - Resolution: 50 km
  - ERA-Interim lateral forcing for validation (1989-2007)
  - Simulations: historical (1950-2005) – RCP4.5 and/or RCP8.5 scenarios (2005-2100)
  - One driving GCM and one transient simulation for each RCM

- TIER1 simulations
  - RCSM: Regional Climate System Model (atmosphere, ocean, land surface, hydrology, river)
  - Very High resolution RCM (up to 10 km for the same domain)
  - Transient runs mandatory for the RCSM
  - Other driving GCMs
  - ERA40 forcings
  - The HyMeX Long Observing Period 2010-2020 for a better evaluation
  - Ocean model scenarios, Land surface model scenarios

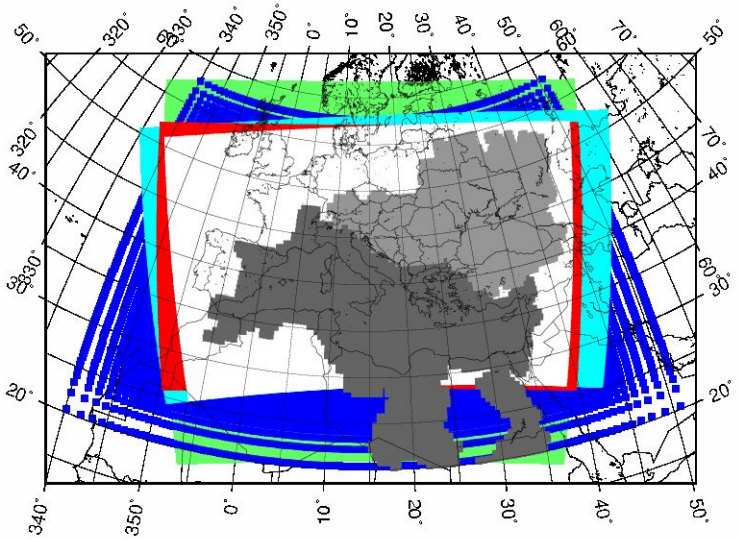
- TIER2 simulations
  - NCEP forcing, Big-Brother approach, RCSM control run, run with explicit convection at 2 km, RESM, other scenarios, other members for ensemble simulations

Med-CORDEX domain

MedCORDEX minimal domain



1. CIRCE RCM domain: ENEA, MPI, LMD
2. Hymex domain: CNRM
3. MedCORDEX minimal domain in white
4. Medit. And Black seas catchment basins in grey



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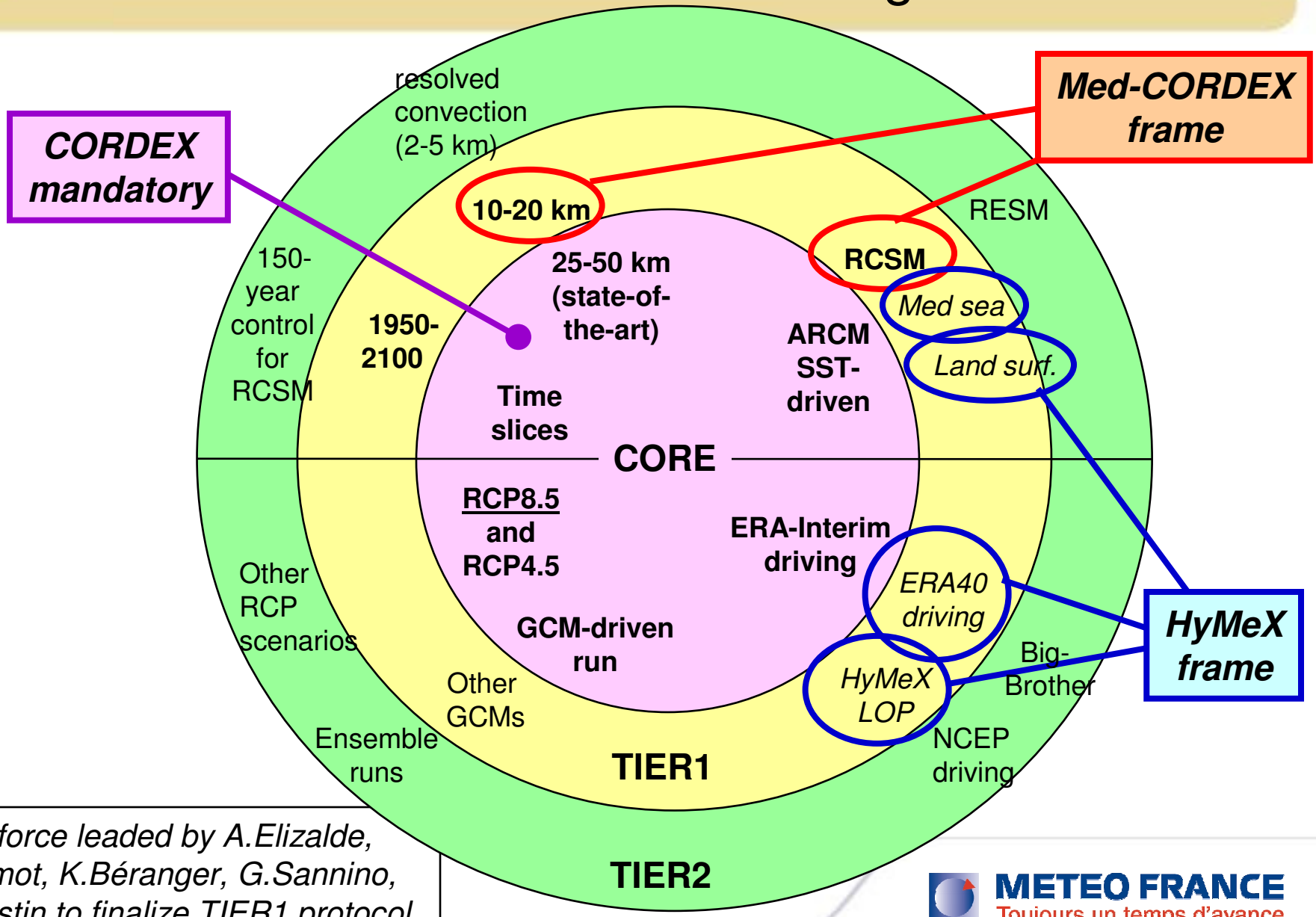
Med-CORDEX run design



