SOOS

SOUTHERN OCEAN
OBSERVING SYSTEM

The
Southern Ocean Observing System
2022 Annual Report

Summary

The Southern Ocean Observing System (SOOS) is a joint initiative of the Scientific Committee on Antarctic Research (SCAR) and the Scientific Committee on Oceanic Research (SCOR). SOOS was launched in 2011 with the mission to facilitate the sustained collection and delivery of essential observations of Southern Ocean systems to all international stakeholders, through design, advocacy, and implementation of cost-effective observing and data delivery systems.

The SOOS International Project Office Core Sponsorship 2022:

Contents

SOOS in 2022

SOOS had a successful and productive year in 2022, with several highlights from different parts of our community. Two major documents were finalised, approved and published; the SOOS Science and Implementation Plan (2021-2025) and the SOOS 5-Year Report (2016-2020). Production of these documents was led by the SOOS International Project Office (IPO), and benefitted from support and input from across the SOOS community. In addition to these publications, 2022 also saw the publication of the SOOS Data Policy, which was a significant contribution from the SOOS Data Management Sub-Committee (DMSC).

Three major SOOS products were released in 2022 that will be of significant value to the wider Southern Ocean community in supporting science, data discovery, fieldwork logistics, operations and the provision of policy-ready information. Polardex and the new interface for DueSouth, which was originally developed by SOOS to help researchers find opportunities for collaborative fieldwork, were launched in April 2022, after development in partnership with the European Polar Board. SOOSmap Version 2 had its soft launch in August 2022, in preparation for its official launch in early 2023. This second version of SOOS' data discovery tool has undergone significant improvement, development and enhancement since its initial version released in 2017. The POLDER Polar Federated Search Tool, for which SOOS is a lead partner alongside SCAR's Standing Committee on Antarctic Data Management (SCADM) and the Arctic Data Committee, was released in March 2022.

SOOS increased its involvement and influence in global and Antarctic-focused policy making throughout 2022, by leading a side event at the 27th Conference of the Parties (COP27) of the UN Framework Convention on Climate Change (UNFCCC) in Egypt in November 2022 and by contributing to further events at COP27, the UN Ocean Conference in Portugal in June 2022, and the 41st meeting of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) in Australia in October 2022.

Two SOOS-focused peer-reviewed publications were published in 2022: LaRue et al., 2022 showed the latest results from the Capability Working Group on Censusing Animal Populations from Space (CAPS) and Beadling et al., 2022 provided the 2021 update for the State of the Climate Report from the Bulletin of the American Meteorological Society (BAMS). Also 2022 saw the publication of the Southern Ocean Action Plan for the UN Decade of Ocean Science for Sustainable Development, in which SOOS is a key partner alongside many other Southern Ocean-focused stakeholder organisations.

SOOS continued to extend its range of community-building and networking activities through hosting 24 events in 2022. These included four Scientific Steering Committee meetings, two Data Management Sub-Committee meetings, a final AUV Task Team meeting, a Weddell Sea Dronning Maud Land Regional Working Group online workshop, the first SOOS-Swedish Southern Ocean Network seminar, eight webinars (from the Amundsen and Bellingshausen Sector Regional Working Group and Southern Ocean Fluxes (SOFLUX) Capability Working Group), four Polar to Global Online Interoperability and Data Sharing workshops/hackathons, as well as launch events

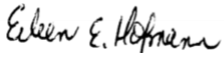
for Polardex and the POLDER Polar Federated Search Tool, and co-hosting a data session at the SCAR Open Science Conference in collaboration with SCADM.

Planning and organisation also continued for the SOOS Symposium in Hobart in August 2023, the 4th International Ross Sea Conference in July 2023 in Naples, Italy, as well as SOOS participation at a number of national and international meetings of relevance to the community.

Finally, SOOS would like to warmly acknowledge the continued core sponsorship and hosting of the IPO through 2023 by the University of Tasmania's Institute for Marine and Antarctic Studies, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Tasmanian State Government Department of State Growth, as well as new sponsorship received from the EU-funded OCEAN:ICE project.

This report showcases SOOS' key achievements and documents progress for 2022, as well as outlining plans for 2023 and beyond. We describe activities that are underway and forthcoming as well as a number of milestones and key performance indicators across all of SOOS' working groups, task teams, leadership groups and the wider community. 2022 was a full and fruitful year for SOOS and we look forward to continuing to support the Southern Ocean community through the collection, management, delivery and optimal usage of data and information from all available sources in line with the SOOS mission.

Signed:



Dr. Eileen Hofmann; Co-Chair
Old Dominion University, United States

Signed:

Dr. Sian Henley; Co-Chair
University of Edinburgh, United Kingdom

Performance Report

SOOS developed a Science and Implementation Plan for 2021-2025 which articulates the scientific priorities for SOOS through identification of key gaps in the observational network and by identifying the priorities in addressing these gaps. The plan has an emphasis on the capabilities required to support data collection and delivery, and the objectives and actions that SOOS will implement. The plan was developed by the SOOS community with extensive input from the broader Southern Ocean community. The SOOS 2021-2025 Science and Implementation Plan underwent an international, independent review coordinated by SOOS' governing bodies, the Scientific Committee for Antarctic Research (SCAR) and Scientific Committee for Oceanic Research (SCOR) and was approved in June 2022.

Incorporated in the SOOS 2021-2025 Science and Implementation Plan is a 5-Year Strategic Plan with five Objectives that combined will deliver the SOOS mission. Within each objective there are several Implementation Actions that indicate more specifically how these objectives will be achieved. The full and detailed SOOS 5-Year Strategic Plan is available here.

The progress against SOOS' Objectives and Implementation Actions are outlined in the table below.

Table 1: The table below shows the progress against the SOOS Objectives and Implementation Actions for the year 2022. The status of the Implementation Action is shown as: Achieved; In progress; Not yet started; Ongoing activity; No longer a priority. All acronyms can be found in Appendix I.

		Comments on 2022 actions	Implementers
Objective 1: Develop and coordinate inclusive and collaborative networks for shared knowledge, enhanced observational capability and data collection, management and delivery			
Coordination of regional networks		In 2022 all RWGs were active, maintained active leadership teams and had growths in members between 10-20 members each (and 37 new members in the ABS RWG). Some RWGs continued to release regular newsletters including ABS and SOIS to their membership teams to provide updates on activities within their regions and upcoming opportunities of relevance. The ABS RWG initiated running bimonthly webinars with high attendance and post-webinar viewing. The WSDML held an online workshop in June 2022 with 42 registered participants. The WAPSA and WSDML RWGs continued coordination of special issues for release in 2023. The Ross Sea RWG began planning for the 4th International Ross Sea Conference and a Ross Sea International Union of Geodesy and Geophysics (IUGG) session. Most RWG are coordinating sessions and lunch meetings for the SOOS Symposium 2023. RWG leadership team members actively represented SOOS at international meetings, conferences and workshops including the SCAR Open Science Conference 2022, AntClim^{now}, BioPole, SO-CHIC and APECS workshops and meetings. Full information and achievements of SOOS' RWGs are available on pages 28-35.	SOOS: RWGs Community: SCAR, SO-CHIC, BioPole, APECS
Coordination of networks to enhance observational capacity at any point in the value chain		In 2022 all CWGs and TTs were active, maintained active leadership teams and had growths in membership. Highlights of SOOS CWGs and Task Teams in 2022 include: - 2 scientific publications (CAPS and SOFLUX) - Establishment of OSD newsletters and online mini-workshops	SOOS: CWGs and Task Teams Community: OASIS, SO-CHIC

		- Coordination of SOOS Symposium workshop, parallel sessions and plenary (Polar Tech, OSD and SOFLUX) - Continuation of SOFLUX monthly newsletters and regular webinars - The final meeting and completion of the AUV Task Team CWG and Task Team leadership team members actively represented SOOS at international meetings, conferences and workshops including the COP27 side-events, Heat and Carbon Uptake in the Southern Ocean: the state of the art and future priorities, European Geophysical Union General Assembly, and FilaChange, an international conference on ocean processes linking filaments and finescales (1-100km) with climate change. Full information and achievements of SOOS' CWGs and TTs are available on pages 37-43.	
Integrate and engage between and across relevant programmes, organisations, and institutes to leverage and enhance impact of the SOOS programme as a whole		SOOS was represented at international meetings, conferences and workshops including COP27, SCOR Annual Meeting, CCAMLR Scientific Committee meetings, Tasmanian Polar Network meetings, CliC/CLIVAR/SCAR Southern Ocean Regional Panel meetings, Norwegian Polar Institute Antarctic Program Meeting, AntClim^{now} Workshop "Connecting Models and Observations of the Antarctic Climate System across Timescales", Integrated Marine Observing System Annual Meeting, Challenger 150: The Challenger Society Conference 2022, UK Antarctic Science Conference 2022, SCAR Open Science Conference, SCAR Business Meetings and Delegates Meeting, ORCHESTRA/RoSES Annual Meeting, UN Ocean Conference, EU-PolarNet Workshop "Recommendations towards an Integrated Polar Observing System", International Online Conference of APECS, OASIS UN Decade Accessible Ocean Laboratory, Heat and Carbon Uptake in the Southern Ocean: the State of the Art and Future Priorities, Australian Hydrographic Office meeting, Bureau of Meteorology seminar, UN Meeting on EDI Workshop, How to Achieve a Clean Ocean in the Southern Ocean Region, 2022 Ocean Sciences Meeting, Defining the Future of the Southern Ocean, Polar Symposium "The Cold is Getting Hot", 13th International Conference on Southern Hemisphere Meteorology and Oceanography, CCAMLR Science Symposium, The Southern Ocean on Europe's Shores – Climate Impacts, Sea Level Rise, and the Marine Environment, Engaging Early Career Ocean Professionals in the UN Ocean Decade, OCEAN:ICE Kick-Off Meeting, monthly SCADM meetings, BioPole meeting.	SOOS: EDI Group, Ross Sea RWG, SOFLUX CWG, DMSC, SOOS IPO, SSC Community: UN Ocean Decade, UN, SCAR, SCOR, CCAMLR, Tasmanian Polar Network, SORP, EU-PolarNet, Norwegian Polar Institute, Integrated Marine Observing System, ORCHESTRA, RoSES, APECS, OASIS, SO-CHIC, Australian Hydrographic Office, OCEAN:ICE

		UN Ocean Decade: SOOS is a key partner in the Southern Ocean UN Ocean Decade Southern Ocean Task Force including holding three positions on the Task Force steering committee, 23 positions in the Task Force Working Groups and had 5 co-authors in the Southern Ocean Task Force Action Plan.	
Build an effective, networked community of data managers		The SOOS DMSC continued to be active through 2022. The DMSC has 22 members from 17 institutions across 12 nations. The DMSC have faced significant challenges in 2022 with the resignation of the SOOS Data Officer (March 2022) and a DMSC Co-Chair (May 2022). Recruitment of replacements for both positions hasn't been successful and continues in 2023. The DMSC continued to hold online meetings throughout 2022. In 2022, the DMSC published a new SOOS Data Policy, worked with the European Polar Board to release Polardex and a new DueSouth interface, worked with EMODnet Physics to release a new version of SOOSmap (with a soft launch in 2022 and an official launch in early 2023), convened a session at the SCAR Open Science Conference and are coordinating many data activities at the SOOS Symposium including a plenary, workshops and a data helpdesk as well as incorporating data aspects in many of the SOOS Symposium sessions. SOOS and the DMSC was also involved in a successful proposal for BELSPO funding (see below). DMSC members actively represented SOOS at international meetings, conferences and workshops including Challenger 150: The Challenger Society Conference 2022, SCADM meetings and the SCAR Open Science Conference. Full information and achievements of the DMSC are available on pages 28-29.	SOOS: DMSC SOOS Partnerships and Collaborations: POLDER Community: BELSPO, Arctic Data Committee, SCADM, EMODnet, European Polar Board, AAD, WoRMS, GBIF, OBIS
Actively review and reflect on networking processes, activities, and structures to ensure that they are equitable, diverse and inclusive (EDI)		The SOOS Equity Diversity and Inclusion (EDI) Group held regular online meetings through 2022. Two APECS representatives, Kathy Gunn and Fernanda Marcello joined the leadership team of the EDI group in 2022. The main priority for the group in 2022 and into 2023 has been supporting EDI initiatives in the SOOS Symposium including the Symposium Code of Conduct, the development of low-cost, asynchronous online offerings at the Symposium, and an EDI plenary. Additionally, EDI group members were involved in a UN Ocean Decade EDI workshop.	SOOS: EDI Group Community: UN Ocean Decade, APECS

