

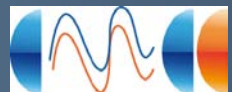
Centro Euro-Mediterraneo
per i Cambiamenti Climatici

The Climate Dilemma

Antonio Navarra

“Universities have departments, society has problems”

- *Traditional reductionist model insufficient*
- *Pressures from the world have pushed scientist to consider messy, multidimensional problems.*
- *Emergence of new technologies that have the potential to empower many different fields*
- *The pressure against the traditional disciplinary barriers is increasing*

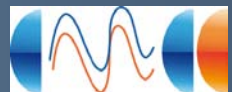


Convergence

“Convergence is the merging of distinct technologies, processing disciplines, or devices into a unified whole that creates a host of new pathways and opportunities. It involves the coming together of different fields through collaboration among research groups and the integration of approaches that were originally seen as distinct or even contradictory

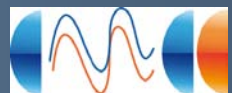
It is a broad rethinking of how scientific research is done.”

– MIT White Paper



Climate Change is a Converging Science

The Science of climate change is converging. Numerical and mathematical modeling are providing the context to share methods and concepts, leading to faster innovations, cheaper implementations and better solutions.



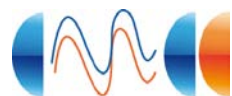
Centro Euromediterraneo per i Cambiamenti Climatici

■ **CMCC** was established in 2005 by a group of Italian Research Institutions that now includes (Istituto Nazionale di Geofisica e Vulcanologia, Fondazione Eni Enrico Mattei, Università degli Studi del Salento, Centro Italiano Ricerche Aerospaziali, Università' di Venezia, Università degli Studi del Sannio)

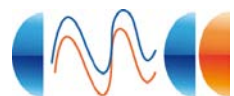
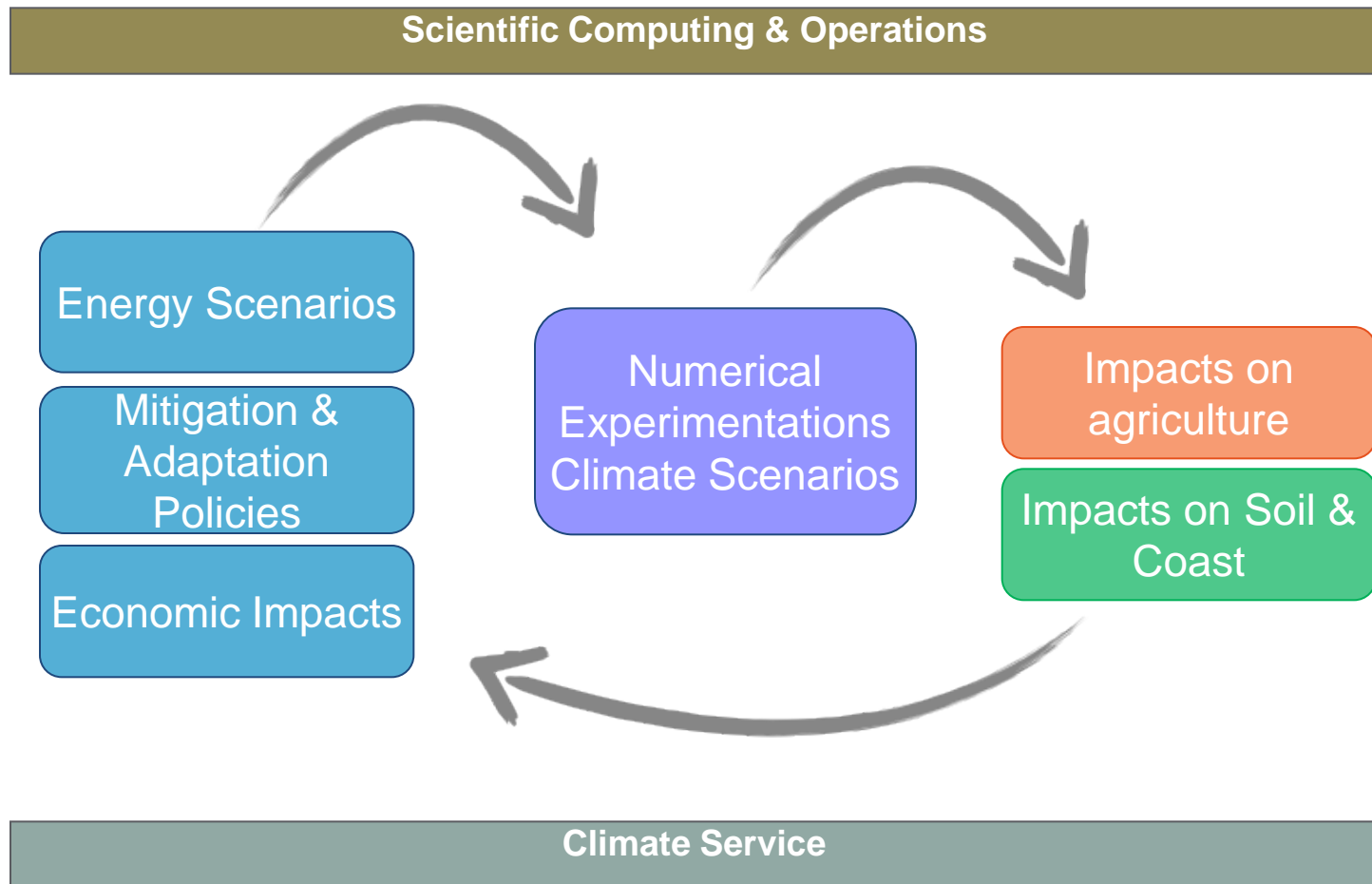
■ **CMCC is the Italian Research Centre on Climate Science and Policy.** Supported by the Italian Ministry for the Environment Land and Sea, the Ministry for Education, University and Research and the Ministry for Economy

