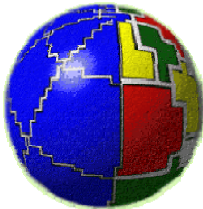


Impacts of climate change on the Mediterranean area: some results from CIRCE project

Sergio Castellari

*Centro Euro-Mediterraneo per I Cambiamenti Climatici (CMCC)
Istituto Nazionale di Geofisica e Vulcanologia (INGV)
IPCC Focal Point for Italy*

E-mail: sergio.castellari@bo.ingv.it



**Istituto Nazionale di Geofisica e
Vulcanologia (INGV)**



CMCC

Euro-Mediterranean Center for Climate Change (Centro Euro-Mediterraneo per i Cambiamenti Climatici)

- an **Italian research center** started in 2006.
- the **climate** system (GCMs and RCMs), the **impacts** of climate changes, **climate policies**, **international cooperation**, with a special emphasis on the **Mediterranean Area**;
- operated by a private **Research Consortium** located and operating in **Lecce** with local units in **Bologna**, **Venezia**, **Capua**, **Sassari**, **Milano**, **Benevento**;
- consisting of different Italian public and private research Institutions:
 1. *National Institute of Geophysics and Volcanology (INGV),*
 2. *Eni Enrico Mattei Foundation (FEEM),*
 3. *University of Salento (UNILE),*
 4. *Italian Aerospace Research Centre (CIRA),*
 5. *Venice Research Consortium (CVR),*
 6. *University of Sannio*

www.cmcc.it

Why the Mediterranean area?

- One of the **climate change hot spots** (*IPCC, 2009*).
- Possibly **the most vulnerable region to climate change in Europe:** future water shortages, losses of agricultural potential and carbon storage potential, increased fire risks, and northward shifts in the distribution of plant species (*EEA 2005*).
- Climate change is likely to **magnify differences of Europe's natural resources:** water availability, crop productivity and forest extent and biomass are likely to decrease in **southern Europe**.
- **Southern and eastern Mediterranean countries are even more vulnerable than European Mediterranean countries**, due to their projected stronger aridification and lower adaptive capacity compared to the northern Mediterranean (“double exposure”), which identifies regions as particularly vulnerable if the climate exposure is accompanied by economic marginalization.

CIRCE

CLIMATE CHANGE AND IMPACT RESEARCH: THE MEDITERRANEAN ENVIRONMENT

<http://www.circeproject.eu/>

The screenshot shows the CIRCE project website. At the top is a large banner with the CIRCE logo on the left and a colorful, abstract graphic of stacked blocks on the right. Below the banner is a navigation bar with three main sections: 'MODELS AND SCENARIOS' (orange), 'IMPACTS AND CASE STUDIES' (purple), and 'ADAPTATION AND MITIGATION' (blue). Below this is a 'Project Menu' sidebar on the left with links to Home, Project, Private Area, PROGETA, Multimedia, CIRCE People, and CIRCE Roadshow. The main content area features a paragraph about climate change being a top media topic and a paragraph about the CIRCE Integrated Project's goals. On the right, there is a 'Last News' section with three bullet points about irrigation effects, the Copenhagen agreement, and a new temperature series method. At the bottom right is a 'CIRCE Newsletter' button and a 'Multimedia Gallery' link.

Circe

A CHANGING CLIMATE, AN ADAPTING WORLD
CIRCE Climate Change and Impact Research: the Mediterranean Environment

MODELS AND SCENARIOS

IMPACTS AND CASE STUDIES

ADAPTATION AND MITIGATION

Home

Project Menu

- Home
- Project
- Private Area
- PROGETA
- Multimedia
- CIRCE People
- CIRCE Roadshow

Climate change is a top ten favourite topic in most media we come across every day. But only some aspects are usually discussed: why, how and what is going to happen next. What if now we start considering climate change in a more complex and multifaceted way? What if we look at it as a result of social dynamics, economic issues, effects on human health, impacts on agriculture and forest and many other criteria with the help of new scientific methods?

The CIRCE Integrated Project, funded under the European Commission's Sixth Framework Programme, aims to reach this objective, highlighting impacts and possible adaptation actions of the climate change in the Mediterranean region, that includes Europe, North Africa and Middle East.

Last News

- The effects of irrigation on climate change
- Reassessing Cancun: a step forward from Copenhagen
- A new method to homogenise daily temperature series from CIRCE researchers

