

# CLIVAR/CliC/SCAR Southern Ocean Region Panel SORP

## National activities report

Country	Australia
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*Receipt of material prior to 1 February 2019 will ensure inclusion discussions at the first SORP video conference for 2019. The reports contribute to future SORP discussions, as well as input to the SOOS and other CLIVAR/CliC/SCAR activities. All reports will be posted on the SORP website.*

- Purpose of material gathered for the SORP:

To build an overview of observational, modeling, national projects and initiatives, ocean reanalysis and state estimation initiatives relevant to the SORP

(This can be detailed as a list of activities; maps showing where instruments have been or will be deployed; examples of modeling developments, experiments and set-ups; major national and international project involvement; etc.)

- Please refer to SORP's terms of reference (also given at the end of this template) for guidance on scope: <http://www.clivar.org/clivar-panels/southern>

Note: Biological topics such as marine ecology research, for example, are not within the scope of SORP's terms of reference and are therefore not required in these reports.

However, SOOS has an interest in such research, so National Representatives are encouraged to include summaries of such research as separate sections.

Note: The Southern Ocean is not explicitly defined in SORP's terms of reference, so please note what the limit used for your national report is (e.g., research on regions only beyond an oceanographic boundary like "south of the Polar Front", or research contained within latitudinal limits like "south of 50 °S").

## **Summary of National Activities**

*(Half page max. This section should include a succinct list of the main annual activities and breakthroughs as well as future plans (including any possible future opportunities for international collaboration))*

Australia has continued to maintain physical and biogeochemical observations in the East Antarctic sector of the Southern Ocean (50°-140° E) through automated systems (Argo floats, pinniped tags and moorings), in conjunction with the research vessel *R/V Investigator*. Much of this work is coordinated by the Integrated Marine Observing System (IMOS), which also curates data for public access.

For higher latitudes, there is unlikely to be significant marine science time available aboard Australia's icebreaker, *R/V Aurora Australis*, other than for under-way observations. Her replacement, *R/V Nuyina* is expected to enter service in the 2020/2021 field season, but no science voyages have been scheduled at the time of writing (updates and scientific capabilities can be found here at <http://www.antarctica.gov.au>).

There is a healthy ocean modelling community in Australia, in particular with the development of ACCESS-OM2 (based on GFDL MOM). Although this is global ocean model much of the scientific focus of the development group, COSIMA, is on the Southern Ocean and the Antarctic margins.

## A. Recent and ongoing activities

*If your country has a national committee tasked with oversight of Southern Ocean climate science (e.g., like US CLIVAR), please give the name of the committee here:*

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*Describe which major activities have been carried out in the last year or are in progress now. For each activity/project, provide a contact information (e.g., Principal Investigators and Associate Investigators), a website if available and a list of relevant publications.*

### 1. Observational Activities

- Integrated Marine Observing System (IMOS) is maintaining the following observing activities:
  - Argo: The IMOS Argo Australia facility will continue to support ~10% of global core Argo out to 2022 and beyond. New investment is being made in ice capable Argo over the same period. New investment is being made in BGC Argo over the same period, leveraging SOCCOM investment in the Southern Ocean.
  - Ships of opportunity (SOOP): IMOS SOOP SST, pCO<sub>2</sub>, Air-Sea Flux, Continuous Plankton Recorder (CPR), and Bio-acoustics will continue out to 2022 and beyond, using RV Investigator, Aurora Australis/Nuyina, Astrolabe (France), Tangaroa (NZ) and fishing vessels (Austral Fisheries, Australian Longline, Sealord). New investment is being made in Southern Ocean phytoplankton through expansion of the SO CPR survey.
  - Moorings: The IMOS Southern Ocean Time Series (SOTS) site will be continued out to 2022 and beyond.
  - Regular (annual) voyages to the SOTS site are enabling significant collaborations to emerge in research on Southern Ocean biogeochemistry, clouds, and aerosols. These voyages include collection of high temporal resolution winds, waves, mixed layer depths, heat, moisture, and CO<sub>2</sub> fluxes, along with measurements of NPZD trophodynamics. Next voyage departs 12<sup>th</sup> March 2019.
  - Animal tagging: IMOS animal tagging (including CTD sensors) of Elephant and Weddell Seals will be continued out to 2022 and beyond
  - Satellite Remote Sensing: IMOS will continue to invest in calibration/validation and delivery of products in the Southern Ocean for SST Ocean Colour, Altimetry, and Surface Waves.
  - Australian Ocean Data Network (AODN: <https://portal.aodn.org.au>): All IMOS observations are turned in to near real time and/or delayed mode quality-controlled data that can be discovered, accessed downloaded, used and reused in perpetuity through the IMOS
- *R/V Investigator* voyage 2018-V5 (October 2016) – extensive physical oceanography survey of a standing meander in the ACC south of Tasmania, in support of Australian Research Council Discovery Project 170102162. Voyage

