The Evolution of CLIVAR

CLIVAR: CLIMATE & OCEAN variability, predictability and change

WCRP's core project to on the
Ocean-Atmosphere System

US CLIVAR Summit 2014
Detlef Stammer

WCRP World Climate Research Programme

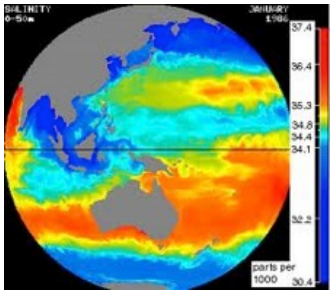
CLIVAR

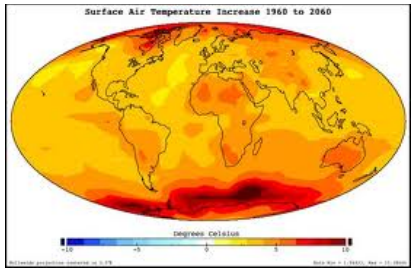
CLIVAR Mission

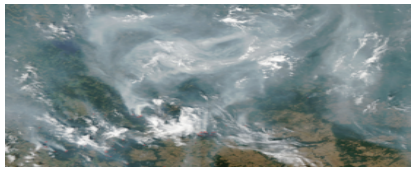
To observe, simulate and predict changes in Earth's climate system with a focus on the **ocean-atmosphere system** as part of the climate sytem

enabling better understanding of climate variability, predictability and change,

to the benefit of society and the environment in which we live.







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WCRP core Projects

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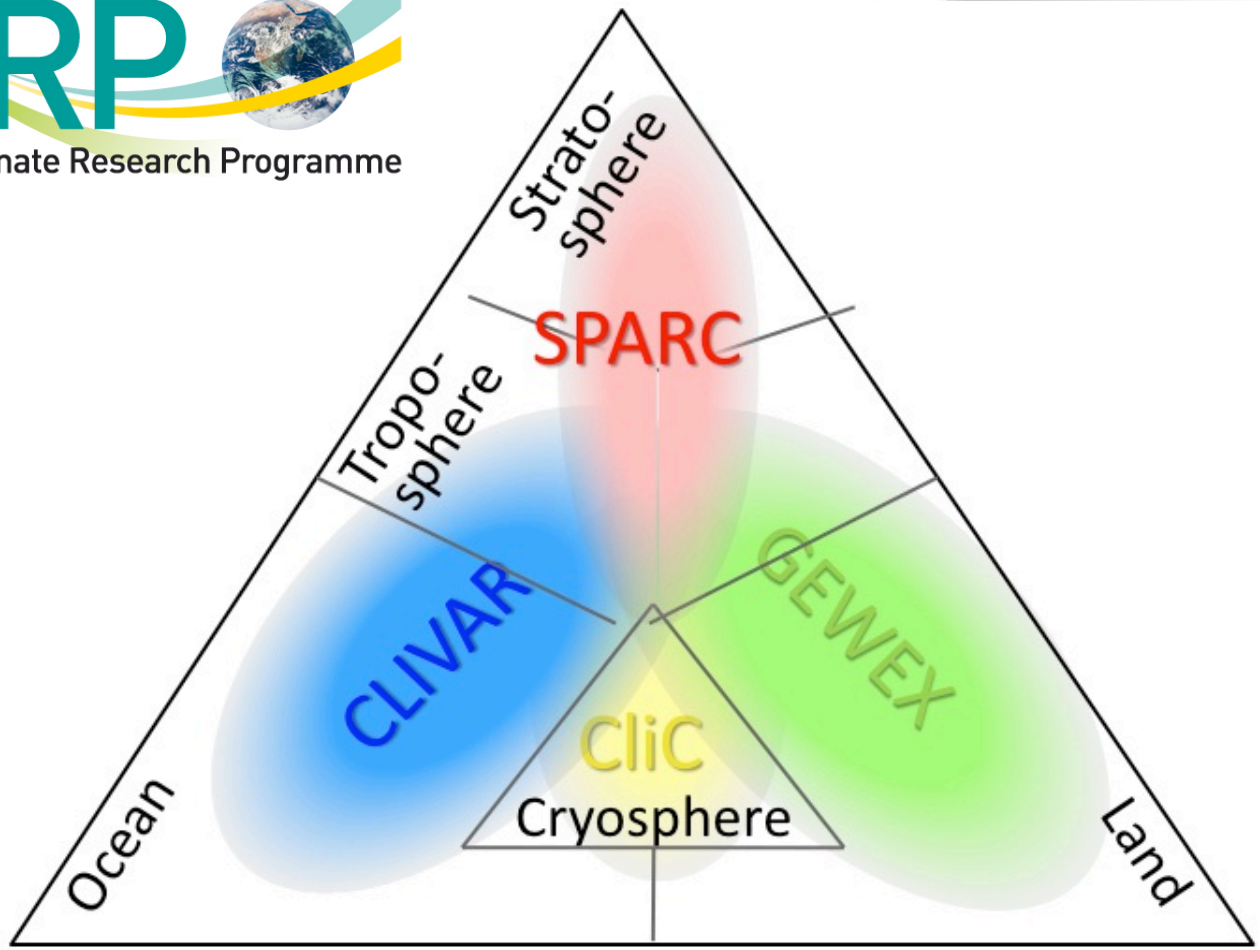
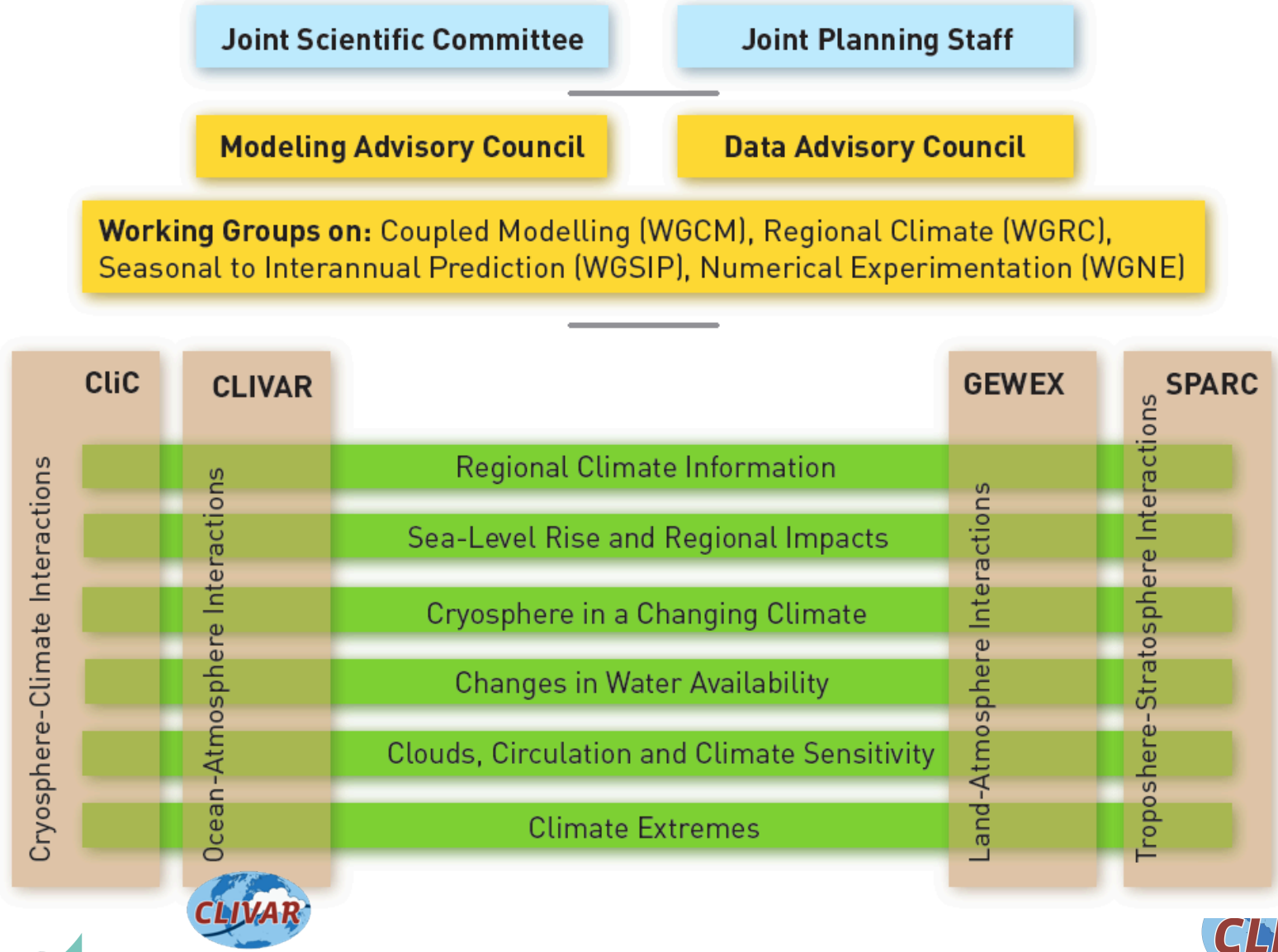


