



Inaugural SOOS Symposium
"Southern Ocean in a Changing World"

14 - 18 August 2023 | Hobart, Tasmania

REPORT

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Executive Summary

The Southern Ocean Observing System (SOOS) held its inaugural SOOS Symposium, “Southern Ocean in a Changing World” from the 14th to 18th August 2023 in Hobart, Tasmania. The Symposium was attended by 300 scientists from 25 nations for a week of plenary presentations, parallel sessions and workshops covering a wide spectrum of Southern Ocean research. In light of the escalating climate crisis, a community statement calling for an urgent expansion of Southern Ocean observations was released.

The Southern Ocean is a critical component of the global climate system. The Southern Ocean controls to a large extent the uptake of human generated heat and carbon into the ocean. Yet, we are currently observing critical changes in the Southern Ocean that are seen in the record low levels of sea-ice extent, record high temperatures and dramatic shifts in penguin populations, among other striking changes. The chronic lack of observations for the Southern Ocean challenges our ability to detect and assess the consequences of change. As such, it is more pressing than ever to have a sustained and coordinated Southern Ocean observing system to provide an understanding of current conditions, inform predictions of future states, and support policies and regulations for the benefit of society.

This community statement has already had lasting impact, including international media attention, propelling the importance of Southern Ocean research into the spotlight. It has also been used as support for discussions on the need for sustained and coordinated observations of the Southern Ocean in policy and decision-making forums.



Attendees of the SOOS Symposium 2023.

Program Overview

SOOS Symposium Themes

The SOOS Symposium focused around the eight topics outlined below to incorporate a wide spectrum of Southern Ocean research and cover the entire observational value-chain (technology development, observing system design, collection of observations, analysis and research, data management, impacts into policy and decision making).

- **Need for a Southern Ocean observing system**
The Southern Ocean plays a critical role in the Earth System, and our understanding of the ongoing changes and our ability to project future changes are reliant on sustained observations. The SOOS has built a strong network of community-driven initiatives and tools that combine to enhance and facilitate the delivery of a sustained observing and data delivery system for the Southern Ocean.
- **Circumpolar observations and programmes**
Circumpolar and global observing programmes ensure a sustained delivery of observations and data across a core set of variables, using prescribed platforms, methods and standards across all steps of the observational life cycle. This topic showcased these programmes, their observational coverage, data and data delivery, and how they feed into policy and societal challenges as well as new and upcoming plans, technology and data systems for these programmes.
- **Regional observations and programmes**
Regionally focused observations and programmes generate knowledge through high sampling resolution and interdisciplinarity, and provide important contributions to local, regional and circumpolar understanding. This topic invited contributions from regional observational and data programmes across all Southern Ocean sectors and disciplines in order to share science and connect regional programmes, with the specific aim of promoting discussions across regions.
- **Data systems**
Innovations in data systems, data integration and standardisation underline all aspects of SOOS data delivery. This topic included presentations and workshops on data approaches and products arising from Southern Ocean observations.
- **Impact of observations in policy and societal challenges**
Southern Ocean data from across the five SOOS Science Themes should be readily accessible to enable the international scientific community to support evidence-based decision-making. This session discussed developing and communicating data products and tools to support decision-making.
- **Southern Ocean in the global UN Ocean Decade**
The Southern Ocean Action Plan provides a framework for Southern Ocean stakeholders to formulate and develop tangible actions and deliverables that support the vision of the UN Decade of Ocean Science for Sustainable Development. This session provided a forum for identifying and advancing SOOS contributions that will contribute to implementation of the Action Plan.

- **New observing technology and systems in Southern Ocean observations**
New methods, approaches and technology are needed to drive a step change in coordinated Southern Ocean science. This topic sought to explore the difficult questions of how new technologies can be leveraged to improve data collection and coverage, science outcomes and coordination, and integration with emerging cyberinfrastructure.
- **Gaps and next steps for the Southern Ocean observing system**
The Southern Ocean observing system has come a long way, but gaps remain in the current observing system that need to be addressed to deliver a cohesive, coordinated, circumpolar observing system. This session considered what a Southern Ocean observing system will look like in 10 years and identify gaps and opportunities the related science questions, new technologies and capabilities, collaborations and data innovations needed to support this future system.

SOOS Symposium Program

The Symposium included a plenary presentation focused on each of the eight themes as well as cross-cutting parallel sessions, workshops and a poster session. Additionally, many the SOOS working groups held open lunch meetings during the Symposium week. An overview of the [SOOS Symposium program](#) is provided in Table 1.