Build Southern Ocean community capacity, including early career development and support for new and emerging national programmes		All SOOS RWGs maintained active APECS Representatives as part of their leadership teams. The EDI group recruited two APECS representatives to join the EDI group leadership team, Kathy Gunn and Fernanda Marcello. Additionally, SOOS has a further 22 early career researchers in leadership positions and has 123 early career members. SOOS has also been active in the UN Ocean Decade EDI activities and presented in the Engaging Early Career Ocean Professionals in the UN Ocean Decade webinar as well as the International Conference of APECS. SOOS maintained the SOOS-Swedish Southern Ocean Network. SOOS endorsed 4 projects.	SOOS: RWGs, CWGs, SSC, DMSC, EDI Group, SOOS-Swedish Southern Ocean Network Community: SCAR, APECS, UN Ocean Decade.
Objective 2: Address gaps and inefficiencies in our ability to collect, deliver, use sustained observations			
Support and lead efforts to better integrate modelling and observational efforts, including observing system design (OSD) elements such as Observing System Simulation Experiments (OSSEs) and Essential Ocean Variable (EOV) identification		SOOS collaborated on a BELSPO proposal for funding to further the development and facilitation of data products based on Essential Biodiversity Variables, Essential Ocean Variables, Essential Climate Variables and ecosystem Essential Ocean Variables. This proposal was successful and an expert, hybrid workshop (Biodiversity.aq/SOOS EG-ABI Essential Variables Workshop) will be held prior to the SOOS Symposium with the aims to: create an inventory of essential variables, identify data requirements and gaps for calculating these essential variables, prioritise essential variables, identify existing workflows and tools, and develop a framework for developing the workflows required to turn public Southern Ocean biodiversity data into relevant essential variables. The OSD CWG commenced compiling lists of methodologies and projects for observing system design.	SOOS: OSD CWG Community: BELSPO, AAD, EMODnet, WoRMS, GBIF, OBIS
Support and lead efforts to advance observing system and data sharing technologies (hardware, software) and methods		The CAPS CWG continued working on refining AI and other machine learning algorithms for automated counting, but these are not at a stage to be shared through an open repository (e.g., GitHub) yet.	SOOS: CAPS CWG

Support and lead efforts to agree, document, advocate for and implement best practice, in both science and data		SOIS has and will continue to develop QC documents to be submitted to Ocean Best Practices (moored temperature and salinity now available, moored oxygen in prep.) The POLDER Group developed a Best Practice Guide to implementing schema.org for data discovery. This was published in May 2023 and accepted by Ocean Best Practices in June 2023.	SOOS: SOIS RWG SOOS Partnerships and Collaborations: POLDER Community: SCADM, ADC
Identify gaps and opportunities across the foundational capabilities and support efforts to address them		SOOS also continued discussions with the Global Ocean Acidification Observing Network (GOA-ON) on developing a joint SOOS/GOA-ON ocean acidification collaborative hub for the Southern Ocean. The establishment of the hub is expected in 2023. As part of the SOOS Symposium, an entire half-day plenary with presentations and panel discussions focused on the "Gaps and next steps for the Southern Ocean observing system".	Community: GOA-ON
Objective 3: Identify the spatio-temporal and thematic requirements of observations needed to address the science themes; identify existing coverage and work to maintain it; and address identified gaps.			
Map the geographic distribution of theme challenges to understand their regional importance, existing data coverage and the national/international effort to address them		All RWGs have defined sub-regions for their sector and worked through 2022 to understand the regional importance of theme challenges, their existing data coverage and the national/international effort to address them. The development of heat maps to present this work was developed in 2022 for publication in 2023.	SOOS: RWGs
Develop a regional understanding of stakeholder requirements and data priorities for data pertaining to the theme challenges		This work will be completed through the above mentioned RWG workshops in 2022 and 2023 as well as the SOOS Symposium 2023.	SOOS: RWGs
Develop and utilise a system for identification of observational coverage and requirements		The SOOS International Project Office (IPO) has developed a system to produce heatmaps of RWG sub-regions with the regional importance of SOOS' Science Themes and Challenges as well as observational coverage. All RWGs worked through 2022 and into 2023 to provide the data required to produce these heatmaps. Once developed, these heatmaps will continue to be reviewed and improved annually.	SOOS: RWGs
Enhance logistical collaborations to ensure sustained data coverage		Support and population of SOOS' Database of Upcoming Expeditions, DueSouth continued through 2022. The European Polar Board partnered with	SOOS: DMSC, RWGs, CWGs, TTs

		SOOS, Svalbard Integrated Arctic Earth Observing System, the International Network for Terrestrial Research and Monitoring to launch a new polar infrastructural database, Polardex which was launched in April 2022. The upcoming planned routes to the Southern Ocean component of Polardex is SOOS' DueSouth database. Additionally, SOOS has been working to update information on field facilitates, vessels and aircraft for the Southern Ocean within Polardex. An automated connection between DueSouth and IAATO's database of planned tourist cruises was launched 2022. Information on over 500 planned routes is now available through DueSouth with Southern Ocean/Antarctic planned route information provided by the SOOS community, CCAMLR, OceanOps, COMNAP and IAATO as well as some planned route information discovered and entered by the SOOS IPO. Full information and achievements of DueSouth and Polardex are on pages 18-19. SOOS also contributed to the Polar Observing Assets Working Group including drafting a spreadsheet for cross-walking metadata standards for observing assets. This working group was initiated as part of the Polardex.	Community: AADC, COMNAP, CCAMLR, OceanOps, European Polar Board, IAATO
Support and advocate for efforts to collect, deliver and use observational data		See above for SOOS representation at international meetings, workshops and conferences, and the number of projects SOOS endorsed in 2022. SOOS contributed to a BELSPO successful funding proposals in 2022, see above for further detail.	SOOS: Ross Sea RWG, SOFLUX CWG, DMSC Community: BELSPO, AAD, EMODnet, WoRMS, GBIF, OBIS
Objective 4: Deliver high-quality scientific data, synthesis activities/products and knowledge that are needed to deliver our mission			
Delivery of publications (scientific, strategic, data) that provide scientific knowledge towards addressing the science themes, enhancing observational capabilities, or delivering directly to policy and management		Newman, L., Hancock, A.M., Hofmann, E., Williams, M.J.M., Henley, S.F., et al., (2022). The Southern Ocean Observing System 2021-2025 Science and Implementation Plan. https://doi.org/10.5281/zenodo.6324359 Beadling, R., Freeman, N., MacGilchrist, G., Mazloff, M., Shi, J., Thompson, A., and Wilson, E. (2022). Southern Ocean [in "State of the Climate in 2021]. Bull. Amer. Meteor. Soc., 103 (8), S329-S332, https://doi.org/10.1175/2022BAMSStateoftheClimate.1	SOOS: DMSC, SOFLUX CWG, CAPS CWG, SOOS IPO, EXCOM SOOS Partnerships and Collaborations: Southern Ocean Task Force Community: SCAR, UN Ocean Decade, SCADM and broad community input.

		LaRue, M., Brooks, C., Wege, M., Salas, L., and Gardiner, N. (2022). High-resolution satellite imagery meets the challenge of monitoring remote marine protected areas in the Antarctic and beyond. Conservation Letters, 15 (4). https://doi.org/10.1111/conl.12884 Janssen, A.R., Badhe, R., Bransome, N.C, Bricher, P., Cavanagh, R., de Bruin, T., Elshout, P., Grant, S., Griffin, E., Grilly, E., Henley, S.F., Hofmann, E.E., Johnston, N.M., Karentz, D., Kent, R., Lynnes, A., Martin, T., Miloslavich, P., Murphy, E., Van de Putte, A.P. (2022). Southern Ocean Action Plan (2021-2030) in support of the United Nations Decade of Ocean Science for Sustainable Development. Zenodo. https://doi.org/10.5281/zenodo.6412191 SOOS Data Management Sub-Committee (DMSC). (2022). SOOS Data Policy. Zenodo. https://doi.org/10.5281/zenodo.6041433	
Populate SOOSmap with high-priority standardised datasets that are required to address the science themes and encourage broader use of SOOSmap by Southern Ocean researchers		During 2022, SOOS worked with SOOSmap's host, EMODnet Physics, to redevelop the SOOSmap interface and underpinning architecture to create SOOSmap Version 2. A soft launch of this new version was announced at the SCAR Open Science Conference 2022 with an official launch in early 2023. Version 2 includes a base layers selection tool with metadata available where possible, dataset filter matrix and dataset cards panel. Version 2 of SOOSmap has over 50 datasets with many new datasets added in the launch of the new version. The SOOS Southern Ocean Mooring Network, an index of known oceanographic moorings, was maintained, and published through SOOSmap. In 2022, additional moorings from Swedish researchers were converted to CF-compliant NetCDF format ready for addition. Full achievements and information on SOOSmap are on pages 18-21.	SOOS: DMSC Community: EMODnet Physics, SOCAT, GLODAP, ASPeCt, NECKLACE, BEPSII, MEOP/AniBOS, OceanSITES, SOCCOM, ACAP, SCAR, INSDC, State Oceanic Administration, PANGAEA, SCAR, Saildrone
Enhance FAIR data management and delivery through the use and linkage of existing tools and networks, and assist in connecting resource needs		Continued support of the NASA EarthData Search (formerly the GCMD). The SOOS metadata portal contains 7,629 records, largely from National Antarctic Data Centres and NASA's satellite programmes. It was used by ~200 unique users during the year. In 2022 new features were added to the NASA EarthData Search including easy access to SOOS portals, added GraphQL support and published machine learning models and training keywords. Full	SOOS: DMSC SOOS Contributions and Collaborations: POLDER Community: NASA, SCADM, ADC

		achievements and information on the NASA EarthData Search are available on page 28-29. POLDER (a joint project between SOOS, SCADM and ADC), continued to work towards a federated search tool. A pilot federated search tool was launch in April 2022. Through POLDER, SOOS has also advocated for all polar-relevant data centres to implement schema.org metadata and to support interoperability of metadata records, with the publication of the Best Practice Guide to implementing schema.org for data discovery released in May 2023. Full achievements of the POLDER Task Team on page 45.	
Ensure SOOS data activities align with a clear data policy that is itself, aligned with the FAIR data principles of the Findable, Accessible, Interoperable and Reusable and with data policy of other polar communities		SOOS Data Management Sub-Committee (DMSC). (2022). SOOS Data Policy. Zenodo. https://doi.org/10.5281/zenodo.6041433	SOOS: DMSC
Objective 5: Maintain SOOS as the world-leading hub to support the collection and delivery of Southern Ocean observations			
Reporting metrics and information are collected, compiled and delivered to stakeholders as required		In 2022 SOOS reported to SCAR, SCOR, CCAMLR, the SOOS Hobart Partners (IMAS/UTAS, CSIRO, Tasmanian Government), Scientific and Technological Research Council of Turkey Marmara Research Centre Polar Research Institute, Antarctica New Zealand, the Swedish Polar Research Secretariat and the UK National Committee on Antarctic Research. SOOS also developed and published a report on SOOS' progress during the last implementation period, 2016-2020. This report was distributed to all SOOS' key stakeholders and available via the SOOS website (SOOS 5-Year Report 2016-2020).	SOOS: IPO, EXCOM Community: SCAR, SCOR. CCAMLR, IMAS/UTAS, CSIRO, Tasmanian Government, Scientific and Technological Research Council of Turkey Marmara Research Centre Polar Research Institute, Antarctica New Zealand and the Swedish Polar Research Secretariat, UK National Committee on Antarctic Research
The SOOS communication and engagement strategy is kept up-to-date and implemented		The SOOS IPO commenced the development of an updated SOOS Engagement and Communications Strategy (in prep.). SOOS produced four issues of the SOOS Newsletter (February, May, August, December), maintained the SOOS website and SOOS' social media accounts (Facebook and twitter). The reach of the SOOS Update Newsletter grew to 713 recipients in December, which includes engagement of 576 active subscribers (versus 485 in 2021).	SOOS: IPO, all SOOS community

