CLIVAR: CLIMATE & OCEAN
variability, predictability and change

WCRP's core project on the
Ocean-Atmosphere System

JSC36, 8-10 April 2015, Geneva
Lisa Goddard (SSG co-chair)

WCRP
World Climate Research Programme

CLIVAR

Outline

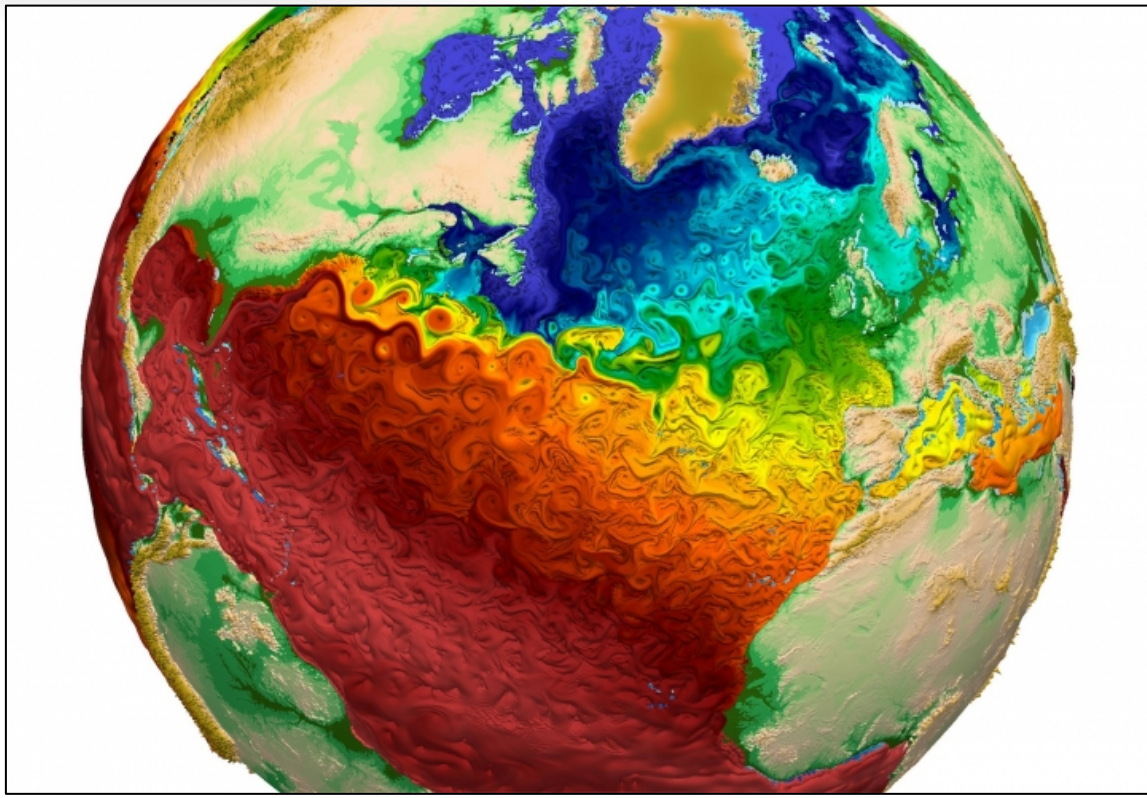
- CLIVAR priorities and opportunities
- Synergies and joint activities with US CLIVAR
- DCVP, CMIP6, and a new WCRP GC
- Upwelling and cooperations CLIVAR-IMBER
- IACS, WCRP, and CLIVAR-Arctic
- CLIVAR 2016 Open Science Conference

CLIVAR: CLIMATE & OCEAN
variability, predictability and change

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

Enabling better understanding of climate variability, predictability and change

To the benefit of society and the environment in which we live



Credit: Los Alamos National Laboratory

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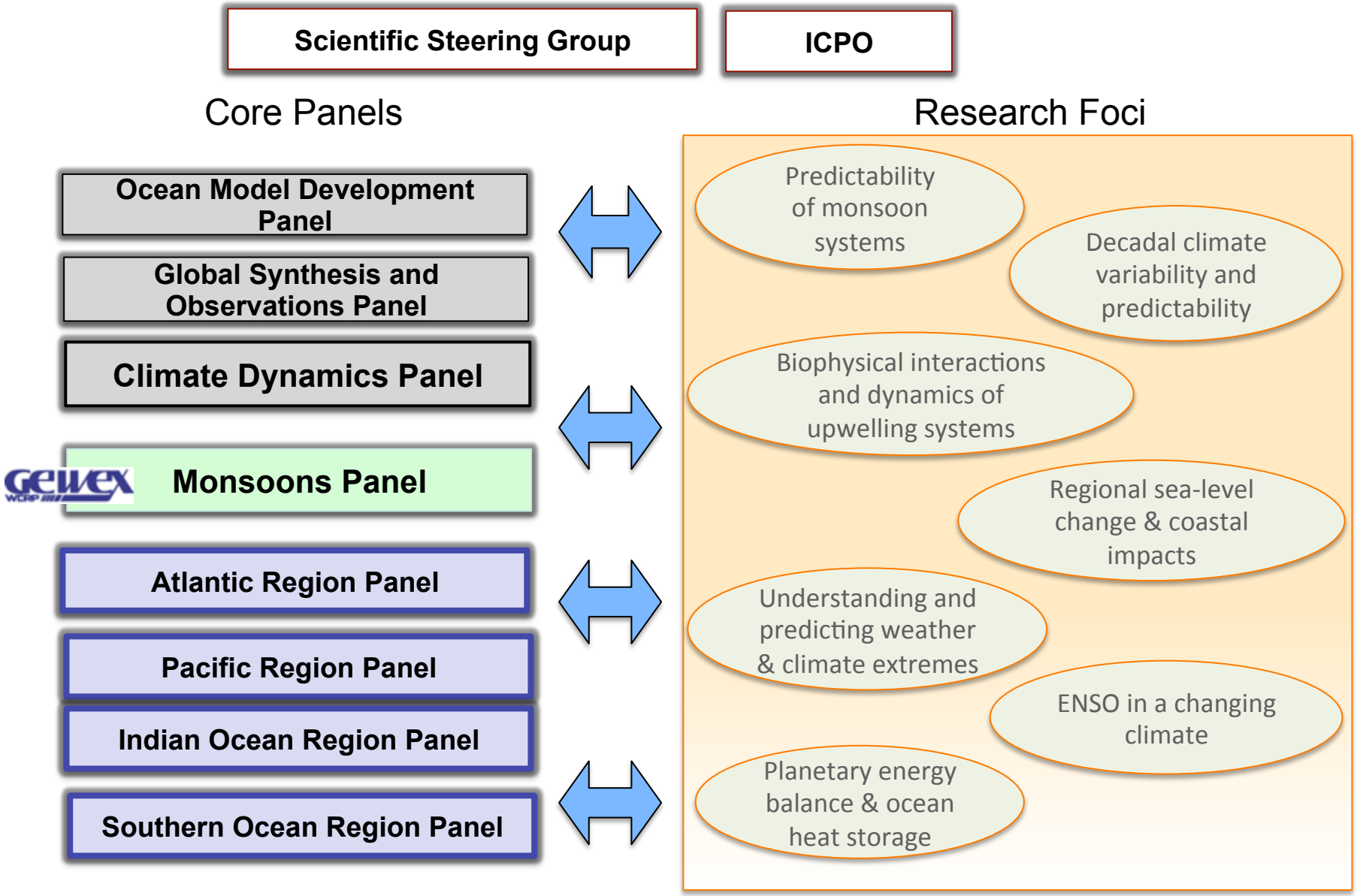
CLIVAR Consolidated Structure



CLIVAR SCIENTIFIC STEERING GROUP

Dr. Lisa Goddard
Co-chair
IRI - Columbia University (USA)
2015

Prof. Detlef Stammer
Co-chair
CEN, Universität Hamburg, (Germany)
2016

Dr. Annalisa Bracco
Georgia Institute of Technology (USA)
2015

Prof. Lixin WU
Ocean University of China (China)
2015

Dr. Pedro Monteiro
CSIR (South Africa)
2015

Dr. Carlos Moffat
University of California, Santa Cruz (USA)
2016

Dr. Clara Deser
UCAR (USA)
2017

Dr. Virginie Guemas
Institut Català de Ciències del Clima (Spain)
2017

Krishna AchutaRao
Indian Institute of Technology (India)
2017

Dr. Ed Hawkins
University of Reading (UK)
2015

Dr. Stephen Griffies
NOAA-GFDL (USA)
2016

Dr. Pascale Braconnot
CEA-CNRS (France)
2016

Prof. Nathan Bindoff
University of Tasmania (Australia)
2017

Dr. Boris Dewitte
LEGOS (France)
2017

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CLIVAR SCIENTIFIC STEERING GROUP

Outgoing co-chair

Incoming co-chair

Dr. Lisa Goddard
Co-chair
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LEGOS (France)
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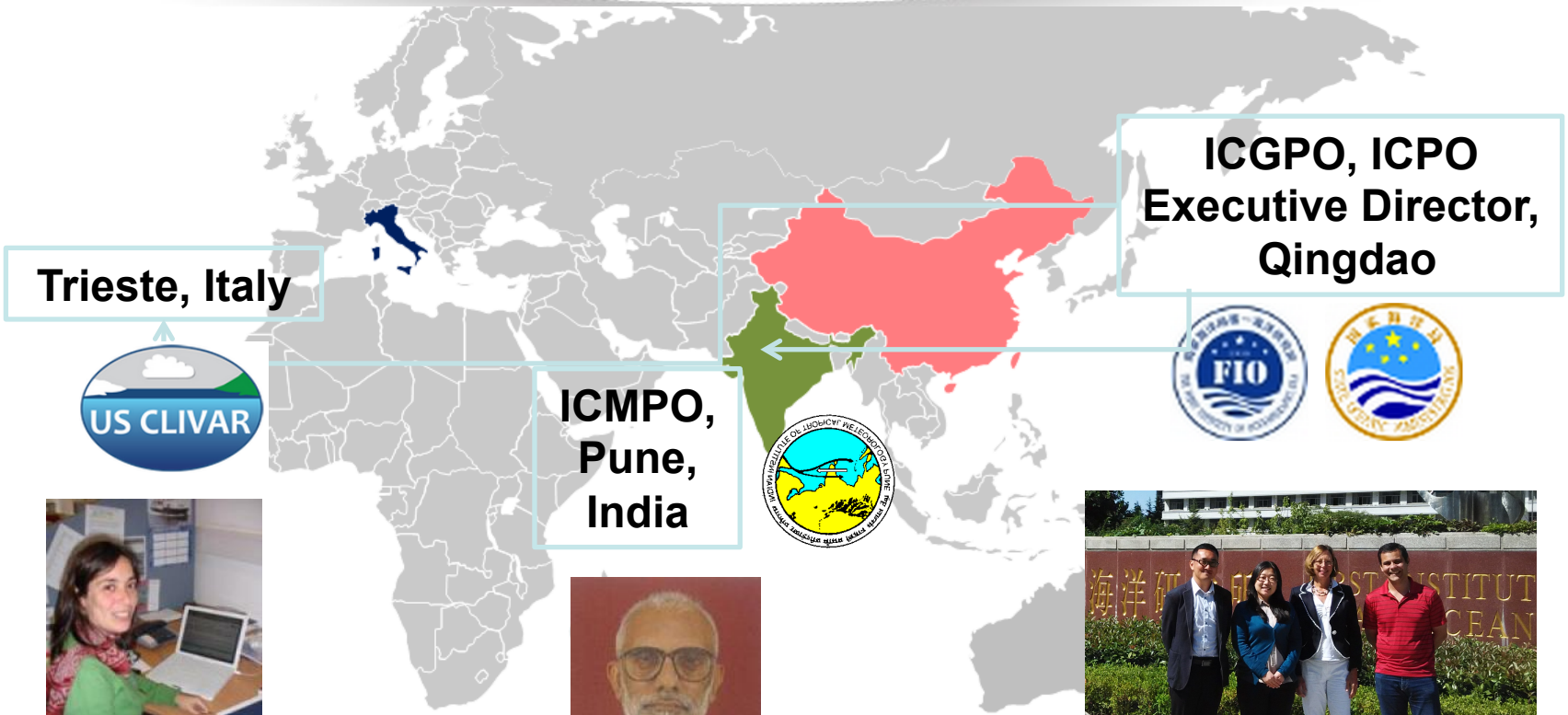
Truly International ICPO



