

# CLIVAR REPORT

Climate and Ocean: Variability, Predictability, and Change



## Project Report

### Report of the 15th Session of the CLIVAR Atlantic Region Panel

17-18 September, 2016, Qingdao, China

January 2017

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## List of Actions

**Action 1:** Strengthen interaction with AtlantOS by providing scientific advice for further development of the Atlantic Ocean Observing System (S. Speich and W. Robinson) - **ASAP**

**Action 2:** Provide scientific input to PIRATA SSC on the need for further observations in areas not well observed and of scientific importance (S. Speich and W. Robinson) – **end of 2017**

**Action 3:** Provide OOPC with scientific input of the need to strengthen the capability to observe the ocean at boundaries as well as air-sea exchanges (S. Speich) - **ASAP**

**Action 4:** Propose a workshop in 2018 on how to accurately represent ocean mesoscale eddy – atmosphere feedback in eddy-resolving ocean-only model simulations (S. Speich, W. Robinson, P. Chang and E. Chassignet) – **ASAP**

**Action 5:** ARP will, jointly with OMDP, develop a proposal on 'Validating and Comparing CORE-II Hindcast Experiments in the Tropical Atlantic' (S. Speich, W. Robinson and G. Danabasoglu) – **end of 2017 or early 2018.**

**Action 6:** Suggest to CLIVAR SSG to ask IOCCP to nominate people with carbon expertise to CLIVAR panels. Jointly sponsored event with IOCCP is also suggested. (S. Speich and W. Robinson) - **ASAP**

**Action 7:** Coordinate proposals from ARP and CDP on HighResMIP to PRIMAVERA (W. Robinson, Y-O. Kwon, S. Minobe) - **ASAP**

**Action 8:** Prepare discussion document on metrics for Atlantic Multidecadal Variability and circulate to ARP and CDP (R. Sutton) – **Beginning 2017**

**Action 9:** Investigate feasibility for joint storm track workshop in 2018/19 (O. Zolina, Y-O Kwon, W. Robinson, P Chang). - **ONGOING**

# 1. ARP Panel Meeting

## 1.1 Welcome

Sabrina Speich and Ping Chang, co-chairs of the Atlantic Region Panel (ARP) welcomed all panel members and invited guests (Appendix 2). Apologies were received from Torsten Kanzow, Bjorn Backberg, and Gary Mitchum, for unable to attend the meeting.

## 1.2 Session 1: Atlantic Observing System

**Sabrina Speich** provided an overview of the Meridional Overturning Circulation (MOC) dedicated observing projects and programmes. In particular, she reported on the Overturning in the Subpolar North Atlantic Program (OSNAP) and OVIDE programs in the North Atlantic. OSNAP 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 Atlantic MOC (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 North Atlantic Subpolar Gyre (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. A first publication describing the program has been edited (Lozier et al., 2016). Very preliminary results from the first two years of data suggest two years of strong deep (and from the point of view of historical observations and more recent data, e.g. Piron et al., 2016) unprecedented convection in the Irminger Sea. OVIDE is French programme with a Spanish component to evaluate Anthropogenic Carbon. It runs along an oblique transect from Lisbon to Greenland sampled every two years. The first cruise started in 2002 and the time series is delivering very interesting estimates within the context of the AMOC variability, changes and influence on the carbon budget.

**Maria-Paz Chidichimo** 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. A first GO-SHIP SAMBA cruise will take place in January 2017 led by GEOMAR and funded partially by the AtlantOS H2020 project. Several modelling activities have also been developed and together with observations will provide better AMOC estimate and understanding of the meridional heat transport.

**Sabrina Speich** presented the EU-funded project: the 'Atlantic Ocean Research Alliance Coordination and Support Action (AORA-CSA)' and AtlantOS. They are research and innovation projects. AORA-CSA objective is to provide Support to the EC in developing & implementing trans-Atlantic Marine Research Cooperation in the Atlantic Ocean Research Alliance between EU, Canada, USA. AtlantOS is building on an 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 is relatively

straightforward since some panel members, including Sabrina, are already part of the AtlantOS consortium. In particular, AtlantOS is organizing a scientific workshop on the Atlantic Observing that will take place in Cape Town, South Africa just before or after the IAMAS-IAGA-IAPSO meeting at the end of August 2017. A parallel project to AtlantOS for the Arctic has been recently funded by the EC: INTAROS coordinated by NERSC (Norway).