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

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Med-CORDEX participant list

ENEA *atm-ocean-land-river*

MPI *atm-ocean-land*

CNRM

LMD

Univ. Belgrade

MORCE-MED

UCLM/UPM

COSMO-CLM (GUF)

INSTM

IC3 *in development*

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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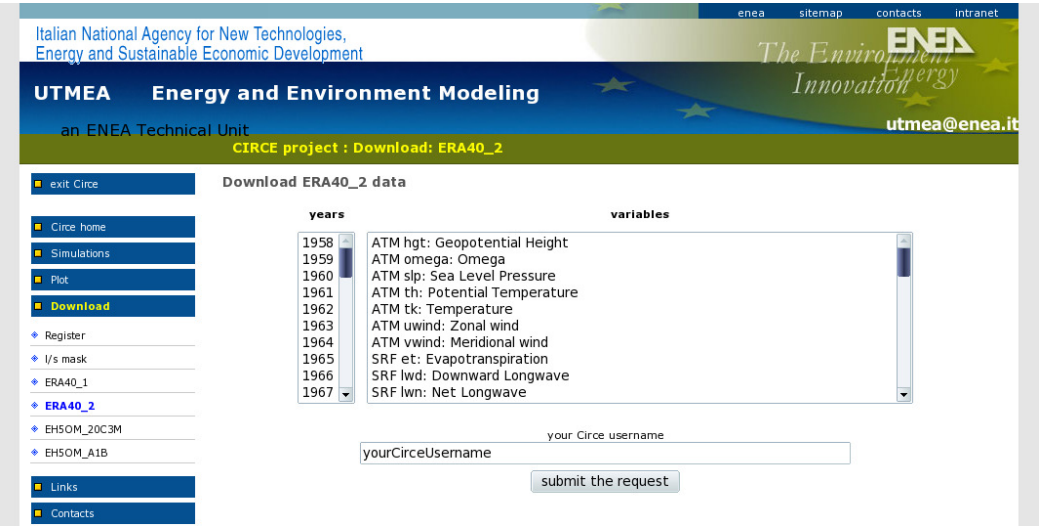
Med-CORDEX archive strategy

ERAInterim-driven run, Control, Scenario:

- Data storage specifications: see CORDEX instructions
- Specific list for Med-CORDEX/HyMeX (task force leaded by M. Gaertner, UCLM)
- Monthly mean files: DMI CORDEX central archive
- Daily files: ENEA Med-CORDEX data archive
- Sub-daily files: ? (ENEA or local storage by partners)

Sensitivity runs, land surface runs, ocean runs, HyMeX LOP runs :

- HyMeX database at IPSL, OMP



Example file:

pr_MED-44_ERAINT_evaluation_r1i1p1_CNRM-ALADIN5_v1_day_19910101_19951231.nc

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Med-CORDEX evaluation team and strategy

Challenges:

- Evaluation in an heterogeneous geograhical area in terms of data coverage (a lot in the North but availability issue, few in the South)
- Need for an evaluation of the other components of the climate system: river, surface hydrology, ocean
- Strong small-scale features and scale interactions
- Complex coast line and islands (satellite blind close to the coast)

The solution:

- Gathering specialist of the various components (atmosphere, ocean, land, hydrology) and fields (process, in-situ, satellite)
- Take advantage of the wide HyMeX community
- Take advantage of the HyMeX field campaign (LOP:2010-2020, EOP/SOP:2012-2014)

The evaluation team:

- First access to the model run outputs
- Based on the HyMeX-TTM3d task team (A. Mariotti UMD-ENEA, D. Gomis IMEDEA)
- ***Please join***

Med-CORDEX community tools

Leaders: P. Ruti (ENEA), S.Somot (CNRM) + F.Giorgi, S.Planton, P.Lionello, L.Li

Emailing list: hymex-ttm3@cnrm.meteo.fr
(soon all@medcordex.org + dedicated web site www.medcordex.org)

