

# SOLAS annual report to SCOR

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Reporting period: July 2023 - June 2024

Version of 7 August 2024 by Li Li

## I. Short summary

The Surface Ocean-Lower Atmosphere Study (SOLAS) is dedicated to achieving quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere, and how this coupled system affects and is affected by climate and environmental changes.

At the end of its second decade, SOLAS coordinated a special issue of *Elementa*, including 12 invited review papers to assess the state of air-sea interaction science, highlight critical future research directions, and identify emerging opportunities for new collaborations, technologies, and discoveries. A series of events have been organised to reboot SOLAS, including a scoping workshop in Xiamen, China (Sep. 2023) and side events at the World Climate Research Programme (WCRP) Open Science Conference in Kigali, Rwanda (Oct. 2023) and the United Nations (UN) Ocean Decade Conference in Barcelona, Spain (Apr. 2024). A community-led new decadal science plan is under development, which will further advance SOLAS' achievements and grapple with emerging issues. Several initiatives were launched under this framework. For example, SOLAS organised the FLARE workshop to formulate a roadmap for integrated wildfire research as climatic and environmental effects as wildfire frequency increases. A marine Carbon Dioxide Removal (mCDR) postdoc programme and a global network of mCDR nodes were launched to advance understanding, model development, and to advance standards for mCDR initiatives, especially concerning Monitoring, Reporting, and Verification (MRV). The SOLAS modelling initiative team has been actively organising/co-organising discussions to prioritise SOLAS Earth System Model (ESM) strategy for the next 5 years, e.g., with WCRP Earth System Modelling and Observations (ESMO).

SOLAS is committed to science communication and capacity building. The quarterly SOLAS seminars have continuously been organised to foster discussions on cutting-edge scientific questions, provide researchers at all career stages with the opportunity to interact, and build the SOLAS community across the globe. The seminars organised during the reporting period featured collaborations with other global research projects, such as the International Global Atmospheric Chemistry (IGAC) project, the Cryosphere and Atmospheric Chemistry (CATCH) and the Second International Indian Ocean Expedition (IIOE-2). SOLAS established its future committee, the Early Career Scientist Committee (ECSC), in 2023 to coordinate and champion the early career activities of the SOLAS community. The ECSC was tasked with new crucial roles in the past year, including co-leading SOLAS Implementation Teams and New Initiatives with SOLAS Scientific Steering Committee (SSC) members, co-organising major SOLAS events, and being part of writing the new science plan and designing SOLAS's future. New ECSC members from Kenya and India have been recruited to build the capacity in Africa and South Asia.

## Table of Content

I. Short summary .....	1
II. SOLAS Mission and Organisation .....	2
III. Progress on implementation of project science.....	3
III.a. Integrated activities.....	3
III.b. Progress on Core Themes .....	4
III.c. Progress on Cross-cutting Themes and Integrated Topics.....	6
IV. Summary of 2023-2024 SOLAS activities.....	8
IV.a. Event organisation and participation .....	8
IV.b. Communications.....	9
IV.c. Publications .....	10
IV.d. National and regional networks / regional panel .....	10
IV.e. Current endorsed projects and time series – ongoing.....	11
IV.f. SOLAS master programme.....	12
IV.g. Income and expenses for the past year and budget for the coming year .....	12
V. Update on the SSC, ECSC, and IPO.....	14
V.a. Scientific Steering Committee.....	14
V.b. Early Career Scientist Committee .....	15
V.c. International Project Office .....	17

## II. SOLAS Mission and Organisation

The SOLAS mission is *to achieve quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and the atmosphere, and of how this coupled system affects and is affected by climate and environmental change.*

The [2015-2025: Science Plan and Organisation](#) organised this mission around five core themes:

Core Theme 1: Greenhouse gases and the oceans

Core Theme 2: Air-sea interface and fluxes of mass and energy

Core Theme 3: Atmospheric deposition and ocean biogeochemistry

Core Theme 4: Interconnections between aerosols, clouds, and marine ecosystems

Core Theme 5: Ocean biogeochemical control on atmospheric chemistry

In addition, the study of these themes is integrated in efforts to understand key environments, e.g. upwelling systems, polar oceans, and the Indian Ocean, as well as to evaluate the environmental efficacy and impacts of climate intervention proposals, policy decisions, and societal developments.

The SOLAS 2015-2025: Science Plan and Organisation ([SPO](#)) is available to download from the SOLAS website, and hardcopies are available upon request from the IPO.

SOLAS chose to use a pragmatic approach to the implementation strategy with a continually-evolving live document developing plans at least 2 years into the future. This approach means that the document is a moving target that is regularly updated. The [implementation strategy](#) is intended to be a live web-based document only, and it will be revisited again in Nov./Dec. 2024.

## Upcoming SOLAS and SOLAS co-sponsored activities

The activities reported below are of various types; some activities present SOLAS's leading role in event organisation, some SOLAS's involvement, and some financial contribution.

