

CLIVAR OCEANS & CLIMATE

variability, predictability and change

The World Climate Research Programme's project on ocean-atmosphere interactions

To improve understanding and prediction
of ocean-atmosphere interactions
and their influence on climate variability and change,
to the benefit of society and the environment.

CLIVAR Scientific Steering Group

ICPOs

Core Panels

Ocean Model Development Panel

Global Synthesis and
Observations Panel

Climate Dynamics Panel

Atlantic Region Panel

Pacific Region Panel

Indian Ocean Region Panel

Southern Ocean Region Panel

Monsoons Panel

ETCCDI

Knowledge Exchange and
Capacity Building Panel



Focused & Integrated Res. Opportunities

Predictability
of monsoon
systems

Decadal climate
variability and
predictability

Biophysical interactions
and dynamics of
upwelling systems

Dynamics of regional
sea level variability

Prediction and
attribution of
extreme events

ENSO in a warmer
climate

Planetary heat
balance & ocean
heat storage

NEW

GeWEX
WCRP 2007

Scoping activity for a Climate Dynamics Panel

A gap in the WCRP structure with respect to atmospheric dynamics was highlighted at this year's JSC meeting. CLIVAR will lead a discussion over this year, in consultation with GEWEX, SPARC, WGNE, CliC, Regional GC and GC on clouds, circulation and climate sensitivity, to propose a solution with regard of the gap in the WCRP structure in the domain of research on atmospheric dynamics. CLIVAR has formed a small scoping team that has been solicited to produce a short proposal (2/3 page document), outlining the following:

1. The motivation for the panel, including the topics primed for accelerated progress
2. Justification of why the community needs this panel
3. Expected impacts of the panel (e.g. strengthened community, linkages, accelerated progress, impact on broader community)
4. Potential activities (e.g. experiment design, diagnostics and metrics design, etc.)
5. Suggested composition (by domain/area of expertise, not nominations)

The proposal will be ready by mid-October and will be shared with all partner communities for discussion/input, working towards a presentation at the next JSC meeting.

CLIVAR Feedback and Recommendations for CMIP6 Planning

A close link of the CMIP planning with WCRP programs and Grand Challenges and CLIVAR Research Opportunities seems necessary. Scientific topics of interest require further analysis either from existing model results or new experiments for providing input to CMIP6.

It would be helpful to undertake a more thorough consultation of the CLIVAR community, including the U.S. CLIVAR. CMIP6 planning is an opportunity for the projects to feed in recommendations on the experiment design for progress in the priority themes.

Suggested paths include surveying the CLIVAR community; more direct communication between the WGCM and CLIVAR project steering committees; ensuring that a representative goes to the steering committee meetings in the coming year (e.g., pan-CLIVAR meeting, July 2014, The Hague, the Netherlands); and a dedicated workshop/meeting, etc.

Coordinated Ocean Wave Climate Project (COWCLIP)

Surface wind waves were identified in the IPCC AR4 as one of the key drivers in the coastal zone, but little information was available on projected changes under future climate scenarios. The IPCC Working Group II recognized that risks to coastal population and ecosystems require inclusion of a broader range of coastal drivers of change. One of the key drivers, which has received insufficient attention to date, is wind-waves.

The COWCLIP team expects to perform similar analyses using CMIP5 and CMIP6 output, so related aspects of design considerations should be maintained.

U.S. CLIVAR Climate Model Evaluation Project (CMEP) 2011

The objective of CMEP is to increase community-wide diagnostic research into the quality of model simulations, leading to more robust evaluations of model predictions and a better quantification of uncertainty in projections of future climate. The results of this research will be used for the subsequent evaluations of the quality of U.S. model global and regional climate projections of the 21st century and beyond in the context of an international multi-model dataset.

Analysis of Climate Model Simulations for the IPCC Fifth Assessment Report (CMEP 2011) - To promote diagnostic analysis of studies of late 19th - 20th century simulations through inter-comparisons and comparisons with observations. The analysis of multiple models and ensembles is especially encouraged. Examinations of physical climate features and processes such as regional climate, climate variability and trends, modes of natural variability, hydrological cycle behavior, and extreme events are appropriate. In addition, we encourage analysis of initialized decadal hindcasts and predictions for predictability studies of the climate system on interannual to decadal time scales.

