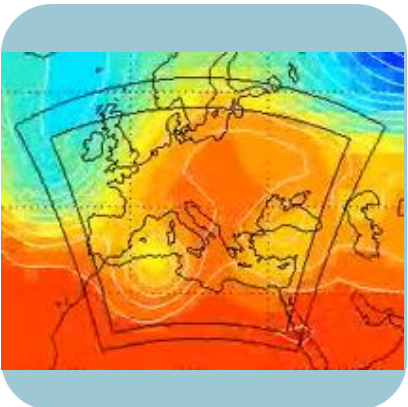




Science

MED

Services



Thanks to:
S Somot (CNRM)
A Dell' Aquila
(ENEA)
L Ponti (ENEA)
G Sannino (ENEA)

PM Rutì

ENEA



Challenges of climate services

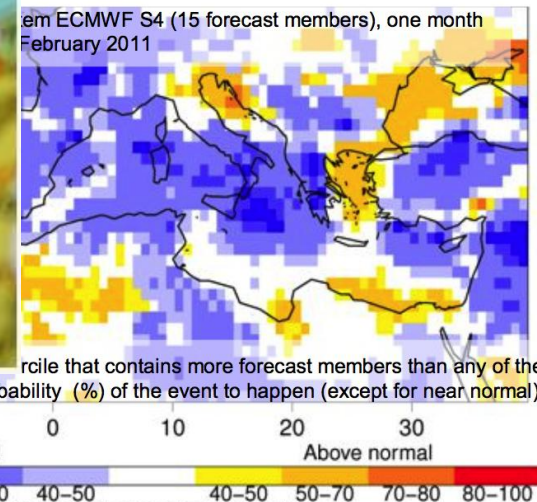
- Med-Services: research on climate services
- MedCORDEX: climate science for society





A typical question – Planning wind-farms

An estimation of local wind conditions is especially crucial in the selection of the site. If the wind speeds are 10% smaller than expected, the energy yield will fall short by more than 30%, which can quickly cause economic problems





Common points



- Stakeholders (policy-makers, industry etc) have relevant questions for climate science.
- Local and regional climate information
- Present climate and near future (6m to 10y)



The first EU research project

www.climrun.eu



CLIM-RUN





What is CLIM-RUN?

CLIM-RUN Case studies

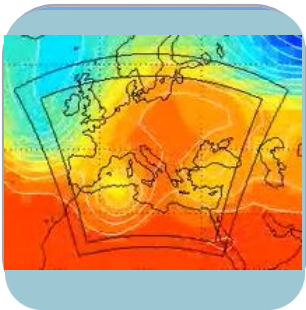


Tourism: Tunisia, France, Cyprus, Croatia

Energy: Spain, Morocco, Cyprus, Croatia

Wild Fires: Greece (see 17.45 presentation
*Climate change and wildfire risk by C.
Giannakopoulos et al.*)

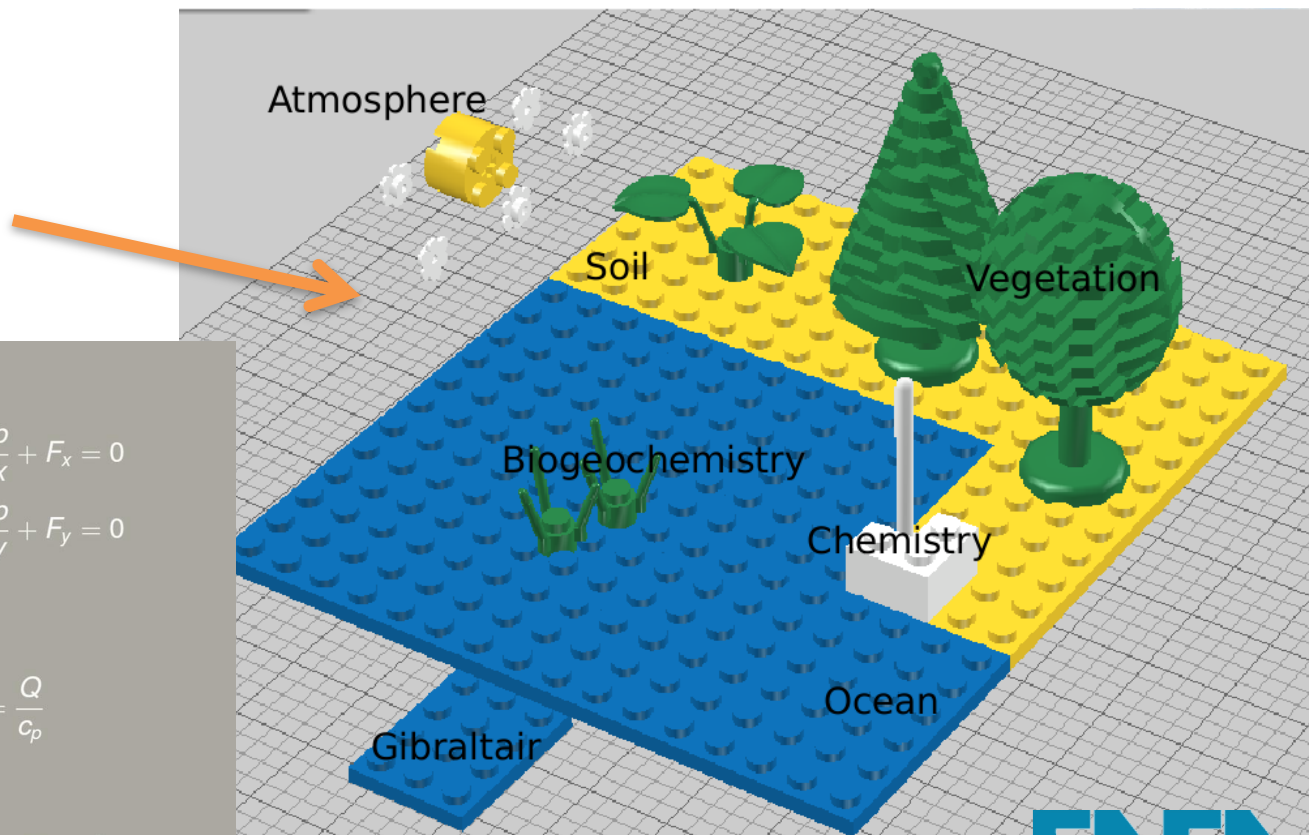
Integrated Case Study: North Adriatic



Weather prediction and climate simulations

The short-term to seasonal prediction and the simulation of the climate change need to define the different components of the climate system:

- atmosphere
- land surface
- hydrosphere
- cryosphere



The Primitive Equations

$$\frac{du}{dt} - \left(f + \frac{u \tan \phi}{a} \right) v + \frac{1}{\rho} \frac{\partial p}{\partial x} + F_x = 0$$

$$\frac{dv}{dt} + \left(f + \frac{u \tan \phi}{a} \right) u + \frac{1}{\rho} \frac{\partial p}{\partial y} + F_y = 0$$

$$\rho = R \rho T$$

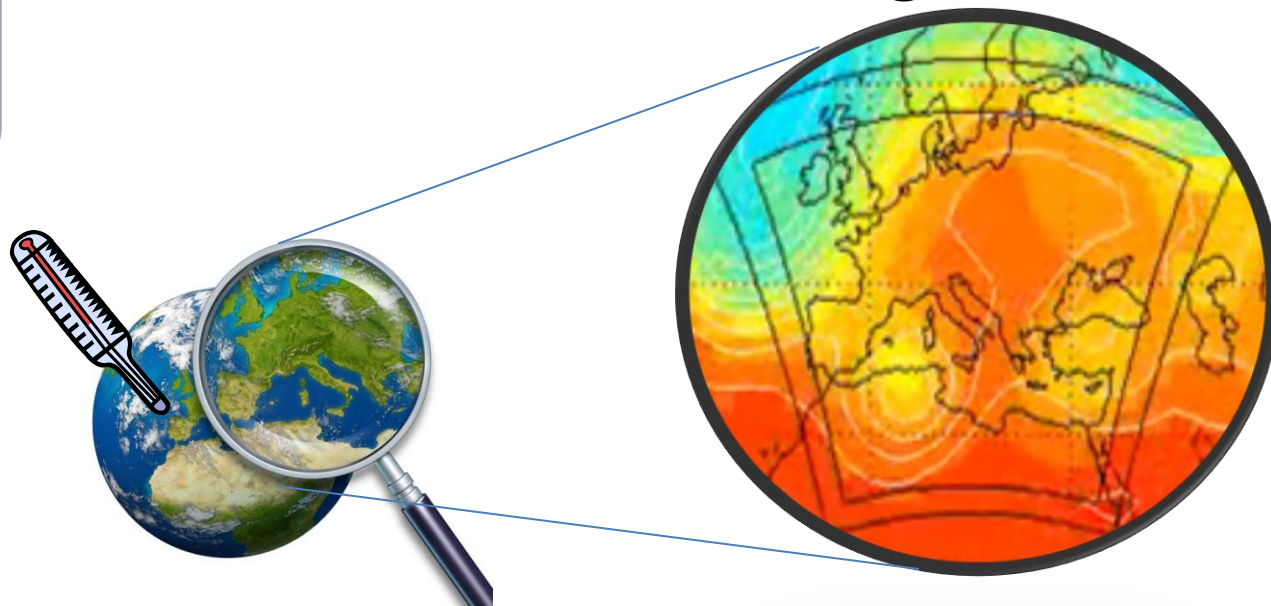
$$\frac{\partial p}{\partial z} + g \rho = 0$$