The ARP found it is important to closely interact with AtlantOS in the coordination of establishing the Atlantic Observing System, in particular through the ARP panel members, including Sabrina Speich, who are already part of the AtlantOS consortium. ARP will take the opportunity to further interact with AtlantOS during the scientific workshop on the Atlantic Observing that will take place in Cape Town, South Africa during the IAMAS-IAGA-IAPSO meeting at the end of August 2017.

**Action 1:** *Strengthen interaction with AtlantOS by providing scientific advice for further development of the Atlantic Ocean Observing System (S. Speich and W. Robinson) - ASAP*

**Peter Brandt** presented the Prediction and Research moored Array in the Tropical Atlantic (PIRATA) project. This array has benefited from recent observing capability expansion: Three new T-FLEX systems have been installed in late 2015 and 2016 (will progressively replace the ATLAS moorings) at 12N-23W, 0N-23W & 10S-10W; Ocean Tracking Network (OTN, acoustic receivers) have been installed on all buoys from 2014; Xpods (turbulence) sensors have been deployed at 23W-0N & 10W-0N from 2014 (for five years within an NSF funded project); one new Acoustic Doppler Current Profiler (ADCP) mooring has been deployed at 0E-0N in 2016 (within the European Preface project). Moreover, New enhancements of PIRATA observing network through the Brazilian contribution (+54 T/S sensors) for three buoys located in the western Tropical Atlantic with the aim to observe barrier-layers and heat content variability induced by the spreading of Amazon river plume as well as ocean-atmosphere interaction and hurricanes tracks. 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.

**Action 2:** *Provide scientific input to PIRATA SSC on the need for further observations in areas not well observed and of scientific importance (S. Speich and W. Robinson) – end of 2017*

### 1.3 Session 2: Modelling and Prediction Studies

**Jeff Knight** presented recent studies on decadal prediction within the Atlantic sector. He introduced the new improved UK Met Office decadal prediction system, DePreSys3, which is now running at 50 km atmospheric resolution compared to DePreSys at 230 km. He also introduced the planned set of CMIP6 decadal hindcasts, forecasts, and uninitialized simulations with increased ensemble size of 10 from 3 and starting every year from 1960 instead of every 5 years. Also introduced were a set of CMIP6 (the Coupled Model Intercomparison Project Phase 6 CMIP6) understanding experiments, including 1) “Pacemaker” experiments 1950-2014, imposing observed sea surface temperatures (SSTs) either in the Eastern Pacific or North Atlantic, or sub-regions, to help evaluate inter-connections, 2) Case study of 1990s Atlantic transition: compare the initialized hindcast ensembles with a set that is initialized with climatology in the sub-polar gyre, for various initialization dates in the 1990s, 3) Volcanic effects: (a) repeat hindcasts without one of the major volcanoes (Pinatubo 1991; El Chichón 1982; Agung 1963), (b) make forecast with repeat eruption in 2015.

**Noel Keenlyside** did not present the progress in tropical Atlantic modelling and bias studies in the panel meeting, but presented it in the cross-panel meeting between ARP and CLIVAR Ocean Model Development Panel (OMDP). One of the most significant achievements of these studies is the understanding of the causes of the infamous SST bias along the Benguela. The emerging evidence points the atmospheric model resolution is the main cause of the SST bias.

By enhancing atmospheric model resolutions, climate model simulations have shown significant reduction of the warm bias along the Benguela coast.

**Ruza Ivanovic** reported on paleo modelling activities in within Atlantic sector. Some of pressing issues which confront the paleo climate community include: Can paleo-records give current observations context? How do we obtain needed quantitative data at sufficient resolution for validating paleo climate simulations? What are the surface and subsurface fingerprint of AMOC changes? Is AMOC variability dependent on climate state? What is the sensitivity of ocean circulation to drivers? What caused abrupt change in the past? Is there bi/multi-stability? What does the future hold carbon storage and release based on our knowledge about the past climate?

**Eric Chassignet** represented the results of high-resolution SAMOC simulations and pointed out the importance of ocean eddies in large scale ocean circulations. The high-resolution simulation also can provide insight into the role of ocean eddies in AMOC connectivity.