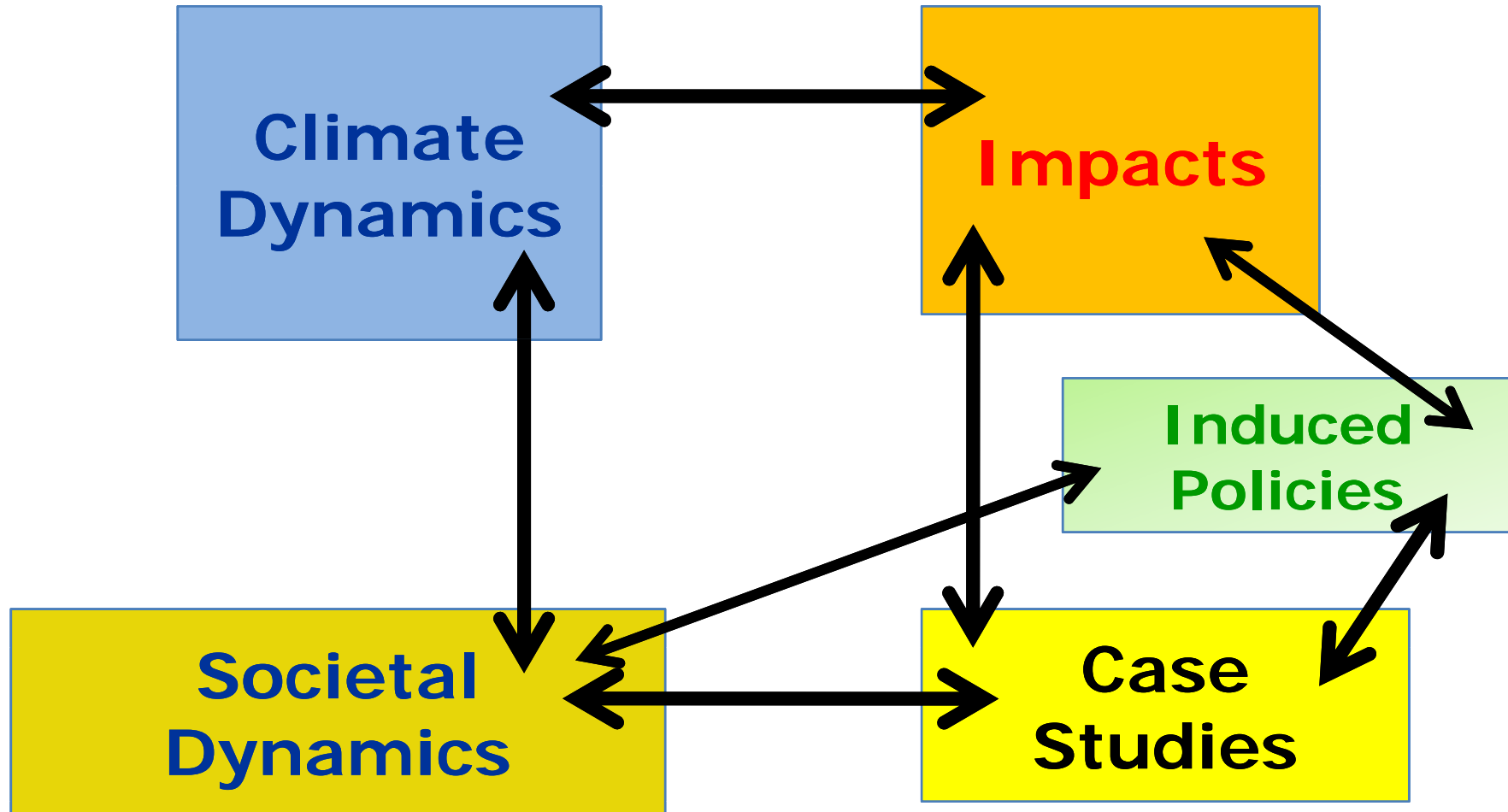
CIRCE Newsletter

Multimedia Gallery

CIRCE aims at developing for the first time an integrated assessment of the climate change impacts in the Mediterranean area.