- SOLAS Seminar IX: Indian Ocean science, online, 2 Aug. 2024
- SOLAS Science and Society Workshop, online and in Goa, India, 8-9 Nov. 2024
- 9<sup>th</sup> SOLAS Open Science Conference (OSC), Goa, India, 10-14 Nov. 2024
- 25<sup>th</sup> SOLAS SSC meeting, online and in Goa, India, 15-17 Nov. 2024
- Chemical, Biogeochemical, and Physical Drivers of the Coupled Polar Atmosphere and Climate: An International Polar Year 2032-33 Planning Workshop, Aussois, France, 17-22 Nov. 2024
- SOLAS session at the Xiamen Symposium on Marine Environmental Sciences 2025, Xiamen, China, 14-17 Jan. 2025
- SOLAS session at the European Geosciences Union (EGU) General Assembly 2025, Vienna, Austria, 27 Apr.-2 May 2025
- Launching event of SOLAS 3.0 at 3rd UN Ocean Conference, Nice, France, Jun. 2025 (tentative)
- 10<sup>th</sup> SOLAS Summer School, Brazil, 2025 (tentative)

## III. Progress on implementation of project science

### III.a. Integrated activities

#### Surface Ocean-Lower Atmosphere Studies: from science to solutions," (SOLAS 3.0)

National Science Foundation (NSF)/SCOR sponsorship and related funding will end in Dec. 2025. SOLAS is thus seeking the possibilities of continuation of the sponsorship. During the SSC meetings in 2022-2024 and an ECSC online meeting in 2023, discussions on the future of SOLAS beyond 2025 took place. SOLAS also gathered ideas from the its summer school students and attendees of various SOLAS sponsored events. Basing on the discussions and feedback, a scoping workshop was organised in Xiamen, China, 25-28 Sep. 2023, which gathered 40 in-person and online international experts from/outside the SOLAS community. The 3<sup>rd</sup> decadal science plan of SOLAS, titled "Surface Ocean-Lower Atmosphere Studies: from science to solutions," (SOLAS 3.0), was framed at the workshop. SOLAS 3.0 consists of the below three pillars, and a team of coordinators has been organising the writing of the three pillars.

- Discovery science. The basic discovery science that has been so successful in previous SOLAS plans will continue to be a central activity for SOLAS 3.0. Essential research is required on newly identified knowledge gaps. This work will provide the foundation for further progress in characterising the mean state for the ocean-atmosphere exchange of climate active gases, aerosols, heat, and momentum. SOLAS will focus new research on extreme events in the SOLAS domain, such as storms and cyclones, dust storms, fires, marine heat waves, extreme sea ice loss, hypoxia and acidic events, and harmful algal blooms.
- Science for solutions. SOLAS 3.0 will both analyse fundamental research data for their contribution to informed solutions and identify knowledge gaps needed to properly evaluate solutions being considered. Elements will include mCDR, marine solar radiation management, solutions for restoration, blue economy and international governance and coordination of ocean solutions.

- Scientific community and skill development. SOLAS 3.0 will work on six areas of interest: 1) Scientific interactions, 2) Early career training and integration, 3) Skill enhancement, 4) Tool and resource accessibility, 5) Science advocacy and 6) Informing policy and outreach. This new science plan will also argue for SOLAS investment in the development of centres for observation, training and solutions as a commitment to equitable research relationships.

### New initiative: Modelling surface ocean and lower atmosphere interactions in the Earth System

Following the recommendation of the SOLAS mid-term review panel, SOLAS launched a modelling initiative in 2023. An online workshop was organised in Jul. 2023 to discuss how SOLAS science can be best integrated in to Earth System Models (ESMs) and what should be the priorities for SOLAS ESM strategy the next 5 years. The outcomes of the workshop have been fed into the new science plan. SOLAS is also building international collaborations through the Modelling Initiative, e.g., with the Earth System Modelling and Observations ([ESMO](#)) project, a new core project of WCRP. Several discussions have taken place online and a SOLAS-EMSO joint discussion session will be organised at the SOLAS OSC2024 to improve the biogeochemical components in ESM and enhance the global/system modelling capacities for SOLAS.

### Contributions to the UN Ocean Decade

SOLAS has updated the Implementation Strategy version2022 with the specific involvement of SOLAS themes into the UN Ocean Decade in the [Activities Table 2022/23](#). A recent contribution to the UN Ocean Decade is co-organised side event on [Unifying strategies to develop integrated global air-sea community networks](#) at UN Ocean Decade Conference in Apr. 2024 online and in Barcelona, Spain. SOLAS is a partner of or is collaborating with the below UN Ocean Decade programmes/projects.

- Coastal Zones Under Intensifying Human Activities and Changing Climate: A Regional Programme Integrating Science, Management and Society to Support Ocean Sustainability ([Coastal-SOS](#))
- Global Ocean Negative Carbon Emission ([Global ONCE](#))
- Global Ocean Oxygen Decade ([GOOD](#))
- Observing Air Sea Interactions Strategy ([OASIS](#))
- Ocean Acidification Research for Sustainability ([OARS](#))
- Climate Seamless Forecasting system ([OSF](#))

## III.b. Progress on Core Themes

### Core Theme 1: Greenhouse gases and the oceans

#### SOLAS- Integrated Marine Biosphere Research (IMBER) Ocean Acidification ([SIOA](#)) Working Group

SIOA is a SOLAS-sponsored activity that provides a key advisory role to the Ocean Acidification International Coordination Centre (OA-ICC) based at the International Atomic Energy Agency Environment Laboratories in Monaco. SIOA facilitates OA-ICC activities, which include support for the Global Ocean Acidification Observing Network (GOA-ON), updating and improving best practices for making ocean acidification measurements and building global capacity. The OARS, UN Ocean Decade programme proposed by GOA-ON, aims to provide systematic evidence of the impacts of ocean acidification on the sustainability of marine ecosystems, enhance ocean acidification capacity,

increase observations of ocean chemistry changes, enhance the communication to policy makers and communities by providing the information needed to mitigate and adapt to ocean acidification, and to facilitate the development and evaluation of strategies to offset future impacts. SOLAS co-sponsored the GOOD-OARS-CLAP-COPAS Summer School, which took place in Coquimbo, Chile, 6-12 Nov. 2024 (See SOLAS Event Report [Issue 36](#)).

