The Evolution of CLIVAR

CLIVAR: OCEANS & CLIMATE
variability, predictability and change

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

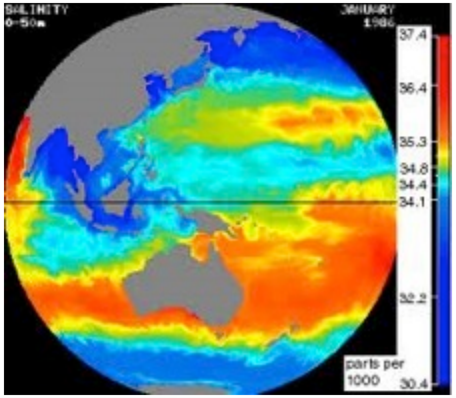
Detlef Stammer and Lisa Goddard
Co-Chair CLIVAR SSG

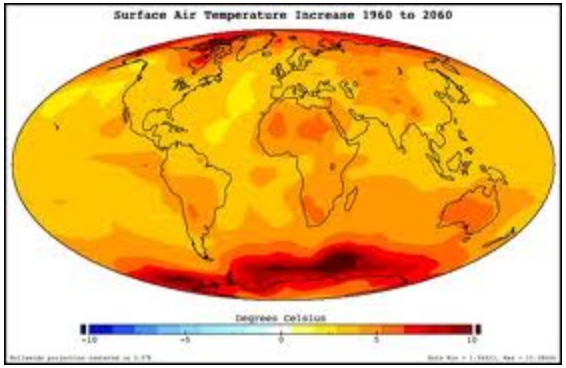
CLIVAR Mission

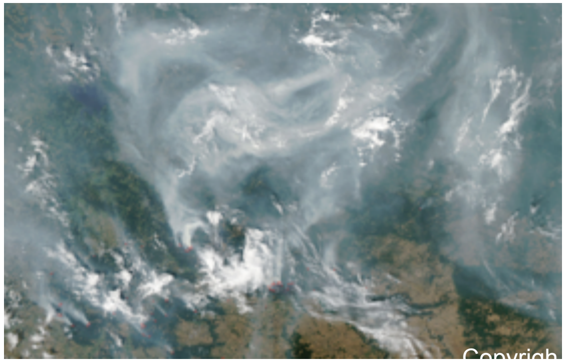
To observe, simulate and predict changes in Earth's climate system with a **focus on ocean-atmosphere system**,

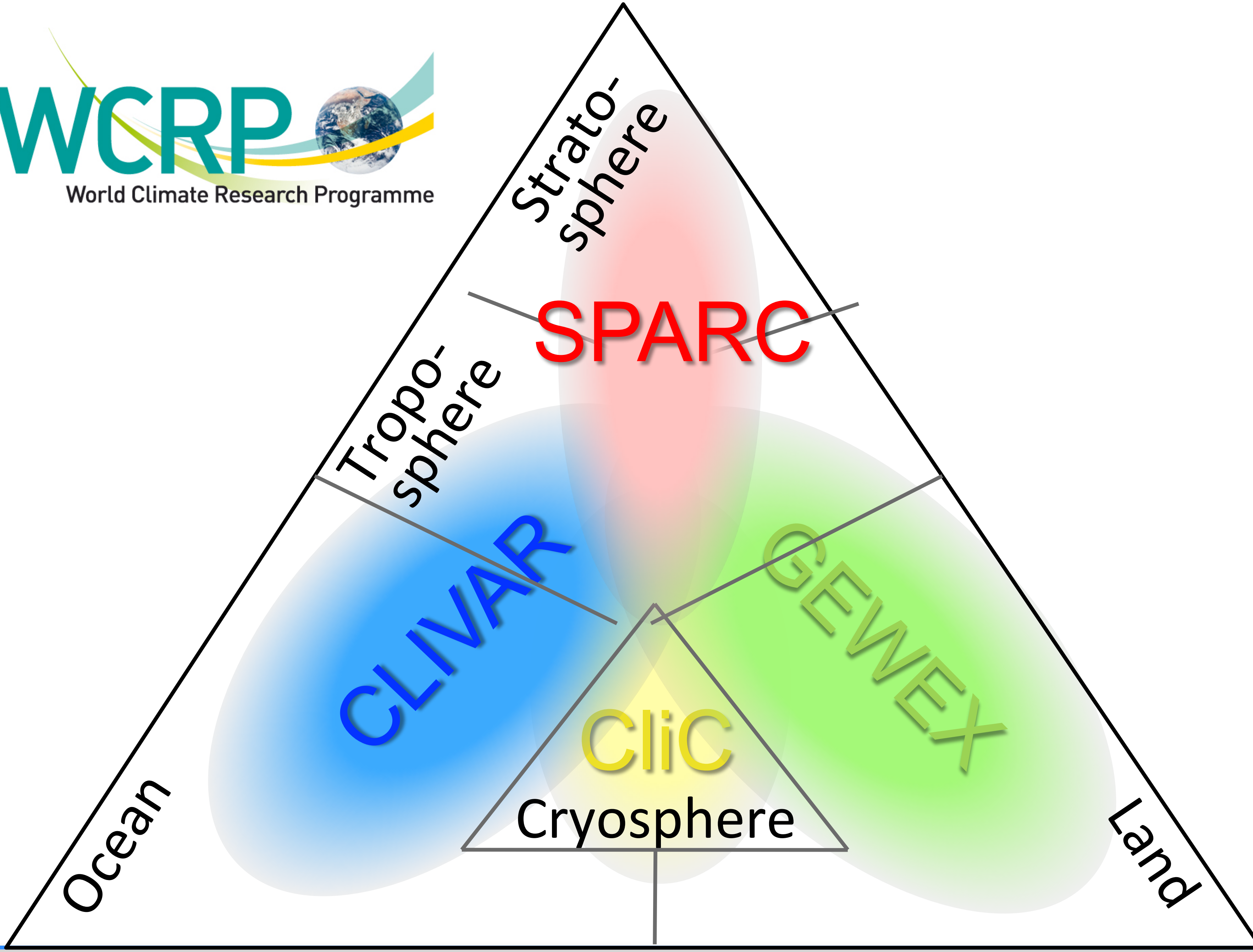
enabling better understanding of climate variability, predictability and change,

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



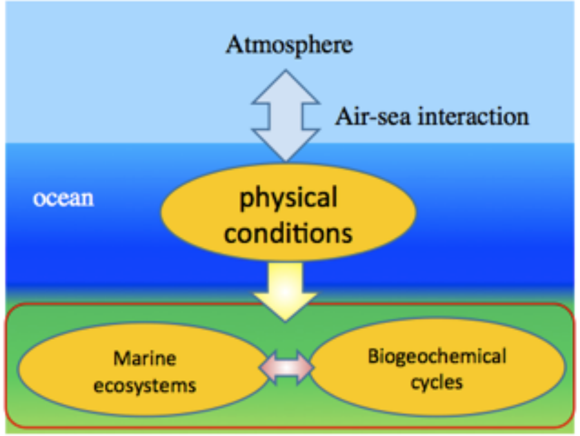





Strato-
sphere
SPARC
Tropo-
sphere
CLIVAR
GEWEX
CliC
Cryosphere
Ocean
Land

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 the marine biogeochemistry and eco-system** community as well as with a selected spectrum of its information user community.



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

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

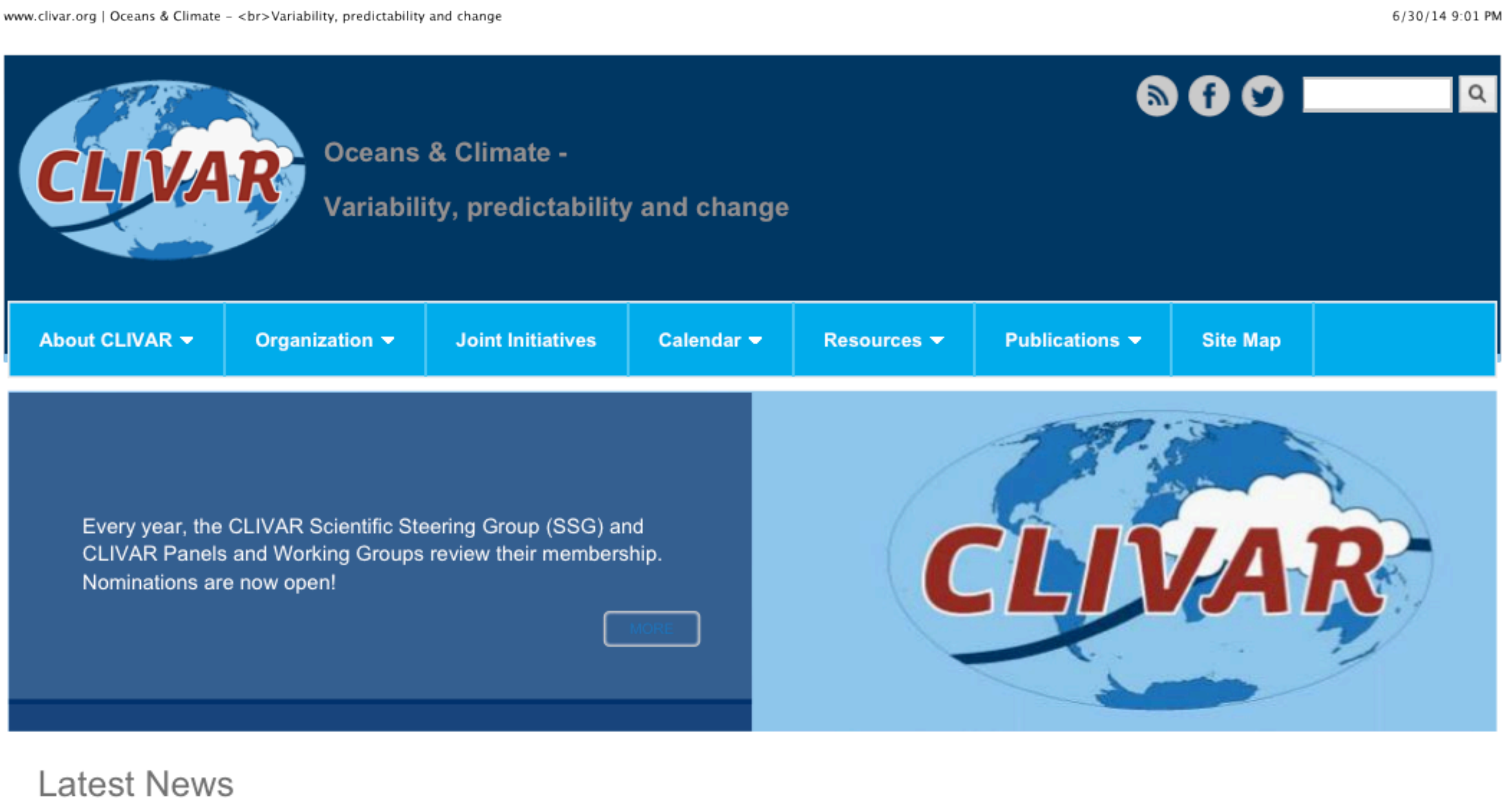
Two "nodes":
- Global at FIO, Qingdao, fully operational September 2014;
- Monsoons at IITM, Pune, fully operational June 2014

Contract staff at Univ. Buenos Aires and ICTP, Trieste

ICPO objectives for 2014:

- Pan-CLIVAR organization and follow up
- Achievements report
- 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
- CLIVAR Conference in 2016 -begin preparations
- ICPO Handbook- new version

New CLIVAR Web Page



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
- …

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

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.

Panel and Workshop Meeting – June 2013 / June 14

Meeting Title	Panel	Location	Date
Global Ocean Sub-Surface Climate Data Workshop	GSOP	Australia	June -13
CLIVAR GSOP/GODAE Ocean View Ocean Reanalyses Intercomparison Workshop	GSOP	UK	July -13
CLIVAR/ESA "Earth Observation Measurement Constraints on Ocean Heat Budget" Consultation Workshop	GSOP	UK	July -13
10th Session of the CLIVAR/IOC-GOOS Indian Ocean Panel	IOP	China	July-13
8th Session of the CLIVAR Pacific Panel	PP	China	July-13
Second 'International Symposium on Boundary Current Dynamics	PP -IOP	China	July-13
16th Session of the VAMOS panel	VAMOS	Peru	September-13
WCRP VAMOS/CORDEX Workshop on Latin-America and Caribbean Phase I - South America	VAMOS	Peru	September-13

Panel and Workshop Meeting – June 2013 / June 14

Meeting Title	Panel	Location	Date
Africa Climate Conference 2013	ACP	Tanzania	October -13
13th Session of the Asian-Australian Monsoon Panel	AAMP	China	October -13
High-End Scenarios of Regional Sea Level Changes and their Uncertainties Workshop		Germany	November -13
AGU & AMS (February 2014) townhall discussion			**December 2013**
OCEAN SCIENCE MEETING rollout of NEW CLIVAR strategy and plans			**March 2014**
WCRP Conference for Latin America and the Caribbean	VAMOS	Uruguay	March-14
WCRP VAMOS/CORDEX Workshop on Latin-America and Caribbean Phase II - The Caribbean	VAMOS	Dominican Republic	April-14
WGOMD Workshop on High Resolution Ocean Climate Modeling	WGOMD	Germany	April-14
12th WGOMD Meeting	WGOMD	Germany	April-14

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.