Some preliminary feedbacks from the CLIVAR community regarding CMIP5 and CMIP6 are similar to the survey feedbacks from the modeling groups and some users. They include:

- Difficulty of providing CMIP5 feedback due to shortness of time for thorough analysis,
- Difficulties with data access or missing data,
- Not enough time between CMIPs to analyze results, provide informed suggestions for model improvements, and incorporate them in models,
- Not enough time between availability of data from the modeling centers and publication requirements,
- Too many experiments,
- Lack of detailed cloud information,
- Need for long control integrations (pre-industrial, RCPs) for variability studies and understanding the role of the deep ocean,
- More idealized process experiments,
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SOME PRELIMINARY INPUT FROM the WCRP Grand Challenge on
Sea Level (also part of CLIVAR activities)
D. Stammer

Science Questions / Objectives:

- Define uncertainties in global and regional sea level projections and understand why model projections or regional sea level changes are so different.
- Improve model projection by including missing physics, especially in the cryosphere. Ultimately this will require to treat sea level as part of an integrated cryosphere/solid earth/ocean problem in which the changing sea level is part of the ice sheet solution and the associated land movement.
- Improve regional projections and underlying dynamical basis through enhanced resolution, especially in coastal areas. Requires to compute regional heat and salt/freshwater budgets. Also requires to better simulate ocean circulation/ice sheet interactions.

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D. Stammer

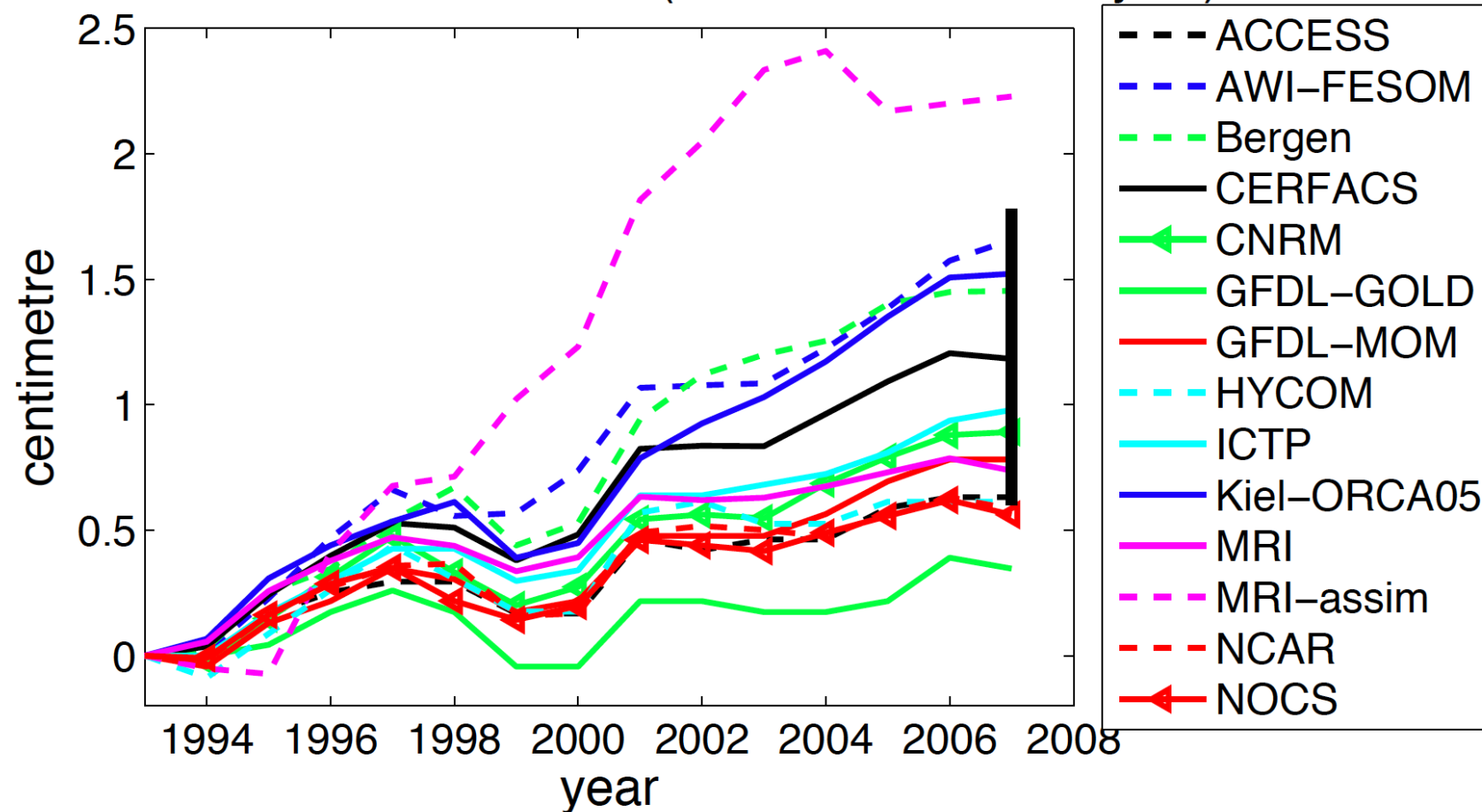
- Investigate sensitivity to aerosol and its impact on ocean heat uptake and sea level (simulations with individual forcings).
- Investigate climate sensitivity, heat uptake (efficiency) of the warming ocean.
- Better understand historical sea level changes and their simulation in CMIP runs (both recent past and last millennium).