		Engagement in the SOOS Twitter and Facebook accounts also grew with 2,834 (a growth of 255 in 2022) and 1,692 (growth of 253 in 2022) followers, respectively. See above for SOOS representation at international meetings, workshops and conferences in 2022.	
Funding for the SOOS IPO is maintained and enhanced		The core SOOS IPO sponsoring partnership continue in 2022 (3-year partnership between IMAS/UTAS, CSIRO and Tasmanian Government for 2020-2022). During 2021 and 2022 there was much discussion on the ongoing sponsorship beyond 2023 with this partnership and potential new partners. A single year agreement for the core SOOS IPO sponsorship and hosting was agreed in late 2022 with contributions from IMAS/UTAS, CSIRO and the Tasmanian State Government. Discussions continue for a longer-term agreement for 2024 and beyond. SOOS' international sponsorship agreements with the Swedish Polar Research Secretariat (for 2020-2022), Antarctica New Zealand (agreed annually), the University of Cape Town's Marine Biogeochemistry Lab (2021-2022) and the Scientific and Technological Research Council of Turkey Marmara Research Centre Polar Research Institute (agreed annually) continued in 2022. A new sponsor was secured in 2022, the newly funded OCEAN:ICE Horizon Europe project. See pages 21-22 for full details on SOOS' sponsorship in 2022.	SOOS: IPO, EXCOM Community: IMAS/UTAS, CSIRO, Tasmanian Government, Swedish Polar Research Secretariat, Antarctica New Zealand, State Oceanic Administration, University of Cape Town, Scientific and Technological Research Council of Turkey Marmara Research Centre Polar Research Institute, OCEAN:ICE
SOOS governance is managed and maintained		SOOS' governance structure was maintained during 2022. A new Vice Chair, Irene Schloss, and two new SSC members, Craig Stevens and Veronica Tamsitt, were appointed. All SOOS working groups also maintained their leadership structures.	SOOS: IPO, EXCOM Community: SCAR and SCOR
Implementation Plan objectives are coordinated and support		SOOS developed a Science and Implementation Plan for 2021-2025 which was submitted to SCAR and SCOR in 2021. The plan underwent an international, independent review coordinated by SCAR and SCOR, and was approved and published in June 2022. All 25 Implementation Actions were commenced by the end of 2022.	SOOS: IPO, broad SOOS community Community: SCAR and SCOR, broad Southern Ocean community

SOOS International Project Office administration and management is carried out efficiently and effectively		The SOOS IPO staff had significant staff challenges in 2022. The SOOS Data Officer, Pip Bricher, finished working for SOOS in early 2022 (March) and a new SOOS Data Officer, Imogen Jones, was appointed in May 2022 only to resign shortly afterwards. The Data Officer role remains vacant whilst a longer-term core SOOS IPO sponsorship and hosting agreement is finalised to allow for the recruitment of a suitable SOOS Data Officer with a multi-year contract. The SOOS Executive Officer, Alyce Hancock, was on maternity leave from October 2022 to May 2023 with the position filled by Lavenia Ratnarajah during Alyce's maternity leave. The SOOS Science and Communications Officer position continued to be filled by Julia Bach throughout 2022. All SOOS IPO activities continued through 2022, with some delays due to the staff challenges. SOOS' finances continued to be administered.	SOOS: IPO Community: IMAS/UTAS

*SOOS made significant progress on the coordination of the inaugural SOOS Symposium, "Southern Ocean in a Changing World" being held between the 14th and 18th August in Hobart, Australia. This Symposium will work towards delivering against all SOOS' objectives. See more on the SOOS Symposium on page 48.

SOOS Key Products

Database of Upcoming Expeditions to the Southern Ocean

DueSouth is a database for sharing information on upcoming field campaigns and planned routes. It enhances opportunities for collaboration and sharing field resources. DueSouth is hosted and maintained for SOOS by the European Polar Board.

Key Sponsors / People:

DueSouth coding and hosting in 2022 were provided to SOOS by the European Polar Board. Information on planned routes is systematically provided by OceanOps, Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), International Association of Antarctic Tour Operators (IAATO) and Council of Managers of National Antarctic Programs (COMNAP) as well as some planned routes supplied by the SOOS community or discovered and entered by the SOOS International Project Office.

2022 Achievements:

- Polardex launch completed in April 2022 and populated with planned route and project information.
- Multiple upgrades to the Polardex interface to increase accessibility, user friendliness, and visual data organization. The platform has also been further developed to enhance the efficiency and accuracy of its data.
- Polardex has increased the number printed materials and digital communication initiatives since the launch, with further events planned.
- Published IAATO planned cruises information through Polardex (completed early 2022).
- Troubleshooting the code under Polardex and renew the data sharing connection with OceanOps.
- Develop and advertised tutorials to help the community use Polardex to both share and discover fieldwork logistical support.
    - SCAR Open Science Conference, August 2022
    - Year of Polar Prediction Final Summit, August 2022
    - The Future of Infrastructure in the Arctic, October 2022
- Contribute to the Polar Observing Assets Working Group discussions on developing a metadata standard for logistics information and encourage associated databases to implement any recommendations from the working group.

- COMNAP and CCAMLR provided annual data on upcoming planned routes which were added to DueSouth.

2023 Plans:

- Maintain dialogue with partners, including COMNAP, Forum of Arctic Research Operators, and Svalbard Integrated Arctic Earth Observing System (SIOS) on data updates, and discuss with potential partners about adding additional data sources.
- Efforts continue to promote the platform to relevant stakeholders. Polardex presentations, e.g., "Observing the Arctic" session at Arctic Summit Science Week, February 2023.
- Continue to contribute to the Polar Observing Assets Working Group discussions on developing a metadata standard for logistics information and encourage associated databases to implement any recommendations from the working group.

SOOSmap

SOOSmap is an interactive web portal for oceanographic data visualisation and dissemination. Specifically, it allows users to discover and access circumpolar data coming from several international research centres and data assemblers, oceanographic repositories and marine infrastructures in the Antarctic.

SOOSmap was developed for SOOS in collaboration with the EMODnet Physics and Southern Ocean Carbon and Heat Impact on Climate (SO-CHIC). Datasets are provided with metadata and are available in multiple data formats. The portal has been developed in Javascript-Angular environment and populated using the existing data infrastructure composed by Geoserver / Erddap/ ncWMS.

Key Sponsors/People

The development and hosting of SOOSmap are provided by EMODnet Physics within the scope of supporting regional ocean observing systems under EMODnet for Global to integrate and make accessible and interoperable real-time data on the physical condition of European and international seas, using the latest IoT, Big Data, webGIS technologies and open protocols.

SOOSmap is also supported by SO-CHIC, aimed to improve understanding of the exchanges of heat and carbon between the atmosphere and the deep ocean, to quantify their flows in the air-sea-ice interface, estimating the interannual variability of the build-up of heat and carbon in the Antarctic Ocean, contributing to the study of global climate change.

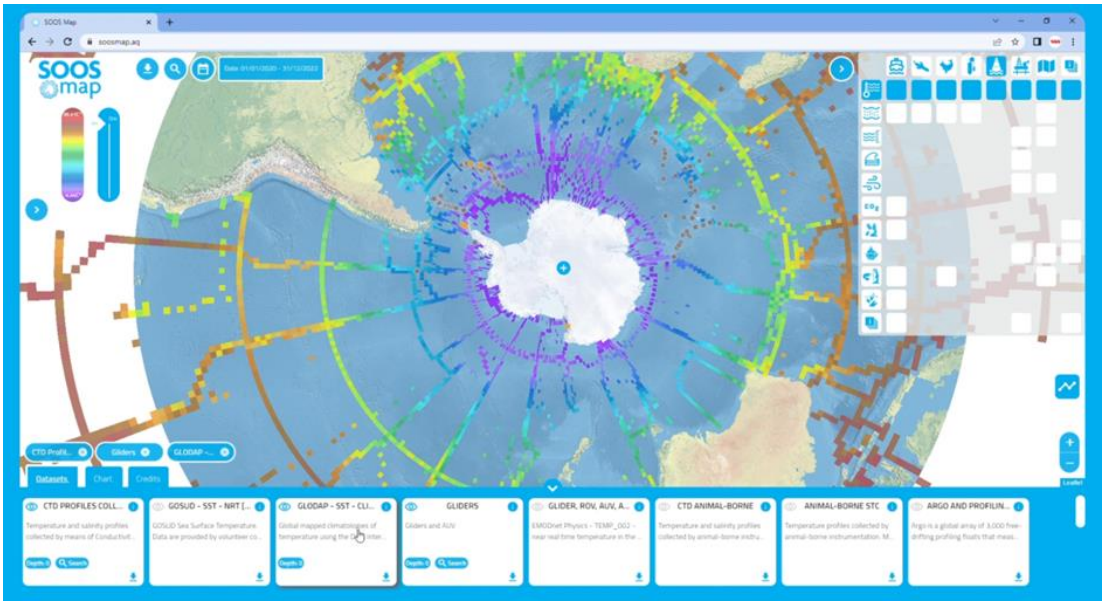
The project development brings together teams of researchers and IT specialists under a common coordination and strategic plan. The relationship between SOOS and EMODnet was negotiated by Patrick Gorringe from the European Component of the Global Ocean Observing System (EuroGOOS) secretariat.

2022 Milestones

- A soft launch of SOOSmap Version 2 was announced during the SCAR Open Science Conference 2022.
- DMSC members provided feedback on the portal functionality and content.
- The EMODnet Physics team member Francesco Misurale and the SOOS DMSC Chair Petra ten Hoopen followed up on the feedback in a series of meetings and worked on the SOOSmap Tutorial.
- The EMODnet Physics team addressed the identified issues and finalised the tutorial.

Summary of SOOSmap Version 2 development:

The main components of SOOSmap Version 2 are: base layers selection tool, dataset filter matrix, dataset cards panel. The base layers selection tool has several thematically grouped pull-down menus. If the base layer has metadata, it is possible to access them by clicking on the map.
By clicking on the right-hand side arrow, it is possible to interact with the dataset filter matrix. Columns represent platform types, while rows represent parameters or group of thematic parameters. Each square in the matrix allows to filter for datasets on the intersection of a column and a row. It is possible to select a single square, a single row or a single column. Datasets that match the filtration are displayed in the dataset cards panel. This panel allows users to select datasets, activate data visualisation, get dataset basic information, interact with plots and easily download data. Multiple datasets may be selected at the same time.



2023 Plans:

In 2023, we plan to:

- Officially launch Version 2 of SOOSmap in March 2023.
- Make the video tutorial available to support and facilitate the user experience with SOOSmap.
- Finalise and share a user guide with glossary to empower the SOOS community.
- Enlarge the data catalogue with new datasets and new data sources.

SOOSmap metrics:

Version 2 of SOOSmap offers more than 50 datasets, including:

- 34,937 CTD casts
- 14,543 Krillbase samples
- 3,630 penguin colony counts
- 1,980 Argo
- 1,378 drifting buoys
- 1,636 marine mammals (MEOP)
- 1,300 sea-ice chlorophyll cores
- 814 SOOS mooring network deployments (metadata)
- 766 continuous plankton recorder transects
- 114 SCAR plastics sampling
- 234 SCAR Iceberg Database
- 65 tide gauges
- 71 moorings
- 40 NECKLACE
- 18 bathy messages on GTS
- 22 gliders; 14 ferryboxes; 7 TESAC messages on GTS
- 1 Saildrone transect
- 6 expendable bathythermographs
- 51 Albatrosses and Petrels Nesting Sites
- 650 Mesozooplankton samples
- 380 DNA barcoding and metabarcoding of marine zooplankton

SOOS IPO Sponsorship in 2022

SOOS remains an initiative of SCAR and SCOR, and in 2022 this support, governance and sponsorship continued. Further, in 2022, SOOS maintained its broad sponsorship base.