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

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	

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

Planned Panel and Workshop Meeting – 2015/16

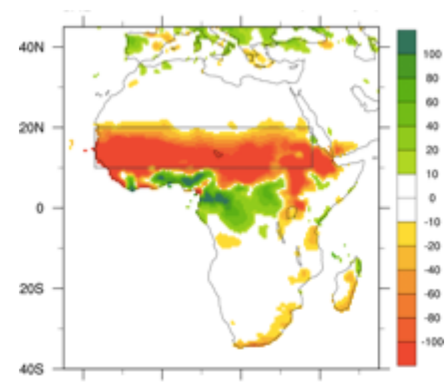
Meeting Title	Panel	Location	Date
CLIVAR SSG-22	SSG	Pune	2015
CLIVAR Science Conference		Quindao	2016
CLIVAR SSG-23	SSG	Quindao	2016

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)

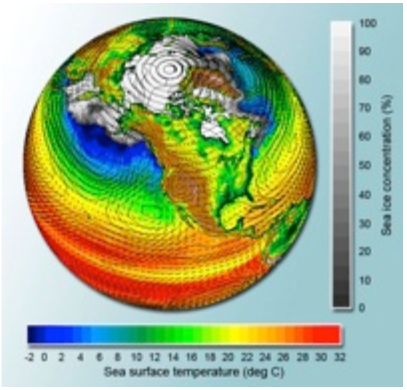
- Intra-to-Seasonal Variability, Predictability and Prediction
  - Monsoons (and ENSO, TAV, …)
  - ISV/MJO
  - Quantifying prediction uncertainty
  - Building pan-WCRP and WWRP links
  - CHFP

- 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

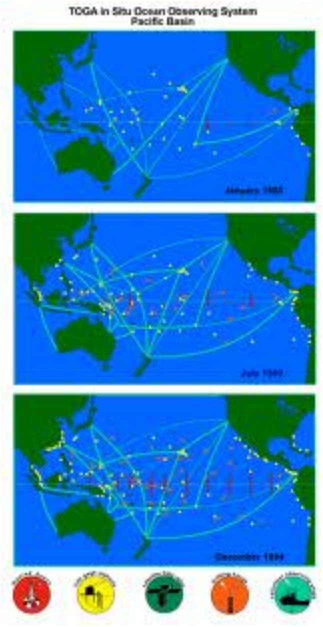


CLIVAR Capabilities

- 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

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

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.

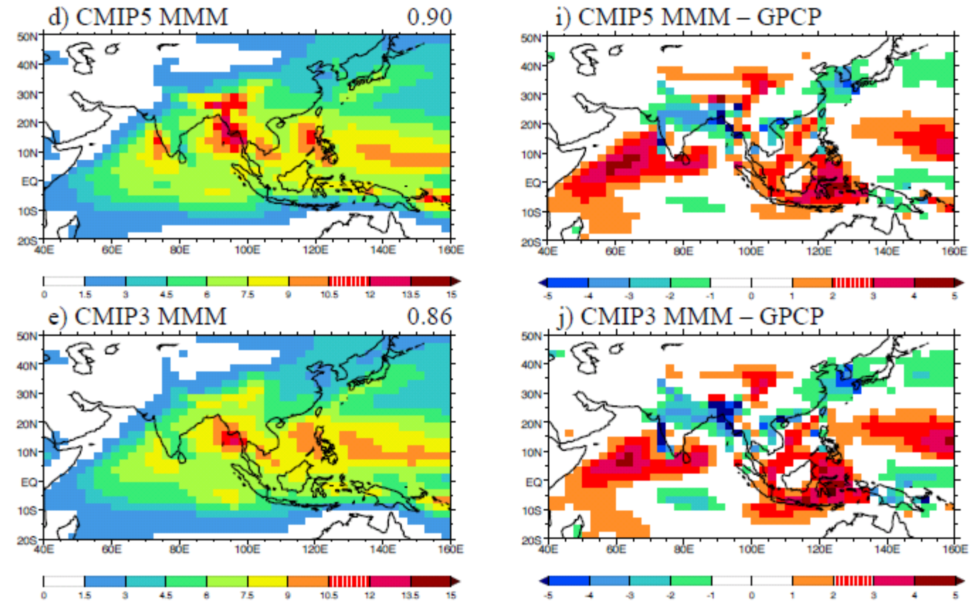
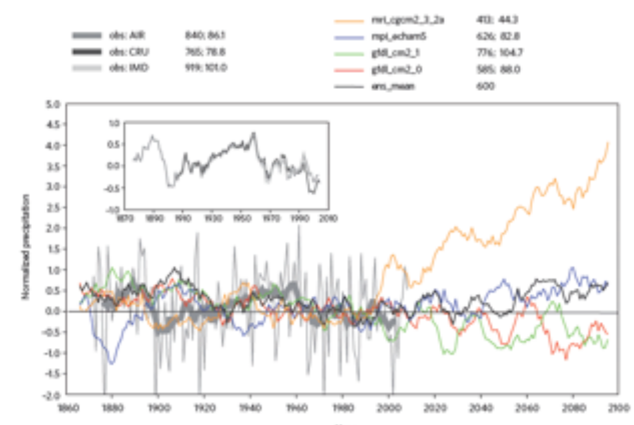


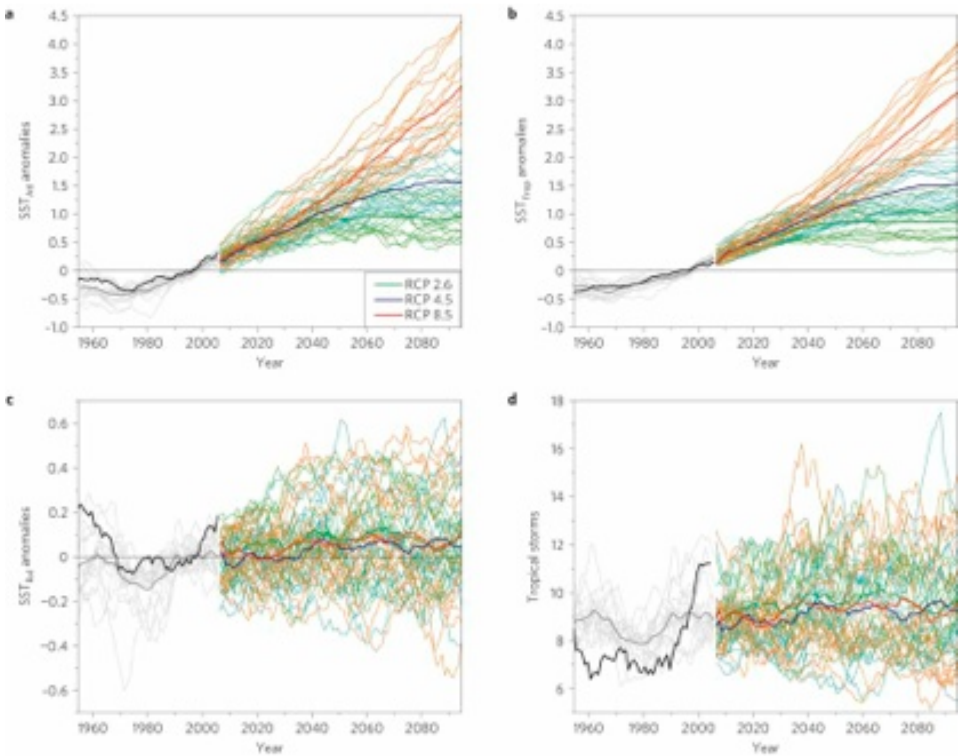
Figure shows large multi-model mean precipitation biases are present for the Asian summer monsoon in CMIP5 (from Sperber *et al.*, 2012, *Clim. Dyn.*).

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*).



Decadal variability and predictability of ocean and climate variability

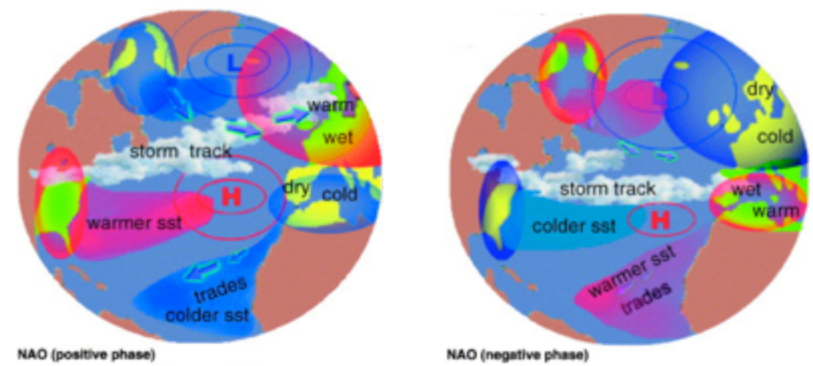
- **Improving understanding** of decadal variability and predictability.
- **Application of past data** sets including instrumental and proxy data.
- **Improving models** to better represent key processes associated with decadal variability.
- **Analysis and development** of current prediction potential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

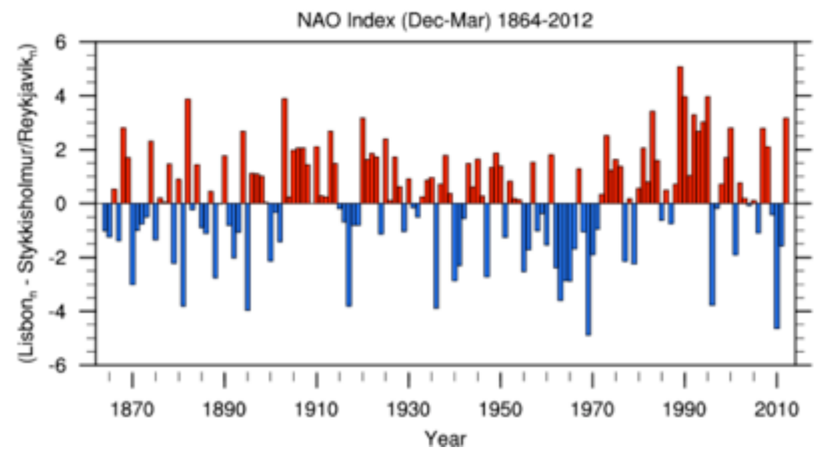


Twenty-first-century projections of SST (top) and North Atlantic Tropical Storm frequency (bottom) using CMIP5 (Villarini and Vecchi 2012)

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.

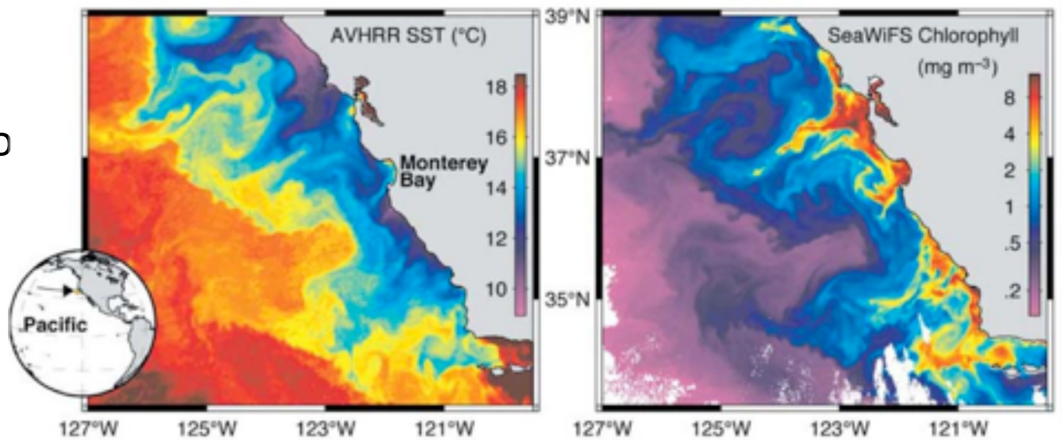




Top: The positive and the negative phases of the North Atlantic Oscillation (Bojariu and Gimeno 2003); Bottom, Hurrell North Atlantic Oscillation (NAO) Index (Hurrell 2012).

Marine biophysical interactions and dynamics of upwelling systems

- **Identifying the key physical processes** that are responsible for upwelling.
- **Improving model representation** o 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.



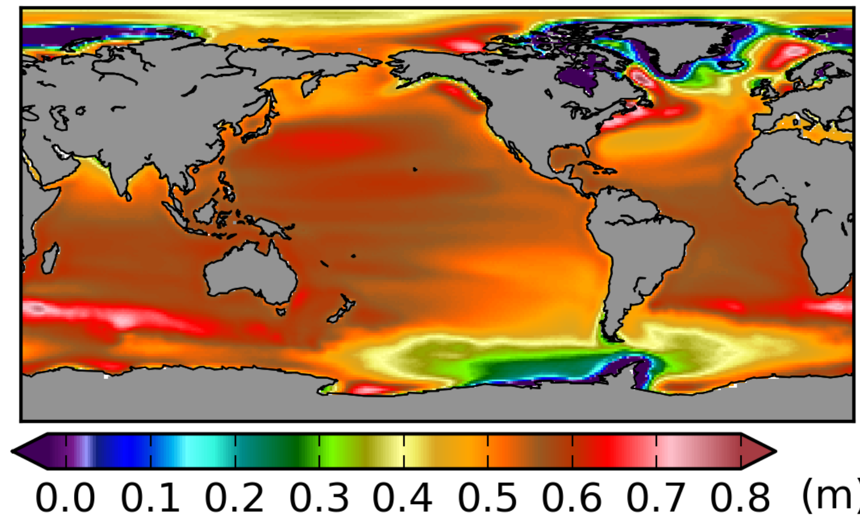
Satellite remote sensing imagery of the central California Current upwelling system. (a) Sea surface temperature (SST) from the Advanced Very High Resolution Radiometer (AVHRR) on August 14, 2000, and (b) surface chlorophyll from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) on August 16, 2000.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