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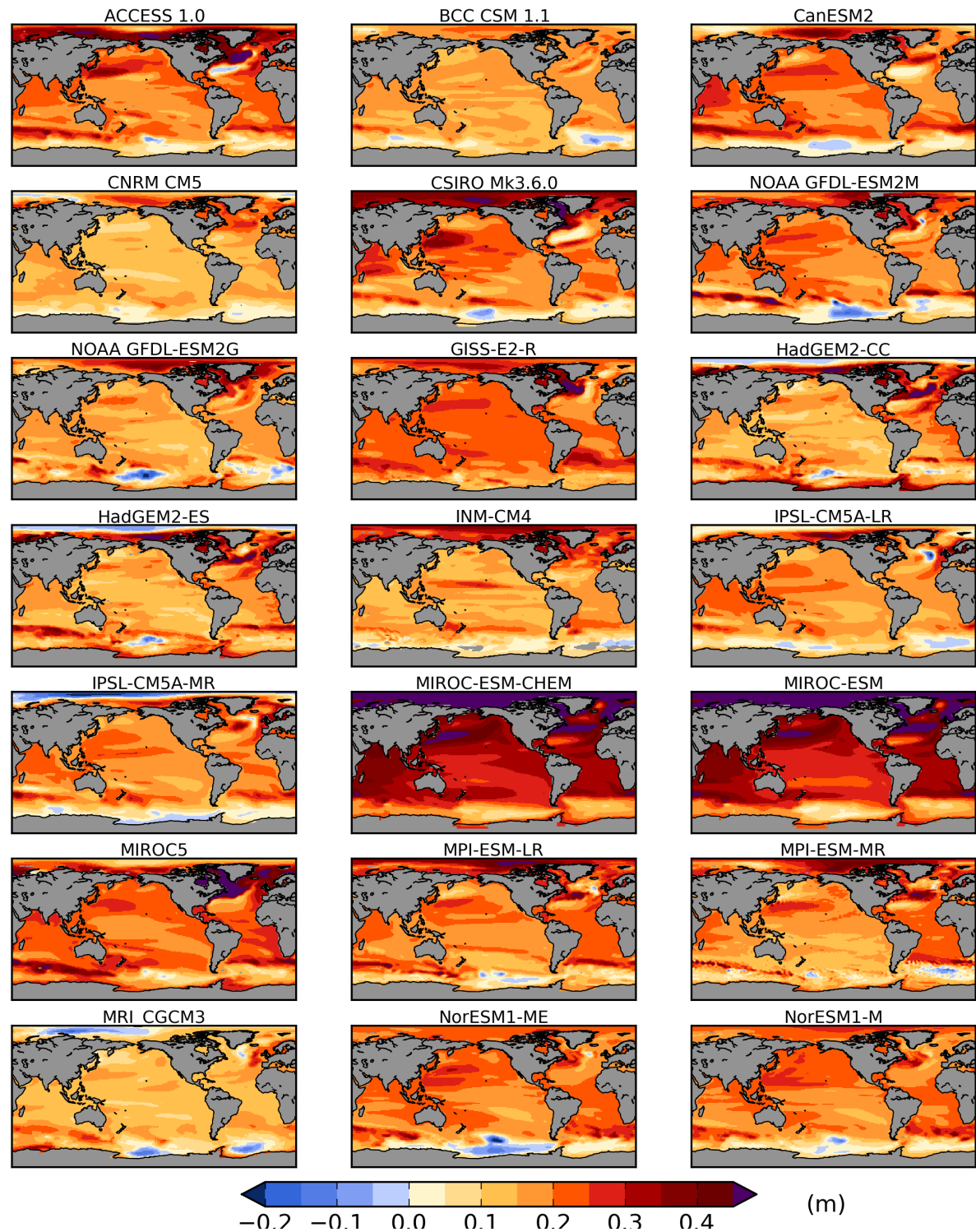
Needed simulations and analysis have not been decided yet, but ...