WCRP Structure



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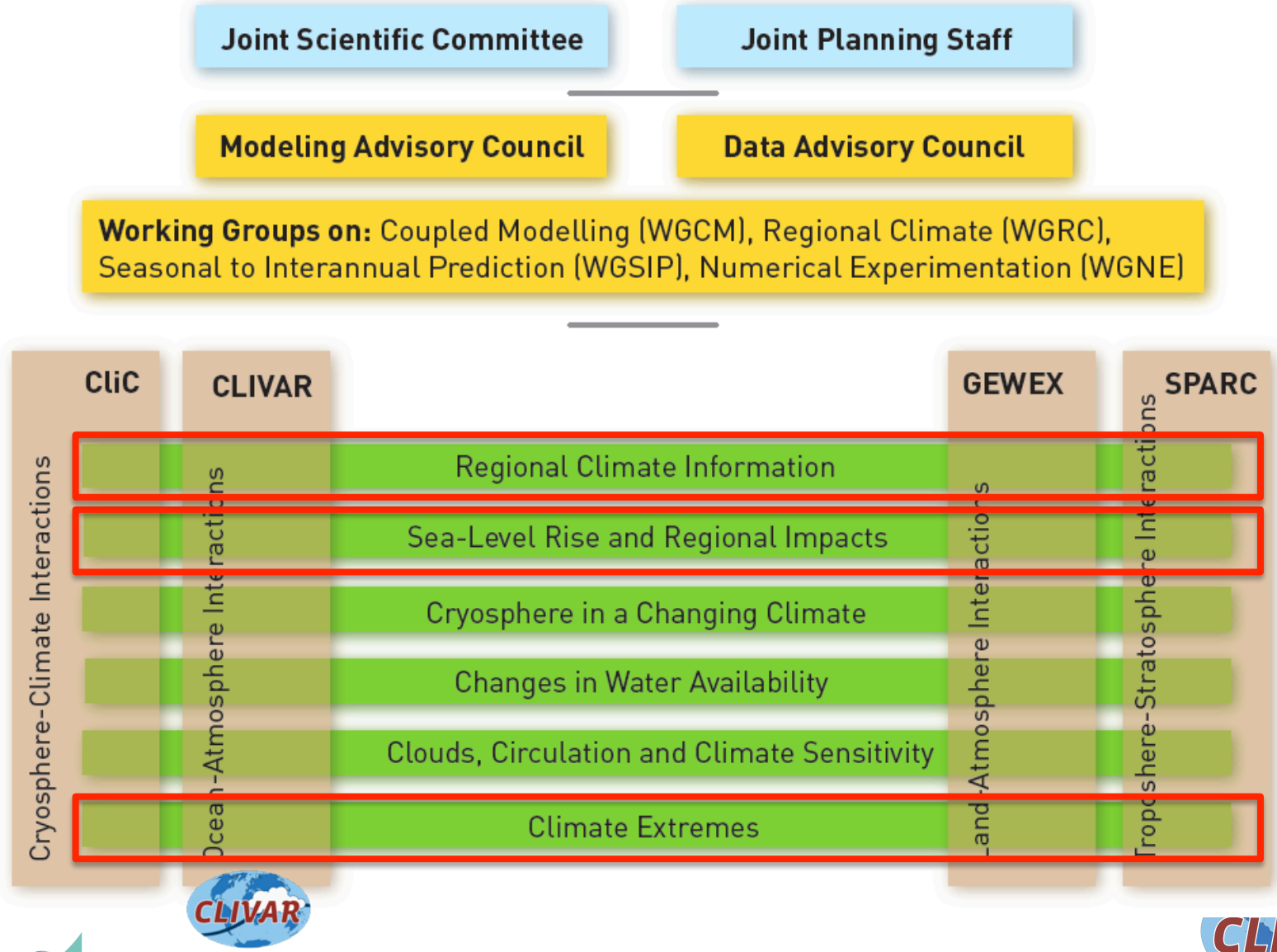
WCRP Structure