## 1.4 Panel Discussion

### ***For Atlantic Observation System:***

Discussions on gaps in Atlantic observing system led to the recommendation that we need to enhance observation network along the ocean eastern and western boundaries. For the Atlantic basin, one critical observation that is currently missing is the wind measurement along the West Africa coast where the atmospheric low-level jet – Benguela Jet – resides. Recent modelling studies suggest that resolving the Benguela Jet is critically important to alleviate climate model biases along the Benguela coast, and yet there is no accurate observations currently available to validate model simulated Benguela Jet. Also, Argo floats are not intended to sample the upper-slope/shelve regions where most of the boundary currents and meridional transport lie as well as ocean variability and air-sea exchanges. We definitively need to strengthen our capability to observe the ocean at boundaries as well as air-sea exchanges, *with special focus on the wind measurement along the West Africa coast, the Benguela Jet along Benguela coast, and the increase of Argo floats in the upper-slope/shelve regions.*

**Action 3:** *Provide OOPC (Ocean Observations Panel for Climate, the Global Ocean Observing System <GOOS> Physics and Climate panel) with scientific input of the need to strengthen the capability to observe the ocean at boundaries as well as air-sea exchanges (S. Speich) - ASAP*

### ***For Modelling and Prediction Studies***

The panel discussion was focused on the role of ocean eddies in climate models. There is emerging evidence that energetic ocean eddies along the Gulf Stream and South Atlantic are critically important in affecting regional climate variability, as such the North Atlantic Oscillation (NAO), as well as carbon cycle. There is also emerging evidence that ocean mesoscale eddy – atmosphere feedback can affect both eddy energetics and ocean circulations. However, this feedback is not fully taken into consideration in eddy-resolving ocean-only model simulations. There is an emergent need to address this issue. Therefore, we recommend to organize a workshop in the coming on how to accurately represent ocean mesoscale eddy – atmosphere feedback in eddy-resolving ocean-only model simulations.

**Action 4:** *Propose a workshop in 2018 on how to accurately represent ocean mesoscale eddy – atmosphere feedback in eddy-resolving ocean-only model simulations (S. Speich, W. Robinson, P. Chang and E. Chassignet) – ASAP*

### ***Panel Business (Chang/Speich)***

The panel co-chairs have been reviewing their membership, and the future leadership of the Panel. The term of the following six members will expire in 2016: Ping Chang (co-chair), Walter Robinson, Moacyr Araujo, Torsten Kanzow, Young-Oh Kwon and Gary Mitchum. ARP

membership nomination for 2017 has been proposed and agreed within the panel. Panel co-chairs will make a proposal for membership to the CLIVAR Scientific Steering Group at the appropriate time.

The next panel meeting is proposed to be organized in February 2018, back-to-back to the 2018 Ocean Science Meeting (OSM) in Portland.

## 2. OMDP/ARP Cross-Panel Meeting

The joint ARP-OMDP discussion focused on a proposal - Validating and Comparing CORE-II Hindcast Experiments in the Tropical Atlantic. After the discussion, many panellists felt that the existing CORE-II model hindcast experiments were probably inadequate to validate against observations in the tropical Atlantic because of the model resolutions are too coarse. The recommendation was to wait for a new set of CORE experiments with higher resolution ocean models forced with new high-resolution CORE forcing dataset - JRA55.

**ARP Participants:** Ping Chang, Sabrina Speich, Eric Chassignet, Jeff Knight, Maria Paz Chidichimo, Moacyr Araujo, Noel Keenlyside, Ruza Ivanovic, Walter Robinson and Young-Oh Kwon

**Action 5:** ARP will, jointly with OMDP, develop a proposal on 'Validating and Comparing CORE-II Hindcast Experiments in the Tropical Atlantic' (S. Speich, W. Robinson and G. Danabasoglu) - **end of 2017 or early 2018.**

## 3. ARP/SORP/EBUS Cross-Panel Meeting

**Sabrina Speich** introduced the observing progresses in the Atlantic Ocean. She also made a point on the role of ocean eddies in the ocean circulation and interocean exchanges as well as on their possible role in air-sea interactions. There is indeed emerging evidence that energetic ocean eddies are critically important in affecting regional climate variability, as such the NAO, as well as carbon cycle. There is also emerging evidence that ocean mesoscale eddy – atmosphere feedback can affect both eddy energetics and ocean circulations.