included 77 CTD casts, 56 Vertical Microstructure Profiles, 8 TRIAXUS transects and 6 EM-APEX float deployments. (Voyage Leaders: Nathan Bindoff, Helen Phillips; University of Tasmania)

## 2. Modeling Activities

- Under COSIMA (Consortium for Ocean and Sea Ice Modelling in Australia), development of global 0.1 ° ocean-sea ice models (ACCESS-OM2-01), with a focus on research questions relating to Southern Ocean upwelling, AABW formation and the Antarctic shelf. (Andy Hogg, Australian National University)
- Investigation of the role of bathymetry in Southern Ocean ventilation, using MITGCM ocean model run with different bathymetric configurations (Australian Research Council Discovery Early Career Research Award DE140100076, PI Andreas Klocker, University of Tasmania)
- Investigation of Antarctic Slope Current dynamics and its role for cross-shelf heat transport, using extremely high-resolution (1/48°) MITGCM global ocean model, and Regional Ocean Modelling System (ROMS). This is a collaboration with University of California Los Angeles, funded by Australian Research Council Antarctic Gateway Partnership. (Andreas Klocker, University of Tasmania)

## 3. Ocean reanalysis and state estimation Activities

## 4. National and International Projects/Initiatives

## **B. Planned activities**

*List which major activities are planned or likely to occur during the next several years, together with a contact information (e.g., Principal Investigators and Associate Investigators).*

1. Observational
2. Modeling
  - Detailed Southern Ocean sea ice model sensitivity study, to better understand how to reduce biases in the ACCESS-OM2-01 global ocean-sea ice model (Andy Hogg, Australian National University).
  - Implementation of higher resolution sectors of the Antarctic continental shelf and slope in ACCESS-OM2-01, modelled at  $\sim 0.025^\circ$  (Andy Hogg, Australian National University).
  - "How the complexity of continental breakup controls ocean circulation". High-resolution modelling study to understand the role of continental breakup in the onset of the Antarctic Circumpolar Current (Australian Research Council Discovery Project DP180102280, PI Joanne Whittaker, University of Tasmania)
3. Ocean reanalysis and state estimation
4. National and International Projects/Initiatives
5. Opportunities for future international collaborations

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## CLIVAR/CliC/SCAR SORP terms of reference

(<http://www.clivar.org/clivar-panels/southern>)

*"To serve as a forum for the discussion and communication of scientific advances in the understanding of climate variability and change in the Southern Ocean. To advise CLIVAR, [CliC](#), and [SCAR](#) on progress, achievements, new opportunities and impediments in internationally-coordinated Southern Ocean research."*

### **Specific Activities:**

1. Facilitate progress in the development of tools and methods required to assess climate variability, climate change and climate predictability of the ocean-atmosphere-ice system in the Southern Ocean.
2. Identify opportunities and coordinated strategies to implement these methods, spanning observations, models, experiments, and process studies.
3. Provide scientific and technical input into international research coordination, collaborating as required with other relevant programs, including the [Southern Ocean Observing System \(SOOS\)](#).
4. Monitor and evaluate progress in Southern Ocean research, and identify gaps.
5. Enhance interaction between the meteorology, oceanography, cryosphere, geology, biogeochemistry and paleoclimate communities with an interest in the climate of the Southern Ocean.
6. Work with relevant agencies on the standardization, distribution and archiving of Southern Ocean observations.