

Report for the year 2022 and future activities

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This report has two parts:

- **Part 1:** reporting of activities in the period of January 2022 - Jan/Feb 2023
- **Part 2:** reporting on planned activities for 2023 and 2024.

The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan. As much as possible, please indicate the specific SOLAS 2015-2025 Science Plan Themes addressed by each activity or specify an overlap between Themes or Cross-Cutting Themes.

- 1 Greenhouse gases and the oceans;
 - 2 Air-sea interfaces and fluxes of mass and energy;
 - 3 Atmospheric deposition and ocean biogeochemistry;
 - 4 Interconnections between aerosols, clouds, and marine ecosystems;
 - 5 Ocean biogeochemical control on atmospheric chemistry;
- Integrated studies of high sensitivity systems;
Environmental impacts of geoengineering;
Science and society.

IMPORTANT: *This report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups, cities).*

First things first...Please tell us what the IPO may do to help you in your current and future SOLAS activities. ?

PART 1 - Activities from January 2022 to Jan/Feb 2023

1. Scientific highlight

Call for global strategy to monitor effect of airborne plastic pollution on oceans

Highlight

An international working group, supported by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection ([GESAMP](#)) and the [World Meteorological Organisation](#), brought 33 international experts in atmospheric, oceanography and plastic pollution to synthesise

the growing evidence of the scale of global plastic pollution and particularly the role of atmospheric transport and quantify trends in the plastic cycle. The international working group called for the creation of a global observation network to address this plastic pollution challenge.

Summary

Plastic particles have now been detected in all investigated spheres of the environment including in water bodies, the soil and air, and it's estimated that by 2040 plastic pollution could reach 80 million metric tons per year. The GESAMP working group assessed the current state of knowledge and estimated that potentially up to 25 million metric tons of micro and nano plastic per year are transported via the atmosphere to the ocean and this flux may include a substantial amount of plastic recycled to the atmosphere from the ocean. Global research into plastic pollution has highlighted that the wind can carry the particles to some of the most remote corners of the earth even faster than transport by ocean currents or rivers. The review findings identify the need for a global monitoring/observation network to track the trends, transport and impact of these tiny plastic particles. Allen et al. 2022 propose a strategy to not only quantify of the ocean-atmosphere micro and nano plastic flux, and therefore the influence on ecosystem and human health, but also to help identify more effective prevention and/or management of plastic pollution. This perspective forms part of the growing narrative on micro and nano particle pollution in remote area and its health impacts, such as the impact of plastic pollution in the Arctic (Bergmann et al, 2022), micro and nano plastic uptake into human blood (Leslie et al. 2022) and the finding of micro(nano)plastic in human lungs (Jenner et al. 2022).

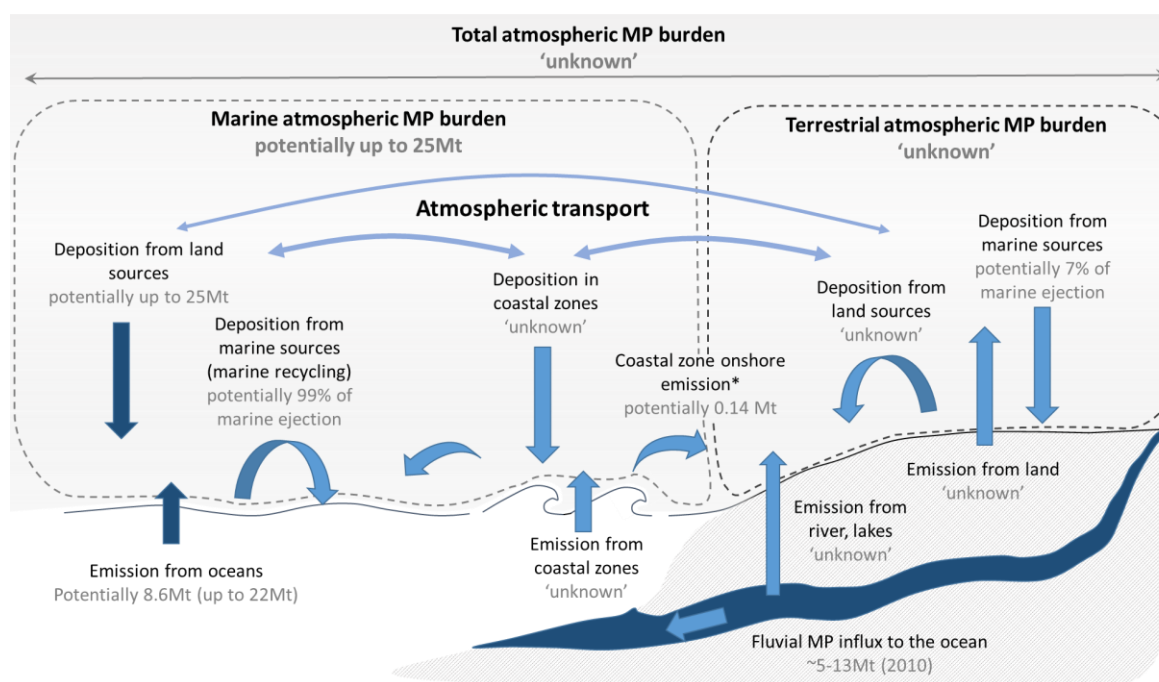


Figure 1. Atmospheric transport, potential flux and burdens of micro and nano plastics to and from the marine environment (Allen et al. 2022). Review of current best knowledge highlights the need for further quantification and long term, global observations to advance this preliminary mass balance and flux of micro and nano plastic movement.