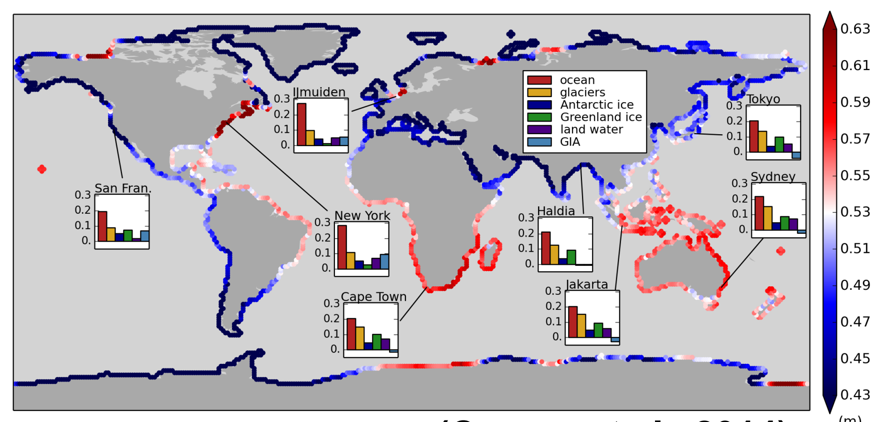
Link to IMBER and SOLAS

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

a.) CMIP5 RCP4.5 + GIA + Terrestrial + Ice



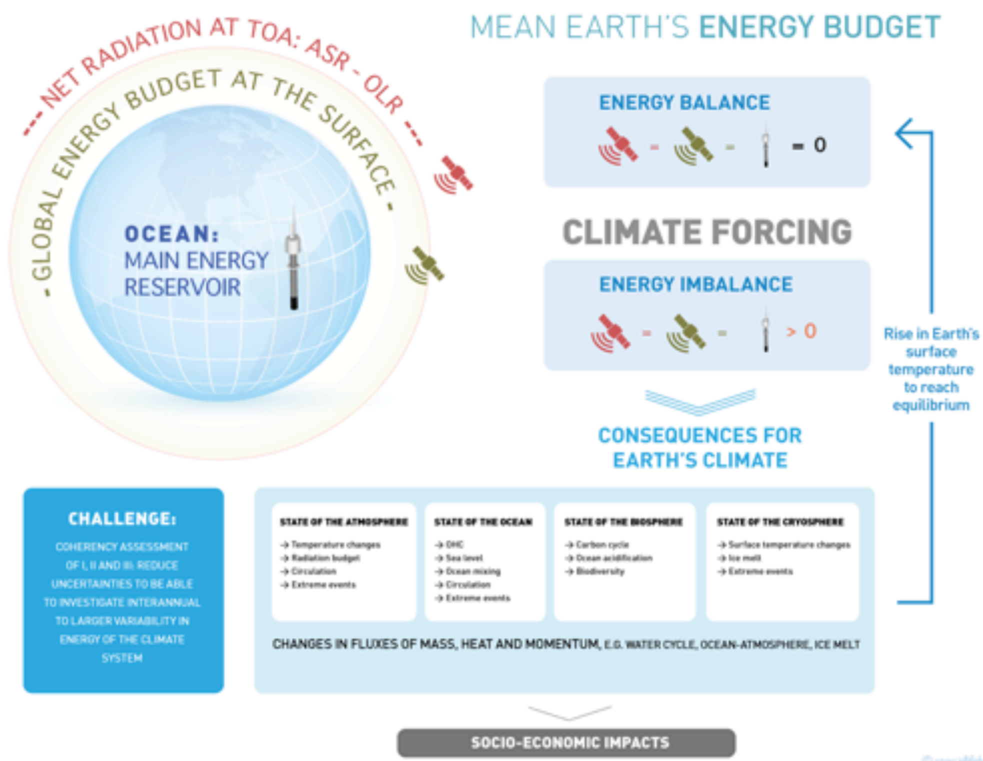


(Carson et al., 2014)

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



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.

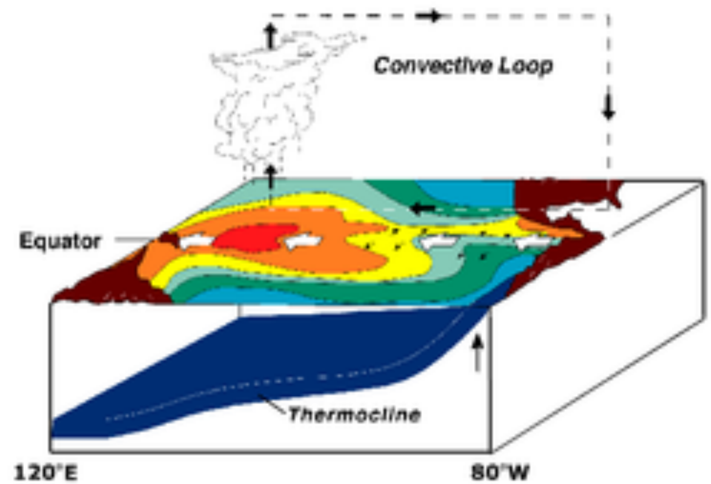
3. Propose ENSO evaluation protocols and develop a strategy for coordinated ENSO analysis of CMIP models.

4. Identify new observations needed to better constrain ENSO processes, both for the current climate and for past climates (via paleo proxies).

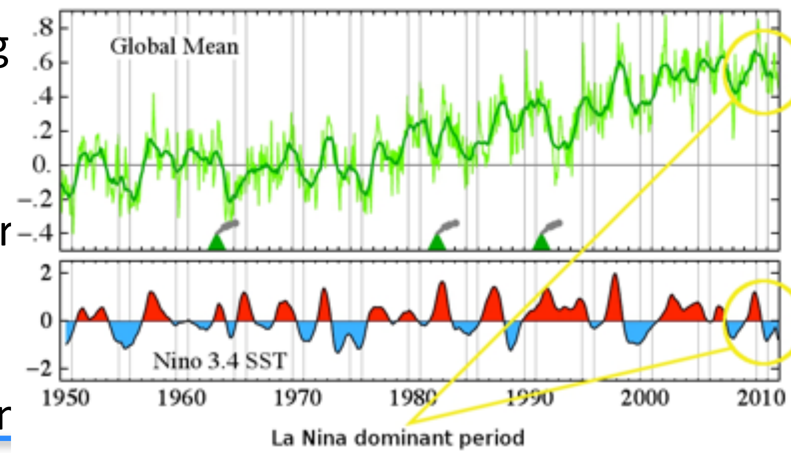
5. Provide a better understanding of how ENSO mig change in the future.

6. Promote and coordinate international collaboration between observationists and modeler for studies of ENSO

7. Build research capacity by contributing to the development of the next generation of talent dealir with ENSO science.



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



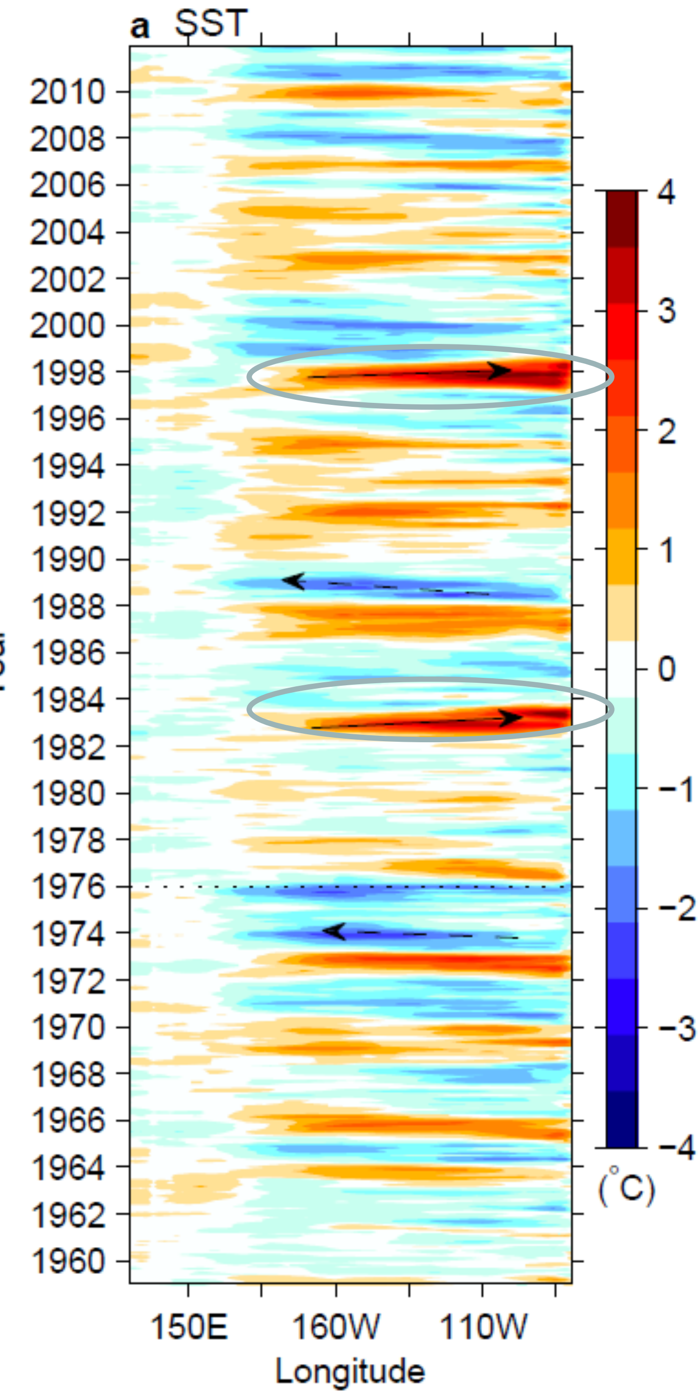
Highlights against CLIVAR Objectives

- 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.

- Extend observational climate record through assembly of quality-controlled data sets.

- Improve the atmosphere and ocean components of Earth-System Models.



LETTER

doi:10.1038/nature12683

Late-twentieth-century emergence of the El Niño propagation asymmetry and future projections

Agus Santoso[1], Shayne McGregor[1], Fei-Fei Jin[2], Wenju Cai[3], Matthew H. England[1], Soon-Il An[4], Michael J. McPhaden[5] & Eric Guilyardi[6,7]

The El Niño/Southern Oscillation (ENSO) is the Earth's most prominent source of interannual climate variability, exerting profound worldwide effects[1–7]. Despite decades of research, its behaviour continues to challenge scientists. In the eastern equatorial Pacific Ocean, the anomalously cool sea surface temperatures (SSTs) found during La Niña events and the warm waters of modest El Niño events both propagate westwards, as in the seasonal cycle[7]. In contrast, SST anomalies propagate eastwards during extreme El Niño events, prominently in the post-1976 period[7–10], spurring unusual weather events worldwide with costly consequences[3–6,11]. The cause of this propagation asymmetry is currently unknown[10]. Here we trace the cause of the asymmetry to the variations in upper ocean currents in the equatorial Pacific, whereby the westward-flowing currents are enhanced during La Niña events but reversed during extreme El Niño events. Our results highlight that propagation asymmetry is favoured when the westward mean equatorial currents weaken, as is projected to be the case under global warming[12–14]. By analysing past and future climate simulations of an ensemble of models with more realistic propagation, we find a doubling in the occurrences of El Niño events that feature prominent eastward propagation characteristics in a warmer world. Our analysis thus suggests that more frequent emergence of propagation asymmetry will be an indication of the Earth's warming climate.

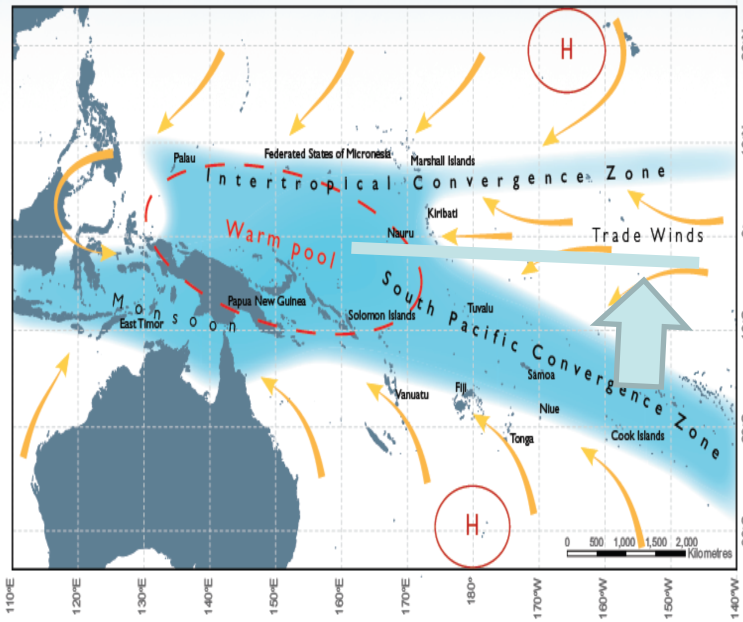
The tropical Pacific is home to intense convection, allowing for strong thermal and dynamical interactions between the upper ocean and the overlying atmosphere[15]. As warm SST anomalies propagate eastwards during extreme El Niño events (for example, 1982–83, 1997–98; see Extended Data Fig. 1a), nonlinear dynamical heating processes tend to intensify the anomalously warm SST[9], while the western Pacific warm pool (water with temperature exceeding 28 °C) extends eastwards, moving the eastern edge of the warm pool beyond 160° W. This induces an eastward shift of equatorial rainfall and an extreme swing of the Southern Hemisphere's largest rainband, the South Pacific Convergence Zone[11], causing extreme hydroclimatic conditions that most severely affect vulnerable island countries in the Pacific[11,16]. Beyond the Pacific, almost every continent felt the impacts of the drastic shift in weather patterns during the 1982–83 extreme El Niño event, and in the USA alone crop losses were estimated to be around \$10–12 billion[4] (approximately \$24–26 billion in 2013 dollars).

These profound impacts demand an improved understanding of ENSO propagation dynamics. Many studies have evaluated the relative importance of various ocean–atmosphere feedback processes[17–19], yet the mechanism for the propagation asymmetry remains unresolved. Here we show that an asymmetry in the zonal flow along the equatorial Pacific upper ocean (hereafter referred to as the equatorial Pacific current) is the main cause.

Using various observational data assimilation systems (see Methods and Supplementary Table 1), we quantify the propagation characteristics of temperature anomalies (T^a) by compositing the equatorial warming and cooling rates (the time derivative of temperature, dT/dt) of the surface mixed layer for the strongest El Niño events on record (1982–83 and 1997–98; see Fig. 1a) and all La Niña events (Fig. 1b) since 1976. The composite covers the evolution over a two-year period, before and after the event peak (usually in January, denoted 'Jan (1)'; see Fig. 1 legend). The contour of $dT/dt = 0$ marks the peak of the temperature anomaly (dashed curve in Fig. 1a and b). A linear regression using the samples of zero-value rates is constructed (green line). The slope β describes the propagation characteristics: a positive slope indicating temperature anomalies peak earlier in the west, that is, eastward propagation; a negative slope indicating westward propagation; and the greater the amplitude, the slower the propagation. This analysis shows opposite zonal propagation of SST anomalies between these two types of events; eastwards during extreme El Niño events ($\beta = 0.82$) and westwards during La Niña events ($\beta = -0.46$). During moderate El Niño events the propagation is westwards (Extended Data Fig. 1b), similar to La Niña events.