■ **CMCC hosts the IPCC Italian Focal Point**

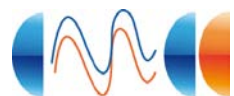
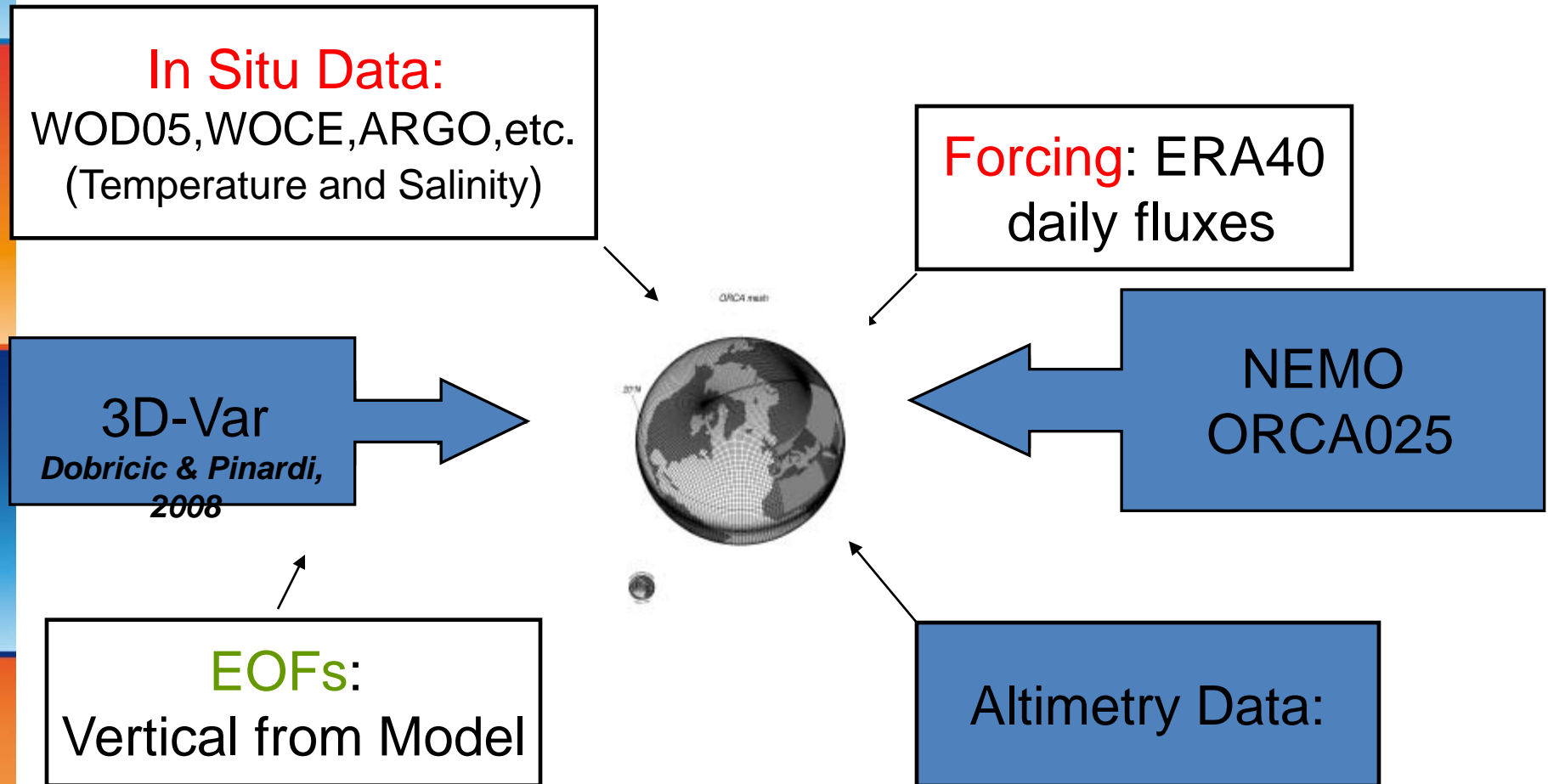
● Associate Centers ● Partners



Six Integrated Divisions

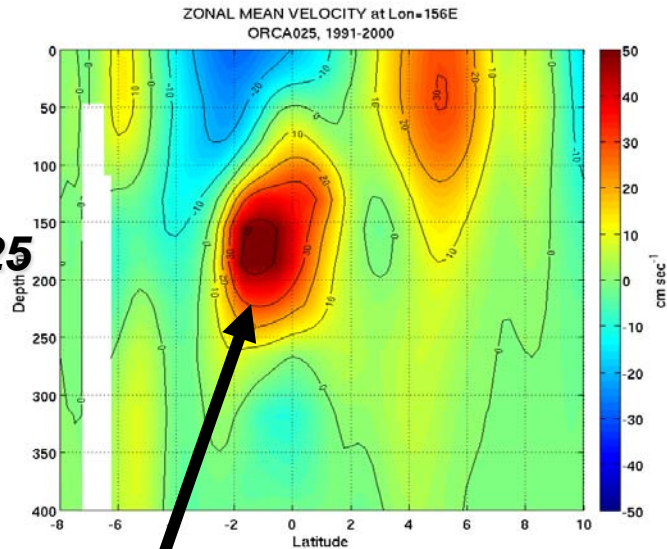


Global Ocean Data Assimilation System at CMCC

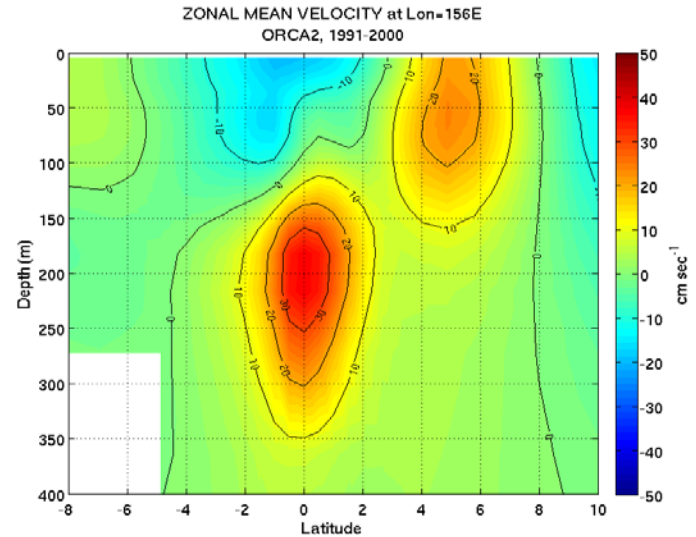


Zonal Velocity at 156°E (West Pacific)

