

Southern Ocean Argo Regional Centre

Report to the 21st Argo Data Management Team meeting

SOARC Partnership

Since last ADMT, the SOARC partnership has grown to include individuals from additional institutions involved in the SOCCOM project as well as the addition of AWI who maintain the sound sources in the Weddell Gyre. This evolution of the partnership has been pursued to work towards addressing all the roles of an Argo Regional Centre through better collaboration between existing efforts rather than existing partners taking on new areas of responsibility.

The SOARC partnership currently includes:

- Matt Donnelly (Matt D., coordinator) and Kamila Walicka, BODC, NOC, UK - matdon@bodc.ac.uk
- Esmee van Wijk, CSIRO, Australia - Esmee.Vanwijk@csiro.au
- Birgit Klein and Ingrid Angel, BSH, Germany - Birgit.Klein@bsh.de
- Tanya Maurer, MBARI/SOCCOM, USA - tmaurer@mbari.org
- Matt Alkire (Matt A.), UK/SOCCOM, USA - alkirem@uw.edu
- Paul Chamberlain, Scripps/SOCCOM, USA - pchmaber@ucsd.edu
- Olaf Boebel, AWI, Germany - olaf.boebel@awi.de

In addition, SOARC has engaged with the Southern Ocean Observing System (SOOS) community through its working groups, and in particular has engaged with Matt Mazloff (Matt M., Scripps/SOCCOM) regarding the observing system design working group.

Evolution of ARCs

SOARC partners have discussed the future role of ARCs and broadly concluded that whilst the responsibilities of ARCs came out of ARC workshops in mid/late 2000s, they remain broadly relevant. However, to achieve these aims the ARCs need to not just focus on data but also include wider basin-scale coordination efforts, particularly with deep and BGC Argo growing in scale. This is particularly critical in the Southern Ocean where deployment opportunities are sparse, normal challenges are amplified, but where there are bodies that could help: e.g. Antarctic Treaty Consultative Meetings (ATCM).

We are considering developing a joint assessment paper to provide a summary of the current status of capabilities and achievements in the Southern Ocean to provide greater clarity and insight in high latitude deployments.

Funding

The European contribution to SOARC is currently funded primarily through the Euro Argo RISE project WP5 for BODC, NOC and BSH. The AWI contribution of the Weddell Sea sound sources available for RAFOS positioning is ongoing infrastructure funding. Australian involvement is primarily through DMQC and under-ice float projects. SOCCOM is the primary funding of US involvement with SOARC.

Report on ARC activities

Documentation

The primary approaches to documenting SOARC activities and output is through material on the SOARC website (www.soarc.aq) host by NOC, and through the SOARC GitHub repository (<https://github.com/argosoarc>). Discussions are progressing on how we make better use of GitHub for future collaboration, particularly around under-ice positioning techniques and transparency of regional data quality assessments.

Coordinating float deployments and infrastructure

General guidance on complying with the Antarctic Treaty System was posted on the SOARC website last year. An action on Matt D. and Brian King to explore further guidance regarding varying national requirements is outstanding and should be addressed in the year ahead.

Deployments of under-ice floats on the continental shelf of Antarctica are growing and Esmee has been sharing CSIRO's experience with shelf floats with other groups who are considering their own field programs.

Following AWI joining the SOARC partnership, Birgit and Olaf are planning to provide information of the status of the RAFOS sound source in the Weddell Gyre and guidance on procuring floats with a RAFOS receiver, summarising the current options and requirements. The currently available option is the TWR iceAPEX with ice sensing algorithm and RAFOS capabilities, with the previously available NEMO floats no longer available. It was agreed that whilst Germany had led RAFOS equipped float deployments in the past, it is essential more countries become involved to make this capability sustainable. The procurement requirements for floats with a RAFOS receiver were shared with the ERIC office and will be included in the next tender, which should open the possibility for European members to obtain such floats through central procurement.

Matt D. and Esmee have been engaged with the Southern Ocean Observing System (SOOS) regarding the potential to make use of the DueSouth tool (<http://www.soos.aq/activities/about-duesouth>) in support of identifying deployment opportunities. In addition, Matt D. has been liaising with SOOS on engaging the International Association of Antarctic Tour Operators (IAATO - <https://iaato.org/>) as a potential source of deployment opportunities, and with Ocean OPS on the potential to use recent ship AIS data to identify potential ships. All of these are in early stages of development.

At the level of observing system design, SOARC partners have begun discussing how to best define what a 'gap' in the array is and how to develop systematic solutions to fill those gaps.

Quality control tests and procedures

The focus for SOARC partners regarding quality control tests and procedures is on under-ice positioning, both in real-time and delayed-mode.

