

SAMOC

South Atlantic Meridional Overturning Circulation

SAMOC VI Workshop Report

Workshop date: *Sunday, February 21, 9am-6pm*

Workshop venue: *Ernest N. Morial Convention Center, New Orleans, LA, USA*

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Executive Summary: South Atlantic Meridional Overturning Circulation VI workshop

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Improving understanding of the South Atlantic Meridional Overturning Circulation (SAMOC) has been a key international science priority since the early 2000s (e.g. CLIVAR, 2003, <http://www.clivar.org/node/355>). The research community held the first SAMOC workshop in 2007, where a pilot observational plan was discussed. The first pilot trans-basin South Atlantic overturning circulation array was deployed in 2008-2009. In 2012, the international SAMOC initiative was endorsed as an important science activity by the International CLIVAR organization. Since the first SAMOC workshop in 2007 and the subsequent pilot deployments, several observing systems have been started and/or augmented to better observe this crucial oceanic phenomenon, and numerous modeling and analysis projects have sought to elucidate the complex physics that controls the spatial and temporal variability of SAMOC.

On February 21st, 2016, an international group of scientists convened the SAMOC VI workshop in New Orleans, Louisiana, USA to discuss recent logistical progress in projects that are contributing to the SAMOC initiative. The group also discussed the coordination of plans for future student and postdoctoral fellow projects, the SAMOC Data Sharing Policy, and other important items. Review presentations on recent advances in the SAMOC observing systems were given in several areas: the western and eastern portions of the South Atlantic Meridional overturning circulation Basin-wide Array at 34.5°S (“SAMBA”), the Tropical South Atlantic Array (“TSAA”) at 11°S, observations in Drake Passage, observations from long-term basin-wide observations (e.g. Argo, XBT, satellite), and related observations being made in the subtropical and subpolar North Atlantic. Some results from basin-wide modeling efforts were also presented.

There were several action items, outcomes, and/or recommendations identified during the workshop (in ***bold italics*** throughout the report). Discussions on data sharing and joint analyses were paired with discussions on future proposals and planned joint research cruises. The Executive Committee for the SAMOC Initiative was restructured, with one member stepping into an ‘emeritus’ status (S. Garzoli), a new chair (A. Piola) and a new co-chair (S. Speich) being appointed, and two new members being added (I. Ansorge and C. Meinen). The Executive Committee also recommended the creation of a “SAMOC Science Team”, which would include the principal investigators of funded projects that relate to the goals of SAMOC. Investigators wishing to be listed as part of the SAMOC Science Team were encouraged to contact a member of the Executive Committee (A. Piola, S. Speich, E. Campos, I. Ansorge, and C. Meinen). A prerequisite of a project being considered part of SAMOC is that the investigators of the project must agree to abide by the SAMOC Data Sharing Policy.

This report presents highlights of the main issues, recommendations, and results that were discussed during the SAMOC VI workshop.

Background

Variations in the Atlantic Meridional Overturning Circulation (AMOC) have been connected in numerical models with changes in numerous climate and weather phenomenon that are crucially important to society, including sea level changes, hurricane intensification, and changes in precipitation patterns (e.g., Broecker, 1995; Enfield et al., 2001; Vellinga and Wood, 2002; Stouffer et al., 2006; Zhang and Delworth, 2006; IPCC, 2013; Lopez et al., 2015; McCarthy et al., 2015). Improving understanding of the mechanisms that control the structure and variability of the AMOC was designated as a key near-term science priority for several countries in the Atlantic region – and enhanced AMOC observation programs began being put in place in the North Atlantic in the early 2000s (e.g. Cunningham et al., 2007; Send et al., 2011). Development of similar observing systems to study the AMOC in the South Atlantic have lagged behind the observing system in the North Atlantic, due primarily to logistical and funding issues rather than questions of scientific importance, however the need for better AMOC observations in the South Atlantic has been widely acknowledged. Consequently, in 2012 the international CLIVAR organization endorsed a broad framework for a South Atlantic Meridional Overturning Circulation (SAMOC) initiative that has been built over the past decade or so by scientists from many countries that border the Atlantic. SAMOC is also one of the two Atlantic regional observing systems being assessed as part of the European AtlantOS effort to integrate the Atlantic observing system under *WP5: Integrated Regional Observing Systems*. Initial efforts for a trans-basin *in situ* AMOC observing array have been made at 34.5°S (Meinen et al., 2013), and plans for an enhanced array at that latitude are well underway (Ansorge et al., 2014). There are also efforts underway to build a sustained trans-basin AMOC array at 11°S (e.g., Hummels et al., 2015).

A series of workshops aimed at improving scientific understanding of the SAMOC have been ongoing for several years, dating back to the first workshop in 2007 in Buenos Aires, Argentina (http://www.aoml.noaa.gov/phod/SAMOC/index_SAMOC1.html). Workshops have been held roughly every 18 months to provide opportunities to review the scientific advances in SAMOC research, identify significant observational gaps, and to develop plans for collaborations for joint research cruises, observing arrays, publications, and student and postdoctoral researcher opportunities. On February 21st, 2016, an international group of scientists met in New Orleans, Louisiana, USA to discuss recent logistical progress in projects that are contributing to the SAMOC initiative. This was termed the sixth SAMOC workshop. The focus of the SAMOC VI workshop was primarily logistics, as a SAMOC science session followed on February 22nd, 2016 during the Ocean Sciences meeting. This report provides an overview of the discussions during the one-day SAMOC VI workshop.