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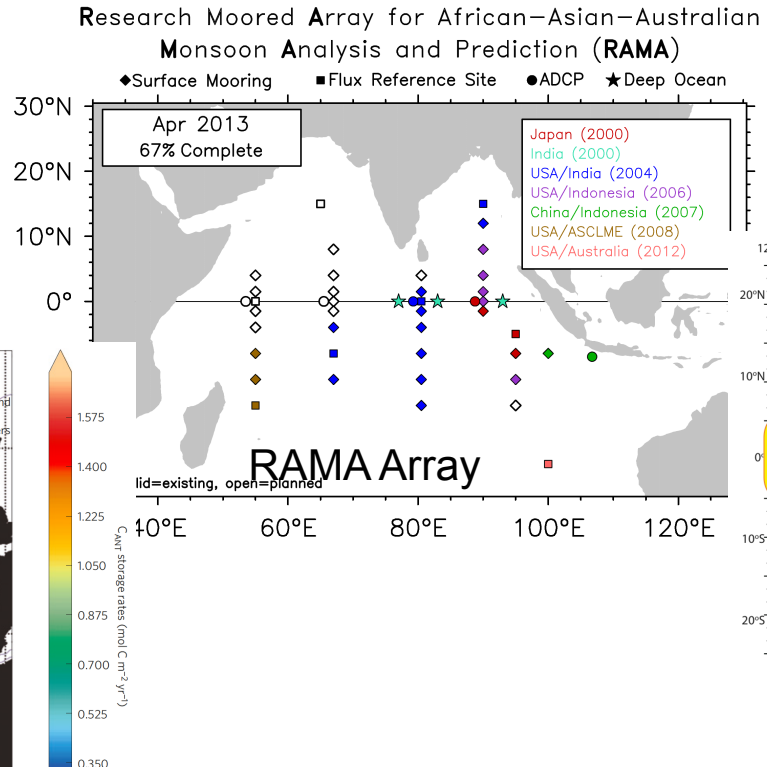
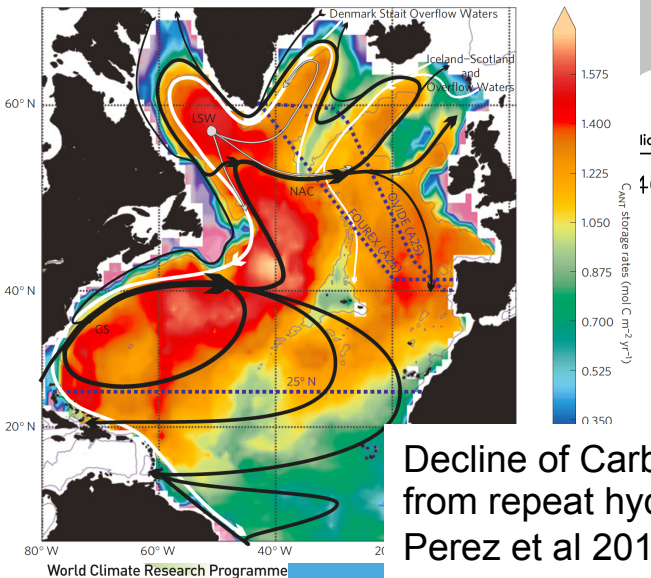
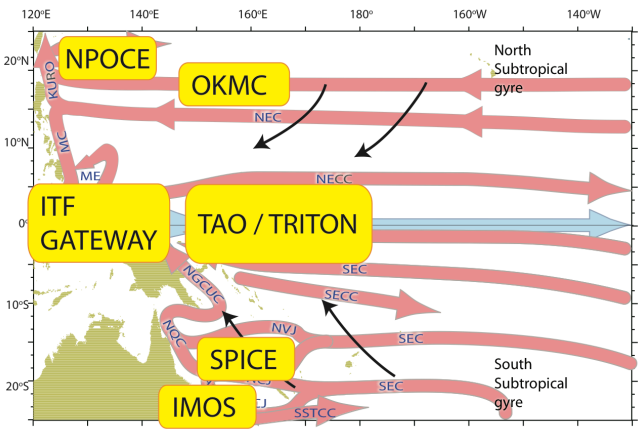
CLIVAR: Basin panels
Int'l Coordination. Regional Implementation.

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





Decline of Carbon uptake from repeat hydrography, Perez et al 2013



Multi-national, -institutional, and -investor process study programs

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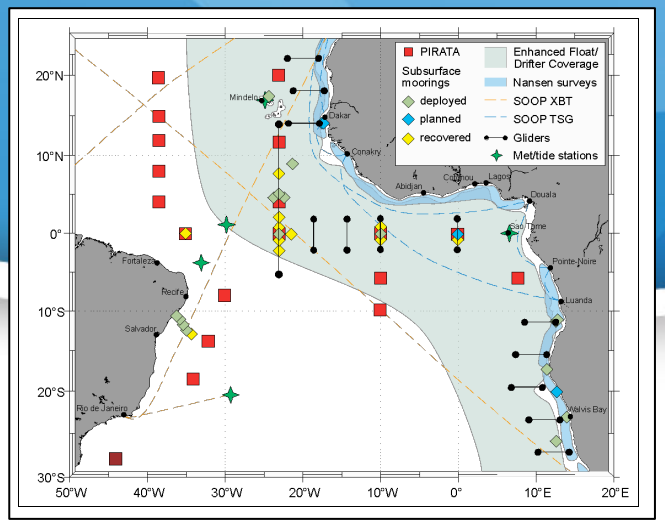
CLIVAR Observations



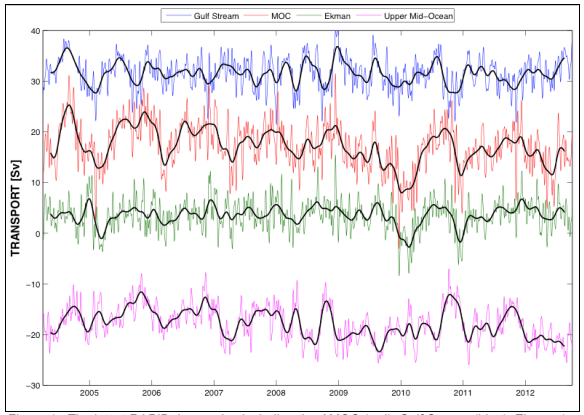
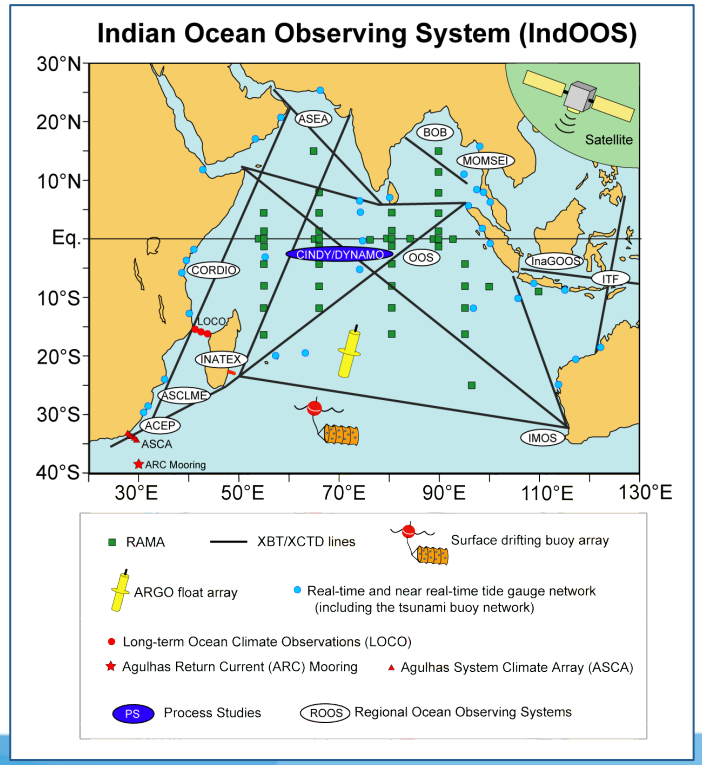
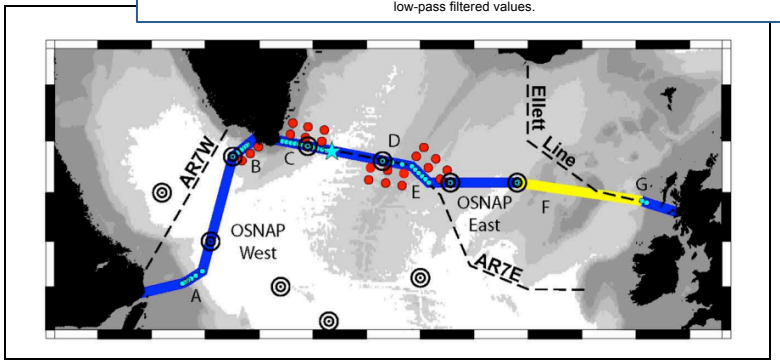
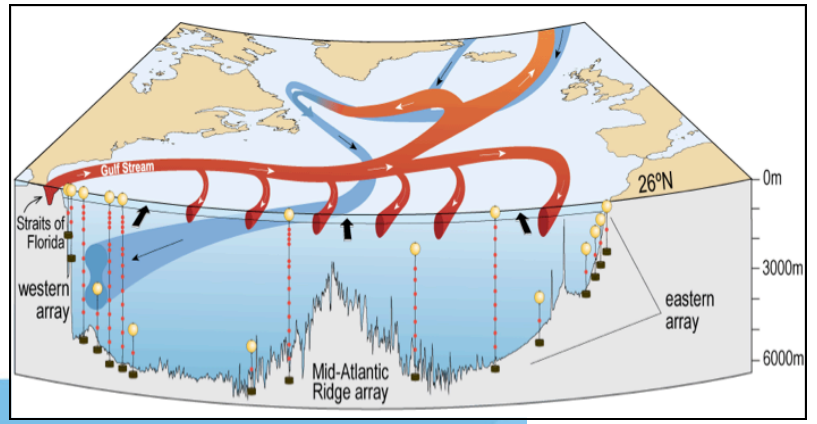


Figure 1. The latest RAPID time series including the AMOC (red), Gulf Stream (blue), Ekman (green) and upper mid-ocean (magenta) transports. Colored lines are ten-day values. Black lines are 90-day low-pass filtered values.







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Argo and GO-SHIP

- Argo and repeat hydrography are of high priority to CLIVAR.
- GSOP is the liaison to both as well and is participating in meetings.
- Basin panels interact with resp. to regional observing components (see below).
- Like with other data sets responsible for the synthesis.