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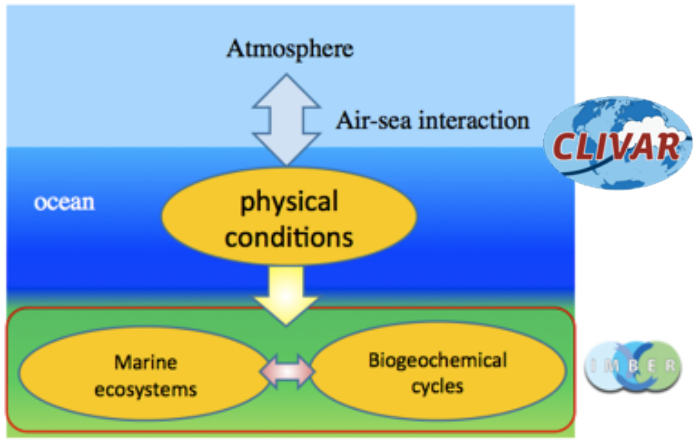
Evolution of CLIVAR

- CLIVAR is in the process of formulating its new **Science Plan and Implementation Strategy**
- CLIVAR formulated a new set of **research foci** that will contribute to the Grand Challenges of WCRP and the wider context of the oceans role in climate variability and change.
- CLIVAR will retain its global and balanced approach based on observations, models and theory and their **joint exploitation for climate assessment and climate prediction.**
- CLIVAR supports the development of **sustained climate and ocean observations** as well as targeted improvements to the climate and ocean components of earth system models.
- CLIVAR will intensify its **partnerships with other WCRP projects, but also with IGBP/PAGES and the marine biogeochemistry and eco-system** community, as well as with a selected spectrum of its information user community.



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CLIVAR Organization

Scientific Steering Group | ICPO

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 (CLIC)
- Monsoons Panel (GEWEX)
- ETCCDI (GEWEX)
- Knowledge Exchange and Capacity Building Panel

Research Foci

- Predictability of monsoon systems
- Decadal climate variability and predictability
- Biophysical interactions and dynamics of upwelling systems
- Regional sea level changes and impacts
- Prediction and attribution of extreme events
- ENSO in a warmer climate
- Planetary heat balance & ocean heat storage
- …

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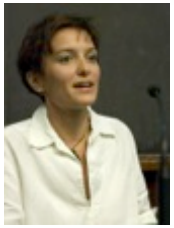
Scientific Steering Group Members

Dr. Lisa Goddard
(co-chair 2015)
Earth Institute at Columbia, USA

Detlef Stammer
(co-chair 2016)
CEN, Universiy Hamburg



Dr. Annalisa Bracco (2015)
School of Earth & Atmospheric Sciences, Atlanta, USA

Dr. Ken Drinkwater (2014)
Institute of Marine Research, Bergen, Norway

Dr. Sergey Gulev (2014)
Russian Academy of Sciences, Moscow, Russian Federation

Dr. Ed Hawkins (2015)
Department of Meteorology, University of Reading, UK

Dr. Pascale Braconot (2016)
CEA-CNRS, France

Professor Martin Visbeck (past Co-chair 2014)
GEOMAR, Kiel, Germany

Dr. Steve Rintoul (2013)
CSIRO, Australia

Dr. Pedro MS Monteiro (2015)
CSIR, South Africa

Dr. Sigfried Schubert (2014)
NASA Goddard Space Flight Centre

Dr. Lixin Wu (2015)
Ocean University of China, China

Dr. Stephen Griffies (2016)
NOAA-GFDL, Princeton

Dr. Carlos Moffat (2016)
University Concepcion – Chile

Resignement end of 2014

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CLIVAR

Transition of CLIVAR project office: from UK to node structure

ICPO

NOC UK

The "new" ICPO

Three **sponsors**: India, China, USA

Executive Director: Valery Detemmerman
Deputy Executive Director: Anna Pirani

Two "nodes":

- Global at FIO, Qingdao, fully operational September 2014;
- Monsoons at IITM, Pune, fully operational June 2014

Contract staff at Univ. Buenos Aires and ICTP, Trieste

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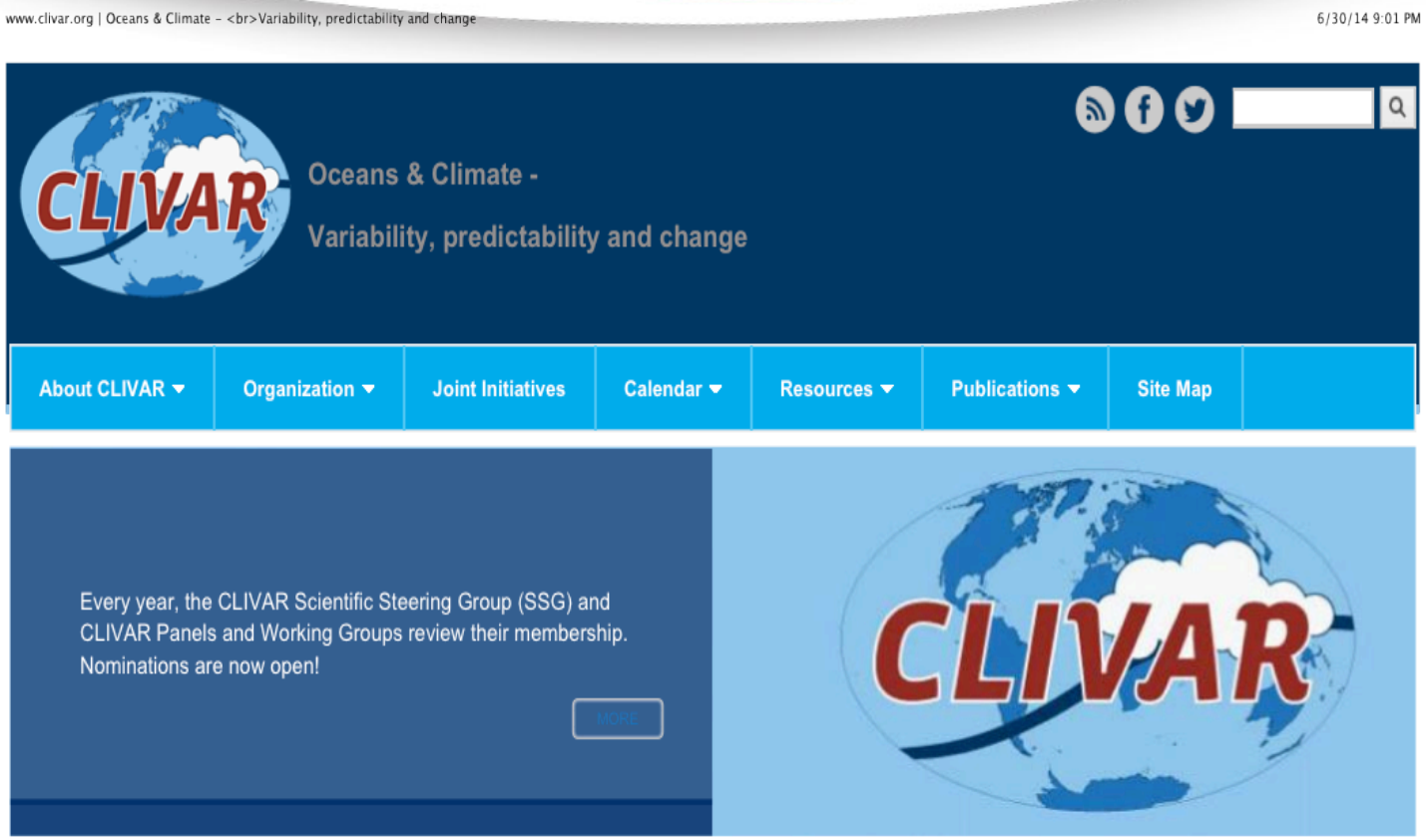
ICPO objectives for 2014:

- Pan-CLIVAR organization and follow up
- CLIVAR Achievements report
- CLIVAR Science Plan
- Exchanges; 2 issues: ocean modelling, monsoons
- New website
- Plan 2015 Panel and Research Foci meetings
- Monsoons Panel -and build community network
- Establish Climate info/ Knowledge Exchange Panel
- Establish Climate Dynamics Panel
- CLIVAR Conference in 2016 -begin preparations
- ICPO Handbook- new version

New CLIVAR Web Page



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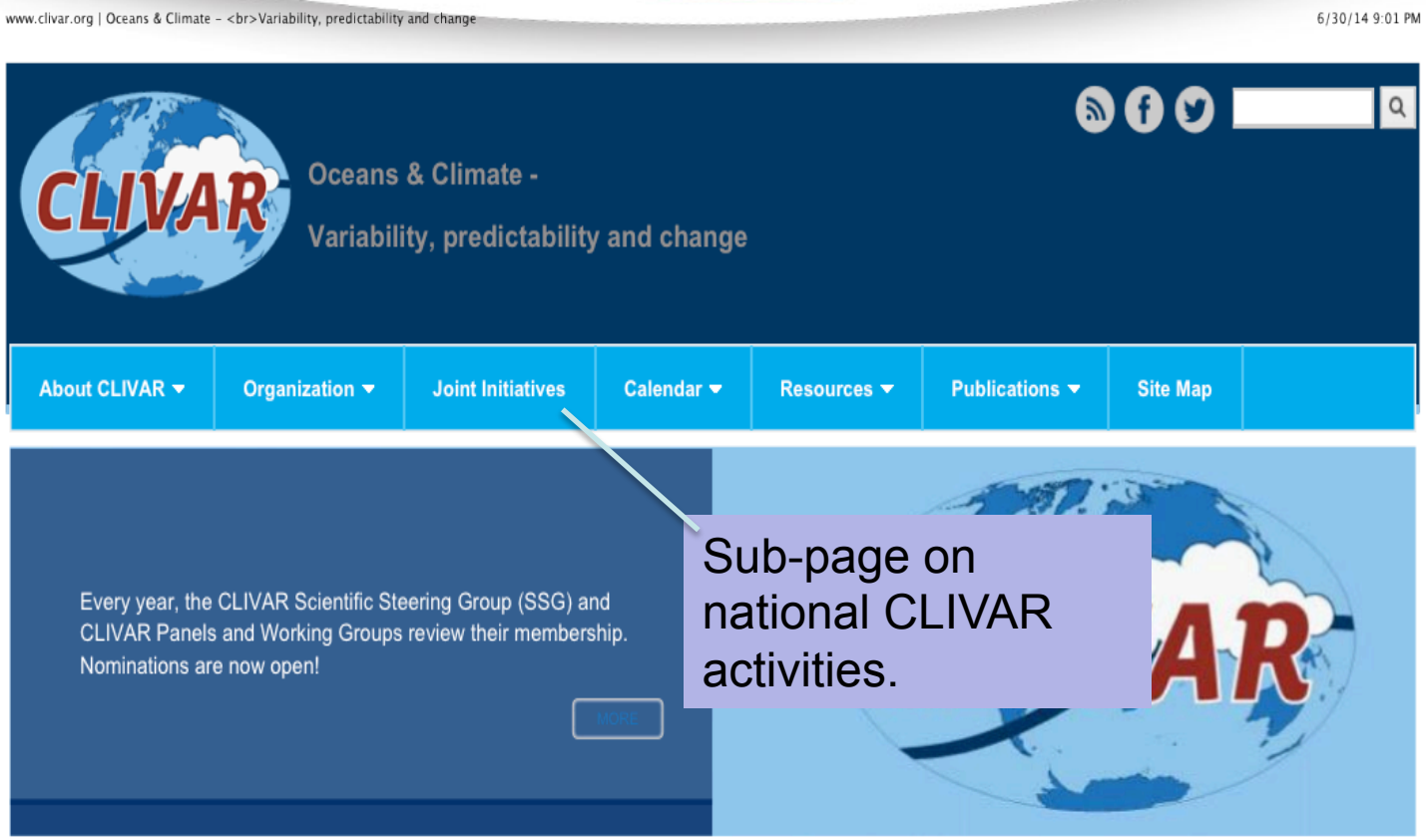
New CLIVAR Web Page



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Monsoons Panel

WCRP CLIVAR/GEWEX **Monsoons Panel**

WG Austral Asian Monsoon	WG American Monsoons	WG African Monsoons	WG Predictability

Build on existing activities

First panel meeting during pan-GEWEX/CLIVAR meetings

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Climate Dynamics Panel

- Focus on the **large-scale dynamics of climate variability and change** over seasonal, interannual, multidecadal to centennial timescales, for example, addressing annular modes, storm track dynamics, teleconnections, and mid-latitude air-sea interactions.
- Linkages with several other CLIVAR panels, and within WCRP with SPARC DYVAR, GEWEX (GASS), CliC, WGNE, WGCM, WGSIP, WGOMD, and the Monsoons Panel.
- Address phenomena that span two or more ocean basins, or those phenomena, which are common to multiple basins, in which **links between ocean and atmosphere processes are important (coupled climate modes).**

Anticipated impacts of the panel

The panel activity will **advance our understanding of climate variability and change**, and facilitate international collaboration. It is intended that the panel will build a new bridge across the broad collection of basic and applied climate dynamics research.

