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Report on 2015 Activities of SOOS relevant to the work of CCAMLR

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Report on 2015 Activities of the Southern Ocean Observing System relevant to the work of CCAMLR

Authors

Andrew Constable (Australian Antarctic Division, Tasmania, Australia, 7050)

Olav Rune Godø (Institute of Marine Research, 5817-Bergen, Norway)

Louise Newman (SOOS International Project Office, IMAS-UTas, Australia)

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Abstract

The Southern Ocean Observing System was established by SCAR and SCOR in 2011 and has been steadily developing its work. In this paper, we summarise the outcomes of strategic planning over 2015 and a recent meeting of the SSC and workshop aimed at implementing the strategic plan. SOOS is developing regional and capability working groups to implement its strategy. The regional working groups will be important to CCAMLR in providing data relevant to conservation and fisheries in different parts of the CCAMLR area. The capability working groups aim to develop long term capabilities of SOOS. Those of interest to CCAMLR include Working Groups on Ecosystems, Acoustics and Monitoring of pack ice seals. The development of the SOOS Data Management System and Portal will also be important to CCAMLR. These are described more fully in the paper. In conclusion, we discuss the value of developing a partnership between SOOS and CCAMLR to help develop a positive relationship between the CCAMLR and international scientific communities and to progress the international coordination and assessments of climate change impacts on Southern Ocean ecosystems, the focus of a conference in 2018.

Introduction

The Southern Ocean Observing System was established by SCAR and SCOR in 2011 and has been steadily developing its work based on the Initial Science and Implementation Strategy (Rintoul et al., 2012; Meredith et al 2013). It has an international project office (IPO) based at the Institute of Marine and Antarctic Studies in Hobart Australia and is coordinated by a Science Steering Committee (SSC). In this paper, we summarise the outcomes of strategic planning over 2015 and a recent meeting of the SSC and workshop aimed at implementing the strategic plan (Wåhlin et al 2015). We then provide some detail on areas of interest and importance to CCAMLR.

Strategic Planning and Outcomes of SOOS meeting (June 2015)

In 2015, the SOOS SSC worked to develop a 5-Year Strategic Plan that builds on the initial strategy, and more clearly identifies the key implementation objectives for SOOS, the actions required to achieve them, and the measures of progress and success. In June 2015, SOOS held its 4th annual SSC meeting and agreed to utilise the draft Strategic Plan as the basis for future work. It is now seeking to have this draft reviewed by the scientific community before being finalized over the coming year.

The draft strategic plan has 6 objectives, which follow a logical sequence from design of the system, through field implementation, to delivery of the data:

1) Facilitate the design and implementation of a comprehensive and multi-disciplinary observing system for the Southern Ocean
2) Advocate and guide the development of new observation technologies
3) Compile and encourage use of existing international standards and methodologies, and facilitate the development of new standards where required
4) Unify and enhance current observation efforts and leverage further resources across disciplines, and between nations and programmes
5) Facilitate linking of sustained long-term observations to provide a system of enhanced data discovery and delivery, utilising existing data centres and programmatic efforts combined with, as needed, purpose-built data management and storage systems.
6) Provide services to communicate, coordinate, advocate and facilitate SOOS objectives and activities

SOOS has already made progress against these objectives. A comprehensive overview of SOOS milestones can be found in the recently published **3-Year Progress Report**

SOOS will be implemented regionally, the natural areas of focus by nations involved in Southern Ocean activities, although some activities will be coordinated at a circumpolar scale, such as Argo. SOOS is therefore developing Regional Working Groups that will coordinate and implement the observing system in their defined region, including facilitating improved readiness of particularly measurements and an ability to measure them where needed. Regional Working Group membership will be open, and will have representation from all nations working in the region, and expertise across all disciplines.

Capability Working Groups will be used to develop important capabilities for SOOS generally, including (i) developing and implementing technologies, (ii) improving observational design, efficiency and coverage, and (iii) developing methods for managing and disseminating information.. The existing national and international projects and programs that contribute to SOOS will be identified and recognised as contributing regionally and/or to enhancing capabilities. Examples of activities undertaken in this category is the development of an international under ice strategy (Rintoul et al, 2015), identification of observational and science gaps in the Ross Sea region (Williams et al, 2015) and a report of community needs for Southern Ocean satellite data which is in preparation (sponsored by SCAR, SOOS, CliC).