The direction of propagation has been understood as arising from three main competing positive feedback processes[17,18]. The zonal advective and Ekman pumping feedbacks associated with fluctuations in the trade winds involve advection of climatological SST along the Equator by anomalous zonal currents (u^a) and upwelling (w^a)[20,21], respectively (that is, $u^a\overline{(dT/dx)}$ and $w^a\overline{(dT/dz)}$; where the overbar indicates climatological mean and superscript 'a' indicates anomaly. The thermocline feedback involves vertical advection ($\overline{w}(dT/dz)^a$) associated with eastward-propagating internal waves that influence SST in the eastern Pacific through the mean upwelling ($\overline{w}$) of water at the thermocline (a narrow depth range of strong vertical temperature gradients below the mixed layer). These processes can establish propagation of SST anomalies in either direction: eastward if the thermocline feedback dominates, and westward otherwise[17]. Linear theories have highlighted a higher importance of the thermocline feedback in the decades since the mid-1970s[8,22,23]; however, this would predict an eastward propagation during La Niña events as well[19], in contrast to observations[10] (Fig. 1b).

La Niña anomalies can be viewed as an enhancement of the prevailing climate, with stronger westward-flowing surface currents. On the other hand, eastward current anomalies during El Niño associated with anomalously weak trade winds[24] (Extended Data Fig. 2), oppose and even exceed in amplitude the background current, leading to a net eastward flow (Fig 1c). This asymmetry in the total zonal current is apparent in all reanalyses (Extended Data Fig 3, Supplementary Tables 2 and 3). Our heat budget analysis (see Methods) shows that advection of anomalous temperature by the total current, $(\overline{u}+u^a)(dT/dx)^a$,



International weekly journal of science

nature

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More Extreme Swings of the South Pacific Convergence Zone Due to Greenhouse Warming

Wenju Cai, Matthieu Lengaigne, Simon Borlace, Matthew Collins, Tim Cowan, Michael J. McPhaden, Axel Timmermann, Scott Power, Josephine Brown, Christophe Menkes, Arona Ngari, Emmanuel M. Vincent and Matthew J. Widlansky

Infrared satellite image obtained with the Geostationary Meteorological Satellite-5 (or GMS5) on January, 4th. 1998 at 14:00 UTC showing three tropical cyclones (from left to right: Katrina, Susan, Ron) during the period of a zonal SPCZ event. Courtesy of IIS, University of Tokyo, processed by Japan National Institute of Informatics.

Reprinted from *Nature*, Volume 488, August 16, 2012

npg

Highlights against 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.

- Extend observational climate record through assembly of quality-controlled data sets.

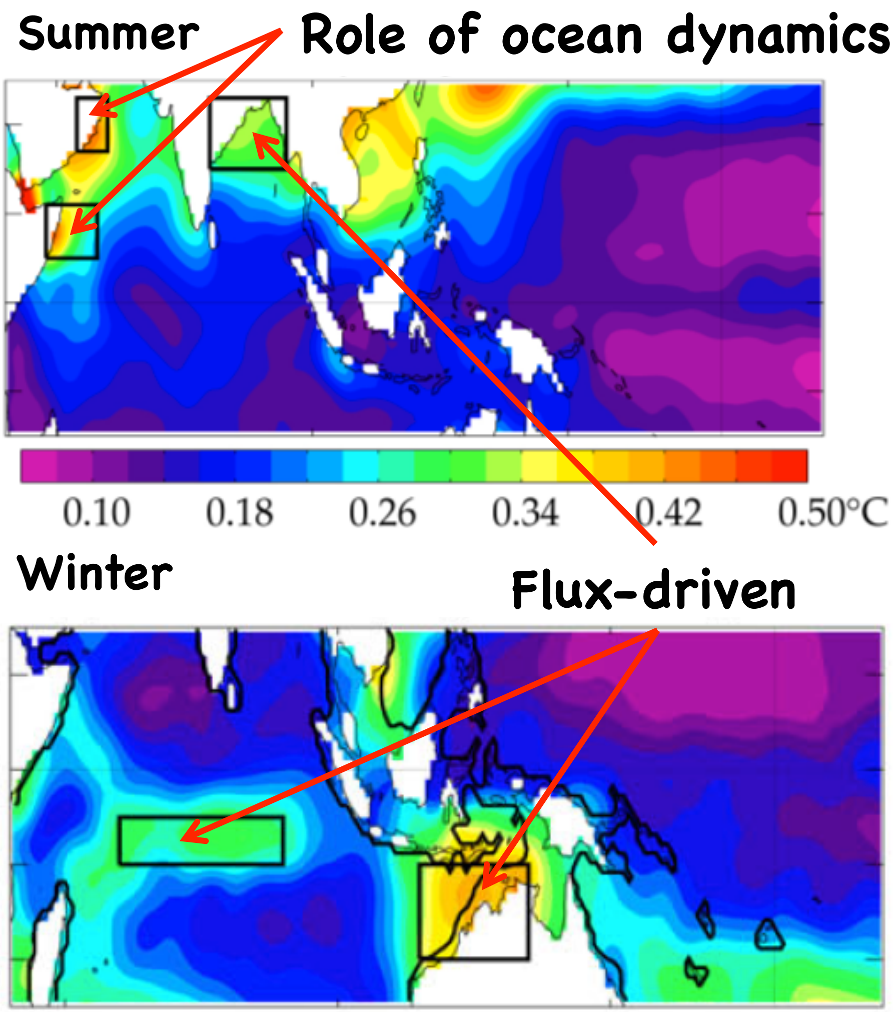
- Improve the atmosphere and ocean components of Earth-System Models.

IOP highlights
Intraseasonal variability

- Large intraseasonal SST variability in the Indian Ocean (e.g. Vialard et al. 2013, 2014, Jayakumar et al. 2012)

- Accounting for this SST signature has the potential to improve prediction at intraseasonal timescale (e.g. Woolnough et al. 2007)

- Is there an impact of those SST anomalies on neighbouring land areas (e.g. in terms of rainfall) ?



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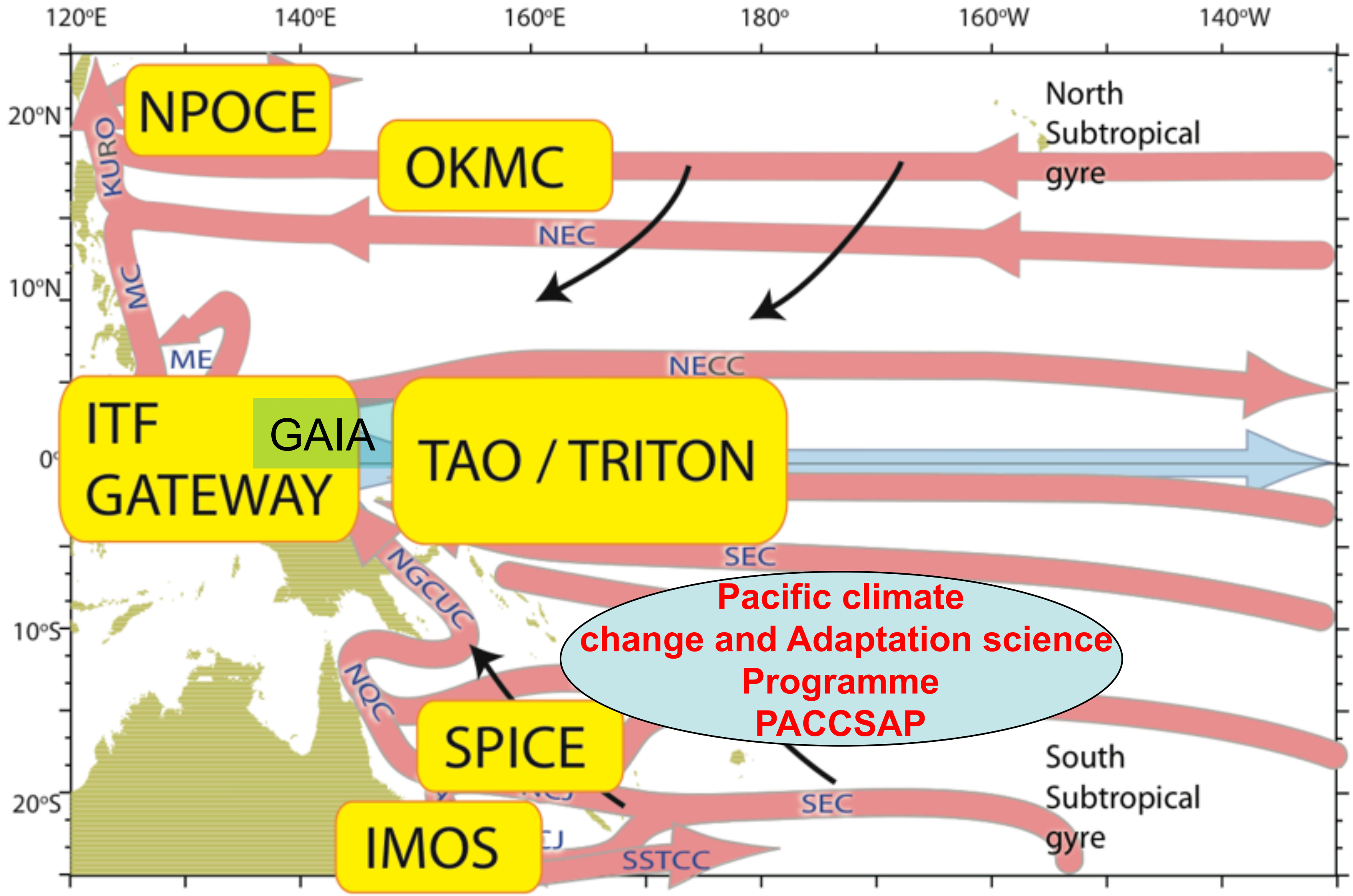
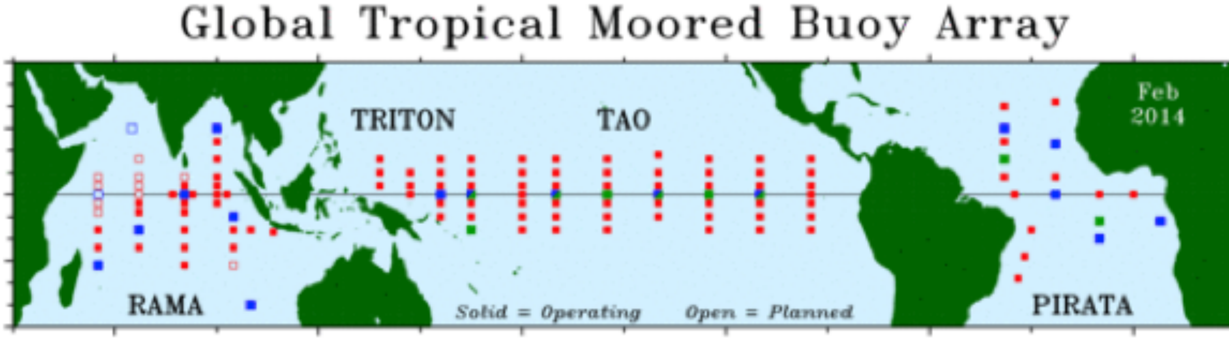
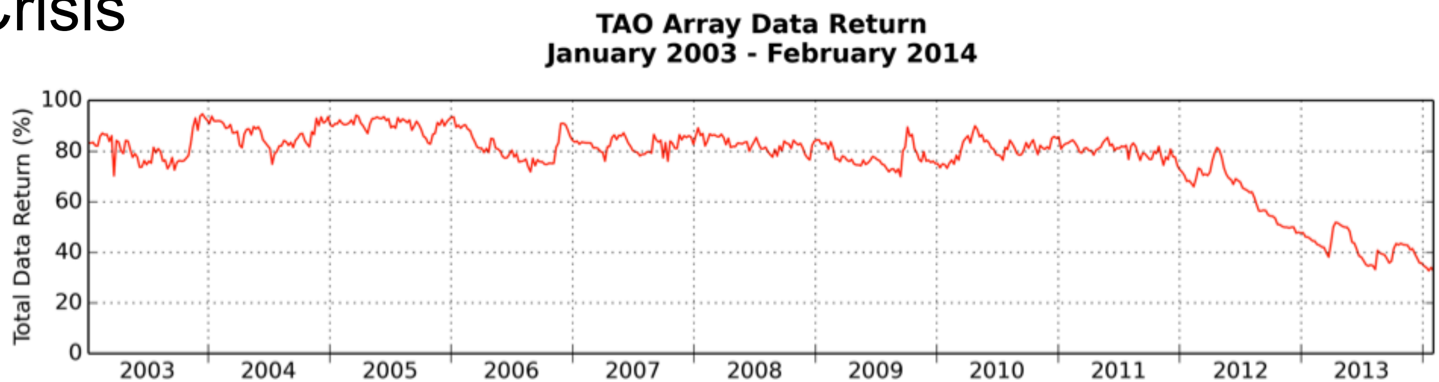
Process Experiments in the Pacific



