

# Argo National Report – South Africa

Report to Argo Steering Team Meeting: March 2017

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The South African Argo Program presently is one of deployment opportunities and educational outreach as opposed to procuring of floats and seeding the global Argo array. However, we are striving to develop projects and funding opportunities in that direction. Given South Africa's unique position geographically of bordering three oceans – The Atlantic, Indian and Southern Oceans – we are able to provide numerous deployment opportunities for Argo floats to the global array. We are also working on dynamic research programs and experiments using Argo floats to a) study physical forcing dynamics and b) contribute to the development of biogeochemical floats particularly in the Southern Ocean. The research groups currently involved in the South African Argo program are: The South African Weather Services (SAWS) – who are the National Focal Point, University of Cape Town (UCT), the Department of Environmental Affairs (DEA), The Council for Scientific and Industrial Research (CSIR), The South African Environmental Observation Network (SAEON), and the Nansen-Tutu Centre for Marine Environmental Research.

## 1. Status of implementation (major achievements and problems in 2016):

### Floats deployed and their performance (please refer to Figure 1 for schematics of transect placements)

#### Southern Ocean and South Atlantic Ocean:

SANAE 56 Cruise (RV SA *Agulhas II*) – December 2016-February 2017

8 ARVOR floats were deployed on behalf of the French team. One float needed to be shipped back as it was at the end of its lifespan.

WMO numbers: 3901918, 3901919, 3901920, 3901923, 3901924, 3901925, 3901927, 3901928

#### Indian Ocean:

ASCA Cruise (RV SA *Agulhas II*) – 5-15 July 2016

4 Apex floats were deployed on behalf of the UK MetOffice. These floats were 'adopted' by our education team and their associated secondary schools and described further below.

WMO numbers: 1901862, 1901863, 1901864, 1901865

### Technical issues encountered and solved:

No updates on the issues reported on in AST-16 (March 2015) report.

### Status of contributions to Argo data management (including status of conversion to V3 file formats, pressure corrections, etc)

None

## Status of delayed mode quality control processes:

Not applicable

## 2. Present level of (and future prospects for) national funding for Argo including summary of human resources devoted to Argo:

Dedicated Argo funding to procure new floats to seed the global array is currently being investigated through the South African Environmental Observation Network (SAEON). Individuals from organisations (listed above) work on different projects involving Argo floats and have come together under the auspices of the South African Argo program to share knowledge, resources, cruise time where applicable and information regarding Argo. We are working towards taking this forward now.

We have one Argo representative for the South African Marine Science community who is also looking to drive the Argo float procurements and data management plans in future endeavours.

## 3. Summary of deployment plans (level of commitment, areas of float deployment, low or high resolution profiles, extra sensors, Deep Argo) and other commitments to Argo (data management) for the upcoming year and beyond where possible:

### Southern Ocean:

Marion Island Cruise (RV SA *Agulhas II*) – April/May 2017.

This cruise follows the CrossRoads Transect on Figure 1.

*available for Argo float deployments*

Gough Island Cruise (RV SA *Agulhas II*) – September 2017. .

This cruise follows the SAMBA Transect on Figure 1.

*available for Argo float deployments*

SANAE Cruise (RV SA *Agulhas II*) – December 2017 / January 2018.

This cruise follows the GoodHope Transect on Figure 1.

*available for Argo float deployments*

### Indian Ocean:

Agulhas System Climate Array (ASCA) deployment cruise – November 2017 / February 2018.

Refer to Figure 1 for positions.

2 APEX floats will be deployed on behalf of UK Met Office in to the Agulhas Current.  
*Additional deployment opportunities are available*

### International Indian Ocean Expedition (IIOE-2) Expeditions

Cruises are being developed for both the eastern and western Indian Ocean and these can be communicated for interested countries wanting to deploy Argo floats into the Indian Ocean. 2 APEX floats from the UK Met Office are available for a cruise in to the Mozambique Channel, however *additional deployment opportunities are available*.

Atlantic Ocean:

SAMBA Mooring Array (RV *Algoa*) – April 2017.

Refer to Figure 1 for positions.