### [The Surface Ocean CO<sub>2</sub> Atlas \(SOCAT\)](#)

SOCAT documents the increase in surface ocean CO<sub>2</sub>, a critical measure as the oceans are taking up one quarter of the global CO<sub>2</sub> emissions from human activity. SOCAT was co-initiated and co-endorsed by SOLAS. The SOCAT 2024 version was released in Jun. 2024 and contains 38.6 million, quality-controlled, in-situ surface ocean  $f\text{CO}_2$  (fugacity of CO<sub>2</sub>) measurements collected between 1957 and 2023 with an estimated accuracy of better than 5  $\mu\text{atm}$ . However, in addition to the decline in observations, the integration, quality control and accessibility of data products by SOCAT is at risk from persistent funding shortfalls, with SOCAT now relying on a single regional hub. At a time where the importance of constraining ocean CO<sub>2</sub> uptake is well recognized by the WMO Global Greenhouse Gas Watch and the UNFCCC Global Stocktake, there is an urgent need for sustained and expanded funding of accurate surface ocean CO<sub>2</sub> observations and their synthesis.

### [Core Theme 2: Air-sea interface and fluxes of mass and energy](#)

#### [Collaboration with the European Space Agency \(ESA\)](#)

The long-standing and fruitful collaboration between SOLAS and ESA is continuing. The ESA-SOLAS workshop on Eddy covariance air/sea gas flux best practice workshop took place in Mar. 2023. It gathered over 20 participants from US, Europe, China and UK. The workshop objectives were to: I) agree best practice for setting up eddy covariance CO<sub>2</sub> flux systems; II) assess results from a data analysis intercomparison exercise; III) agree best practice for EC data analysis; and IV) plan for a possible eddy covariance CO<sub>2</sub> flux intercomparison field experiment (See SOLAS Event Report [Issue 37](#)).

### [Core Theme 3: Atmospheric deposition and ocean biogeochemistry](#)

#### [Collaboration with the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection \(GESAMP\) WG 38](#)

SOLAS has been collaborating with GESAMP WG 38. A new activity is to develop a joint working group with GESAMP WG 38 and the World Meteorological Organization (WMO)'s Global Atmospheric Watch (GAW) programme to improve global flux estimates of atmospheric deposition to the ocean. An initial meeting between a small group of experts from GESAMP WG 38, GAW and SOLAS is being planned to set the agenda for a main meeting, at which both modelers and observationalists will be brought together to create a list of research priorities for future studies of atmospheric deposition to the ocean, including efforts to reduce the modelling uncertainties.

#### [New Initiative on wildfire](#)

SOLAS launched a wildfire initiative to address the impacts of fire emissions on the ocean and society in 2022. Following a successful side event at COP27 in 2023, the team organised the FLARE workshop: Fire science Learning Across the Earth system online and in Bermuda, UK from 18-21 Sep. 2023. The workshop, funded by the ESA-Future Earth Joint Program, brought together more than three dozen physical and social scientists, artists, communicators and others, to discuss the challenges in understanding fire behaviour and its impacts across the world and over varied

timeframes, the tools that we have and the need to address these challenges, and how to communicate better across disciplines (See SOLAS Event Report [Issue 35](#)). A [white paper](#) on the holistic role played by fire in the Earth system has resulted from the workshop.

#### [Collaboration with the SCOR WG 167 “Reducing Uncertainty in Soluble aerosol Trace Element Deposition \(RUSTED\)”](#)

RUSTED is led by and includes high involvement of SOLAS Core Theme 3 Implementation Team members. The SOLAS OSC2024 will host a side event and discussion session of RUSTED. The outcomes of the activities will be published in the SOLAS Event Report on the OSC2024, which will be available in late 2024/early 2025.

#### [Core Theme 4: Interconnections between aerosols, clouds, and marine ecosystems and Core Theme 5: Ocean biogeochemical control on atmospheric chemistry](#)

##### [Collaboration with IGAC](#)

The 6<sup>th</sup> SOLAS Seminar was hosted by the SOLAS ECSC and IGAC ECSC on Halogen chemistry: from ocean to stratosphere, on 25 Jul. 2023. In addition to the scientific talks, further collaborations between IGAC and SOLAS was discussed. A discussion session will take place at the SOLAS OSC 2024 on Coastal cities air quality under the influence from the ocean – shared common mission of IGAC and SOLAS.

#### [Collaboration with the SCOR WG 166 “Developing resources for the study of Methylated Sulfur compound cycling PROCesses in the ocean \(DMS-PRO\)”](#)

The objectives of DMS-PRO are well aligned with those of Core Themes 4&5. Many SOLAS scientists are involved in this WG, and Tom Bell acts as a main contact point between DMS-PRO and SOLAS. DMS-PRO was represented at the SOLAS OSC 2022, SOLAS Seminar V and the SOLAS-OASIS side event at the UN Ocean Decade Conference in Apr. 2024 in Barcelona, Spain.

### [III.c. Progress on Cross-cutting Themes and Integrated Topics](#)

#### [Polar Oceans and Sea Ice](#)

##### [Biogeochemical Exchange Processes at Sea Ice Interfaces \(BEPSII\)](#)

The BEPSII project started in 2011 with a focus on sea-ice biogeochemistry, was a SCOR WG from 2012 until Sep. 2016, and has since been endorsed as a SOLAS- Climate and Cryosphere (CliC) activity (from 2016) and as a Scientific Committee on Antarctic Research (SCAR) Action Group (from 2017).

