



Project report

Report of the 14th Session of the CLIVAR Atlantic Region
Panel

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1. Welcome

Peter Brandt and Ping Chang, co-chairs of the Atlantic Region Panel (ARP) welcomed all panel members and invited guests (Appendix 1). Apologies were received from Tom Farrar, Torsten Kanzow, Young-Oh Kwon, Gary Mitchum, Walter Robinson, Eric Chassignet and Jeff Knight for unable to attend the meeting.

2. Session 1: Atlantic Observing System

Bill Johns provided an overview of the Overturning in the Subpolar North Atlantic Program (OSNAP). It is a US-led programme with involvement of researchers from the UK, Germany, Netherlands, France, Canada and China. OSNAP's specific objectives are to: (i) Relate AMOC variability to deep water mass variability and basin-scale wind forcing; (ii) Assess overturning sensitivity to variations in Arctic freshwater input; (iii) Determine the pathways and transports of overflow waters in the North Atlantic subpolar gyre (NASPG) to investigate the connectivity of the deep boundary current system; (iv) Determine the nature and degree of the overflow-subpolar-subtropical AMOC connectivity; and, (v) Determine from new OSNAP measurements the configuration of an optimally efficient long-term AMOC monitoring system in the NASPG. The overall goal is to quantify the large-scale, low-frequency, full water-column net fluxes of mass, heat and fresh water associated with the meridional overturning circulation in the subpolar North Atlantic. The observational period is from 2014 to 2018, and contains a biogeochemistry component that could be further extended. OSNAP aims to establish a long-term comprehensive observing system in the North Atlantic.

Sabrina Speich gave an update on the South Atlantic Meridional Overturning Circulation (SAMOC), an international cooperation between Argentina, Brazil, France, South Africa and the USA, with collaborators from Germany, Russia, Spain and the UK. SAMOC is a CLIVAR endorsed project and incorporates the 34.5°S SAMBA (South Atlantic MOC Basin-wide Array). Since 2008, there were 29 South Atlantic SAMOC related cruises, with funding provided from different funding agencies on different time scales. Several modelling activities have also been developed and together with observations will provide better AMOC estimate and understanding of the meridional heat transport.

Peter Brandt presented the EU-funded project AtlantOS. It is a research and innovation project that proposes the integration of ocean observing activities across all disciplines for the Atlantic, including European as well as non-European partners. It is based on the Galway statement between US, Canada and EU and includes cooperation with tropical and South Atlantic partners. The ARP should closely interact with AtlantOS in the coordination of establishing the Atlantic Observing System. This should be possible since some panel members are already part of the AtlantOS consortium.

Moacyr Araujo presented the Brazilian contributions to the tropical and South Atlantic observing system. Brazil has a comprehensive participation in international projects in the region and strong national efforts in ocean observing. These include the

Prediction and Research moored Array in the Tropical Atlantic (PIRATA) project, Tropical Atlantic Island (TAIS) programme, the Amazon Cone Observing Network (ACONE), and SAMOC. Several of the projects also include Ocean-atmosphere exchanges and biogeochemical studies.

The further development of the tropical and South Atlantic observing system particularly including regions off Africa connected with capacity building and development should be a main focus of the ARP work aimed to enhance observing system in regions not well covered by observations so far.

3. Session 2: Modelling Program and Activity

Roberto Mechoso spoke on the activities of the US CLIVAR Eastern Tropical Oceans Synthesis (ETOS) Working Group. Remote bias experiments suggest the southeast Atlantic SST biases deliver a broader global impact than those of the southeast Pacific, and hindcast experiments indicates that the dominant processes establishing the eastern basin SST biases are model-dependent. In the southeast Pacific, the importance of oceanic eddy-mixing processes to the offshore SST cooling still lacks a robust consensus. The southern hemisphere stratocumulus clouds remain underestimated in most CMIP5 models, and the cloud decks' seasonal cycle is inadequately captured by many models. The cloud fractions are underestimated even when the SST field is unbiased, suggesting the atmospheric model component as the origin of the cloud error. Improvements in atmospheric spatial resolution improve model topography, and thereby better capture the coastal atmospheric jets and the equatorial cold tongue. For this reason, causes for coastal and offshore SST and cloud cover biases may differ.