Developed in 2020, the core sponsorship 3-year (2020-2022) partnership between the Institute for Marine and Antarctic Studies, University of Tasmania (IMAS/UTAS), Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Tasmanian State Government Department of State Growth, was commenced, supporting the continuation of the SOOS International Project Office in Hobart, Australia. Discussion for the ongoing sponsorship and hosting of the SOOS International Project Office (IPO) in Hobart progressed significantly through 2022 and an agreement for the 2023 sponsorship and hosting of the SOOS IPO with the same partnership was finalised in late 2022. Discussions continue for the ongoing sponsorship and hosting of the SOOS IPO for beyond 2023.

Additionally, in 2022 several partnerships and agreements continued including a 3-year (2020-2022) collaboration with the Swedish Polar Research Secretariat, a 2-year (2021-2022) sponsorship agreement with the University of Cape Town's Marine Biogeochemistry Lab (South Africa), sponsorship was received from the Scientific and Technological Research Council of Turkey Marmara Research Centre Polar Research Institute (Turkey), and Antarctica New Zealand. A new sponsor was finalised in 2022 for sponsorship in 2023 to 2026, the newly funded Horizon Europe project OCEAN:ICE.

In-kind service providers are important and enable SOOS to achieve outputs and outcomes that would not be possible if they had to be funded directly by SOOS. The figure below shows the Service Providers for SOOS in 2022.

SOOS is grateful to all sponsors for the contribution they make to ensuring the efficient and sustained delivery of SOOS for the community.

Sustained support for the IPO

Sustaining funding and support of the SOOS IPO remains a significant activity. Building on the significant effort to develop new sponsoring partnerships in 2022, further discussions took place with several other national communities on potential sponsorship opportunities to commence in 2023.

SOOS Governing Bodies

SOOS Sponsors

Service Providers

Governance

Executive Committee

In 2022, the SOOS Executive Committee (EXCOM) held approximately monthly virtual meetings. The SOOS Co-Chairs are Mike Williams (New Zealand) and Eileen Hofmann (USA), and SOOS Vice Chairs are Sian Henley (UK) and Sebastian Moreau (Norway). Mike finished his term as on EXCOM in September 2022, SOOS thanks Mike for his dedication and contribution to SOOS since his initial appointment to the Scientific Steering Committee in 2015. In September, Sian Henley rotated from Vice Chair to Co-Chair and Irene Schloss (Argentina) joined EXCOM as Vice Chair.

Scientific Steering Committee

Two new SSC members was brought on to the committee in 2022: Craig Stevens (New Zealand) and Veronica Tamsitt (USA). The composition of the SSC in 2022, including the Data Management Sub-Committee (DMSC), Regional Working Group (RWG) and Equity, Diversity and Inclusion (EDI) Co-Chair ex-officios, is shown in Table 1.

Table 1: Current SSC membership as of January 2023 with first term shown as (1) and second term shown as (2). Table includes DMSC, RWG Co-Chair and EDI Co-Chair ex-officios. The SOOS Governance and Terms of Reference are available here.

Name	Country	Gender	Expertise	Role	17/18	18/19	19/20	20/21	21/22	22/23	23/24
Eileen Hofmann	USA	Female	Biological	Co-Chair		Vice Chair	Vice Chair	Co-Chair	Co-Chair	Co-Chair	
Sian Henley	UK	Female	Biogeochemical	Co-Chair	RWG	RWG	RWG	Vice Chair	Vice Chair	Co-Chair	Co-Chair
Sebastien Moreau	Norway	Male	Biogeochemical	Vice Chair		RWG	RWG	RWG	Vice Chair	Vice Chair	Co-Chair
Irene Schloss	Argentina	Female	Biological	Vice Chair		SSC (1)	SSC (1)	SSC (1)	SSC (2)	Vice Chair	Vice Chair
Dake Chen	China	Male	Physical	SSC	SSC (1)	SSC (1)	SSC (1)	SSC (2)	SSC (2)	SSC (2)	
Burcu Ozsoy	Turkey	Female	Sea ice	SSC	SSC (1)	SSC (1)	SSC (1)	SSC (2)	SSC (2)	SSC (2)	
Sarah Fawcett	South Africa	Female	Biogeochemical	SSC & EDI		SSC (1)	SSC (1)	SSC (1)	SSC (2)	SSC (2)	SSC (2)
Andrew Meijers	UK	Male	Physical	SSC		SSC (1)	SSC (1)	SSC (1)	SSC (2)	SSC (2)	SSC (2)
Luciano Pezzi	Brazil	Male	Physical	SSC				SSC (1)	SSC (1)	SSC (1)	SSC (2)
Delphine Lannuzel	Australia	Female	Biogeochemical	SSC				SSC (1)	SSC (1)	SSC (1)	SSC (2)
Jilda Caccavo	Germany	Female	Biological	SSC				SSC (1)	SSC (1)	SSC (1)	SSC (2)
Wolfgang Rack	New Zealand	Male	Physical	SSC					SSC (1)	SSC (1)	SSC (1)
Veronica Tamsitt	USA	Female	Biogeochemical	SSC						SSC (1)	SSC (1)
Craig Stevens	New Zealand	Male	Physical	SSC						SSC (1)	SSC (1)
Petra ten Hoopen	UK	Female	Data	DMSC		DMSC (1)	DMSC (1)	DMSC (2)	DMSC (2)	DMSC (2)	
TBA				DMSC						DMSC (1)	DMSC (1)
Patricia Yager	USA	Female	Biogeochemical	ABS RWG				RWG (1)	RWG (1)	RWG (2)	RWG (2)
Pierre Dutrieux	US	Male	Physical	ABS RWG					RWG (1)	RWG (1)	RWG (2)
Paola Rivaro	Italy	Female	Biogeochemical	Ross Sea RWG				RWG (1)	RWG (1)	RWG (1)	RWG (2)
Michelle LaRue	New Zealand/ USA	Female	Biological	Ross Sea RWG						RWG (1)	RWG (1)
Elizabeth Shadwick	Australia	Female	Biogeochemical	SOIS RWG				RWG (1)	RWG (1)	RWG (1)	RWG (2)
Sarat Tripathy	India	Male	Biological	SOIS RWG				RWG (1)	RWG (1)	RWG (1)	RWG (2)
Oscar Schofield	USA	Male	Biological	WAPSA RWG	RWG (1)	RWG (1)	RWG (1)	RWG (2)	RWG (2)	RWG (2)	
Juan Höfer	Chile	Male	Biological	WAPSA RWG				RWG (1)	RWG (1)	RWG (1)	RWG (2)
Markus Janout	Germany	Male	Physical	WSDML RWG			RWG (1)	RWG (1)	RWG (1)	RWG (2)	RWG (2)
Stefanie Arndt	Germany	Female	Sea ice	WSDML RWG					RWG (1)	RWG (1)	RWG (1)
Steve Diggs	USA	Male		EDI				EDI	EDI	EDI	EDI
Joana Beja	Belgium	Female		EDI					EDI	EDI	EDI

Annual Scientific Steering Committee Meeting

Due to travel restrictions from the COVID pandemic, the 2022 meetings of the SOOS SSC were conducted online. Four sets of two-hour meetings were conducted virtually on the 22nd of February, 1st of June, 13th and 14th of September and the 8th of November.

The February meeting was centred around discussing the implementation of the SOOS Science and Implementation Plan (2021-2025). Four breakout groups identified various pathways that SOOS Scientific Steering Committee (SSC) members could assist in facilitating this implementation and they included 1) connecting to UN Decade programmes, Southern Ocean relevant programmes (e.g., SCAR, BEPSII etc.) and national Antarctic programmes, 2) improving SOOS' communications and outreach efforts, 3) developing, advocating for, and promoting best practices/codes of conduct and 4) advancing SOOS initiatives through national programmes. Additionally, following on from the initial discussions in 2021, the February SSC meeting continued discussions on the SOOS Open Science Conference (now named the SOOS Symposium) in Hobart in 2023, adopted a new format for SSC meetings of 3 virtual meetings and 1 in-person/hybrid meeting, and concluded with discussions on Executive Committee (EXCOM) and SSC rotations.

The June meeting discussed the formation of the International Planning Committee for the SOOS Symposium. The committee members include Jilda Caccavo (SSC), Irene Schloss (SSC), Wolfgang Rack (SSC), Deneb Karentz (SCAR), Steve Diggs (DMSC/EDI), Sarat Tripathy (SOIS), Andreas Marouchos (Polar Tech.), Alessandro Silvano (ABS APECS Rep.), Parli Bhaskar (Indian National Rep.), Alyce Hancock (EXCOM/IPO - chair). The International Planning Committee proposed different scenarios and formats for the Symposium.

The September meeting started with presentations and discussion on all RWGs. The meeting continued with a discussion on the Symposium. The SOOS Equity, Diversity and Inclusion (EDI) Group then provided an update on recent activities followed by updates from various SOOS Partnerships and Collaborations including the UN Decade of Ocean Science,SOS Southern Ocean Task Force, Marine Ecosystem Assessment for the Southern Ocean (MEASO), and the Southern Ocean Research Panel (SORP).

The final meeting in December highlighted SOOS' presentation at COP27 in Egypt, showcased the new version of SOOSmap being developed by EMODnet Physics and had a presentation from POLDER. There was an update from CWGs, TTs, SOOS/GOA-ON Ocean Acidification Southern Ocean Collaborative Hub (OA) and the SOOS Symposium.

The minutes from the SSC meeting are available here.

SOOS Implementation Groups

Data Management Sub-Committee (DMSC)

The SOOS Data Management Sub-Committee (DMSC) has been engaged on a wide range of data activities, in addition to the development of DueSouth and SOOSmap (see above).

Leadership

The DMSC had significant changes in leadership in 2022 with the resignation of the SOOS Data Officer, Pip Bricher in March 2022, and DMSC Co-Chair, Benjamin Pfeil, in May 2022. A new SOOS Data Officer was appointed but resigned shortly after. This position will be re-advertised in mid-2023 when the long-term funding of the SOOS IPO is finalised. A new co-chair to replace Benjamin was sought but no nominations received. Petra Ten Hoopen continued in her roles as chair through 2022. A call for new DMSC members was released in late 2022 and again in early 2023 to recruit new DMSC members and future DMSC co-chairs.

Total DMSC membership: 22 members from 17 institutions and 12 nations.

Data Policy

The SOOS Data Policy was finalised and released in early 2022.

SOOS Metadata Portal

The SOOS Metadata Portal on NASA's EarthData Search (formerly the GCMD contains 7,629 records, largely from National Antarctic Data Centres and NASA's satellite programme. Usage of the portrait is generally low, in the range of 200-300 users over the course of the year).

Summary:
From April 2022 to April 2023 206 users visited the SOOS Portal viewing 331 pages. Peak months were 29 visits in June 2022, 28 in October 2022, and 26 users in March 2023. Most visitors link directly to the Portal. Only 11 users linked to the portal from the soos.aq and the scar.org websites. Most users linking to the portal originated from the United States and Australia followed by China and India. The number of data sets discoverable via the SOOS Portal as of May 2023 is 7,629.

New Features:

- Easy access to the SOOS and Antarctic Metadata Directory Portals from NASA's Earth Data Search.
    - Link to https://search.earthdata.nasa.gov/
    - Choose "Browser Portals"
    - Added support for GraphQL (https://graphql.earthdata.nasa.gov/api)

- Published Machine Learning Models and Training Data Keywords (GCMD Keywords 14.0)

SOOS participants are encouraged to visit the GCMD Keyword Forum for the latest news and discussion about the keywords.

Southern Ocean Mooring Network

Mooring datasets from Swedish researchers were converted to CF-compliant NetCDF format ready for addition into the mooring network in 2023.

Annual Meeting

The DMSC annual meeting was organised by the DMSC Chair and held on 17th October 2022 via the online platform Zoom. The topics discussed included data priorities and requirements for SOOSmap candidate datasets, recruitment strategy for a new Data Officer and new Co-Chair, feedback on SOOSmap data layers and ideas for the SOOS Symposium 2023.

