

**WCRP**

World Climate Research Programme



# The Role of Observations & Research in Climate Services

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ICSU

International Council for Science

## WCRP Core Projects



### Climate Variability and Predictability

**Mission:** To identify the physical processes involved in the Climate dynamics, including anthropogenic effects, and develop models and predictive capabilities

### Climate and Cryosphere

**Mission:** To assess and quantify the impacts that climatic variability and change have on components of the cryosphere and its overall stability



### Stratospheric Processes and their Role in Climate

**Mission:** To focus on climate-chemistry interactions; detection, attribution and prediction of stratospheric change; stratospheric-tropospheric dynamical coupling

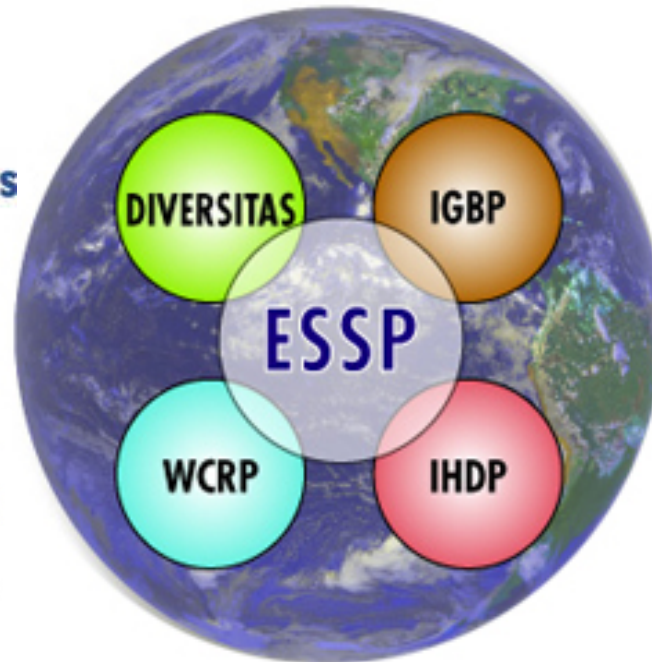
### Global Energy and Water Cycle Experiment

**Mission:** To observe, analyze, understand and predict the variations of the global energy cycle and hydrological regime and their impact on atmospheric and surface dynamics





The Earth System Science Partnership (ESSP) consists of four international global environmental change (GEC) research programs for the integrated study of the Earth system, the changes that are occurring to the system and the implications of these changes for global and regional sustainability.



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# International Earth Observing Systems



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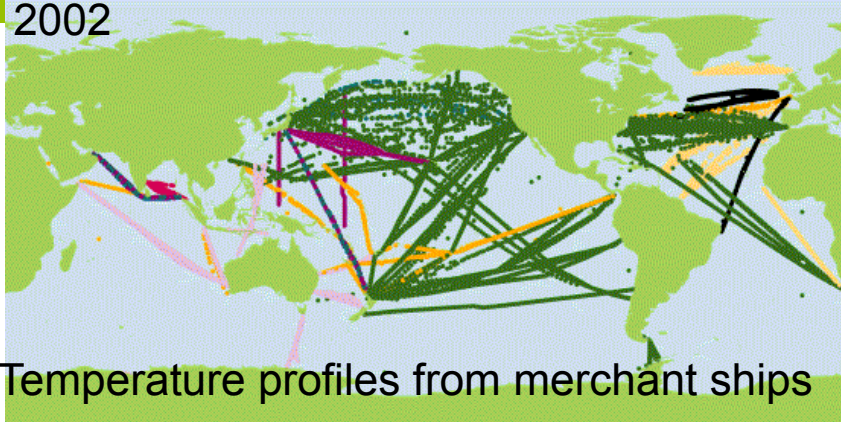