Communication:
Somot & Planton (2009) at the international HyMeX-TTM3 meeting (Toulouse, France)
Ruti et al. (2010), talk at EGU, CORDEX session (Vienna, Austria)
Ruti & Calmanti (2011), talk at the International CORDEX meeting (Trieste, Italy)
Ruti et al. (2011), talk at EGU, CORDEX session (Vienna, Austria)
Ruti & the MedCORDEX team (submitted), WCRP-OSC2011 meeting (Denver, USA) in the MedCLIVAR session
Somot & the MedCORDEX team (submitted), WCRP-OSC2011 meeting (Denver, USA) in the CORDEX session

Publication:
Ruti & the MedCORDEX team (in prep. for EOS)

Model and runs status

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

atm-ocean-land-river: model Ok

atm-ocean-land: model Ok

Model in development

ERA40 runs: Ok

ERAInterim runs: Ok

atm: model Ok

Same ARCM as in RCSM (25-50km)
RegCM, ALADIN, WRF, ETA, LMD, PROMES, REMO, COSMO-CLM

ERAInterim runs: Ok
ERA40 runs: Ok

+ other ARCM (50 km)
TAU, IIBR, Univ. Istanbul (RegCM)

+ very high-resolution ARCM (10-20 km)
RegCM, ALADIN, WRF, COSMO-CLM (GUF)

ERAInterim run: Ok

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Med-CORDEX and the scientific environment

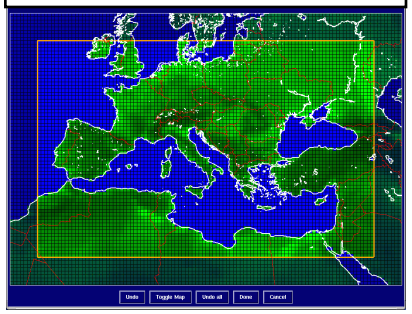
Circe

HyMeX
HYdrological cycle in Mediterranean EXperiment

Modelling community
Evaluation team
Scientific questions
Common man power

Follow-on
Modelling community
Impact community

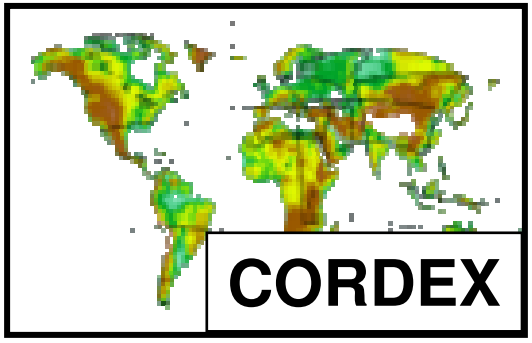
Med-CORDEX



CLIM-RUN

Common domain
Impact community
Financial support

One of the 12 domains



MedCLIVAR

Scientific interest
Shared objectives
Endorsement

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Med-CORDEX scenario: the GCM/RCM 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		GCM					
		CNRM	MPI	IPSL	INGV	HadGEM	EC-Earth
RCM	ENEA	?	?				
	MPI		x				
	CNRM	x					
	LMD			x			
	Univ. Belgrade				x		
	MORCE-MED			x			
	UCLM/UPM					?	
	COSMO-CLM		?				
	INSTM			?			
	IC3						?

Med-CORDEX preliminary results

First intercomparison of Regional Climate System Models (RCSM) :

CIRCE or CIRCE-like runs:

25-50km, ERA40 driven (available on 1960-2001)

LMD (LMDZ/NEMOMED8): AOL-RCM

MPI (REMO/MPI-OM/MPI-HD): AOLR-RCM

ENEA (PROTHEUS: RegCM/MITgcm/IRIS): AOLR-RCM

CNRM (ALADINv5/ISBA/NEMOMED8/TRIP): AOLR-RCM

HyMeX and MedCORDEX runs:

50km, ERA-Interim driven (available on 1989-2008)