Atlantic Region Panel

Co-chairs: Peter Brandt (Germany) and Ping Chang (USA)

Main focus on Eastern Atlantic

• Panel played a key role in coordinating discussions on model biases in Eastern Atlantic Upwelling region, which led the creation of the **US CLIVAR Eastern Tropical Oceans Synthesis WG**

• Several members were essential in setting up the EU funded **PREFACE** (Enhancing PREdiction oF Tropical Atlantic ClimatE & its impact) – 2012/2017

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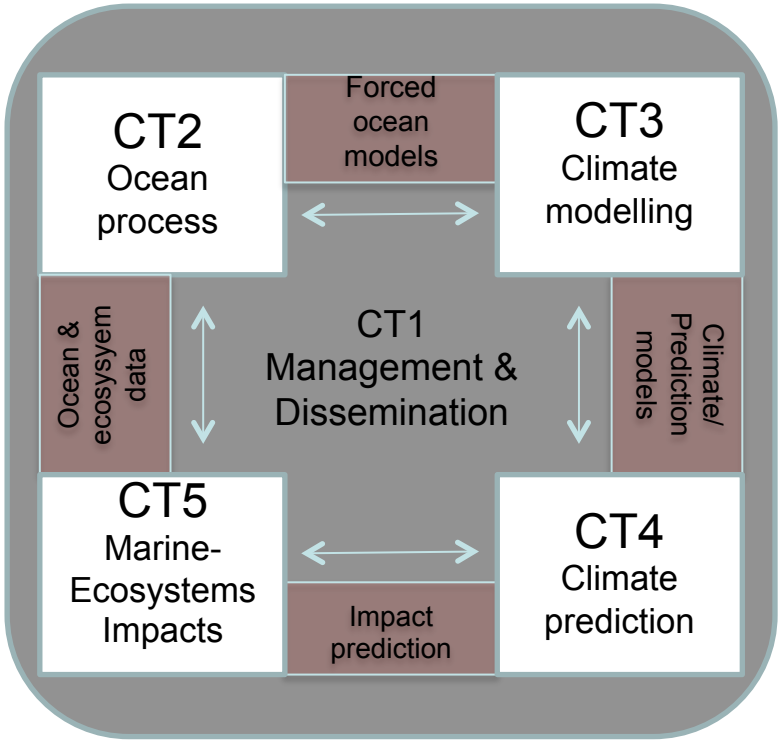
PREFACE: Enhancing PREdiction oF Tropical Atlantic ClimatE & its impact

- **EU Framework 7 cooperative project** (2013-2017)
- **27 partners from 17 countries**
  - 17 from 8 European countries
  - 10 from 9 African countries
- **Coordinator:** Noel Keenlyside

- Associated projects/initiatives
  - AWA (PI P. Brehmer)
  - SACUS-SPACE (PI P. Brandt)
  - US NSF (PI P. Chang)



Continuation of CLIVAR TACE program (2006-2011) with more emphasis on coastal upwelling regions

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CLIVAR/CliC/SCAR Southern Ocean Region Panel

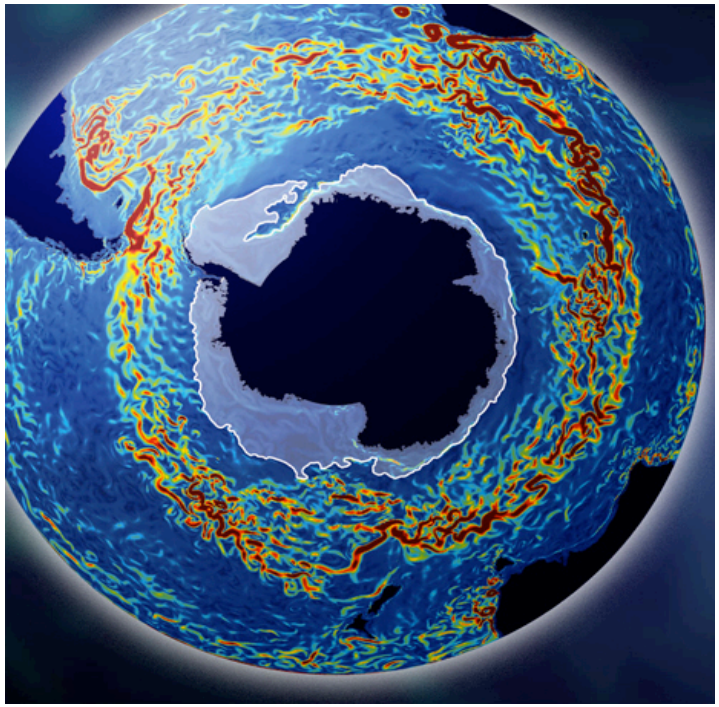
• Some SORP members (Talley, **Russell**) instrumental in developing SOCCOM. Panel will foster further coordination of SOCCOM with other countries' initiatives

• Development of proposal of SOMIP with wind perturbation protocols
• SOMIP metrics based on observations (with US CLIVAR Southern Ocean WG)

Observations

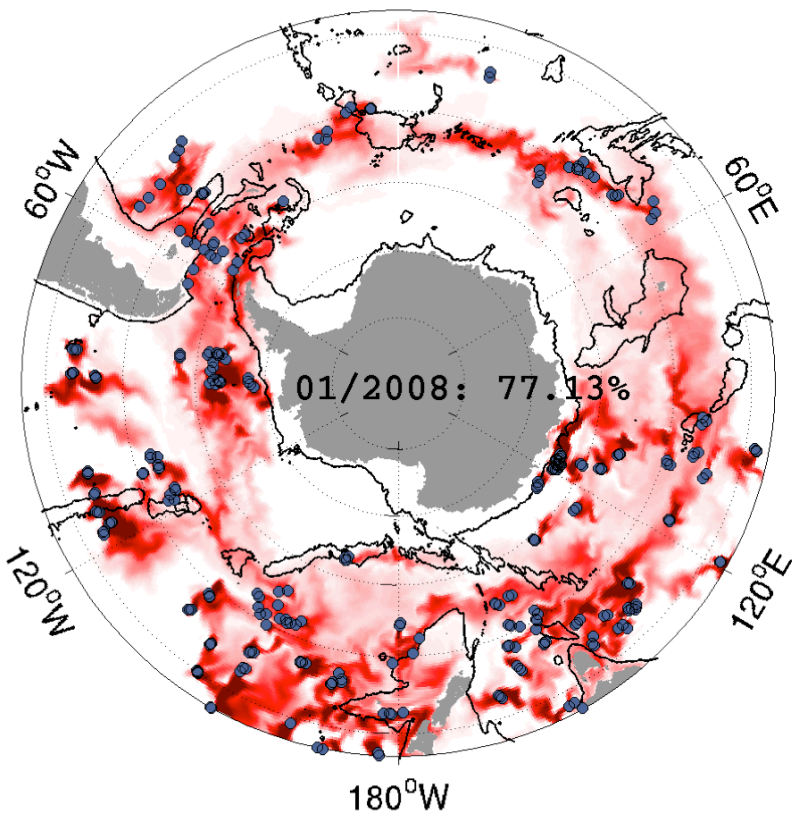
SORP advising GOOS on **EOV**s, working on list of most important, practical, near-term priorities (under-ice observations; surface fluxes)

Use of state estimates (ocean reanalysis) to aid with analysis of the broad-scale data



Southern Ocean State Estimate (SOSE)

Use of state estimates and OSSEs to assist with optimizing sampling plans

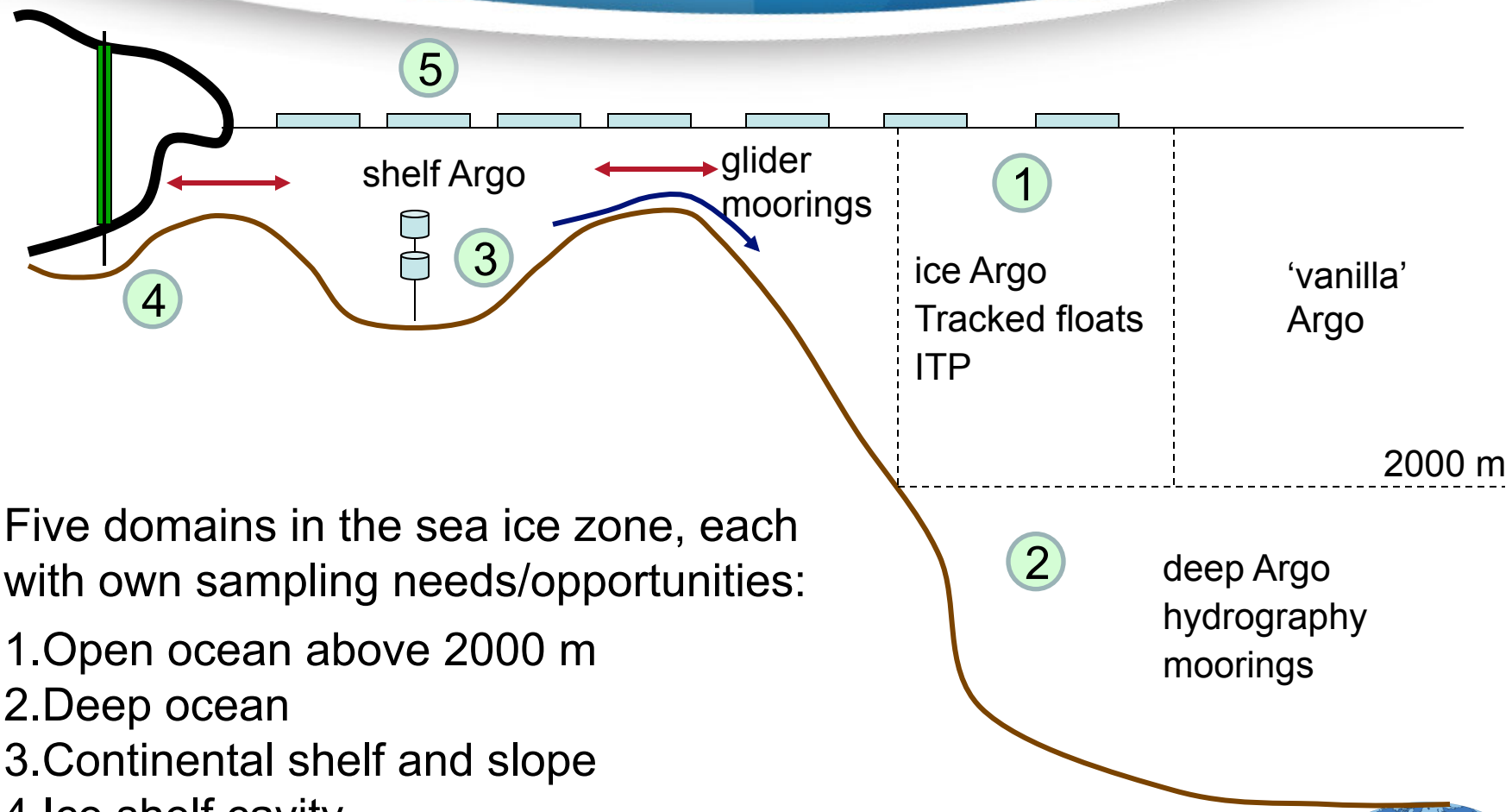


SOSE's map of where pH measured on ~100 floats would influence pH field in SOSE

Observations

SORP working with SOOS on a strategy for an integrated under-ice observing system

Diagram under development ….



Five domains in the sea ice zone, each with own sampling needs/opportunities:

1. Open ocean above 2000 m
2. Deep ocean
3. Continental shelf and slope
4. Ice shelf cavity
5. Sea ice and atmosphere

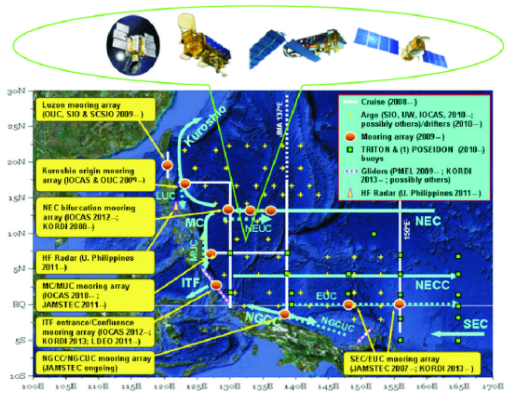
CLIVAR-Arctic

- An equivalent effort in the Arctic seems missing (my perspective).
- Discussion at the IACS meeting in Japan about the state of the observing systems.
- CLIC seems resistant to a joint Arctic panel
- AIP now puts a member on teh IACS ocean panel to sort out what is there and what CLIVAR needs to take care of.