In June 2015, SOOS held its first international planning workshop, 'Implementation of a Southern Ocean Observing System', at the Institute for Marine and Antarctic Studies at the University of Tasmania. This workshop brought together 70 international Southern Ocean researchers to identify the regions for Regional Working Groups and distil the capabilities of highest priority for development through Capability Working Groups.

Five priority regions were identified:
- West Antarctic Peninsula*
- Weddell Sea,
- Indian Sector*,
- Ross Sea,
- Amundsen and Bellingshausen Seas

Those asterisked have applications for creating SOOS regional working groups submitted to the SSC, and the community is encouraged to register interest of

creating working groups or becoming involved in the existing applications. Furthermore, a number of key observing system capabilities were highlighted for development:

- Underwater acoustics (passive, active, communication),
- Satellites (algorithms, specific communities, calibration/validation, upcoming missions), including a proposal for assessing abundance of pack ice seals using satellites,
- Air-sea fluxes (Impact on models, sensor gaps, quantification of fluxes in many regions),
- System Design (observing system simulation experiments [OSSE], sampling strategies),
- Ecosystem (ecosystem Essential Ocean Variables [eEOVs], products to support management, models),
- Sensor development (in particular low cost, small, operable on autonomous platforms),
- Ships of opportunity (including tourist vessels and fishing vessels),
- Under ice capabilities (under ice Argo, technology, ice cavities, sensors, fluxes).

The community is asked to register interest in these capabilities, or other ones that were not highlighted here.

Activities directly related to the work of SC-CCAMLR

Apart from the regional working groups, which will be of direct interest to the implementation of monitoring programs in different regions of the CCAMLR area, discussions at the June workshop highlighted a number of capabilities being developed in SOOS, which are likely to be established as working groups, and which would be of direct interest to CCAMLR

Ecosystem Working Group

A proposal for an ecosystem working group is being developed following discussions at the workshop. This working group would be expected to address observing of (i) the impacts of pressures on the ecosystem, including fisheries and climate change, (ii) the spatial and temporal variation of the system, (iii) distribution and abundance of key biota, and (iv) linkages between components of the system. This Working Group will aim to develop a design for ecosystem observing, i.e. what to measure, where and when, which will include:

- Developing ecosystem Essential Ocean Variables (eEOVs) for assessing status, trends, attribution, and future change
- Harmonising and contributing to the Global Ocean Observing System (GOOS) essential ocean variables (EOVs), CCAMLR and other existing networks (e.g. Marine Mammals Exploring the Oceans Pole to Pole [MEOP], Southern Ocean Continuous Plankton Recorder Survey [SO-CPR])
- Determining feasibility (stage of readiness) for sustained observations in the long term
- Designing minimum requirements to address needs
- Developing a program to advance readiness of important variables
- Maintaining an adaptive (iterative) approach to take account of improved feasibility, changes in technology, changes in importance

A strategy for this work could include:

1) What variables do we have?
    a) Method of measurement (are they

standardised)
b) Archived data:
- data discovery (summarise what is available, prioritise what we need, encourage data consolidation and publication – use SOOS Data Management Sub-Committee, SCAR research programs/expert groups, national data centres)
- assessment of quality for the purpose of assessments, models
- can they be easily integrated into assessments with other data

c) What sampling strategies were used to generate archived data (was there a strategy)
d) Progress existing standard methods/ strategies using GOOS template (e.g. MEOP, CPR)

2) Methods for integrating with/using other observing systems e.g. CEMP and CCAMLR to avoid duplicating effort
3) What can we learn from different regions at present and apply elsewhere where there are gaps

a) How might feasibility may differ between regions, strategies may need to be regionally specific (work with regional WGs)

4) Use example archived data to see how well they address needs – use this as a part of identifying gaps
5) Test existing data against models
6) Develop strategy for working through the candidate variables (take some each year), including
a) Conceptual basis and standardization of methods:
e.g. Assessments of priorities of variables taking account of their value in integrating many variables (criterion)
b) Pilot (evaluation using existing data)
- baseline data requirements

c) Design of sampling and evolution to maturity

This working group will be expected to be closely linked to the work in SCAR, ICED, CCAMLR and GOOS. A general invitation will be made for scientists to become involved in this group. In the first instance, it was expected that a catalogue of data holding relevant to different end users will be developed.