Noel Keenlyside gave an overview of the ongoing European-funded “Enhancing Prediction of Tropical Atlantic Climate and its Impacts” (PREFACE) project. The main objectives of PREFACE, particularly its modelling and prediction component, is to understand mean model errors and forecast drift and the relation between simulated mean state and variability errors. PREFACE will also examine the mechanisms for the zonal mode and interbasin teleconnections and their modulation. The main goal is to improve climate prediction in the Tropical Atlantic to a level where socio-economic benefit can be realised, with a focus on sustainable management of marine ecosystems and fisheries. These aspects will be further explored by the CLIVAR Research Focus on Upwelling, and the ARP should work closely with that group in order to avoid duplication of efforts.

Ruza Ivanovic focussed her presentation on the role of Atlantic Ocean circulation in abrupt climate changes that are known to have taken place in the recent geological past (last 21 ka), discussing ways in which changes in the large-scale overturning circulation may have triggered, responded to and fed back to rapid episodes of warming, cooling and sea level rise. She introduced different numerical modelling tools that are used by the paleo climate research community to understand these events and outlined efforts to internationally coordinate research on these themes through the new Palaeoclimate Modelling Intercomparison Project (PMIP) Last Deglaciation Working Group. She also described the more established PMIP initiatives, including the CMIP6 experiments (Last Millenium, Mid Holocene, Last Glacial Maximum, Last Interglacial, Pliocene), and the

‘Ocean Circulation and Carbon Cycling’ (OC3) and ‘Investigating Past Ocean Dynamics’ (iPODS) projects on compiling global geochemical data ($\delta^{13}\text{C}$, $\Delta^{14}\text{C}$, $\delta^{18}\text{O}$, Pa/Th, ϵNd) to reconstruct the condition of past oceans, supported by PAGES and INQUA, respectively. Other major, new projects in the field include ‘Fast climate changes, new Tools to understand and Simulate the evolution of the Earth System’ (FATES); a French initiative funded by BNP Paribas to carry out transient simulations with Earth System Models and compile marine, terrestrial and ice-core records of past climate change.

Ping Chang updated the panel on the US AMOC Science Team activities, focussing on modelling activities. He also showed the near term priorities for each of the Task Team under the US AMOC Science Team. There have been 48 funded projects supported by four US agencies at the start of FY15, consisting of both observational and modeling AMOC studies. Some highlights of US AMOC Science Team research include the coordinated AMV Climate Impacts Experiments conducted by GFDL and NCAR. Preliminary results show that the Tropical Atlantic controls the first order AMV impacts, with AMV+ (AMV-) leading to a negative (positive) PDV response in the Pacific Ocean. Other impacts include poleward shift of tropical precipitation, and stronger zonal winds in the Southern Ocean. These remote AMV impacts likely result from mechanisms involving atmospheric teleconnections.

Another new study focussed on the predicted growth of Atlantic sea-ice in the coming decades using the Community Earth System Model (CESM). Results show a skill forecast of decadal trends of North Atlantic sea-ice extent, while predicting a neutral-to-weakly-positive decadal trends in North Atlantic sea-ice extent in the coming decade.

4. Session 3: International Collaboration

Ingo Richter presented diverse range of modeling activities at JAMSTEC. There are two CGCMs in JAMSTEC’s Applications Laboratory: the SINTEX-F model, mainly used for seasonal prediction, and the CFES GCM, mainly a research model, but with seasonal prediction under development. Currently there are no experiments targeted at tropical Atlantic but with future plans in developing diagnostics of equatorial Atlantic momentum budget, assessment of the influence of equatorial Pacific, influence of off-equatorial SST anomalies on equatorial surface winds, and suppress convection south of equator (bias problem).

South Africa Research Initiative on Past and Present Seasonal Cycle: Three South African scientists were invited to present a research initiative on past and present seasonal cycle led by South Africa during the panel meeting:

Willem Landman spoke about several aspects of seasonal forecast skills over the South Africa. He showed examples of Atmospheric General Circulation Models’ (AGCM’s) ability to simulate the seasonal (rainfall) cycle over different regions of the South Africa. However, there is still the issue of how correctly simulate the seasonal-to-interannual anomalies on top of the climatological cycle. Proper verification of hindcasts can provide new insights into forecast systems’ strong and weak points, providing guidance on how to improve operational forecast systems. **Bjorn Backeberg** presented ocean modelling and data assimilation capability in South Africa that can be used to

initialize seasonal climate forecasts and ocean environment forecasts in the region. *Sarah Fawcett* showed the ongoing research in ocean biogeochemistry in South Africa and its connection to other ongoing international research projects.