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2002

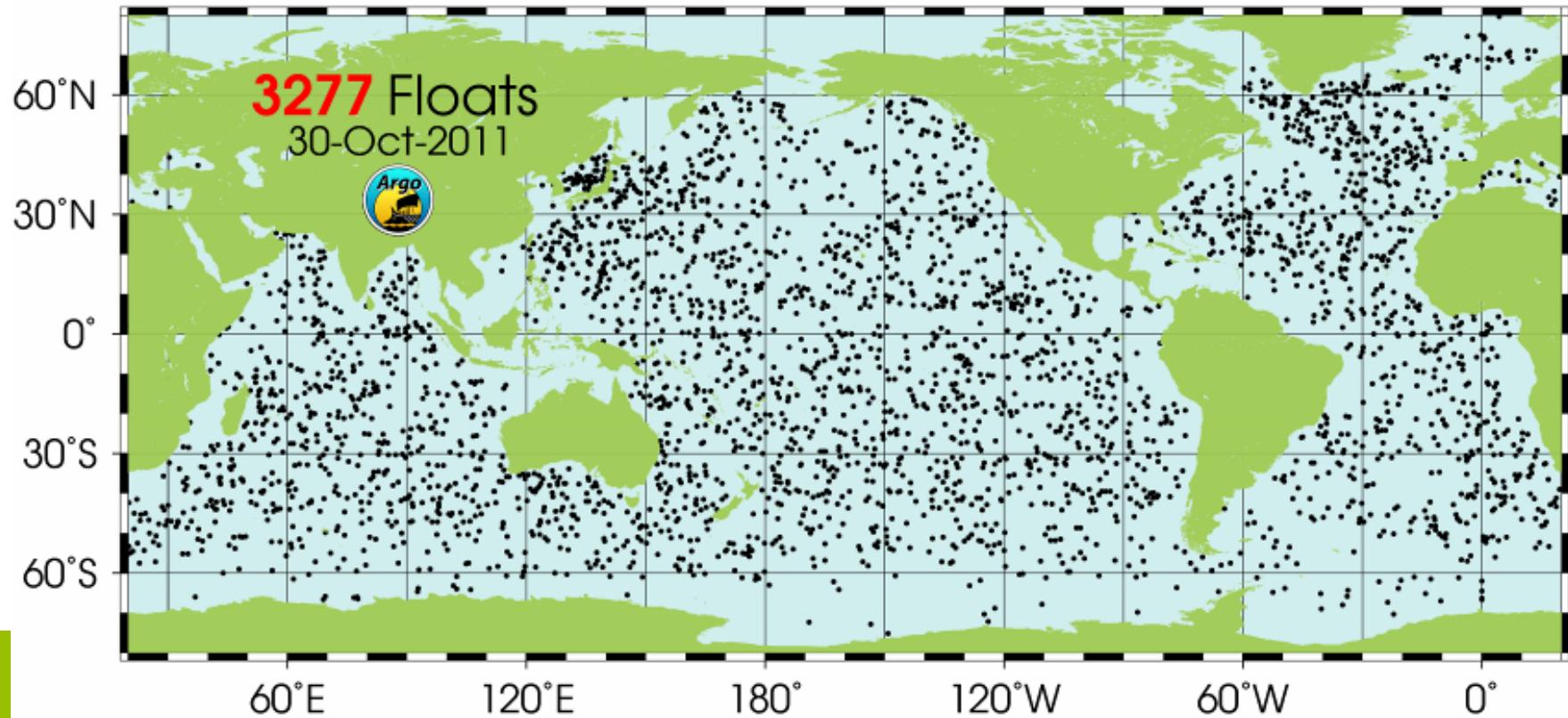


Temperature profiles from merchant ships

2003



ARGO installation



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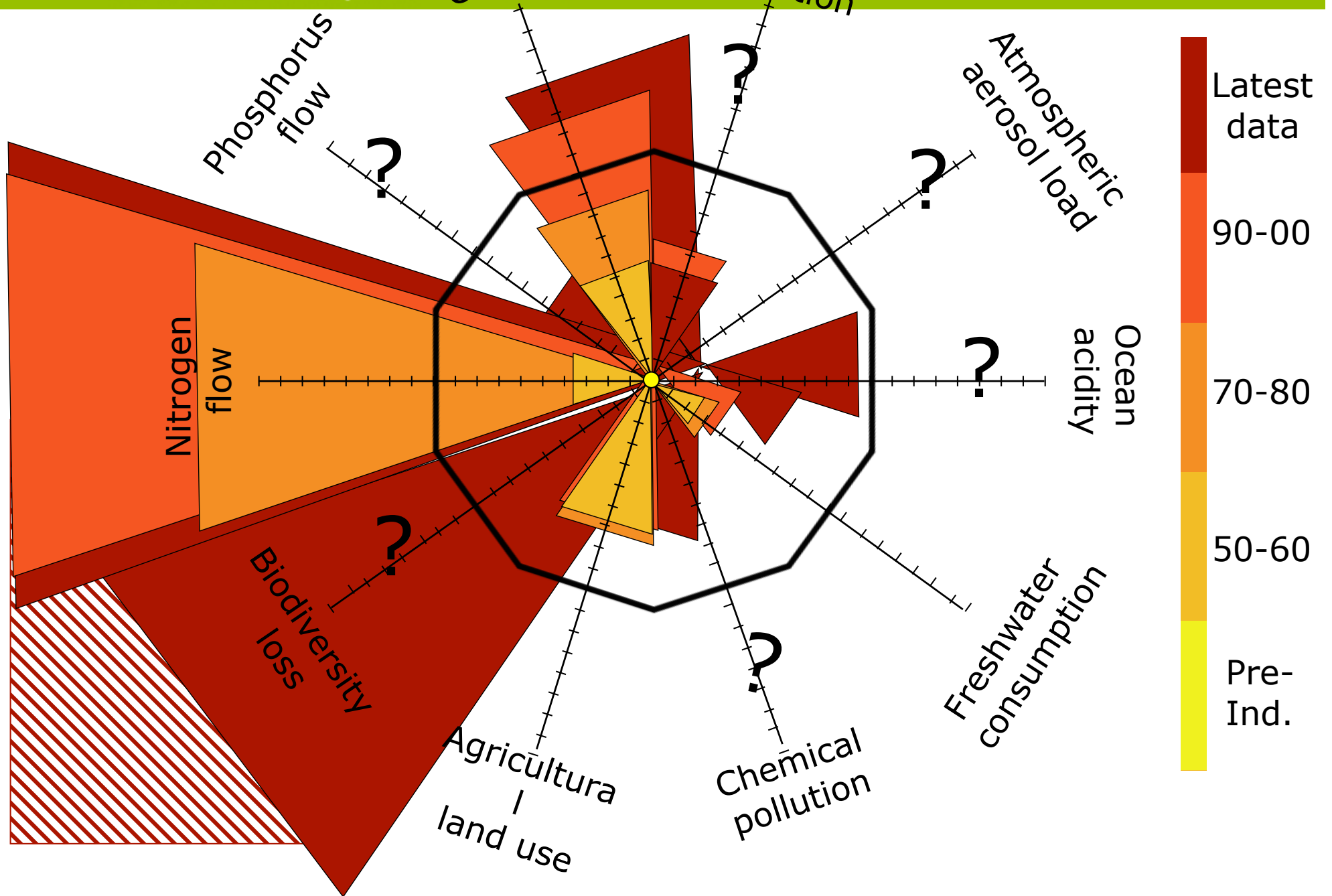


Climate Change

Ozone depletion

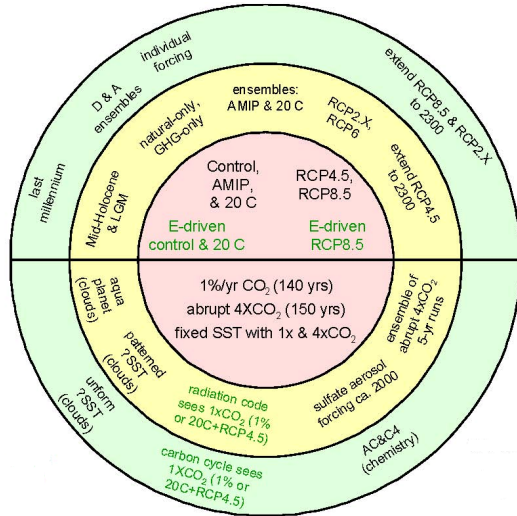


Earth System Science Partnership





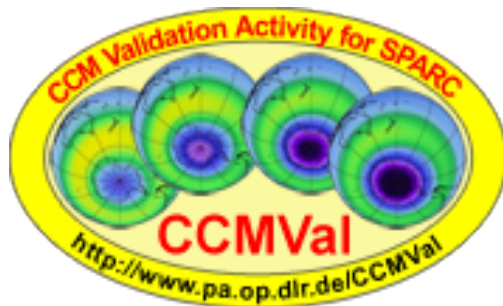
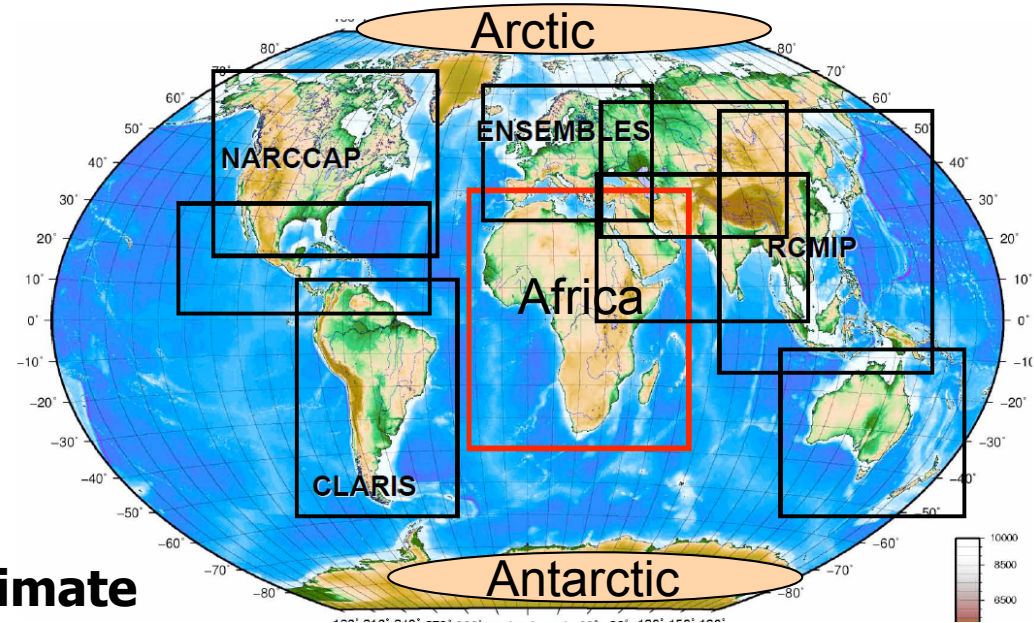
# Example: Major Climate Prediction & Projection Experiments