**Lynne Talley** updated the panel on the US Southern Ocean Carbon and Climate Observations and Modelling (SOCCOM) project activities and preliminary results, focussing on the multiple upwelling phases of deep-water in the Southern Ocean in relation with the float observed carbon fluxes. The study is based on analyses of the 1/10° GFDL (Geophysical Fluid Dynamics Laboratory, NOAA) CM2.6 global coupled model, the 1/10° CESM (Community Earth System Model) global coupled model, and the 1/6° Southern Ocean State Estimate (SOSE), all with sea ice models. A first phase, that brings deep waters from deep layers in the upper 1000m of the water column, happens essentially along the Antarctic Circumpolar Current (ACC) downstream of steep topographies and islands. These deep upwelling sites are therefore intense, localized geographically and seem to be well identified, consistent across the three models. The physical processes responsible for these deep upwelling cells correlate well with the intense eddy activity that develops within the ACC downstream of steep topography and islands. These cells originate by the strong interaction of the ACC with the steep topography giving rise to intense submesoscale/mesoscale dynamics and the related vertical motion. The second phase of the deep-water upwelling, which conveys the upwelled waters to the sea surface and therefore in contact with the atmosphere, happens more broadly along the southern ACC fronts and south of the ACC as an Ekman-pumping related geographically homogeneous processes.

**Thomas Toniazzo** exposed the latest achievements on CLIVAR research foci of Eastern Boundary Upwelling System (EBUS) observing and theoretical understanding in ocean-atmosphere interactions and variability.

### **Discussion:**

The question arising at this point is the similarities of this phase of the upwelling with that of Eastern Boundaries Upwelling systems. As the resolution of CM2.6, CESM, and SOSE are eddy-resolving or eddy-permitting but not submesoscale ( $1/10^\circ$  and  $1/6^\circ$ , therefore eddy permitting), it is difficult to look at very small scales in this context. However, it was noted that submesoscale modelling of various important Southern Ocean hotspots – Kerguelen, Drake Passage, Scotia Arc - has or is being carried out and could readily be incorporated in general work on circumpolar upwelling. The frontal processes should be very similar and it would be interesting to assess and compare the submesoscale role on both Southern Ocean upwelling and EBUS.

The discussion was then concentrated in the points below that would be four possible common themes of interest:

- "Climate" teleconnections between the Southern Ocean and EBUs regions
  - a) Global thermocline and water mass properties in coastal and open-ocean upwelling, including source of upwelled waters
  - b) Changes in wind forcing & consequences on upwelling under changes in large-scale circulation (climate change and/or interannual variability)
- Mesoscale (& sub-mesoscale) "mixing" and restratification processes responsible for the surface effects of wind-driven upwelling
- Importance of spatio-temporal variability of wind forcing field and its consequences for the spatio-temporal distribution of upwelling
- Related to all of the above, model systematic biases and underlying process representation in open ocean and in coastal upwelling systems, in particular dependence on resolution, representation of mixing processes (e.g. near-inertial waves or Langmuir turbulence) and coupling frequency

### **Participants:**

**ARP:** Ping Chang, Sabrina Speich, Eric Chassignet, Jeff Knight, Maria Paz Chidichimo, Moacyr Araujo, Noel Keenlyside, Ruza Ivanovic, Walter Robinson and Young-Oh Kwon

**SORP:** Lynne Talley, Joellen Russel, Inga Smith, John Fyfe

**EBUS:** Thomas Toniazzo

## **4. ARP-SORP-PRP-IORP: Joint effort in Carbon and Other Ocean-Climate Researches**

### **Paths for carbon into deep ocean**

**Sabrina Speich** introduced in her talk that both Argo observations and Regional Ocean Modeling System (ROMS) modelling were used to study ocean water masses pathways and mixing. Those rings such as 600m Agulhas deep ring and the more well-defined eddies identified by coupling the Weather Research and Forecasting (WRF) Model and ROMS were thought for the paths for carbon into deep ocean.

Those deep rings have seasonal stratification, and the cold dense rings will eventually disappear from altimetry because they sink. The modelling tried to find out the processes that lead to deep injection of carbon in super-gyre. Eddies coincide with where high carbon value were found. The longest tracking time with altimetry is seven years.

### **Locations of carbon uptake and storage**

Location of uptake of carbon not necessarily where it ends up. Understanding where the carbon uptake occurs and where it ends up is an important aim for carbon research.