- BEPSII organised a side event at the COP28 Cryosphere pavilion in Dubai, UAE, Nov.-Dec. 2023, on The role of sea-ice biogeochemistry and ice-associated ecosystems in the Earth system. BEPSII also contributed to another COP28 Cryosphere pavilion side event with a talk on The relevance of the sea-ice ecosystem to the functioning of the Southern Ocean food web.
- The BEPSII General Open Online Meeting 2024 will take place from 24-27 Sep. 2024. The meeting will focus largely on developing a new 5-year science plan with the intention to feed into the SOLAS 3.0.
- BEPSII launched its Early Career Scientist Exchange Program in 2022. A 2nd competitive call was released in 2024. SOLAS is a co-sponsor of the program and will financially support two awardees to conduct their overseas research this year.

## Cryosphere and Atmospheric Chemistry (CATCH)

CATCH, co-sponsored by SOLAS and IGAC, facilitates atmospheric chemistry research within the international community, with a focus on natural processes specific to cold regions of the Earth. CATCH scientists have had prominent roles in the following SOLAS related science projects and activities:

- [Arctic Bromine Model Intercomparison](#). Compare and evaluate 3-D atmospheric models which include polar halogen sources and reproduce surface ozone depletion. Models will be evaluated against in situ and satellite observations in the Arctic from 2012 and 2020.
- Climate Relevant interactions and feedbacks: the key role of sea ice and Snow in the polar and global climate system ([CRiceS](#)). This H2020 project focuses on improving model predictions of the role of polar processes in the climate system that consists of the oceans, ice and snow cover, and the atmosphere. Its latest annual meeting was held 11-15 Sep. 2023 in Grenoble, France, with CATCH's leadership and BEPSII's engagement.
- Cloud-aERosol inTeractions & their impActs IN The earth sYstem ([CERTAINTY](#)). CERTAINEY with CATCH's leadership was funded by the Horizon Europe programme. The project aims to deliver the knowledge and models that provide improved confidence and representation of the role of cloud-aerosol-radiation interactions in climate and weather.
- Partnerships for Investigations of Clouds and the biogeoChemistry of the Atmosphere in Antarctica and the Southern Ocean ([PICCAASO](#)). PICCAASO was originally started under CATCH with an aim to amplify the scientific discovery of the many upcoming projects occurring in the Antarctic and Southern Ocean region by facilitating global collaboration and coordination. SOLAS will host a discussion session of PICCAASO at OSC2024.
- Coupling of ocean-ice-atmosphere processes: from sea-Ice biogeochemistry to aerosols and Clouds ([Clcea2Clouds](#)). This CATCH-BEPSII initiative grew out of a joint discussion session at the 2019 SOLAS OSC in Sapporo, Japan, which has resulted in the SCOR WG 163 Clcea2Clouds. Its 2022 annual meeting took place back-to-back with the 8<sup>th</sup> SOLAS OSC in Cape Town, South Africa, and its 2024 annual meeting is being scheduled as a side event of SOLAS OSC 2024.

## Upwelling Systems

Understanding how land-air-sea interactions control the dynamics behind the oxygen minimum zone in the eastern boundary upwelling system (EBUS) and may potentially exacerbate deoxygenation is not only of scientific interest but also a major societal concern. SOLAS has been leading, coordinating and endorsing research projects and campaigns and capacity building activities to understand the complex atmosphere-ocean interaction and physical-chemical-biological coupling in the EBUS regions. Recent relevant activities include:

- GOOD-OARS-CLAP-COPAS Summer School 2023, La Serena Chile, 6-12 Nov. 2023, with a focus on the Humboldt system.
- GO2NE/GOOD/OARS Summer School 2025, 4-11 Nov. 2025, Penang, Malaysia.
- OceanICU campaign, from South Africa upwelling to the Canary Current upwelling, is scheduled for spring 2025
- Future of Tropical Upwelling Regions in the Atlantic Ocean ([FUTURO](#)) campaign. This multi-scale, year-round, multidisciplinary observational campaign is planned to take place in the coastal upwelling system off West Africa for the time frame 2027-2029.

## Indian Ocean

Our current understanding of the Indian Ocean is mainly based on sporadic ship campaigns and remote sensing data. Details of the large-scale features, such as the seasonal cycles over the individual ocean basins, variations of the latitudinal gradients, and the vertical distributions and long-term changes for several trace gases, are not well known, nor are all the processes well understood. The 9<sup>th</sup> SOLAS seminar was jointly organised by the SOLAS and IIOE-2. At the upcoming OSC2024, SOLAS Indian Ocean research will have a strong presence. In addition, SOLAS India meeting will be organised during the conference to discuss how to facilitate research information exchange and help forge collaborations.

## Climate Intervention

Since a successful workshop in Sapporo, Japan, 2019, SOLAS has been building a coalition of global research programmes to provide a forum through which the efficacy and potential side effects of climate intervention proposals can be evaluated, as well as to explore governance concerns. SOLAS co-organised a COP26 side event on Carbon conservation and sequestration in the ocean: Nature-based and technology solutions to discuss the role of marine nature-based solutions to mitigate climate change. During the reporting period, SOLAS established a global network of ocean experts that work in regional nodes and has been working on establishing an internationally agreeable foundation of Monitoring, Reporting, and Verification (MRV) standards for mCDR. SOLAS also co-ordinated the funding from philanthropic organizations to support two [postdoc projects](#) on mCDR that aim to advance understanding and model development of mCDR and contribute to robust MRV protocols and consensus within the international scientific community.