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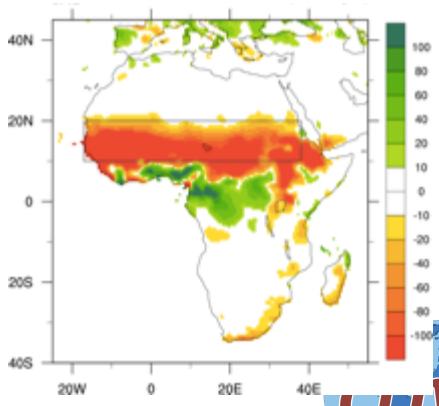
Current CLIVAR Research

- Anthropogenic Climate Change
  - Natural variability versus forced change
  - Climate sensitivity and feedbacks
  - Regional phenomena (e.g., ENSO, AMOC, …)
  - Extremes
  - CMIP#
  - Climate Engineering (Geo-engineering)

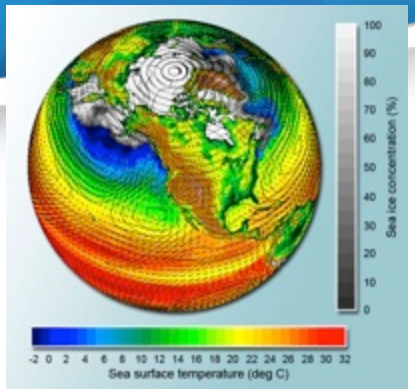
- Intra-to-Seasonal Variability, Predictability and Prediction
  - Monsoons (and ENSO, TAV, …)
  - ISV/MJO
  - Quantifying prediction uncertainty
  - Building pan-WCRP and WWRP links
  - CHFP

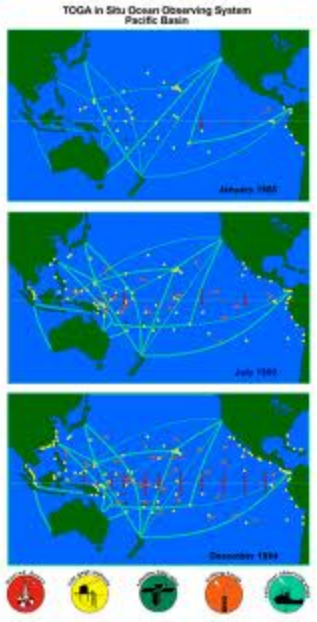
- Decadal Variability, Predictability and Prediction
  - Determine predictability
  - Mechanisms of variability (AMO, PDV, …)
  - Role of oceans
  - Adequacy of observing system
  - Coupled Initialization
  - Quantifying prediction uncertainty
  - Building pan-WCRP links



CLIVAR Capabilities

- Improved (Atmosphere and) Ocean Components of ESMs
  - Analysis and Evaluation
  - "Climate Process Teams" (process studies)
  - Building links pan-WCRP and IGBP
  - Model-Data comparisons





- Data Synthesis and Analysis
  - Ocean
  - Coupled Data Assimilation Systems
  - Links – carbon, biogeochemistry, marine-ecosystems

- Ocean Observing System
  - Development, implementation and system design
  - Advocacy for sustained observations
  - IGBP links for Carbon, Biogeochemistry, Ecosystems

- Education, Capacity Building
  - Summer schools and topical workshops
  - Expert training
  - Call for panel membership

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CLIVAR Research Foci

- Science and work plans are currently designed and reviewed by the SSG.
- Outcome of planning process available later this year.
- Participation by community intended (please contact leads of research foci).
- Proposals for new research foci possible.

CLIVAR Research Foci

- 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
- Sea level changes and regional impacts
- Consistency between planetary heat balance and ocean heat storage
- ENSO in a changing climate

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Intraseasonal, seasonal and interannual variability and predictability of monsoons

Key areas for progress in the next 5-10 years:

- **Improved model constraint** on monsoon variability and change.
- **Better model representation** of the key processes involved in monsoon variability.
- **Improved prediction** of monsoon variability and change using land surface modelling and incorporation of land surface initialisation.
- **Enhanced understanding** of natural climate variability and anthropogenic change on monsoon systems.

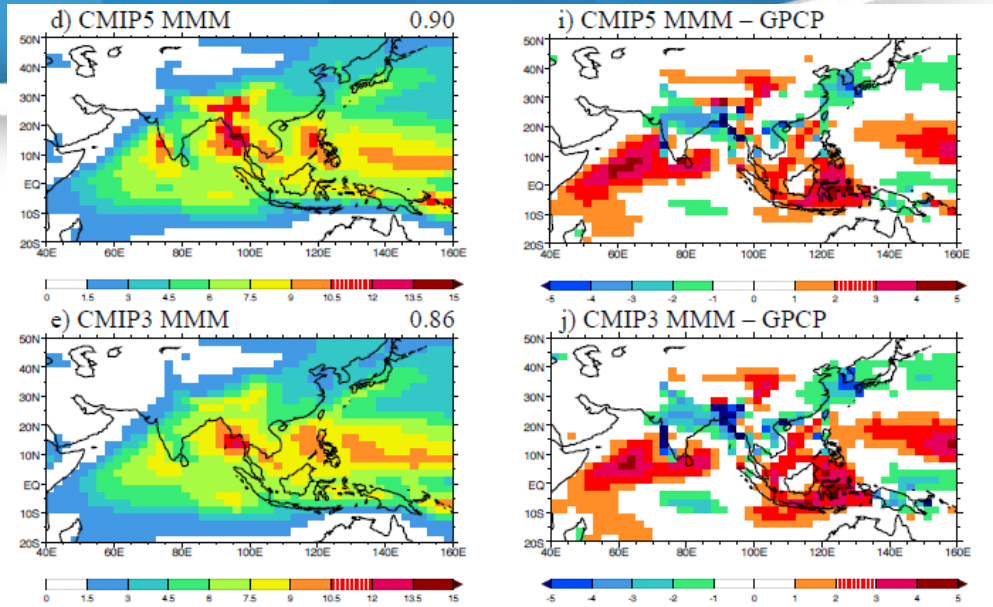
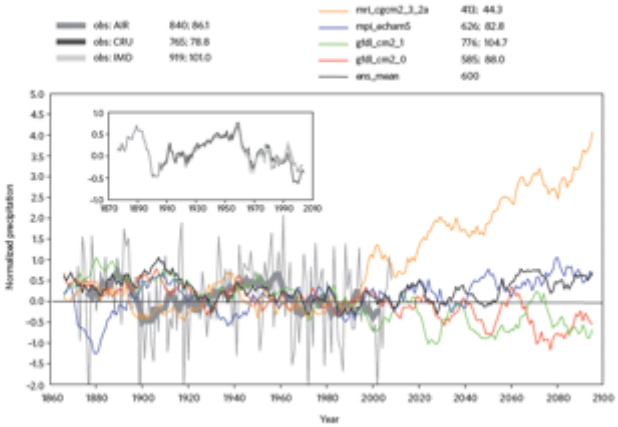


Figure shows large multi-model mean precipitation biases are present for the Asian summer monsoon in CMIP5 (from Sperber *et al*., 2012, *Clim. Dyn.*).

Figure demonstrates (for South Asian monsoon):
• Discrepancies between observed datasets.
• Apparent recent downward trend in monsoon rainfall
• Large decadal variability
• Uncertainty in future projections in SRES-A1B (from Turner & Annamalai, 2012, *Nature Climate Change*).