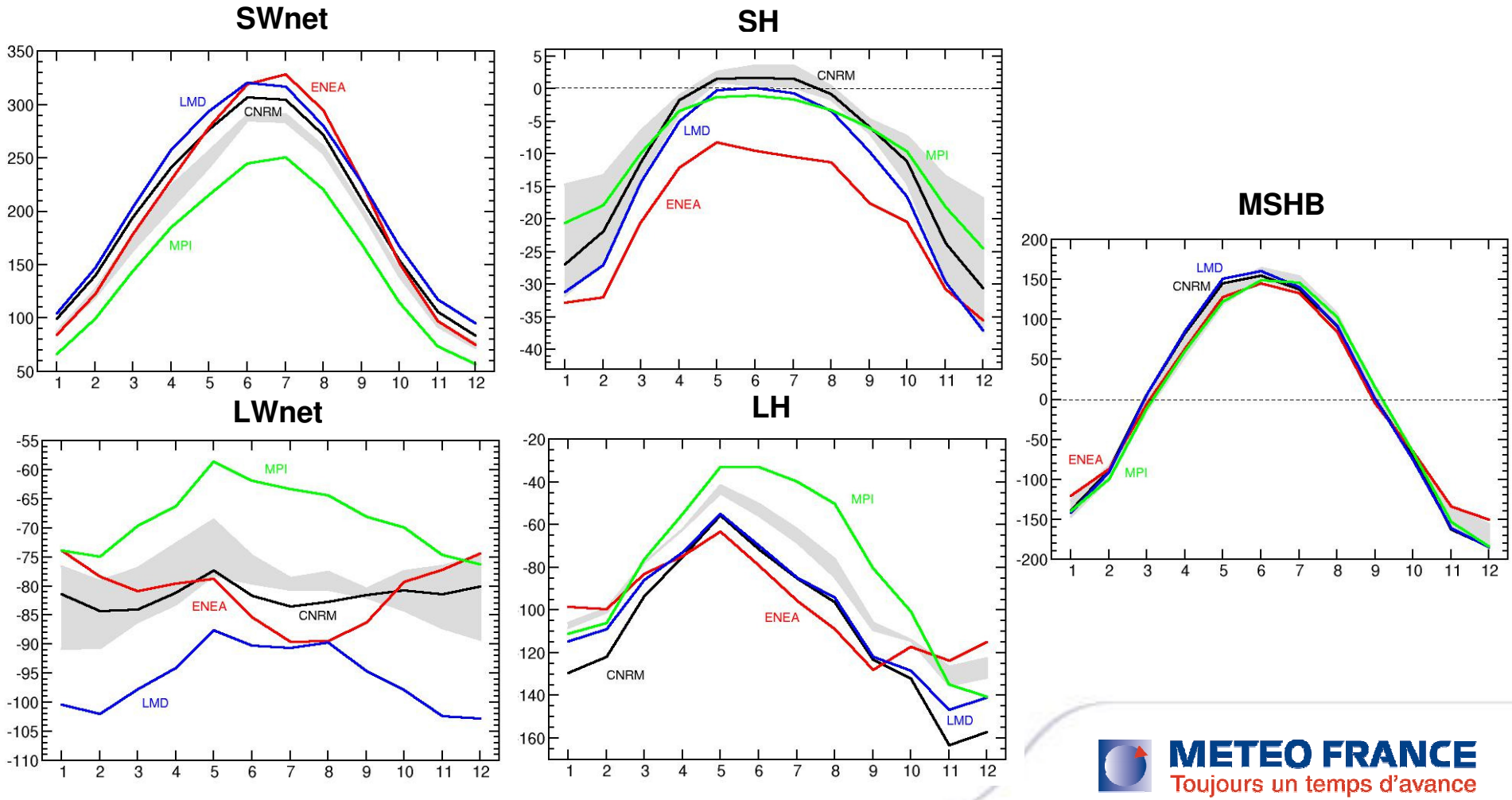
CNRM (ALADINv5.1/NEMOMED8/TRIP): AOLR-RCM

Medit Sea surf. Heat Budget (1989-2001)

W/m2	SW	LW	SH	LH	MSHB	source
Range	**[178;186]**	**[-77;-84]**	**[-6;-13]**	**-89**	**[-8;0]**	**OBS**
Reanalyses						
ERA40	**167**	**-80**	**-9**	**-93**	**-15**	ECMWF
ERAInterim	**198**	**-83**	**-11**	**-95**	**+9**	ECMWF
ERA40 driven RCSMs						
ENEA	**198**	**-81**	**-20**	**-99**	**-2**	CIRCE
LMD	**211**	**-96**	**-15**	**-102**	**-2**	CIRCE
MPI	**154**	**-68**	**-10**	**-80**	**-4**	CIRCE
CNRM	**199**	**-82**	**-11**	**-109**	**-3**	CIRCE-like
ERA-Interim driven RCSMs						
CNRM	**200**	**-83**	**-10**	**-109**	**-2**	Med-CORDEX

Medit Sea surf. Heat Budget (1989-2001)

Mean seasonal cycle (CIRCE runs)