## Science and Society

SOLAS and its co-sponsor Future Earth have been committed to bridging the gaps between science and society. A 2-day workshop will be organised by the Science and Society team as a back-to-back event with the OSC2024. The workshop will bring together leading experts from diverse backgrounds, including ocean-atmosphere interactions, social sciences, and humanities, to discuss the three key topics: nature-based marine solutions to climate change, harmful algae blooms, and marine plastic. The discussions will feed into the new SOLAS decadal science plan.

# IV. Summary of 2023-2024 SOLAS activities

## IV.a. Event organisation and participation

### SOLAS Seminar Series

The SOLAS Seminar Series was launched in 2022, which is structured around SOLAS relevant topics covered by the SOLAS 2015-2025 Science Plan and beyond, with the aims of fostering discussions on innovative scientific questions, providing researchers at all career stages with the opportunity to interact and building SOLAS community across the globe. Three seminars were organised during the reporting period. The recordings are available on the [SOLAS YouTube Channel](#).

- Seminar VI: Halogen chemistry: from ocean to stratosphere, 25 Jul. 2023
- Seminar VII: Ice-nucleating particles linked to marine biogeochemistry, 26 Oct. 2023
- Seminar VIII: Iodine cycle in polar regions and its impact on aerosols and clouds, 22 Apr. 2024



## Other events

- Scoping Workshop, online and in Xiamen, China, 25-28 Sep. 2023
- FLARE Workshop, online and in Bermuda, UK, 18-21 Sep. 2023
- SCOR annual meeting, online and in Guayaquil, Ecuador, 17-19 Oct. 2023
- Side event on Community engagement and feedback on the SOLAS science agenda at WCRP OSC, Kigali, Rwanda, 23-27 Oct. 2023
- GOOD-OARS-CLAP-COPAS International Summer School 2023, 6-12 Nov. 2023, La Serena, Chile
- International Digital Twins of the Ocean Summit 2023, 9-12 Nov. 2023, Xiamen, China
- SOLAS session on The Surface Ocean-Lower Atmosphere Study (SOLAS): 20-years of Progress and Developments in Ocean-Atmosphere science at the American Geophysical Union (AGU) Fall Meeting 2023, San Francisco, USA, 11-15 Dec. 2023
- SCOR China annual meeting, Shanghai, China, 6-7 Mar. 2024
- Side event on Unifying strategies to develop integrated global air-sea community networks at the UN Ocean Decade Conference, online and in Barcelona, Spain, 10-12 Apr. 2024
- SOLAS session on Impacts of Air-Sea Fluxes on Biogeochemistry and Climate: Challenges and Opportunities from 20 years of Surface Ocean Lower Atmosphere Study (SOLAS) at EGU General Assembly 2024, online and in Vienna, Austria, 14-19 Apr. 2024
- 45<sup>th</sup> Session of the WCRP Joint Scientific Committee (JSC-45), online, 27-30 May 2024
- Sustainability Research & Innovation Congress 2024, Helsinki, Finland, 10-14 Jun. 2024
- Future Earth Assembly 2024, Helsinki, Finland, 12-13 Jun. 2024

## IV.b. Communications

Website: <http://www.solas-int.org/>

**Newsletter:** 12 SOLAS newsletters have been sent to over 1200 SOLAS scientists since the last SCOR report. The monthly newsletter releases compile scientific highlights, news from SOLAS, opportunities for meetings, abstract submission deadlines, recent publications, vacancies, and news from relevant partner projects and collaborators. Past issues can be viewed on the SOLAS website: <https://www.solas-int.org/news/newsletter-archive.html>

**Event Report series:** Reports on SOLAS sponsored or co-sponsored events are published after each SOLAS-sponsored event. These reports are sent to the SOLAS sponsors and other interested parties and are released in combination with the monthly newsletters.

<https://www.solas-int.org/publications/event-reports.html>

The following reports were published since the last reporting:

- [Issue 31](#): BEPSII Sea-Ice School 2022, Cambridge Bay, Canada, 14-23 May 2022.
- [Issue 32](#): BEPSII General Meeting 2023, La Jolla, USA and online, 12-14 Mar. 2023.
- [Issue 33](#): 9<sup>th</sup> SOLAS Summer School, Mindelo, Cabo Verde, 5-16 Jun. 2023.
- [Issue 34](#): 3<sup>rd</sup> CATCH Open Science Workshop, online, 9-13 May 2022..
- [Issue 35](#): FLARE workshop: Fire science Learning Across the Earth system, Bermuda, UK and online, 18-21 Sep. 2023.
- [Issue 36](#): International GOOD-OARS-CLAP-COPAS Summer School, Coquimbo, Chile, 6-12 Nov. 2023.

- [Issue 37](#): Eddy Covariance (EC) Air/sea Gas Flux Best Practice Workshop, London, UK, 28-30 Mar. 2023.

**X (Twitter)**: Regular posts (currently 2116) and the number of followers is steadily increasing (currently 1814). [@SOLAS\\_IPO](#)

**YouTube**: SOLAS YouTube channel (152 subscribers) includes videos of the seminar series (8 videos, 2092 views in total), the 2022 virtual summer school (5 videos, 389 views in total), and workshops (4 videos, 1136 views in total). <https://www.youtube.com/channel/UCXrW8qhTFH54mgWoVJ0h2Og>

**Flickr**: SOLAS public photo stream shows pictures (currently 115) of the most recent SOLAS events and SOLAS related research.

**Summer School alumni survey**: A survey for summer school alumni was organised during the mid-term review process. The results will be included in a manuscript to be submitted to The Oceanography Society (TOS) special issue of the open access journal Oceanography on "A Vision for Capacity Sharing in the Ocean Sciences."