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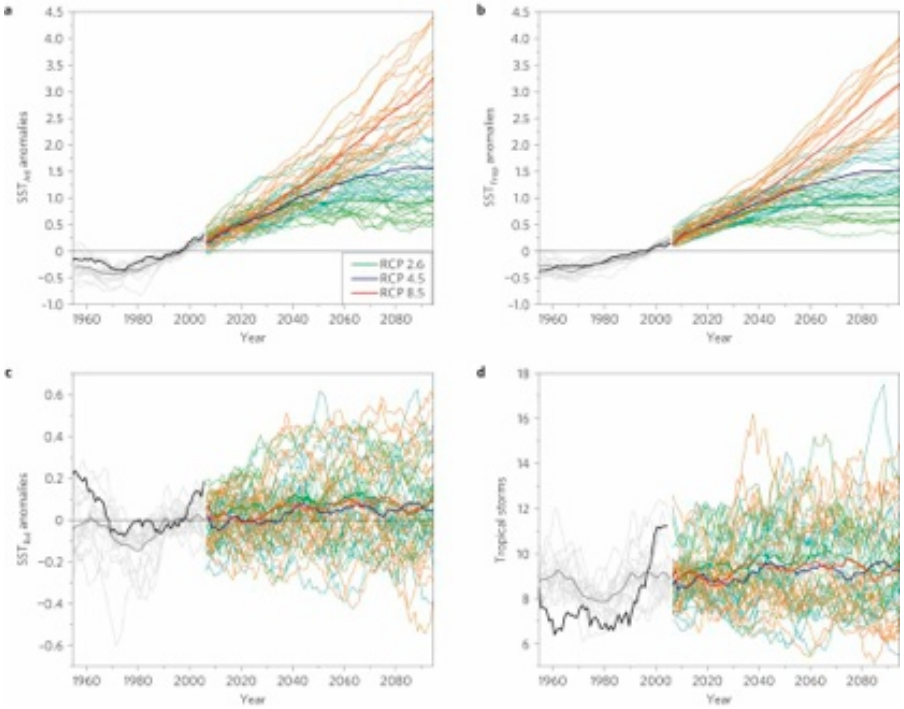
Decadal variability and predictability of ocean and climate variability

- **Improving understanding** of decadal variability and predictability.
- **Application of past data** sets including instrumental and proxy data.
- **Improving models** to better represent key processes associated with decadal variability.
- **Analysis and development** of current prediction potential of CMIP5 hindcasts.
- **Developing critical evaluations** of proposed climate/geo engineering methods.



Twenty-first-century projections of SST (top) and North Atlantic Tropical Storm frequency (bottom) using CMIP5 (Villarini and Vecchi 2012)

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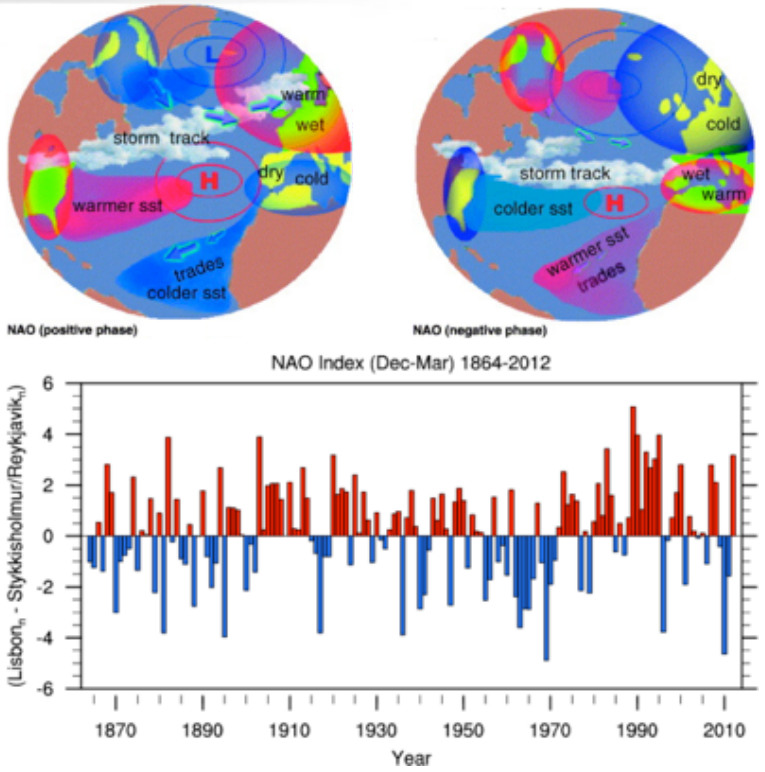
Trends, nonlinearities and extreme events

- **Ocean-atmosphere variations** influencing the magnitude and frequency extreme events, both now and in the future.
- **Increasing observational data sets**, providing higher temporal and spatial resolution for ocean-atmosphere processes.
- **Developing ocean-atmosphere models,** which simulate extreme events, focusing on observational approaches.
- **Investigating the physical mechanisms** leading to changes in high impact extreme events.



Top: The positive and the negative phases of the North Atlantic Oscillation (Bojariu and Gimeno 2003); Bottom, Hurrell North Atlantic Oscillation (NAO) Index (Hurrell 2012).

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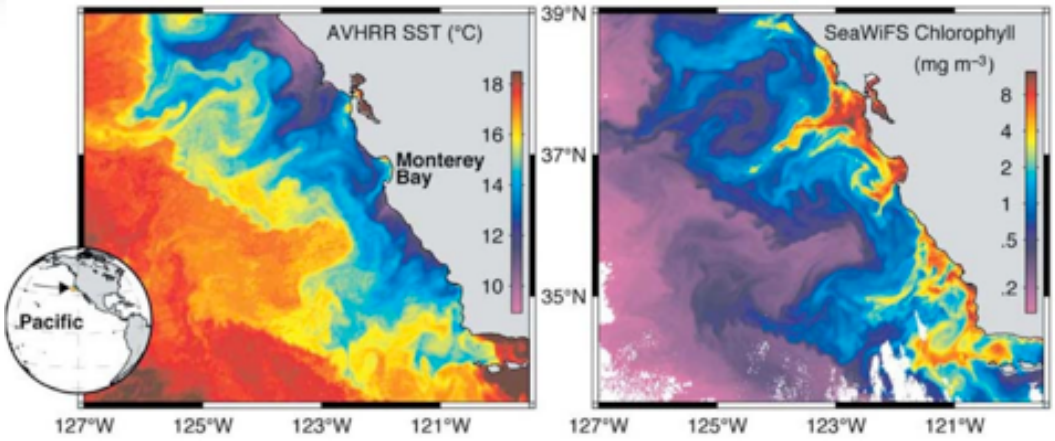
Marine biophysical interactions and dynamics of upwelling systems

- **Identifying the key physical processes** that are responsible for upwelling.
- **Improving model representation** of upwelling processes.
- **Examining interactions** between the physical, biogeochemical and marine ecological systems.
- **Examining the cause of tropical bias** in climate models.
- **Understanding future variability** of upwelling systems, including changes in the biology and biogeochemistry associated with upwelling.