Table 1: Overview of the SOOS Symposium program with plenary presentations (blue), parallel sessions (purple) and parallel workshops (orange).

Monday	Tuesday	Wednesday	Thursday	Friday
Symposium Opening	“Regional observations and programmes” Plenary	“Impact of observations in policy and societal challenges” Plenary	“Southern Ocean in the global UN Ocean Decade” Plenary	“Gaps and next steps in Southern Ocean observing system” Plenaries including presentations and panel discussion from key observing initiatives, ECR perspectives and concluding plenary
“Need for a Southern Ocean observing system” Plenary	“Equity, diversity and inclusions in Southern Ocean research” Plenary			
Parallel Sessions including “Creating impact for your observational data beyond research” workshop	Parallel Sessions including a workshop on Polardex/DueSouth	Parallel Sessions	Parallel Sessions	Symposium closing
“Circumpolar observations and programmes” Plenary	“Data Systems” Plenary	“New observing technology and systems in Southern Ocean observations” Plenary	Parallel sessions including workshops on SOOSmap, data surgery and Antarctica InSync	
ECR Networking Event	Poster Session (posters on display all day)	Symposium Dinner		
		*Trade Exhibition and Data Helpdesk running all day	*Trade Exhibition running all day	*Media conference and media release of the SOOS Symposium community statement

Plenary presentations were provided by:

- Need for a Southern Ocean Observing System = Steve Rintoul (CSIRO, Australia) and Eileen Hofmann (Old Dominion University, USA)
- Circumpolar observations and programmes = Andrew Meijers (British Antarctic Survey, UK)
- Regional observations and programmes = Oscar Schofield (Rutgers University, USA)
- Equity, diversity and inclusion in Southern Ocean research = Kimberly Aiken (University of Tasmania, Australia), Angus Aldis (Accessibility in Polar Research), Dani Jones (British Antarctic Survey, UK), Emma Robertson (Polar Impact), Alex Thornton (Pride in Polar

- Research) and Renuka Badhe (Women in Polar Science) as well as Lydi Keppler (Accessibility in Polar Research) on the panel discussion
- Data Systems = Vito Vitale (CNR Institute of Polar Sciences, Italy)
 - Impact of observations in policy and societal challenges = Indi Hodgson-Johnston (ARC Australian Centre for Excellence in Antarctic Science, Australia) as well as Tony Press (University of Tasmania, Australia) and Mary-Anne Lee (University of Tasmania, Australia) on the panel discussion
 - New observing technology and systems in Southern Ocean observations = Noah Lawrence-Slavas (NOAA, USA)
 - Southern Ocean in the Global UN Ocean Decade = Alison Clausen (Intergovernmental Oceanographic Commission of UNESCO), Renuka Badhe (European Polar Board, Netherlands), Anton Van de Putte (Royal Belgium Institute of National Sciences, Belgium), Stuart Corney (University of Tasmania, Australia), Karen Evans (CSIRO, Australia) as well as Sian Henley (University of Edinburgh, UK) on the panel discussion
 - Gaps and next steps for the Southern Ocean observing system:
 - o Presentation and panel discussion with key observing initiatives = NECKLACE, INSTANT, ASPECT, SORP, AntClim^{now}, SOCCOM, BEPSII, ICED, MEASO, Ant-ICON, AniBOS, IAATO, Polar Citizen Science Collective, European Polar Board, EMODnet Physics
 - o ECR perspectives presentations = Kathy Gunn (CSIRO, Australia), Ethan Campbell (University of Washington, USA), Alessandro Silvano (University of Southampton, UK), Minkyong Kim (Kyungpook National University, South Korea), Svenja Halfter (NIWA, New Zealand)
 - o Closing plenary presentation = Irene Schloss (Instituto Antártico Argentino, Argentina)

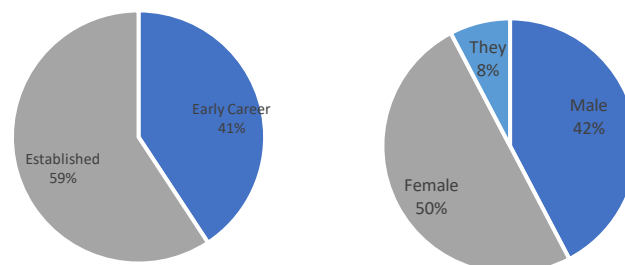


Figure 1: Diversity of plenary speakers and panel members at the SOOS Symposium 2023 showing career stage and gender (left to right) of each plenary speaker and panel member.