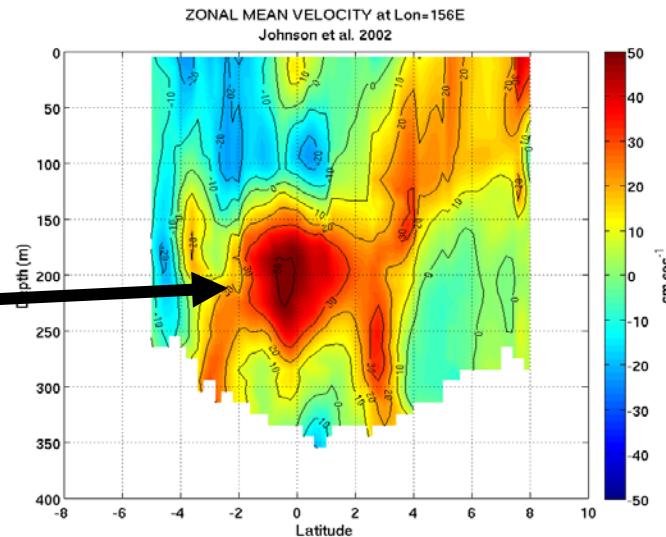
ORCA025



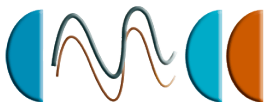
ORCA2



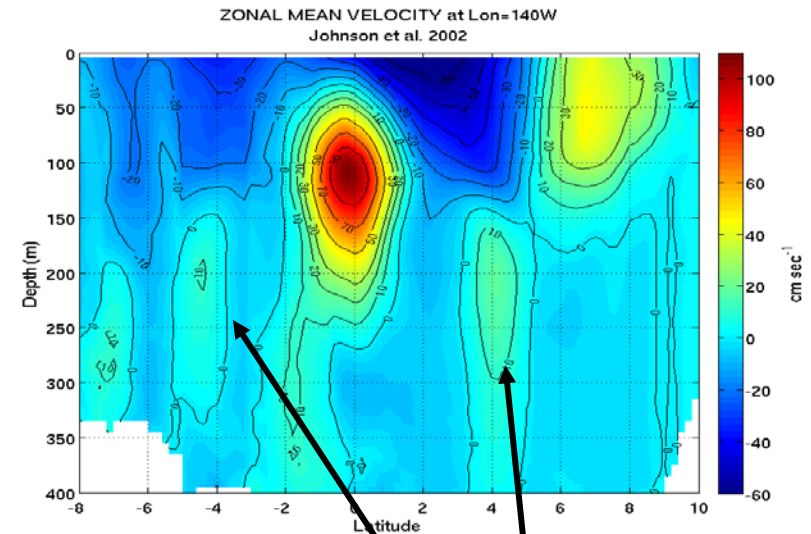
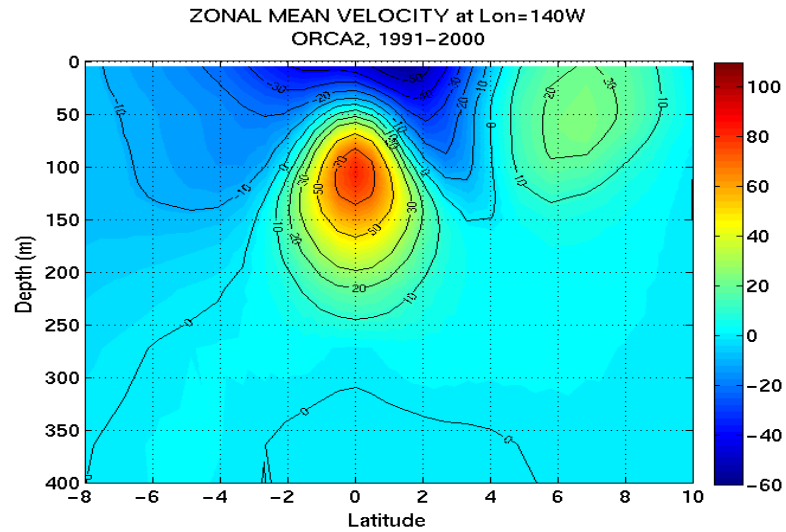
The spatial shape and the intensity of the **Equatorial Undercurrent** seem to be more realistic



OBS



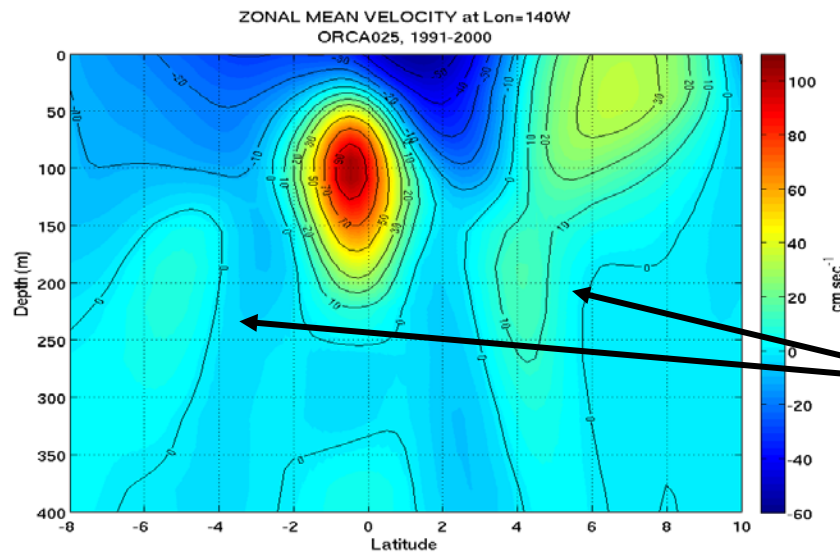
Zonal Velocity at 140°W (East Pacific)