**Outreach**: SOLAS figures, conceptual diagrams, 3-fold SOLAS flyer, and logos are available for download from the SOLAS website. <https://www.solas-int.org/publications/downloads.html>

**Presentation**: A SOLAS presentation is available upon request from the IPO.

#### IV.c. Publications

Key integrative SOLAS publications from 2023 to 2024 can be found on the SOLAS website: <https://www.solas-int.org/publications/publications.html>

#### IV.d. National and regional networks / regional panel

Currently SOLAS has 33 scientific National and Regional Networks coordinated by 37 Representatives and one Regional Panel. The representatives are listed on a separate website at <https://www.solas-int.org/index/networks.html>, which includes their profile pictures, affiliations, website links, and information on expertise. The annual reports are now under "Publications" at <https://www.solas-int.org/publications/national-regional-reports.html>.

The representatives report annually on SOLAS-related activities. The information contained in the reports is a valuable source of information for the IPO to report to sponsors and to facilitate coordination and dissemination of results and progress from national projects to the rest of the SOLAS community. Information provided through the reports is also used by the Scientific Steering Committee to develop the implementation strategy.

Since the last annual report, SOLAS recruited new representatives for Canada, Germany, France and Peru. SOLAS is also working on the establishment of regional networks in Latin America. We put effort in getting the representatives more engaged in SOLAS, e.g., recruiting them to the Implementation Teams and soliciting them to organise the SOLAS seminars. A representative's dinner was organised at the 2019 and 2022 OSCs and will be organised again at the OSC2024.

#### Current networks:

- Australia: Andrew Bowie and Ruhi Humphries
- Belgium: Nathalie Gypens
- Brazil: Raquel Oliveira

- Canada: Rachel Chang *\*new rep\**
- Chile: Alexander Galán Mejía
- China (Beijing): Huiwang Gao
- China (Taipei): Hon-Kit Lui
- Denmark: Carolin Löscher
- Finland: Heidi Pettersson *\*new rep\**
- France: Marie Boye and Karine Sellegri *\*new reps\**
- Germany: Leonie Esters and Manuela van Pinxteren *\*new reps\**
- Greece: Alexandra Gogou
- India: Sheryl Oliveira Fernandes
- Israel: Yoav Lehahn
- Ireland: Peter Croot
- Italy: Luisa Galgani
- Japan: Yuzo Miyazaki
- Korea: Kitack Lee
- Mexico: Jose Martin Hernandez Ayon
- Netherlands: Jan-Berend Stuut
- New Zealand: Holly Winton
- Norway: Siv Lauvset
- Peru: Maricarmen Igarza *\*new rep\**
- Poland: Timon Zielinski
- Portugal: Catarina Guerreiro
- South Africa: Brett Kuyper
- South East Asia Regional Panel: Co-Chairs Mohd Talib Latif & Iskhaq Iskandar
- Spain: Jordi Dachs
- Sweden: Paul Zieger
- Turkey: Baris Saglihoglu, Mustafa Koçak, Nazli Olgun
- United Arab Emirates: Diana Francis
- UK: Philippa Rickard
- USA: Rachel Stanley

#### IV.e. Current endorsed projects and time series – ongoing

- Apr. 2024: Tracing of ship plumes and impact to seawater (PlumeBaSe)
- Apr. 2024: Ocean Alkalinity Enhancement Pelagic Impact Intercomparison Project ([OAEPIIP](#))
- May 2023: Ocean Observatories Initiative ([OOI](#))
- Jul. 2022: Biogeochemical processes and Air–sea exchange in the Sea-Surface microlayer ([BASS](#))
- Apr. 2022: Carbon Storage in German Coastal Seas - Stability, Vulnerability and Perspectives for Manageability ([CARBOSTORE](#))
- Sep. 2021: [Marine Carbon Sink](#) - Quantifying and Predicting Canada's Marine Carbon Sink ,
- Jun. 2021: Climate Relevant interactions and feedbacks: the key role of sea ice and Snow in the polar and global climate system ([CRiceS](#))
- Apr. 2021: Breathing Oceans: understanding the organic skin that modulates the exchange of greenhouse gases between the atmosphere and the ocean ([BOOGIE](#))

- Nov. 2020: Global shipping: Linking policy and economics to biogeochemical cycling and air-sea interaction ([ShipTRASE](#))
- Jul. 2020: Penlee Point Atmospheric Observatory ([PPAO](#))
- Jul. 2020: [Boknis Eck](#) Time-Series Station
- Dec. 2019: Are marine microorganisms influencing clouds? ([Sea2Cloud](#))
- Nov. 2019: Atmospheric Composition and Radiative forcing changes due to UN International Ship Emissions regulations ([ACRUISE](#))
- Oct. 2019: Atlantic Meridional Transect Ocean Flux from Satellite Campaign ([AMT4oceanSatFlux](#))
- Jun. 2016: [Tudor Hill](#) Marine-Atmospheric Observatory
- Apr. 2007: Surface Ocean CO<sub>2</sub> Atlas ([SOCAT](#))

Information on all endorsements (also completed ones) and the formal application processes is available on the [SOLAS website](#).

#### IV.f. SOLAS master programme

The SOLAS structured research Master programme on [Ocean, Atmosphere and Climate](#) in collaboration with the University of Galway started in its 1<sup>st</sup> round in Sep. 2022. Peter Croot (SOLAS National Representative of Ireland) is the programme director position, while Jurgita Ovadnevaite (SOLAS SSC member) is the programme coordinator.