Over the week of the Symposium, there were 245 presentations including 24 plenary presentations, 154 oral presentations, 10 workshop presentations and 57 posters covering key topics from the past, present and future of Southern Ocean observations. These presentations highlighted the importance of collaboration, innovation, and inclusivity in advancing Southern Ocean research and monitoring. In addition to the main Symposium program, there were two pre-Symposium workshops and annual meetings post-Symposium of the SOOS Scientific Steering Committee and Data Management Sub-Committee. The two pre-Symposium workshops were: an [essential variables workshop](#) coordinated by [biodiversity.aq](#), SOOS and the SCAR Expert Group on Antarctic Biodiversity Informatics (EG-ABI), and a [workshop on observing system design](#) coordinated by the SOOS Observing System Design Capability Working Group and Polar Technologies Task Team as well as Animal Borne Sensors (AniBOS).

At the conclusion of the week, best ECR presentation prizes (sponsored by the Royal Society of Tasmania) were presented. The best ECR presentation was awarded to Paulina Latour for her oral presentation titled “Living on the edge: response of deep phytoplankton communities to light, iron, and manganese additions”. Honourable mentions were also awarded to Ethan Campbell for his oral presentation titled “Antarctic sea ice formation and melt rates estimated from under-ice Argo observations”, and to Safiyyah Moss for her poster presentation titled “Investigating the dynamics and exchanges across the ice-ocean interface in artificial sea ice.”

The overall feedback on the SOOS Symposium 2023 program was positive in the post-Symposium survey. Of the responses, 87% felt that the Symposium themes were highly relevant and overall, 95% rated the program content as 5/5 (55%) or 4/5 (40%). Specifically, comments on the program highlighted the great plenary presentation by Oscar Schofield, Andrew Meijers, Steve Rintoul, Indi Hodgson-Johnston and Noah Lawrence-Slavas as well as the equity, diversity and inclusion plenary.

Networking and Industry Engagement

In addition to the scientific program of the SOOS Symposium, there were a number of opportunities for attendees to network and engage with industry. All early career attendees were invited to join a [mentoring program](#) during the Symposium where early career attendees were buddied with an established attendee for the duration of the Symposium. Mentors provided support and guidance during the Symposium, with each mentor/mentee relationship differing depending on the needs of the mentee. On the first evening of the Symposium, an early career networking event was run, sponsored and hosted by the Tasmanian Museum and Art Gallery, and sponsored by the Associate of Polar Early Career Scientists (APECS). On the Tuesday evening, a [poster session](#) sponsored by the Tasmanian Polar Network provided an opportunity for poster presenters to engage with the Symposium attendees along with a trade exhibition by members of the Tasmania Polar Network. This was then followed by a general trade exhibition over the Tuesday and Wednesday of the Symposium with exhibitions from the SOOS Symposium sponsors and exhibitors. A Symposium dinner was held on the Wednesday evening at the Franklin Wharf Function Centre which included an ad-hoc streaming of the Australia/England FIFA Women’s World Cup semi-final.

The SOOS Symposium dinner had mixed reviews whereas the poster session and exhibition were overall rated positively, 72% and 66% ranked the poster session and exhibition either 4/5 or 5/5, respectively. The ECR event also had positive feedback although could have run for longer to facilitate longer conversations.

Attendance

The SOOS Symposium had 296 registrations from 133 institutes and 25 countries. The majority of registrants were full registrations, followed by student registrations and registrations of attendees from developing countries (Table 2). The Symposium had a fairly good diversity across gender and career stage. Most registrants worked in Antarctic research or a related discipline (Figure 2). Whilst there was representation from a good geographic spread, most registrants were from Australia (130), followed by the US (36), China (19), New Zealand (11), Japan (10) and United Kingdom (10). There was a notable lack of registrations from Europe (Figure 2).