4 APEX floats will be deployed on behalf of UK Met Office in to the South Atlantic. **Additional deployment opportunities are available**

SEAmester Training Cruise (SA Agulhas II) – July 2017.

The cruise will service CPIES along the SAMBA transect. Refer to Figure 1 for positions.

4 APEX floats will be deployed on behalf of UK Met Office in to the South Atlantic. **Additional deployment opportunities are available**

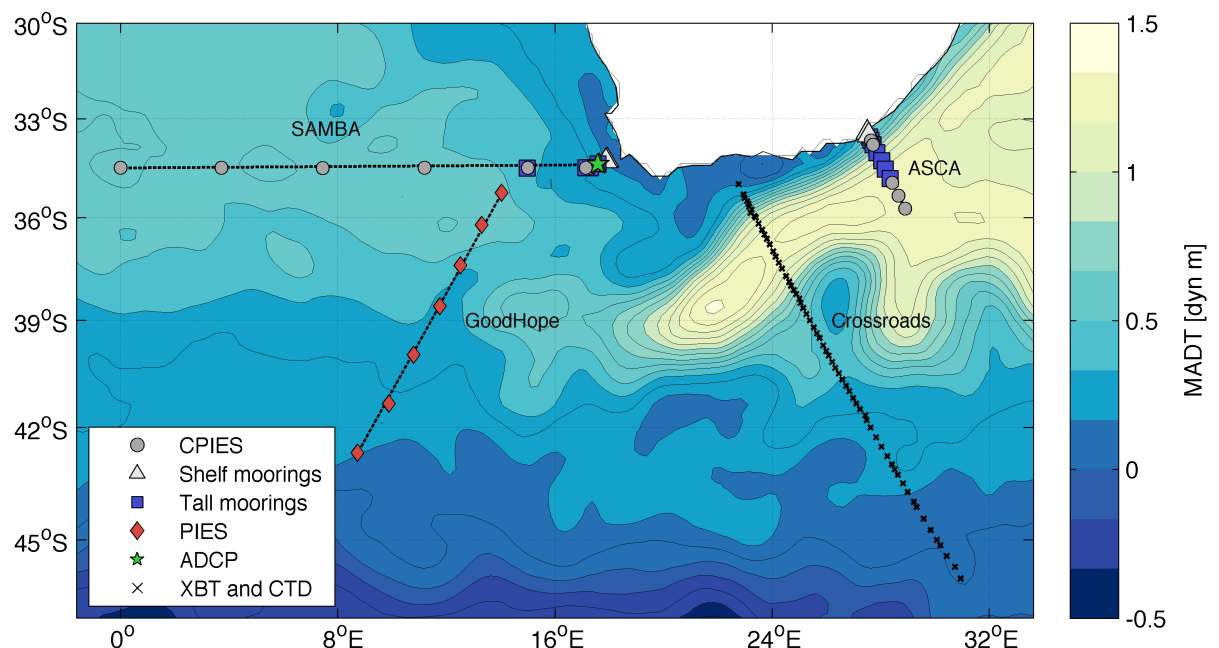


Figure 1: Large mooring array and CrossRoads transects around South Africa where floats could be deployed if available (Morris et al submitted).

**4. Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers. Please also include any links to national program Argo web pages to update links on the AST and AIC websites:**

Three research and two outreach project are noted below:

a) SOCCOM:

*Isabelle Ansorge*

The Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) are a focused group developing a new ocean observing system for carbon, nutrients and oxygen that will complement the already established observing system for heat and freshwater. To this end, 150-200 profiling floats equipped with biogeochemical sensors will be deployed throughout the

Southern Ocean and the cruises run by UCT (Prof. Anson) in this region (i.e. SANAE and Gough Island) will be used as a platform for deployments.

b) Southern Ocean Seasonal Cycle Experiments (SOSCEX) I–IV and ongoing:

*Pedro M.S. Monteiro, Sebastiaan Swart, Sandy Thomalla and Thato Mtshali*

SOSCEX is the focus of a suite of five NRF-SANAP projects funded for the 2015 – 2017 cycle. This forms a central part of the new Climate focused research theme in the Southern Ocean as articulated in both ARESSA as well as the emerging Antarctic and Southern Ocean strategy of the NRF-DST. It is our aim to attract wider collaboration from national, regional and international partners into this unique Climate – Carbon – Ecosystems research platform. SOSCEX focuses on understanding the role of the Southern Ocean in driving large-scale carbon-climate sensitivities through sub-seasonal scale observations of the influence of fine scale upper ocean physical dynamics on CO<sub>2</sub> fluxes and primary production. Bio-Argo floats (Fluorescence, Oxygen, PAR, two wavelengths of backscattering and an with upward facing transmissometer for flux estimates) were deployed on both SOSCEX I, II and III with little success (sensor issue with Wetlabs Puck on SOSCEX I, deployment error on SOSCEX II and on SOSCEX III all communication with the float was lost after 3 days of deployment during which time it completed 6 profiles and one drift session for flux estimates). One bio-optics float remains with the CSIR and is planned to be deployed as part of the GoodHope +11 seasonal cycle cruise with multiple occupations of the GoodHope line in Winter and Summer 2018.

[www.socco.org.za](http://www.socco.org.za)

[www.csir.co.za/nre/coasts\\_and\\_oceans/osc.html](http://www.csir.co.za/nre/coasts_and_oceans/osc.html)

c) Validating Hycom-EnOI in the Agulhas using Argo profiling floats - The Nansen-Tutu Centre for Marine Environmental Research (UCT)

*Charine Collins, Björn Backeberg, François Counillon and Johnny Johannessen*

The greater Agulhas Current system, one of the most energetic systems in the world, plays a key role in the global ocean circulation, regional weather, and the marine environment. A prediction system of the marine environment around southern Africa would not only be beneficial to regional commercial, industrial, and leisure activities, but it would also aid search and rescue activities, and the monitoring of accidental pollutants and harmful algal blooms.

Despite the emergence of various global prediction (operational data assimilation) systems (e.g. MyOcean, Blue-Link), there is hitherto no system for the southern African regional ocean. As a first attempt towards an ocean prediction system for southern Africa, A regional data assimilation system of the greater Agulhas system was developed recently (Backeberg et al., 2014). This system, while not operational yet, assimilates satellite altimeter along-track sea level anomaly (SLA) data into a HYbrid Coordinate Ocean Model (HYCOM) simulation of the Agulhas Current System using the Ensemble Optimal Interpolation (EnOI) data assimilation scheme (hereafter referred to as HYCOM-EnOI). While HYCOM-EnOI improved the meso-scale dynamics in the Agulhas Current system, as well as the water mass characteristics and velocities at ~1000m, there was a slight degradation of the SST distribution.

In this study, we assess the limitations of HYCOM-EnOI in reproducing the water mass properties of the Agulhas Current region through a detailed comparison with Argo profiling floats. A comparison between HYCOM-EnOI and the Argo profiling floats is made in terms of temperature and salinity differences at various depths, differences in water mass characteristics, and mixed layer depth.

The temperature values in the upper 100m simulated in HYCOM-EnOI are, for most of the region, in close agreement ( $\pm 1^\circ\text{C}$ ) with the observations (Figure 3a). On the contrary there is an overestimation of the salinity values in the upper 100m simulated in HYCOM-EnOI by about 0.1psu (Figure 3b). In the 500-1000m depth range, HYCOM-EnOI tends to underestimate temperature (Figure 3c) and salinity (Figure 3d) values south of the Agulhas bank, in the vicinity of the Agulhas Retroflexion region and the Agulhas Return Current. West of the Agulhas bank, the temperature of HYCOM-EnOI is in good agreement with the observations ( $\pm 1^\circ\text{C}$ ), however, there is again an overestimation of the salinity values by more than 0.1psu. In the deeper layers (1000-2000m, HYCOM-EnOI tends to underestimate the temperature and salinity throughout the region, except east of the Agulhas Bank where there is a good agreement with the observations.