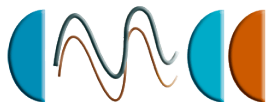
ORCA2

ORCA025

OBS

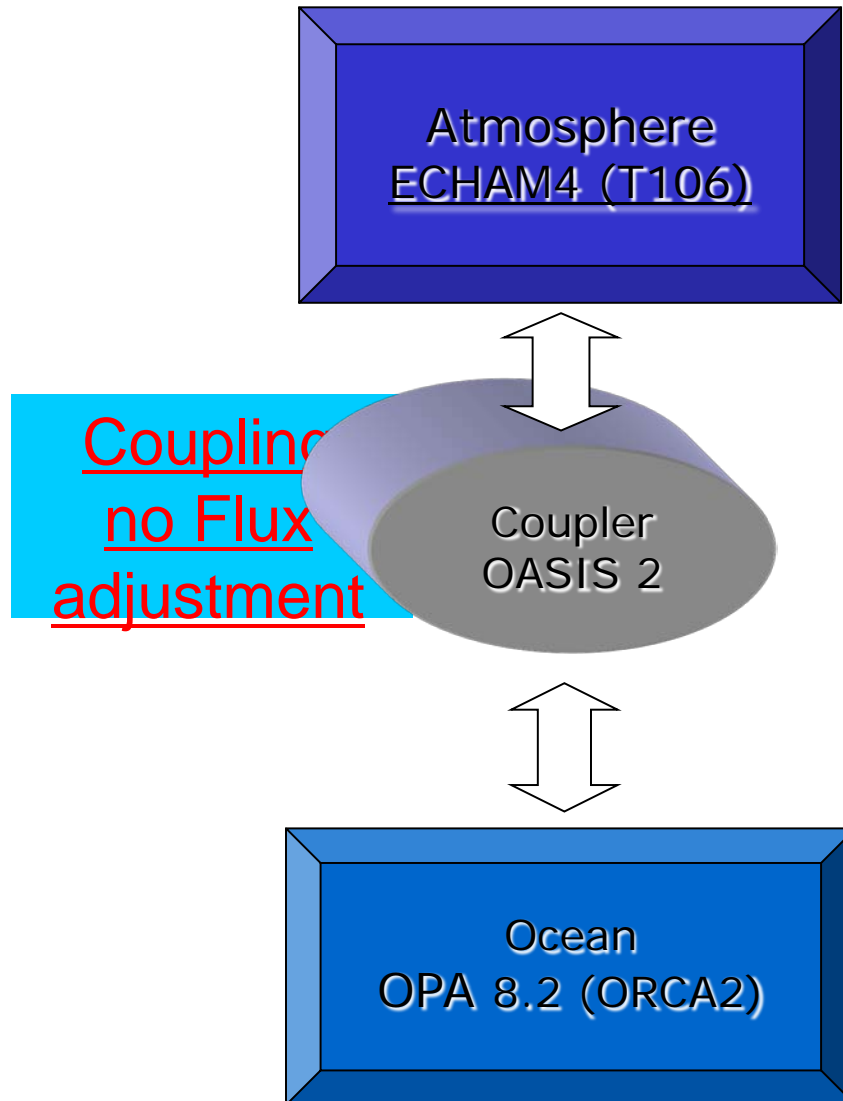


**The subsurface
jets are
simulated**



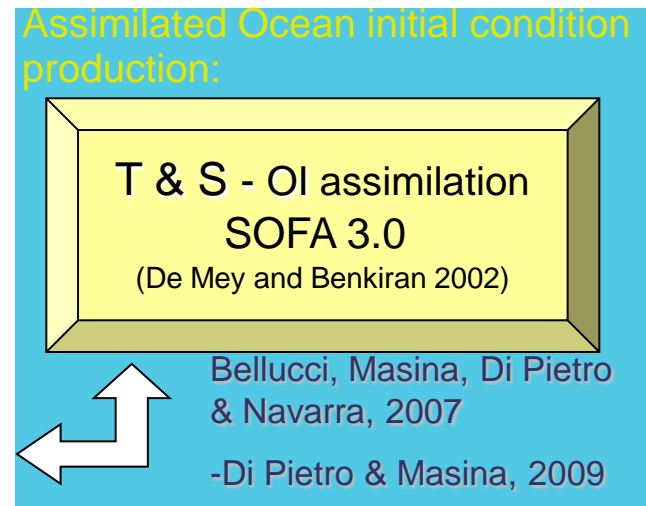
CMCC-INGV Seasonal Prediction System

Coupled Model Components



Off line Initialization Tools

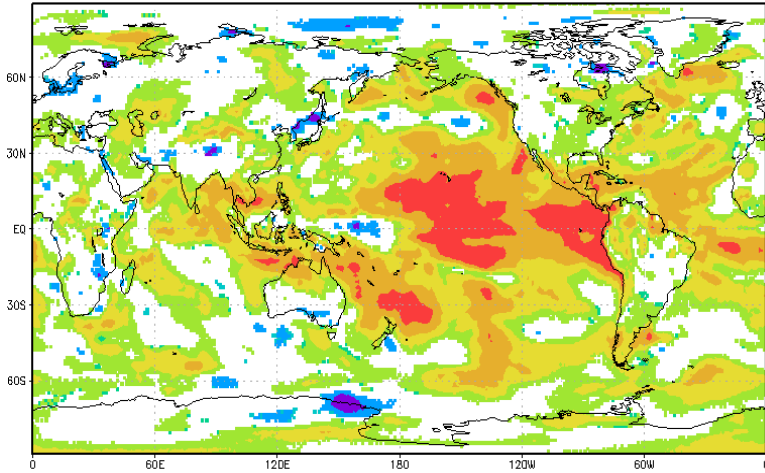
CMCC-INGV Global Ocean
Data Assimilation
System(CIGODAS)



Surface

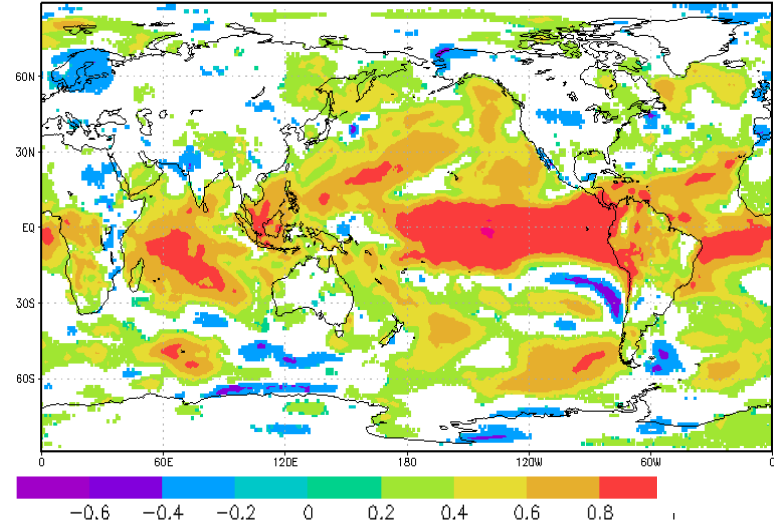
Anomaly Correlations (months) (2-10-4)