TPOS 2020

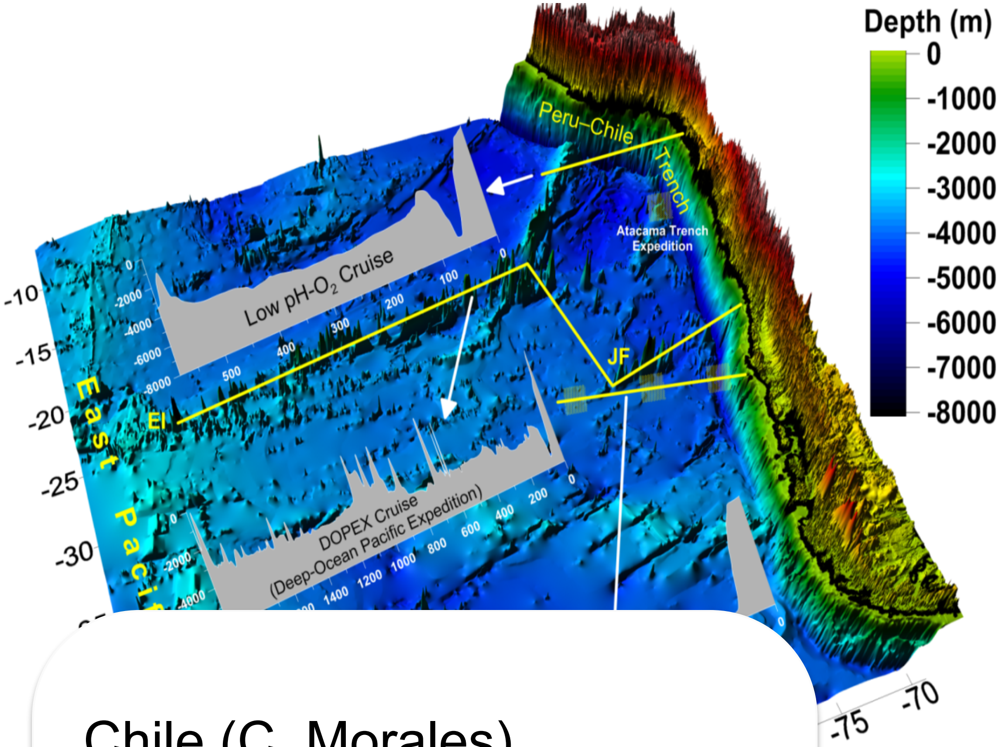


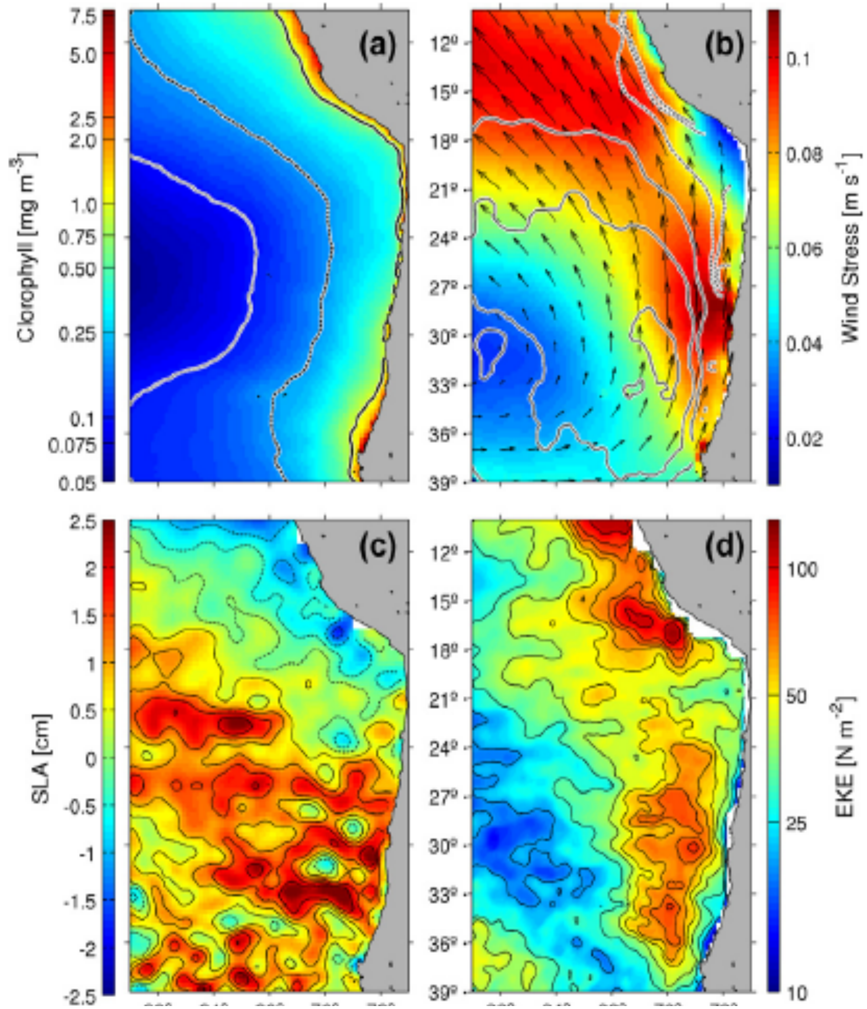
- GCOS/GOOS Workshop in Jan2014 to address TAO/ TRITON Crisis



- Birth of an international coordinated program: gaps and new requirements for observations in support of ENSO research, modelling and forecasting; importance and value of long time series

Southeast Pacific





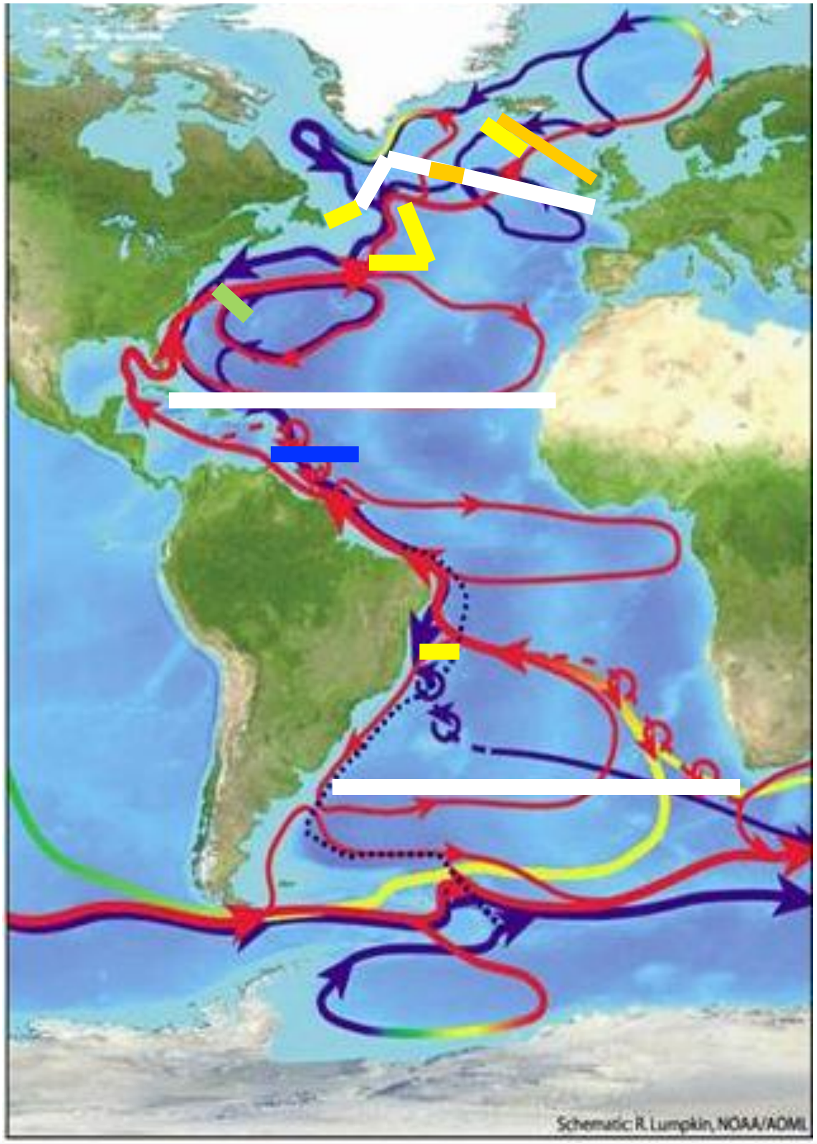
Chile (C. Morales)

1. Center for Climate and Resilience Research
2. SPICES (!)
3. Millenium Institute
4. COPAS / OOS
5. Cabo de Hornos

MARINE BIOPHYSICAL INTERACTIONS & DYNAMICS OF UPWELLING SYSTEMS

CLIMATE VARIABILITY

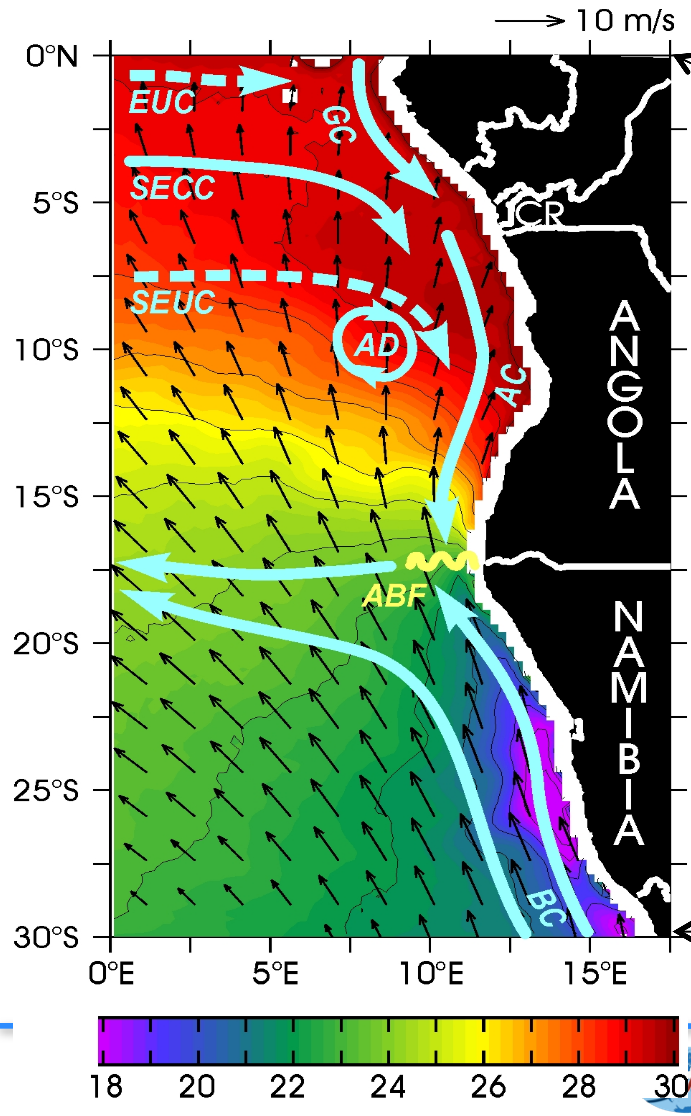
AMOC Observing System

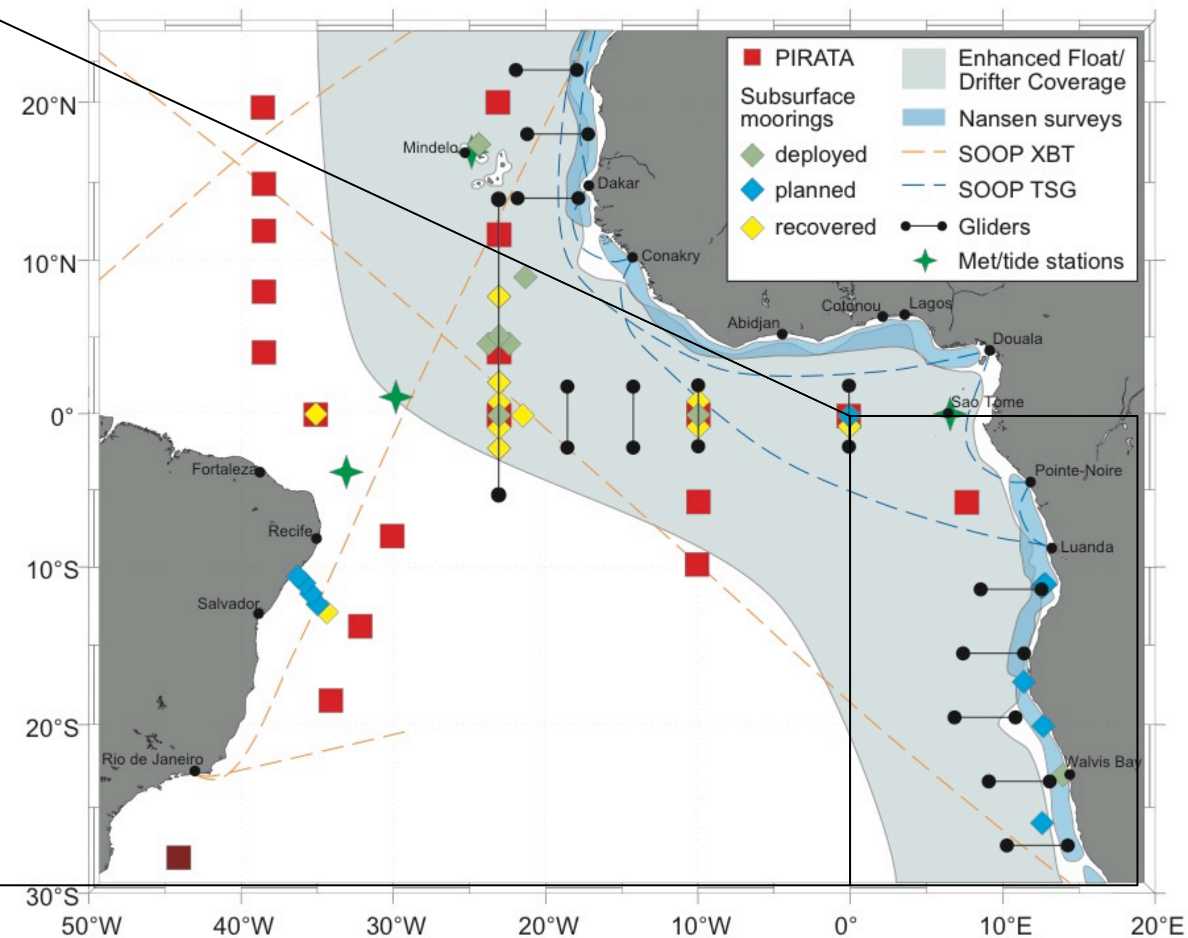


- AMOC observing system including trans-basin, overflow & western boundary current observations.
- EU-NACLIM exchange across Greenland-Scotland ridge, subpolar North Atlantic BMBF RACE (different locations, overflow and western boundary)
- OSNAP in the subpolar North Atlantic
- WHOI Line W at 40°N
- RAPID-WATCH/MOCHA/WBTS at 26°N
- US MOVE at 16°N
- SAMOC at 34.5°S