$$\frac{dT}{dt} + (\gamma - 1) T \nabla \cdot \mathbf{V} = \frac{Q}{c_p}$$

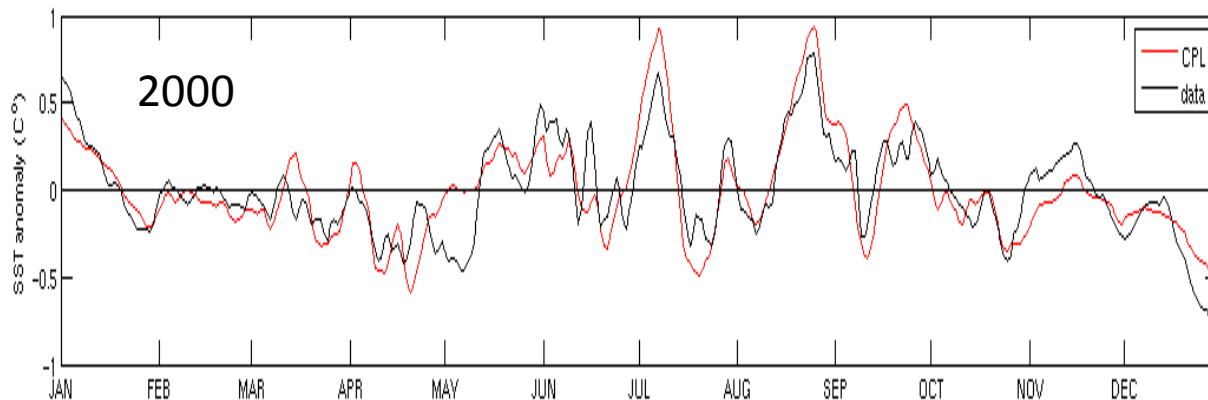
$$\frac{\partial \rho}{\partial t} + \nabla \cdot \rho \mathbf{V} = 0$$

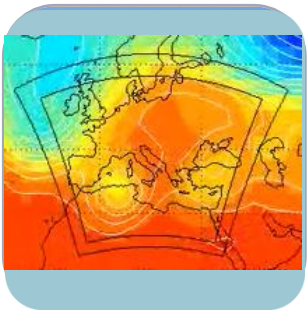
$$\frac{\partial \rho_w}{\partial t} + \nabla \cdot \rho_w \mathbf{V} = [\text{Sources} - \text{Sinks}]$$

Climate information at regional scale



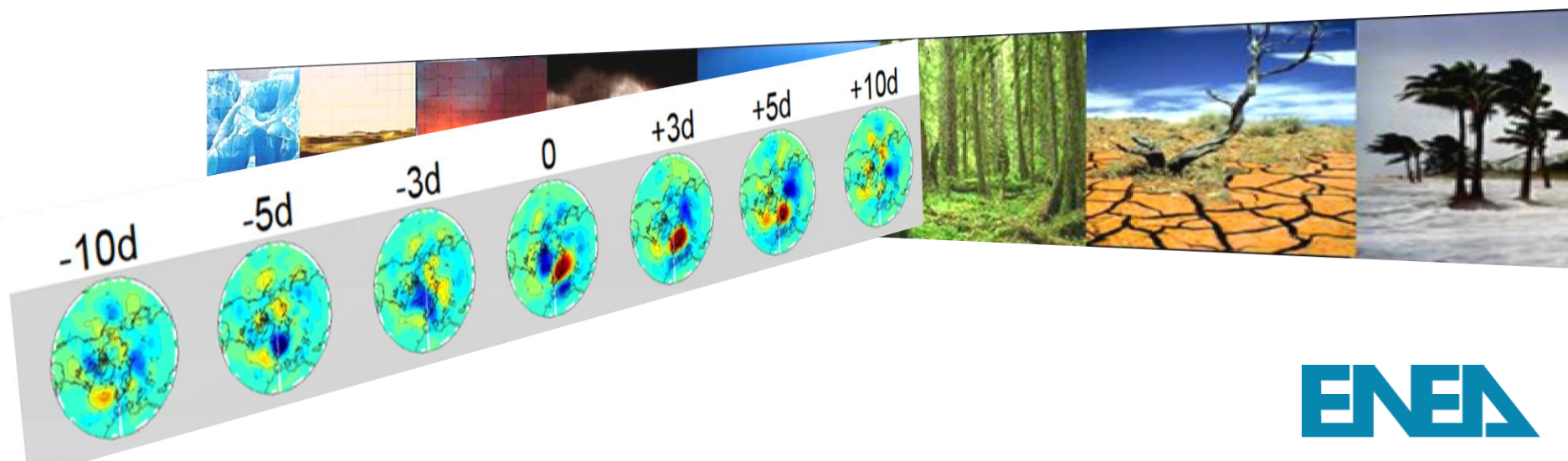
Regional modeling able to reconstruct present climate variability and Extremes Here a comparison between obs and modeled SST after 40 years of coupled simulation





Climate services: few ingredients

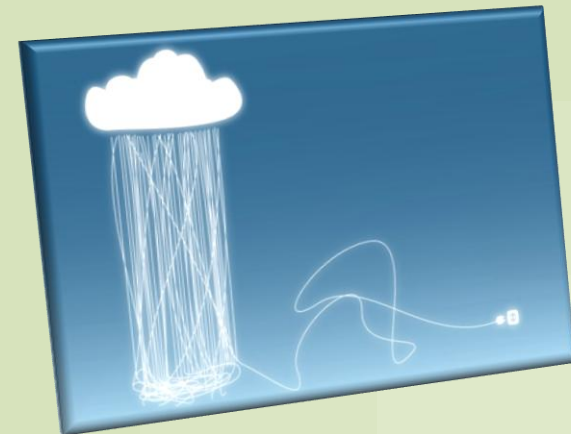
- Modeling skills especially at regional scale
- A better understanding of climate processes
- A multi-disciplinary approach