Participants: Antonio Novellino, Patrick Gorringe, Marco Alba, Joana Beja, Taco de Bruin, Scott Ritz, Alyce Hancock, Steve Diggs, Alex Kozyr, Petra ten Hoopen

2022 Milestones:

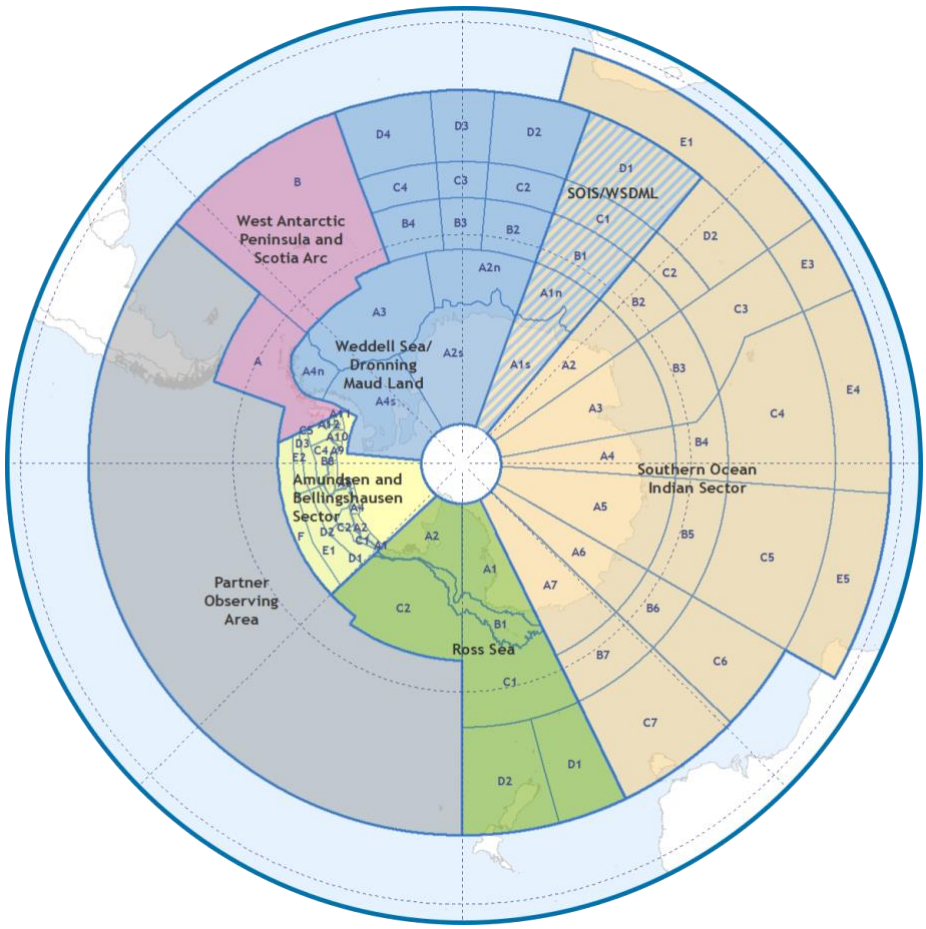
During 2022 the DMSC:

- Developed and launch a new version of SOOSmap (see above).
- Improved the POLDER Federated Search so that it now has a spatial search functionality.
- Released a call for new DMSC member nominations.
- Convened a data session at the SCAR Open Science Conference 2022 in collaboration with the SCADM.
- Coordinated data activities for the SOOS Symposium 2023 (continuing through 2023).
- Presented SOOS at several international meetings and workshops including SCAR Open Science Conference 2022 and the Challenger 150 Conference (London, United Kingdom).

Regional Working Groups

SOOS Regional Working Groups (RWG) develop, coordinate and implement the observing system in their defined region. The regions align with the natural areas of focus of nations involved in Southern Ocean activities (although some activities will be coordinated at a circumpolar scale e.g., Argo). Given the long-term requirements for coordination and implementation, the SOOS Regional Working Groups are viewed as ongoing efforts, whilst still undergoing annual reviews.

In 2018, SOOS SSC recommended that all RWGs develop sub-regions for quantification of observational requirements, coverage and gaps. In 2020, the last two RWGs to define sub-regions, West Antarctic Peninsula and Scotia Arc (WAPSA) and Ross Sea, drafted their sub-regions. These were finalised in early 2021.



Amundsen and Bellingshausen Sector (ABS) Regional Working Group

Leadership:

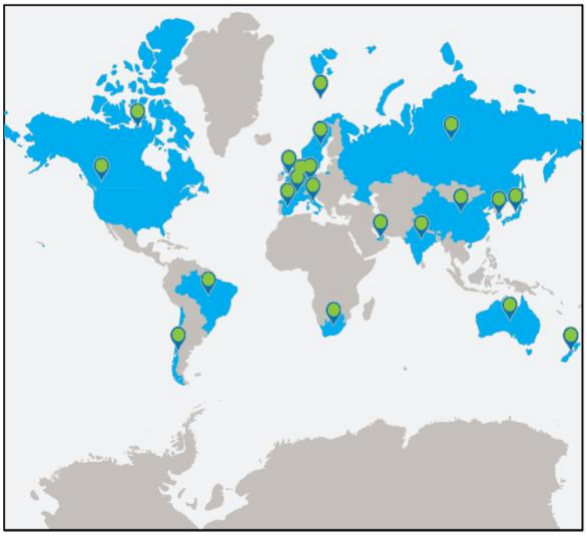
P. Yager (Co-Chair, USA), P. Dutrieux (Co-chair, UK), B. Queste (Sweden), A. Wåhlin (Sweden), T-W Kim (South Korea), Y. Nakayama (Japan), A. Thompson (USA), T. Dotto (Brazil/UK), A. Silvano (APECS Representative, UK)

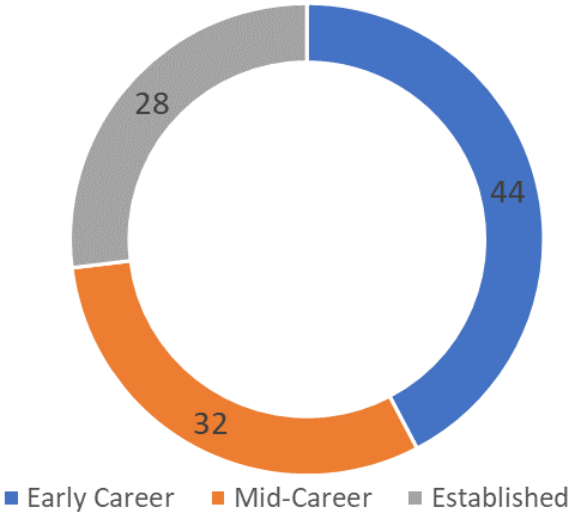
2022 Milestones:

During 2022 the ABS RWG:

- Initiated a webinar series in 2022. 2022 Webinars were:
  - "Initial reports from the RV NB Palmer 2022 Expedition to the Amundsen Sea" presented by Patricia Yager (University of Georgia), Tiago Dotto (University of East Anglia), Anna Wåhlin (University of Gothenburg) and Robert Hall (University of Tasmania)
  - "K-NOW Korea Network for Observation and prediction of ice sheet and sea level changes" presented by Won Sang Lee (Korean Polar Research Institute)
- Released an Amundsen and Bellingshausen Sea Regional Working Group newsletter.
- Coordination of a parallel session with WSDML RWG and WAPSA RWG at the SOOS Symposium.

Total working group membership: 125 from 67 institutions across 22 countries
(growth of an additional 37 members in 2022)





Ross Sea Regional Working Group

Leadership:

W. Smith (Co-Chair till October 2022, USA), P. Rivaro (Co-Chair, Italy), M. LaRue (Co-Chair from October 2022, NZ/USA), J. Park (South Korea), C. Stevens (NZ), J. He (China), Z. Wang (China), K. Heywood (UK), P. Falco (Italy), M. Kim (APECS Representative, South Korea)

2022 Milestones:

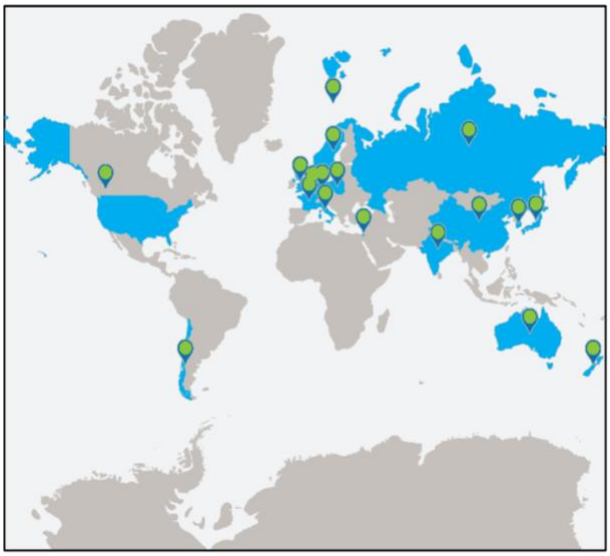
During 2022 the Ross Sea RWG:

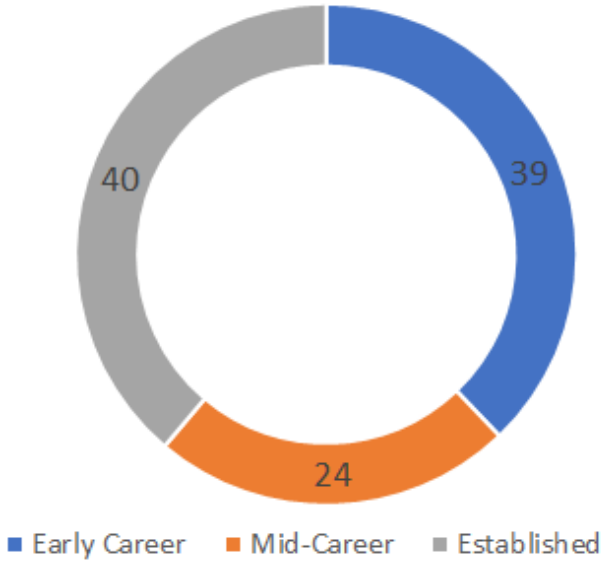
- Coordinating the 4th Ross Sea Conference, 3-7th July 2023 in Naples, Italy.
- Proposed (successful) a session for including at the 23rd IUGG General Assembly (Berlin, Germany), "Atmosphere-Ocean-Ice Interactions: Physical, Biogeochemical and Biological Processes in the Ross Sea".
- Coordination of a Ross Sea session at the SOOS Symposium.

Members from the Ross Sea RWG represented SOOS and the Ross Sea RWG at:

- AntClim[now] Workshop in "Connecting Models and Observations of the Antarctic Climate System across Timescales" (Cambridge, UK and online, September 2022), Craig Stevens
- BioPole meeting, Paolo Rivaro and Pierpaolo Falco

Total working group membership: 105 from 71 institutions across 23 countries
(growth of an additional 11 members in 2022)





Southern Ocean Indian Sector (SOIS) Regional Working Group

Leadership:

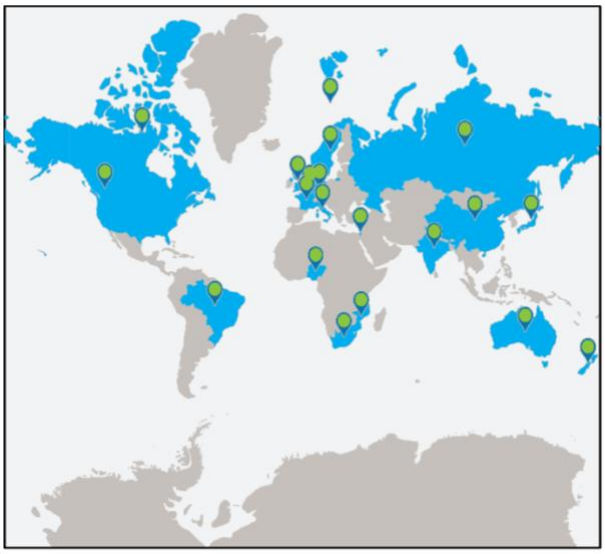
E. Shadwick (Co-chair, Australia), S. Tripathy (Co-Chair, India), J. Shi (China), A. Makhado (South Africa), C. Cotté (France), C. McMahon (Australia), W. Hobbs (Australia), J. George (India), T. Hirawake (Japan), T. Tamura (Japan), S. Halfter (APECS Representative, Australia)

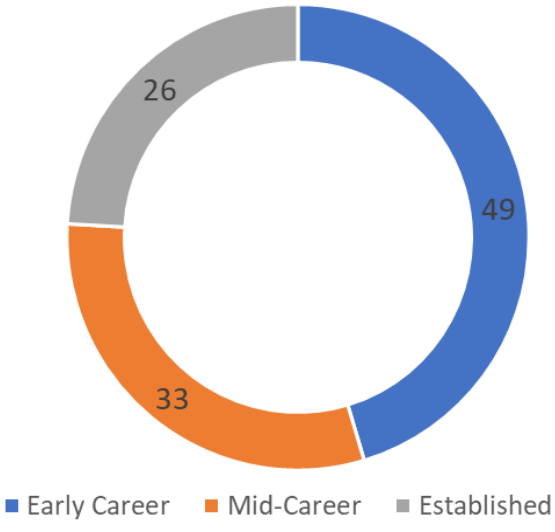
2022 Milestones:

During 2022 the SOIS RWG:

- Quarterly newsletters.
- Presentation at SCAR Open Science Conference 2022 by Svenja Halfter.
- Online workshop on the ecoregionalisation projects between South Africa, France, Australia and the UK.
- SOOS, IMAS, CSIRO PhD student commenced in December 2021, Xiang Yang. PhD project is titled "Drivers of change in air-sea CO_2 exchange and carbon cycling in the subantarctic and coastal East Antarctic – a contribution to the Southern Ocean observing system".
- Continued operation of the Southern Ocean Time Series (SOTS) mooring.