Tropical Atlantic Observing System

Gulf of Guinea and Eastern Boundary Upwelling regions

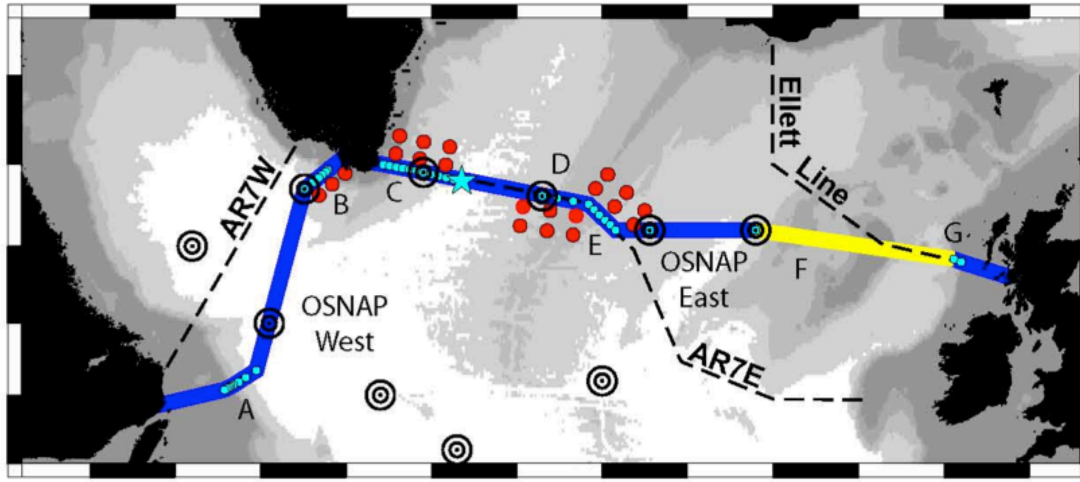


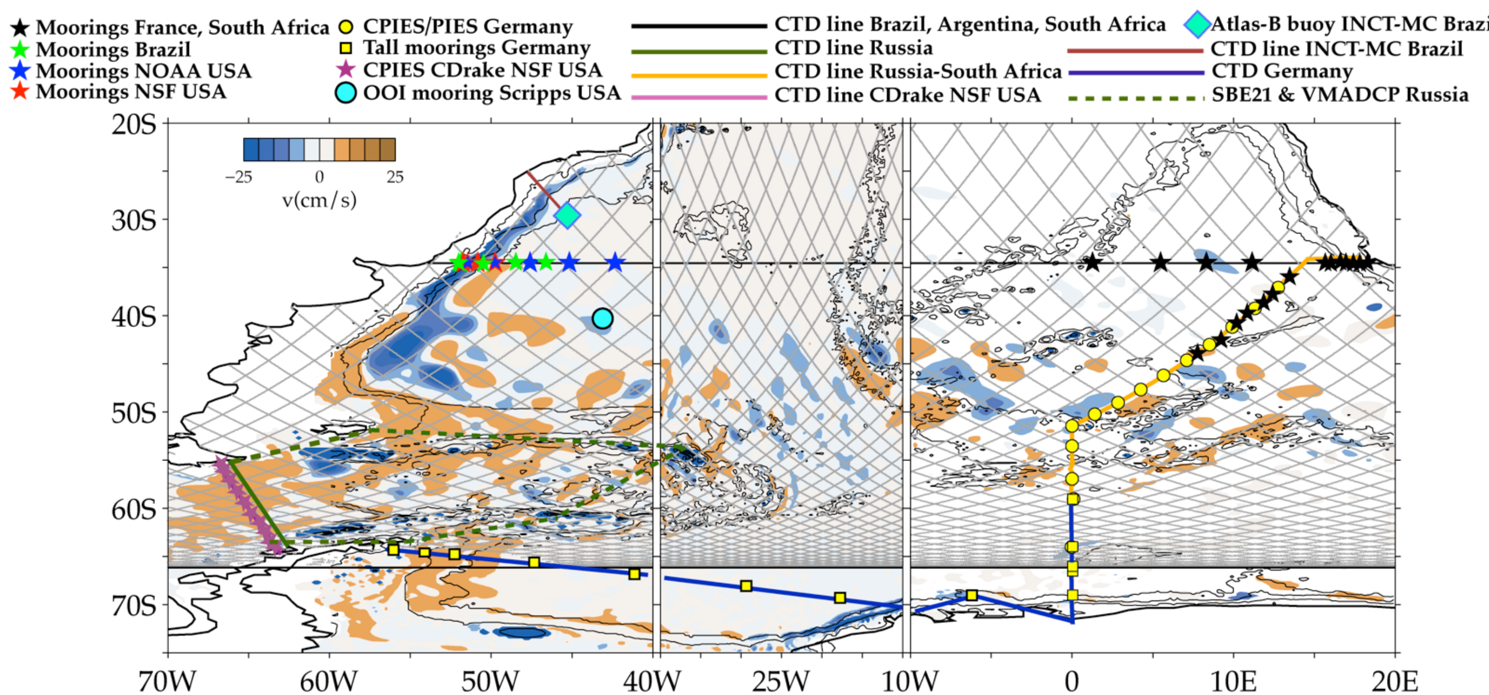


AMOC Observing System

New components

- OSNAP
- SAMOC

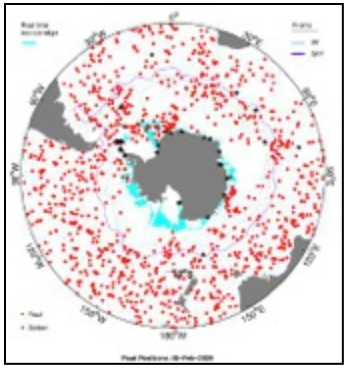
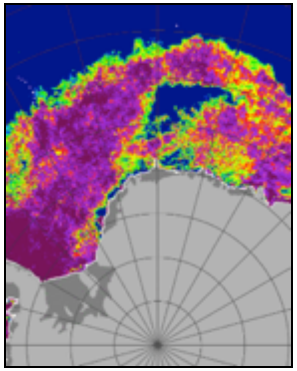
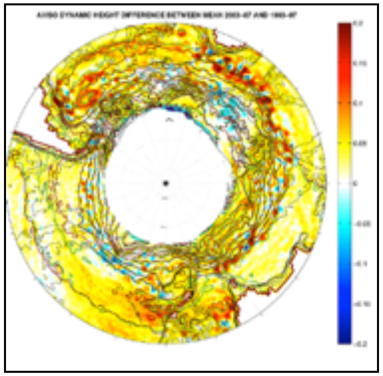
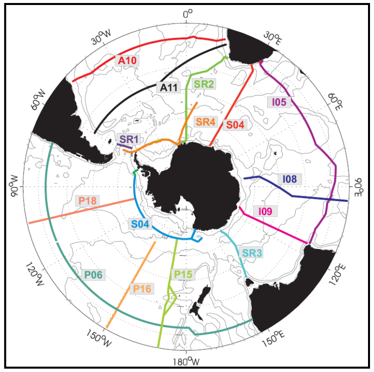




A Southern Ocean Observing System – SOOS





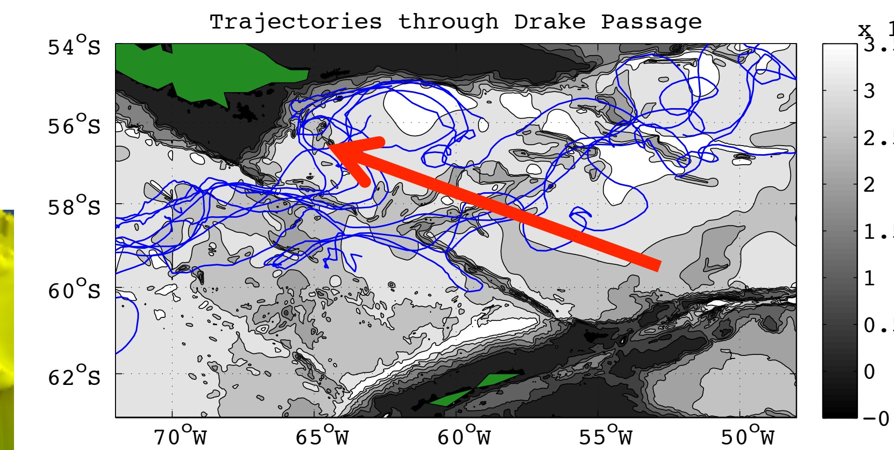





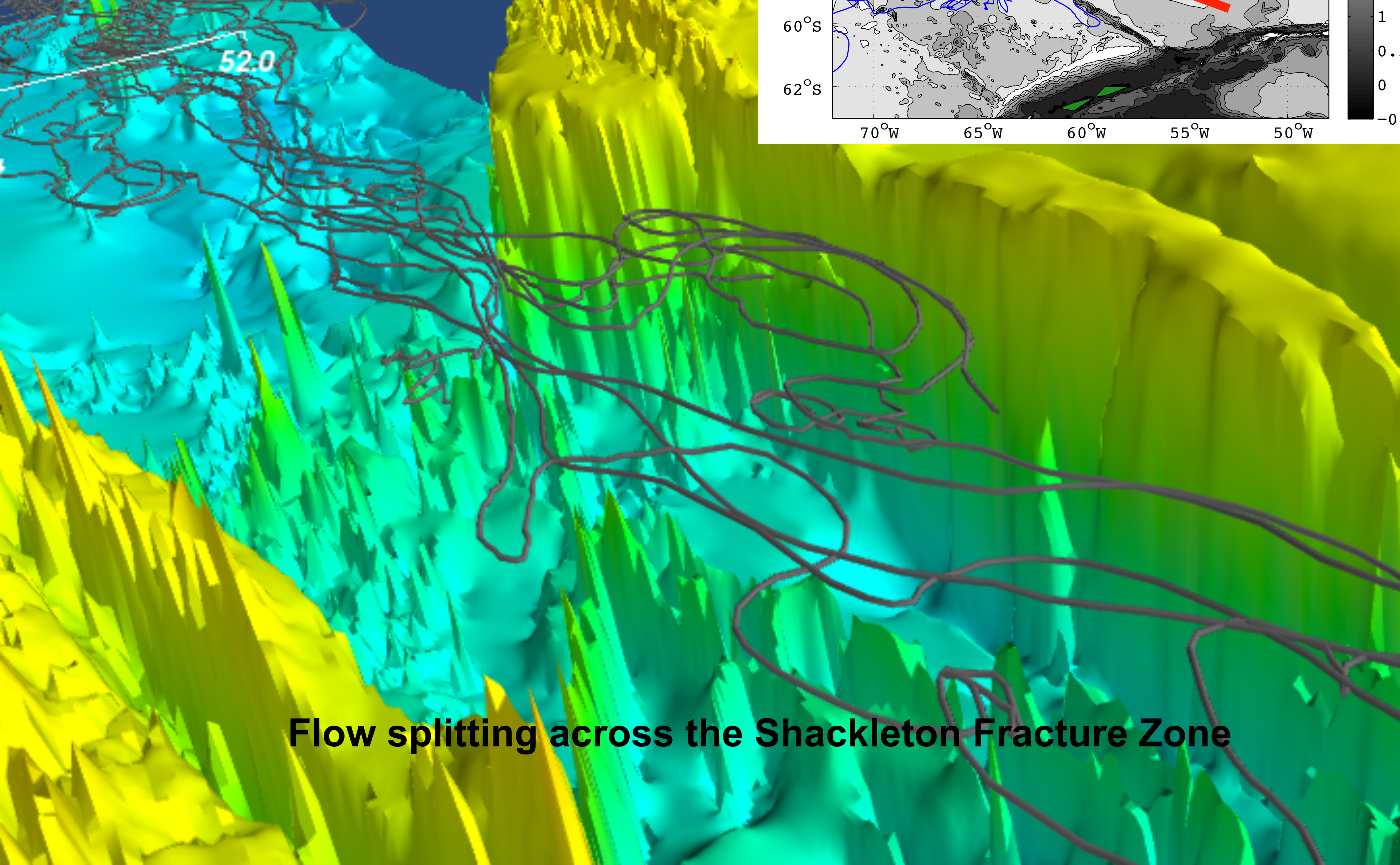


SSG20 Kiel May 6-9 2013

DIMES floats

- Flow split by f/H over ridges
- Basin-wide stirring in the Scotia Sea



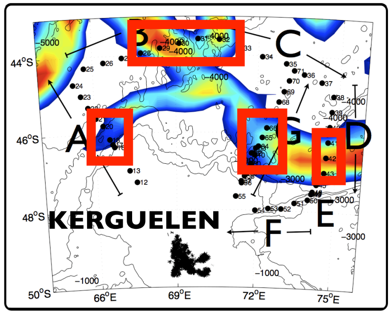


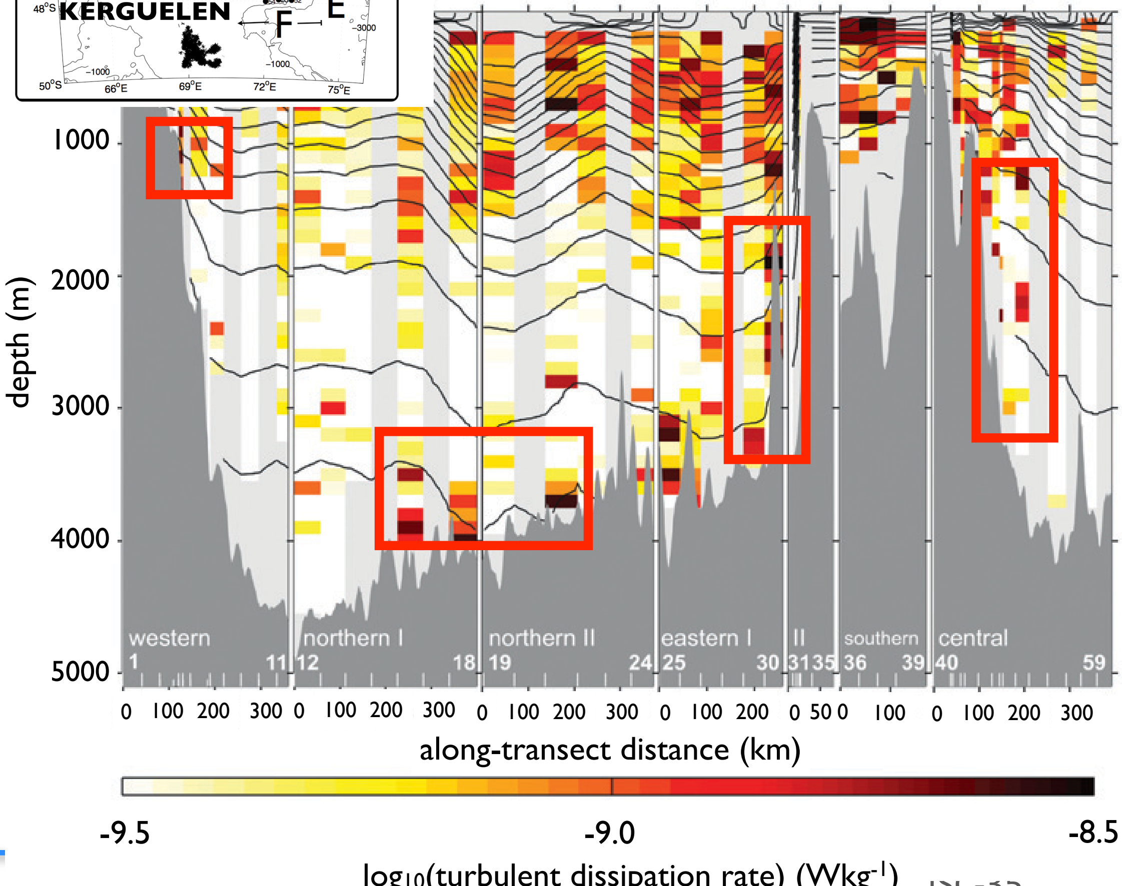
Flow splitting across the Shackleton Fracture Zone