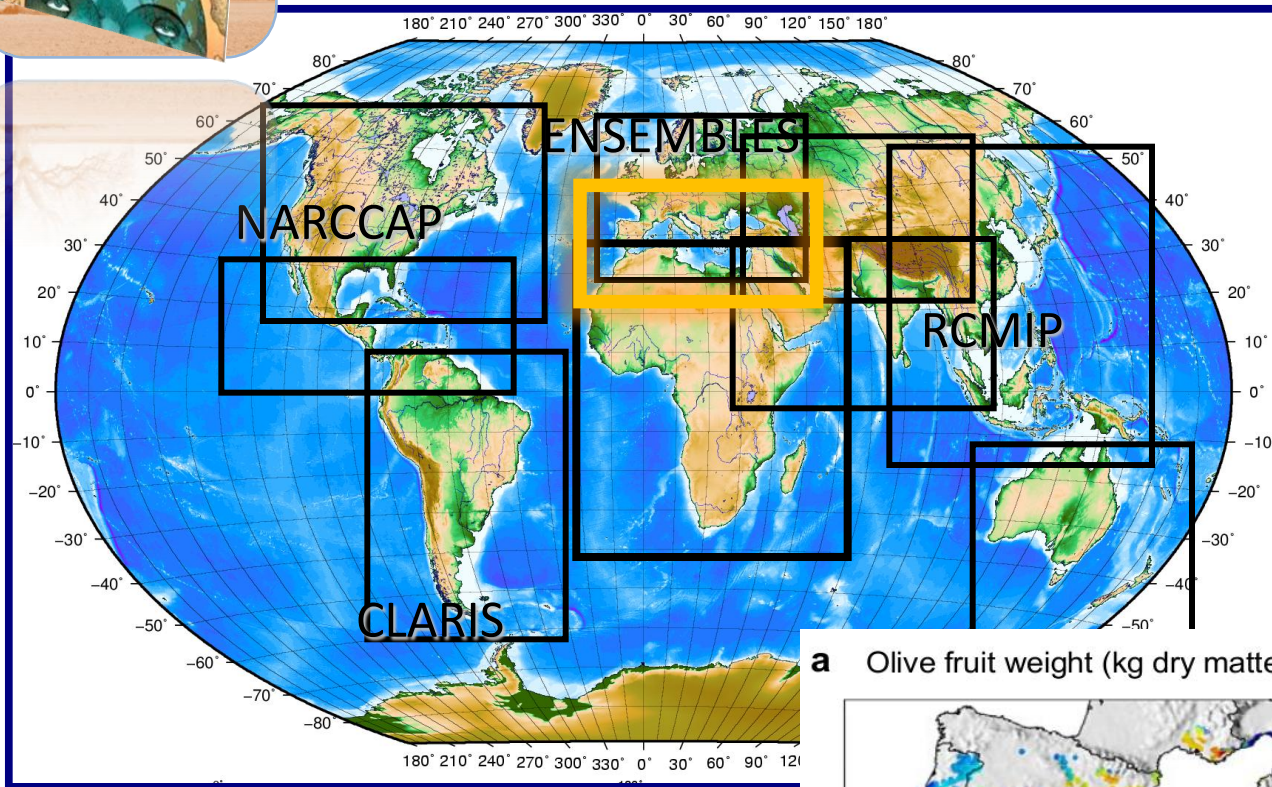
Med-CORDEX

- Med-Services: research on climate services
- MedCORDEX: climate science for society



CORDEX project

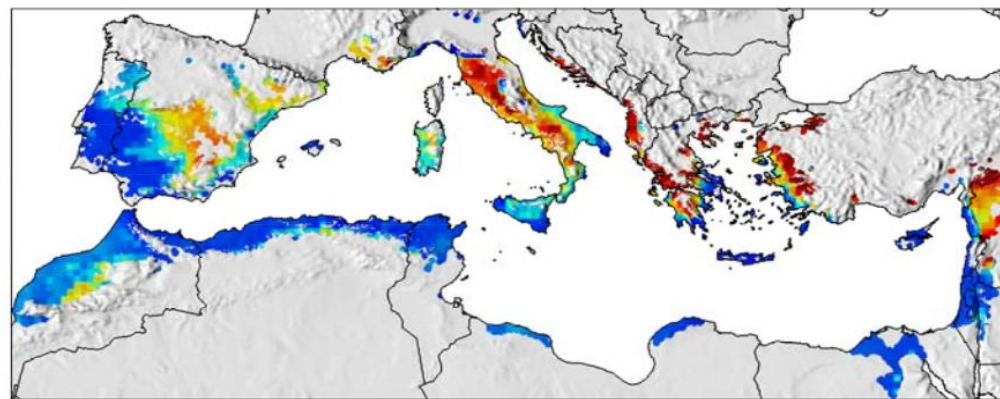
Giorgi, WMO Bulletin 2009



CORDEX will develop regional downscaling scenario and it will increase the link with stakeholders and impact studies

Med-CORDEX will be developed within the HyMeX Framework

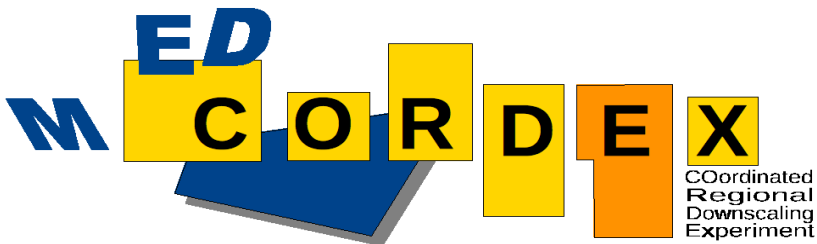
a Olive fruit weight (kg dry matter tree⁻¹), SD 1958-2000



0.1

4.4

8.9





MedCORDEX

Further understanding of the feedbacks between earth system components at regional scale (chemistry, land-surface, ocean etc)

Further understanding of the processes acting at the air-sea interface

Characterization and analysis of all components of the regional hydrological cycle

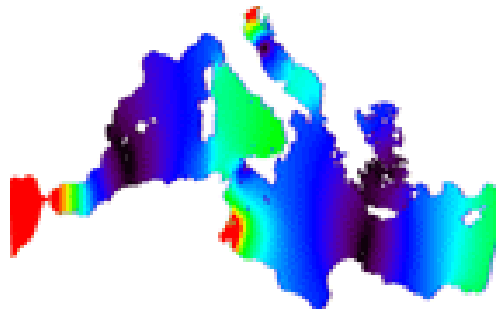
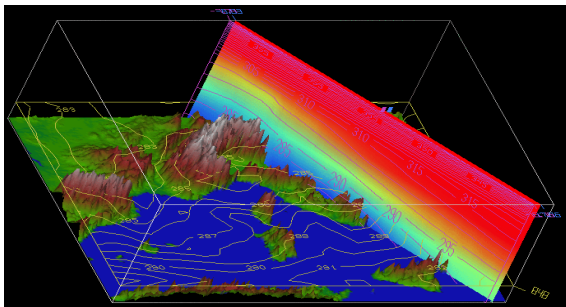
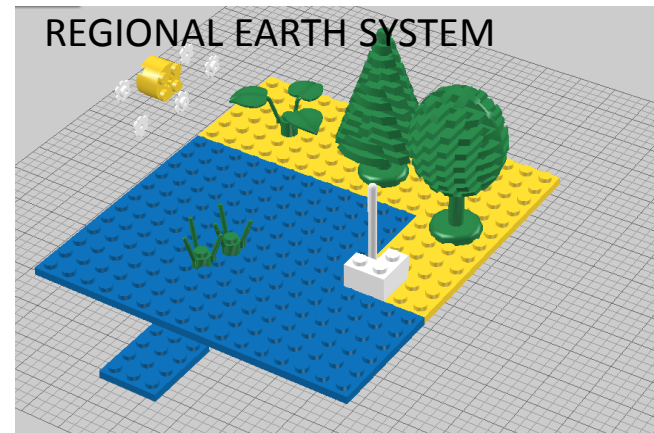
Provisions of new sets of scenarios for the Mediterranean basin (AR5)

Regional coupled models - AORCM (CIRCE)

ARCM – ORCM - Rivers

High resolution ARCM → non-hydrostasy

RESM



MedCORDEX – Portal

www.medcordex.eu



HyMeX

Hydrological cycle in Mediterranean EXperiment

Med-CORDEX

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data base](#)

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April 02nd,
2014](#)

[publications](#)

[references](#)

[contacts](#)

[HYMEX data
base](#)

models

Med-CORDEX participating teams and models

Today, Med-CORDEX gathers 20 different modelling groups from 9 different countries (France, Italy, Spain, Serbia, Turkey, Israel, Tunisia, Germany, Hungary) in Europe, Middle-East and North-Africa. It includes 9 atmosphere RCMs, 8 regional ocean models and 12 Regional Climate System Models. Evaluation runs use the ERA-Interim reanalysis as lateral boundary conditions. Historical and scenario runs use 6 different GCMs from CMIP5.

The community meets regularly during dedicated international workshops (Toulouse Sept 2009, Toulouse March 2012), at EGU every year or during the HyMeX annual workshops (Bologna 2010, Menorca 2011, Primosten 2012). The last MedCORDEX meeting sponsored by the INSU-MISTRALS program in Toulouse was held in March 2012 during 3 days and gathers 50 persons.