CLIVAR Pacific Region Panel (PRP)

Co-chairs: Alex Ganachaud (France) and Matthieu Lengaigne (France)

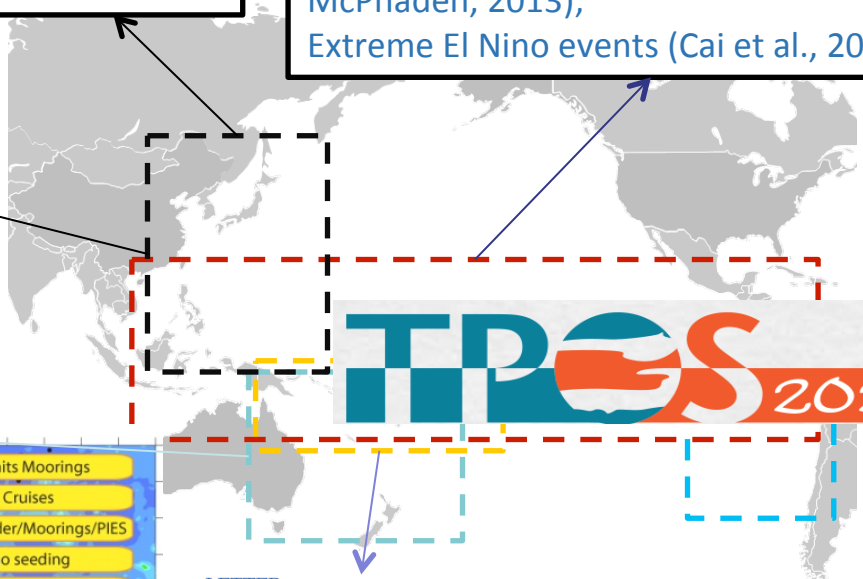
NPOCE program (Northwestern Pacific Ocean circulation and climate)



NPOCE observation design

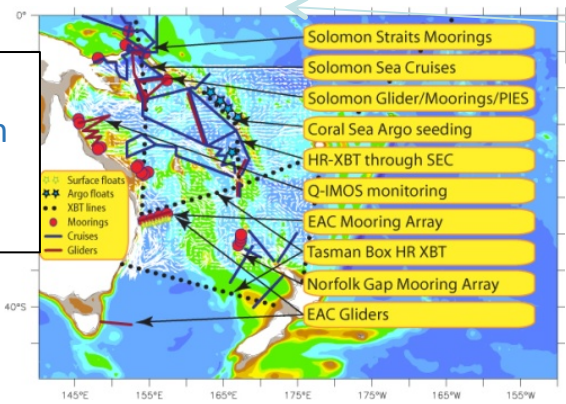
JGR special issue on Western Pacific Ocean Circulation and Climate

ENSO study:
ENSO metrics to evaluate climate models (Guilyardi et al., 2009);
ENSO-IOD relationship (Nagura and McPhaden, 2013);
Extreme El Nino events (Cai et al., 2014



TPOS 2020 Tropical

SPICE (2008-)
(Southeast Pacific Ocean Circulation and Climate Experiment)




LETTER

More extreme swings of the South Pacific convergence zone due to greenhouse warming

SPCZ (South Pacific convergence zone) **study**

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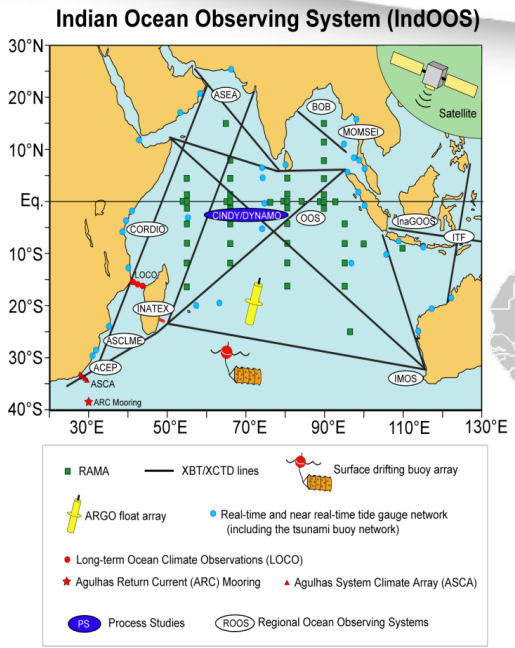
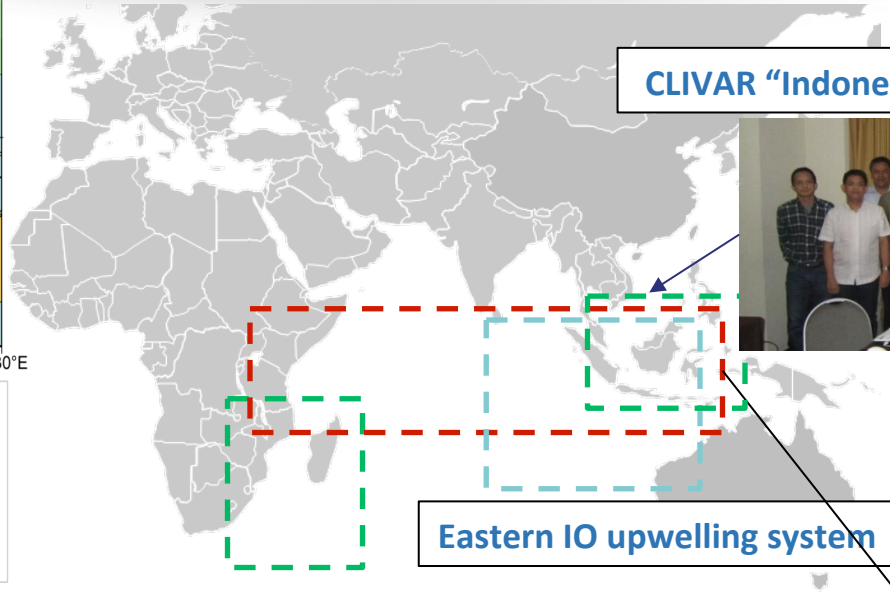
CLIVAR/IOC-GOOS Indian Ocean Region Panel (IORP)

Co-chairs: Jerome Vialard (France) and M. Ravichandran (Indi





CLIVAR "Indonesian Through Flow" task team

Eastern IO upwelling system

Agulhas System Climate Array (ASCA)
South Africa, USA, Netherlands

IOD study:
MISMO (Yoneyama et al. 2008) and VASCO/CIRENE (Vialard et al. 2009a)
Review paper on decadal variability in IO (Han et al., 2014);
Response to warming climate (Cai et al., 2013, nature)
Extreme IOP events (Cai et al., 2014, nature)

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CLIVAR/IOC-GOOS Indian Ocean Region Panel (IORP)

IIOE-2: The 2nd International Indian Ocean Expedition (2015-2020)

ICSU: International Council for Science
WMO: World Meteorological Organization
IOC: Intergovernmental Oceanographic Commission of UNESCO
WCRP: World Climate Research Program
SCOR: Scientific Committee on Oceanic Research
GOOS: Global Ocean Observing System
SOLAS: The International Surface Ocean - Lower Atmosphere Study
…….

Next Panel meeting:

Nov 30 – Dec 4, 2015, alongside with the "International Symposium on the Indian Ocean" in Goa, India.

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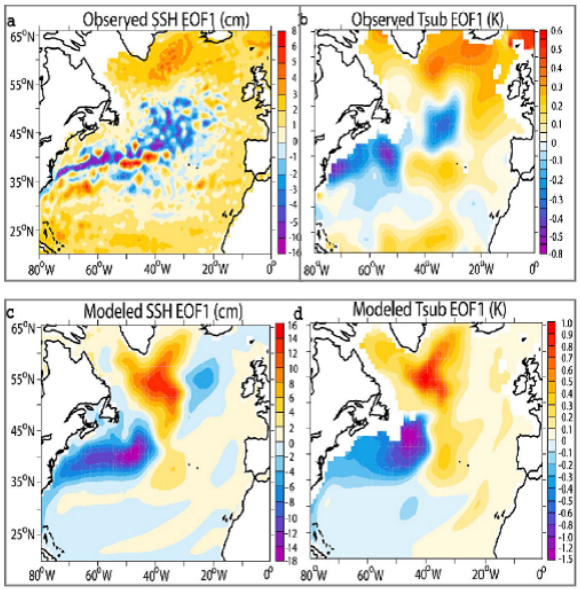
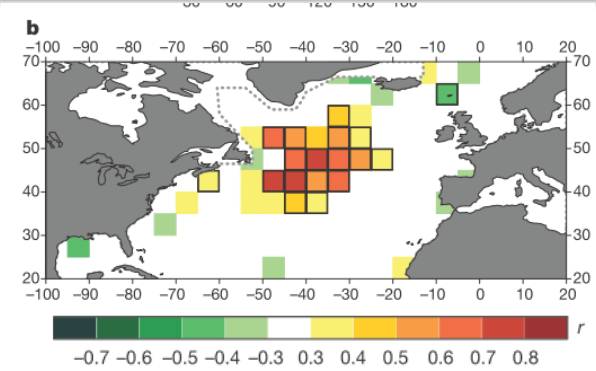
CLIVAR: Ocean-Atmosphere Climate System

Understanding the interaction of the surface and deep ocean with the climate system

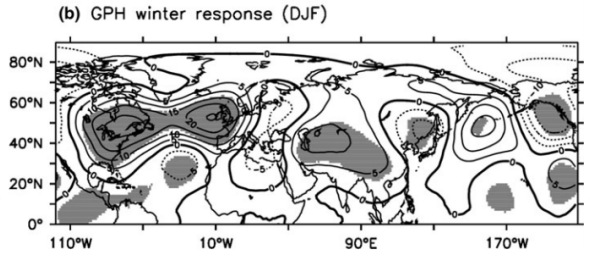
Global Synthesis and Observations Panel	Climate Dynamics Panel	Ocean Model Development Panel