Model vs ERA40 JJA

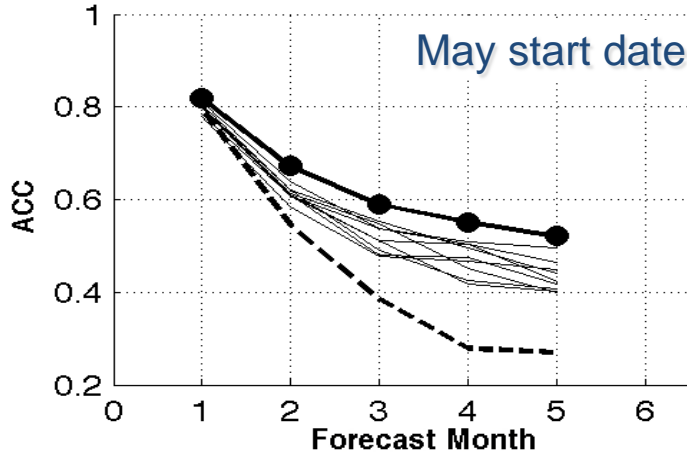


temperature

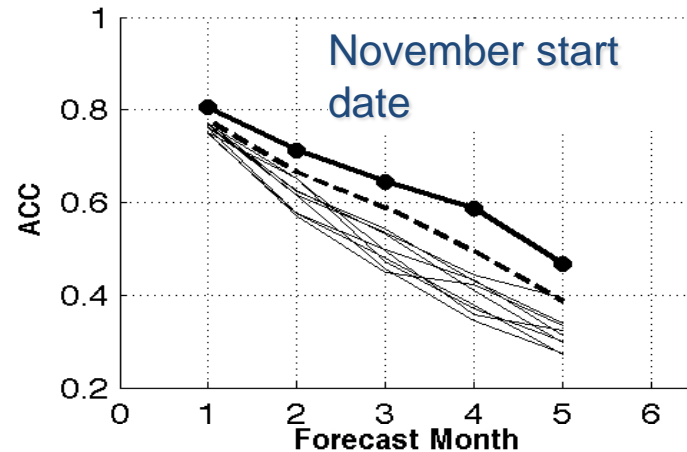
Model vs ERA40 DJF



Tropical Pacific [25S-25N; 140-280] – Anomaly Correlation Coefficient (ACC)



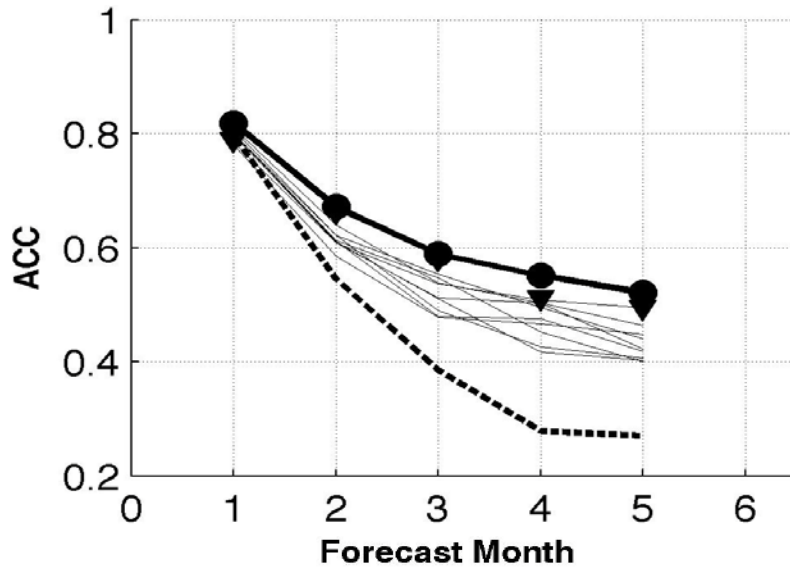
Solid thick & circles = Ensemble means
 Solid thin = Ensemble members