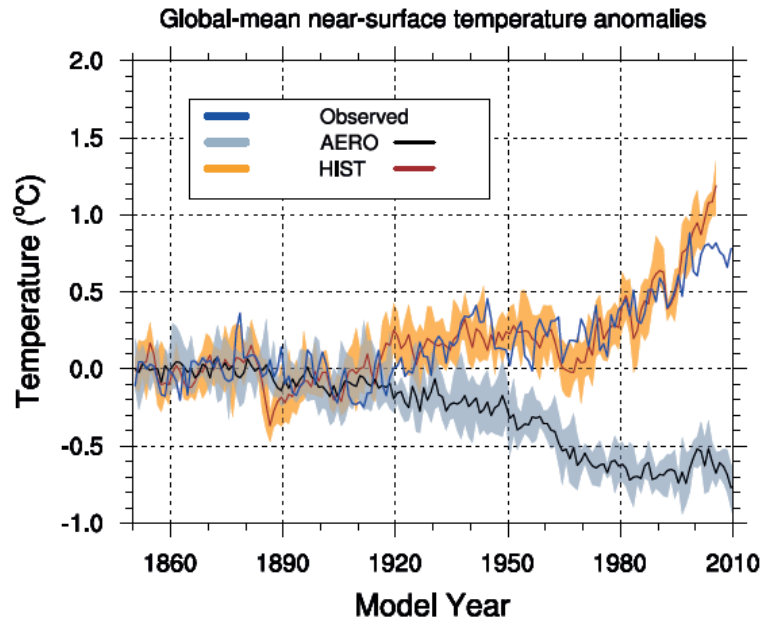
## Climate-system Historical Forecast Project - CHFP

## Coordinated Regional Downscaling Experiment – CORDEX → IPCC AR5

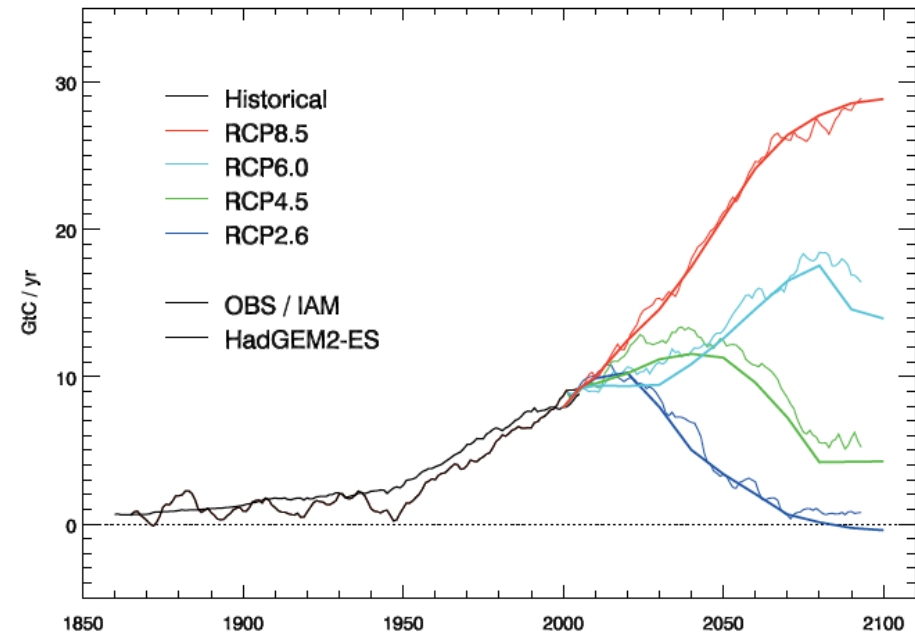
## Coupled Model Intercomparison Phase 5 – CMIP5 → IPCC AR5



## Chemistry-Climate Model Validation



Global-mean near-surface temperature anomalies in simulations with all natural and anthropogenic forcings (red line), and with the anthropogenic aerosol forcing alone (black line), in one of the CMIP5 models. (from Boucher et al, 2011)

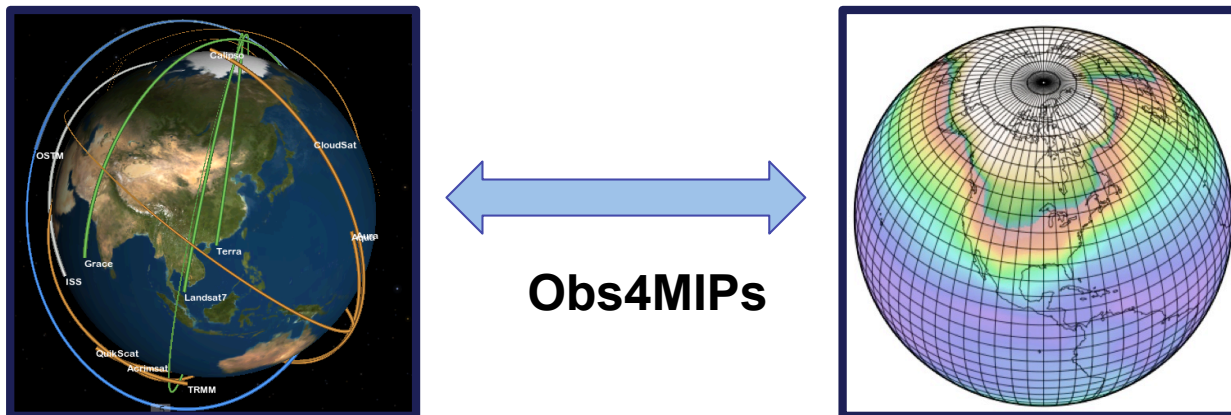


Permissible emissions as simulated by a CMIP5 model (HadGEM2-ES) compared with observed CO2 emissions for the historical period and those projected for the RCP scenarios (OBS/IAMs) (from Friedlingstein and Jones, 2011)