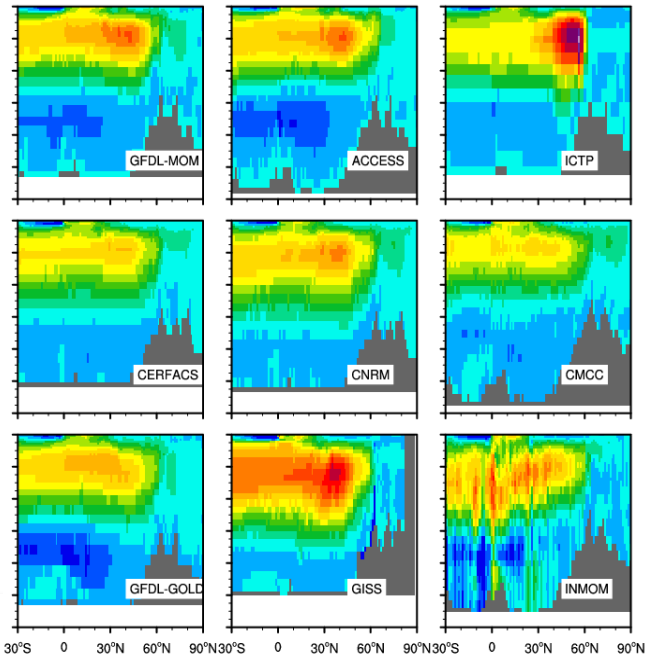
Zhang et al., 2008



Gulev et al., 2013



Hand et al. ,2014

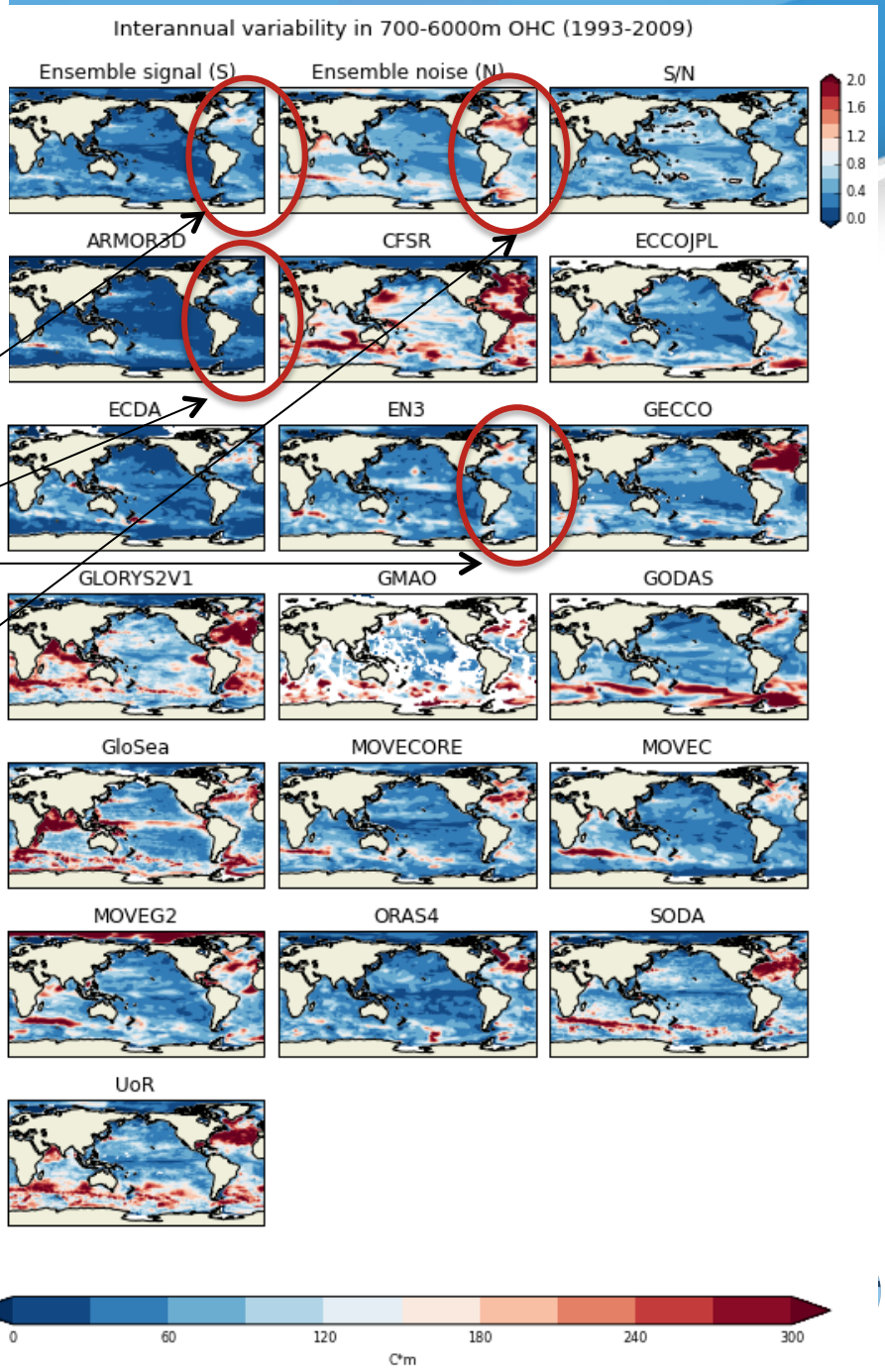


Danabasoglu et al., 2014

CLIVAR GSOP/GODAE Ocean View

Ocean Reanalysis Inter-comparison (ORA-IP)

- Some Signal in N Atlantic and S Ocean
  - Check against Obs. only products ARMOUR3D, EN3
- High Noise (disagreement between products) in same regions so S/N < 1
- Planned to monitor OceanSITES locations to compare variability levels between sites
- Strategy for future deployment by investigating the consistency of temporal variability in ocean synthesis products in space
- Results preliminary: May be v. sensitive to outliers (models with strong drifts).



International Quality-Controlled Ocean Database

IQuOD

- Aim: To construct the most complete, consistent and high quality subsurface ocean temperature (**EOV/ECV**) long-term database, with intelligent metadata and assigned uncertainty to each observation,

- **Future plans** to expand IQuOD effort to other EOVs/ECVs such as subsurface salinity, oxygen, etc.

- globally-coordinated single best standard practice to avoid duplication.
- Deliverables will be tailored in close cooperation/collaboration with end-users (e.g., observational, reanalysis/modelling communities and ocean/climate services).

www.iquod.org

World Climate Research Programme

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Climate Dynamics: Dynamical Processes and their Role in Climate Variability and Change

Focus on large-scale phenomena, processes, and mechanisms of coupled climate variability/modes, teleconnnections and change on seasonal to centennial time-scales.

(i) storm tracks, jet streams and weather systems

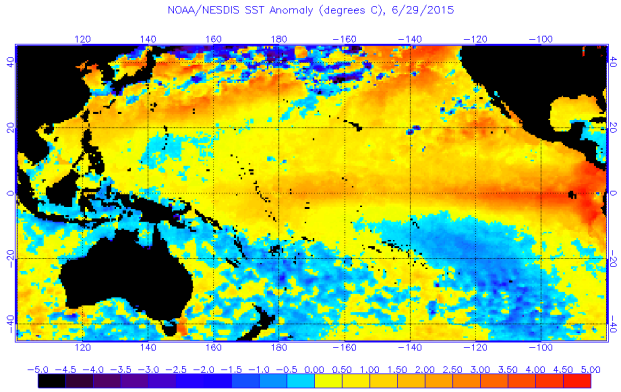
- *Extratropical Atmosphere-Ocean Coupling*
- *Remote Influences and External Forcing*
- *A Theoretical Challenge*

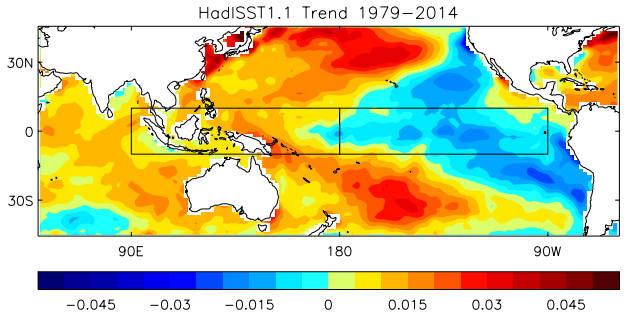
(i) Tropical-Extratropical Interactions

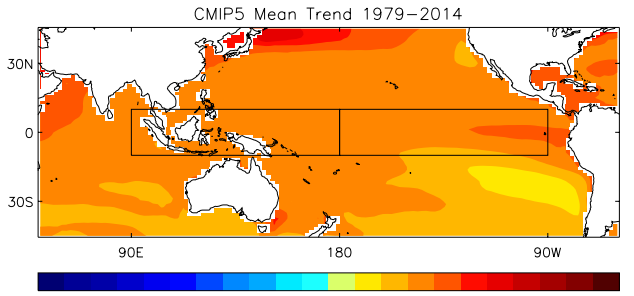
- *Zonal Asymmetries in Tropical Convergence Zones*
- *Dynamical links Between the Tropics and Midlatitudes*
- North-South Asymmetry in the Climate Change Signal

(ii) Long-term Coupled Atmosphere-Ocean Circulation

- *Patterns of Future SST Change*
- *Precipitation Changes over Land*
- *Variability as an Analog for Forced Change*







Climate Dynamics: Dynamical Processes and their Role in Climate Variability and Change

1st Meeting: 2-4 July 2015, Exeter, UK

- Overview of research and recent findings
- Open questions and challenges
- Forthcoming opportunities (workshops, meetings, funding calls)
- Suggestions for panel activities/deliverables e.g. coordinated meetings, model experiments/analyses, collaboration with other WCRP activities and projects

Ocean Model Development Panel

Given the **widespread use of CORE-II**, and the associated broad advances to ocean and climate science, there is an urgent need to advance the scientific and engineering foundations of CORE-II to serve model development, applications and mechanistic understanding needs, eg:

- High resolution modeling applications
- Upwelling
- Decadal Variability and Predictability

OMDP priority: to reignite both science and engineering efforts to advance the foundations of CORE-II, including the extention/update of forcing datasets for CORE-II

Ocean Model Development Panel

Maturing of CORE-II

CMIP6 Ocean Model Intercomparison Project (OMIP)

- OMDP has developed the CORE-II proptocol as an Ocean Model Intercomparison Project (OMIP) for inclusion in CMIP6
    - Includes the merger with the OCMIP ocean biogeochemistry effort.

Ocean-Ice Model Surface Forcing Function

- OMDP Mini-Workshop on Forcing Ocean-Ice Models - Grenoble, January 2015 (*report on OMDP webpage*)
- Major outcome: consideration of the new JRA-55 product – presented here for the first time - to provide the next generation of atmospheric forcing data sets for use in future CORE (OMIP) frameworks.
- Exciting prospect for a new high resolution, near real-time forcing dataset for future COREs and potentially OMIP
- JRA effort supported through a community evaluation effort by OMDP, the workshop participants and other members of the community over the course of 2015 and 2016.

Ocean Model Development Panel

Maturing of CORE-II

Extended OMDP Session - Yokohama, Japan, 14-15 January 2016

The detailed evaluation of the new JRA-55 product, advancing the CORE-II framework and CMIP OMIP.

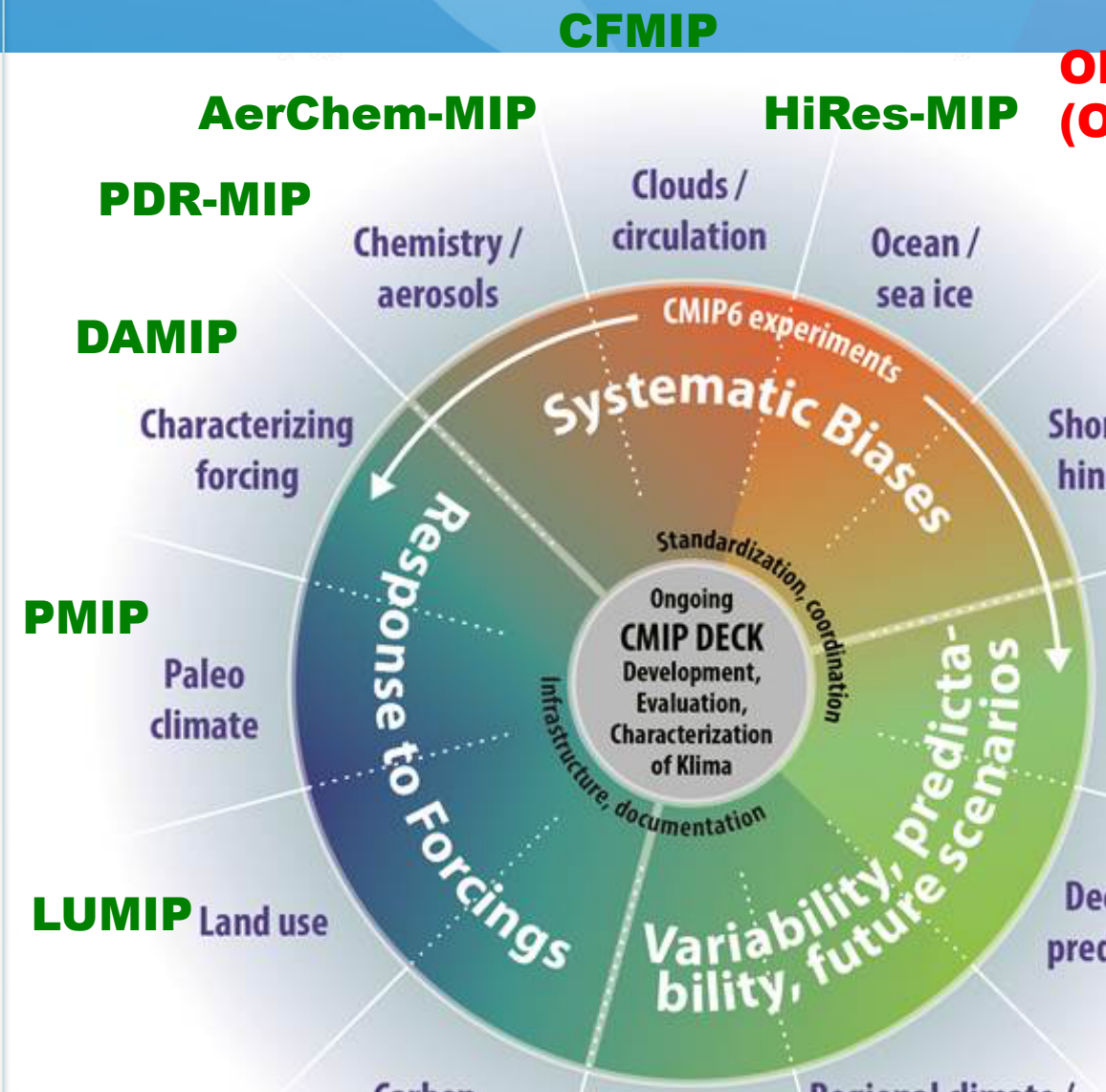
- **Specific topics:**
  - review of technical aspects of JRA-55; its on-going evaluation;
  - reviews of applied and / or additional corrections;
  - creation of a normal-year forcing data set;
  - presentations of preliminary scientific results, directly related to the development of the CORE-II framework and CMIP6 OMIP experiment.

- **Potential outcome**:
  - Evaluation and decision regarding the endorsement of the JRA-55 by OMDP (with input from the broader ocean and climate modelling communities) as the forcing for the future CORE-II efforts and OMIP ocean-ice climate model simulations.

- Another important goal of the meeting is to receive input from the wider ocean and climate modeling communities participating in the CORE-II and / or OMIP efforts on OMDP planning for these efforts.