Satellite remote sensing imagery of the central California Current upwelling system. (a) Sea surface temperature (SST) from the Advanced Very High Resolution Radiometer (AVHRR) on August 14, 2000, and (b) surface chlorophyll from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) on August 16, 2000. Source: Ryan et al. (2005). Marine Ecology Process Series. 287:23-32.

Link to IMBER and SOLAS

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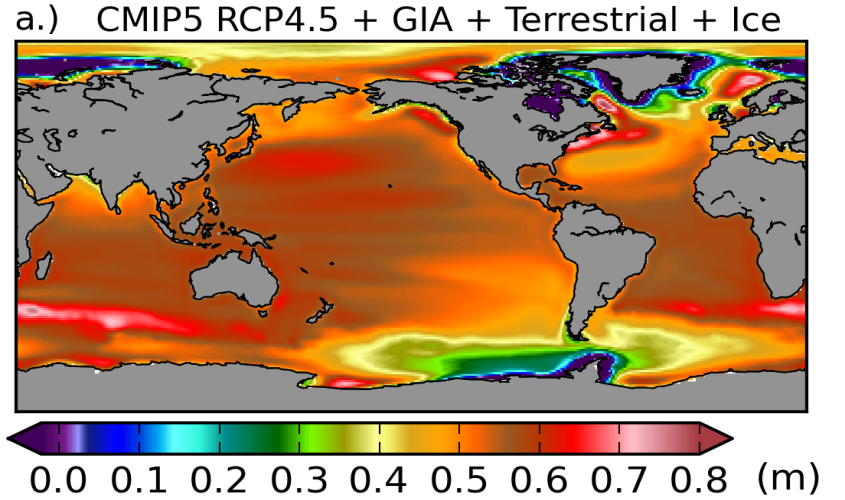
Sea Level Rise and Regional Impacts

- An integrated approach to historic sea level estimates (paleo time scale)
- Process understanding of fast ice sheet dynamics (contemporary)
- Causes for contemporary regional sea level variability and change
- Predictability of regional sea level
- Sea level science for coastal zone management

Will go forward before the end of 2014.

Paris 2016 on Sea Level envisioned.



(Carson et al., 2014)

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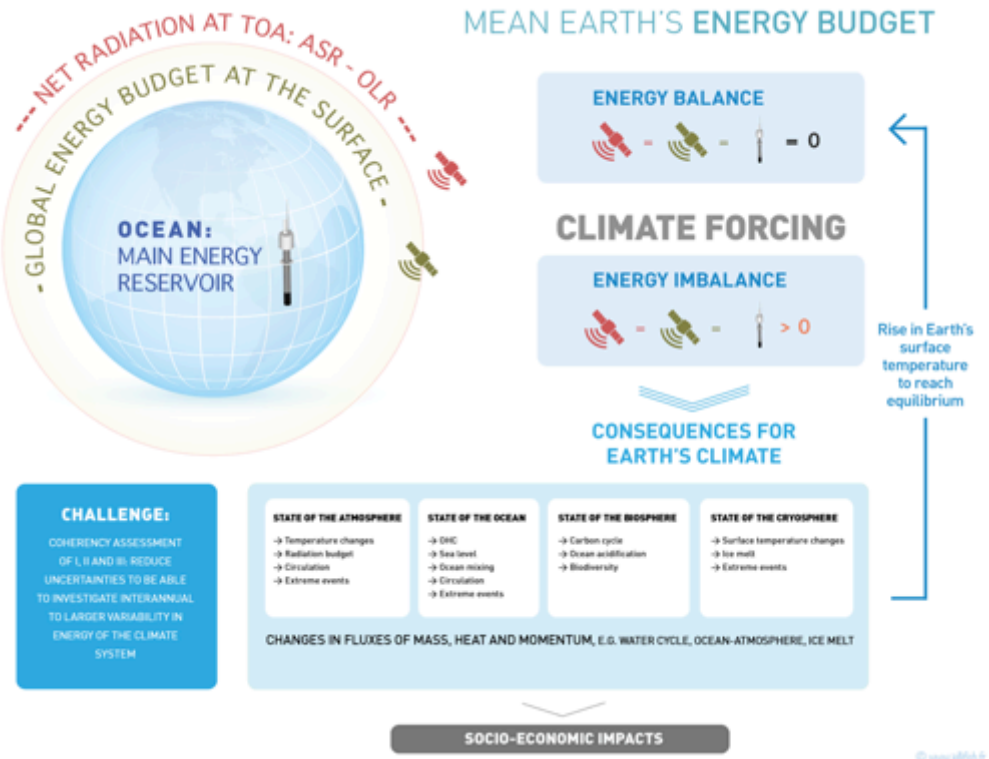
Consistency between planetary heat balance and ocean heat storage

Analyze the consistency between planetary heat balance and ocean heat storage estimates, data sets and information products based on different parts of the global observing systems and ocean reanalysis.

- Earth Observation Measurement Constraints on Ocean Heat Budget
- In situ observations of ocean heat content changes
- Ocean reanalysis for atmosphere-ocean heat exchange and ocean heat content estimate



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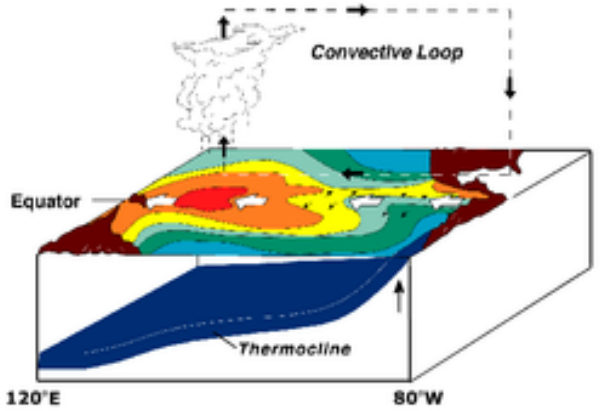
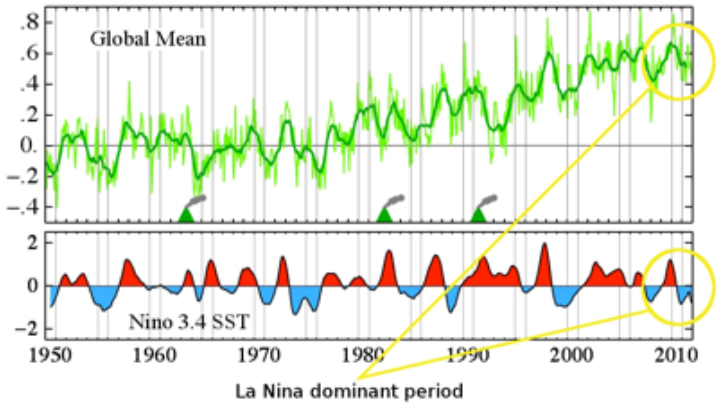
ENSO in the climate system and how it may change in a warmer world