Workshop presentations

The SAMOC VI workshop began with five brief presentations providing updates on key elements of the broader SAMOC observing system. SAMOC review presentations were given on: the western portion of the South Atlantic Meridional overturning circulation Basin-wide Array (“SAMBA”) – by A. Piola, the eastern portion of SAMBA and the region south of Africa – by S. Speich, the TSAA at 11°S – by R. Hummels, observations in Drake Passage – by T. Chereskin, and observations from long-term basin-wide observations (e.g. Argo, XBT, satellite) – by S. Dong. A sixth brief review presentation was given on related observations being made in the subtropical and subpolar North Atlantic to provide a more holistic picture of the whole-Atlantic AMOC system – by D. Smeed. Highlights of these presentations are provided here.

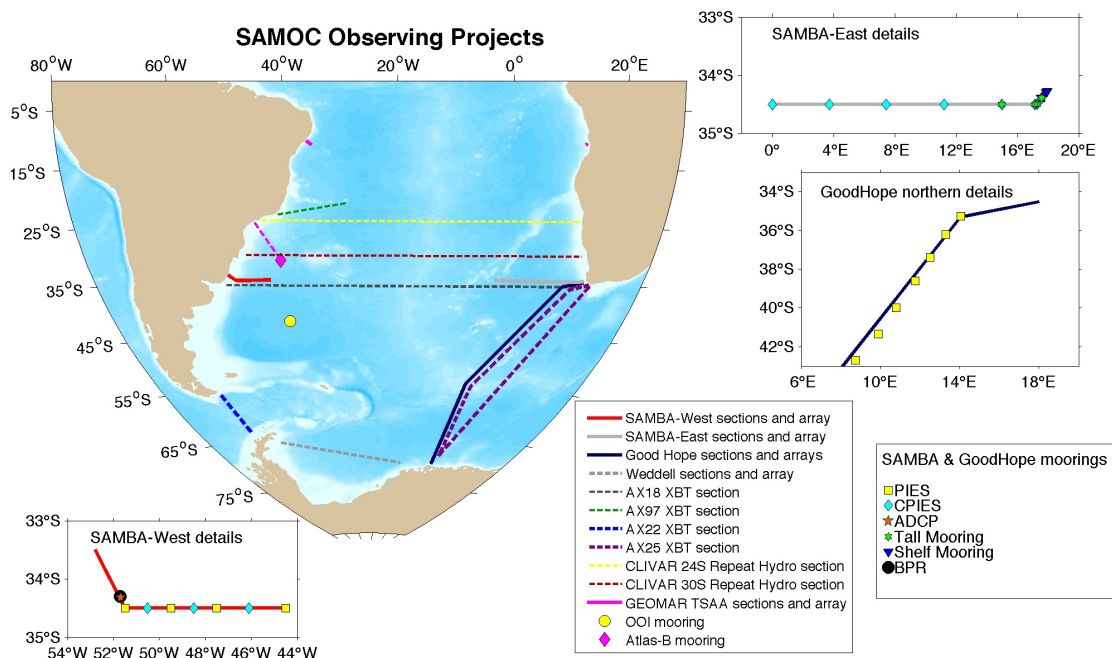


Figure: Schematic map illustrating many of the observing system components collecting SAMOC-related measurements in the South Atlantic.

SAMBA West

The SAMBA array has moorings on both the western and eastern sides of the basin, with moored instruments extending from near the shelf break on either side out to several degrees of longitude offshore of the continental slope. The western component of the SAMBA array consists of four pressure-equipped inverted echo sounders (PIES), which have been maintained via the NOAA-funded Southwest Atlantic MOC (SAM) project since March 2009, and three current-and-pressure-equipped inverted echo sounders (CPIES), which have been maintained via the Brazilian-funded “SAMOC-Br” project since December 2012. The Brazilian array also included a bottom pressure recorder (BPR) and a bottom-moored acoustic Doppler current profiler (ADCP) at the 200 m and

400 m isobaths, respectively, during December 2013 to November 2015; the BPR and ADCP will be redeployed in May 2016. In addition to the moored instruments, routine CTD sections (some including lowered-ADCP) are conducted both along the SAMBA-west mooring line and up onto the shallow continental shelf (where important Brazil Current signals are observed).

The most recent cruise on the western boundary was in November 2015, when the NOAA Site B PIES was recovered and redeployed, and when the Brazilian BPR and ADCP were recovered. Several cruises are planned for the SAMBA-west line within the next two years. The first cruise is scheduled for May 2016 onboard the Brazilian research vessel N. Oc. Alpha-Crucis; during this cruise three of the NOAA PIES and all three Brazilian CPIES will be recovered and redeployed, the Brazilian BPR and ADCP will be redeployed, and a full-depth CTD section will be occupied along the array and up onto the continental shelf. Later cruises are scheduled for September 2016, on the Argentine research vessel ARA Austral, in April-May 2017, on the N. Oc. Alpha-Crucis, and in September 2017, on the ARA Austral. During each of these future cruises CTD (and sometimes lowered-ADCP) profiles will be collected along the line and up onto the shelf, and daily average data from the PIES and CPIES will be acoustically downloaded.