CMIP6 Experiments Analysis

CLIVAR



CFMIP

AerChem-MIP

HiRes-MIP

OMDP OMIP (OCMIP6)

PDR-MIP

Monsoons Panel
Global Monsoon MIP

DAMIP

ENSO RF
ENSO MIP

PMIP

Scenario MIP

LUMIP

DCVP RF
DCPP
Component C, VolMIP

Sea Level GC
FAFMIP

C4MIP

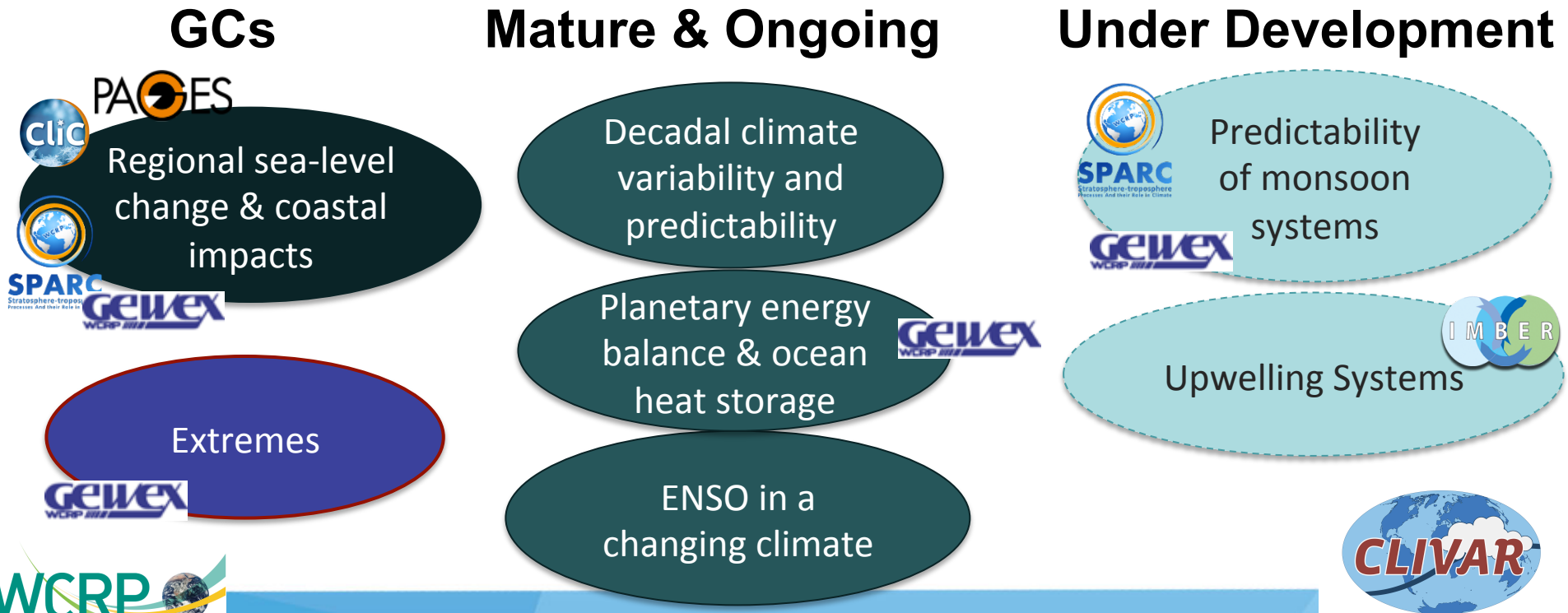
GDDEX

CORDEX

WCRP World Climate Research Programme

Research Foci

- Timely, tractable and socially-relevant research challenges; limited life-time (2-5 yrs)
- Cross-cutting between CLIVAR & WCRP, modeling & obs.



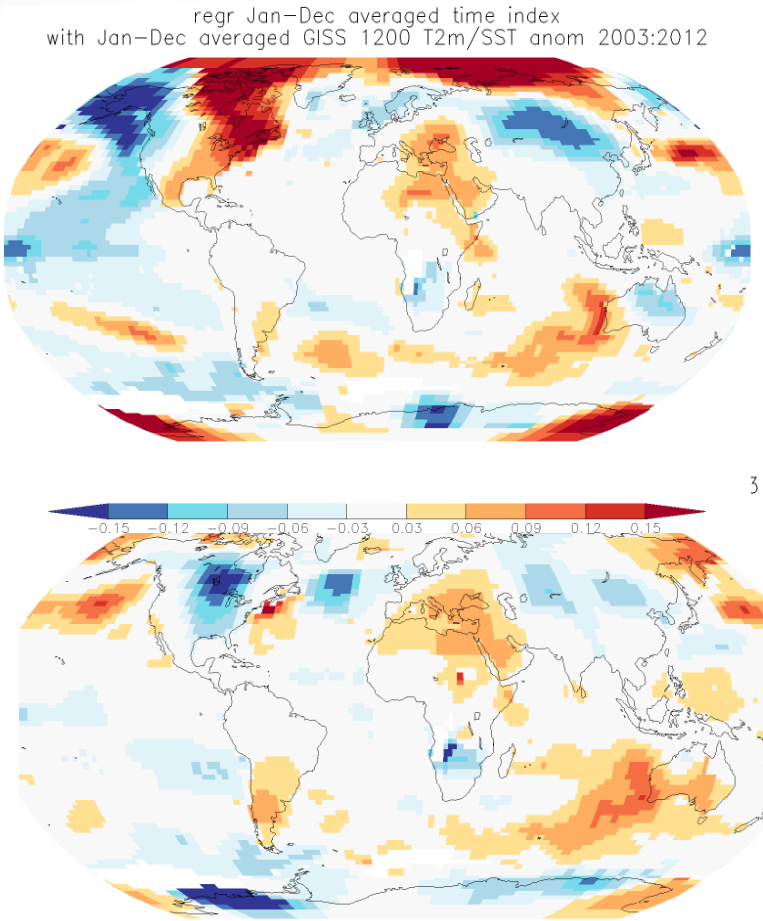
Decadal Climate Variability and Predictability (DCVP)

Objectives: Characterize, understand, attribute, and predict global and regional multi-year to multi-decade observed climate anomalies

Focus:

Explaining, understanding and predicting the modulation – accelerations and slowdowns – of the anthropogenic warming trend

Determining the role of volcanic eruptions in decadal climate variability and their impact on decadal climate prediction



Source: KNMI

DCVP RF Working Group membership

		Role	Year	Country
Cassou, Christophe	CERFACS Climate Modelling and Global Change	Co-Chair		France
Kushnir, Yochanan	LDEO Columbia University	Co-Chair		USA
Danabasoglu,Gokhan	NCAR, Climate and Global Dynamics Laboratory	Member		USA
Doblas-Reyes, Francisco	Institut Català de Ciències del Clima, SpainInstitut Català de Ciències del Clima	Member		Spain
Hawkins, Ed	University of Reading	Member		UK
Heimbach, Patrick	The University of Texas at Austin; Institute for Computational Engineering and Science (ICES); Jackson School for Geosciences (JSG), Institute for Geophysics (UTIG)	Member		USA
Von Schuckman, Karina	Mediterranean Institute of Oceanography, University of Toulon	Member		France
Masahide, Kimoto	Atmosphere and Ocean Research Institute, University of Tokyo	Member		Japan
Msadek, Rym	NOAA GFDL and UCAR	Member		USA
Mueller, Wolfgang	Max Planck Institute for Meterology	Member		Germany
Power, Scott	Bureau of Meteorology	Member		Australia
Zhou, Tianjun	LASG, Institute of Atmospheric Physics, Chinese Academy of Science	Member		China
Aldo Montesinos	University of Concepción	Member		Chile.
Amy Solomon	NOAA/ESRL	Member		USA

WCRP World Climate Research Programme

CLIVAR

Decadal Climate Variability and Predictability (DCVP)

- **Improve the physical characterization and understanding of decadal variability, internal and forced**, using instrumental and proxy records and models
- **Improve models** ability to capture and simulate the observed phenomena, their time scales and regional impact, test hypotheses on cause and underlying mechanisms.
- **Use models of varying complexity to determine the predictability of decadal climate** (perform hindcasts and forecasts, address data and physical uncertainties and model drift and biases).
- **Assess the observing systems** and develop recommendations to sustain and enhance capabilities for model initialization and reliable monitoring of decadal climate variability.
- **Develop best practices for delivering decadal predictions by understanding the needs users of decadal climate information** - the development of appropriate information products geared to specific societal use based on probabilistic understanding of decadal climate variability.

Decadal Climate Variability and Predictability (DCVP)

Ongoing Activities

Leading design of DCPP MIP Component C experiments

Coordinated multi-model investigations of a restricted number of mechanism/ predictability/case studies believed to be of broad interest to the community.

- Pace-maker experiments on understanding mechanisms of climate shifts, internal modes of variability and predictability
- Perturbation experiments on the impact of volcanoes on predictability and predictions
- Idealized Atlantic Multidecadal Variability (AMV) experiments to investigate the climate impacts of AMV variability due to its natural variability

Coordination:

Regional panels, other RF (e.g., CONCEPT-HEAT), & other related national CLIVAR activities (e.g., US AMOC, UK RAPID and CLIVAR ocean observing activities)

WCRP (DCPP, GEWEX, SPARC, CliC), PAGES

Near-term DCVP Activities

- Establish links to CLIVAR regional panels, other RF (e.g., CONCEPT-HEAT), and other related national and international CLIVAR activities (e.g., US AMOC, UK RAPID and CLIVAR Ocean observing activities) to identify common objectives and activities.
- Contribute to the WCRP "Concept Team" on "Near-Term Climate Prediction" and work to:
  - Establish links to CMIP6 MIPS: DCPP, VOLMIP & RFMIP
  - Establish link to WGCRP projects: CLIC, GEWEX, and SPARC for more effective means to meet DCVP RF objective within CLIVAR and the broader WCRP community.
- Establish links to PAGES to expand the data window of DCVP RF beyond the instrumental period, in particular to resolve and understand better the nature and mechanisms of natural decadal climate variability.

Decadal Climate Variability and Predictability (DCVP)

CLIVAR-ICTP International Workshop on Decadal Climate Variability and Predictability: Challenge and Opportunity

16-19 November 2015 – ICTP, Trieste, Italy

www.clivar.org/dcvp2015

The state-of-the-art and perspectives from theory, simplified to fully coupled modelling, instrumental and paleoclimate research:

- General introduction to DCV
- The Atlantic DCV
- The Pacific DV
- Monsoons
- Recent hiatus and AMV/PDV connection
- Cryosphere: Arctic/Antarctic sea ice
- Predictability and Prediction
- DCVP Challenge and Opportunity
- Discussion and DCVP Working Group Meeting

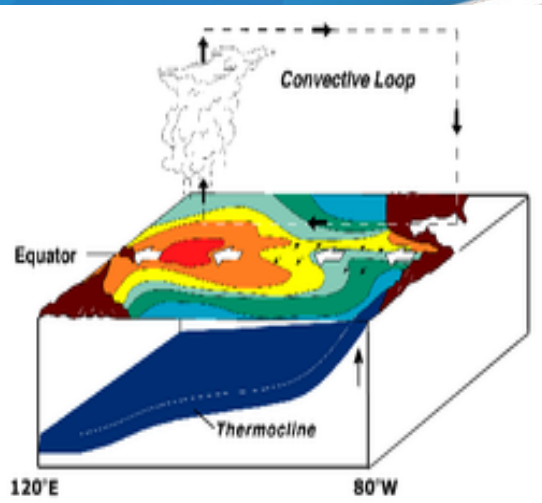
Participants are asked to address:

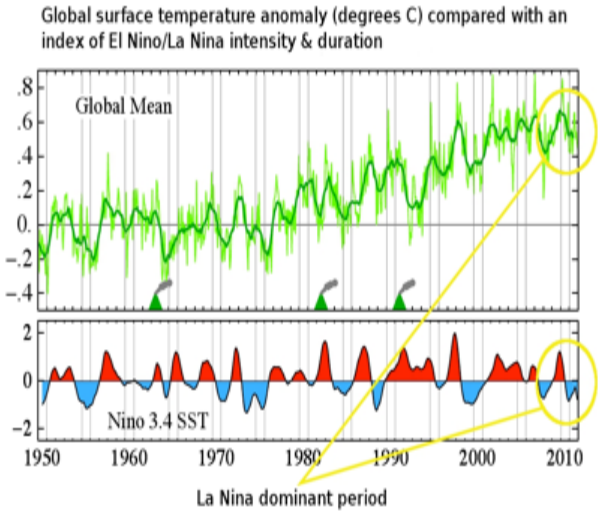
What are major advances, what are the frontiers, where are there opportunities for significant progress. DCVP planning will integrate the community's recommendations.