List of the registered modelling groups: *ENEA, CNRM, LMD, MPI, IPSL, Univ. Belgrade, UCLM, UPM, INSTM, KIT, GUF, UAH, IC3, CMCC, ENSTA, MERCATOR, TAU, ITU, IIBR, Eotvos Lorand U*

List of the participating models:

9 Atmosphere-only 50-25 km RCM: *RegCM3, RegCM4, ALADIN, REMO, LMDZ, EBU, WRF, COSMO-CLM, PROMES*

4 Atmosphere-only 10-20 km RCM: *RegCM4, ALADIN, WRF, COSMO-CLM*

8 Ocean-only regional models: *MITgcm, NEMOMED8, MPIOM, NEMOMED12, MOSLEF, POM, INSTM-MED, NEMO-MFS*

12 Fully coupled RCM (at least ocean-atmosphere): *ENEA, MPI, CNRM, LMD, Univ. Belgrade, MORCE-MED, UCLM/UPM, INSTM, COSMO-CLM, UAH, IC3, CMCC*

List if the GCM used for the scenario runs: *CNRM-CM5, IPSL-CM5, HadGEM, MPI, CMCC, EC-Earth* (at least two RCM runs per GCM are planned)

List of the participants also called the Med-CORDEX modelling team: *Ahrens B, Alias A, Arsouze T, Aznar R, Bartholy J, Bastin S, Béranger K, Beuvier J., Brauch J, Cabos W., Calmanti S, Calvet J-C, Carillo A, Decharme B, Déqué M., Dell'Aquila A, Djurdjevic V, Drobinski P, Dubois C, Elizalde-Arellano A, Gaertner M, Galán P, Gallardo C, Giorgi F, Gualdi S, Harzallah A, Herrmann M, Jacob D, G. Jordá, Khodayar S, Krichak S, Lebeau-pin-Brossier C, L'Heveder B, Li L, Liguori G, Lionello P, Onol B, Planton S, Raikovic B, Rostkier-Edelstein D, Ruti P, Sannino G, Sevault F, Somot S*

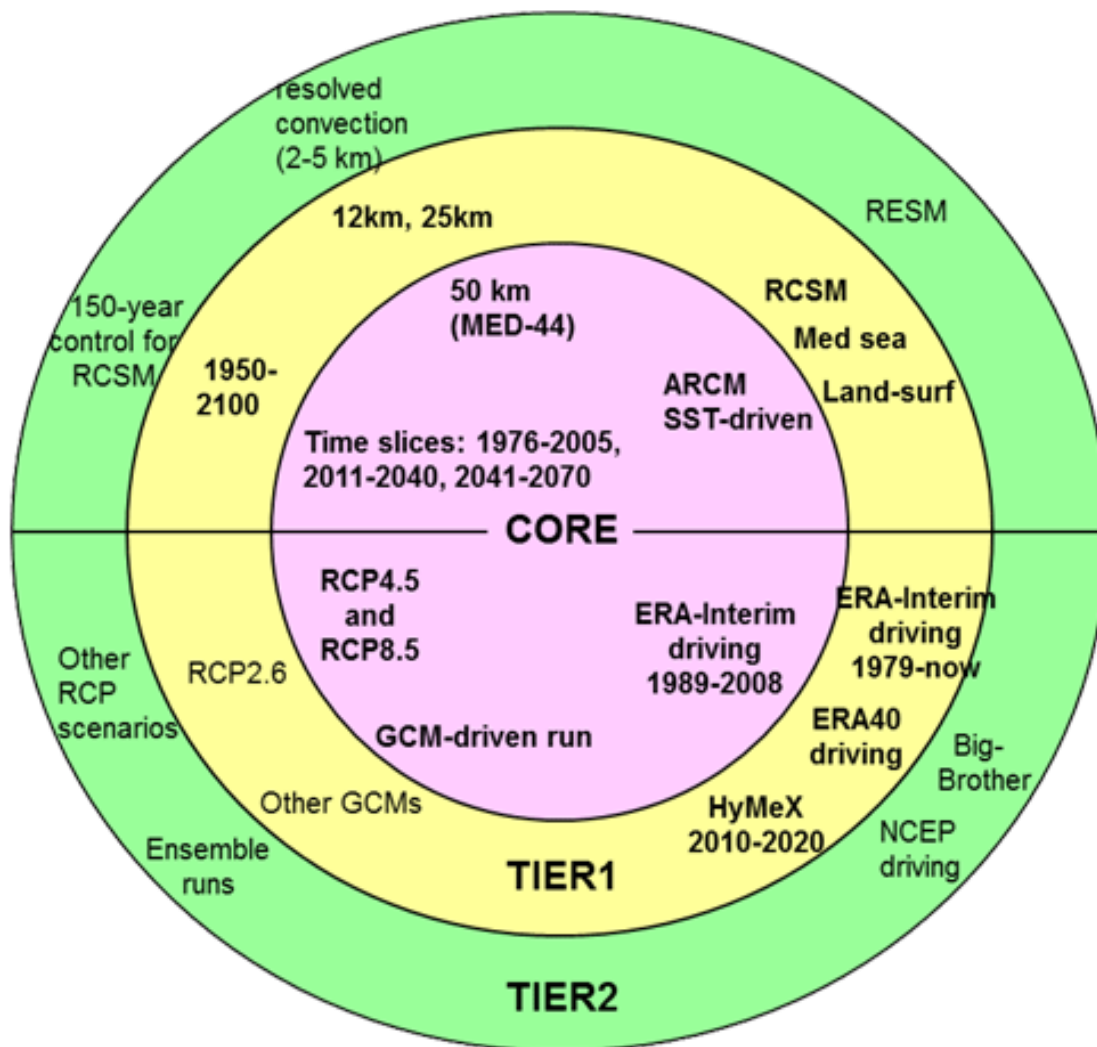
Evaluation team: The Med-CORDEX evaluation team is based on the MedCORDEX modelling team and on the HyMeX TTM3d group.

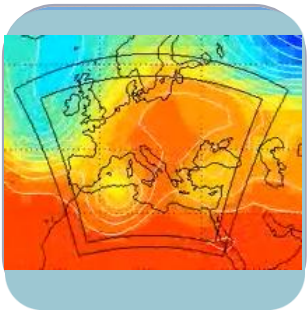




MedCORDEX – Portal

www.medcordex.eu



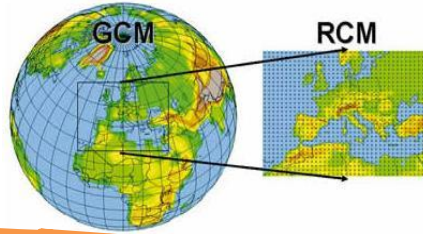
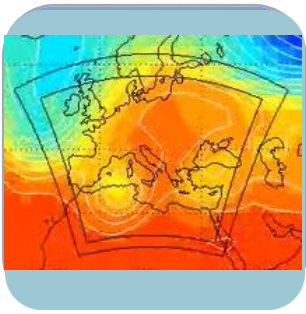


Med-Questions

- **Geophysical sphere:** Are we able to characterize extremes at local scale? Are coupled processes so relevant?
- **Impact sphere:** Are we able to define ecosystems tipping points?