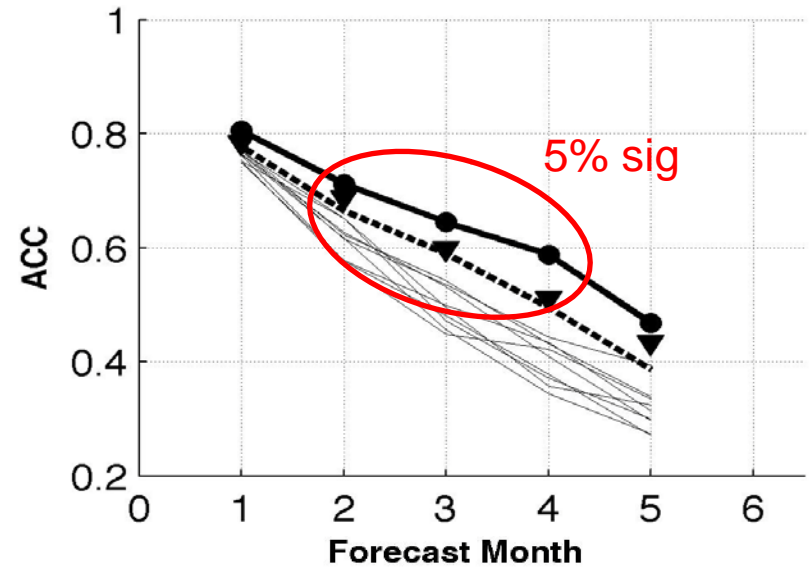
Dashed = persistence

Impact of improved IC: Tropical Pacific SSTA

MAY START DATE



NOVEMBER START DATE



Solid thick & circles = DAS Ensemble means
Solid thin = DAS Ensemble members

Triangles = NODAS
Dashed = persistence

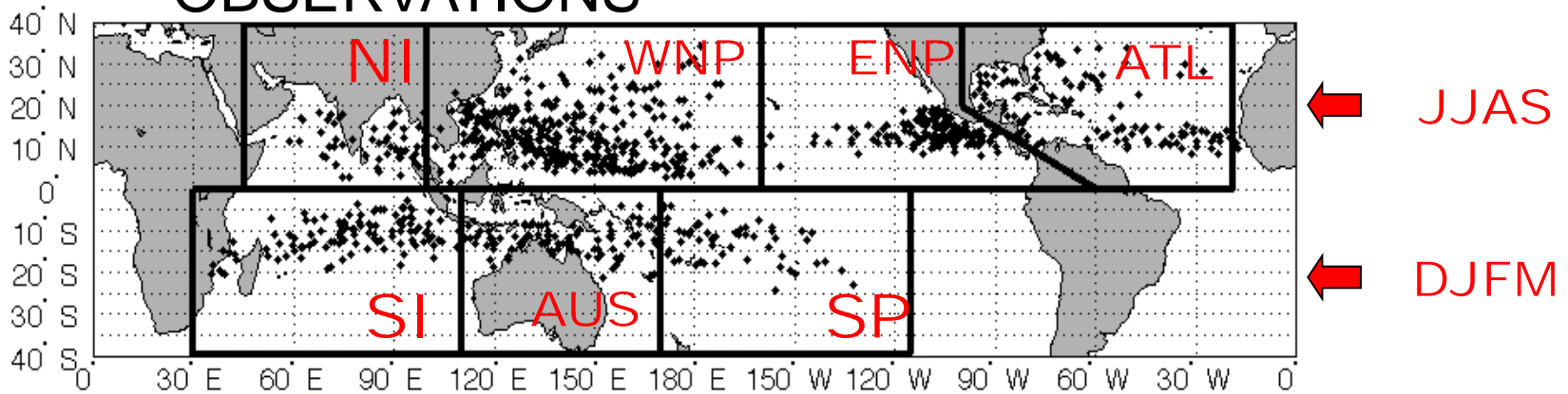
How good is the model in predicting tropical

?

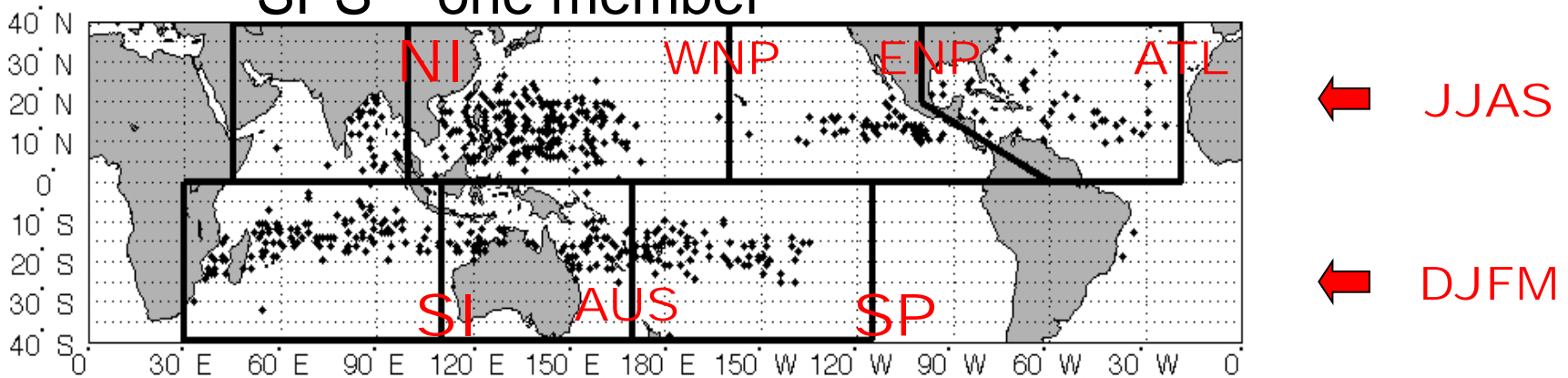
Tropical Cyclone tracks starting points 1992-2001

OBSERVATIONS

ff



SPS – one member



Regions as in Camargo et al. 2004

OBSERVATIONS:
NHC [National Hurricane Center] &
JTWC [U.S. Joint Typhoon Warning Center]