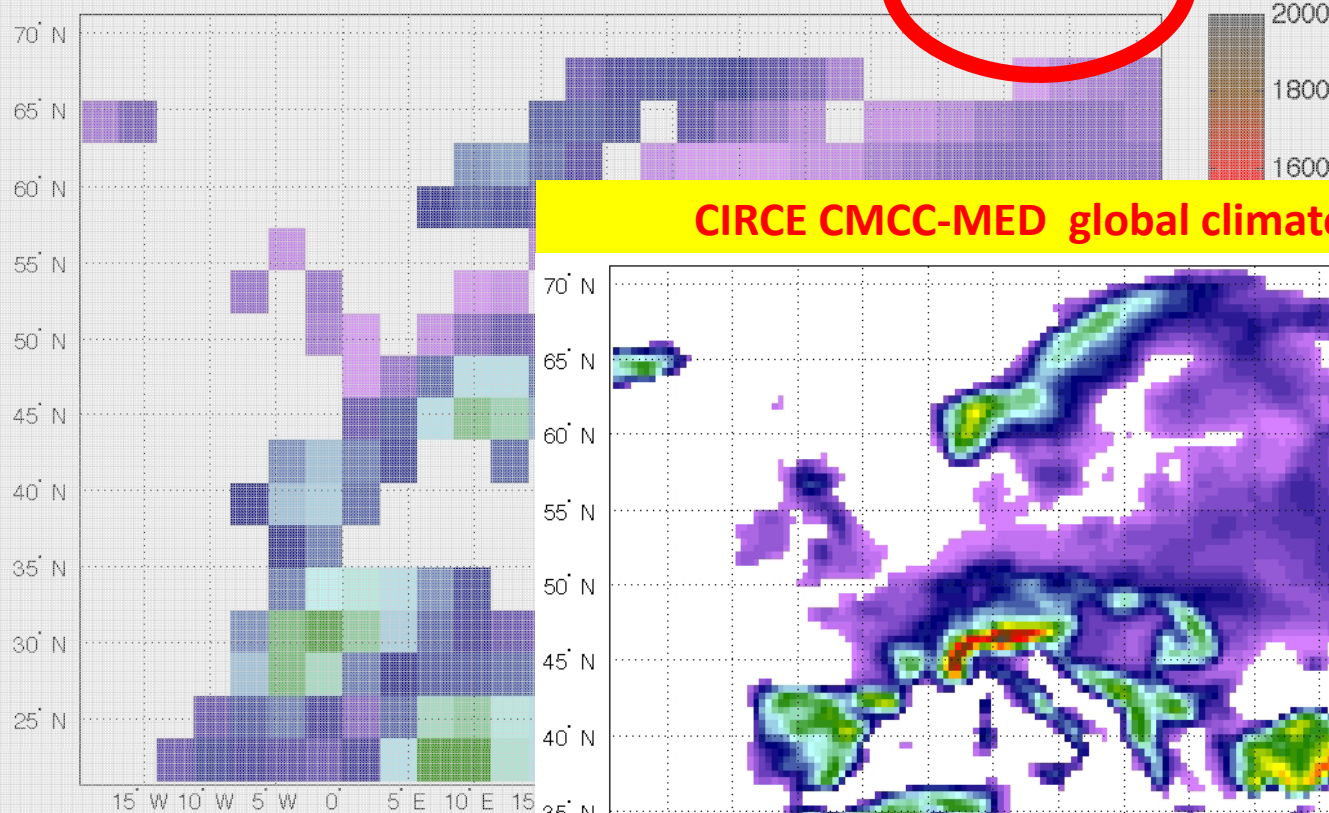
- **Funded by** : *European Commission, FP6, Global Change and Ecosystem*
- **Coordinator and Manager**: *National Institute of Geophysics and Volcanology (INGV)
Euro-Mediterranean Center for Climate Change (CMCC) – ITALY*
- **65 partners**
- **4 years**: **01/04/2007 - 31/03/2011**
- **Main objectives:**
 - to **predict** and to **quantify physical impacts** of climate change in the *Mediterranean area*;
 - to **evaluate** the consequences of climate change for the **society** and the **economy** of the **populations** located in the *Mediterranean area*;
 - to **develop** an **integrated approach** to understand combined effects of climate change;
 - to identify **adaptation** and **mitigation strategies** in collaboration with regional stakeholders.

The CIRCE Concept:

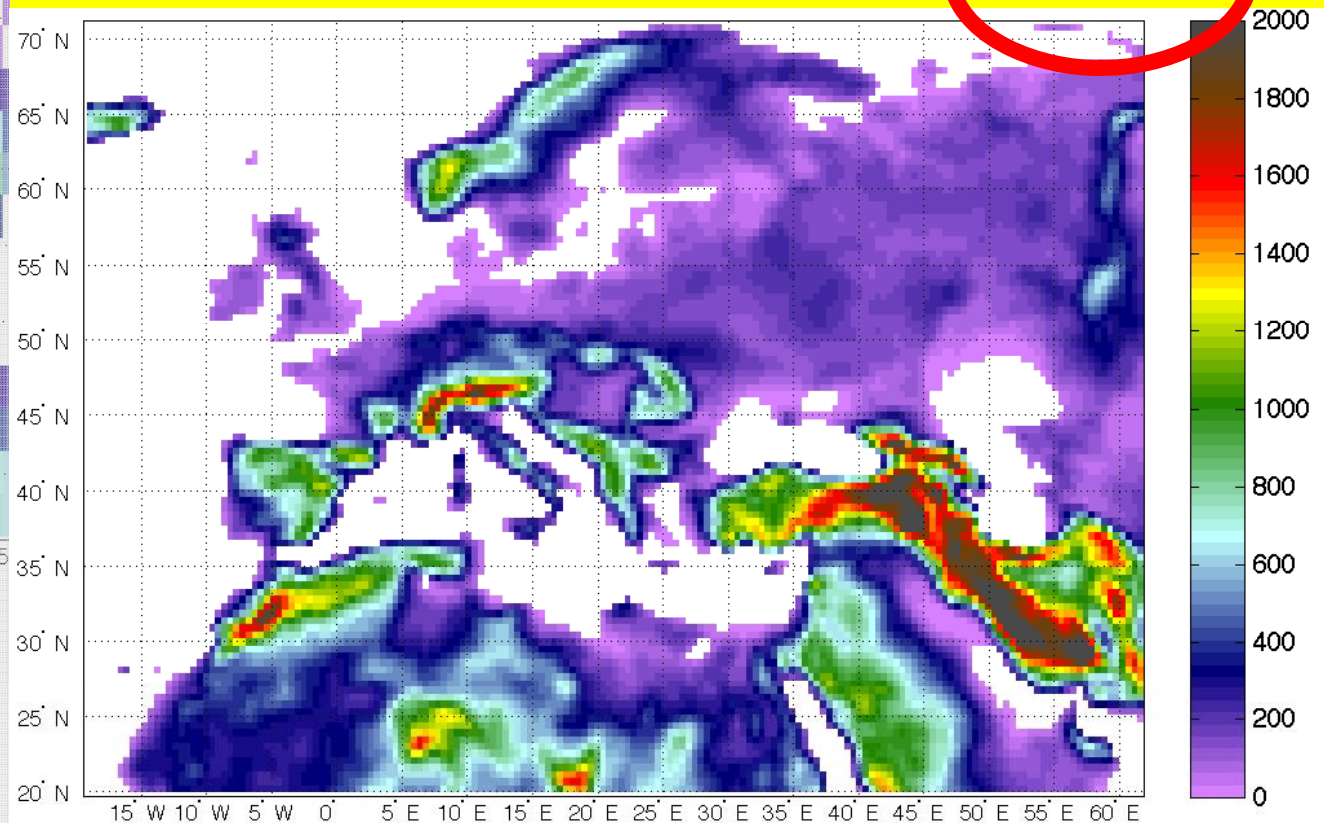


The global climate models are improving over the Mediterranean area.

IPCC-AR4 global models' standard resolution (~ 300Km)



CIRCE CMCC-MED global climate model (~ 80 Km)