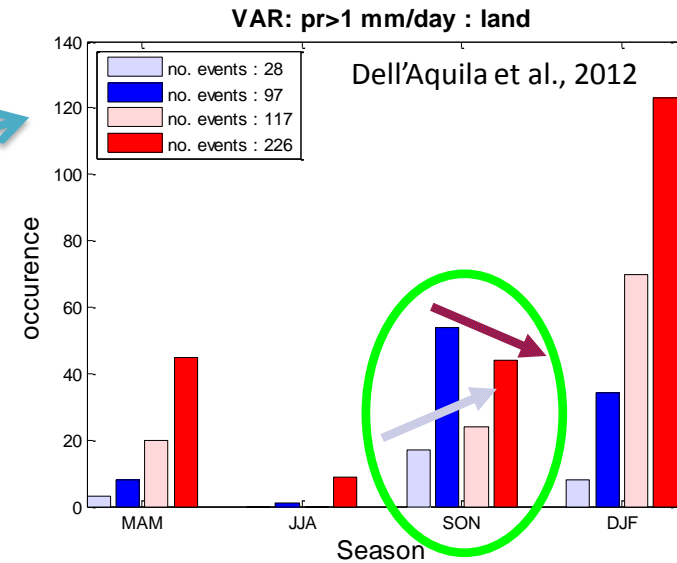
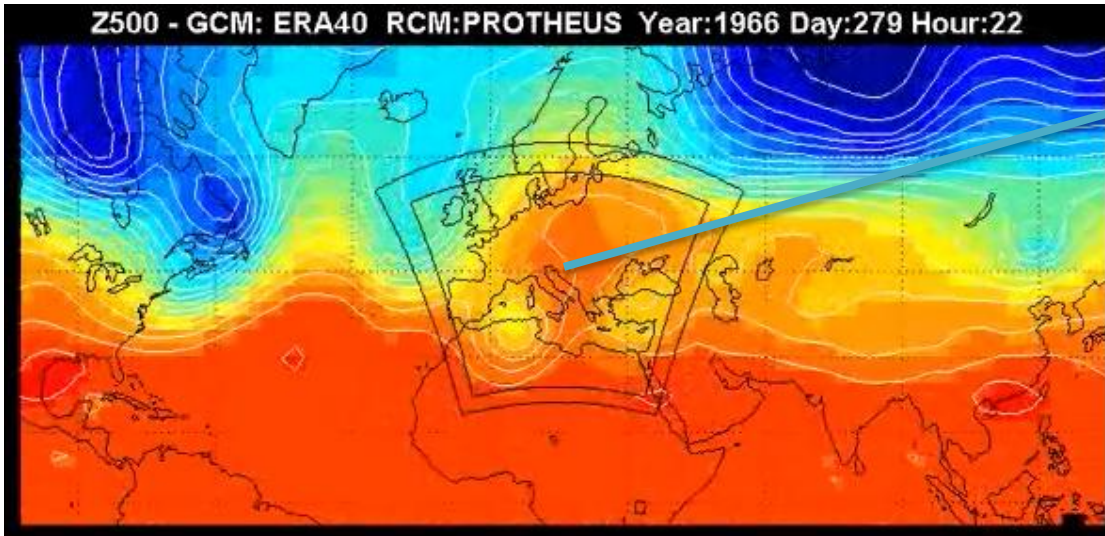
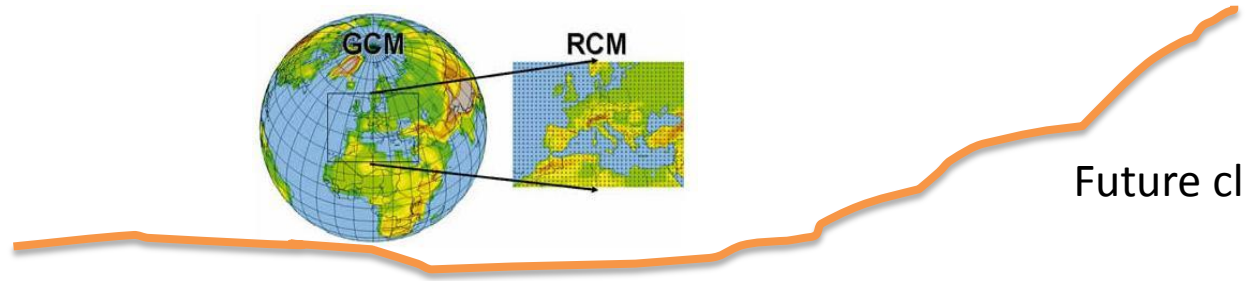


Climate projections at regional scale

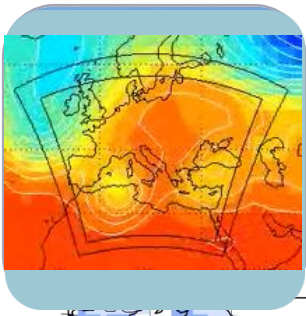


Present climate

Future climate



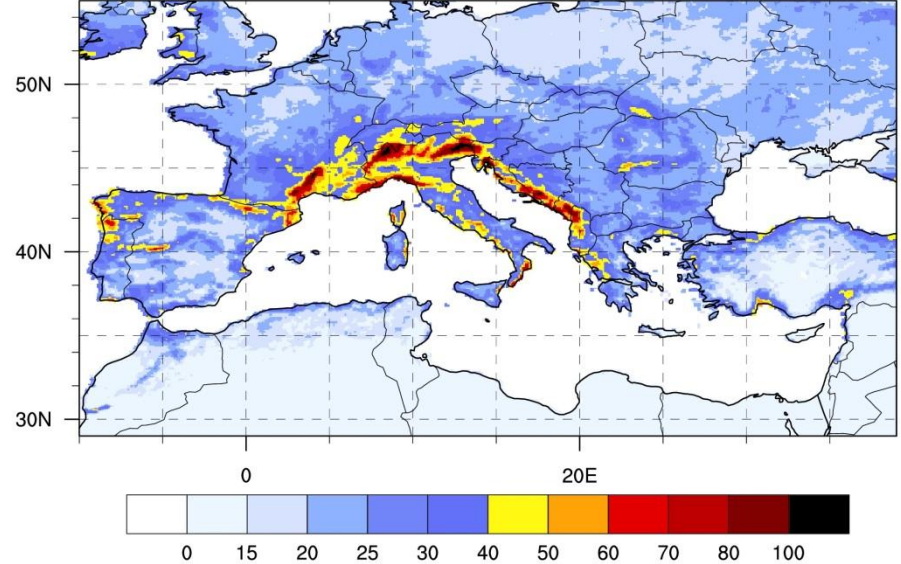
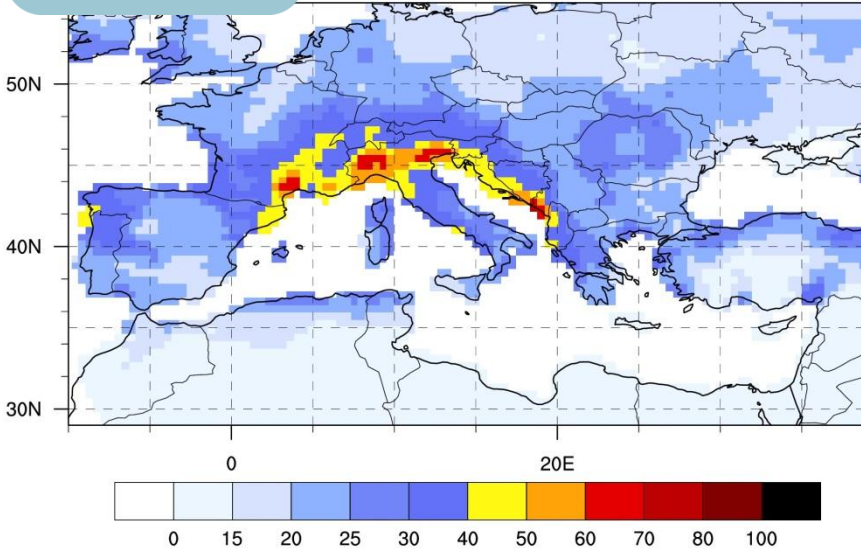
Rainfall extremes



Quantile 99

SON 1989-2008

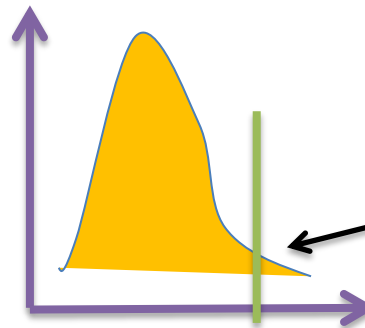
Quantile 99



Do the resolution matter?