#### IV.g. Income and expenses for the past year and budget for the coming year Including funding from all sources

- NSF/SCOR funding
  - NSF fund via SCOR 9.1k USD for SOLAS activities
  - Leftover of Esther Rickert's project officer salary 54.3k USD, transferred to general SOALS activities pot
  - The next NSF grant is expected to start in Jan. 2025
- MEL
  - Executive Director and Project Officer salaries, office space and in kind provided by MEL until Dec. 2025.
  - Funds for scoping workshop and OSC/SSC 2024, 50.5k USD
- Future Earth
  - Annual block grant of 10k EUR in 2021, 5k EUR in 2022, 6k EUR in 2023, and 6k EUR in 2024 without strings attached.
- WCRP
  - Provides funding for the travel of the WCRP representative on the SSC (Lisan Yu) to attend the SOLAS SSC meeting.
- iCACGP
  - Facilitate SOLAS funding applications to IAMAS/IUGG for event organisation, e.g., OSC and SSS

Income, expenses and budget for Jun. 2023 until Dec. 2024:

<b>FROM Jun 2023 (in USD)</b>			
<b>INCOME</b>		<b>Credit</b>	<b>Debit</b>
	Funds from MEL for salary	55,100	
	NSF fund via SCOR	9,100	
	NSF fund via SCOR leftover from project officer salary	54,300	
	Miscellaneous funds held by SCOR	7,400	
	MEL fund for scoping workshop	31,300	
	Future Earth block grant 2024	6,500	
	Future Earth block grant 2023	6,700	
	Future Earth block grant 2022	5,400	
	Future Earth block grant 2021	10,800	
	OCB fund for summer school	800	
	IUGG fund for SOLAS OSC2024	5,000	
	Elementa fund for OSC2024	1,700	
	PICES fund for OSC 2024	4,400	
	SCOR capacity building fund for OSC2024	8,000	
	MEL fund for OSC/SSC 2024	19,200	
	CRNS fund 2024	8,600	
<b>Total Income</b>		<b>234,300</b>	
<b>EXPENSE</b>		<b>Credit</b>	<b>Debit</b>
	<b>Salary</b>		55,100
	<b>Representational travel</b>		7,450
	<b>Event</b>		38,000
	Scoping workshop		38,000
	BEPSII support		5,200
	CATCH support		3,200
	IPY workshop		6,500
	SSC meeting 2024		40,000
	OSC2024 foreign keynote/early career support		36,400
	Science and Society workshop		6,500
	SOLAS France activities		8,600
	ECSC 2023/24 activities		5,700
	SIOA support		6,500
	IOC-R support		6,500
	<b>Publication</b>		150
	SOLAS website subscription 2023		150
	Mid-term special issue		1,950
<b>Total Expense</b>			<b>227,750</b>
<b>Balance</b>			<b>6,550</b>

Note:

This does not include the following items:

in kind from MEL with office space/computer/printing/administration etc.

OSC2024 income from registration fees/local sponsors and all the local expenses

## V. Update on the SSC, ECSC, and IPO

### V.a. Scientific Steering Committee

Christa Marandino (F, Germany) and William Miller (M, USA) were appointed as SOLAS SSC co-chairs in Jan. 2024, acting for a term of three years. The past SSC co-chairs Minhan Dai and Cécile Guieu stay on the SSC as ex officio members until the end of 2024.

SOLAS has an Executive Committee composed of Christa Marandino (F, Germany) and William Miller (M, USA), Maria Kanankidou (F, Greece), Anoop Mahajan (M, India), Jurgita Ovadnevaite (F, Ireland) and Nadja Steiner (F, Canada)

The following SSC members will rotate off at the end of 2024:

- Anoop Mahajan (M, India)
- Jurgita Ovadnevaite (F, Ireland)

The following members will finish their 1<sup>st</sup> terms at the end of 2024:

- Arvind Singh (M, India), expressed the willingness to rotate off after the 1<sup>st</sup> term,
- Thomas Bell (M, UK)

The current membership of the SOLAS SSC:

Last name	First name	Country of employment	Gender	Scientific expertise	SOLAS expertise	Term	End
Marandino	Christa	Germany	F	air-sea exchange, trace gases, eddy covariance	Co-chair, Theme 2, Indian Ocean, Science&Society	1	2026
Miller	William	USA	M	photochemistry, chemical cycles, ocean optics	Co-chair, Theme 3, Upwelling	1	2026
Bach	Lennart	Australia	M	marine C cycle, marine CO <sub>2</sub> removal, plankton ecology & physiology	Theme 1, Climate intervention	1	2025
Bell	Thomas	UK	M	air-sea chemistry & gas exchange; bgc cycles; modelling	Themes 1&2 ESA connection	1	2024
Harrould-Kolieb	Ellycia	Australia	F	ocean governance, ocean-climate nexus, science-policy interface	Science and Society	1	2026
Kanakidou	Maria	Greece	F	chemistry-climate modelling, bgc, air pollutants	Themes 4 and 5, iCACGP connection	2	2026
Kvale	Karin	New Zealand	F	ocean bgc, climate modelling, ecological microplastic impacts	Theme 1, 3 and 5	1	2026
Lachkar	Zouhair	UAE	M	marine biogeochemical modeling, oxygen minimum-zones,	Theme 1, Indian Ocean, Upwelling	1	2026

				coastal upwelling systems			
Llort	Joan	Spain	M	ocean bgc, aerosols, biological C pump	Theme 3, Chair of Early Career Scientist Committee	1	2025
Mahajan	Anoop	India	M	Atmospheric chemistry, halogens, climate modelling	Theme 5, Indian Ocean, Polar ocean	2	2024
Montes	Ivonne	Peru	F	ocean dynamics & modelling, upwelling system, climate change	Upwelling	1	2026
Nomura	Daiki	Japan	M	biogeochemical cycles, sea ice, polar oceans	Theme 1, Polar ocean	1	2026
Ovadnevaite	Jurgita	Ireland	F	aerosol chemistry, physics and cloud processes	Themes 4 and 5	2	2024
Raspotnik	Andreas	Norway	M	Arctic policies, blue Arctic economy, Arctic geopolitics & security	Science and Society	1	2025
Singh	Arvind	India	M	C, N, P bgc cycles, stable isotope tracers	Theme 1, Indian Ocean, Upwelling	1	2024
Steiner	Nadja	Canada	F	Bgc of trace gases	Theme 5, Polar Ocean BEPSII liaison	1	2025
Yu	Lisan	USA	F	Air-sea physical interaction, Remote Sensing	Theme 2, Indian Ocean, WCRP rep	1	2025