### ***Southern Ocean Carbon and Climate Observations and Modelling (SOCCOM)***

SOCCOM is a mix of modelling and observation, with particular focus on carbon. There are around 200 biogeochemical (BGC) floats sample in winter and under ice. A total of around 1000 floats are needed for global coverage of ocean carbon and climate observations and modelling (GOCCOM), with 200 in SO. Measurements should include DO, pH, nitrate, bio-optics in addition to normal ARGO floats.

### ***Southern Ocean anthropogenic acidification***

Southern Ocean anthropogenic acidification is an alarming scenario, and is realistic. Upwelling of 7.6 pH deep waters reaches very close to the surface.

### ***Suggestions on best measures for carbon***

Best measures for carbon are pH and alkalinity (better even than PCO<sub>2</sub>), but no good alkalinity sensor for floats yet. Sensors of T, S, nitrate and oxygen are needed for carbon measurement in profilers. The pH measurement would help reduce errors. Gliders are ideal carrier for more sensors can be mounted, but the maintenance is quite expensive. The combination of Argo at open ocean and glider around coast is a suggested method.

### ***Including carbon expertise into CLIVAR panels***

CLIVAR SSG could ask International Ocean Carbon Coordination Project (IOCCP) to nominate people to CLIVAR panels. Jointly sponsored event with IOCCP is also suggested.

### ***Ocean Reanalysis data and modelling***

BGC is now incorporated into Southern Ocean State Estimate (SOSE). MITgcm is still the basis of most ocean state estimations. But there are some problems such as underperforming in AABW formation and in carbon fluxes. The next version will include full BGC (BLING model).

The GFDL-CM2.6 is about to apply 0.1 degrees. There will be 300 TB of data to be served by University of Arizona servers (supported by state of Arizona funding). Verification of emissions would be eventual outcome.

**Participants:** *SORP members: John Fyfe, Inga Smith, Lynne Talley, Joellen Russell, Kats Katsumata, and Jiuxin Shi; Jeff Knight and other five ARP members. PRP and IORP members did not attend.*

**Action 6:** *Suggest to CLIVAR SSG to ask IOCCP to nominate people with carbon expertise to CLIVAR panels. Jointly sponsored event with IOCCP is also suggested. (S. Speich and W. Robinson) - ASAP*

## **5. ARP- CDP Cross-Panel Meeting**

**Sabrina Speich (ARP)** introduced the observing progresses in the Atlantic Ocean. She also made a point on the role of ocean eddies in the ocean circulation and interocean exchanges as well as on their possible role in air-sea interactions. There is indeed emerging evidence that energetic ocean eddies are critically important in affecting regional climate variability, as such the NAO, as well as carbon cycle. There is also emerging evidence that ocean mesoscale eddy – atmosphere feedback can affect both eddy energetics and ocean circulations.

**Shoshiro Minobe (CDP)** introduced HighResMIP. Some of ARP members showed their interest in the project, and Walter Robinson and Young-Oh Kwon *will collect proposals from ARP, and send it to Malcolm Roberts and David Hein (both at UK MetOffice). PRIMAVERA groups will discuss about those proposals in their workshop.*

**Action 7:** Coordinate proposals from ARP and CDP on HighResMIP to PRIMAVERA (W. Robinson, Y-O. Kwon, S. Minobe) - **ASAP**

**Rowan Sutton (CDP)** introduced discussion of the Climate Dynamics Panel (CDP) for metrics in particular for Atlantic Multidecadal Variability. He will prepare discussion document and circulate to ARP for comments in view of next HighResMIP simulations that are in the processes to be undertaken soon.

**Action 8:** Prepare discussion document on metrics for Atlantic Multidecadal Variability and circulate to ARP and CDP (R. Sutton) – **Beginning 2017**

**Discussions:**

It was discussed the possibility of a joint workshop or joint panel meetings. One possibility for funding request in the next year is PRIMAVERA (PRocess-based climate sIMulation: AdVances in high-resolution modelling and European climate Risk Assessment) workshop in November 2017. Olga Zolina (CDP) asked the interest of ARP for possible storm track workshop in France in 2018/19, and Young-Oh Kwon, Walter Robinson, and Ping Chang showed their interest. Also, both panels are interesting in possible joint panel meeting.