Challenges for the SAMBA-west region continue to include finding reliable ship time on research vessels, finding funding for tall ‘dynamic height’ style moorings that would better capture the nuances of water property changes particularly in the Deep Western Boundary Current, and finding funding to support personnel to process and analyze the data collected from the moored instruments (and the related programs such as Argo, high density XBT, satellite altimetry, etc.). Possible solutions and/or new possibilities that were discussed include a possible proposal from new British partners (G. McCarthy and D. Smeed and colleagues at the National Oceanography Centre) to place tall dynamic height moorings interspersed within the existing PIES/CPIES array, and the possibility of deploying glider(s) to collect additional hydrographic data in the region and/or to acoustically download data from the existing PIES/CPIES instruments.

SAMBA east

The eastern side of the SAMBA array presently consists of seven CPIES and two bottom-moored ADCP that are deployed from the top of the continental slope offshore to near the Walvis Ridge, which have been maintained by France since September 2013 (an earlier pilot array of two CPIES was deployed by France during 2008-2010), as well as four tall dynamic height and current meter moorings, which have been maintained by South Africa since September 2014. France is also maintaining an array of seven PIES along the “GoodHope” line that extends to the southwest from the SAMBA-east array under a satellite altimeter track toward the prime meridian; these have also been in place since September 2013. In addition to the moored instruments, CTD sections have previously been collected along these lines by South Africa, Russia, and Germany.

The French CPIES and ADCP were recovered and redeployed in September 2015, and the South African tall moorings were turned around shortly thereafter in October 2015.

Future cruises are planned in order to recover and redeploy the French and South African moored instruments every 12-24 months. The South African partners are also working to deploy moorings up on the shallow continental shelf in the near future, however fishing activities in the region complicate this planning. A new postdoc (M. Kersale) has just been brought onboard at the Univ. of Cape Town to work on the analysis of the SAMBA-east and GoodHope moored data sets. In addition, a dedicated full hydrographic cruise along this section of the SAMBA array is being planned for July 2016.

Challenges for the SAMBA-east region include the aforementioned fishing challenges for moorings near the top of the continental shelf, as well as funding for processing and analysis of the data from the moored instruments (both CPIES/PIES and tall moorings). Technical challenges in telemetering data from PIES/CPIES also persist. ***Action item: A suggestion was made to investigate the possibility of sending a NOAA/AOML technician on a future cruise to help investigate the acoustic conditions of the South African vessel and for telemetry training purposes.*** A troubling issue with salinity corrections in the Argo profiles in the region was also noted – which will cause additional difficulties in interpreting the CPIES/PIES data and the CTD data. There are also some logistics challenges ongoing between agencies in France that are supporting substantial components of the SAMBA-east and GoodHope arrays – it is hoped that a way forward to address this has been found.

TSAA at 11°S

Several previous observing programs have been led by German institutions looking at the western boundary flows using mooring arrays at both 5°S and 11°S in the tropical South Atlantic. The earlier array at 11°S during 2000-2004 in particular found important results for the deep lower limb of the AMOC at that latitude. A new project, funded/supported under the German RACE, PREFACE, and SACUS programs with additional funding from GEOMAR, led to the July 2013 deployment of four tall current meter moorings and one PIES on the western boundary and two tall current meter moorings and one PIES on the eastern boundary along 11°S in order to observe AMOC related variability.

These moored instruments have been recovered and redeployed twice on the west side, and once on the east side, since the initial deployment, most recently when the entire array was turned around in October-November 2015. The array will be turned around again in September-October 2016, with a final cruise scheduled for boreal spring 2018.

Challenges for the 11°S array are centered around finding a sustained funding source beyond 2018. The plan beyond that point is for the western array to continue as a collaboration with Brazil, with instruments provided by GEOMAR and consumables provided from Brazil. Plans for extending the eastern boundary are still under discussion.

Drake Passage

Continuous and/or routine observations of the flow through Drake Passage have been ongoing for decades. The ‘SR1b’ section was first occupied in 1993-1994, and there

have been 21 complete hydrographic sections collected to date by international partners. The most recent full 'GO-SHIP' section (formerly known as CLIVAR Repeat Hydrography) along this line was in 2008-2009, and a repeat is planned in 2018-2019. Continuous observing via BPR on the northern and southern continental slopes has been ongoing since 1992 via funding from the United Kingdom. Routine underway air-sea observations for climate research have been collected six or more times each year via the ARSV Gould since 1996, with X-CTD and XBT profiles obtained at high spatial resolution and new observational systems added every few years (e.g., NB150 ADCP in 1999, pCO₂ in 2002, OS38 ADCP in 2004, and atmospheric O₂ and CO₂ in 2012). The 'cDrake' project involved an array of about 35 CPIES and three short current meter moorings that quantified the detailed flow through the Passage from December 2007 through December 2011. Lastly, there is work ongoing to develop an improved observing system in the Drake Passage that will capture carbon, nutrients and oxygen using about 200 biogeochem-equipped profiling floats deployed in the Southern Ocean through the Southern Ocean Carbon and Climate Observations and Modeling project (SOCCOM, <http://socom.princeton.edu/>). Coupled with work using the Southern Ocean State Estimation (SOSE) system, these observation and modeling systems are providing unprecedented information about the flow through Drake Passage.