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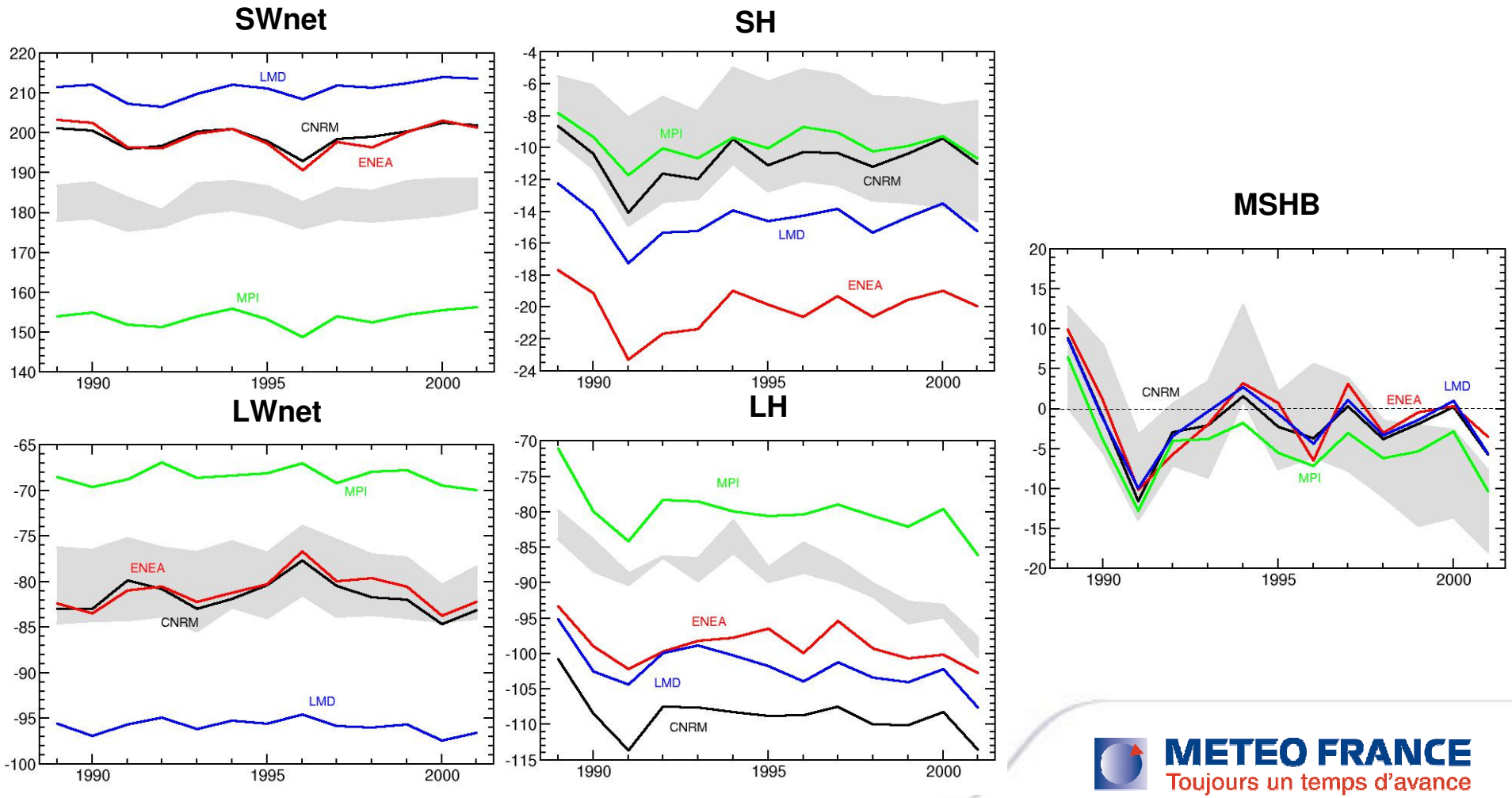
Medit Sea surf. Heat Budget (1989-2001)

Interannual variability 1989-2001 (CIRCE runs)



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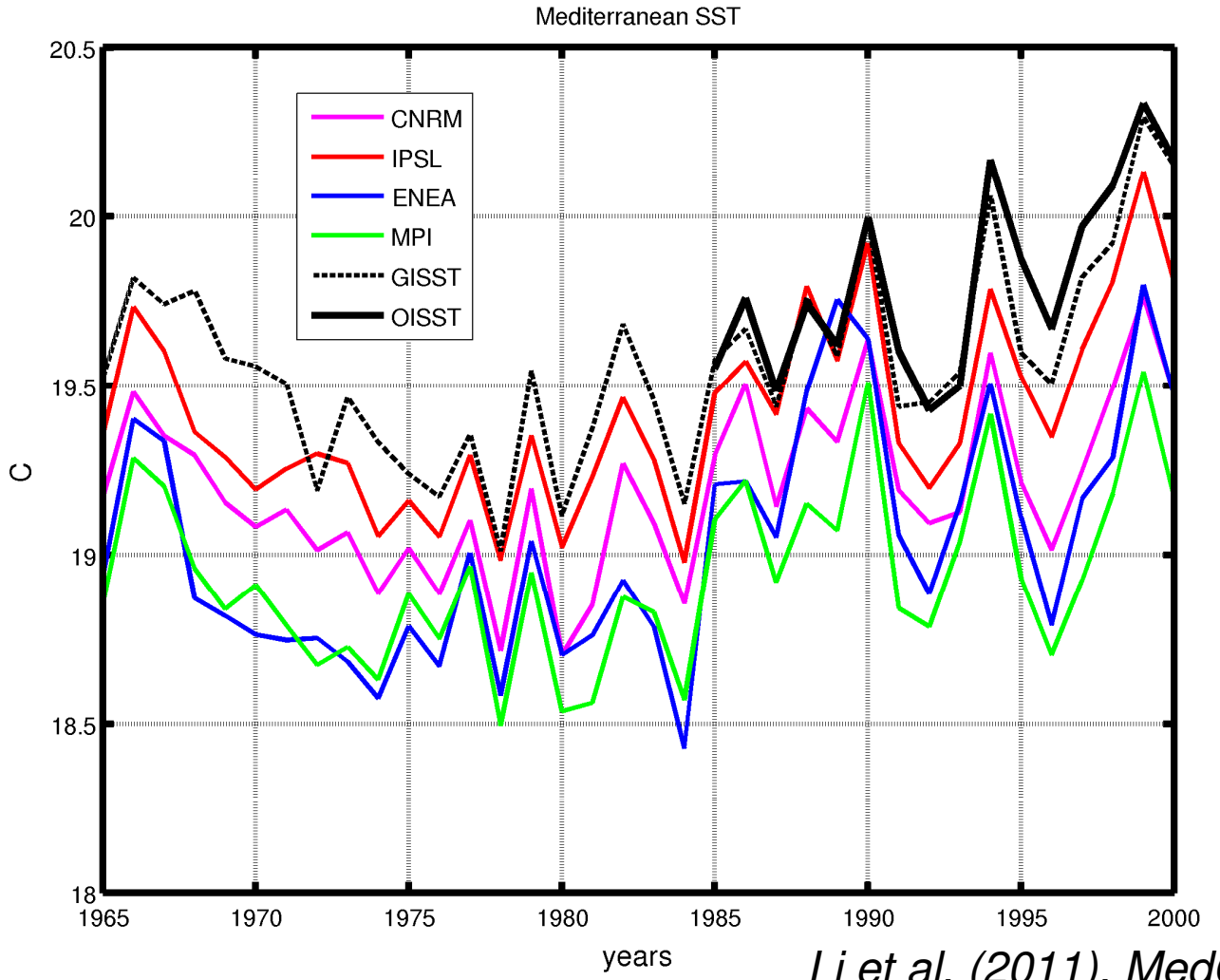
SST in RCSM (1965-2000)