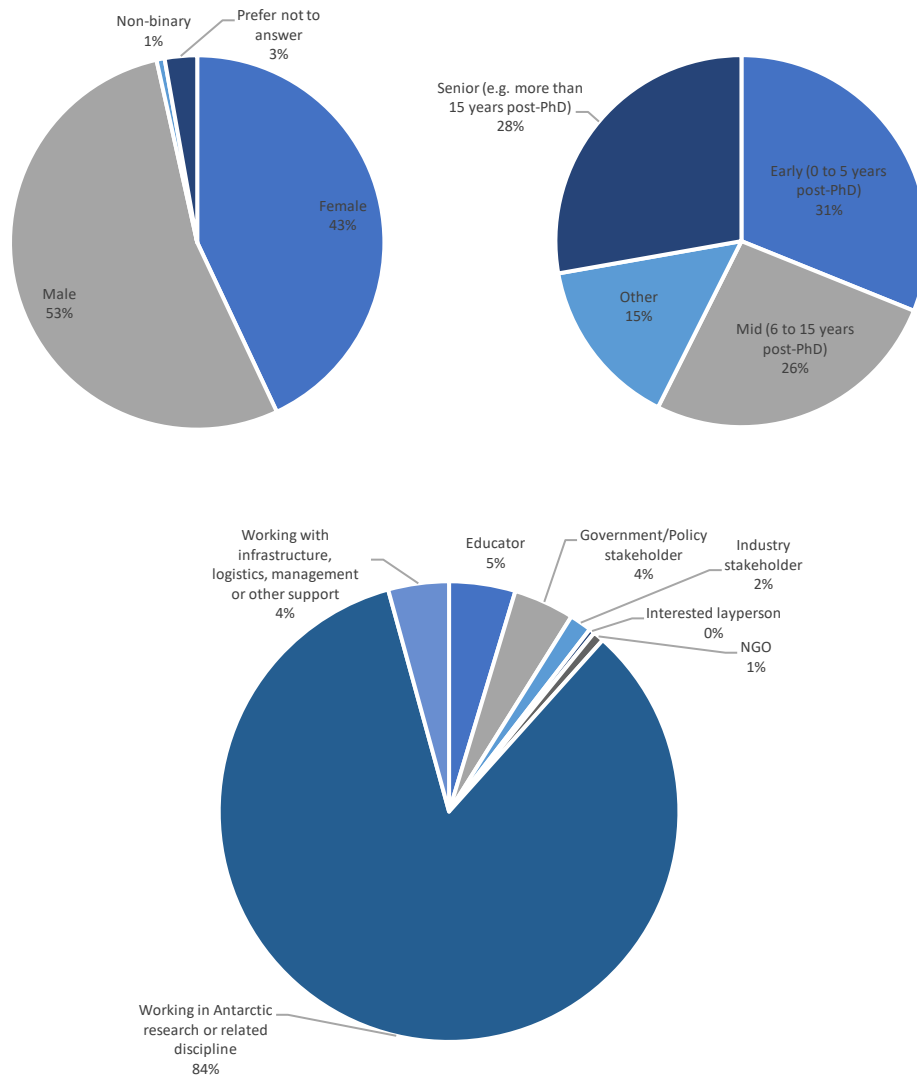


Figure 2: Diversity of SOOS Symposium 2023 registrants showing gender, career stage (top row left to right) and profession (bottom).

Table 2: Number of registrations to the SOOS Symposium 2023 per registration type.

Registration Type	Number of Registrants
Full Registration	138
Student Registration	41
Developing Countries Registration	31
Day Full Registrations	24
Day Student Registrations	6
Sponsor/Exhibitor Registrations	22
Online Plenary Presenters/Panel Members	14

Equity, Diversity and Inclusion Considerations

The SOOS Symposium ran a few initiatives to ensure the SOOS Symposium was as equitable, diverse and inclusive as possible. These included a pilot online offering and the early career initiatives (travel scholarships for ECRs from developing country, mentoring program and ECR presentation prizes). All session submissions were encouraged to include geographic diversity and early careers in their convenors (11 out of the 18 sessions had early career convenors). The SOOS Symposium had a [Code](#)

[of Conduct](#) for the Symposium to help create an inclusive and productive environment that fostered positive discussion, as well as encouraged participants to consider the viewpoints of others. There were two Safety Officers at the Symposium to be first points of contact for any incidents of inappropriate behaviour and University of Tasmania teams of stand-by to support. Lastly, the local early career committee ran an initiative where labels were available for attendees to add to their lanyards to add keywords to facilitate ice-breaking conversations with other attendees.

SOOS Symposium Online Offerings

During the SOOS Symposium the SOOS Equity, Diversity and Inclusion Group ran a pilot virtual option through a range of online initiatives for those unable to attend in person. These included:

- Pilot, low-cost live streaming of selected sessions via Zoom. This was facilitated through in-kind sponsorship of Owl Labs.
- Daily session summaries highlighting key scientific questions and future directions.
- Recordings of plenary presentations available post-Symposium as well as parallel presentation slides and posters (which have been consented to by presenters) available at a low cost (\$5 AUD) post-Symposium.