Antarctic Pack Ice Seals (APIS) II

A working group has been proposed for consideration by the SSC on Antarctic Pack Ice Seals (APIS) II: A circumpolar assessment of the status and trends of Antarctic pack-ice seals based on satellite remote sensing. The proposed co-chairs are Prof Mark Hindell (IMAS, AUS) and Dr Peter Fretwell (BAS, UK). Its proposed terms of reference include:

1) Coordinate research and development into the use of satellite remote sensing with the ultimate aims of:
a) Undertaking a global census of Antarctic pack-ice seals and
b) Implementing regular monitoring of pack-ice seals in the Southern Ocean, which provide an integrated signal on the state of the Southern Ocean;
2) Hold annual meetings of the working group, and to source funding to enable this;
3) Develop standardized methods that are easily understood by different Antarctic stakeholders, including policy stakeholders, which are repeatable, and easily transferred to other research teams looking to contribute to these surveys;
4. Develop methods for validation, and algorithms for transformation of images

to estimates of abundance as well as undertake ground-truthing of satellite-derived abundance estimates using direct observations;

5. Determine the optimal division of labour to achieve regular continental-scale surveys. One option might be to perform regional assessments that could be combined post-facto into a global assessment. The advantage of this approach is that it naturally accommodates regionally specific approaches that account for differences in satellite coverage, regional climate differences e.g. cloud cover, sea ice conditions, the spatial distribution and composition of the seal assemblages, and the capacity to perform ground truth surveys.
6. Develop analytical/statistical procedures for estimating seal abundance and associated estimates of error, with particular consideration of estimator bias and precision;
7. Establish how population estimates and other products would be delivered to end users such as CCAMLR, SOOS, and SCAR.

Acoustics and automated systems

The workshop considered a variety of automated systems, including using ships of opportunity, moorings and mooring arrays, gliders, benthic crawlers and the like. It recognised the value of routine acquisition of data from resupply, research, tourism and fishing vessels, such as is achieved in the Australian Integrated Marine Observing System. It noted that regional coordination of the deployment of sensors and monitoring devices and the acquisition of underway data, such as active acoustics, plankton and oceanographic variables, would be extremely beneficial to researchers and management organisations such as CCAMLR. The data management system of SOOS will provide a useful repository of such data, or could serve as a portal to other data repositories.

Data Management System

SOOS has an active program of work through a Data Management Sub-Committee (DMSC) to build a data management system that is aligned with the observing system. The system is being designed to delivers the data in real-time and have a cyberinfrastructure that enables the implementation of an effective adaptive sampling strategy. Key to achieving the SOOS goal is enhanced discoverability and delivery of SOOS data. One of the challenges in the Southern Ocean is the lack of a unified data access. The broader scientific goals of SOOS cannot be realized without a strong understanding of what data already exist, and better coordination of data collection activities. The SOOS DMSC is a multinational team of experts working directly on linking various data sets of interest into the SOOS information web.

A searchable metadata portal within NASA's Global Change Master Directory has been created and is currently being populated with records describing key SOOS datasets. These metadata records will lead the user to the associated data located in areas that intersect with the SOOS region and are related to any of the candidate Essential Ocean Variables (EOVs) identified by the SSC. In addition, the GCMD provides web services which will allow other interfaces to be implemented in the future. A data

rescue effort has been launched and is focused on historical data by making their metadata discoverable through the SOOS GCMD domain. The DMSC is also tracking down orphan datasets so that they can be documented and housed in easily-accessible data repositories and linked into the portal. An orphan dataset is one that is not publicly documented and available, often because the responsible researchers have been unaware of potential repositories for housing their data. The SOOS DMSC also encourages researchers to work through their national data centers to ensure that their data are safely stored and made accessible. Where this is not possible, we are identifying alternative data repositories and working with researchers to find appropriate homes for their data.

The DMSC is also developing tools for visual data exploration, and will populate it with representative samples of the datasets available through the metadata portal. SOOS is also designing a platform for researchers to easily share their field work plans. This platform, a GIS based tool providing classes of information provided by researchers before their field seasons start, is intended to facilitate collaborative activities such as offering and taking advantage of ships-of-opportunity, moorings-of-opportunity, adding sensors to packages, deploying instruments or sharing calibration information.