- Possibility of a MIP for ice sheet - ocean interactions,
- More ensemble members and long control runs,
- Surface flux perturbation experiments to investigate the effects on the patterns of regional SL change,
- For the simulations of the recent past, proposed "CORE-II simulations as part of CMIP6", with groups running their identical ocean-ice configurations used in their companion climate simulations, will be useful. If such simulations are in fact provided, then the models can be assessed for their ability to represent the historical record.

Global mean steric sea level (1993–2007 in 5th cycle)

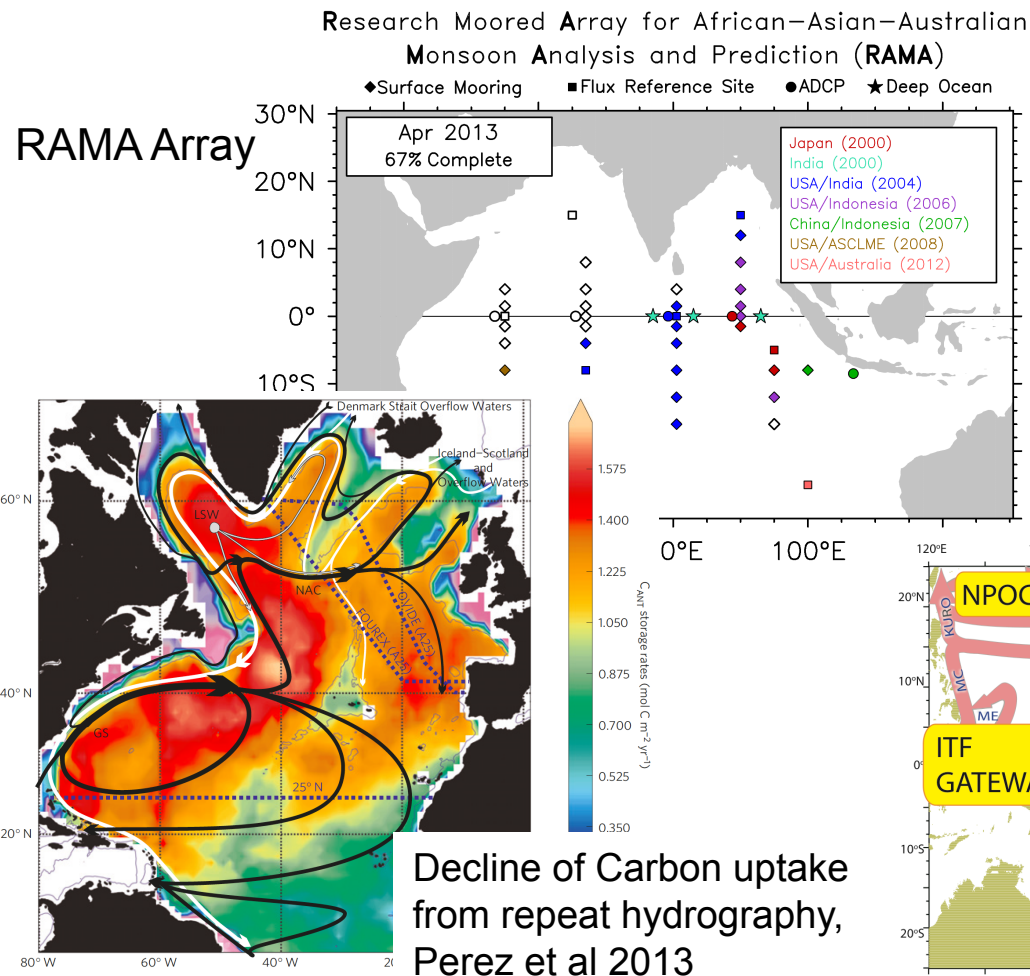


Projected steric/
dynamic sea-level
change, including AL
for the period 1986-
2005 to 2081-2100
for RCP4.5

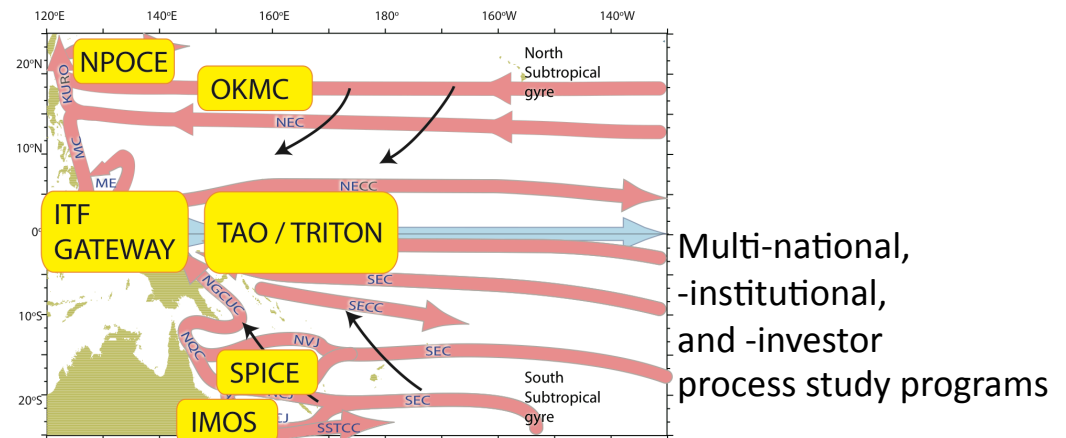
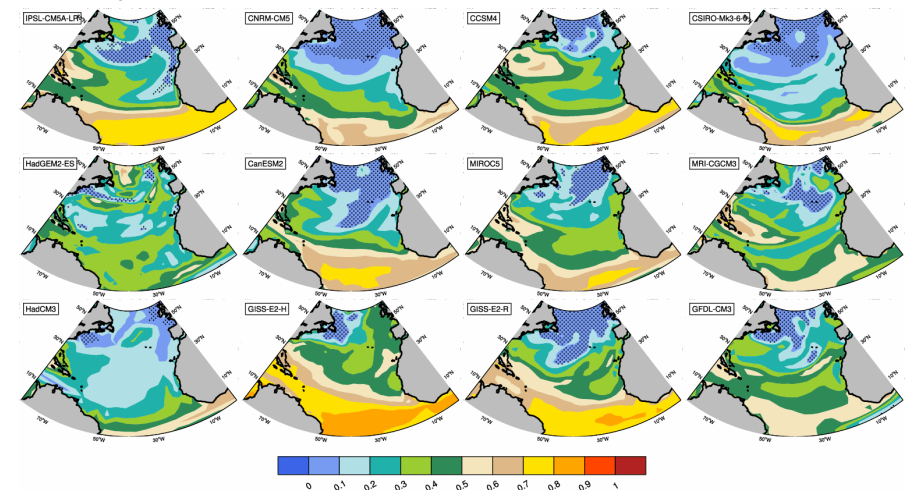


CLIVAR: International coordination, regional implementation

Regional and global studies - observations-process studies-modeling - of the variability and predictability of the climate system.



