



Working Group on the South Atlantic Meridional Overturning Circulation SAMOC-WG

FINAL REPORT

Project Summary:

The SAMOC-WG was created with the overall goal to expand the international participation in the SAMOC initiative, for the enhancement of the general moored array, to help in the conduct of more intense samplings of hydrographic properties along the whole extent of the SAMBA line and to conduct and analyze the results of numerical experiments. The general strategy was to strengthen the existing collaboration among South Atlantic countries and to establish closer links with the North Atlantic initiatives, allowing for inter-comparison of the array designs, data analysis techniques and methods for calculating the transports of volume, heat and freshwater, enabling best practices to be shared amongst all teams observing the AMOC.

Activities Conducted from July to November 2015:

The main activities in the period, as indicated in the original proposal, were the participation of WG members in key international meetings and conferences, to present the status of the SAMOC and to discuss ways for its strengthening and increase in international collaboration. Following is a list of the meetings attended during this period.

- 1) **The RAPID-US AMOC International Science Meeting, in Bristol, U.K. – 21-25/Jul/2015.**

SAMOC WG Participants: Edmo Campos (Brazil); Renellys Perez (U.SA); Elaine McDonagh and David Smead (U.K).

Activities conducted: Presentations about SAMOC and discussion with potential collaborators.

- 2) **The COCOA Meeting, in Southampton, U.K. – 27-29/Jul/2015.**

WG Participants: Edmo Campos and Olga Sato (Brazil); Alberto Piola and Maria Chididhimo (Argentina); Isabelle Ansorge and Mike Roberts (South Africa); Elaine McDonagh and David Smead (U.K.).

Activities Conducted: Discussions towards the establishment of a partnership between the National Oceanography Center and the current participants of the South Atlantic Array, with the following objectives :

- To identify forms of linking the observations of the AMOC in the North Atlantic sub-tropical and sub-polar gyres with those in the South Atlantic, to provide new insights to the AMOC that have not previously been possible ;



- Promote inter-comparison of the array designs, data analysis techniques and methods for calculating the transports of volume, heat and freshwater will enable best practice to be shared amongst all teams observing the AMOC. This work is essential to ensure that comparable data products are produced by each array.

3) **The PREFACE/PIRATA/TAV meetings, in Cape Town, South Africa – 25-28/Aug/2015;**

WG Participants: Regina Rodrigues (Brazil); Coleen Maloney, Isabelle Ansorge, Mike Roberts and Pedro Monteiro (South Africa); Sabrina Speich (France).

Activities conducted: Presentations about SAMOC and discussions that included the drafting of topics of the agenda of a meeting between South African and South Americans, to be conducted later in the year, in Brazil.

4) **The GO-SHIP/Argo/ IOCCP conference in Galway, Ireland – 4-15/Sep/ 2015.**

WG Participants: Edmo Campos (Brazil); Elaine McDonagh (U.K.)

Activities conducted: Presentations on SAMOC and discussions towards a wider international participation in SAMOC. One topic of these discussions that resulted particularly fruitful was the idea of conducting a Go-Ship cruise along 34.5°S (the SAMOC Basin-wide Array, SAMBA). In January 2017 there a first SAMBA/Go-Ship cruise will be conducted on board the German Research Vessel Maria Merian, with participation of scientists from Europe, South Africa, Argentina and Brazil.

5) **The AtlantOS/H2020 South Atlantic Workshop, in Brasilia, Brasil – 20-22/Oct/2015.**

WG Participants: Edmo Campos, Mauricio Mata, Andrei Polejack (Brazil); Sabrina Speich (France); Isabelle Ansorge (South Africa); Maria Chidichimo (Argentina).

Activities conducted: This meeting was organized by the Brazilian Ministry of Science and Technology with participants from Europe, South Africa, Brazil, Argentina and Uruguay. Several topics related to an increased South-South cooperation were discussed and resulted in the signing of a formal agreement between Brazil and South Africa.

6) **Working Visit to NOAA/AOML – Jan 15-22/2016**

During the week prior to the 2016 POGO Meeting, in Japan, E. Campos visited the NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), in Miami, to carry out research work and to discuss matters related to SAMOC and the SAMOC-WG.

7) **17th POGO Annual Meeting – Jan 26-28/2016 – JAMSTEC, Yokohama, Japan**

E. Campos participated in the POGO meeting, in Japan, with presentations on SAMOC and a the SAMOC Working Group.

8) **The Joint SAMOC VI and SAMOC-WG Workshop – New Orleans, Feb 20-21, 2016**

WG and other SAMOC Participants:

Edmo Campos	University of Sao Paulo, Brazil
Marcela Charo	University of Buenos Aires, Argentina
Teri Chereskin	Scripps Institution of Oceanography, USA
Maria Paz Chidichimo	University of Buenos Aires & Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina
Shenfu Dong	CIMAS, University of Miami & NOAA/AOML, USA
Silvia Garzoli	CIMAS, University of Miami & NOAA/AOML, USA
Raul Guerrero	El Instituto Nacional de Investigación y Desarrollo Pesquero, Argentina
Rebecca Hummels	GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany
Marion Kersalé	University of Cape Town, South Africa
Nicolas Kolodziejczk	Laboratoire de Physique des Oceans, University of Brest and IFREMER, France
Christophe Maes	Laboratoire de Physique des Oceans, University of Brest and IFREMER, France
Sudip Majumder	CIMAS, University of Miami & NOAA/AOML, USA
Gerard McCarthy	National Oceanography Centre, United Kingdom
Chris Meinen	NOAA/AOML, USA
Jose Pelegri	Institut de Ciencies del Mar, CSIC
Renellys Perez	CIMAS, University of Miami & NOAA/AOML, USA
Alberto Piola	Servicio de Hidrografia Naval, and Universidad de Buenos Aires, UMI IFAECI/CONICET/CNRS, Argentina
Regina Rodrigues	Universidade Federal de Santa Catarina, Brazil
Martin Saraceno	University of Buenos Aires, 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
Dani Valla	University of Buenos Aires, Argentina

Activities conducted: Taking advantage of the 2016 AGU Ocean Sciences Meeting, attended by a large number of scientists interested in the South Atlantic, a joint workshop was organized to discuss matters related to SAMOC, in general, and to the SAMOC-WG in particular. There were several action items, outcomes and/or



recommendations identified during the workshop. It was decided 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. Anson, 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.

Of particular interest for the WG, two specific future proposals were discussed. 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. Several 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.

9) **The AtlantOS 2nd Annual Meeting – June 28-20, Kiel, Germany**

Working Group Participants: E. Campos, O. Sato, M. Paz Chidichimo, D. Smeed, E. McDonagh, A. Piola, A. Polejack.

Activities Conducted: Several presentations on SAMOC and discussions related to the South African-South American participation in the AtlantOS. Particular emphasis was dedicated to the planning of the SAMBA/Go-Ship Cruise, to be conducted in January 2017.

10) **The 2016 CLIVAR Science Conference and the Global Ocean Summit – September 2016 – Qingdao - China**

Several members of the WG attended the CLIVAR Conference, with presentations on SAMOC and SAMOC related activities. E. Campos participated in the GOS2016, making an invited presentation on SAMOC.

Working Group Accomplishments

In all meetings attended, members of the SAMOC WG participated actively, making presentations, discussions and gathering input for the drawing of a working plan for the



enhancement of the existing SAMOC efforts and its expansion with a broader international cooperation. A brief description of this plan, based mainly in the discussions during the New Orleans Workshop, is given as follows.

New funding and proposal plans

Action Item: Seek new international funding opportunities that can broaden the interdisciplinary nature of SAMOC research, and further examine the societal impacts of SAMOC.

All 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. In the New Orleans meeting, two specific future proposals were discussed – both still being in the planning stages at that time. 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 University, 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. Several 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 may also 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 to piggy-back projects where ship time could be shared. The second point that was raised was that new proposals 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 is already working in this area, and there was general agreement to promote the inclusion of societal impacts in future proposals on 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. 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/).

The SAMBA/Go-Ship Cruise

One of the main achievements of the POGO WG resulted from the participation of some its members in the GO-SHIP/Argo/IOCCP conference in Galway, Ireland (Sep 2015). Discussions during that meeting greatly contributed to the decision to have a GO-SHIP cruise along 34.5°S.

The proposed SAMBA/GO-SHIP cruise will be carried out on board the German RV Maria S. Merian (MSM60), in January 2017. It will be the first full depth ship occupation of the SAMBA line, all the way from South Africa to Brazil. The oceanographic program will consist of full water depth (down to 5200m) CTD, O₂, fluorescence, and LADCP sampling. The water samples will be analyzed for oxygen, nutrients, carbon, chlorophyll structure, and transient tracers (CFC12 and SF6). The sampling and measurements will be performed to the highest standards with the aim to qualify as a GO-SHIP cruise.

The expedition will be conducted with personnel originating mostly from the SAMOC core Pls' countries: Brazil, Argentina, South Africa, France, and UK. It will be a milestone in the cooperation between South Atlantic bordering countries and Europe in general, and Germany in particular. The meridional heat and volume flux estimates over that section will provide a benchmark for the SAMOC geostrophic end-point array. The biogeochemical data will be compared to historic data that have been acquired along the WOCE/GO-SHIP A10 section (30°S) with the aim of quantifying trends, particularly in the inorganic carbon and transient tracer content. The A10 section was occupied by the German RV *METEOR* in 1993, as part of the WOCE program, and again in 2003 by the Japanese RV *MIRAI*. The cruise will be also a contribution to the EU H-2020 AtlantOS project.

Future publication plans

Numerous publications that are 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. Many student-led papers are being prepared on their ongoing graduate work, as well as postdoc-led papers.

One key point that came up throughout the different WG discussions was the idea of a possible future synthesis article as well as the need for an AMOC-related white paper for the OceanObs'19 meeting.