surface ocean solas lower atmosphere study

Report for the year 2024 and future activities

SOLAS *France*

compiled by: Karine Sellegri, Marie Boye

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 2024 to Feb/Mar 2025

1. Scientific highlight

*Describe one scientific highlight with a title, text (**max. 300 words**), a figure with legend and full references. Please focus on a result that would not have happened without SOLAS, and we are most interested in results of international collaborations. (If you wish to include more than one highlight, feel free to do so).*

Highlight 1 (Core Theme 1): Global ocean carbon uptake enhanced by rainfall

Among the processes involved in exchanges of energy and mass between the atmosphere and the ocean, the impact of precipitation on the global CO2flux has never been comprehensively quantified. Precipitation can indeed alter the properties of the ocean surface and impact the carbon exchange in three ways: (i) Precipitation increases the momentum transfer to the ocean and generate turbulence that enhances the renewal of interfacial water (First column, “Turbulence”, in Fig. 1). This tends to increase both in- and out-gassing and the impact of this effect alone is weak because wind dominates turbulence generation in the ocean; (ii) Rain dilutes and cools the near surface waters, which perturbs chemical equilibria and leads the ocean to absorb more CO_2 (Second column, “Dilution”, in Fig. 1). The result of dilution and turbulence effects of rain, which is named “Interfacial”, is a clear increase in global CO2 sink (Third column in Fig. 1); and (iii) Raindrops directly inject in the ocean CO2 molecules that they absorb during their fall through the atmosphere (Fourth column, “Wet deposition”, in Fig. 1). Using two precipitation datasets (the satellite-derived product IMERG and the ERA5 reanalysis) and two diagnostics of the rain-induced dilution, Parc et al. (2024) shows that rain increases the ocean carbon sink by 140 to 190 million tonnes of carbon per year, equivalent to 5% to 7% of the 2.66 billion tonnes of carbon absorbed annually by the oceans. Because Rainfall amounts and patterns will change in the future, impacting the ocean carbon sink, these results call for explicitly including rain effects in the annual global carbon budget estimates.

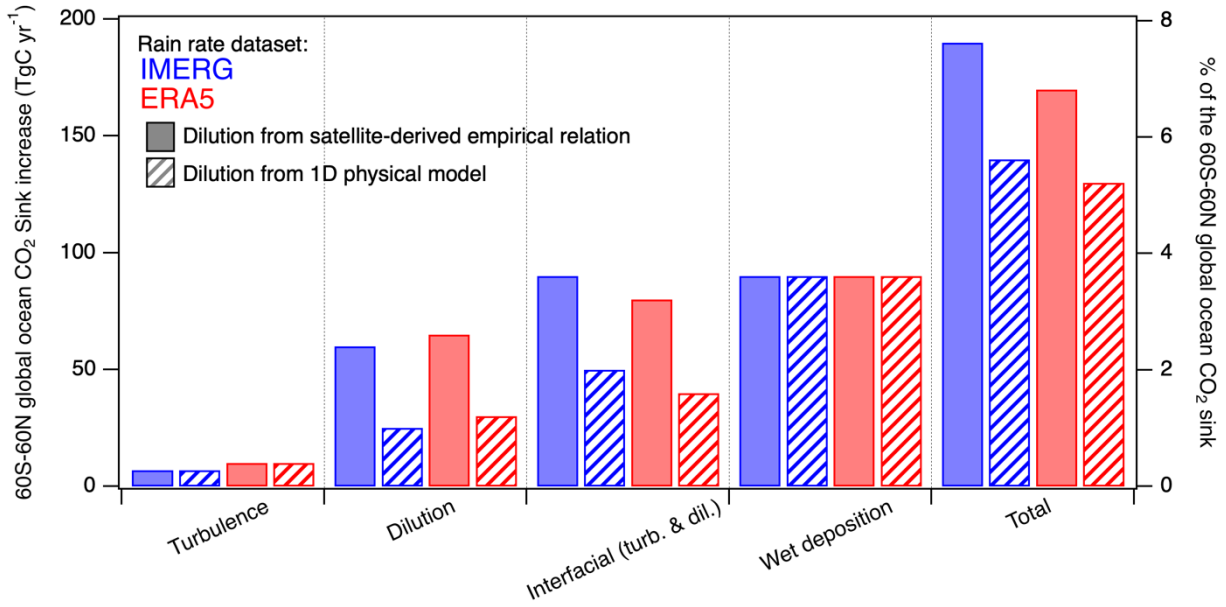

Figure: Histograms of 2008-2018 global ocean (60°S-60°N) CO2 sink increase due to rain-induced turbulence only, rain-induced dilution only, the resultant of turbulence and dilution (named the interfacial effect), the wet deposition of CO2 absorbed during the raindrops fall and the total (interfacial plus wet deposition) using 1-h rain rates from IMERG (blue) and ERA5 (red). The rain-induced dilution is diagnosed from a satellite-derived empirical relationship (full) or a 1D physical model (stripes). Figure based on Table 1 of Parc et al. (2024).