The SOOS data effort thus far has been limited by a lack of dedicated personnel, but recently gained support through the Australian Research Council's Special Research Initiative for Antarctic Gateway Partnership (Project ID SR140300001) and hired a Data Officer in April 2015 for 2 years.

Conclusions

Activities in SOOS relating to ecosystems are of direct interest to CCAMLR. SOOS can provide a framework for observing change in Southern Ocean and provide data streams useful to CCAMLR in estimating status and trends of species and the ecosystem of interest to CCAMLR. Activities of direct interest will be:

- The development of the data portal, including providing access to data relevant to Southern Ocean ecosystems,
- The consolidation of information on existing observing activities (variables, field programs),
- The development of ecosystem Essential Ocean Variables for the region, including coordinated activities to test candidate variables and assessments (field, simulation, data analyses), and
- Contribution to the 2018 International Conference on Assessing status and trends in Southern Ocean ecosystems, which includes consideration of (i) Design of ecosystem observing, (ii) Models and processes, (iii) Assessment methods, and (iv) Assessments of key habitats, species, foodwebs.

SOOS also aims to facilitate regional and circumpolar coordination of the observing system, leading to circumpolar assessments. A possible target for SOOS ecosystem work could be to build on the work of IPY and the Census of Antarctic Marine Life by having coordinated circumpolar activities in 2020 to provide a circumpolar benchmark

of Southern Ocean ecosystems.

Work in the Council of Managers of National Antarctic Programs (COMNAP) and support of SOOS by the CEP and ATCM at their recent 2015 meetings indicates growing support for contributions to and coordination of Southern Ocean ecosystem observing by nations involved in Antarctica and the Southern Ocean. This support also recognises how SOOS and ecosystem modelling will contribute to understanding the future of Southern Ocean ecosystems under climate change.

We suggest that CCAMLR can both gain from and contribute to SOOS. Last year, the Commission noted the importance of the impact of climate change to the work of CCAMLR and noted the previous important advice on climate change prepared by SCAR and urged the Scientific Committee to liaise with SCAR (CCAMLR-XXXIII, paragraph 5.92). The Commission also endorsed advice from the Scientific Committee that development of a feedback management strategy for the krill fishery offers the opportunity to adapt to the impacts of climate change (CCAMLR-XXXIII, paragraph 5.89; SC-CAMLR-XXXIII, paragraphs 8.1 to 8.6). These conclusions indicate that climate change represents a source of uncertainty in the assessment of the Antarctic ecosystems and their harvest potential. SOOS provides an opportunity for addressing this challenge and CCAMLR would also benefit from building productive relationships with the broader international scientific community through a partnership with SOOS.

Vessels fishing under the auspices of CCAMLR will be operating throughout the year. They have the capacity to collect valuable environmental information by installing automated sensor systems onboard. Such data together with all the biological information regularly streamed to CCAMLR represent a unique set of information that could be made available to the scientific community through SOOS (noting that procedures associated with accessing such data will need to be maintained and managed). Further, as SOOS will store and make available scientific data from the international science community outside CCAMLR, CCAMLR scientist will over time get access to an expanded source of information that might become crucial for some management issues ,such as to support implementation of feedback management of the krill fishery.

We propose that it is timely that CCAMLR develops a relationship with SOOS. By clarifying its own data requirements and potential for collecting data of value to SOOS, CCAMLR will develop a positive and constructive relationship with the international scientific community, and better harness international efforts to understand trends and variability of the Antarctic environment.

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References

Meredith, M.P., Schofield, O., Newman, L., Urban, E., Sparrow, M., 2013. The vision for a Southern Ocean Observing System. Current Opinion in Environmental Sustainability 5, 306-313.

Rintoul, S.R., Meredith, M.P., Schofield, O., Newman, L.. 2012. The Southern Ocean Observing System. Oceanography 25(3):68–69, http://dx.doi.org/10.5670/oceanog.2012.76.

Rintoul, S., van Wijk, E. et al. 2015: Seeing Below the Ice: A Strategy for Observing the Ocean Beneath Antarctic Sea Ice and Ice Shelves. SOOS workshop report (http://soos.aq/products/soos-products?view=product&pid=26).

Wåhlin, A., Newman, L., Bricher, P., Constable, A., Diggs, S., Schofield, O., Swart, S. 2015. Towards an integrated Southern Ocean Observing System. Report to CLIVAR, June 2015.