Coordinated with CMIP5 are parallel efforts to collect and make available observationally-based products



**Obs4MIPs is a pilot effort to improve the connection between data experts and scientists involved in climate model evaluation. It is closely aligned with CMIP5, with encouragement from the WGCM and WGNE. NASA and the U.S. DOE have initiated the project with significant contributions of appropriate NASA products. An overarching goal is to enable other data communities to contribute data to Obs4MIPs.**

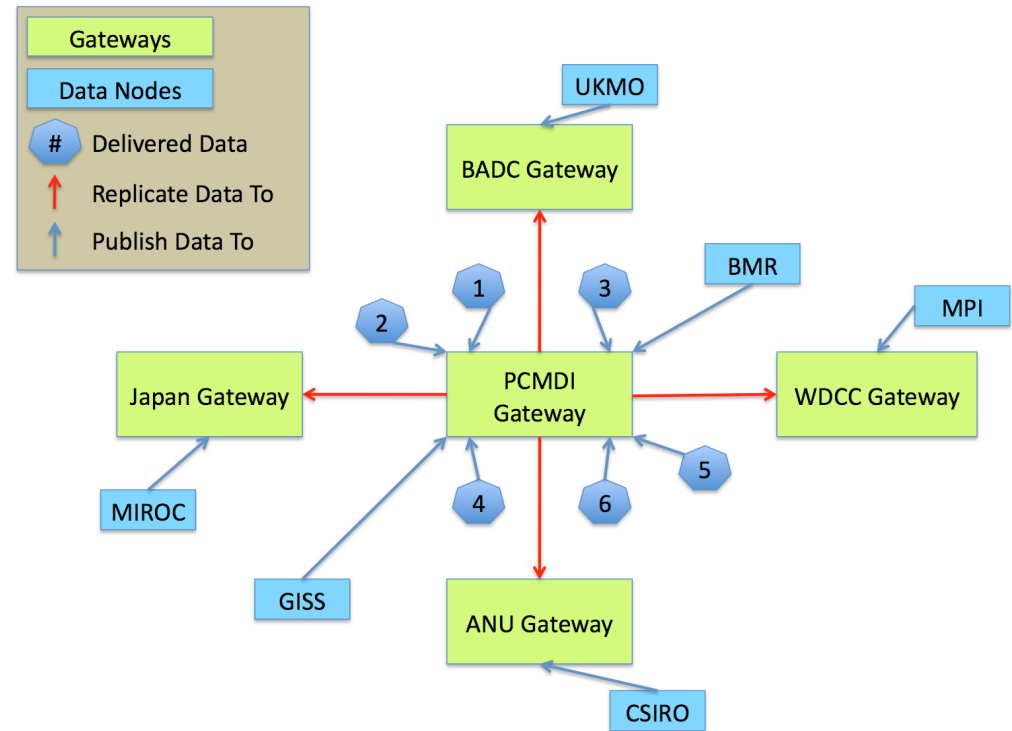


CMIP5 participating groups (20+ groups; ~40 models).

2.3Pbytes of model output expected - 100 times greater than CMIP3.

Model data will be accessed by the Earth System Grid - output will be served by federated centers around the world and will appear to be a single PCMDI archive.

The archive will become available to analysts from end 2010 to Spring 2011.





- Urgent need for “**actionable**” **climate information** based on sound science
- The need for “**symbiotic**” **relationship between providers and users of climate information** to ensure climate information is timely, accessible, easy to understand
- Urgent need for **training and development of “next generation” of scientists and decision makers** who pursue and promote the use of actionable climate/environmental information

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## WCRP Grand Science Challenges

- **Provision of skillful future climate information on regional scales (includes decadal and polar predictability)**
- **Regional Sea-Level Variability and Change**
- **Cryosphere response to climate change (including ice sheets, water resources, permafrost and carbon)**
- **Improved understanding of the interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity**
- **Past and future changes in water availability (with connections to water security and hydrological cycle)**
- **Science underpinning the prediction and attribution of extreme events**



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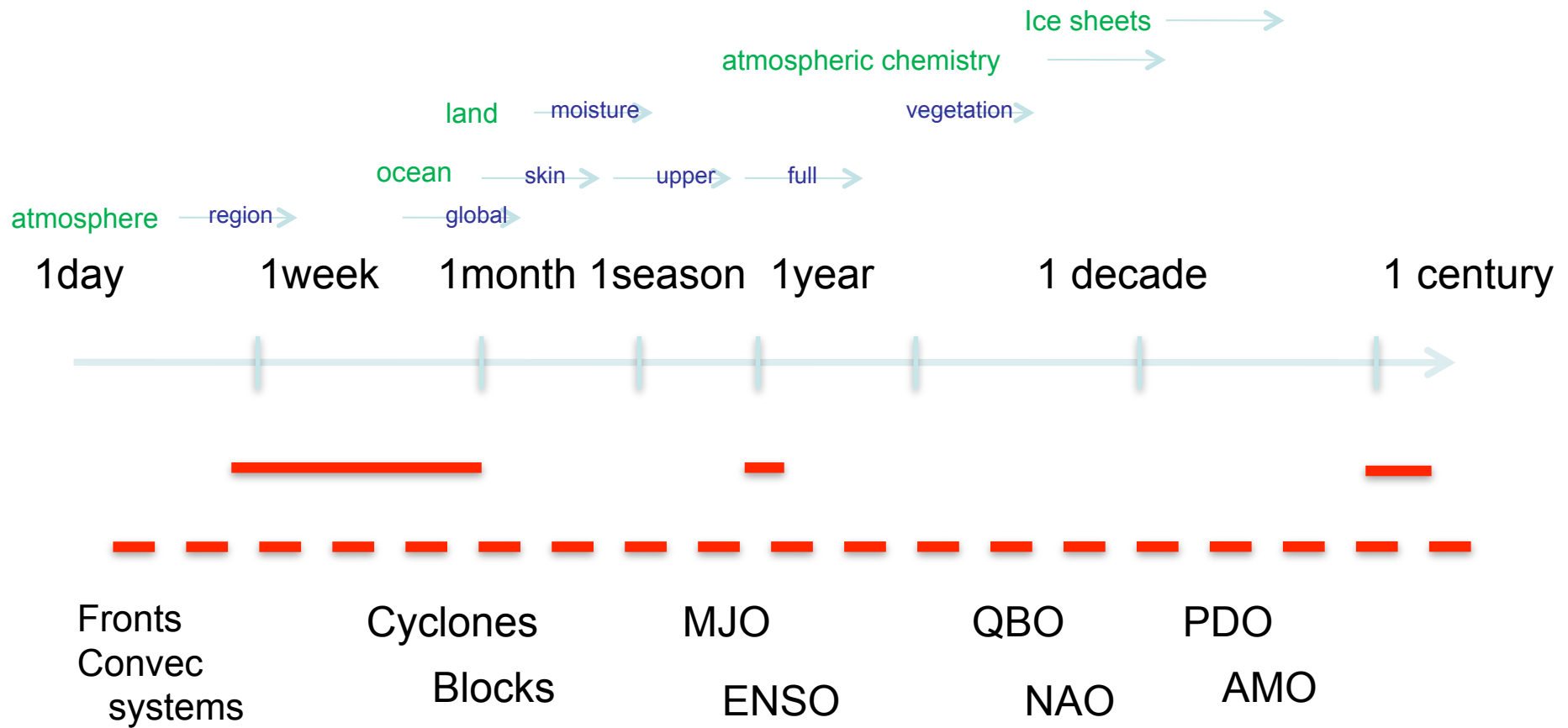