RCM 50 km

RCM 12 km

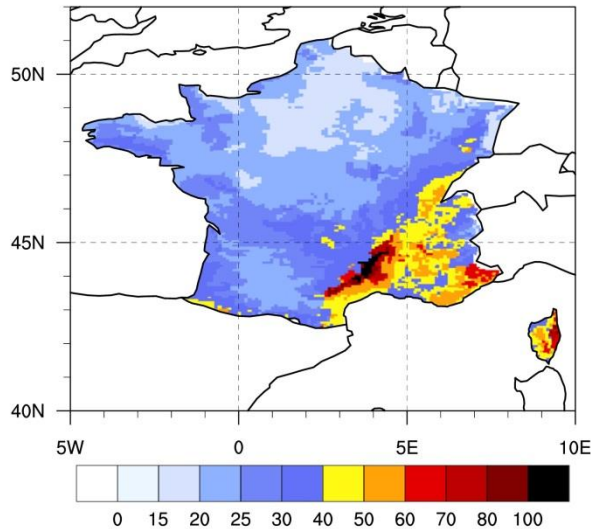


99 percentile

Rainfall extremes

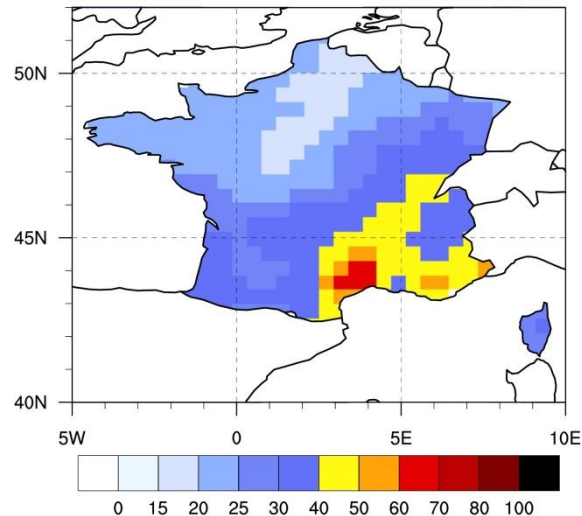
SON 1989-2008

Quantile 99



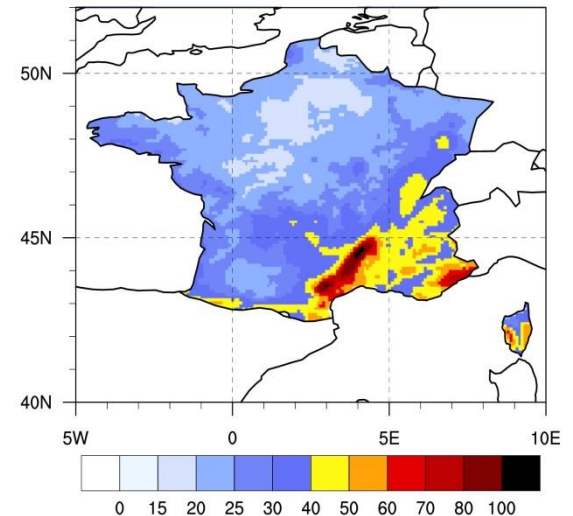
Obs Safran

Quantile 99



RCM 50 km

Quantile 99

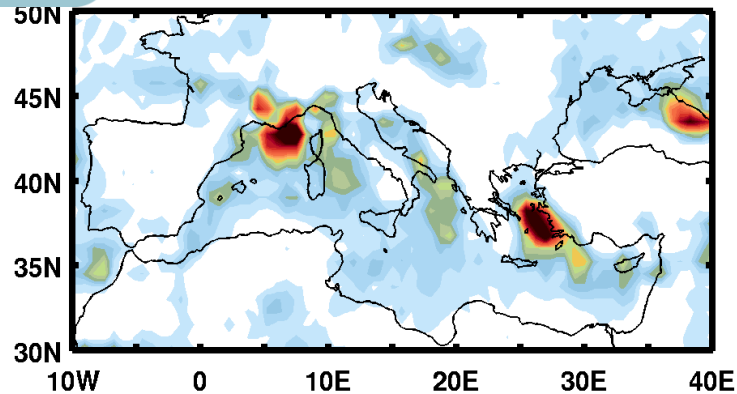


RCM 12 km

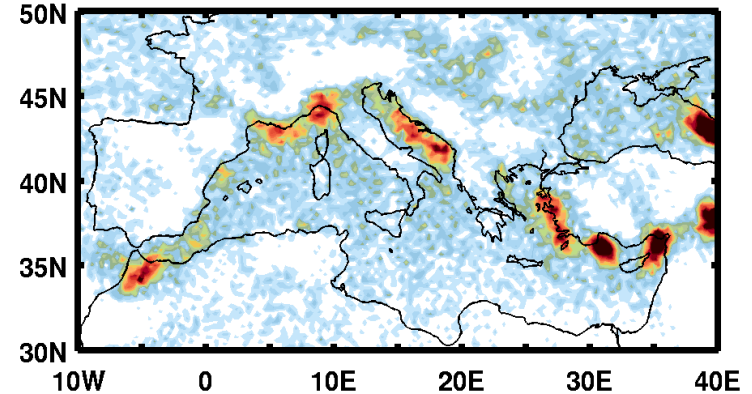
Extreme dynamics

Total cyclone center density in SON and DJF.

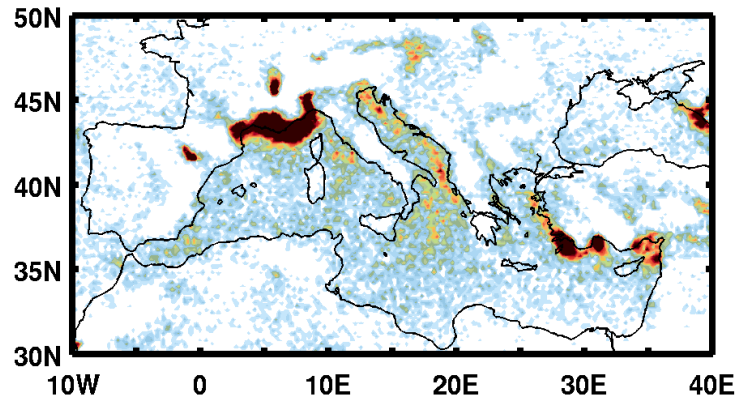
(A) ERA-Interim



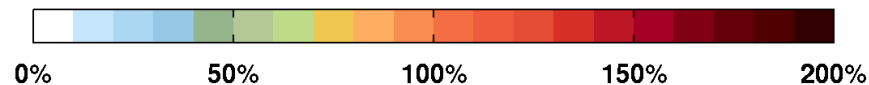
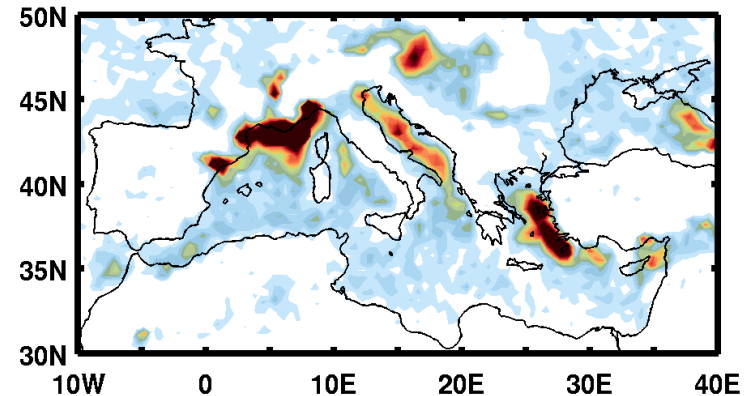
(B) ENEA-PROMETHEUS