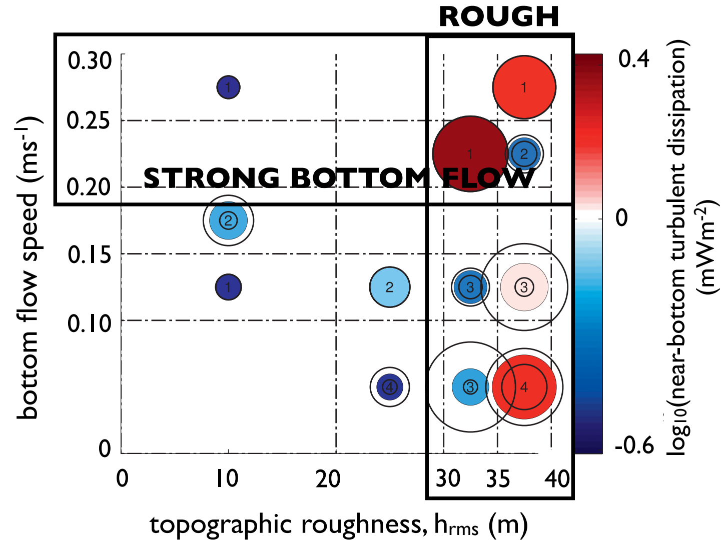
The Southern Ocean FINEstructure project (SOFINE) 2008 - 2011

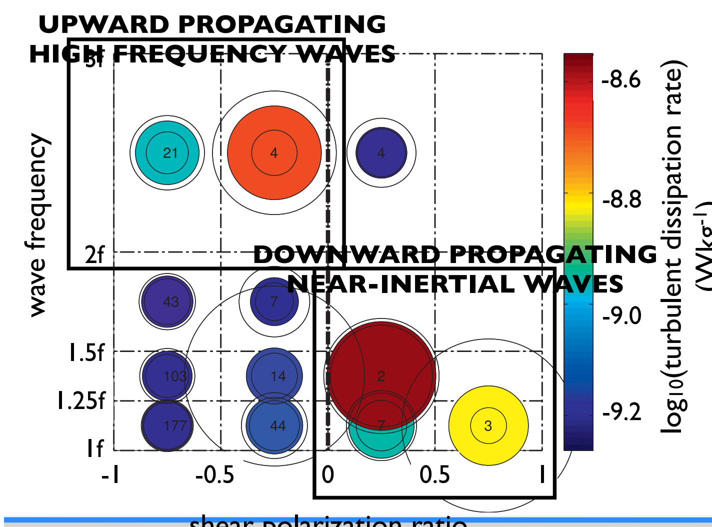
the first full-depth microstructure observations of the turbulent dissipation rate in the ACC

Confirms several of our expectations of the relation between the internal wave field and turbulent mixing and dissipation in the Southern Ocean interior ...



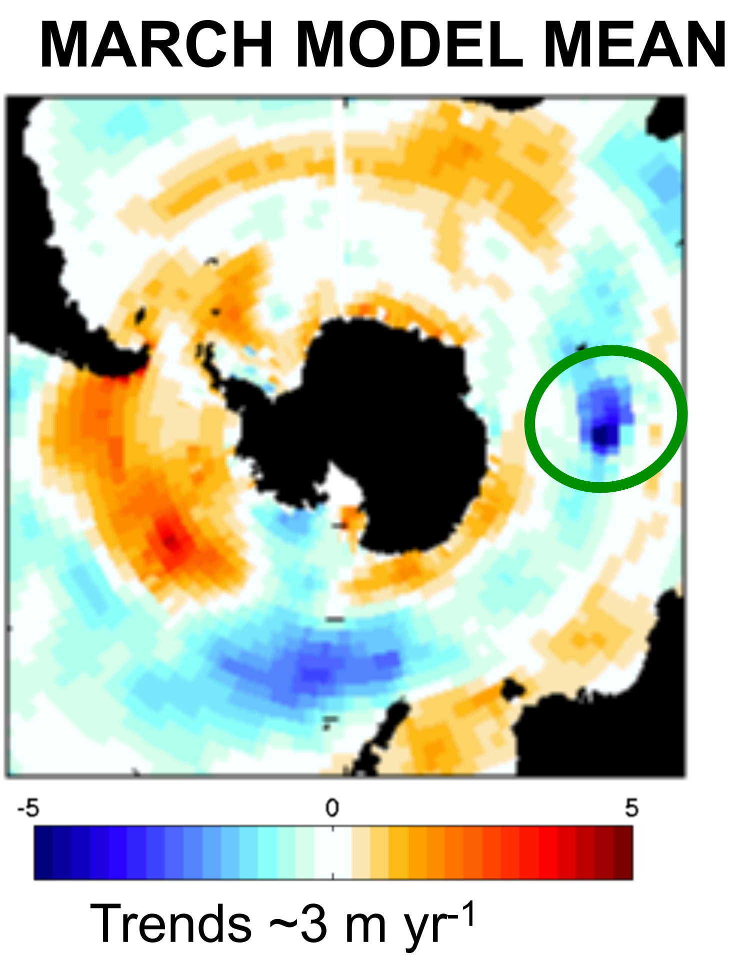


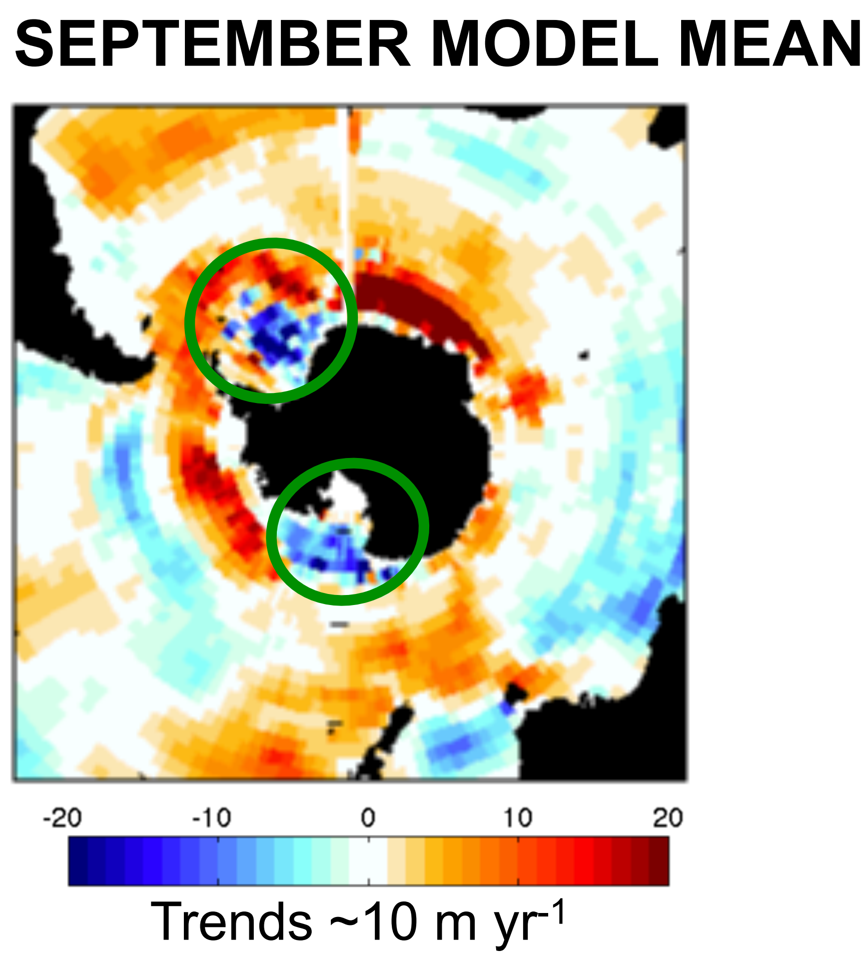




Waterman et al. 2013a

1988 – 2007 TREND: mixed layer depth (m/yr)





COREII: Overall spatial pattern coherent across models

Courtesy of Stephanie Downes

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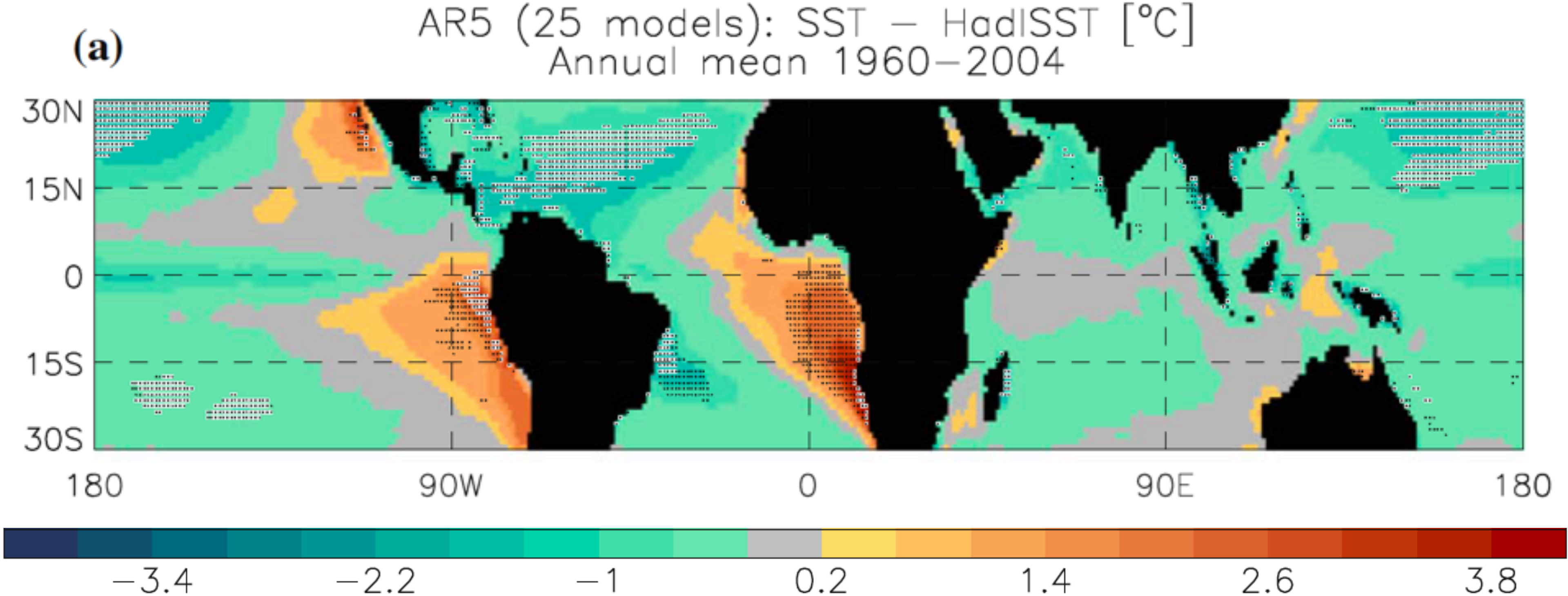
CLIVAR: Impact of Up-welling regions