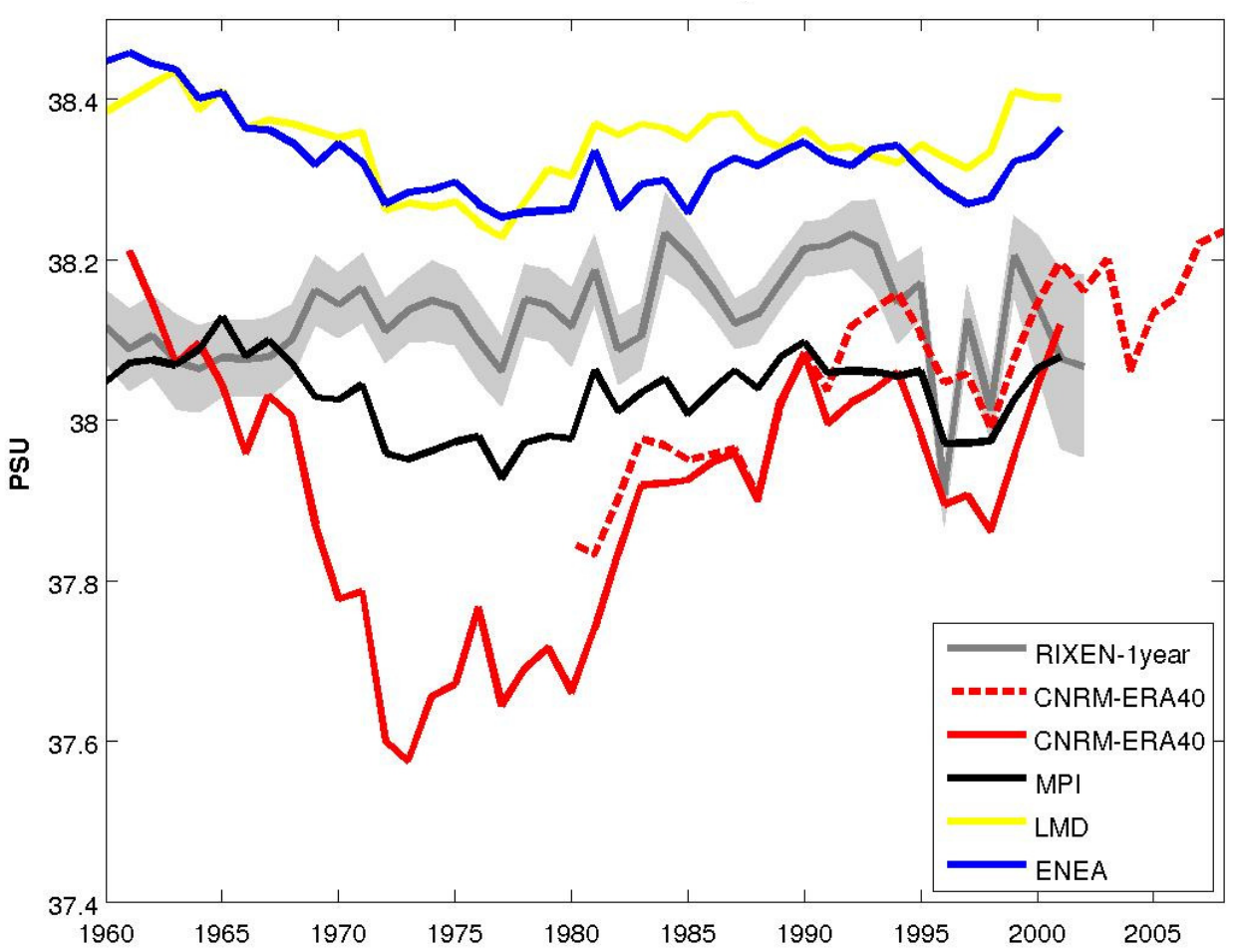
CIRCE and CIRCE-like runs, ERA40 driven



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

SSS in RCSM (1960-2008)

CIRCE, CIRCE-like, Med-CORDEX runs, ERA40 and ERAInterim driven (1960-2008)