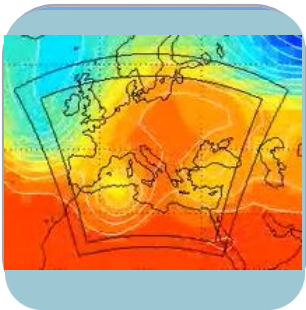


(C) MORCE-MED



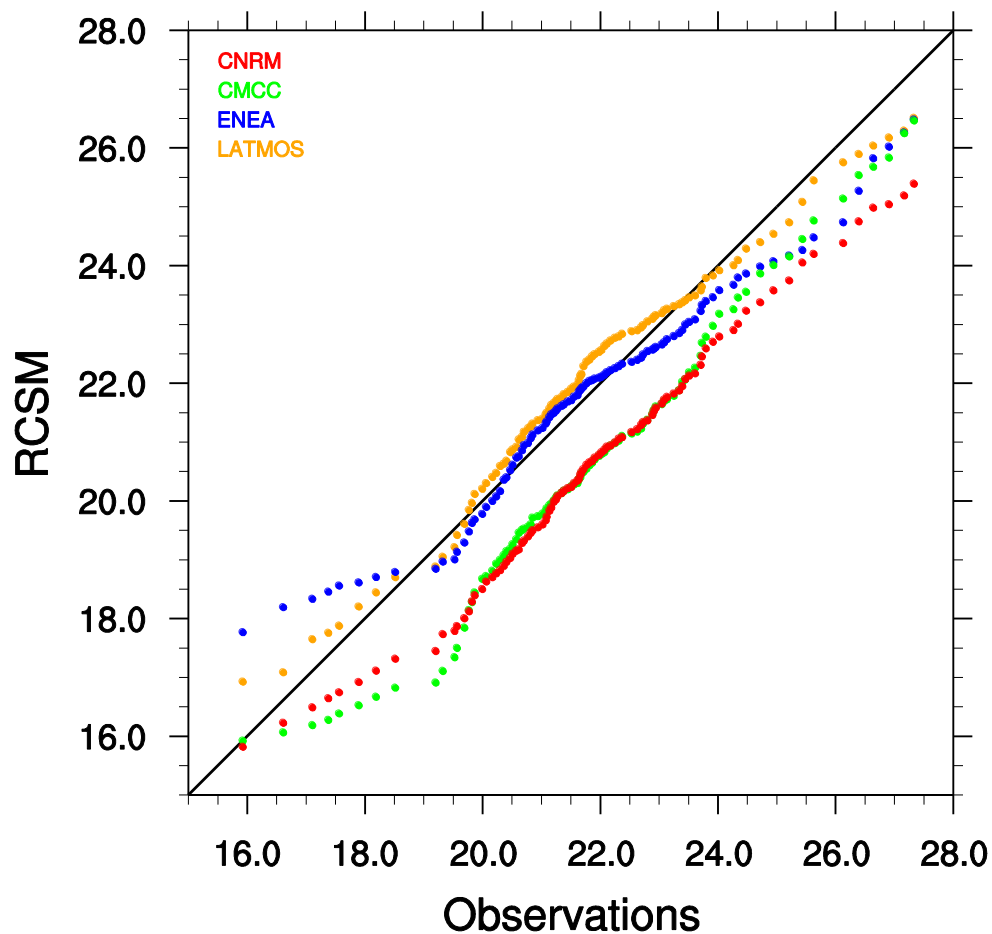
(D) CNRM-ALADIN



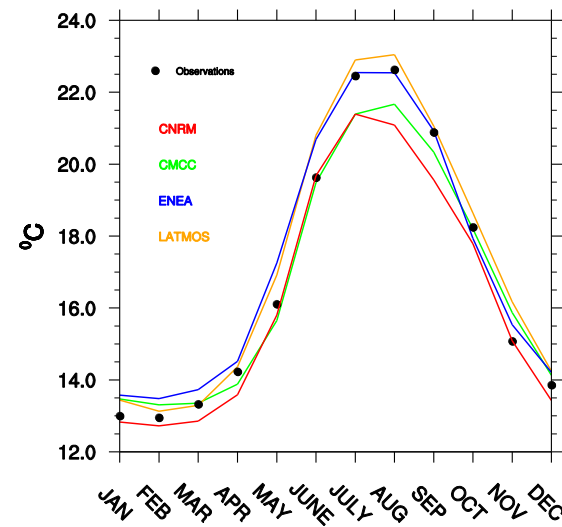
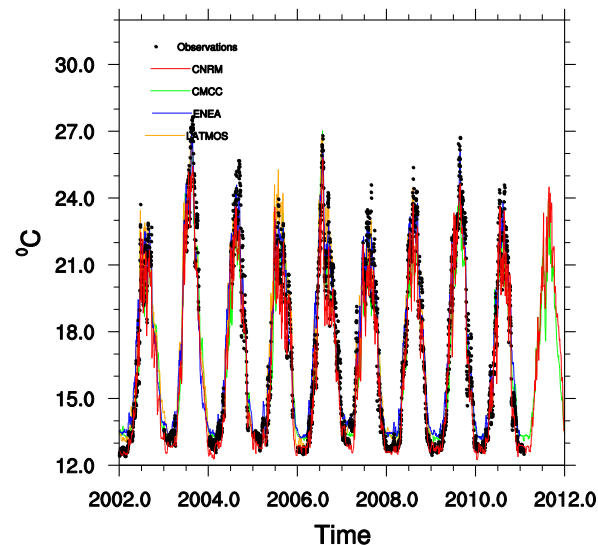