The current gender and country balance of the SSC for 2 co-chairs and 15 members:

- 8 female members and 9 male members
- 3 members from developing countries and 14 from developed countries

### V.b. Early Career Scientist Committee

In Jan. 2023, the SOLAS Early Career Scientist Committee (ECSC) was launched and Joan Llort was appointed as the 1<sup>st</sup> chair of the committee, based on the decisions of 22<sup>nd</sup> and 23<sup>rd</sup> SSC meetings.

The following ECSC members rotated off in 2023/2024:

- Andrea Baccharini (M, Switzerland)
- Patrick Duke (M, Canada)

The ECSC decided to expand the ECSC to achieve a better geographic coverage and bring more expertise. A call for new members was released in Mar. 2024 and the below five new members were appointed.

- Abbie Allela (F, Kenya)
- Yuanxu Dong (M, Germany)
- Sarkawt Lateef (M, Iraq)
- Precious Mongwe (M, South Africa)
- Garima Shukla (F, India)

The current membership of the SOLAS ECSC:

<b>Last name</b>	<b>First name</b>	<b>Country of employment</b>	<b>Gender</b>	<b>Scientific expertise</b>
Llort	Joan	Spain	M	ocean bgc, aerosols, biological carbon pump
Allela	Abbie	Kenya	F	marine spatial planning, ocean governance, marine ecology
Dinasquet	Julie	USA	F	microbial VOC cycling, bioaerosol, atmospheric deposition
Dong	Yuanxu	Germany	M	air-sea gas exchange, ocean CO <sub>2</sub> uptake, eddy covariance
Galgani	Luisa	Italy	F	ocean bgc, sea-surface microlayer, marine gels & microplastics
Hamilton	Douglas	USA	M	Earth system modelling, natural aerosols, wildfires
Jaars	Kerneels	South Africa	M	atmospheric chemistry, atmosphere/biosphere interaction, atmospheric deposition
Kurisu	Minako	Japan	F	atmospheric chemistry, ocean chemistry, trace metals
Kvale	Karin	New Zealand	F	ocean bgc, climate modelling, ecological microplastic impacts
Lateef	Sarkawt	Iraq	M	atmospheric chemistry and air pollution, aerosols and gases
Leyba	Inés	Argentina	F	air-sea interaction, sea surface temperature, South Atlantic
Marshall	Tanya	USA	F	ocean bgc, nitrogen cycling and fluxes
Mongwe	Precious	South Africa	M	ocean carbon cycle, marine biogeochemistry, and marine ecosystems
Oliveira	Raquel	Brazil	F	ocean bgc, air-sea CO <sub>2</sub> fluxes, remote sensing
Perron	Morgane	France	F	atmospheric bgc, trace metals, Southern Hemisphere
Shukla	Garima	India	F	aerosols, reanalysis data, ocean biogeochemistry



Tham	Yee Jun	China	M	atmospheric chemistry, halogen cycling, chemistry in air-sea gas exchange
Tinel	Liselotte	France	F	volatile organic compounds, surface microlayer, iodine
Xue	Lei	USA	M	marine photochemistry, marine organosulfur and carbon cycle, sea spray aerosols

The current gender and country balance of the ECS Committee for 1 chair and 18 members:

- 11 female members and 8 male members
- 8 members from developing countries and 12 from developed countries

### V.c. International Project Office

#### State Key Laboratory for Marine Environmental Science (MEL) in Xiamen, China

The State Key Laboratory of Marine Environmental Science (MEL), Xiamen University hosts the SOLAS IPO-China and the Executive Director, Li Li until Dec. 2025 with possible renewal. The former project officer, Chengcheng Gao left the position on 15<sup>th</sup> Aug. 2023. Yan Yang took over the responsibilities since Sep. 2023. Yan Yang is working 50% for SOLAS and 50% for GOA-ON.

#### GEOMAR in Kiel, Germany

The SOLAS IPO was hosted at the GEOMAR Helmholtz Centre for Ocean Research Kiel in Kiel, Germany until Aug. 2021. The US-NSF via SCOR annual grant allowed maintaining the project officer position at GEOMAR on a half-time basis until May 2023. Esther Rickert left the SOLAS project officer position at GEOMAR on 30<sup>th</sup> Apr. 2023, which means that there is no SOLAS IPO representation at GEOMAR anymore.

#### University of Galway, Ireland

From Jan. 2022, the University of Galway, Ireland, hosts the IPO-Ireland and the co-executive director for 5 years with the possibility of an extension. The hosting agreement is connected to running a 1-year international SOLAS structured research MSc program on Ocean, Atmosphere and Climate (code [MSC-OAC](#)). Jessica Gier left the SOLAS IPO co-executive director position on 30<sup>th</sup> Jun. 2023. Discussions on keeping the SOLAS IPO-Ireland by advertising an administrative project officer/ MSc coordinator position and developing a MSc programme board are still on-going.