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

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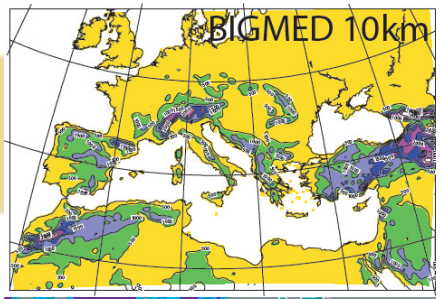
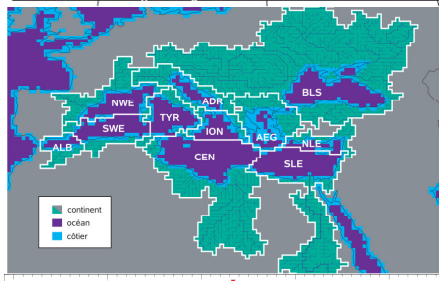
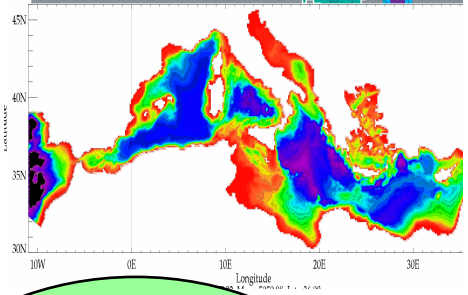
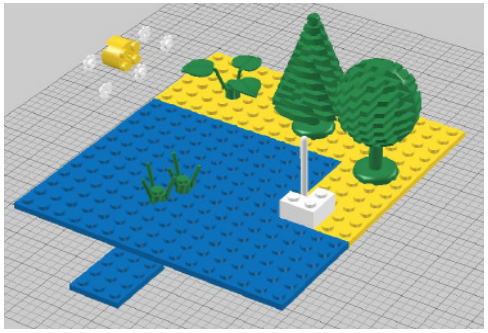
Conclusions and perspectives

- Need for a specific exercise in CORDEX for the Mediterranean
- MedCORDEX is a reality: existing community, meetings, first communication, EOS in prep., database, model, runs, evaluation
- Follow-on of CIRCE, set-up in synergy with HyMeX, MedCLIVAR and CORDEX
- ERA40-driven runs available from CIRCE: must be saved, can be analysed
- First ERA-Interim runs carried out
- CMIP5 GCM ready to be used (see PCMDI)
- First RCP Med-CORDEX runs ready to be launched
- TIER1 (RCSM) Med-CORDEX run to be finalized
- If you are interested (model, evaluation, impact, statistic), please join