ENSO in a changing climate

Objectives:

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.





CLIVAR Research Foci : ENSO in a changing climate

Implementation Strategy

- Task 1. Processes responsible for ENSO characteristics
  Deliverables: a workshop report and a review paper about physical mechanisms responsible for ENSO characteristics
- Task 2. Model ENSO evaluation protocol
  Deliverables: a report/paper on the proposed ENSO evaluation protocol and a web site, including web services to compute the metrics/ analysis required for the protocol.
- Task 3. ENSO in a changing climate
  Deliverable: peer-reviewed paper on ENSO in a changing climate providing latest estimates of likely ENSO changes over the next few decades.

Membership

Name	Expertise	Affiliation, Country	Liaison for the group
Eric Guilyardi	ENSO metrics	IPSL, France & NCAS-Climate, UK	Co-chair
Andrew Wittenberg	ENSO metrics, data assimilation	GFDL, USA	Co-chair
Wenju Cai	ENSO and climate change	CSIRO, Australia	CLIVAR PP
Mat Collins	ENSO and climate change	Uni. of Exeter, UK	CLIVAR PP
Ben Kirtman		RSMAS, USA	WGSIP
Mike McPhaden	ENSO observations	PMEL, USA	CLIVAR IOP
Tony Lee	ENSO impacts	JPL, USA	CLIVAR GSOP and IOP
Soon-Il An	ENSO-mean state, non-linearity	Yonsei Uni. Korea	
Masahiro Watanabe	ENSO in CGCMs	Uni. of Tokyo, Japan	
Pascale Braconnot	Paleo ENSO, modelling	IPSL, France	
Lisa Goddard	ENSO impacts	IRI, USA	
Jaci Brown	ENSO regional impacts	CSIRO, Australia	
Lei Han	Ex officio	CLIVAR ICPO, China	

CLIVAR Research Foci : ENSO in a changing climate

Recent activity:

"4th CLIVAR ENSO workshop on the evaluation of ENSO in climate models: ENSO in a changing climate" in Paris, France, July 8-10 2015.

The workshop is co-sponsored by

CLIVAR

US CLIVAR

Sciences de l'environnement Institut Pierre Simon Laplace

INVESTISSEMENTS D'AVENIR

cnrs

NOAA MAPP Modeling, Analysis, Predictions, and Projections

NOAA Earth System Science

WCRP World Climate Research Programme

CLIVAR

CLIVAR ENSO Paris Workshop

- The CLIVAR ENSO Paris workshop was a deliverable of Task 1
  About 60 researchers, including 12 Early Career Scientists attended this workshop. A summary on the fruit of this workshop is anticipated to be published this fall.
- Task 2: The model evaluation protocol was discussed in a dedicated session, including metrics and observations, in conjunction with TPOS.
- There is a need for more diagnostics and metrics which help us to understand the role of atmospheric processes in the ENSO cycle. We have identified a few experts to be part of a metrics task team and the next call of the RF group will be to define in more detail its mission (metrics, observations, model evaluation software, with other related community activities). We may have identified some funding to help.

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CLIVAR ENSO Paris Workshop

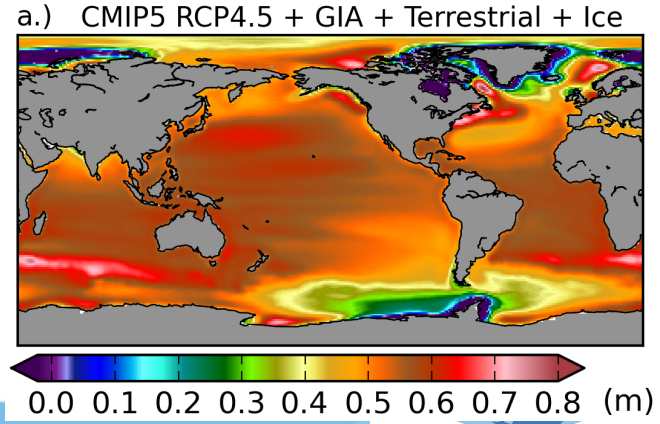
- Task 3 is now in press in Nature Climate Change
- There was some discussion about the role this RF should play in commenting on ENSO predictions. The consensus seemed to be that this is best left to operational centres.
- There is significant interest in recent decadal variability in the tropical Pacific within the group. Hence some overlap or possible interaction with the new WCRP grand challenge on decadal.

Regional Sea Level Change and Coastal Impacts

team leaders: Stammer, de Wal, Nicholls

Five parallel, but interconnected, working groups established:

1. An integrated approach to paleo time scale sea level estimates
2. Quantifying the contribution of land ice to near-future sea level rise
3. Causes for contemporary regional sea level variability and change
4. Predictability of regional sea level
5. Sea level science for coastal zone management



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Ongoing work

- ISMIP
- FAFMIP
- New GIA model
- Climate modes and sea level
- Ocean-Ice interaction
- Coastal impact studies
- Review paper

Sea Level Conference „2016“

- Tentative location: New York University
- Possibly July 2017

Panel meeting during solar eclipse in Utrecht

WCRP World Climate Research Programme

CLIVAR

Consistency between planetary energy balance and ocean heat storage (CONCEPT-HEAT)

Co-chairs: Karina von Schuckmann (France) and Kevin Trenberth (USA)

- **Main objectives:**

1) Quantify Earth's energy imbalance, the ocean heat budget, and atmosphere-ocean turbulent and radiative heat fluxes,

2) Analyze the consistency between the satellite-based planetary heat balance and ocean heat storage estimates

29 Sep – 02 Oct 2015: **Workshop** on
"**Energy flows in the Earth's climate system**"
MetOffice (Exeter, UK)

Co-sponsored by CLIVAR, US CLIVAR, NOAA, EU-COST, ESA

WCRP World Climate Research Programme

CLIVAR

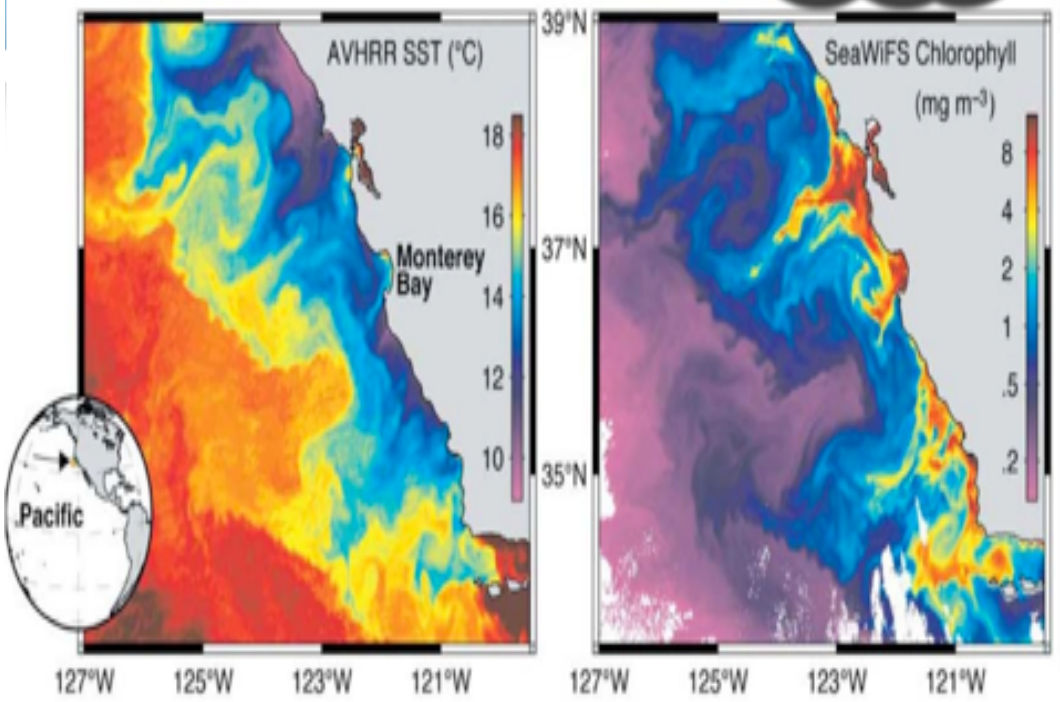
Marine biophysical interactions and dynamics of upwelling systems

Activity leader:
Enrique Curchitser (Rutgers University, USA)

Recent activities:
• Pan-CLIVAR meeting, The Hague, The Netherlands

• Upwelling systems under future climate change workshop *(Third International Symposium "Effects of Climate Change of the World's Oceans, Santos, Brazil – 21-22 March 2015)*

Planned activities:
• Planning workshop (Ankara, Turkey - 2-3 October 2015)



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.

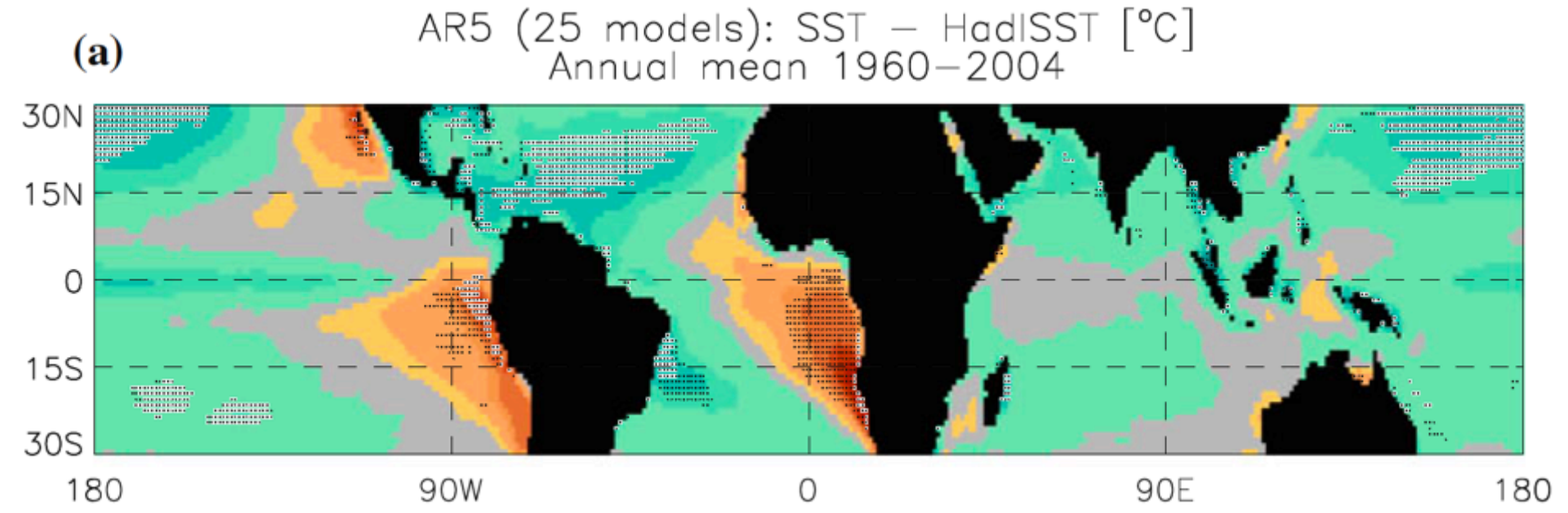
World Climate Research Programme

Marine biophysical interactions and dynamics of upwelling systems

Major research themes *

- Identifying the key physical and biogeochemical processes and impacts on ecosystem dynamics in upwelling regions and improving their representation in models
- Addressing upwelling related biases in climate models
- Exploring how upwelling systems will respond to change in climate

* These themes will be refined at the planning workshop in Oct 2015



NEW Collaborations

- Monsoons Panel with WCRP
- Climate Dynamics Panel
- Decadal Climate Variability
- Sea Level with PAGES and many others
- Upwelling RF with IMBER
- New GEC Ocean projects network,
  - CLIVAR, SOLAS, IMBER, OceanCarbon, PAGES, SCOR, WCRP, GOOS, Future Earth
- ECS network
- Strong links to national programs, e.g. USCLIVAR