d) Comparing Argo and animal-borne observations in the Southern Ocean

*Anne Treasure*

The polar oceans play crucial roles in regulating the Earth's climate system. Nevertheless, adequately sampling these regions is extremely difficult. Consequently, autonomous oceanographic sampling devices such as Argo floats have become a major component of the ocean observing system and have proven invaluable to the polar ocean science community. However, these devices currently do not operate regularly in sea ice and tend to be advected to the north in the Southern Ocean (SO), resulting in very few Argo profilers south of  $60^\circ\text{S}$ . Instrumented animals provide a solution to this problem. Since 2002, they have dramatically extended the spatial and temporal reach of ship-based observations and overcome some of the issues with other devices such as Argo operating in polar waters. The instruments, conductivity-temperature-depth satellite relay data loggers (CTD-SRDLs), are deployed as animal-borne platforms to sample vertical temperature and salinity profiles. These loggers provide novel observations of the SO, particularly in areas where data collection would otherwise not be possible, and provide valuable research opportunities for physical and biological oceanographers alike. While studies have already used both Argo and CTD-SRDL data, little is known about how well the two data sets complement each other in both spatial and temporal extent, and how comparable they are in data quality. Therefore, my research examines data from CTD-SRDLs and Argo to assess the comparative value of the two data sources to increasing our understanding of SO ocean dynamics. This includes a spatial and temporal comparison, as well as an ongoing investigation on the efficacy of the two data sources in identifying the characteristics, position and structure of SO fronts. Understanding the structure and location of SO fronts is of considerable importance due to their influence on climate and ecosystems.

e) Educational Outreach – The Argo Floats Program by SAEON Egagasini:

*Thomas Mtontsi and Tamaryn Morris*

Five secondary schools have been identified in the Western Cape region to track changes at sea from data collected on floats 1901469 and 1901470 purchased by SAEON/SANAP with support from SAWS and deployed in 2009. Both these floats have stopped reporting now, but the data is still used as described below:

In 2016 school monitoring teams were encouraged to do schools science projects on:

1. The Identification of deep water masses and their direction using temperature
2. Relationships between salinity and depth
3. Relations of temperature, pressure and salinity

The overall focus of the SAEON Egagasini education programme is to:

- primarily encourage awareness of science skills to learners

- to create a platform where Marine Science Research can be integrated into School Sciences curriculum by encouraging interactions between learners, educators and scientists
- to promote an understanding of, create awareness and generate an interest about our oceans

Four Argo floats deployed on the ASCA cruise in July 2016 were also “adopted” by the schools themselves to monitor in near-real time as ongoing school projects in 2017. Each school got a chance to visit the research vessel and officially adopt their float as part of a school excursion. The deployment of the floats at sea in July were documented for the schools and they were notified by email so they can begin their projects and monitor how the floats behave in particular within the Agulhas Current. This work will be presented at the 1<sup>st</sup> Ocean Observers meeting in France in June 2017 and be used as part of the Eskom Young Scientist Expo run in South Africa each year.

- 5. Issues that your country wishes to be considered and resolved by the Argo Steering Team regarding the international operation of Argo. These might include tasks performed by the AIC, the coordination of activities at an international level and the performance of the Argo data system. If you have specific comments, please include them in your national report.**

None at this stage.

- 6. To continue improving the quality and quantity of CTD cruise data being added to the reference database by Argo PIs, it is requested that you include any CTD station data that was taken at the time of float deployments this year. Additionally, please list CTD data (calibrated with bottle data) taken by your country in the past year that may be added to the reference database. These cruises could be ones designated for Argo calibration purposes only or could be cruises that are open to the public. To help CCHDO track down this data, please list the dates of the cruise and the PI to contact about the data.**

No data was loaded this year, but new data is available from the east coast of South Africa and will be loaded shortly.

- 7. Keeping the Argo bibliography ( <http://www.argo.ucsd.edu/Bibliography.html> ) up to date and accurate is an important part of the Argo website. This document helps demonstrate the value of Argo and can possibly help countries when applying for continued Argo funding. We reached more than 2000 papers published using Argo data! To help me with this effort, please include a list of all papers published by scientists within your country in the past year using Argo data, including non-English publications. I've added a thesis citation list too ([http://www.argo.ucsd.edu/argo\\_thesis.html](http://www.argo.ucsd.edu/argo_thesis.html)). If you know of any doctorate theses published in your country that are missing from the list, please let me know**

None at this stage.