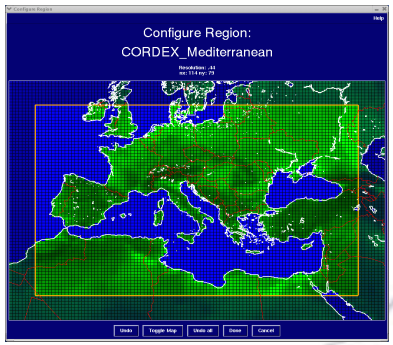


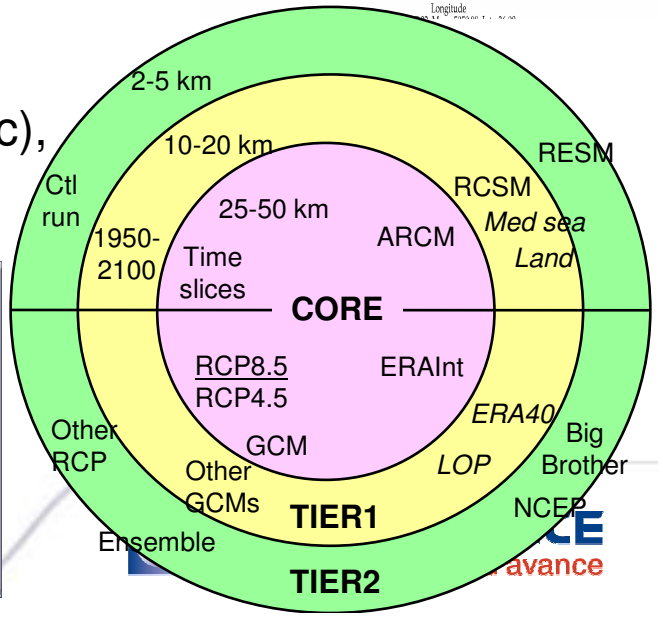




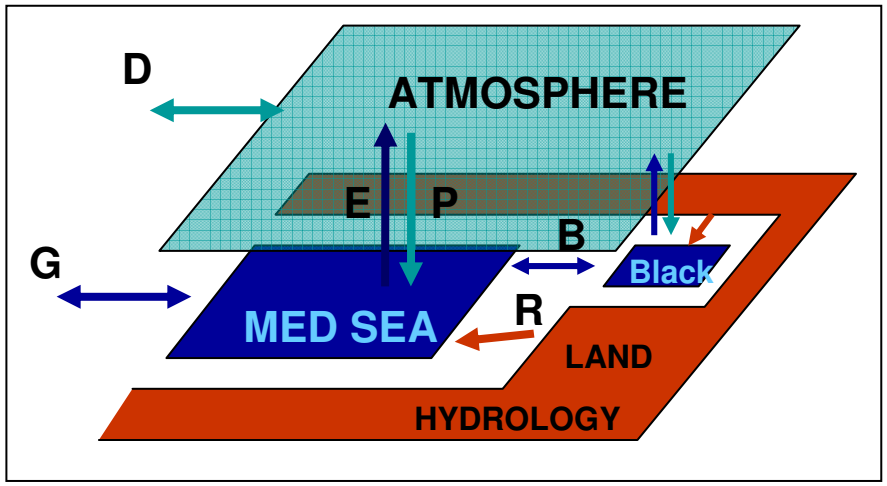


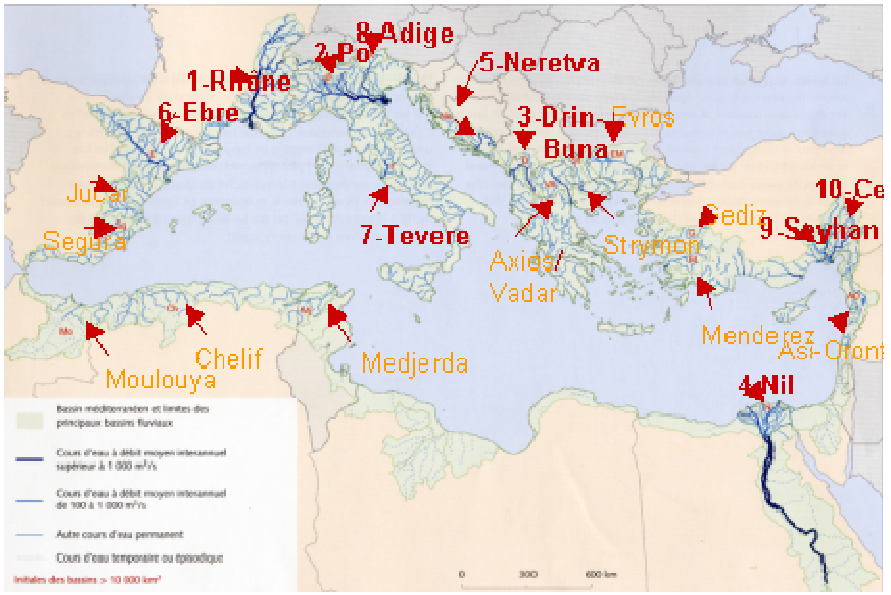
Regional Climate System Model

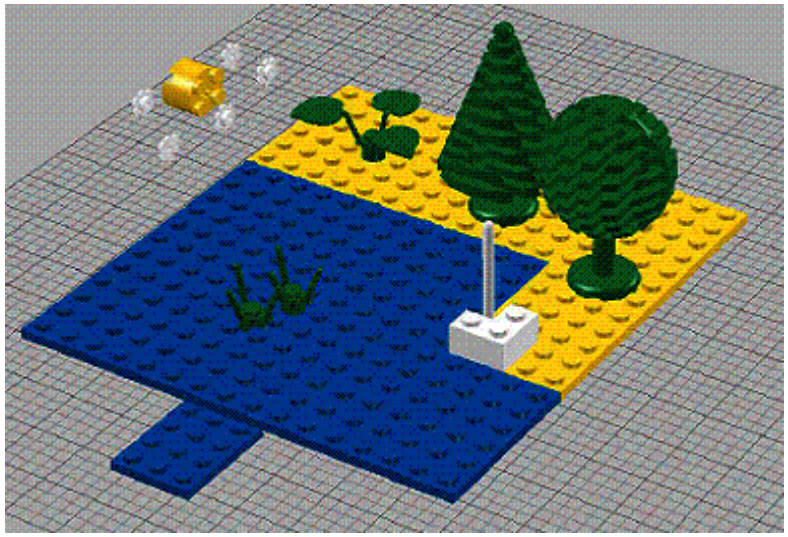


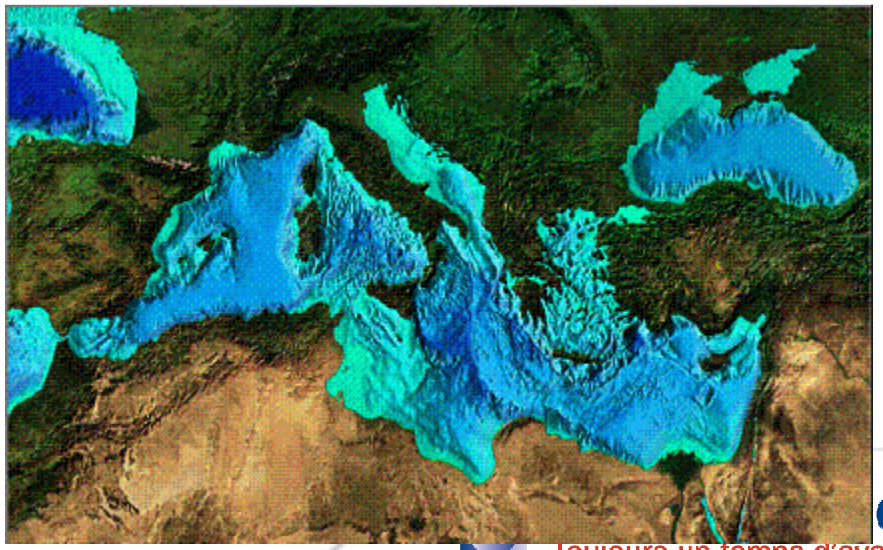


The Mediterranean area: A complex Regional Climate System









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