5. Session 4: Discussion

Participants of the meeting discussed several issues, including further plans for ARP involvement. Mathieu Rouault led the discussion on capacity building and development. Panel members have been involved in several activities organised in Africa. As discussed during previous panel meetings, the ARP aims to collect information regarding capacity building from the different programs and projects having particular interaction with developing countries surrounding the Atlantic Ocean. These capacity building activities could also be linked to several of the CLIVAR Research Foci such as the Decadal Climate Variability and Predictability (DCVP), Upwelling and Sea-Level Rise and Regional Impact.

The panel also identified several opportunities and gaps. One of them was regarding to the possibility of a *South Africa-led Research Initiative on Seasonal Cycle in the Past and Present*. All the panelists were very impressed with the quality of the presentations by the three South African scientists and were extremely supportive of the research initiative idea. The seasonal-cycle focus of the program seems to fit to the CLIVAR objectives well, particularly in understanding of climate model biases in the region. However, at the same time, the panel felt that there was a lack of cohesion of the science plan and the program needed to be more focused and further developed. The general feeling among the panel members was that there was a level of reluctance in the South African younger scientists in terms of assuming a leadership role in this program. The panel would like to work with the South African scientists to further develop this program and participate in the workshop planned for the next year.

At the end of the meeting, panel members briefly discussed issues regarding membership and location of the next meeting. The CLIVAR Scientific Steering Group has encourage all panels to meet in Qingdao, China, in association with the CLIVAR Open Science Conference, on 18-25 September 2015.

Appendix A: Agenda

9:00 AM Welcome and Introduction of New Panel Members

Session 1: Atlantic Observing System

9:10 AM OSNAP Progress and Activity (Bill Johns)

9:30 AM SAMOC Progress and Activity (Sabrina Speich)

9:50 AM AtlantOS Program (Peter Brandt/Sabrina Speich)

10:10 AM Brazilian Contribution to the Atlantic Observing System (Moacyr Araujo)

10:30 AM Coffee Break

Session 2: Modeling Program and Activity

10:50 AM US CLIVAR ETOS Activity (Roberto Mechoso)

11:10 AM PREFACE Modeling Activity (Noel Keenlyside)

11:30 AM Paleo-Climate Modeling Activity (Ruza Ivanovic)

11:50 AM US AMOC Modeling Activity (Ping Chang)

12:10 PM Lunch

Session 3: International Collaboration

13:30 PM Japanese Modeling Activity (Ingo Richter)

13:50 PM South Africa Research Initiative on Past and Present Seasonal Cycle

- Aspects of the seasonal cycle of forecast skill (Willem Landman)
- Ocean modelling and data assimilation capabilities in SA using HYCOM (Bjorn Backeberg)
- Biogeochemistry of the seasonal cycle with a focus on the Southern Ocean (Sarah Fawcett)

14:50 PM Coffee Break

Session 4: Discussion

15:10 PM Capacity building and development

- South African perspective (Mathieu Rouault)

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- CLIVAR endorsed projects
 - Others

Contribution of ARP to CLIVAR Research Foci

- Decadal Climate Variability and Predictability (DCVP)
- Sea-Level Rise and Regional Impact
- Others

Opportunity and Gap

- Sub-seasonal forecast
- Climate-Process-Team and US CLIVAR Workshop on “Translating Process Understanding to Improve Climate Models”
- South Africa-led Research Initiative
- Others

Panel Business

- Membership
- Next Meeting

17:00 PM Adjourned

Appendix B: List of attendees

Name	Country	Role
Peter Brandt	Germany	Panel Co-Chair
Ping Chang	USA	Panel Co-Chair
Mathieu Rouault	South Africa	Panel Member
Moacyr Araujo	Brazil	Panel Member
Ruža Ivanović	UK	Panel Member
Sabrina Speich	France	Panel Member
Roberto Mechoso	USA	Invited Expert
Bill Johns	USA	Invited Expert
Willem Landman	South Africa	Invited Expert
George Philander	USA	Invited Expert
Ingo Richter	Japan	Invited Expert
Noel Keenlyside	Norway	Invited Expert
Bjorn Backeberg	South Africa	Invited Expert
Sarah Fawcett	South Africa	Invited Expert