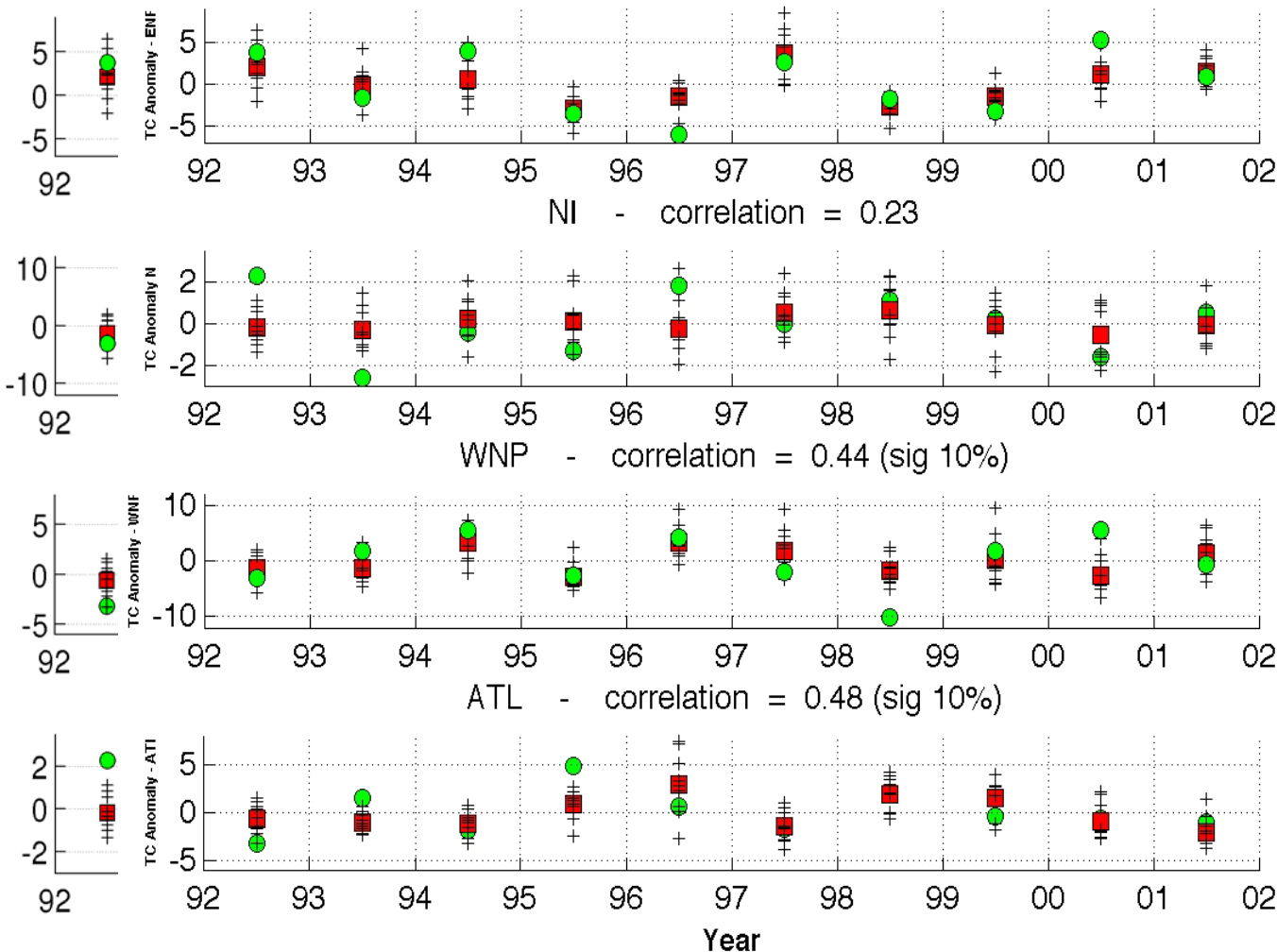
Interannual TC Count anomalies Prediction (Boreal

ENP - correlation = 0.76 (sig 5%)

MAY-to-September
(JJAS)

Green=Observations
Red=Ensemble means

crosses = ensemble members



CORRELATIONS
SPS vs OBS

	May IC
ENP-East North Pacific	<u>0.76</u>
NI-Northern Indian	0.23
WNP-West North Pacific	<u>0.44</u>
ATL-North Atlantic	<u>0.48</u>

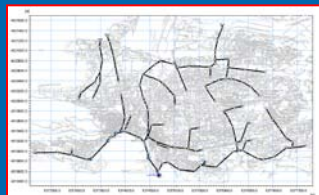
Underline indicate significance (10% at least)