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CLIVAR

US/Intl CLIVAR synergy
Research Challenges / Research Foci

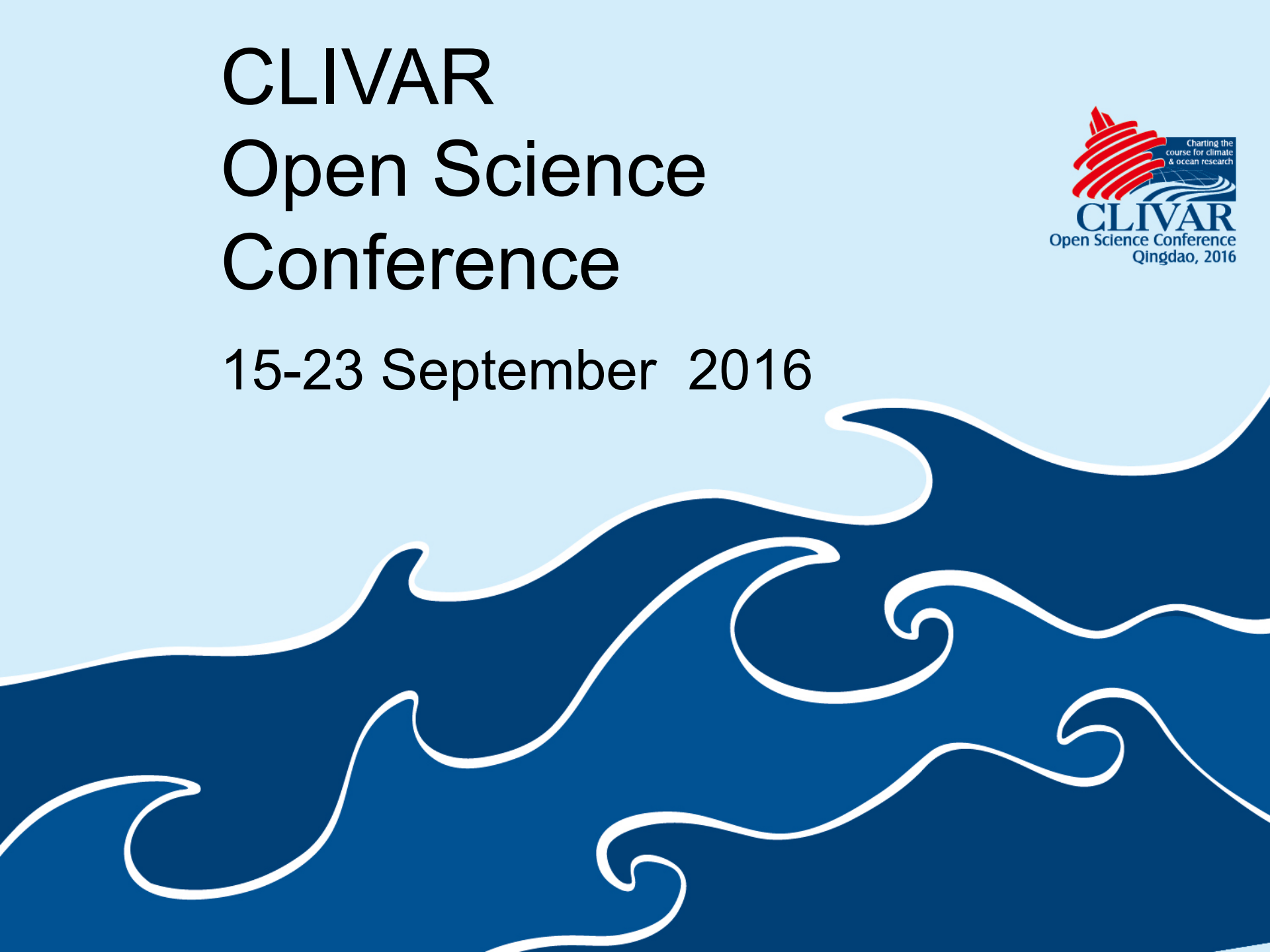
US CLIVAR Research Challenges: Broad areas of climate science that are societally important, reflect the interests of the scientific community and funding agencies, concern most of the CLIVAR Panels, and typically **extend US CLIVAR beyond its traditional research agenda**

US CLIVAR Research Challenges		International CLIVAR Research Foci
• Decadal variability and predictability	⟷	Decadal variability and predictability
• Climate and extreme events extremes	⟷	Understand & predict wx & climate
• Polar climate changes	⟷	Regional sea-level change and Arctic
• Climate and carbon/biogeochemistry	⟷	(Biophysical interactions & dynamics of upwelling systems)

Can we think of joint efforts, such as AGU or OSM sessions? Town hall meetings? Joint workshops? Joint experiments? Will highlight CLIVAR better.

CLIVAR Open Science Conference

15-23 September 2016




Charting the
course for climate
& ocean research
CLIVAR
Open Science Conference
Qingdao, 2016

WCRP CLIVAR 2016 Open Science Conference Scientific Organizing Committee

Co-Chairs		
Annalisa Bracco	**Georgia Institute of Technology**	**USA**
Fangli Qiao	**FIO**	**China**
Detlef Stammer	**University of Hamburg,**	**Germany**
Lixin Wu	**OUC**	**China**
Members		
Krishna Achuta Rao	IITM	India
Noel Baker	ECS	USA
Jerome Benveniste	ESA	
Pascale Braconnot	IPSL	France
Nathan Bindoff	University of Tasmania	Australia
Wenju Cai	CSIRO	Australia
Boris Dewitte	LEGOS	France
Clara Deser	NCAR	USA
Ken Drinkwater	IMR, Norway	Norway
Lisa Goddard	Columbia University	USA
Stephen Griffies	GFDL	USA
Sergey Gulev	IORAS	Russia
Virginie Guemas	Institut Català de Ciències del Clima	Spain
Ed Hawkins	University of Reading	UK
Dunxin Hu	IOCAS	China
InSik Kang	Seoul National University,	Rep. of Korea
Arun Kumar	NOAA	USA
Carlos Moffat	University of Califonia	USA
Pedro Monteiro	CSIR	South Africa
Bill Merryfield	University of Victoria	Canada
Dahe Qin	CAST	China
James Renwick	Victoria University of Wellington	New Zealand
Graeme Stephens	JPL, NASA	USA
Seok Woo Son	Seoul National University	Rep. of Korea
Bjorn Stevens	MPI Hamburg	Germany
Toshio Suga	Tohoku University	Japan
Martin Visbeck	GEOMAR	Germany
Anna Wahlin	University of Gothenburg	Sweden
Weidong Yu	FIO	China
Tianjun Zhou	IAP CAS	China
Jiang Zhu	IAP CAS	China

WCRP CLIVAR 2016
Open Science Conference

Charting the Course for Climate & Ocean Research

CONFERENCE VISION

"The collective voice and expertise of the international climate community is essential to shaping the international research agenda on the coupled ocean-atmosphere system. The World Climate Research Programme's (WCRP) core project on Climate and Ocean – CLIVAR - invites the international climate community to ***review the state of the science, to prioritize international research plans and to initiate new collaborations."***

WCRP CLIVAR 2016
Open Science Conference

Charting the Course for Climate & Ocean Research

CONFERENCE OBJECTIVES

- **Review progress** toward improved understanding of the dynamics, the interaction, and the predictability of the coupled ocean-atmosphere system
- **Shape ideas** to meet emerging ocean and climate science challenges
- **Engage with the future generation** of climate scientists
- **Identify** key climate research and **stakeholder issues**
- **Develop and strengthen collaborations** across nations, disciplines and age groups **and promote integrative studies**

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Open Science Conference
Charting the Course for Climate & Ocean Research

CONFERENCE OUTCOMES

- High profile, peer-reviewed journal articles
- Perspective papers on daily themes
- Overview paper in open access journal
- Adjustments to Science Plan
- New activities
- New collaborations

WCRP CLIVAR 2016
Open Science Conference
Charting the Course for Climate & Ocean Research

PROGRAMME FORMAT

Morning

- Plenaries
- Dedicated Poster Sessions

Afternoon

- 3 Parallel Sessions
- Dedicated Poster Sessions
- Keynote

Evening

- Town Hall sessions
- Reception/Banquet

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Charting the Course for Climate & Ocean Research
PROGRAMME OUTLINE

- **Daily Themes**
  - The Ocean's Role in the Climate System
  - Climate Variability and Predictability
  - Understanding Ocean Processes
  - The Changing Ocean in a Warmer World
  - Climate Information and Sustainable Development
  - Future of Climate and Ocean Science

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Parallel Session Themes

- **The Ocean's Role in the Climate System**
  - **Energy, Carbon, Water**
- **Climate Variability and Predictability**
  - **Interseasonal to interannual, Decadal, Centennial**
- **Understanding Ocean Processes**
  - **Mixing, Dynamics, Upwelling**
- **The Changing Ocean in a Warmer World**
  - **Modes, Sea Level, Boundary current systems**

WCRP CLIVAR 2016
Open Science Conference
Charting the Course for Climate & Ocean Research
Early Career Scientists Symposium

- Two and half-day event for up to 200 Students and Early Career Scientists; Local host: FIO

- Career-enhancing event designed by and for the CLIVAR YESS ECS community

- International ECS SOC
  - Noel Baker (USA, NASA) (Chair)
  - Sarah Perkins (Australia, U.New South Wales, Australia)
  - Debashis Nath (India, IAP, China)
  - Victor Dyke (Nigeria, IAP, China)
  - Ariane dos Santos (Brazil, CPTEC, Brazil)
  - Jonathan Durgadoo (Mauritius, GEOMAR, Germany)

- Funding – support sought from national, regional and intl. sources; APN proposal submitted;

WCRP CLIVAR 2016 OSC

Early Career Scientist Symposium

A Career-Enhancing Opportunity designed by and for ECS

Scientific Organizing Committee

- Noel Baker (USA, NOAA, USA)
- Sarah Perkins (Australia, University of New South Wales, Australia)
- Debashis Nath (India, IAP, China)
- Victor Dyke (Nigeria, IAP, China)
- Ariane dos Santos (Brazil, CPTEC, Brazil)
- Jonathan Durgadoo (Mauritius, GEOMAR, Germany)
- Fionna Tummon (SPARC IPO)
- Pascale Braconnot
- James Renwick
- Virginie Guemas
- Ed Hawkins,
- Steve Griffies
- Tianjin Zhou
-

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Qingdao, 2016

WCRP CLIVAR 2016
Open Science Conference
Charting the Course for Climate & Ocean Research
Regional Stakeholder Forum

- One-day event for scientists, practitioners and policy makers
- Providers and users of climate and ocean information
- Discuss requirements and future collaborations
- Particular focus on the Asia Pacific Region
- Lead by regional institutions such as QNML, WESTPAC, PICES, SOA

WCRP CLIVAR 2016 Open Science Conference

Charting the Course for Climate & Ocean Research

KEY DATES

- September/ October 2015 – Second Announcement
- December 2015 – Registration and Abstract submission opens
- March 2016 – Funding and Abstract deadline
- September 15-17, 2016 -**Early Career Scientists Symposium**
- September 18, 2016 - **Regional Stakeholder Forum**
- September 19-23, 2016 - **Main Conference**

WCRP CLIVAR 2016
Open Science Conference

Charting the Course for Climate & Ocean Research

Hosting agreement

Local Host: Qingdao National Laboratory for Marine Science and Technology

Local Organizers: ICPO, FIO, with help from OUC, IOCAS, USCLIVAR, WCRP JPS

WCRP CLIVAR 2016
Open Science Conference
Charting the Course for Climate & Ocean Research
CONFERENCE BUDGET

Item	Est cost (1K USD)	Funding source	status
Venue	60	QNML	committed
Catering	100	Reg fee/QNML	
ECS travel (100x2000)	200	APN, WCRP, WESTPAC, etc	
Invited speakers (50x3000)	150	National agencies	
Dev country participants (75 x 3000)	225	National/intl agencies	
Website, abstract mgmt.	50	ESA	committed
Conference services	30	QNML	committed
Local organization	30	Commercial sponsors/reg fee	
Total	845		