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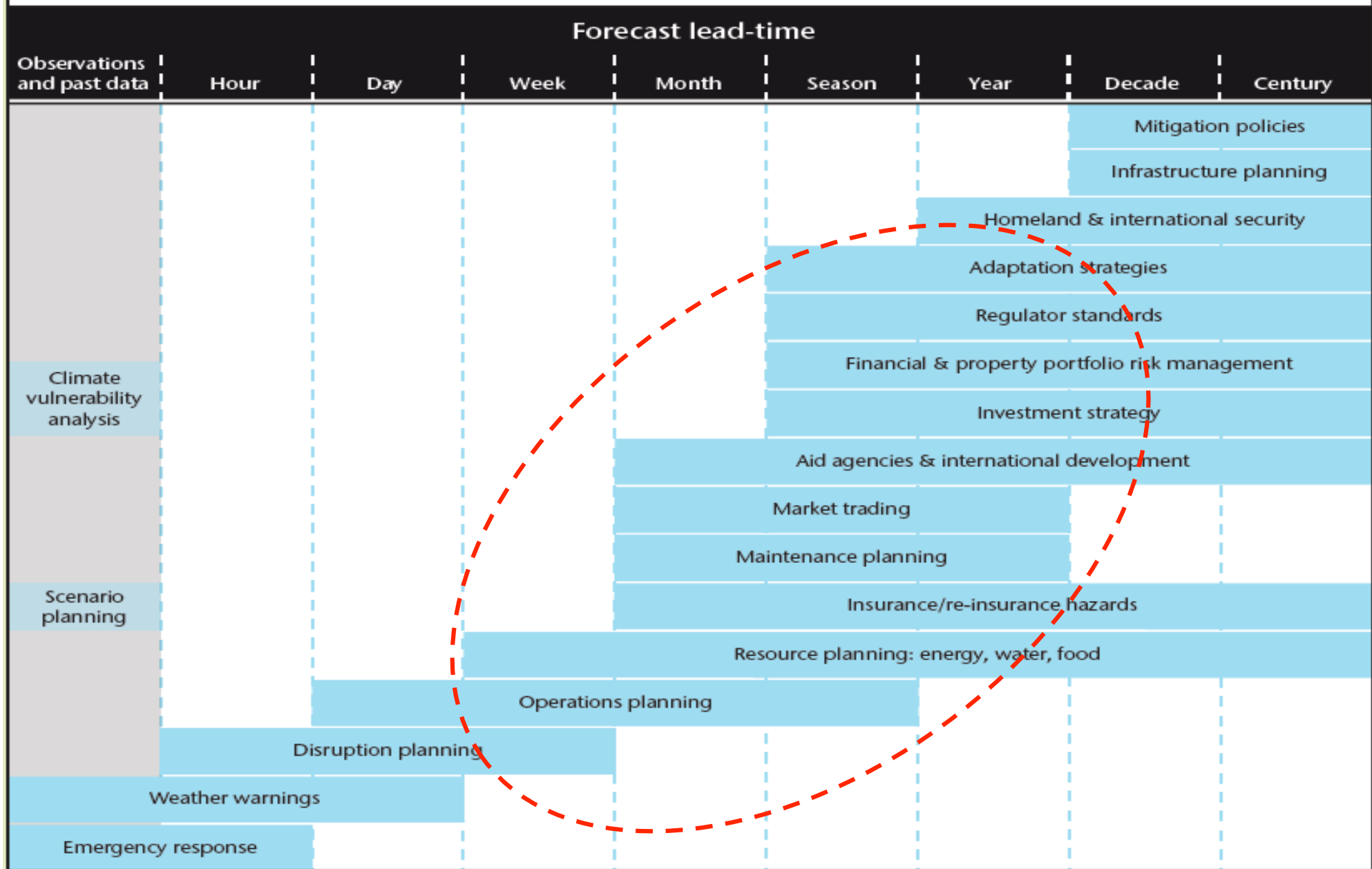
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## The Seamless Prediction of Earth System



# Seamless forecasting services



Courtesy of UK MetOffice

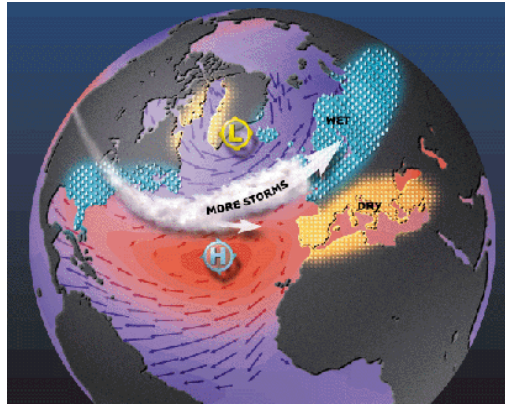


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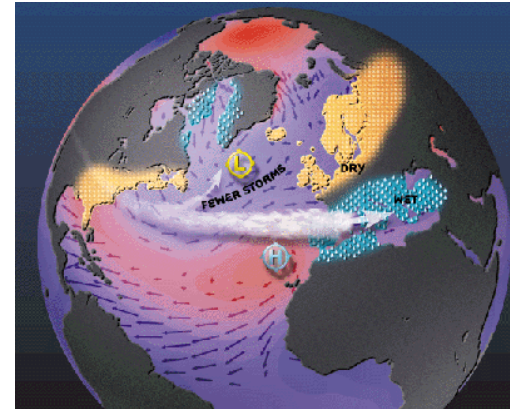