Challenges in Drake Passage are centered on obtaining a sustained funding source, at least for several of the projects. The 'cDrake' project ended in 2011, and as such the continuous time series observations that were being provided across the Passage are no longer being made. The routine underway observations made on the ARSV Gould are funded only through 2016, although proposals are pending that would continue this project through 2019.

XBT, CTD, Argo and Altimetry

Several basin-scale observing programs continue to provide crucial measurements in the South Atlantic that can produce estimates of the AMOC and/or key components of the AMOC at select time scales. There were no GO-SHIP CTD cruises in the past 18 months, however the long-term XBT program continues to collect trans-basin sections along 34.5°S ("AX18") approximately quarterly each year, and AX8, AX22, AX25, and AX97 routinely sample in the South Atlantic, south of South Africa, and across Drake Passage. Quarterly AMOC (and heat transport) estimates from AX18 now extend for almost 15 years.

In addition to routine ship sections, *in situ* observations from Argo have been combined with satellite altimetry and wind products to create lower frequency (monthly and longer period) time series of AMOC and heat transport estimates extending either back to 2004 (for the Argo-centered product) or to 1993 (for the altimeter-centered product). These products allow for analysis of the latitudinal coherence of the AMOC variability in a way not possible with the *in situ* moored arrays (which are much further apart latitudinally). These products can also be used to study key components of the AMOC as they vary with latitude. Several studies are also ongoing for using numerical models to determine the impact of reduced AMOC sampling in time and/or in space. Finally, new coupled

climate model products are being used to understand the impacts of AMOC variations on continental precipitation patterns and other weather signals in both the southern and northern hemisphere.

North Atlantic

The AMOC variability in the South Atlantic does not occur in a vacuum, and it is important to understand these variations in the context of the variations in the North Atlantic, which have been more intensively studied over a longer period. The longest *in situ* continuous (12-hourly) AMOC record, collected at 26°N as part of the “RAPID-MOC”, “MOCHA”, and “WBTS” projects, now extends for 4211 days, or just over 11.5 years. The U.K.-NERC (RAPID-MOC) and U.S.-NSF (MOCHA) components are funded through 2020; the U.S.-NOAA (WBTS) component is part of the Global Ocean Observing System (GOOS) and should continue indefinitely. The MOVE array at 16°N captures the deep limb of AMOC in the western basin; this record now extends for nearly 16 years and is expected to continue for some years. There are also long time series of several AMOC components at different choke points, including the overflows from the Greenland-Iceland-Norwegian basins. The need for better observations near the deep water formation regions has resulted in a new array, the “Overturning in the Subpolar North Atlantic Program” (OSNAP, <http://www.o-snap.org/>), that extends from Labrador to the southern tip of Greenland and over to Scotland. The OSNAP array was first deployed in mid-2014, and the moored instruments in the array have been and/or will be turned around every 1-2 years since. The OSNAP experiment also involves glider observations and an extensive RAFOS float deployment. The first AMOC estimates from the array are expected to be reported by mid-2017, and the data will be made publicly available within 2 years after that.

In addition to the moored observing systems, routine trans-basin XBT sections continue between Miami and Gibraltar (“AX7”), and routine observations by the Argo array and satellite observations allow for similar computed products such as the 41°N AMOC time series available over the altimeter period since 1993. Numerous ongoing studies are comparing the observed AMOC variations in the North Atlantic with nearby weather and climate signals, and the expanding AMOC data sets in the South Atlantic should prove to be excellent analysis tools together with the existing and extending North Atlantic time series going forward.

Future plans and logistics discussions

After the overviews of key components of the SAMOC observing system were presented, the late morning and afternoon of the SAMOC VI workshop focused on discussions of future plans of the many international partners in the project. In what follows, the highlights of these discussions are presented.

New funding and proposal plans

All of the major SAMOC field studies appear to be safely funded through 2016, although several are in the process of submitting renewal proposals to continue their observing projects beyond 2016.

Focusing on new components of the SAMOC observing system, one new addition that was discussed was that the South African group had obtained funding to support a postdoctoral researcher, M. Kersale, who will be collaborating with both I. Ansorge in South Africa and S. Speich in France to process and analyze the CPIES and tall mooring data from the eastern side of the SAMBA array. Two other relatively recent postdoctoral researchers at CIMAS-AOML, H. Lopez and S. Majumder, are continuing to work on SAMOC related science using funding obtained in the past 1-2 years. A new postdoctoral researcher, P. Castellanos, has begun working in Brazil on a project studying the western boundary currents in the South Atlantic in the HYCOM model and comparing the model realizations to observations. Support for graduate students to work on SAMOC-related science has been obtained in several countries. ***Action Item: It was suggested that SAMOC projects seek to provide fieldwork-training opportunities going forward for existing and future students, and there seemed to be broad support to do this via existing proposals and to include it in future proposals.***

Two specific future proposals were discussed – both still being in the planning stages. The first, led by G. McCarthy, D. Smeed and colleagues at the National Oceanography Centre (NOC) in Southampton, would seek funding to deploy tall dynamic height moorings interspersed within the PIES/CPIES moorings in the western side of the SAMBA array. The second proposal, to be led by A. Bower at WHOI and S. Lozier at Duke Univ., would be for a RAFOS float deployment that would target the DWBC and the associated water mass pathways in the South Atlantic between 5°S and 40°S. In addition to these new proposals, several future funding opportunities were discussed, including the bilateral proposal opportunities between Brazil and France, between Brazil and the United Kingdom, and within the European Union as part of the AtlantOS initiative. A number of attendees at the workshop indicated that they would be considering submitting future proposals to these and other proposal calls. Another goal that was discussed in relation to future proposals was the idea of testing new Deep Argo floats in the South Atlantic region – it was noted that the U.K. researchers had several Deep Argo floats that they were considering deploying in the South Atlantic. Researchers in Germany also may have Deep Argo floats available for this endeavor.