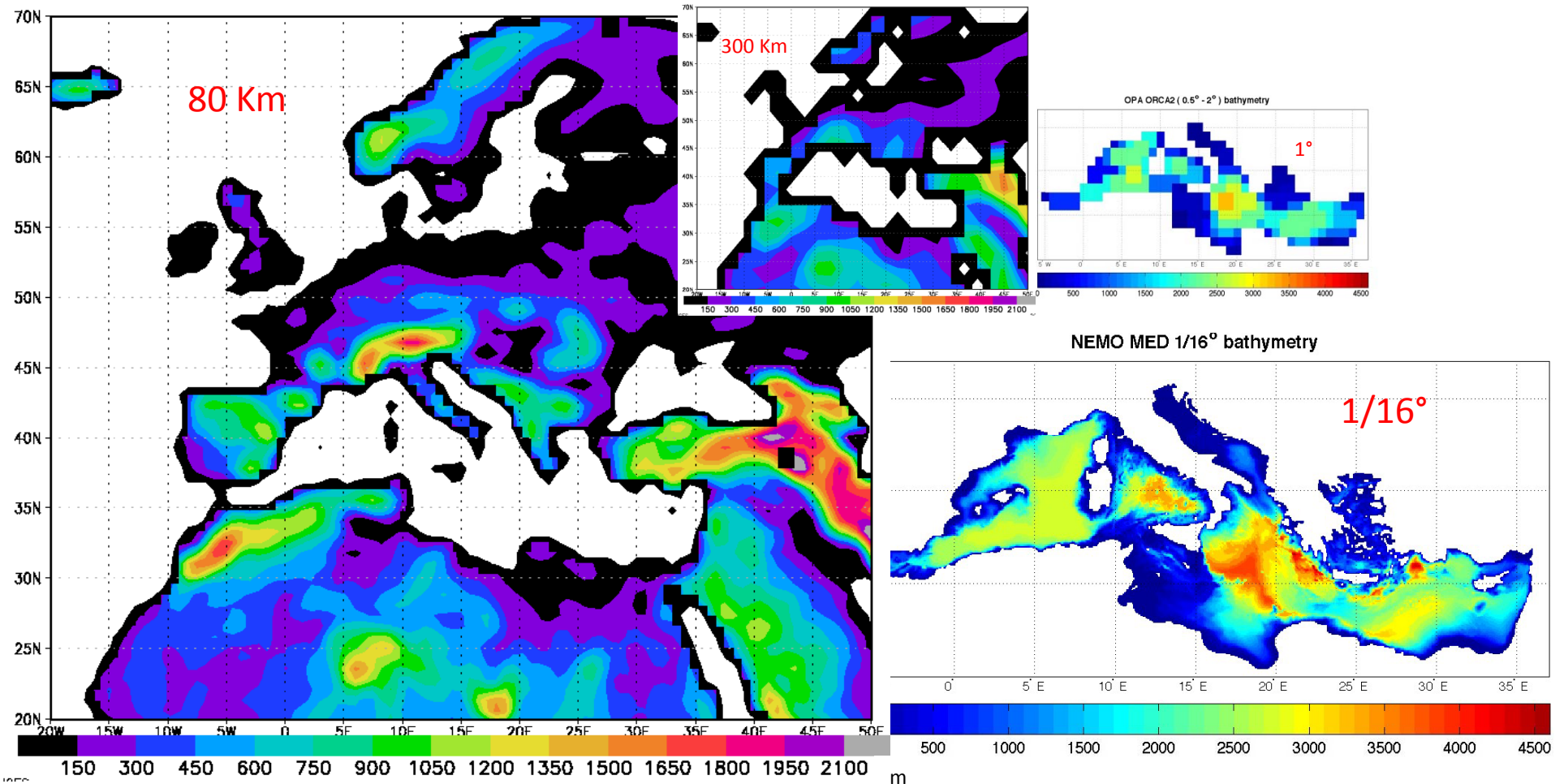


CIRCE COUPLED MODELS: global climate models with a fully resolved interactive Mediterranean Sea

Model	Atmospheric component	Global Oceanic component	Mediterranean Sea
CMCC-Med (INGV)	ECHAM T159 (~80Km), 31 vertical levels	OPA8.2 ~ 2°x2° (0.5° equator), 31 vert. levels	MFS(OPA9) 1/16° (~ 7Km), 71 vertical levels
IPSL-Glob (IPSL)	LMDZ global + LMDZ regional 300 Km, 19 vert. levels + regional Euro-Mediterranean 30 Km, 19 vert. levels	OPA9 ~ 2°x2° (0.5° equator); 31 vert. levels	MED8 (OPA9) 1/8° (9-12 km), 43 vertical levels
Météo-France (CNRM)	ARPEGE-Climate TL159c2.5 , 31 vert. lev. (stretched model: 50x50 km over Europe-Mediterranean-North Africa)	OPA9 ~ 2°x2° (0.5° equator), 31 vert. levels	MED8 (OPA9) 1/8° (9-12 km), 43 vertical levels
PROTEUS (ENEA)	REG-CM3 30 Km, 19 vertical levels	/	MIT-gcm 1/8° (9-12 km), 42 vertical levels
IPSL-Reg (IPSL)	LMDZ regional 30 Km, 19 vert. levels	/	MED8 (OPA9) 1/8° (9-12 km), 43 vertical levels
MPI-Med (MPI-HH)	REMO 25 Km, 31 vertical levels	/	MPI-OM 10Km, 30 levels

The regional climate models are improving over the Mediterranean area.

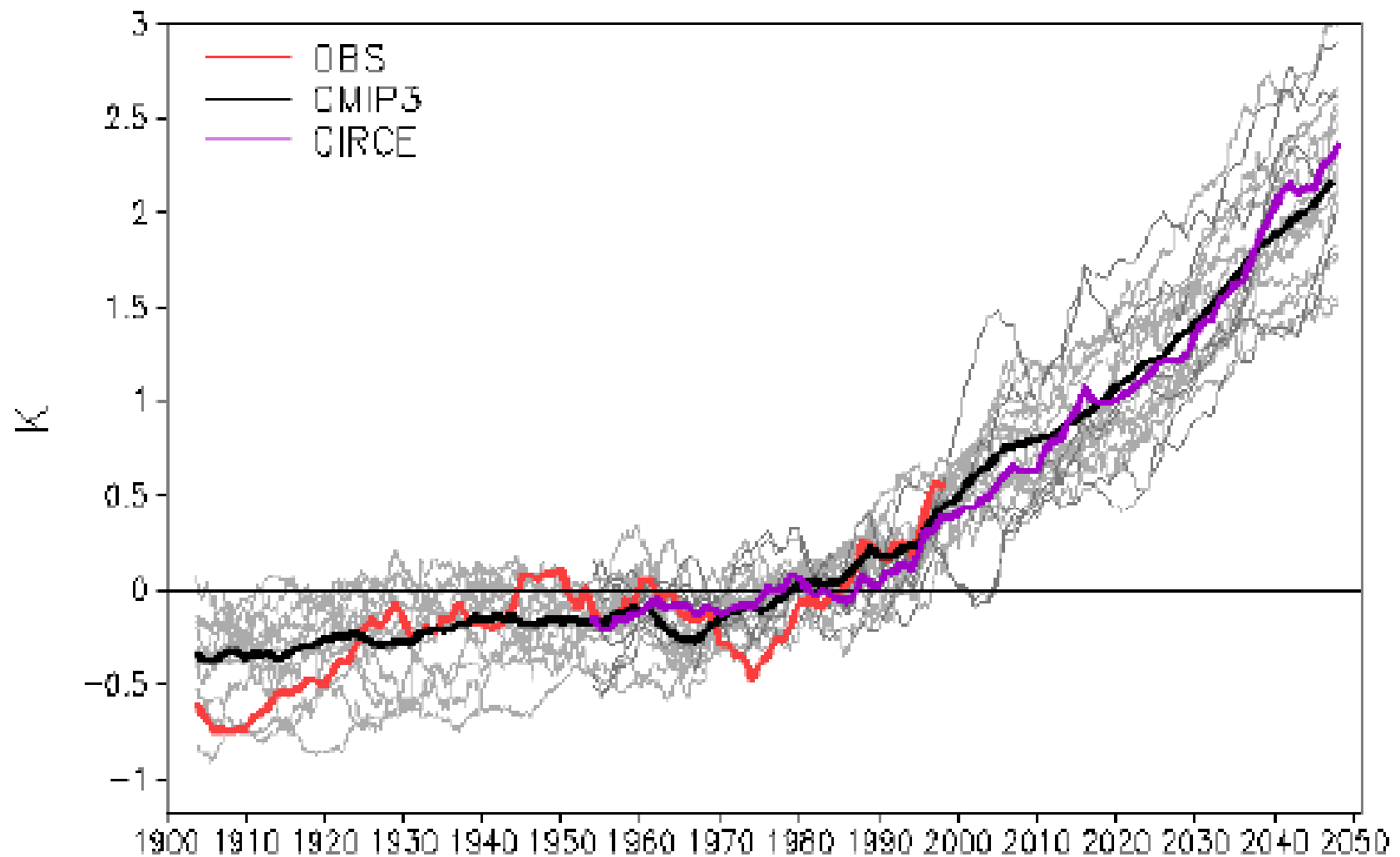
Orography, Land-Sea mask and Mediterranean Sea bathymetry in the new CMCC-MED model