Olaf gave a presentation to partners at a meeting in July 2020 providing an update on the status of not only the RAFOS array in the Weddell Gyre, but also on development of RAFOS positioning data processing through the latest generation of the 'artoa4argo' software which has been recently developed. Past deployments are currently being reprocessed. Esmee and Birgit are taking a lead on developing guidance for including RAFOS positioning data in the Argo data system.

Paul also gave a brief presentation on the concept of Kalman smoothing of under-ice positional information (Chamberlain et al. 2018), both forward and backward combined, to obtain best estimate. Integration of Paul's techniques into artoa4argo is intended to enhance this package.

Esmee and Luke Wallace (formerly from CSIRO) published a paper on a new under-ice positioning method for floats on the continental shelf (Wallace et al. 2020).

There is a recognised need to move from a very small group of experts of under-ice positioning experts to a new wider generation with involvement in under-ice positioning.

Reference data

Roseanna Wright (BODC, NOC) has completed a metadata audit of floats deployed south of 30°S which looked at the presence and consistency of deployment platform, cruise and CTD metadata. This identified that for most floats this information was ambiguous or empty, posing a challenge in identifying and making use of ship's CTDs taken on deployment. Whilst initially done under the EU EASME MOCCA project in support of SOARC and reference data availability, this work is also feeding into the work under the EU H2020 ENVRI-FAIR project to host the Argo reference tables on the NERC vocabulary server.

Also under the MOCCA project, Ingrid Angel (BSH) has developed a Matlab tool (https://github.com/euroargodev/check_CTD-RDB) for checking the spatial and temporal availability of data in the ship's CTD reference database maintained by Christine Coatanoan. Initial examination of Southern Ocean reference data suggests there is obvious missing data that are known to exist. It is planned as part of the EU H202 EuroArgo RISE project WP5 to review the Southern Ocean data in further detail using this tool, and to do so in close collaboration with Matt A., and in cooperation with Christine Coatanoan.

General discussion amongst SOARC partners regarding reference databases across all Argo missions has provisionally concluded that the preferred approach is to contribute to global reference database(s), with SOARC being a focal point for ensuring the Southern Ocean is thoroughly reviewed and added to. Development of regional databases in the context of the Southern Ocean was considered unsustainable, and made little sense in the Southern Ocean which is contiguous with other major ocean basins.

DMQC support

There has been limited demand for DMQC support to national programmes in the past year, but SOARC partners do have some limited capacity to provide this is requested.

Regional analysis of Argo data

Under the EuroArgo RISE project WP5, regional data quality assessments will be established with a focus on the Antarctic Circumpolar Current and Weddell Gyre. This work will be a major focus for Kamila Walicka during 2021 and progress will be reported at ADMT-22.

Feedback to PIs

The initiation of feedback to PIs will begin as part of the EuroArgo RISE project WP5 which is funding the establishment of regional data quality assessments in the Antarctic Circumpolar Current and Weddell Gyre. This work will be undertaken by Kamila Walicka, supported by Matt Donnelly, Birgit Klein and Brian King (NOC).

Data products

Development of the float characterisation undertaken as a collaboration between BODC, NOC and the University of Bristol has been completed, although making the output of this analysis available publicly is pending further work. The Matlab code is available from:

https://github.com/argosoarc/soarc_floatchar

Identifying existing groups producing relevant data products, raising the profile of these products, and identifying any additional needs is the intended future direction for SOARC regarding data products. There are currently no plans to create new data products.

Comparison with model data

Matt Alkire is taking the lead with exploring options for comparing Argo observations with model data, and has begun discussing with Matt Donnelly and Matt Mazloff on the potential direction of future development. This activity is in its early stages.

Summary

The SOARC partnership is developing towards being able to meet the responsibilities of ARCs, and while the evolution is moving in the right direction, resources remain tightly constrained and this impacts on the capability to make the most of the enlarged pool of expertise and more rapid progress. There remains a need to further develop the partnership to include those who can add value particularly in the areas of data products, comparison to model data and feedback of this into observing system design.

References

Chamberlain, P. M., Talley, L. D., Mazloff, M. R., Riser, S. C., Speer, K., Gray, A. R., & Schwartzman, A. (2018). Observing the ice-covered Weddell Gyre with profiling floats: Position uncertainties and correlation statistics. *Journal of Geophysical Research: Oceans*, 123, 8383–8410.

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Wallace, L. O., van Wijk, E. M., Rintoul, S. R., & Hally, B. (2020). Bathymetry-constrained navigation of Argo floats under sea ice on the Antarctic continental shelf. *Geophysical Research Letters*, 47, e2020GL087019. <https://doi.org/10.1029/2020GL087019>