176 people registered indicated their interest in this pilot virtual option, stemming from 25 countries and 89 institutions. Most registrants were from Australia (44), USA and (35) and UK (30) and were early career (Figure 3). 60 individuals logged into the pilot, low-cost streaming with approximately a third attending each day (17-21 online attendees daily). Of these 60 individuals, 12 were in-person attendees of the SOOS Symposium. From the remaining 48 individuals, most were from Australia (17), the USA (8) and China (5), and most were early careers (Figure 3). The daily summaries were very popular with 728 views on the daily highlights page (the second highest page viewed after the program) and 426 downloads. 11 people registered post-Symposium for access to the delegates’ portal to gain access to plenary recordings and presentation PDFs. The plenary recordings will be made available via the SOOS YouTube channel in 2024 as part of a SOOS webinar series, building these plenaries beyond the Symposium.



Figure 3: Career stage diversity of SOOS Symposium 2023 176 people who registered their interest in the pilot virtual option (left) and the 60 people who attended (right).

Travel Scholarship for ECRs from Developing Countries

The SOOS Symposium 2023 offered eight partial-travel scholarships to ECRs from developing countries to attend the Symposium. These scholarships were provided through the sponsorship of the Scientific Committee on Oceanic Research (SCOR) and the Partnership for Observation of the Global Ocean (POGO). The [recipients of the scholarships](#) were Thiago Monteiro (Federal University of Pará, Brazil), Martini Mascioni (Universidad Nacional de La Plata, Argentina), Athirpankandi Sreerag (National Centre for Polar and Ocean Research, India), Aakriti Srivastava (Barkatullah University, India), Salman Tariq (University of Panjab, Pakistan), Melena Soares (National Centre for Polar and Ocean Research, India), Raul Rodrigo Costa (Federal University of Rio Grande, Brazil), and Marina Noro (University of Sao Paulo, Brazil).

Sponsors, Supporters and Exhibitors

The SOOS Symposium 2023 would not have been possible without the generous support of the Symposium sponsors, supports and exhibitors. The SOOS Symposium received platinum sponsorship from the Australian Antarctic Program Partnership (AAPP); silver sponsorship from the ARC Australia Centre for Excellence in Antarctic Science (ACEAS) and K.U.M. Umwelt und Meerestechnik Kiel GmbH; bronze sponsorship from the Korea Polar Research Institute (KOPRI) and CSIRO; Symposium supporters Antarctica New Zealand, the Coalition of Legal Toothfish Operators (COLTO) and the Joint Task Force on Smart SubSea Cable Systems; the Tasmanian Polar Network sponsored the Symposium poster session; the Tasmanian Museum and Art Gallery (TMAG) and Associate of Polar Early Career Scientists (APECS) sponsored the ECR networking event; the “Creating impact for observational data beyond research” workshop was sponsored by the Theo Murphy Initiative (Australia); ECRs from developing countries travel scholarships to attend the Symposium were provided by the Scientific Committee on Ocean Research (SCOR) and the Partnership for Observation of the Global Ocean (POGO); travel awards for US attendees to the Symposium were provided by the National Science Foundation (NSF) through the US Scientific Committee on Antarctic Research (US-SCAR); the Symposium received a Tasmanian Attraction Grant supplied by Business Events Tasmania; the pilot hybrid running during the Symposium was supported by the in-kind support of Owl Labs; the Royal Society of Tasmania provided a cash prize for the best ECR presentation at the Symposium as well as books to contribute to plenary presentation gifts; sponsorship by the Gobierno de Tierra del Fuego Antártida e Islas del Atlántico Sur, Secretaría de Ciencia y Tecnología, OCEAN:ICE, the Second Institute of Oceanography (SOA) and the University of Edinburgh; and the support of all SOOS sponsors the University of Tasmania’s Institute for Marine and Antarctic Studies (IMAS), CSIRO, Tasmanian State Government, Swedish Polar Research Secretariat (SPRS), Antarctica New Zealand, the University of Cape Town’s Biogeochemistry Lab, the TUBITAK Polar Research Institute, OCEAN:ICE, the European Marine Observing Data Network (EMODnet), the European Polar Board, the Scientific Committee on Oceanic Research (SCOR) and the Scientific Committee on Antarctic Research (SCAR). The SOOS Symposium was also supported by the Symposium exhibitors, CLS Oceania, Echoview, the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) and Imbros.



Figure 4: Sponsors, supporters and exhibitors of the SOOS Symposium 2023.