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Jenner, L.C., Rotchell, J.M., Bennett, R.T., Cowen, M., Tentzeris, V., Sadofsky, L.R. (2022) Detection of microplastics in human lung tissue using μ FTIR spectroscopy, *Science of the Total Environment*, 831, 154907, <https://doi.org/10.1016/j.scitotenv.2022.154907>

2. Activities/main accomplishments in 2022 (e.g., projects; field campaigns; workshops and conferences; model and data intercomparisons; capacity building; international collaborations; contributions to int. assessments such as IPCC; collaborations with social sciences, humanities, medicine, economics and/or arts; interactions with policy makers, companies, and/or journalists and media).

Capacity building:

Helen Czerski (University College London) has spearheaded UK air-sea gas transfer community capacity building. This includes a database of community equipment, facilities and expertise available for collaboration (open for additions: email details to [Philippa Rickard](#)), and a mini seminar series, the first of which was held on 19th April 2023 (Jamie Shutler, University of Exeter: What we can do to decarbonise our research and to reduce other environmental impacts that come from our own work). The second is to be held on 14th June 2023, with the focus on carbon dioxide removal. The [mailing list](#) is open to the academic UK air-sea gas transfer community to join, and the community has a [homepage](#) with information on past, present and planned activity.

Collaborations:

Ryan Pereira has been hosted by the Hanse-WissenschaftsKolleg on a fellowship working with the ICBM at Oldenburg University and the AWI, Bremerhaven, hosted by Profs. Dittmar, Wurl, Mollenhauer and Koch.

Mingxi Yang (Plymouth Marine Laboratory) has been involved with studies that:

- Produced a revision on the impact of cool skin on global air-sea CO₂ flux (see citation [11](#))
- Quantified DMS and VOC cycling near sea ice in the Arctic (see citation [45](#))
- Synthesized shipboard eddy covariance studies of CO₂ transfer velocity (see citation [47](#))

Conferences:

The 8th International Symposium on Gas Transfer at Water Surfaces ([GTWS](#)) was held at Plymouth Marine Laboratory (and online) on 17th – 20th May 2022, with nearly 100 participants (approx. 75% in-person, 25% online); the SOLAS event report is available [here](#).

The Challenger Society Conference 2022 was held on 6th – 8th September 2022, hosted by the Natural History Museum and Imperial College, London on behalf of the Challenger Society for Marine Science. This marked the 150th anniversary of the Challenger expedition and celebrated the birth of international and interdisciplinary oceanography.

Fieldwork:

Alex Baker participated in the RV *Polarstern* cruise PS132 (Bremerhaven to Cape Town, September 2022), aerosol and seawater sampling (NERC-funded [ThorMap project](#)).

Ryan Pereira's team (Heriot-Watt University) have undertaken field campaigns in the Cape Verde Islands in collaboration with the Cape Verde Atmospheric Observatory (CVAO) and the Ocean Science Centre Mindelo (OSCM), and to the Essequibo River, Guyana, as part of the ERC-funded [BOOGIE project](#).

Dwayne Heard (University of Leeds) has undertaken glyoxal measurements in the remote tropical Atlantic and compared the results with model outputs (see citation 40).

Projects:

Jamie Shutler (University of Exeter) has begun two new projects:

1. The EU Horizon Europe funded OceanICU (led by Norway)
2. The European Space Agency (ESA) Funded Ocean Health Ocean Acidification (lead by university of Exeter, partners with Plymouth Marine Lab, Ifremer, ETH-Zurich and Ocean Data Lab).

3. Top 5 publications in 2022 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

The following alphabetical list of SOLAS-relevant, peer-reviewed March 2022 – February 2023 publications (n = 47) with UK authors and/or co-authors is based on researchers' input. There has been no attempt to formally rank the "top 5" in terms of scientific quality or importance.

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4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2022? If yes, who? How did you engage?

PART 2 - Planned activities for 2023 and 2024

1. Planned major national and international field studies and collaborative laboratory and modelling studies (incl. all information possible, dates, locations, teams, work, etc.).

Fieldwork:

The 30th Atlantic Meridional Transect ([AMT30 – DY157](#)) took place over 21 February – 30 March 2023 on RRS *Discovery*, and sailed from the Falkland Islands to Southampton (UK) with international participants, led by Plymouth Marine Laboratory. Sampling activities included: carbon chemistry, microbial biodiversity, nutrient distribution, nitrogen fixation, optical properties, oxygen status, organic matter composition, air-sea gas exchange, atmospheric deposition, zooplankton diversity and particle export. NASA also joined the cruise to ‘sea-truth’ their satellite ocean colour sensors.