One issue that was raised several times during the discussions of existing and new SAMOC fieldwork was ship time challenges. Several people mentioned the ongoing difficulties of obtaining reliable ship time, particularly in the western basin region, and that this has potential impact on proposals for new fieldwork in the region. While no simple solutions were found in the discussions, two suggestions were raised. First, it was noted that limited ship time is often prioritized toward cruises that involve multiple programs, so proposals for future fieldwork might have an incentive to look for opportunities for piggy-back projects where ship time could be shared. The second point that was raised was that new proposal might seek funding to employ new technologies that will reduce the need for future ship time. Specifically, the use of ‘data pods’, gliders,

or other technologies that would get data back to land without need for ship time, or which require reduced amounts of ship time, may provide advantages for proposals looking to do new field work. It was noted that all annual logistic voyages on the South African Polar Research vessel the SA Agulhas II offer an opportunity for both Argo/glider deployments as well as underway measurements across the SAMBA (September – October), GoodHope (December – February).

Another suggestion that was made for future proposals was that there was a strong incentive in the proposal calls in several countries to include research into the societal impacts of the AMOC variations. One postdoc involved in a SAMOC project (H. Lopez) is already working in this area, and there was general agreement to promote the inclusion of societal impacts in future proposals on SAMOC. ***Action Item: Seek new international funding opportunities that can broaden the interdisciplinary nature of SAMOC research, and further examine the societal impacts of SAMOC.***

Finally, it was noted that in addition to science proposals, there are opportunities available for small proposals that would fund short trips to participate in cruises conducted by other groups, foster collaboration among SAMOC groups and/or conduct small, focused workshops. Opportunities from POGO, and for SCOR working groups were specifically discussed, as well as national and international funding for such interactions that are available in several countries. For the SCOR working group, it was noted that few physical oceanography proposals are submitted each year, and this seemed like a good opportunity for an early career scientist to take the lead, with the help of the SAMOC Executive Committee. ***Action item: Put together a SCOR WG proposal that would help set up the framework for future workshops as well as facilitate collaborative work on SAMOC science.***

Future cruise plans

The wealth of observations presently being collected on SAMOC topics of interest is in many ways the result of significant research ship time provided by the international partners involved in SAMOC. In order to maximize the opportunities for piggy-backing additional science on these cruises, it is crucial for the community to know about cruise possibilities far enough in advance to be able to develop and execute plans. ***Action Item: A strong recommendation that came from the discussions on this topic is that project lead investigators and cruise chief scientists need to make sure they provide information about their future cruises on the SAMOC International web page that is hosted at NOAA/AOML (www.aoml.noaa.gov/phod/SAMOC_international/).*** This web page is presently maintained by R. Perez, and is updated roughly once a month (or when new information is submitted). Keeping the future cruise list up to date may also help find opportunities for drifter and Argo float deployments and supporting other crucial basin-wide observing system programs that will ultimately contribute to advancing the goals of SAMOC. We will return to a discussion of the web page and improving communication within and beyond the community shortly.

Future publication plans

The attendees of the workshop mentioned numerous publications that are presently underway or planned, including papers on boundary currents on both the western and eastern sides of the basin, model-data comparisons, and analyses of spatial and temporal variability of AMOC in the South Atlantic. A number of student-led papers were also discussed based on their ongoing graduate work, as well as postdoc-led papers. Perhaps the two key discussion items that came up within this topic were the idea of a possible future synthesis article as well as the need for an AMOC-related white paper for the OceanObs'19 meeting. Regarding the synthesis article, S. Speich noted that she and S. Cunningham are involved in an already-underway whole-Atlantic AMOC review article, for which S. Cunningham will be leading the North Atlantic discussion and S. Speich will be leading the South Atlantic discussion. The general consensus within the group was that planning for any future SAMOC-based synthesis articles should wait until the already underway article is completed. Discussion then turned to the OceanObs'19 white paper. It was widely agreed that unless the SAMOC community pushes hard and gets some of its members involved as lead/co-authors of the AMOC white paper for the OceanObs'19 meeting, the article will likely revert to a 'North-Atlantic-only' discussion as has been a problem in the past. ***Action Item: Members of the SAMOC Executive Committee and other SAMOC-involved researchers should seek involvement in the AMOC white paper for the OceanObs'19 meeting to prevent the white paper from missing several critical science issues that are best addressed in the South Atlantic.***

Student and postdoctoral research plans

Developing a strong new generation of scientists is of great importance to the SAMOC community, and it is a major area of effort for many of the SAMOC participants. Research by students and postdoctoral researchers often provides innovative and important new results in any field – and research into SAMOC is no different. The workshop discussions on this topic revealed that a number of students and postdocs are already working on exciting analyses, and much of the discussion at the workshop focused on finding ways to further facilitate research and opportunities for students and postdocs while avoiding overlap and/or duplication on research topics. The best solution that emerged from this discussion is for both student/postdoc advisers and the students and postdocs themselves to keep the SAMOC community informed about what they are working on by keeping up to date the list of student/postdoc projects on the aforementioned SAMOC International web page. ***Action Item: Advisers of students and postdoctoral researchers, as well as the students and postdocs themselves, will post information about their projects on the SAMOC International webpage, and the SAMOC community is also encouraged to review this web page from time to time to ensure that none of us unintentionally scoop or otherwise impinge on ongoing projects without communicating and coming to some sort of agreement beforehand.*** (This also relates to the Data Sharing Policy discussion, which we will come to shortly.)