1. Better understand the role of different physical processes that influence ENSO characteristics.
2. Provide a synthesis of existing ENSO evaluation methods in GCMs.
3. Propose ENSO evaluation protocols and develop a strategy for coordinated ENSO analysis of CMIP models.
4. Identify new observations needed to better constrain ENSO processes, both for the current climate and for past climates (via paleo proxies).
5. Provide a better understanding of how ENSO might change in the future.
6. Promote and coordinate international collaboration between observationists and modelers for studies of ENSO
7. Build research capacity by contributing to the development of the next generation of talent dealing with ENSO science.



Global surface temperature anomaly (degrees C) compared with an index of El Nino/La Nina intensity & duration



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Pan CLIVAR Meeting

- July 16-18 2014 in The Hague, Netherlands jointly with GEWEX.
- All panels and WGs members meet at the same time.

Goals of the week's meeting:

1) Communication of new CLIVAR structure, introduction of new ICPO.
2) Internal communication and coordination between CLIVAR activities.
3) Further development of new science and implementation plans.
4) Interaction with GEWEX and coordination of joint activities.

- **Based on the output of the pan CLIVAR meeting a concise science plan will be put together by the end of 2014.**
- **Will serve as strategy for the implementation of the new CLIVAR for the next 5 to 10 years.**

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Pan CLIVAR Meeting

Room	Mon 14 July 2014				Tues 15 July 2014			
	I 8:30-10:00	II 10:30-12:30	III 13:30-15:00	IV 15:30-17:30	I 8:30-10:00	II 10:30-12:30	III 13:30-15:00	IV 15:30-17:30
Amazon ** Capacity: 320	SOP	SOP	SOP		PP	PP	PP	
Everest 1 ** Capacity: 50	Joint GSOP/OMDP	Joint GSOP/OMDP			GSOP	GSOP	GSOP *	
Everest 2 ** Capacity: 60	Climate Dynamics	Climate Dynamics			OMDP	OMDP		
Kilimanjaro 1 Capacity: 40	Joint PP/IOP	Joint PP/IOP	Joint PP/GSOP	Joint PP/GSOP	SOP	SOP	SOP	SOP
Kilimanjaro 2 Capacity: 40			IOP	IOP	AIP	AIP	AIP	AIP
Mississippi ** Capacity:320/400	AIP	AIP	AIP		IOP	IOP	IOP	
Africa Capacity: 56	AAMP	AAMP	VAMOS	VAMOS	Monsoons Panel	Monsoons Panel	Monsoons Panel	Monsoons Panel

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Pan CLIVAR Meeting

	Wednesday	Thursday	Friday
AM	GEWEX Conference Plenary Session: Processes and phenomena	GEWEX Conference Plenary Session: Water resources	Joint pan-CLIVAR / pan-GEWEX Plenary
	CLIVAR Opening Plenary	Break-out sessions • Planetary Heat Balance and Ocean Heat Storage • Scoping for a CLIVAR Climate Dynamics Panel	
PM	Break-out sessions • ENSO in a changing climate • Dynamics of Regional Sea Level	Break-out sessions • Variability and Predictability of Monsoon Systems • Biophysical Interactions and Dynamics of Upwelling Systems	CLIVAR Plenary
	Break-out sessions • Decadal Variability and Prediction • Attribution and Prediction of Extremes	Break-out sessions • Sustained Ocean Observations • Ocean Model Improvements and Process Studies • Climate Information and Regional Engagement	

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Pan CLIVAR Workshop, The Hague, NL

Meeting Title	Panel	Location	Date
pan-CLIVAR Workshop		The Hague, NL	July -2014
Panel meetings	All panels		14/15
Research Foci and Capabilities			16/17
Joint CLIVAR/GEWEX Session			18
SSG (CLIVAR/GEWEX)			
21st Session of CLIVAR SSG	SSG	Moscow	November -14

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Planned Panel and Workshop Meeting – 2015/16

Meeting Title	Panel	Location	Date
CLIVAR SSG-22	SSG	Pune	2015
CLIVAR Science Conference		Quindao	2016
CLIVAR SSG-23	SSG	Quindao	2016

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Joint CLiC/CLIVAR/SCAR SOP

- Issues of CliVar/CliC coordination in the Southern Ocean has been raised by CLIC.
- Some initial discussions toward a more joint SOP are on a way forward which has a stronger link between CLIVAR and CLIC.
- Will be continued during pan CLIVAR.

Joint CLiC/CLIVAR Arctic Panel?

- Issues of CliVar/CliC coordination in the the Arctic has been raised and should go forward.
- Some initial discussions toward joint panels are on a way forward.
- We will be discussing detailed possibilities of implementation and will propose some concrete next steps after pan CLIVAR.
- Should take future of GRISO into account.

IGBP/PAGES-WCRP Interaction?

- CLIVAR Informed IGBP and PAGES on discontinuation of CLIVAR/ PAGES Panel.
- In the future CLIVAR will not support a separate panel of PAGES-CLIVAR activities but encourages all CLIVAR groups to directly liaise with PAGES where appropriate (like we do with CARBON and IMBER/SOLAS).
- However, PAGES/IGBP is quite relevant for **WCRP at large.** Moreover, PAGES seeks closer affiliation with WCRP.
- **To sound out interactions a pan-WCRP / PAGES scoping workshop will be organized.**

CLIVAR – US CLIVAR

- There is a very good working relation between US CLIVAR and CLIVAR/WCRP
- Considerable US participation in international CLIVAR panels, and these people usually are (or were) part of US CLIVAR.
- Participation of US CLIVAR scientists in the CLIVAR Research Foci, as well as the WCRP GCs.
- CLIVAR representation in US CLIVAR working groups, and I think CPTs also.
- Long-standing financial support.

Thank you !!

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CLIVAR – US CLIVAR

But there is also room for improvements!

- Closer coordination and interaction, e.g.,
  - science goals – is there a mapping onto WCRP efforts?
  - priorities in implementation
  - “one language” to community and agencies
- Joint activities (coordinated CPTs)?
  - CLIVAR Science Conference
  - Research foci and workshops
- Continued US participation in CLIVAR ICPO support
- National reports on CLIVAR web page
- Flow of information from CLIVAR to national activities

Thank You!

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