Source: "Regional Assessment on Climate Change in the Mediterranean" (RACCM), CIRCE Final Report (2011), in press.

1900 - 2050

**Surface air temperature averaged over the
Mediterranean land (respect to 1961-1990)**



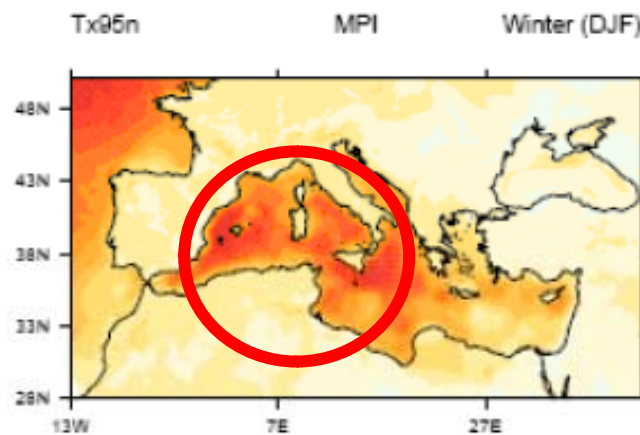
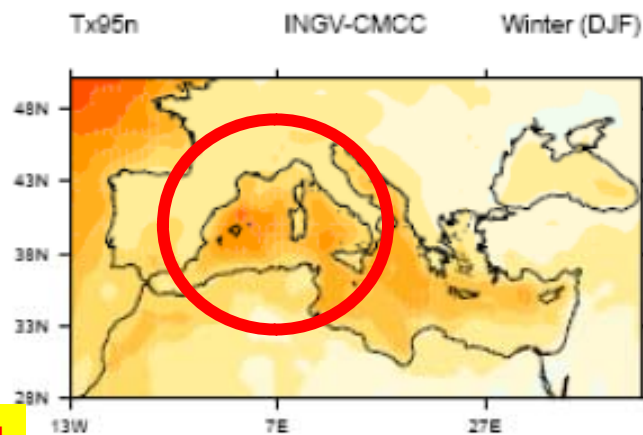
*Source: "Regional Assessment on Climate Change in the
Mediterranean" (RACCM), CIRCE Final Report (2011), in press.*

Changes in extremes:

Changes in the number of very hot days in 2021-2050 from 1961-1990 for the A1B emission scenario.

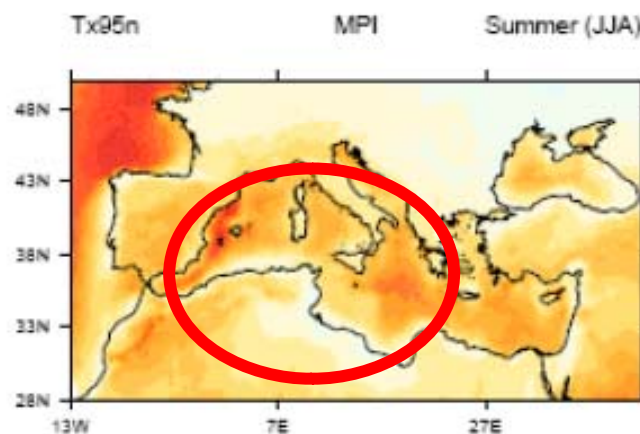
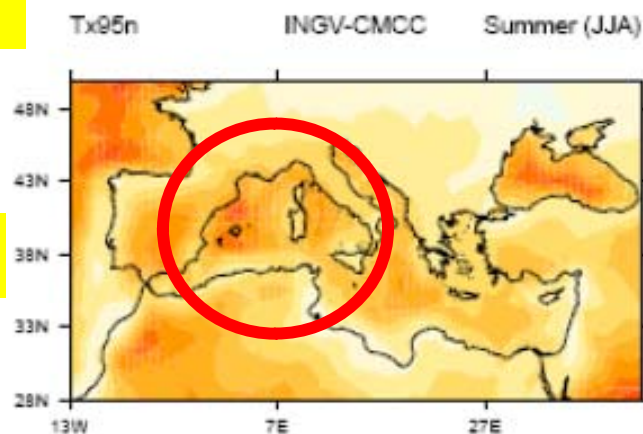
WINTER