Total working group membership: 110 from 65 institutions across 22 countries
(growth of an additional 9 members in 2022)





West Antarctic Peninsula and Scotia Arc (WAPSA) Regional Working Group

Leadership:

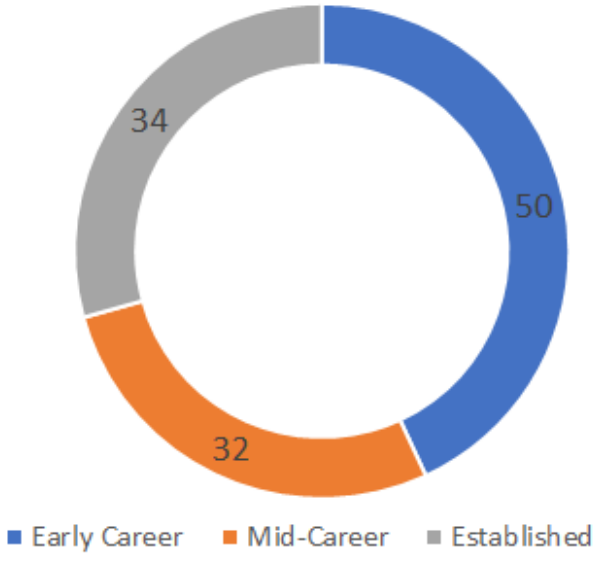
J. Höfer (Co-Chair, Chile), O. Schofield (Co-chair, USA), I. Schloss (Argentina), P. Trathan (UK), K. Hendry (UK), , I. Ahn (South Korea), J. Arata (Canada), C. Mendes (Brazil), I. Schloss (till October 2022, Argentina), E. Seyboth (APECS Representative, Brazil)

2022 Milestones:

During 2022 the WAPSA RWG:

- Presented by Irene Schloss on SOOS at the International Online Conference 2022 of the Association of Polar Early Career Scientists (online).
- Coordination of a WAPSA RWG session at the SOOS Symposium.

Total working group membership: 119 from 71 institutions across 29 countries
(growth of an addition 13 members in 2022)



Weddell Sea and Dronning Maud Land (WSDML) Regional Working Group

Leadership:

M. Janout (Co-Chair, Germany), S. Arndt (Germany), S. Fawcett (South Africa), A. Meijers (UK), U. Nixdorf (Germany), JB. Sallée (France), L. Biddle (Sweden), R. Kerr (Brazil), S. Thomalla (South Africa), T. Photopoulou (UK), E. Campbell (APECS Representative, USA)

2022 Milestones:

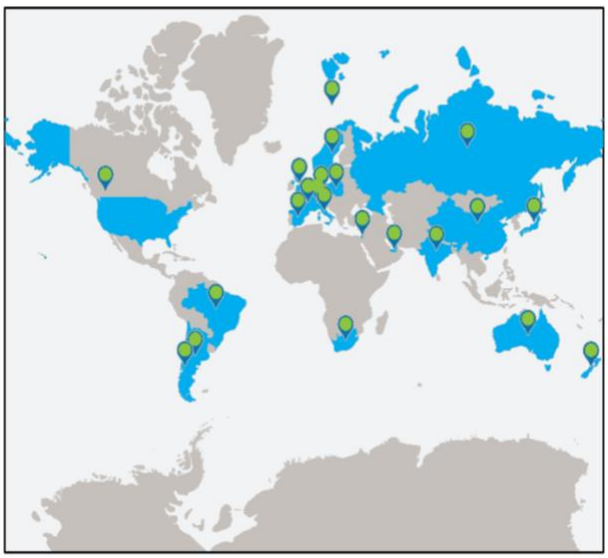
During 2022 the WSDML RWG:

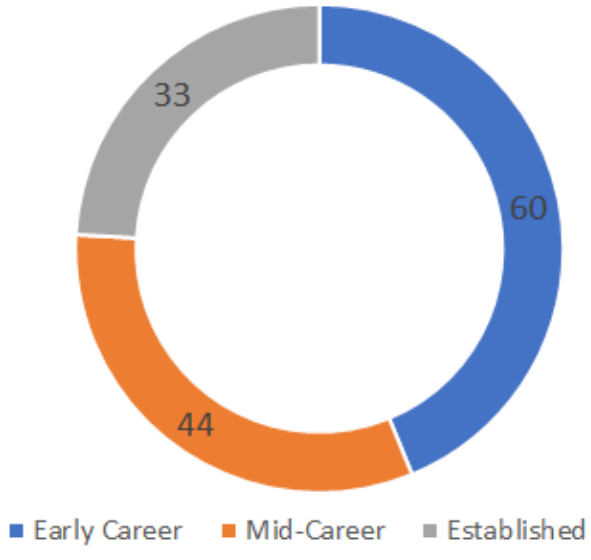
- Hosted a Regional Working Group Workshop on the "Weddell Sea – Dronning Maud Land Science" virtually from 14th to 16th June 2022 (workshop report).
- Coordinated a special issue in Copernicus journals titled, "The Weddell Sea and the ocean off Dronning Maud Land: unique oceanographic conditions shape circumpolar and global processes – a multi-disciplinary study". Call for submissions closed 31st December 2022 and the special issue will be released mid-2023.
- Coordination of a session at the SOOS Symposium with WAPSA RWG and ABS RWG.

Members from the WSDML RWG represented SOOS and the WSDML RWG at:

- Heat and carbon uptake in the Southern Ocean: the state of the art and future priorities (UK, May 2022), Andrew Meijers and other SOOS leadership team members.
- Southern Ocean on Europe's shores – climate impacts, sea level rise, and the marine environment (online, February 2022), Jean-Baptiste Sallée.

Total working group membership: 139 from 79 institutions across 25 countries
(growth of an additional 17 members in 2022)





Capability Working Groups

SOOS Capability Working Groups enhance observational capabilities for SOOS, such as:

- Developing and implementing technologies.
- Improving observational design, efficiency and coverage.
- Developing associated methods for managing and disseminating information.

The enhanced knowledge, technology and observing capabilities from these groups are intended to feed directly into the implementation plans of the RWGs. Capability Working Groups (CWG) are multi-year efforts, with annual review of progress provided by SOOS governance. With 2020 being the final year of the 5-Year Implementation Plan (2016-2020), all the CWGs completed their first phase. Those interested to continue as SOOS CWGs were invited to submit a proposal for continuation under the new Science and Implementation Plan (2021-2025). Proposals were received from three of the previous five SOOS CWGs: Southern Ocean Fluxes (SOFLUX) CWG, Censusing Animal Populations from Space (CAPS) CWG and Observing System Design (OSD) CWG.

Censusing Animal Populations from Space (CAPS) Capability Working Group

Leadership:

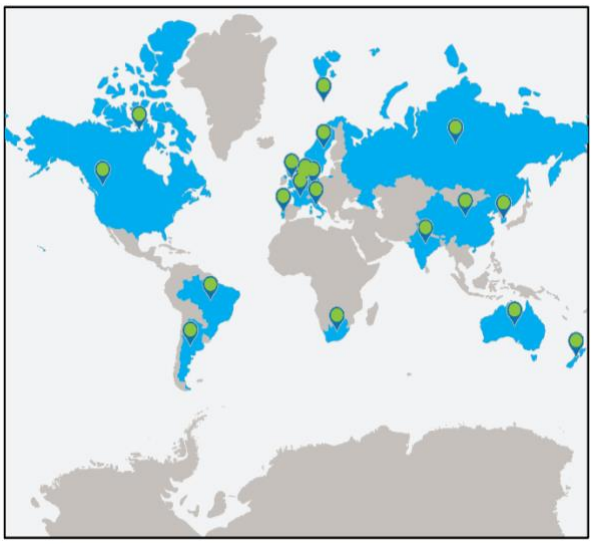
M. Hindell (Co-Chair, Australia), P. Fretwell (Co-Chair, UK), P. Trathan (UK), H. Lynch (USA), D. Costa (USA), A. Lowther (Norway), M. LaRue (New Zealand), C. McMahon (Aus), H. Bornemann (Germany), B. de la Mare (Australia), M. Wege (South Africa)

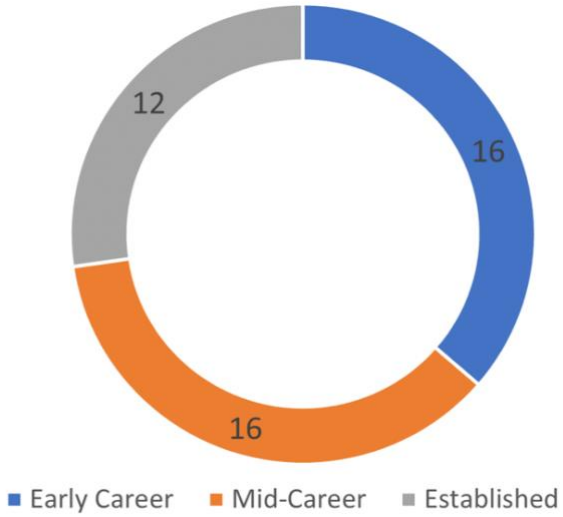
2022 Milestones:

During 2022 the CAPS CWG:

- Publication: High-resolution satellite imagery meets the challenge of monitoring remote marine protected areas in the Antarctic and beyond (LaRue *et al*, 2022)

Total working group membership: 47 from 36 institutions across 23 countries
(growth of an additional 2 members in 2022)





Observing System Design (OSD) Capability Working Group

Leadership:

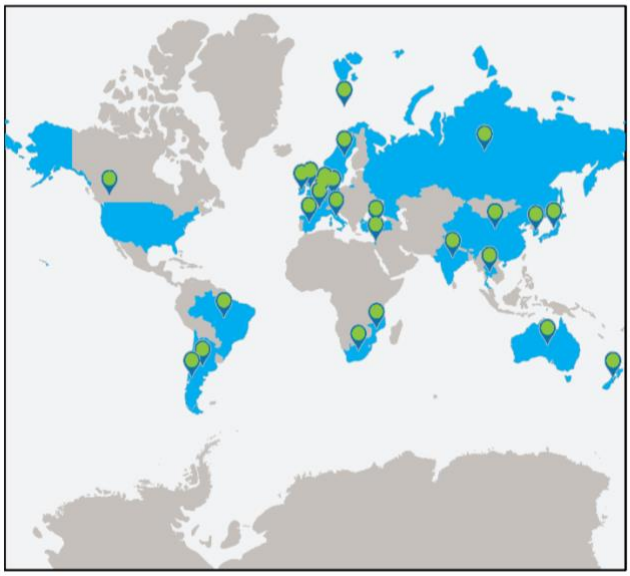
D. Jones (Co-Chair, UK), L. Lenain (Co-Chair, USA), M. Mazloff (USA), K. Baldry (Australia), R. Eriksen (Australia), B. Ward (Ireland), S. Halfter (Australia), Y. Ammar (APECS Representative, Sweden)

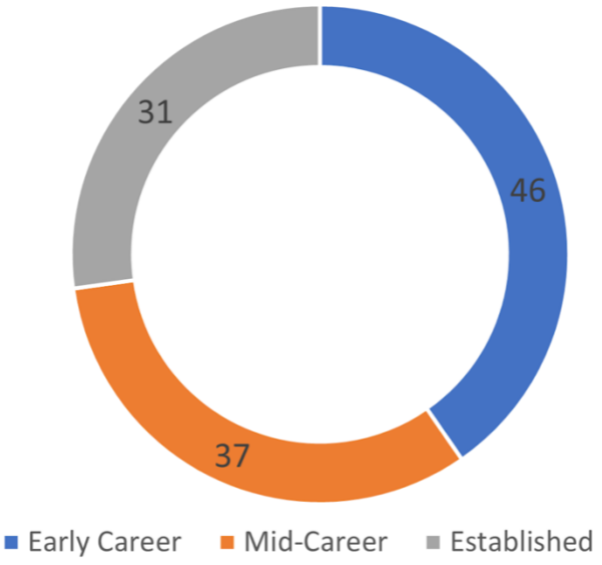
2022 Milestones:

During 2022 the OSD CWG:

- Commencement of Observing System Design Capability Working Group newsletters.
- Launched the Observing System Design mini-workshops webinar series (first workshop in January 2023).
- Organisation of an Observing System Design Workshop, "Observing System Design: Gaps, Requirements and Opportunities" to be held as a side-event of the SOOS Symposium 2023.