## Month – Seasons: The North Atlantic Oscillation

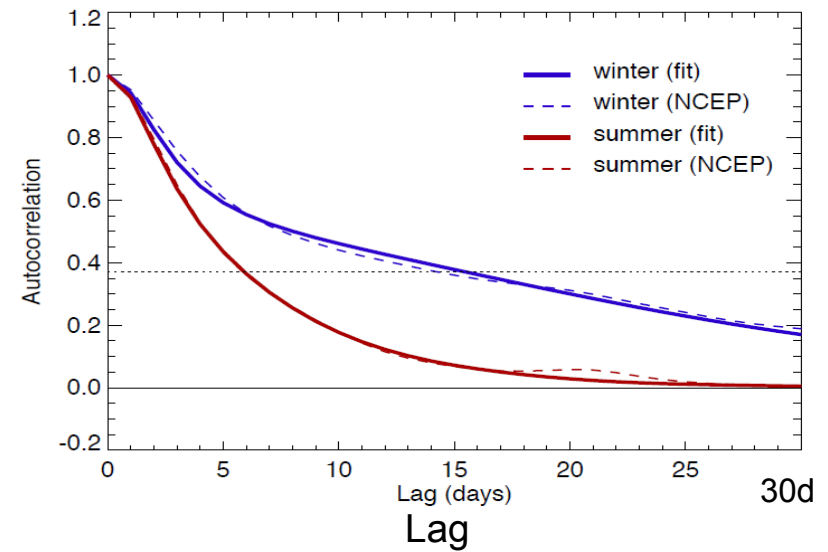
### Positive NAO phase



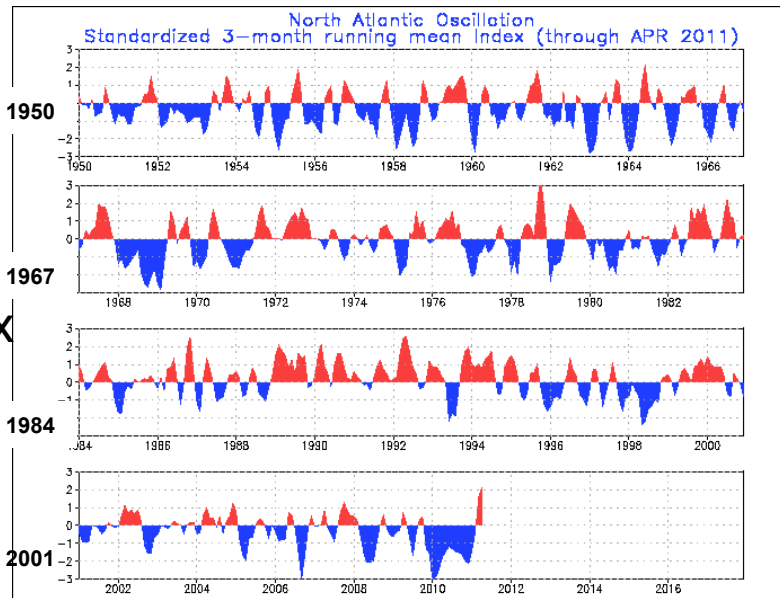
### Negative NAO phase



### Autocorrelation



3-month running mean of NAO index 1950-date

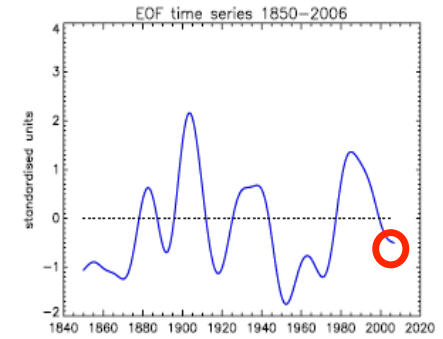
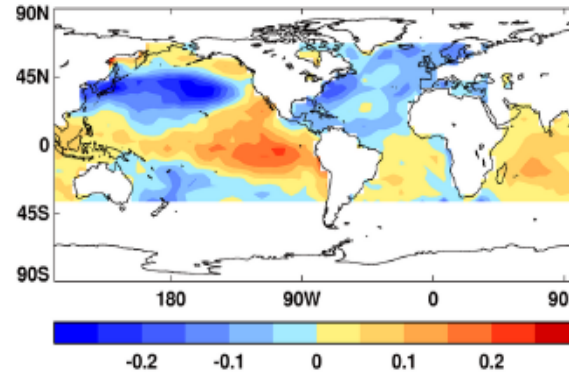
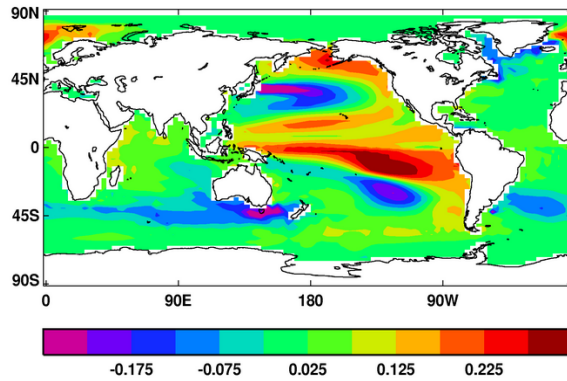




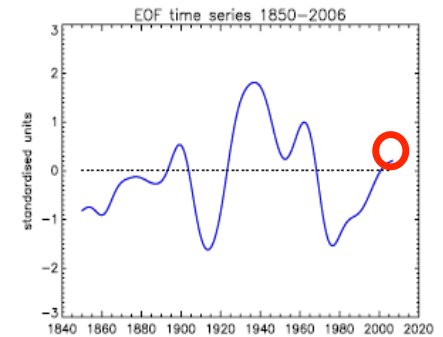
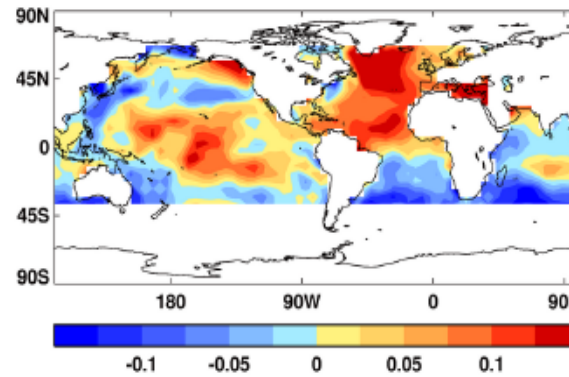
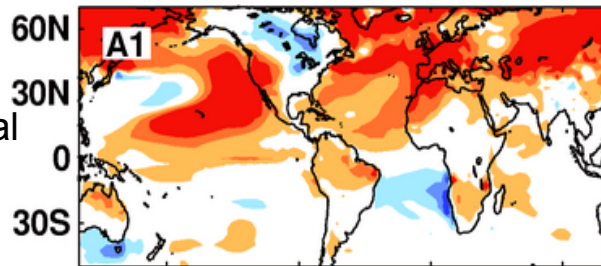
## Model