Forced variance versus internal variability, Terry 2012



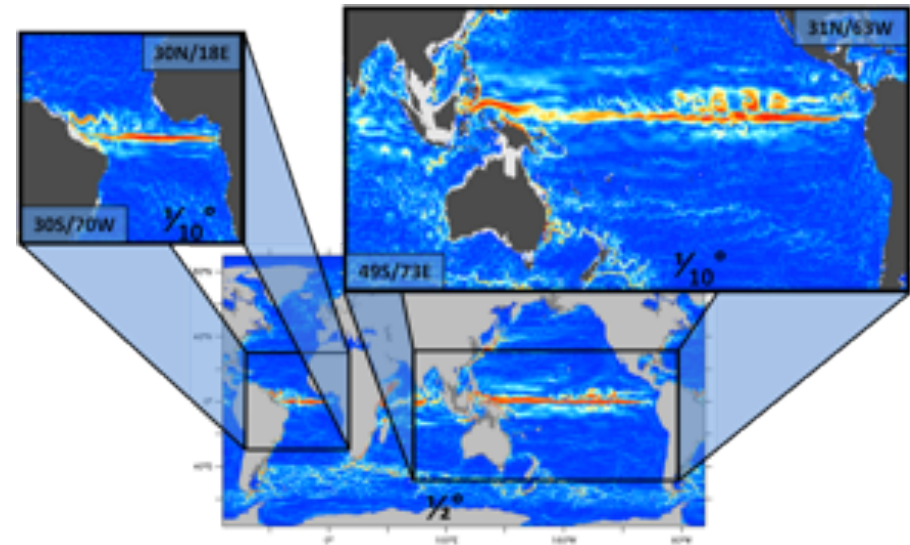
CLIVAR

Core Research Areas

- Anthropogenic Climate Change
- Decadal Variability, Predictability and Prediction
- Intra-to-Seasonal Variability, Predictability and Prediction

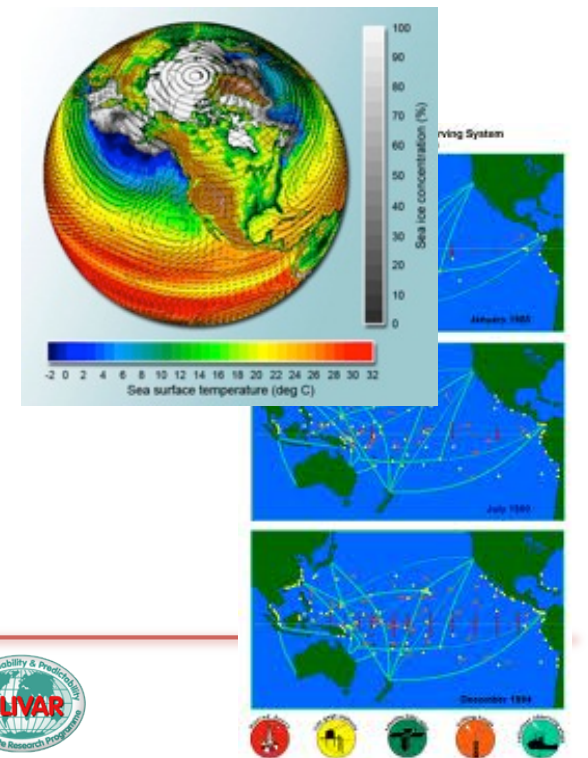
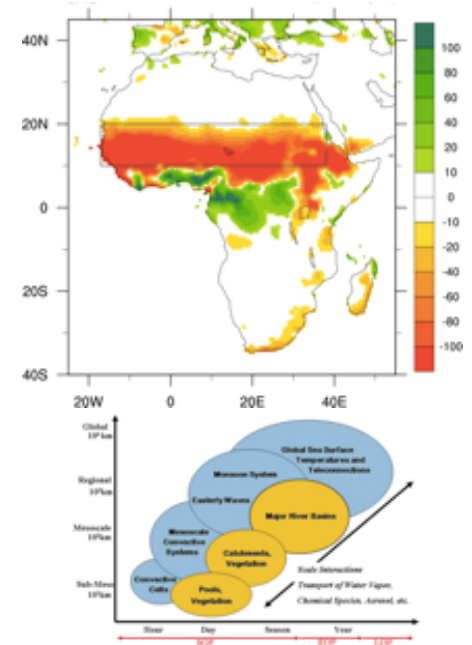
Core Capabilities