Total working group membership: 115 from 76 institutions across 28 countries
(growth of an additional 18 members in 2022)





Southern Ocean Fluxes (SOFLUX) Capability Working Group

Leadership:

S. Gille (Co-Chair, USA), M. du Plessis (Co-Chair, Sweden/South Africa), B. Delille (Belgium), S. Swart (Sweden), C-A. Clayson (USA), S. Josey (UK), A. Lenton (Australia), E. Schulz (Australia), V. Tamsitt (Australia/USA), I. Orselli (APECS Representative, Brazil)

2022 Milestones:

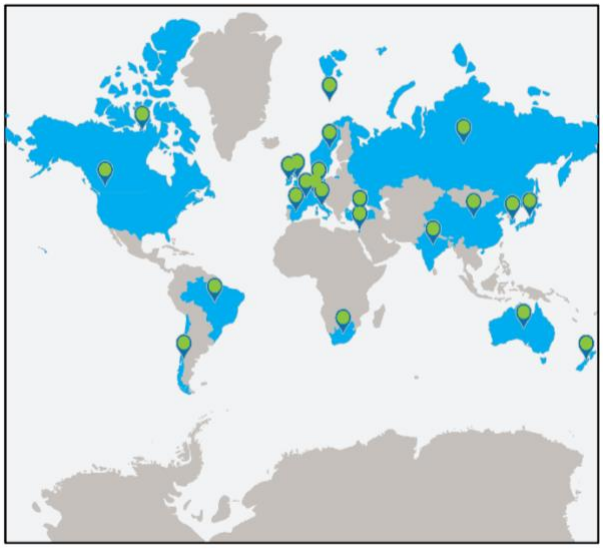
During 2022 the SOFLUX CWG:

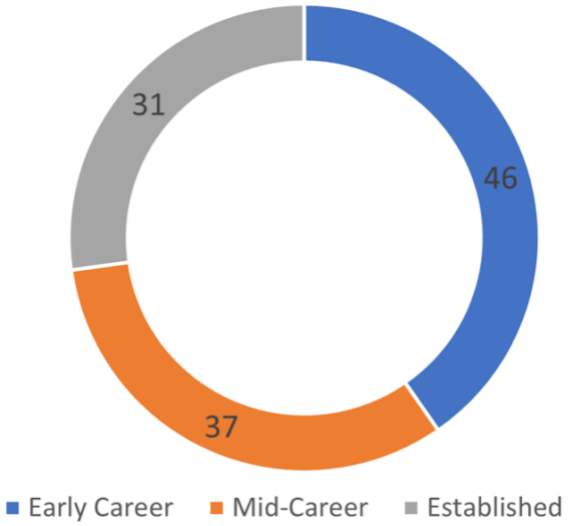
- Endorsed as a UN Ocean Decade Action, project No. 129.2 (February 2022-December 2025).
- Contributed to the Bulletin of America Meteorology State of the Climate Report 2022, Southern Ocean chapter.
- Continued to produce approximately month newsletters.
- Continued a webinar series with six webinars produced 2022:
    - "Carbonate system at the Northern Antarctic Peninsula: current knowledge and future perspectives" presented by Andréa a Consalação de Oliveira Carvalho (Universidade Federal do Rio Grande).
    - "The Atmosphere signature of Southern Ocean carbon flux" presented by Matt Long (National Centre for Atmospheric Research, USA).
    - "Air-sea CO2 fluxes from SOCAT and direct measurements in the Southern Ocean" presented by Dorothee Bakker and Yuanxu Dong (University of East Anglia).
    - "Towards a clearer view of Southern Ocean air-sea interactions" presented by Simon Josey (National Oceanography Centre, UK)
    - "Drivers of abrupt circumpolar surface warming events across the Southern Ocean" presented by Earle Wilson (Standford University).
    - "Observing the Southern Ocean carbon cycle with autonomous floats" presented by Channing Prend (University of Washington).
- Coordination of a SOFLUX session at the SOOS Symposium.
- Continued engagement and participation in the SCOR OASIS working group (including shared co-chair).

Members from the SOFLUX CWG represented SOOS and the SOFLUX CWG at:

- Heat and carbon uptake in the Southern Ocean: the state of the art and future priorities (online May 2022), Marcel du Plessis and other SOOS leadership team members.
- FilaChange, an international conference on ocean processes linking filaments and finescales (1-100km) with climate change (Paris, France, August 2022), Marcel du Plessis.
- European Geophysical Union (EGU) General Assembly (Vienna, Austria, May 2022). Marcel du Plessis.

Total working group membership: 151 from 81 institutions across 27 countries





Task Teams

SOOS Task Teams are developed to produce specific products, organise events, or solve a particular problem. Each Task Team is made up of a small group of experts and aims to complete its work within weeks or months. SOOS Capability Working Groups can be formed to address issues requiring a long-term effort (e.g., months to years).

Autonomous Underwater Vehicles (AUVs) Task Team

Leadership:

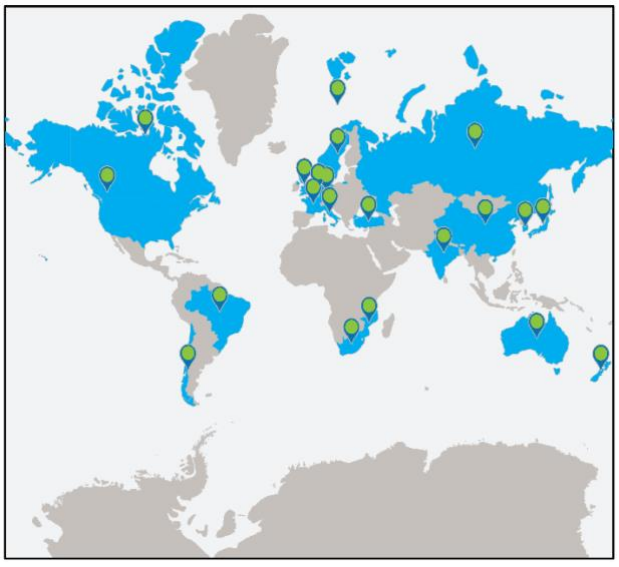
G. Williams (Co-Chair, Australia), K. Heywood (Co-Chair, UK) W.S. Lee (Co-Chair, South Korea), A. Wählin (Co-Chair, Sweden), P. van der Merwe (Australia), T. Tamura (Japan), D. Chen (China), J. O'Callaghan (New Zealand), P. Dutrieux (UK), A. Martin (Australia), B. Schmidt (USA)

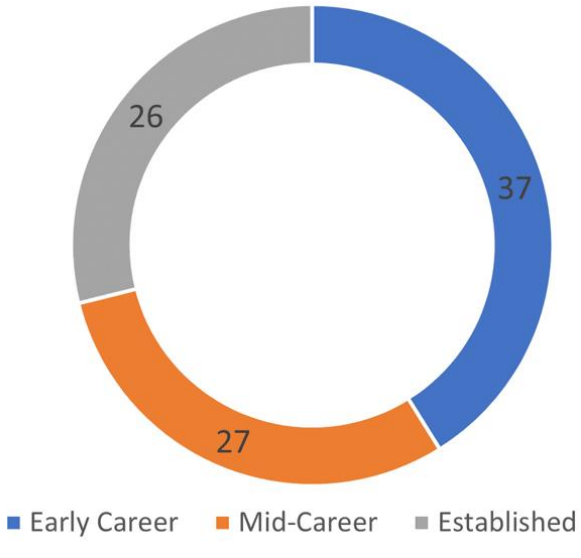
2022 Milestones:

The AUV Task Team was completed in late 2022. During 2022 the AUV Task Team:

- Held an online AUV Task Team meeting to discuss the outputs of the AUV Task Team.
- Continued collaboration between the Australia (University of Tasmania) and South Korea (KOPRI) to support polar AUV field deployments.
- Continued to strengthen connections and build an international polar AUV network with engagement for all key polar AUV programmes.

Total working group membership: 91 from 55 institutions across 23 countries
(growth of an additional 4 members in 2022)





Ecosystem Essential Ocean Variables (eEOVs) Task Team

Leadership:

A. Constable (Co-Chair, Australia), M. Muelbert (Brazil), J. Melbourne-Thomas (Australia)

2022 Milestones:

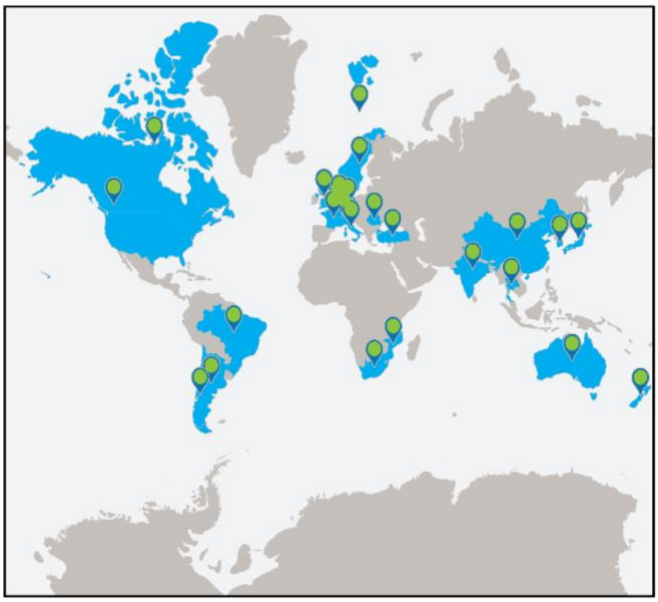
During 2022 the eEOV Task Team:

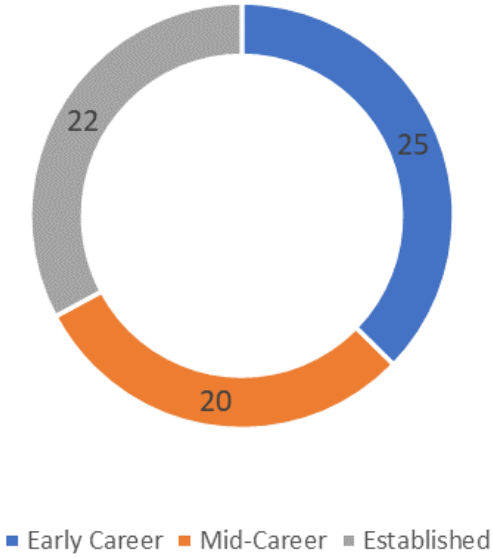
- Work continued on a publication of Southern Ocean sentinels for submission to the Marine Ecosystem Assessment of the Southern Ocean (MEASO) Special Issue (in prep.).