**CMCC-Med
Model**



**MPI-HH
Model**

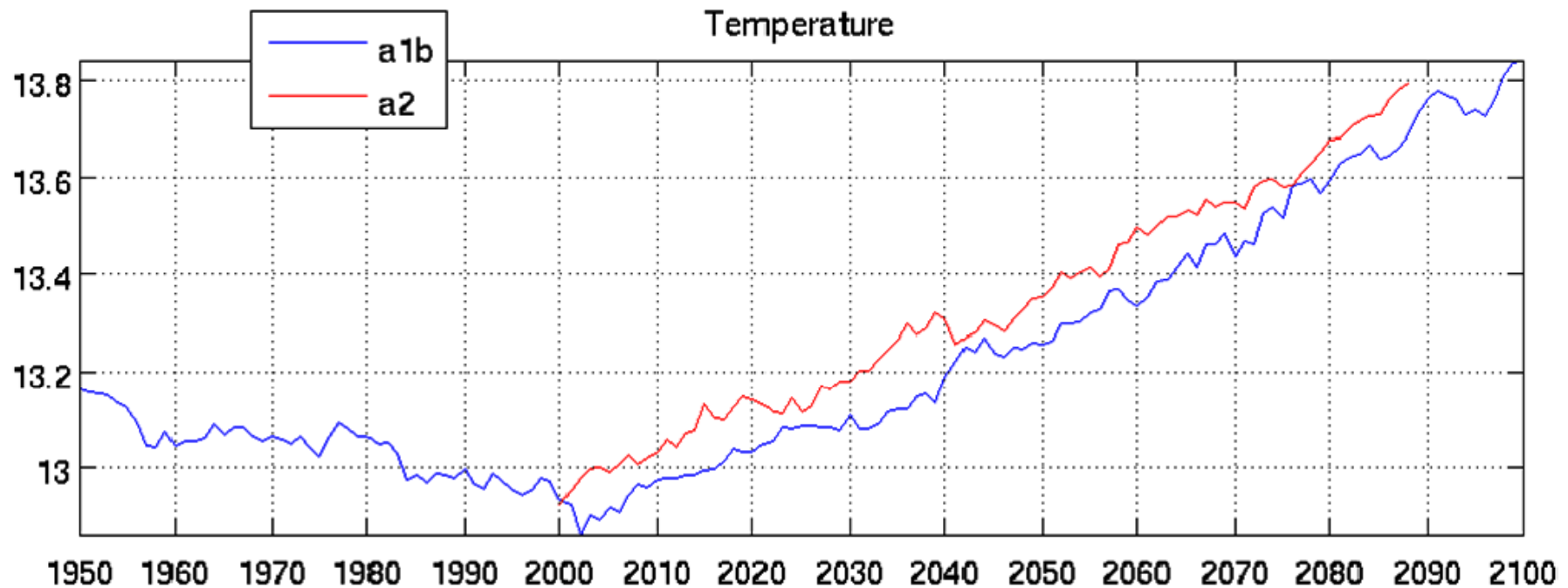
SUMMER



Source: "Regional Assessment on Climate Change in the Mediterranean" (RACCM), CIRCE Final Report (2011), in press.

1951 – 2100: Projection of Mediterranean T (A1B and A2)