Output and Impact Summary

The inaugural SOOS Symposium 2023 was a resounding success, deepening our understanding of the Southern Ocean's vital role in global systems and ecosystems as well as the necessity for ongoing, sustained observations. Researchers and experts gathered to share their findings, discuss challenges, and highlight the ocean's significance in the global context. As we navigate the challenges posed by climate change and increased human activity in the region, the Symposium served as a catalyst to deepen collaborative efforts to enhance the collection of Southern Ocean observations.

The SOOS Symposium through the program of plenary, oral, poster and workshop presentations substantially added to the collective understanding of the region, offering valuable resources for further study. Researchers and scientists actively participated in discussions, exchanging insights and strengthening the global network of Southern Ocean experts. This collaborative spirit further enriched the knowledge-sharing experience. In addition to this knowledge sharing between Symposium participants, the SOOS Symposium had international impact over social media and press media.

Social Media Engagement

The SOOS Symposium 2023 wasn't confined to the physical event space. The Symposium's reach extended far beyond its physical location, thanks to active engagement on social media platforms. Attendees and participants, as well as the global community interested in Southern Ocean research, eagerly shared conference highlights, research findings, and thought-provoking discussions using the conference's dedicated hashtag, [#SOOSymposium2023](https://twitter.com/SOOSymposium2023). The strong social media engagement during the SOOS Symposium 2023, with 105 mentions and 1500 interactions on Twitter, signifies its global impact. The enthusiastic participation of attendees, coupled with engagement from the international community interested in Southern Ocean research, amplified the event's reach and message. The high engagement on the closing statement tweet, garnering nearly 17,000 views, over 100 likes, and 60 reposts, underscores the symposium's effectiveness in highlighting key findings and advancing the

organization's mission. These metrics provide concrete evidence of the symposium's significance in raising awareness and fostering collaboration in the field of Southern Ocean research. Further, it signifies increased visibility, effective outreach, and the establishment of a supportive community around SOOS enhancing SOOS's reputation, impact, and potential for collaboration, ultimately advancing its mission to enhance and facilitate Southern Ocean observations.

Press Coverage

The SOOS Symposium 2023 was not just a gathering of experts—it was a newsworthy event. Media outlets from around the world covered the conference, showcasing its importance and the significance of the Southern Ocean in global contexts. The press coverage not only disseminated knowledge but also raised public awareness about the Southern Ocean's vital role in Earth's systems and ecosystems. The event was featured in multiple online articles, podcasts, radio interviews and television broadcasts around the globe from Australia, New Zealand, Chile and Argentina to several European countries such as Germany, the UK, Switzerland, Spain, France, and Italy. This wide-reaching media coverage reflects the global significance of the SOOS Symposium and its impact on Southern Ocean research and monitoring.

On the final day of the SOOS Symposium, a community statement was released highlighting the pressing need for a sustained and coordinated Southern Ocean observing system to provide an understanding of current conditions, inform predictions of future states, and support policies and regulations for the benefit of society. The statement was released in the final plenary of the Symposium as well as at a press conference and press release to the media. The SOOS Symposium statement was translated into 11 languages and the full press release into 6 languages (SOOS Symposium statement, press release and translations can be found [here](#)). This has since been shared by over 40 media products including print, TV and radio media internationally.

International Program Committee and Local Steering Committee

Alessandro Silvano (University of Southampton, United Kingdom)

Alyce Hancock (Southern Ocean Observing System International Project Office, Australia)

Andreas Marouchos (Commonwealth Scientific and Industrial Research Organisation, Australia)

Delphine Lannuzel (Institute for Marine and Antarctic Studies, University of Tasmania, Australia)

Deneb Karentz (University of San Francisco, United States)

Irene Schloss (Instituto Antártico Argentino, Argentina)

Jilda Caccavo (Institute Pierre Simon Laplace, France)

Julia Bach (Southern Ocean Observing System International Project Office, Australia)

Kathy Gunn (Commonwealth Scientific and Industrial Research Organisation, Australia)

Parli Bhaskar (National Centre for Polar and Ocean Research, India)

Sarat Chandra Tripathy (National Centre for Polar and Ocean Research, India)

Steve Diggs (Scripps Institution of Oceanography, United States)

Steve Parker (Commission for the Convention of Antarctic Marine Living Resources, Australia)

Sue Cook (Australian Antarctic Program Partnership, Australia)

Wolfgang Rack (University of Canterbury, New Zealand)

Lavenia Ratnarajah (Southern Ocean Observing System International Project Office, Australia)