Eastern Tropical Atlantic SST Bias

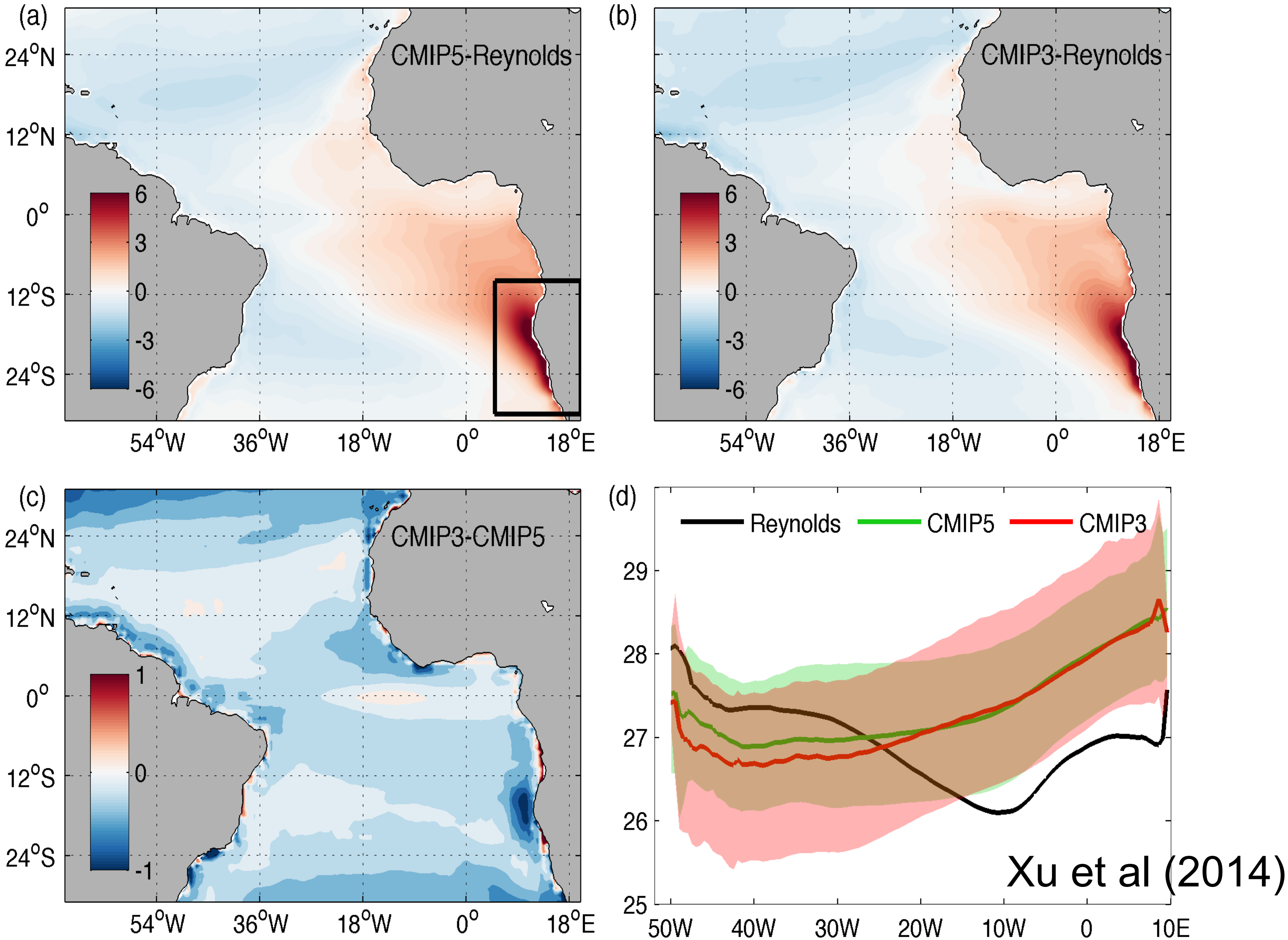
Foster research to improve observational network, reduce systematic model errors, and improve tropical Atlantic predictability



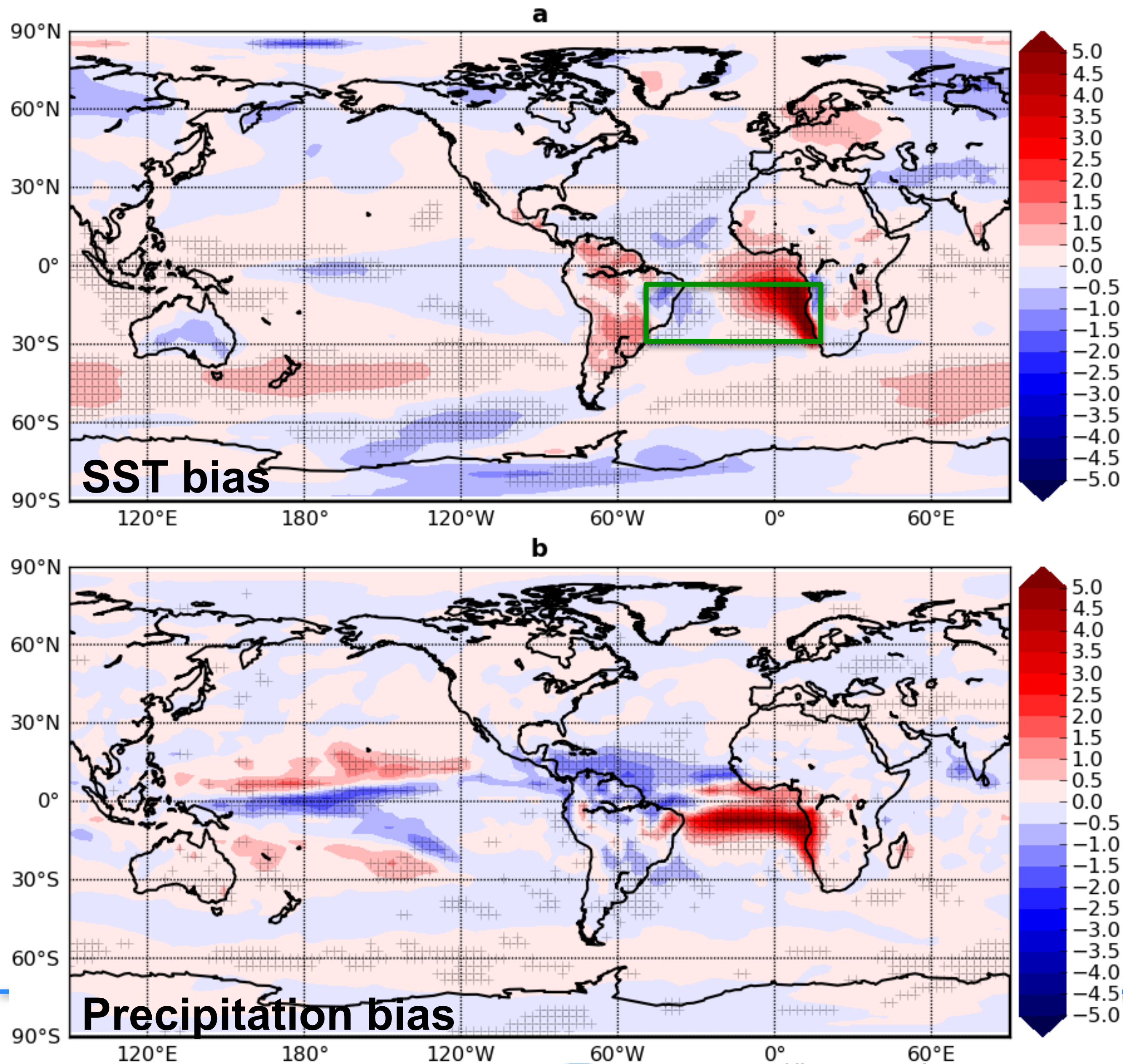
Mean SST error in the historical integrations of a set of 25 coupled GCMs in the CMIP5 ensemble. White hatching denotes areas where the sign of the error agrees in all models; black dots where all but one (CSIRO-Mk3.6.0) agree.

Toniazzo and Woolnough (2013)

Tropical Atlantic SST Bias in CMIP3 & CMIP5



Impact of Atlantic SST Bias



CAM-SOM Experiments

- ***CTRL run***: 50-year run with Q-flux computed using observed annual cycle of SST
- ***BIAS run***: 50-year run with Q-flux=0 in the south tropical Atlantic (30°S-5°S) (see the box)
- Removing Q-flux in the south tropical Atlantic results in a warm SST bias that bears close resemblance to the bias in the CMIP5 ensemble
- The warm SST bias has a strong remote influence

Issues for the JSC

- CLIVAR will rework all the TORs for its panels as part of pan-CLIVAR meeting.
- CLIVAR will consult further with GEWEX on the ETCCDI member etc.
- CLIVAR made WGOMD a panel (OMDP); will rework its role as model development panel within WCRP.
- … continue to wrestle with the connection to WGSIP and WGCM …
- Knowledge Exchange and Capacity Building Panel still spinning up.

Joint CLiC/CLIVAR Arctic Panel?

- Issues of CliVar/CliC coordination in the Southern Ocean and the Arctic has been raised; some initial discussions toward joint panels are on a way forward.
- We will be discussing detailed implementation during the margins of the JSC meeting and will propose some concrete next steps soon thereafter.

Atmospheric Dynamics Panel?

- CLIVAR was charged to discus this with core Projects.
- It was communicated by all that there is no need for an atmospheric dynamics panel beyond existing activities in panels and GC activities.

IGBP/PAGES core project?

- CLIVAR Informed IGBP and PAGES on discontinuation of CLIVAR/PAGES Panel.
- CLIVAR will not support a separate panel of PAGES-CLIVAR activities but encourages all CLIVAR groups to 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; they see them more closely related to physical climate research (WCRP) than to research on sustainability (the Future Earth).

Suggestion: To sound out interactions have a pan-WCRP / PAGES scoping workshop.

Ocean Platform in Future Earth?

“Future Earth - Ocean Alliance”

“A global research platform for marine sustainability research”

Mission: To encourage and facilitate the co-design, co-production and co-delivery of marine knowledge with relevant stakeholders in order to address and create solution pathways for global, regional and local ocean and coastal sustainability problems. To support current and new marine core projects and their interaction and integration in the context of Future Earth research.

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Should be joint WCRP/Future Earth

Thank You!

CLIVAR SSG Co-chairs and Director ICPO

Action 1
WCRP JSC and its constituencies to engage in implementation of the Research, Modelling and Prediction component of GFCS, for which WCRP has the lead; engage in this work National Hydrometeorological Services; and make an effort on achieving successful outcomes during the initial stage of GFCS implementation, particularly in the activities of the Compendium of GFCS activities with WCRP responsibilities, focussing on GFCS initial priorities: water resources management, food security and agriculture, disaster risk reduction, and human health protection.
Deadline: Workplans to be determined by the end of 2013
We have not done anything about this at the SSG level rather than pointing the members to this process. We think that not more to be done 'top down' beyond what we are doing in CLIVAR already.
Action 3
WCRP projects and constituencies WCRP engaged in joint activities with IGBP (such as IGAC, iLEAPS, AIMES, IMBER, PAGES, SOLAS) to monitor their status and continuity.
Deadline: report on status and progress of joint activities at JSC-35
We keep very close tabs on IMBER and plan to participate in the IMBER Future Oceans conference next summer in Norway.
Action 8
Ensure that members of WGRC representing projects not only work within WGRC but also serve as active liaisons between WGRC and project regional activities, especially GEWEX GHPs, and that they participate in corresponding project meetings such as SSGs. Recommend to GEWEX- and CLIVAR-affiliated WGRC members to participate in the 2014 Pan- GEWEX and CLIVAR meeting.
Deadline: continuously, start immediately after JSC
The PAN – CLIVAR meeting will take place in 2 weeks and welcome every WGRC members to participate.

CLIVAR SSG Co-chairs and Director ICPO

Action 14

To prepare an expanded contribution on interannual – decadal predictability research to the Regional GC white paper and include in it contribution from all WCRP Projects, with emphasis on tractable opportunities for regional predictability research. To include an analysis of opportunities to involve research on modes of climate variability as a contribution to this white paper. To brainstorm on this problem, and particularly on the idea of focussing on science versus services and on moving ahead as a series of smaller initiatives under the GC focus of the provision of climate information on regional scales.

Deadline: Approach/strategy to be reported to JSC-35

We are aware of this issue and charging the CLIVAR research opportunity groups with a revised perspectus and implementation strategy that would also make key contributions to the Regional GC.

Action 15

To identify optimal choice of leadership for the WCRP research work on provision of skilful/action-oriented regional climate information on interannual to decadal time scales.

Deadline: report at JSC 35

Both topics will be served through the CLIVAR research foci. Once those activities have been better defined additional areas of research might have to be filled from other parts of the WCRP research family.

Action 25

To recommend to all GCs to *consider* the benefits of including within their activities, if feasible, the approach of U.S. Climate Process Teams CPTs), which are, as a rule, built around the idea of using observations to motivate climate model improvements, take advantage of regular meetings, e-mail discussions, and telecons, and involve a number of full-time post-doctoral researchers. CLIVAR IPO to send information to GC leaders.

Deadline: once leadership of GC is determined

That has been communicated to the CLIVAR teams more than once.

CLIVAR SSG Co-chairs and Director ICPO

Action 38
Inform IGBP and PAGES on discontinuation of CLIVAR/PAGES Panel.
Deadline: August 2013
Done. We want to move closer to PAGES research on specific issues rather than the more generic issues covered under the current CLIVAR/PAGES panel. Note also that PAGES might reorganize in the context of the FutureEarth transition.

Action 39
To inform CCl and JCOMM that GEWEX was accepted by WCRP as a cosponsor of the CLIVAR/CCl/JCOMM ETCCDI and to invite CliC to provide to ETCCDI an expert with cryospheric expertise.
Deadline: August-September 2013
A brief communication has been initiated and confirmed to inform CCL about the changes.

Action 40
Encourage JSC members to participate in the Pan-GEWEX/CLIVAR meeting of 2014 and act as conveners.
Deadline: in the course of the meeting preparation
The PAN – CLIVAR meeting will take place in 2 weeks and welcome every WGRC members to participate.

Action 41
CLIVAR to review ToRs for all its groups.
Deadline: to report at JSC-35
Ongoing. To be done in 2014 and given to the SSG before the PAN-CLIVAR meeting. Action been given to panels.

CLIVAR SSG Co-chairs and Director ICPO

Action 42
CLIVAR to develop an implementation strategy for the Regional GC pertaining to regional predictability on time scales from seasons to decades.
Deadline: once feasible
Part of the CLIVAR research foci team challenge.
Action 43
CLIVAR, GEWEX, SPARC, WGNE, CliC, Regional GC and GC on climate sensitivity to propose a solution with regard of the gap in the WCRP structure in the domain of research on atmospheric dynamics. CLIVAR to take the lead in organising this discussion.
Deadline: to report at JSC-35
Done: no need seen by all for such an activity
Action 44
CLIVAR and GEWEX to co-develop strategy for management and oversight of the Monsoon Panel
Deadline: to report at JSC-35
Done. New panel was formed; will meet first time in The Hague
Action 57
CLIVAR to review engagement of CLIVAR basin panels in renewed GOOS/OOPC and their new structure.
Deadline: when feasible
Basin panels all participate in next OOPC meeting
Work in progress and consultation with respective panels is ongoing.
Action 59
Update information on WCRP and Core Project websites, especially with regard to membership of working bodies, calendar of meetings, and other current information.
Deadline: As soon as possible
We think the information is pretty up to date.