A second line of discussion on this topic revolved around possibly developing future summer schools or brief educational opportunities for students. One such activity immediately preceded the SAMOC V workshop in Buenos Aires in December 2014 and

was deemed successful by the SAMOC community, and several other summer school examples were mentioned. While there was no specific suggestion that arose from this discussion, there was general agreement that as an *Action Item, the SAMOC community should continue to look into possibilities for a SAMOC-related summer school or similar student education opportunity.*

Data analysis issues and bottlenecks

Many of the SAMOC-related projects have been ongoing for some years now, with their data processing streams well established and their major issues successfully addressed. The newest projects, in particular the eastern contributions to the SAMBA array, were the center of much of the discussion on this topic. Data return from the SAMBA-east moored instruments has in general been quite good, and with the addition of the new postdoctoral researcher working with the South African and French groups, it is envisioned that the personnel-time situation to address the PIES/CPIES, ADCP, and tall mooring data is now in good shape. Key members of the technical group in South Africa participated in a joint workshop in July 2015 with mooring experts from the U.K. NOC in Southampton, and many of the ‘lessons learned’ by the group involved in the 26°N array have been brought to the attention of the 34.5°S team. Consensus is that within six months it will be possible to reevaluate whether there are any remaining bottlenecks in the processing stream for the SAMBA-east instruments. Another problem that has arisen in the SAMBA-east region has been fishing issues relating to the shallow bottom-ADCP and short mooring on the continental shelf. The shallow sites will not be redeployed until a firm agreement with the fishing organizations in the region can be reached. Fishing is also a concern for the deployment of instruments in the shallow continental shelf off southern Brazil and Uruguay, and statistics on fishing activity have been used to select the deployment locations of the BPR and ADCP on the upper slope.

The other items that came up in this discussion related to the future plans and proposals that were discussed earlier. There have been some institutional changes of personnel in France over the past two years, but there is hope that these changes can be managed and that perhaps with the involvement of additional researchers, the French contribution to the SAMBA array can continue uninterrupted. There was also some concern within the groups proposing new work in the area with regards to whether the existing groups expected and planned to still be working and making their data available for joint analyses in a few years, when the new observations would be available. While there have been a few observing systems that contributed previously to SAMOC that are no longer being maintained (e.g., the extensive cDrake array), the discussion revealed that the bulk of the observing systems making key SAMOC measurements are envisioned to continue for years to come. The consensus view is that for AMOC-related observations, records of at least one decade in length are really necessary to detect AMOC variability, and longer records would be even more valuable. So the group agreed that the new observations being proposed would make the available data sets even richer, and there is universal support for future joint analyses that would involve these new observations. The long-term members of the SAMOC community made it clear that the SAMOC initiative is intended to be broad, encompassing any research in the region that is directly or

indirectly associated with the AMOC, and the group is always happy to incorporate new participants. It was noted though, that a prerequisite of a project being considered part of the SAMOC initiative is that the investigators must agree to abide by the SAMOC Data Sharing Policy (see Appendix 3, and also next section).

Data sharing policy, issues and plans

One of the outcomes of the SAMOC V workshop in December 2014 in Buenos Aires, Argentina was the recommendation that a formal written SAMOC Data Sharing Policy be created and posted on the SAMOC International web page. Shortly after the December 2014 workshop, this data policy was created and approved by the SAMOC Executive Committee, and the policy has been posted on the initiative's web page ever since (see Appendix 3). In essence, data collected as part of a project that is part of the SAMOC Initiative is to be made publicly available with 'no-strings-attached' as soon as possible after collection and calibration – i.e. definitely within one year and ideally within six months or less. The policy also encourages people who use this data to invite the data collectors to participate in papers that are strongly dependent on their data sets, and it also strongly encourages data users to strive to avoid duplicating work that is already being done, particularly by students and postdoctoral researchers. ***Outcome: During the new SAMOC VI workshop, the participants reviewed the Data Sharing Policy and agreed that in order to claim that a project is part of the SAMOC Initiative, researchers must follow the SAMOC Data Sharing Policy.***

Another discussion item in this topic was the recommendation for data providers to obtain 'digital object identifiers', or 'doi', for their data sets. These doi can then be cited by data users to ensure proper credit goes to the originating people and agency for different data sets. The participants also discussed the possibility of publishing data sets directly in data journals, which represents another way to ensure data originators get credit for their work producing data sets. ***Action Item: SAMOC participants with experience in this area (e.g. A. Piola) will provide information via a post on the SAMOC International webpage, detailing their experience doing this with hydrographic data collected along the western boundary at 34.5°S.***