Members from the eEOV Task Team represented SOOS at the following international meetings:

- COP27 (Sharm-El-Sheikh, Egypt, November 2022), Jilda Caccavo, Sian Henley and Sebastien Moreau

Total working group membership: 69 from 52 institutions across 24 countries





Polar Technologies Task Team

Leadership:

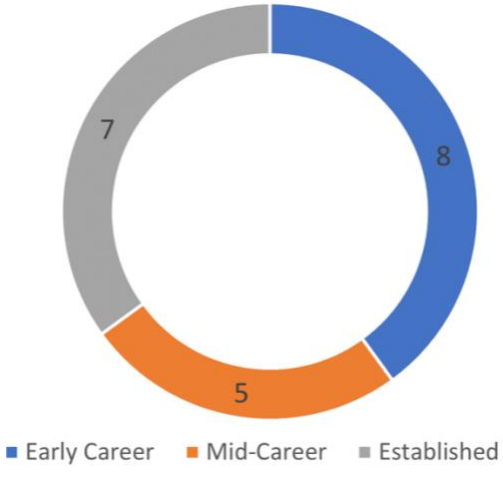
A. Marouchos (Chair, Australia), A. Meijers (UK), R. Verrinder (South Africa)

2022 Milestones:

During 2022 the Polar Technology Task Team:

- Co-coordinating a workshop for the SOOS Symposium with OSD CWG as well as coordinating a session and plenary for the SOOS Symposium on emerging technologies to facilitate observations.

Total working group membership: 20 from 15 institutions across 9 countries



SOOS National Networks

SOOS-Swedish Southern Ocean Network

The Swedish Polar Research Secretariat has partnered with SOOS in a 3-year partnership (2020-2022) to develop a national network of researchers, policy and industry members with an interest in the Southern Ocean; to enhance the connections of the Swedish Southern Ocean community to the international community; and to provide support for increased visibility of Swedish Southern Ocean data and activities. This partnership is currently in the process of being renewed for 2022 onwards.

Leadership:

S. Swart (Co-Chair; Sweden), T. Dahlgren (Co-Chair; Sweden)

2022 Milestones:

During 2022 SOOS-Swedish Southern Ocean Network has:

- Held the first SOOS-Swedish Southern Ocean Network "Southern Ocean Research Seminar" in July 2022, Gothenburg, Sweden (Network Meeting Communique).
- Prepared Swedish mooring datasets to be included into the SOOS Mooring Network (to be added in 2023).

Equity, Diversity and Inclusion (EDI) Group

The SOOS Equity, Diversity and Inclusion (EDI) group is a mechanism to ensure there is discussion, reflection and recommendations on all equity issues with SOOS to focus on real actions relevant to the SOOS community.

Leadership:

S. Fawcett (Co-Chair; South Africa), S. Diggs (Co-Chair; USA), J. Beja (Co-Chair; Belgium), K. Gunn (APECS Rep.; Australia), F. Marcello (APECS Rep.; Brazil)

2022 Milestones:

- Appointed 2 APECS Representations, Kathy Gunn and Fernanda Marcello.
- Developed a webpage on the SOOS website.
- Advised on EDI aspects for the SOOS Symposium including low-cost, asynchronous hybrid option and drafted a SOOS Symposium Code of Conduct.

SOOS Partnerships and Collaborations

Polar Data Discovery Enhancement Research (POLDER)

Polar Data Discovery Enhancement Research (POLDER) is a collaboration between the Arctic Data Committee, SCAR Standing Committee on Antarctic Data Management and SOOS. The aim of POLDER is to develop tools and resources to support metadata aggregation, and federated search tools to improve the discoverability of polar science data.

During 2022 POLDER has:

- Completed V1 of the "POLDER best practice guide to implementing schema.org for data discovery"
- Hosted four online data hacks in the "Polar to Global Online Interoperability and Data Sharing Workshop Series" with ~20-40 attendees per session.
- Launched the Polar Federated Search tool into Production (March 2022).
- The PFS currently has 19 repositories aggregated into the search tool.
- Since the launch, the Polar Federated Search tool has added 'Author', and 'Spatial' search faceting to the PFS interface.
- Planned 2 workshops to help repositories complete the POLDER recommended schema.org workshop for early 2023.

Total working group membership: 92 (from 71 institutes across 27 countries)

Marine Ecosystem Assessment of the Southern Ocean (MEASO)

The MEASO project has provided the first circumpolar assessment of status and trends in Southern Ocean biota and food webs. The project will release a summary for policy makers and a Frontiers in Marine Science Special Issue in mid-2023. SOOS has been a key partner in the MEASO project with strong engagement from the SOOS community.

During 2022 the SOOS contributions to MEASO included:

- Co-convened a COP27 side-event with SOOS and SCAR titled "Southern Ocean ecosystems: need for augmented understanding, research efforts and protection" with SOOS speakers and panel members including Sian Henley (side-event lead), Jilda Caccavo (SSC) and Andrew Constable (ex-SOOS Co-Chair).
- Published to the MEASO Frontiers in Marine Science Special Issue
    - Johnston et al. 2022 Status, Change, and Futures of Zooplankton in the Southern Ocean. https://doi.org/10.3389/fevo.2021.624692
    - Swadling et al., 2023 Biological responses to change in Antarctic sea ice habitats. https://doi.org/10.3389/fevo.2022.1073823

Southern Ocean UN Ocean Decade Task Force

The Southern Ocean UN Ocean Decade is coordinated by SCAR and was set up to develop the Southern Ocean Action Plan for the UN Ocean Decade. SOOS is a key partner in the Task Force with representation from SOOS EXCOM members Eileen Hofmann, Sian Henley and Mike Williams (stood down from the Task Force in September 2022). SOOS has also had strong involvement in the Working Groups for the Southern Ocean Action Plan, which identified the needs of the Southern Ocean community to deliver into the seven societal outcomes of the UN Ocean Decade.

During 2022, the achievements of the Southern Ocean Task Force and the contributions of SOOS included:

- Publication of the Southern Ocean Action Plan for the UN Ocean Decade (published in April 2022, https://doi.org/10.5281/zenodo.6412191). SOOS co-authorship included Eileen Hofmann (SOOS Co-Chair), Sian Henley (SOOS Co-Chair), Anton Van de Putte (DMSC), Mike Williams (former SOOS Co-Chair) and Pip Bricher (former SOOS Data Officer).
- Contribution to UN Oceans Conference high-level side event hosted by Prince Albert II of Monaco and his Foundation, 'Polar oceans: engine of the global ocean'. SOOS Co-Chair Sian Henley presented on the Southern Ocean Action Plan and its importance to global society. Lisbon, Portugal, June 2022.

SOOS Co-Chair Eileen Hofmann organised the Antarctic Regional Team contribution for the kick-off meeting of UN Decade Collaborative Centre on Ocean Prediction. Planning and organisation for the Antarctic Regional Team took place in Fall 2022 for the kick-off meeting that was held 11-12 January 2023. Eileen Hofmann made a presentation on SOOS as one of the Antarctic Regional Team contributions to the kick-off meeting.

Now that the Southern Ocean Action Plan is published, the key question is how to turn Action Plan into Action. This is the current focus of the Task Force, Working Groups, collaborative efforts and wider stakeholders, and will be reported on in the 2023 Annual Report.

CliC/CLIVAR/SCAR Southern Ocean Regional Panel (SORP)

The CliC/CLIVAR/SCAR Southern Ocean Regional Panel (SORP) aims to coordinate the discussion and communications of scientific advances in the understanding of climate variability and change in the Southern Ocean. SOOS has a long history of collaboration and partnership with SORP including holding an ex-officio position on the SORP steering committee. This position has been occupied by SOOS Scientific Steering Committee (SSC) member, Luciano Pezzi since mid-2021. Luciano attends monthly telecom meetings and present on SOOS at SORP meetings, when needed. Luciano is co-editing a SORP CLIVAR Exchanges Special Issue about Antarctic National Programs (re-planned to be released in late 2023). Luciano is also leading the Southern Ocean chapter in the State of Climate Report for 2022, Bulletin of the American Meteorological Society.

New Initiatives in 2022

SOOS is holding its inaugural SOOS Symposium, “Southern Ocean in a Changing World” in Hobart, Australia between the 14-18th August 2023. An International Planning Committee was formed in early 2021 and the symposium aims to re-engage with the community, re-educate on SOOS, and create linkages across the entire Southern Ocean observations value-chain. The symposium has 8 sub-themes: need for a Southern Ocean observing system, circumpolar observations and programmes, regional observations and programmes, data systems, impact of observations in policy and societal challenges, Southern Ocean in the global UN Decade, new observing technology and systems in the Southern Ocean observations and gaps and next steps for the Southern Ocean observing system. The symposium received 32 session proposals across these sub-themes. Abstract submission and registrations will open in early 2023.

Appendix I: Acronyms

AAD - Australian Antarctic Division
ABS - Amundsen and Bellingshausen Sector
ACAP – Agreement on the Conservation of Albatrosses and Petrels
ADC - Arctic Data Committee
AniBOS – Animal Borne Ocean Sensors
AntClim^{now} – Near-term variability and prediction of the Antarctic climate system (SCAR)
APECS - Association of Polar Early Career Scientists
ASPeCt - Antarctic Sea Ice Processes and Climate
AUV(s) - Autonomous Underwater Vehicle(s)
BELSPO – Belgian Science Policy Office
BEPSII - Biogeochemical exchanges at Sea Ice Interfaces
BioPole – Biogeochemical processes and ecosystem function in changing polar systems and their global impacts
CAPS - Censusing Animal Populations from Space
CCAMLR - Commission for the Conservation of Antarctic Marine Living Resources
CLIVAR - Climate Variability and Predictability
CliC - Climate and Cryosphere
COMNAP - Council of Managers of National Antarctic Programs
COP – United Nations Climate Change Conference of the Parties
CSIRO - The Commonwealth Scientific and Industrial Research Organisation
CTD - Conductivity, Temperature, Depth
CWG(s) - Capability Working Group(s)
DMSC - Data Management Subcommittee
EDI - Equity, Diversity and Inclusion
EMODnet - European Marine Observation and Data Network
eEOV - ecosystem Essential Ocean Variables
EuroGOOS - European Global Ocean Observing System
EXCOM - Executive Committee
GBIF – Global Biodiversity Information Facility
GCMD - Global Change Master Directory
GLODAP – Global Ocean Data Analysis Project
GOA-ON – Global Ocean Acidification Observing Network
GOOS – Global Ocean Observing System
GTS - Global Telecommunication System
IAATO - International Association of Antarctic Tour Operators
IMAS - Institute for Marine and Antarctic Studies
INSDC – International Nucleotide Sequence Database Collaboration
IPO – International Project Office
MEASO - Marine Ecosystem Assessment of the Southern Ocean
MEOP - Marine Mammals Exploring the Oceans Pole to Pole
NASA - National Aeronautics and Space Administration
NECKLACE - Network for the Collection of Knowledge on meLt of Antarctic iCe shElves
OASIS – Observing Air-Sea Interactions Strategy

OBIS – Ocean Biodiversity Information System
OCEAN:ICE – Ocean Cryosphere Exchanges in Antarctic: Impacts on Climate and the Earth system
OSD - Observing System Design
ORCHESTRA – Ocean Regulation of Climate through Heat and Carbon Sequestration and Transports
PolarTech – Polar Technology Task Team
POLDER - Polar Data Discovery Enhancement Research
RoSES – Role of the Southern Ocean Earth System
RWG(s) - Regional Working Group(s)
SCADM - Standing Committee on Antarctic Data Management
SCAR - Scientific Committee on Antarctic Research
SCOR - Scientific Committee on Oceanic Research
SOCAT – Surface Ocean CO_2 Atlas
SO-CHIC - Southern Ocean Carbon and Heat Impact on Climate
SOCCOM – Southern Ocean Carbon and Climate Observations and Modelling project
SOFLUX - Southern Ocean Fluxes
SOIS - Southern Ocean Indian Sector
SOOS - Southern Ocean Observing System
SORP - Southern Ocean Regional Panel Expert Group
SSC - Scientific Steering Committee
TT(s) – Task Team(s)
UN - United Nations
UTAS - University of Tasmania
WAPSA - West Antarctic Peninsula and Scotia Arc
WoRMS – World Register of Marine Species
WSDML - Weddell Sea and Dronning Maud Land