UK based scientists and technicians were:

- *Plymouth Marine Laboratory*: Andy Rees (Chief Scientist), Sarah Breimann, Ian Brown, Glen Tarran and Gavin Tilstone (ESA, [AMT4CO2Flux project](#)).
- *National Marine Facilities*: Tom Ballinger, Andy Cotmore and Nick Harker ([Scientific Engineering](#))
- *National Oceanography Centre*: Roseanna Wright ([BODC](#)); Will Major, Mojtaba Masoudi, Marika Takeuchi and Jack Williams (ERC, [ANTICS project](#)); Eloïse Savineau (*University of Southampton* affiliated).
- *Heriot-Watt University*: Philippa Rickard (ERC, [BOOGIE project](#)).
- *Scottish Association of Marine Science*: Adam Francis.
- *University of East Anglia*: Rachel Shelley (NERC, [ThorMap project](#)).
- *University of Exeter*: Kathryn Cook and Dan Mayor.

- *University of Liverpool*: Prima Anugerahanti.
- *University of Oxford*: Tzu Hao (David) Wang (NERC, [ThorMap project](#)).

Internationally based scientists were:

- *CICESE, Mexico*: Yéssica Vanessa Contreras Pacheco ([POGO Visiting Fellow](#)).
- *Michigan State University, USA*: Kirsten Fentzke.
- *NASA, USA*: Joaquin Chaves and Harrison Smith.
- *University of Athens, Greece*: John Gittings.
- *University of Lisbon, Portugal*: Federico Ienna and Andreia Tracana.
- *University of Pretoria, South Africa*: Mayibongwe Buthelezi.

Ian Brooks (University of Leeds) is participating in the 2023 Field Campaign (May-June) ARToFMELT (Atmospheric Rivers and The Onset of Sea-Ice Melt), which is an international research cruise on icebreaker *Oden*. Ian's participation is studying the impact of warm air intrusions on Arctic sea-ice during spring.

Ian Brooks (University of Leeds) and Helen Czerski (University College London) are planning to participate in the Bubble Exchange in the Labrador Sea expedition (BELS), on the RV *Maria S. Merian* (Nov/Dec 2023), with Christa Marandino (GEOMAR) as Chief Scientist. They will be at sea for five weeks as part of a large collaboration measuring gas exchange (both eddy covariance and tracer methods), meteorological and wave conditions, and the deep overturning and local physical oceanography. Our project will be to measure the small scale (1-10 metre) spatial variability of bubbles, gas saturation and water flow in the top few metres of the ocean in high wind conditions, to pick apart the mechanisms that transfer gas into the ocean and then carry it away from the atmosphere. The task of the overall project is to better understand oxygen and CO₂ uptake by the ocean and their spatial distribution and movement after that.

Ryan Pereira, Philippa Rickard and Sevda Norouzi Alibabalou (Heriot-Watt University) plan to undertake fieldwork in the Cape Verde Islands (September 2023) at the Ocean Science Centre Mindelo (OSCM); in collaboration with the Cape Verde Atmospheric Observatory (CVAO) and OSCM. This is to kick off a two-year (2023-2025) project, with year-round technical support based at the OSCM, exploring temporal variability organic matter composition in the surface microlayer and subsurface water, and the subsequent control on air-sea gas transfer.

2. Events like conferences, workshops, meetings, summer schools, capacity building etc. (incl. all information possible).

Capacity building and seminar series:

Mobilisation of the UK air-sea gas transfer community, led by Helen Czerski (University College London), is ongoing:

- Active call for additions to the database of community equipment, facilities and expertise available for collaborations (email details to [Philippa Rickard](#)).
- Virtual mini seminar series, with seminar Chair rotated within the community. The next seminar is to be held on 14th June 2023, with the focus on carbon dioxide removal.
- The [mailing list](#) is open to the academic UK air-sea gas transfer community to join.
- Community [homepage](#) with information on past, present and planned activity.

3. Funded national and international projects/activities underway.

Ryan Pereira (Heriot-Watt University) is continuing his Hanse-Wissenschaftskolleg Fellowship (October 2022-January 2023 and June-August 2023), and Philippa Rickard (Heriot-Watt University) is joining as a Twin Fellow in June and August 2023.

Mingxi Yang (Plymouth Marine Laboratory) has deployed a state-of-the-art buoy to measure air-sea fluxes (so far momentum and heat) using the eddy covariance technique (ongoing since Jul 2022).

4. Plans / ideas for future national or international projects, programmes, proposals, etc. (please indicate the funding agencies and potential submission dates).

5. Engagements with other international projects, organisations, programmes, etc.

Jamie Shutler (University of Exeter) is continuing to contribute to, and act as a lead author, for the Intergovernmental Oceanographic Commission (IOC) and United Nations Education Scientific and Cultural Organisation (UNESCO) organised Integrated Ocean Carbon Research (IOC-R) programme.

Comments