Finally, on this topic area the participants discussed ensuring the data collected as part of the SAMOC Initiative is archived appropriately so that it is available into the future – a critical need for the study of a system like the AMOC that varies on time scales of decades and beyond. It was noted that funding agencies in several of the participating countries have mandatory data archiving requirements (e.g., NOAA data must be archived through NCEI/NODC), which is helpful, however in past experience no single archive has demonstrated 100% reliable archiving. ***Outcome: The workshop participants agreed that a goal for all projects would be to archive their data in at least two locations, i.e. their own national mandated archive location and a second, independent, archive site either through a different country's archive or via a second venue such as OceanSITES.*** There was also some discussion of hosting data sets, or links to data sets, on the SAMOC International webpage. There seemed to be some interest in setting up a 'Data Access' subpage for the SAMOC web page, with links to data sets hosted on

individual data originator web pages and/or for small data sets to be hosted directly on the SAMOC International web page. **Action Item: This possibility will be explored over the next year or so, as data sets become available.**

[SAMOC web page, data serving, email list, etc.](#)

As noted previously, the SAMOC International webpage (www.aoml.noaa.gov/phod/SAMOC_international/) came up several times in the discussions during the workshop, particularly as a place to inform the community about upcoming cruise opportunities, about ongoing student and postdoctoral researcher projects, and possibly as a location for sharing data sets. Beyond these tasks, the discussion regarding the web page was centered mainly on whether the web page as it exists was useful and being used, and on how the SAMOC community could use the web page and/or other social media venues (Twitter, blogs, etc.) to provide information both to the SAMOC community and to the public at large. It was noted that some ‘tweets’ had already been sent out through Twitter using the hashtag #SouthAtlanticMOC, and that this might be a way to bring our research to a wider audience. Another suggestion that was raised was that it might be a good idea for the community to obtain a simpler web page address such as “www.samoc.org”. There was some favorable discussion about this, and it will be pursued over the next few months. **Outcome: A strong recommendation that arose was for each of the SAMOC participants to make sure that their home institutions and home project web pages all have a link to the SAMOC International web page.**

[New technology ideas](#)

The discussion on new technology, an important issue given the ongoing ship time issues, was spread somewhat throughout the afternoon discussion. Primarily the two technology ideas that were discussed were the ‘data pod’ possibilities for getting data home from subsurface moored instruments without need (or with reduced need) for research ships, and the use of gliders to collect hydrographic profiles and mooring data remotely without need for research vessel time. The ‘data pod’ idea is being pursued by groups in several countries, but implementation on anything other than a prototype-testing level is likely a few years in the future. Gliders are already being used in the upper ocean in many locations, and they may represent a useful option for measuring upper limb AMOC signals. However gliders that can reliably observe the deeper limb of the AMOC are some years off as well. The general consensus of the workshop participants was that this was something that should continue to be pursued, but that it would not likely make radical changes to the existing systems in the next few years.

[Executive committee update](#)

After completing the primary topics on the agenda, the workshop participants shifted to a few ‘housekeeping’ items. First was an update for the SAMOC Executive Committee. **Outcomes: The Executive Committee for SAMOC was restructured, with one member stepping into an ‘emeritus’ status (S. Garzoli), a new chair (A. Piola) and a new co-**

chair (S. Speich) being identified, and two new members being added (I. Ansorge and C. Meinen). The Executive Committee also recommended the creation of a “SAMOC Science Team”, which would include the principal investigators of funded projects that relate to the goals of SAMOC. It was stated that investigators wishing to be listed as part of the SAMOC Science Team were encouraged to contact a member of the Executive Committee (A. Piola, S. Speich, E. Campos, I. Ansorge and C. Meinen) with the names of the principal investigators, the name of the project, and (if available) the project web page. The EC members will then add this information to the SAMOC International webpage. (Note the earlier requirement that projects wishing to be listed as part of SAMOC are required to follow the SAMOC Data Sharing Policy.)

Plans for the next meeting

The final item discussed at the workshop was planning for the next SAMOC workshop (“SAMOC VII”). Several possible venues were discussed, and there was general agreement that it would be useful to have the meeting adjacent to another major meeting. The idea of having the next workshop roughly 18 months in the future seemed agreeable to most, which suggested a mid-2017 time window. One option that was suggested, which garnered considerable agreement, was the possibility of having the next SAMOC workshop adjacent to the IAPSO-IAMAS-IAGA meeting that will be held in Cape Town, South Africa, during August 27-September 1, 2017. Other options that were mentioned were upcoming meetings in Barcelona and Kiel, although there were questions on how many SAMOC participants would be planning to attend those meetings. **Action Item:** *The SAMOC Executive Committee will discuss this further and will circulate news at some point in the next few months.*

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Appendix 1: Workshop agenda

South Atlantic Meridional Overturning Circulation (SAMOC) VI Workshop New Orleans – February 21, 2016