## Observation

Pacific Decadal Oscillation



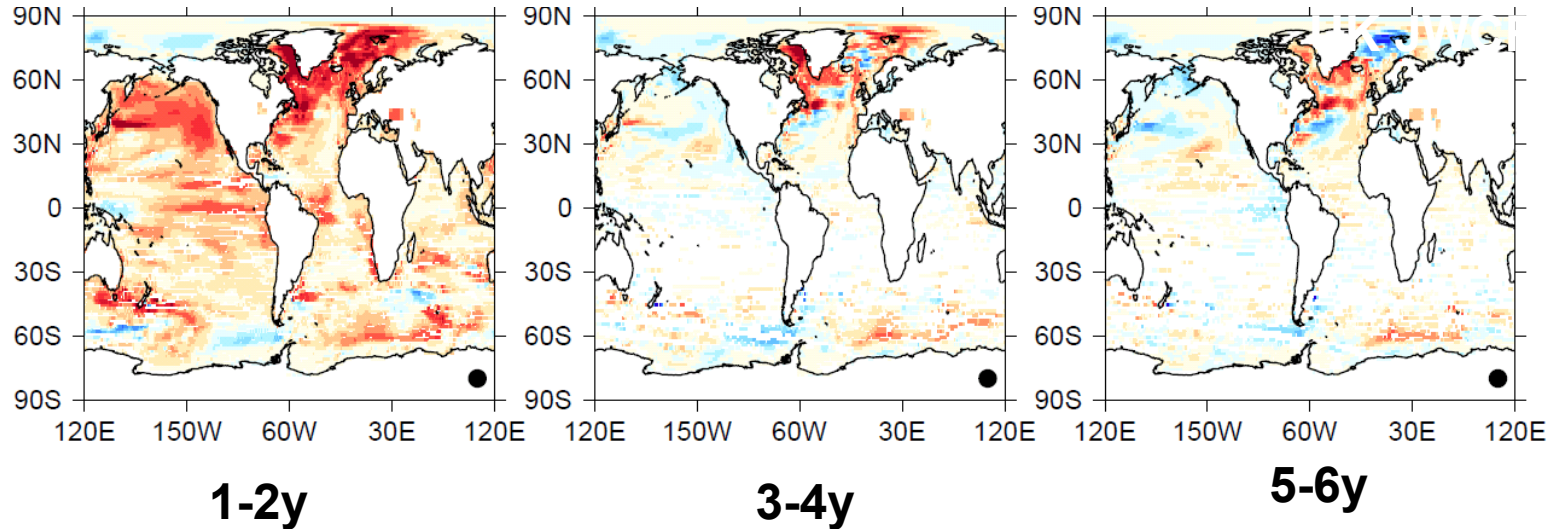
Atlantic Multidecadal Oscillation



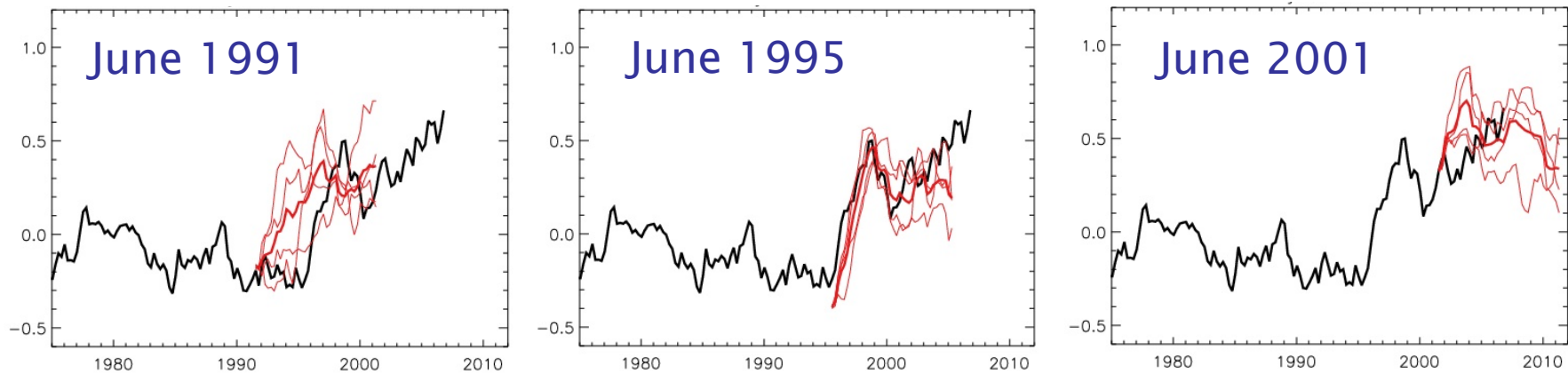




### Heat in top 100m ocean: Improvement in Skill from initialisation

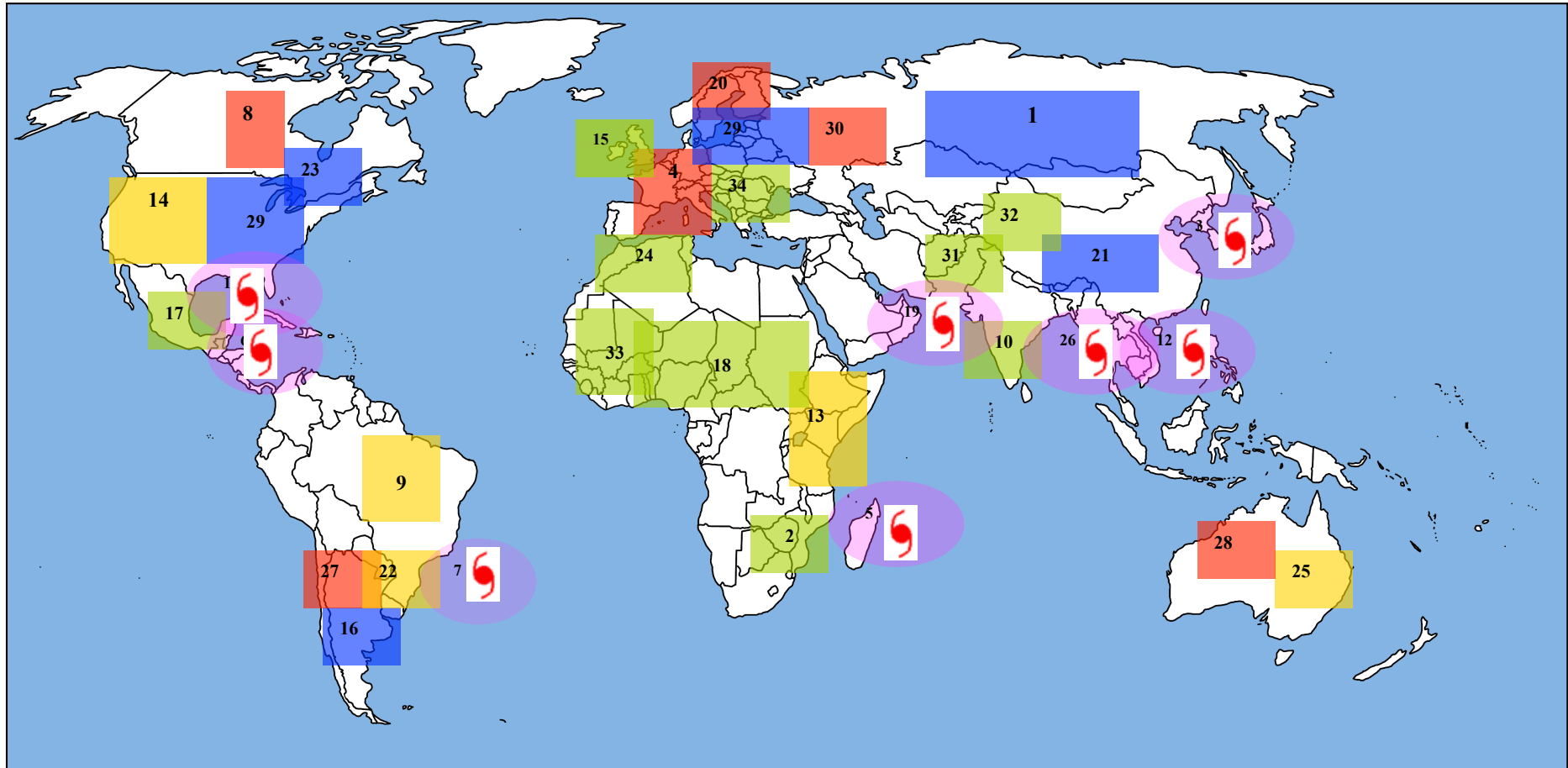


### Hindcast predictions of 500m heat content in Atlantic sub-polar gyre





### Snapshot of Extreme Events over the Past Decade



Heat waves / Extreme high temperatures

Severe or prolonged droughts

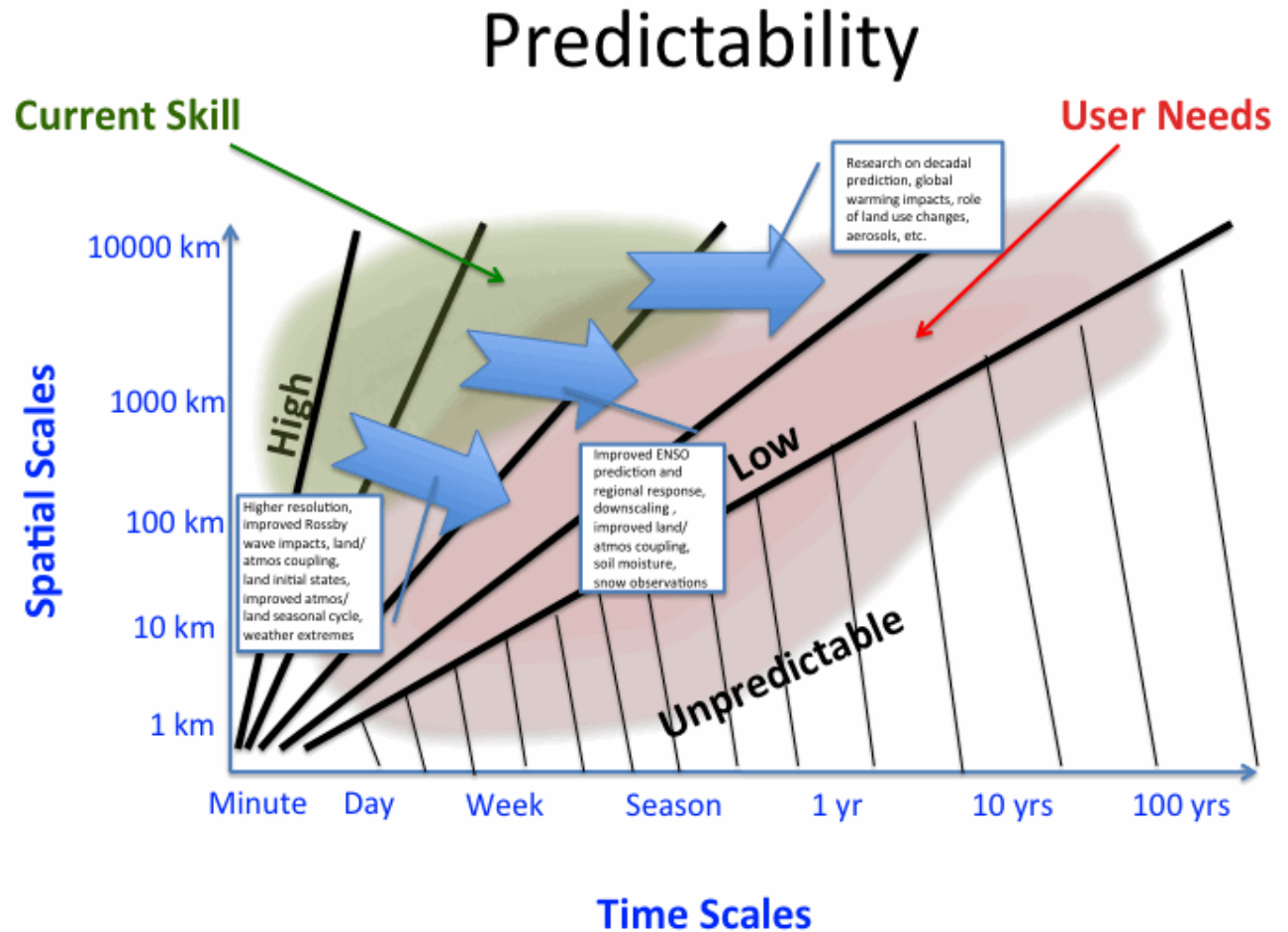
Cold waves / Extreme low temperatures / Snow storms

Tropical cyclones, hurricanes and typhoons

Intense storms / Flooding / Heavy rainfall



## Example: Global Drought Information System



**WCRP Drought  
Workshop  
11-13 April 2012  
Frascati ITALY**



## Research Foci;



Quantify and communicate **uncertainties** in climate change information/knowledge;



Develop **seamless regional and intera-seasonal to inter-annual, and decadal** climate prediction/projection;



Support development of **climate information** for adaptation planning, mitigation policies, and for assessing risks of climate variability and change;



Promote and enable development of **timely, reliable, and easy to access** climate information and knowledge; and



Support education, training and development of **next generation of climate experts and networks.**