- Improved Atmosphere and Ocean Components of ESMs
- Data Synthesis and Analysis
- Ocean Observing System
- Knowledge Exchange
- Capacity Building



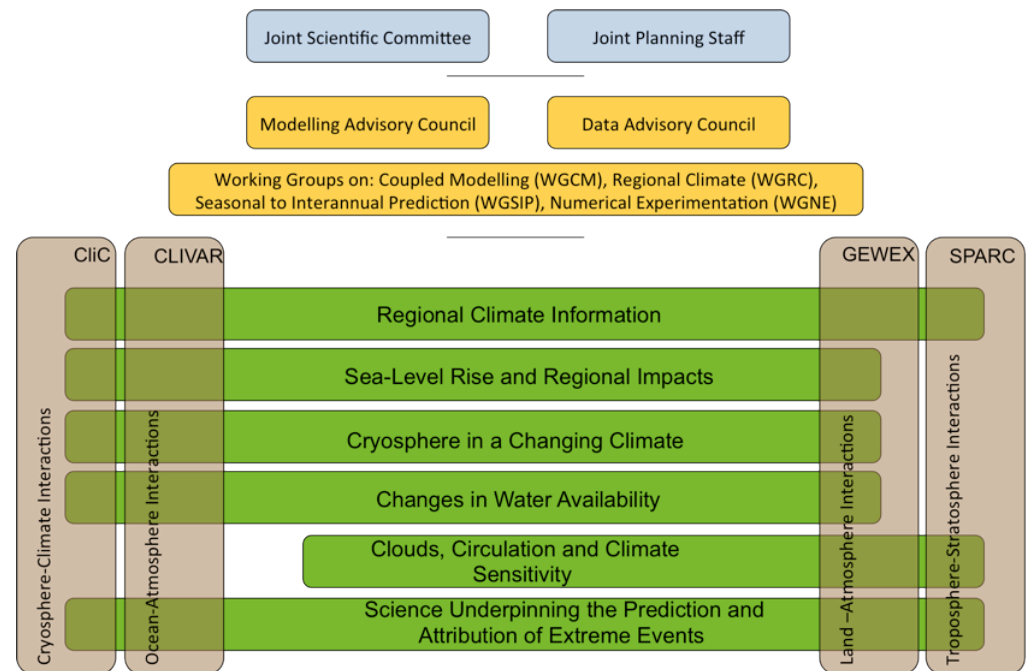
CLIVAR Objectives

- Understand the causes of climate variability on intra-seasonal to centennial time-scales through observations, analysis, and modeling.
- Improve predictions of climate variability and change associated with both internal and external processes.
- Improve the atmosphere and ocean components of Earth System Models.
- Extend observational climate record through assembly of quality-controlled data sets.



CLIVAR Research Opportunities

- Intraseasonal, seasonal and interannual variability and predictability of monsoon systems
- Decadal variability and predictability of ocean and climate variability
- Trends, nonlinearities and extreme events
- Marine biophysical interactions and dynamics of upwelling systems
- Dynamics of regional sea level variability
- ...
- Planetary heat balance and ocean heat storage
- ENSO in a warmer world



WCRP Grand Challenges