**Action 9:** Investigate feasibility for joint storm track workshop in 2018/19 (O. Zolina, Y-O Kwon, W. Robinson, P Chang). - **ONGOING**

**Participants:**

**CDP:** Malcolm Roberts, Rein Haarsma, Shoshiro Minobe, Rowan Sutton (CDP)

**ARP:** Sabrina Speich, Ping Chang, Walter Robinson, Jeff Knight, Young-Oh Kwon

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## Appendix 1: Agenda

Time	Items
<b>September 17, 2016</b>	
<b>09:00-12:00</b>	<b>1. ARP Panel Meeting</b>
<b>09:00-10:00</b>	<b><i>Session 1: Atlantic Observing System (Speich)</i></b>
09:00	AMOC/SAMOC (Speich/Chidichimo)
09:20	Status of H2020 “Atlantic” European Projects
09:30	PIRATA/PREFACE (Araujo/Peter Brandt)
09:45	Discussions: Going from deep to coastal, from MOC to small-scale, from physics to fisheries? (Speich/Young-Oh Kwan)
<b>10:00-11:00</b>	<b><i>Session 2: Modelling/Prediction Studies (Chang) (10:00 – 11:00, Sep. 17, 2016)</i></b>
10:00	Decadal Prediction (Knight)
10:15	Tropical Atlantic Modelling & Bias Studies (Keenlyside/Chang)
10:30	Paleo Modelling Activities (Ivanovic)
10:45	Discussions: Going from coarse- to fine-resolution climate simulations? (Chassignet/Robinson) SAMOC high-res model/data comparison (Chassignet)
<b>11:00-11:15</b>	<b><i>Coffee Break</i></b>
<b>11:15-12:15</b>	<b><i>Session 3: Panel Business (Chang/Speich)</i></b>
11:15	Capacity Building (Speich/Brandt)
11:30	New Events: Organizing two topical workshops (perhaps with other panels) in the coming 3 years (one next year and another in three years)?
11:45	Membership issues
<b>Noon</b>	<b><i>Adjourn of ARP Panel Meeting</i></b>
<b>13:00-15:00</b>	<b>2. OMDP/ARP Cross-Panel Meeting</b>

Time	Items
	<b>(20-30 min; Ping Chang, Noel Keenlyside, Peter Brandt, &amp; Anne-Marie Treguier)</b> Discussion on a possible CORE-II paper focusing on the Tropical and South Atlantic, including eastern boundary upwelling regions.
	<p><b>(60 min; Ping Chang, Gokhan Danabasoglu, Simona Masina, &amp; Eric Chassignet)</b> Observations and modeling needs. How have the observations in the Atlantic Ocean helped the development and improvements of ocean models? Are there critical observations that are lacking for future ocean model development and improvements? Are there critical areas that we should focus on to improve ocean models using new observations? What is the best strategy to integrate observations and ocean models? Combined use of forward models, reanalysis, and observations to improve understanding of the Atlantic Ocean.</p> <ul style="list-style-type: none"> <li>• General introduction / review (5-10 min): Chang</li> <li>• Modeling needs from observations, including high-res needs (10-15 min): Chassignet</li> <li>• Forward models and reanalysis products (10 min): Danabasoglu, Masina</li> <li>• Discussion</li> </ul>
	<b>(15-20 min; Hiroyuki Tsujino)</b> An overview of the JRA-55 data sets for use in the next version of the CORE simulations. The overview will include why JRA-55 is chosen, its current status, and some preliminary results from CORE experiments.
<b>15:30-18:00</b>	<b>3. ARP/SORP/EBUS Cross-Panel Meeting</b>
<b>September 18, 2016</b>	
<b>13:30-15:00</b>	<b>4. ARP/SORP/PRP/IORP: Joint effort in Carbon and Other Ocean-Climate Researches</b>
<b>September 21, 2016</b>	
<b>12:10-13:30</b>	<b>5. ARP/CD Cross-Panel Meeting</b>

## Appendix 2: Participants to ARP Panel Meeting

<b>Name</b>	<b>Country</b>	<b>Role</b>
Ping Chang	USA	Co-Chair
Sabrina Speich	France	Co-Chair
Eric Chassignet	USA	Panel Member
Jeff Knight	UK	Panel Member
Maria Paz Chidichimo	Argentina	Panel Member
Moacyr Araujo	Brazil	Panel Member
Noel Keenlyside	Norway	Panel Member
Ruza Ivanovic	UK	Panel Member
Walter Robinson	USA	Panel Member
Young-Oh Kwon	USA	Panel Member
Jing Li	China	ICPO