

**Proposed SOOS Capability Working Group:**  
**Enhancing Air-Sea Flux Observations in the Southern Ocean**

**SOOS Request for Assistance**

The Southern Ocean Observing System (SOOS) is an international initiative that aims to facilitate the collection and delivery of essential observations on variability and change of the Southern Ocean systems to all international stakeholders through the design, advocacy, and implementation of cost-effective observing and data delivery systems. SOOS requests assistance in developing the community, best practices, and initiatives through community Working Groups (WG). These WGs will provide critical information that will be incorporated into a maturing SOOS. SOOS will provide the WG with (i) a means of incorporating grass roots ideas into a lasting international system, (ii) mechanisms for enhancing collaboration and resources, and (iii) a means for achieving citations of developed products along with a presence on the world-wide web.

**SOOS Working Group Objective**

To reduce uncertainties in air-sea and air-sea-ice exchanges. The working group will design and facilitate the implementation of an observing system of essential ocean variables (EOVs) to support investigations on dynamics and change in Southern Ocean air-sea fluxes, including the formal definition of EOVs for fluxes, the development of priority measurements, standardized methodologies for collecting and archiving data, the optimal design of field programs, and strategies for implementing field observations, including supporting regional working groups and networking with existing and emerging programs. The working group may also need to address fundamental errors in bulk formulae used to parameterize fluxes, since these formulae are not tuned for the time-varying waves and winds typically found in the Southern Ocean. The presence of sea ice is a further complication that must be addressed.

**Terms of Reference**

The working group (WG) will fulfill the following terms of reference over the next 5 years:

1. Facilitate the identification and development of candidate air-sea flux EOVs and ECVs for the Southern Ocean, and to progress these to a mature state of readiness for inclusion in SOOS
2. For those with a mature state of readiness, provide standardised methodologies for collecting and archiving data
3. Identify and assemble legacy data sets from ships and stations (not already undertaken by other initiatives) that may assist in validating and furthering our knowledge of SO air-sea fluxes
4. Promote and coordinate existing programmes and platforms to collect essential observations that are identified as scarce and required for validation purposes
5. Develop standardized methods that are easily understood by different stakeholders, including policy stakeholders, which are repeatable, and easily transferrable
6. Develop methods for validation/ground truthing of satellite-derived flux estimates using in situ observations
7. Define targets that will make the flux products more usable and that will serve as metrics for assessing progress
8. Identify critical spatial and temporal gaps (including key regions – sea ice, upwelling, islands etc) in Southern Ocean air-sea flux observations and knowledge; links to optimal sampling strategies and data assimilation

9. Identify ‘fast-track’ approaches to obtaining observations that address existing spatial and temporal gaps
10. Identify end users of such data and provide guidelines to facilitate the delivery of this data to end users; develop procedures to achieve efficient sharing of data across the science community according to SOOS data policy and via the SOOS Data Portal
11. Guide development of a series of coordinated pilot studies projects for SO air-sea fluxes across the Southern Ocean. The pilot studies can include observations of the atmospheric boundary layer and upper ocean state over selected regions of the Southern Ocean (ships, planes, wave gliders, profiling floats).
12. Use observations to
  - a. validate satellite air-sea fluxes and mapped (e.g. reanalysis) products
  - b. improve models in terms of atmospheric state and coupling to the ocean
  - c. assess air-sea coupling parameters in evolving sea states
  - d. evaluate the impact of the improved coupling parameters on ocean model performance
13. As part of the pilot study, augment the observing program with coupled ocean-surface wave-ice-atmosphere process modeling to evaluate model physics at the air-sea interface, the sensitivity to bulk formulae, and perform a comparative analysis of varying resolution models
14. Development of white paper(s) that guide the community of recent gains and way forward
15. Hold annual meetings of the working group, and source funding to enable WG sustainability and “spin-off” flux-related initiatives
16. Convene focussed sessions at national and international meetings, including SCAR and SCOR, and facilitate synthesis products, to increase the awareness of the science community to the importance of the air-sea fluxes. Provide annual reports to the SOOS SSC on activities and outcomes of the WG, and regular updates for the SOOS newsletter

## **Participants**

Co-Chairs:

Membership:

TBD: Working Group membership can include observational oceanographers, atmosphere/ocean/coupled modellers, and specialists in atmospheric boundary layer processes.

## **Products and Outcomes**

- 1) Air-Sea Flux EOVs for the Southern Ocean with detailed specification sheets highlighting temporal/spatial requirements, standardised methodologies, and preferred data management etc etc
- 2) White paper / peer reviewed paper / community report highlighting status, key spatial-temporal gaps, technology/sensor issues and requirements, data management issues/requirements, strategy for way forward (to be used as rationale for funding bids for pilot study)
- 3) Funding and logistics proposals submitted internationally for a coordinated pilot study addressing key air-sea flux observational gaps – likely timed to coincide with, and contribute too YOPP. Ultimate pilot study outcomes could include development of robust sensors (including improvements in ship-based met packages and ship drag assessment), standard operating procedures/protocols for collecting air-sea flux observations, ground truth data for analyzing air-sea fluxes, improved air-sea coupling parameterizations for the Southern Ocean to be used in climate modeling, improved infrastructure for coupled ocean-ice-atmosphere modeling and assimilation

**Mode of Operation**

The group will work remotely and opportunistically at scientific conferences until funding can be arranged for the group's activities. The SOOS website will be used to provide information and share resources. All efforts will be made to harmonize the efforts of this group with other relevant efforts, such as EOV/ECV efforts of GCOS, OOPC, and GOOS communities; field efforts of COMNAP ARC, ASPeCt, and many other national and multi-national programs.

**Strategy & Milestones**

A strategy with milestones on an achievable timeline of delivery will be developed in the months following the September 2015 workshop, and will be provided to SOOS EXCOM and SSC for review in time for the 2016 May SSC meeting to be held at Scripps Institution of Oceanography.

Efforts will be made to hold a lunchtime meeting with available WG members at the 2016 Ocean Sciences Meeting to further refine WG strategy and objectives.

**Facilitator and SOOS SSC Sponsor**

SOOS SSC sponsor(s): Seb Swart, Alberto Naveira Garabato