Date: Sunday, February 21, 9am-6pm

Venue: Ernest N. Morial Convention Center, Room: 217-219

Workshop organizers: Christopher Meinen and Renellys Perez

Agenda

<i>9:00am-9:10am</i>	Welcome and overview of workshop goals	Chris Meinen
<i>9:10am-9:30am</i>	Brief overview of SAMOC	Silvia Garzoli
<i>9:30am-10:30am</i>	Updates on Observing System status	Chair: Renellys Perez
	<ul style="list-style-type: none">• SAMBA-west (Alberto Piola)• SAMBA-east (Sabrina Speich)• 11°S array (Rebecca Hummels)• Drake Passage (Teri Chereskin)• XBT, CTD, Argo, Altimeter (Shenfu Dong)• N. Atlantic (David Smeed)	
<i>10:30am-11:00am</i>	Coffee break	
<i>11:00am-Noon</i>	Updates on Observing System status continued	
<i>Noon-1:30pm</i>	Lunch break	
<i>1:30pm-3:30pm</i>	Discussion of Logistics issues	Chair: Chris Meinen
	<ul style="list-style-type: none">• Future proposal plans and opportunities• Future cruise plans and opportunities• Existing and future publication plans• Student and postdoc project plans• Data analysis issues: Are there bottlenecks?• Data sharing: Policy, issues and future plans• SAMOC webpage, data serving, email list, etc.• New Technology ideas?	
<i>3:30pm-4:00pm</i>	Coffee break	
<i>4:00pm-5:20pm</i>	Discussion of Logistics issues continued	
<i>5:20pm</i>	Closing	

Appendix 2: Workshop participants

Edmo Campos	University of Sao Paulo, Brazil
Marcela Charo	Servicio de Hidrografia Naval, Argentina
Teri Chereskin	Scripps Institution of Oceanography, USA
Maria Paz Chidichimo	Servicio de Hidrografia Naval, University of Buenos Aires, and CONICET, Argentina
Shenfu Dong	CIMAS, University of Miami & NOAA/AOML, USA
Silvia Garzoli	CIMAS, University of Miami & NOAA/AOML, USA
Raul Guerrero	Instituto Nacional de Investigación y Desarrollo Pesquero, Argentina
Rebecca Hummels	GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany
Marion Kersalé	Department of Oceanography and Marine Research Institute, University of Cape Town, South Africa
Nicolas Kolodziejczk	Laboratoire de Physique des Oceans, University of Brest and IFREMER, France
Christophe Maes	Laboratoire d'Océanographie Physique et Spatiale (LOPS), Univ. of Brest, Ifremer, CNRS & IRD, France
Sudip Majumder	CIMAS, University of Miami & NOAA/AOML, USA
Gerard McCarthy	National Oceanography Centre, United Kingdom
Christopher Meinen*	NOAA/AOML, USA
Jose Pelegri	Institut de Ciencies del Mar, CSIC, Spain
Renellys Perez*	CIMAS, University of Miami & NOAA/AOML, USA
Alberto Piola*	Servicio de Hidrografia Naval, and University of Buenos Aires, UMI IFAECI/CONICET/CNRS, Argentina
Regina Rodrigues	Universidade Federal de Santa Catarina, Brazil
Martin Saraceno	University of Buenos Aires, CIMA/DCAO and UMI IFAECI/CONICET/CNRS, Argentina
Claudia Schmid	NOAA/AOML, USA
David Smeed	National Oceanography Centre, United Kingdom
Sabrina Speich	Ecole Normale Supérieure, France
Janet Sprintall	Scripps Institution of Oceanography, USA
Diane Stanitski	NOAA/CPO-COD, USA
Daniel Valla	Servicio de Hidrografia Naval, CONICET, Argentina

*Workshop organizing committee

Appendix 3: SAMOC Initiative Data Sharing Policy

The Data Sharing Policy agreed upon and approved as part of the earlier SAMOC V workshop is reproduced here. The participants in the South Atlantic Meridional Overturning Circulation (SAMOC) Initiative have agreed to the following sharing policy for data collected in projects that are part of SAMOC:

The overarching goal of this policy is to make high quality, fully calibrated, data available broadly to the science community and to the public as quickly as possible. Toward that end, we agree to the following:

- Data collectors are encouraged to publish data in journals that publish original data sets such as Earth System Science Data, Geoscience Data Journal, or CODATA Data Science Journal, etc. as soon as possible after collection with the objective of establishing the source institution(s) that funded the collection of the data sets.
- Data collected will be made available to other SAMOC participants, the science community, and the public immediately after collection and quality control are completed solely for the purpose of calibrating parallel observations and/or models. Users receiving data immediately agree to not use this data for publication or to include it in scientific presentations without the prior approval of the data collectors.
- Data will be made available to other SAMOC participants, the science community, and the public without restriction at the soonest possible time after collection, ideally within six months, and no longer than one year. Data will be made available through at least some of the major data centers including (but not limited to): the National Oceanographic Data Center, the British Oceanographic Data Centre, OceanSITES, etc. in addition to any individual project web pages.
- Within the SAMOC group, data recipients are encouraged to invite scientists involved in the data collection to participate in analyses and publications that depend significantly on the data they collected. This is not intended to force co-authorship; scientists who are invited to participate but who fail to significantly contribute to manuscript development will have no expectation of co-authorship. This practice of inviting participation of data collectors in analyses and publications is also encouraged with data users in the broader scientific community.

Users of SAMOC data are encouraged to keep the groups collecting data informed on how their data is being/will be used. Users are also strongly encouraged to make a good faith effort to inform others and to inform themselves about what graduate students are working on and the projects they are presently conducting in order to minimize duplication of effort to the extent possible and to protect the work of students that may require more extended development time.

This policy does not in any way prevent SAMOC data collectors from sharing their data in a less restrictive manner than is described here - this policy represents only a minimum requirement for inclusion in the SAMOC Initiative.