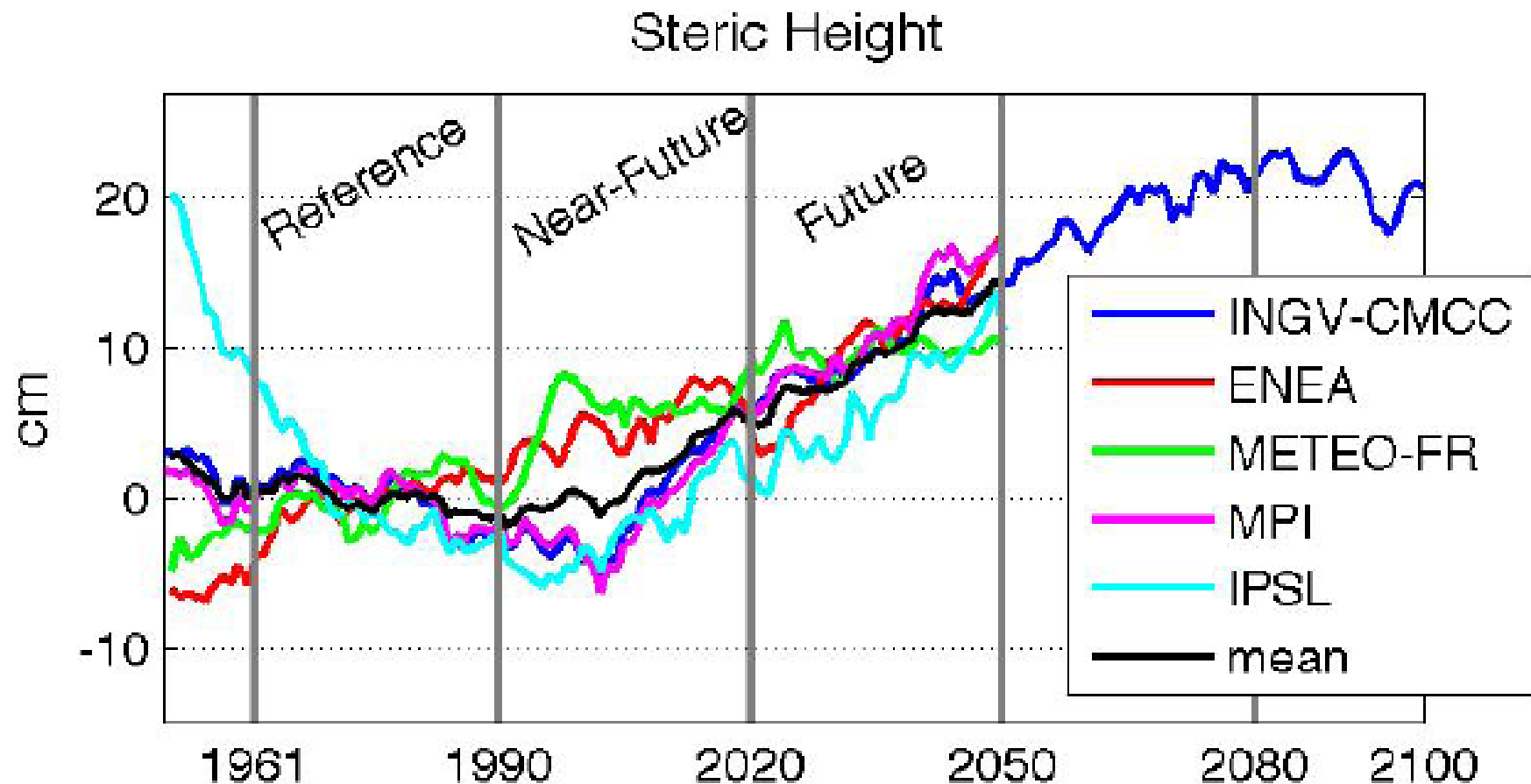
CMCC-MED
Model



Source: "Regional Assessment on Climate Change in the Mediterranean" (RACCM), CIRCE Final Report (2011), in press.

1951 - 2100

Mediterranean sea level rise projections (ensemble of CIRCE coupled models)



**A1B
Scenario**

Source: "Regional Assessment on Climate Change in the Mediterranean" (RACCM), CIRCE Final Report (2011), in press.

Climate change impacts on typical Mediterranean crops

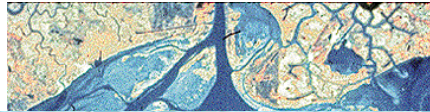
- Rising temperature and reduced rainfall negatively affect yield by both **reducing the time for biomass accumulation and increase heat and water stress of the crops** during sensible stages of their growth.
- The enhanced CO₂ air concentration may counterbalance these negative effects by **increasing water and radiation use efficiency**.
- The response of the crops to climate change depends on which of these effects is prevailing.
- Results indicated that the **shortening of the reproductive phase**, due to the increasing temperature, strongly affected the **final yield of both durum wheat and grapevine**, while **rising CO₂** may only **partially recover** the yield losses.
- **Grapevine** resulted more vulnerable than durum wheat, due to the **longer growing cycle** and the timing of the reproductive phase that highly exposed this crop to heat and drought stress.

Source: "Regional Assessment on Climate Change in the Mediterranean" (RACCM), CIRCE Final Report (2011), in press.

Climate change impacts on forests and forest products in the Mediterranean area

- Climate change will not only affect **functionality or productivity of forests** but also their **distribution**.
- Large areas of ecosystems in Europe are likely to be affected already under a climate stabilisation scenario at 2 °C.
- **The Mediterranean countries** will have a decrease in the number of plant species.
- **Under future climate scenarios, the distribution of typical Mediterranean tree species is likely to decrease in the region**, but could expand to new areas where Mediterranean like climatic conditions will appear.
- Climate change, together with **trends of land-use change** (e.g. rural abandonment) are likely to **diminish forested areas within the Mediterranean basin**.

Source: "Regional Assessment on Climate Change in the Mediterranean" (RACCM), CIRCE Final Report (2011), in press.



The final CIRCE Report:

“Regional Assessment on Climate Change in the Mediterranean” (RACCM)

is in press for ***Springer Verlag***.