The ADRICOSM-STAR new coastal integrated observational and modelling approach

Atmospheric and climate models

Urban waters



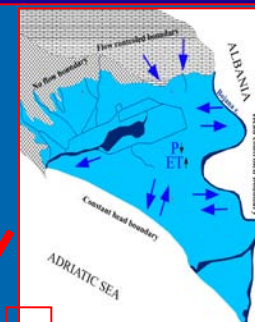
Coastal area



River



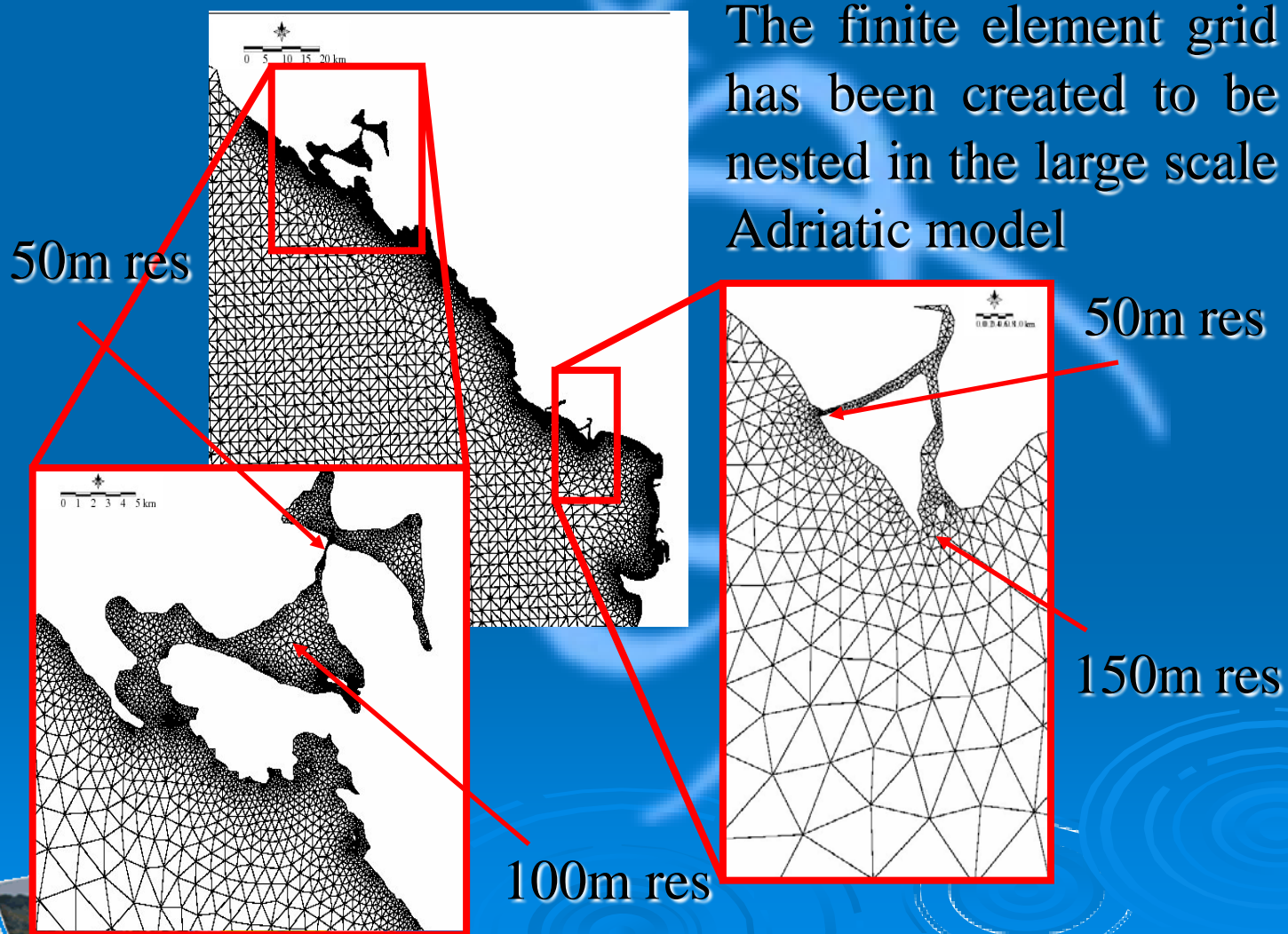
Underground Waters



Data QC, Model interfaces
Geoportal

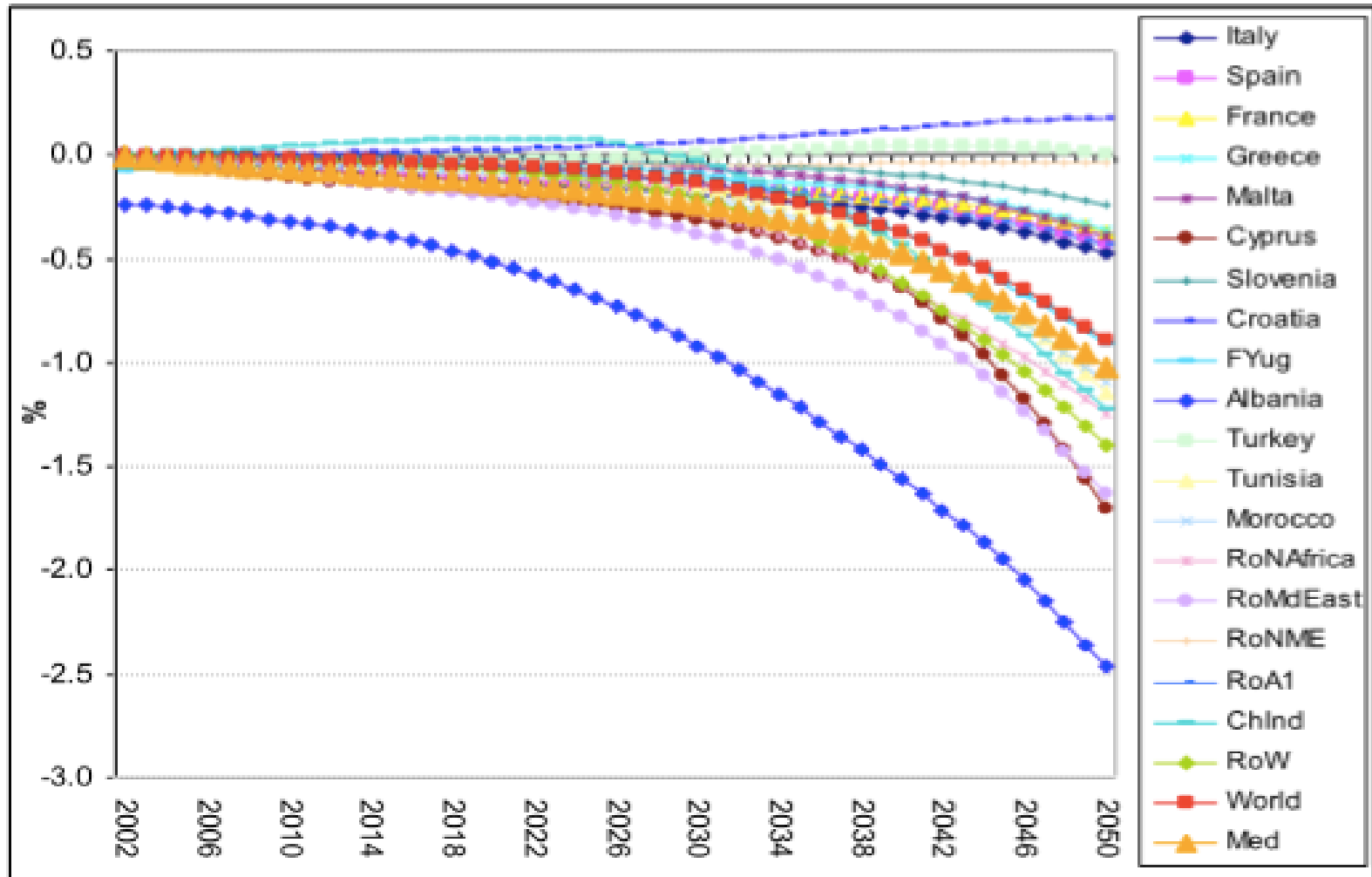
Monitoring, forecasting and
Climate scenario impacts

Montenegro coastal strip modelling



Climate Change Impacts on GDP

% Change of GDP for No-Action Climate Change



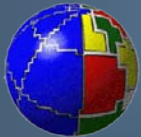
Sustaining and directing the research effort

Funding for Earth Systems research is stationary or decreasing.

University programs, with their reliance on individually funded research, are too small to engage in a global programmatic approach.

Research spending from those institutions that do have scale – e.g. defense budgets and private sector entities – is significantly lower than it used to be.

We are not increasing our investments in research right at the time when we need to generate new intellectual capital that can help us manage both the planet and our economic activities in the 21st Century.



A new international research paradigm

We need to identify the new questions. What are the big scientific and technological questions that will make a real difference to policy and investment decisions in the coming decade, and that can drive the research agenda of the next generation of researchers and scientists?

We need to mobilize new sources of funding. We need to be able to articulate the scale of funding needed. What is the scale of that funding? How does it compare to other efforts to accomplish other advancements in knowledge and technology?

We need new global institutional solutions to deliver the support this research deserves. What forms of global public-private partnerships do we need to ensure the private sector invests for the long term? What institutional arrangement should we set in place?