...and the ocean ... SST

Q-Q plot - SST Lion - 2002-2008

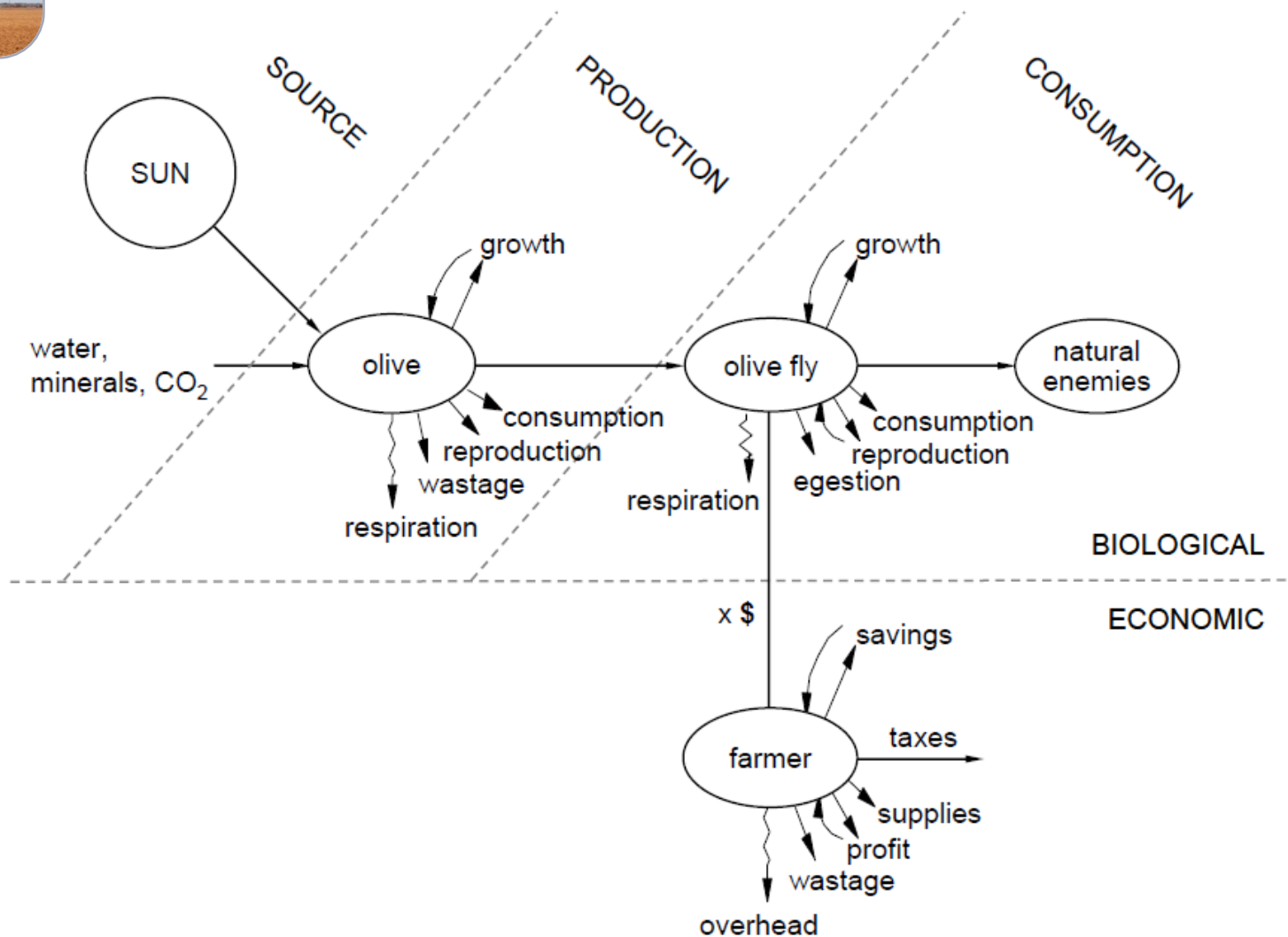


SST Lion



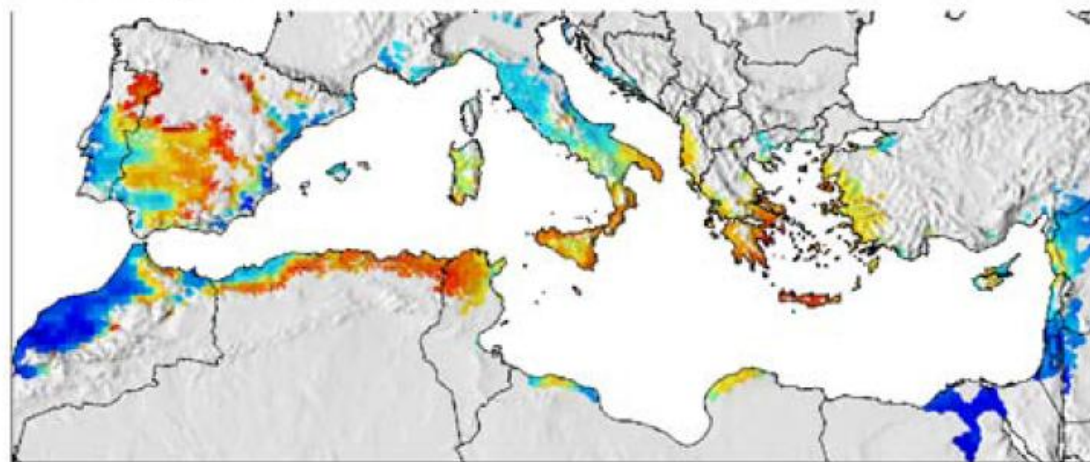


Ecosystem impacts



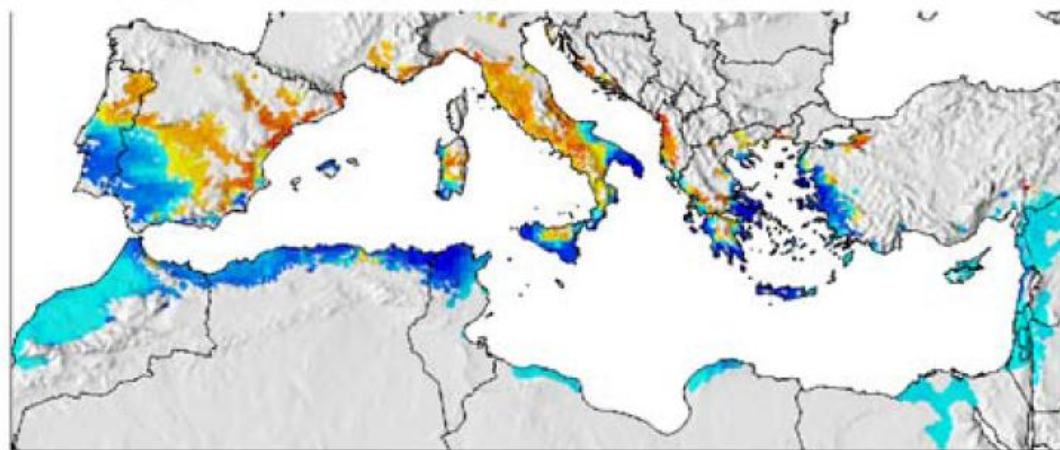
Ecosystem impacts

A Change in olive bloom date (days)



Impact of climate warming on olive phenology and olive fly abundance in the Mediterranean Basin, for the 2C target

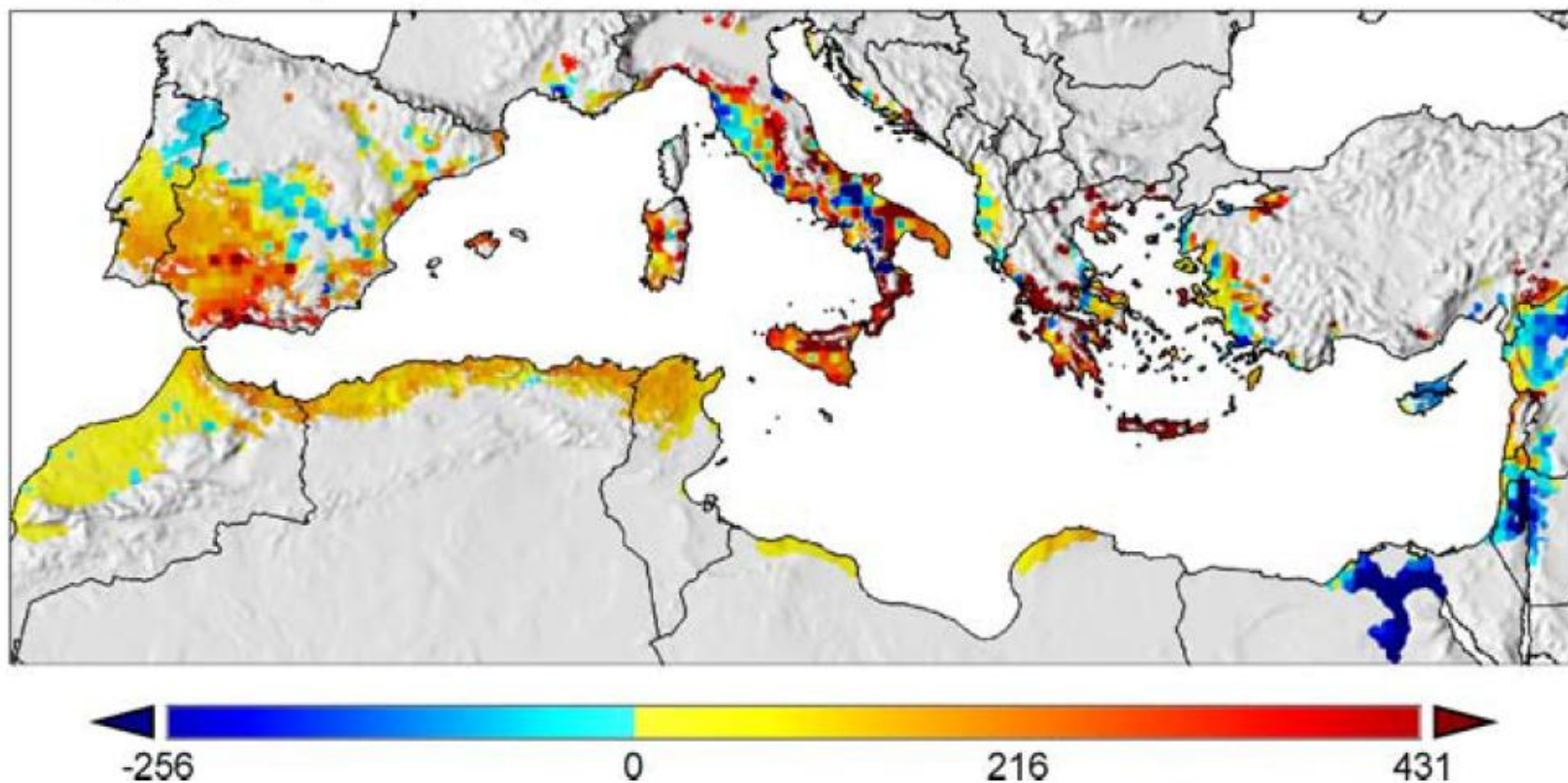
B Change in fly pupae ($10^3 \text{ tree}^{-1} \text{ y}^{-1}$)

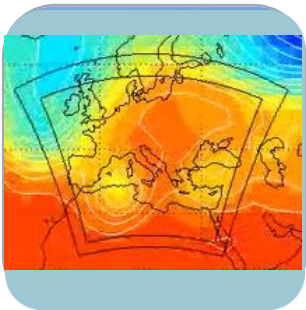




Ecosystem impacts

C $\Delta\Pi$ (change in profit, € ha⁻¹)





Med-challenges

- to develop a regional climate system considering and improving all the components from climate dynamics to human behavior;
- to gather and organize observational data into tailored data set for climate process validation and for impact studies;
- to increase the link with the groups working on the impact side and to integrate impact modeling into the Med-CORDEX initiative;
- to build-up tailored data-sets able to directly provide detailed and actionable climate information.



Thank you

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- www.medcordex.eu