Citation: Parc, L., H. Bellenger, L. Bopp, X. Perrot, D. T. Ho : Global ocean carbon uptake enhanced by rainfall. *Nat. Geosci.* **17**, 851–857 (2024). https://doi.org/10.1038/s41561-024-01517-y

Highlight 2 (Core Theme 3): The potential of organic phosphorus substrates present in dust as airborne microorganisms to impact the biogeochemistry of oligotrophic environments via atmospheric deposition

Phosphorus is a critical nutrient affecting primary productivity across all ecosystems. Many regions worldwide are limited or co-limited by phosphorus availability, which can be alleviated through atmospheric deposition. Dust is known to be a key external source of phosphorus in ecosystems, assumed to be in the form of various insoluble inorganic minerals. We show that this view is largely incomplete and here we present conclusive evidence, that organic phosphorus as diesters, primarily associated with biological materials. Phosphate diesters significantly correlated with soil bacteria found in dust, implying a direct link with microbial soil communities, without excluding the eukaryotic cells. Phosphate diesters in dust, along with abundant alkaline phosphatase, may contribute 70% to daily primary productivity in the eastern Mediterranean, highlighting the potential of organic phosphorus substrates present in dust as airborne microorganisms to impact the biogeochemistry of oligotrophic environments via atmospheric deposition.

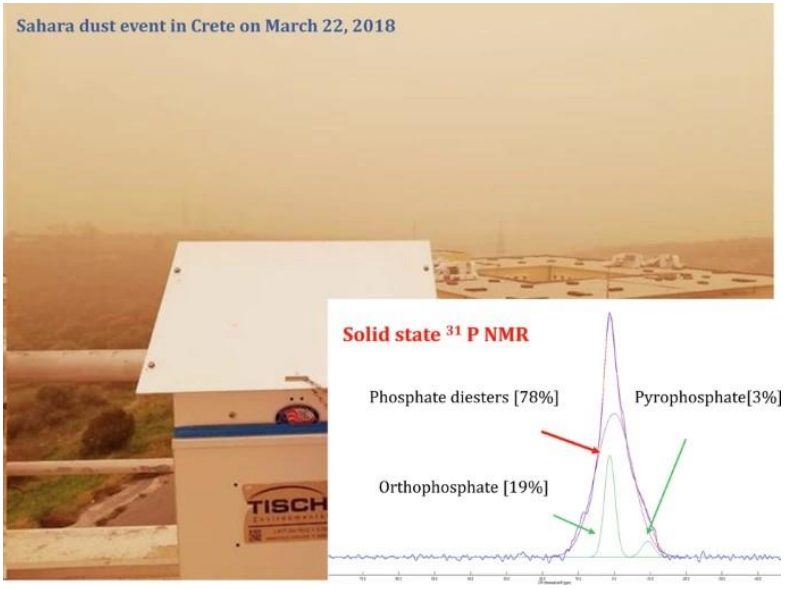

Figure: ^{31}P NMR spectra (blue line) of a dust sample (Dust- 98) and the dmfit Monte Carlo simulation (red line). Note that the blue line of ^{31}P NMR spectrum of the sample is overlaid by red line of the Monte Carlo simulation. Signal deconvolution revealed the presence of three functional P groups namely: orthophosphate (green line). P-diesters (violet line) and pyrophosphate (dash line)

Citation: Violaki, K., Panagiotopoulos, C., Avalos, C.E. et al. Solid-state 31P NMR reveals the biological organophosphorus compounds as the dominant phosphorus species in Saharan dust aerosols. Commun Earth Environ 6, 225 (2025). https://doi.org/10.1038/s43247-025-02164-w

Highlight 3 (Core Theme 3): Fractional solubility of iron in mineral dust aerosols over coastal Namibia: a link to marine biogenic emissions?

Mineral dust plays a key role in transporting nutrients and metals to terrestrial and marine ecosystems, particularly iron, which is essential for oceanic primary productivity. While most research has focused on the Northern Hemisphere (e.g., the Sahara and Gobi deserts), dust emissions from the Southern Hemisphere, especially from Namibia, remain underexplored. Moreover, the unique conditions of the Namibian coast, influenced by the Benguela Upwelling System, create an environment of intense phytoplankton activity, which plays a key role in biogeochemical cycles and atmospheric interactions in the region. Understanding the contribution of the mixed of aerosols to iron enrichment in nearby oceans is crucial for refining climate and ecosystem models in this area. Between May and December 2017, aerosol samples were collected at the Henties Bay Aerosol Observatory (HBAO) on Namibia's coast. Chemical analyses and atmospheric transport models identified the main dust sources in the northern and southern gravel plains, while coastal riverbeds—often thought to be significant contributors of soluble iron—appeared to have little impact. On average, iron accounted for 5.8% of the total dust mass, with an aqueous solubility of 6.9%, making it a potentially important source of bioavailable iron for marine life. The study highlights a link between iron solubility, solar irradiance and marine biogenic emissions, through the oxidation of dimethyl sulfide (DMS) into methane sulfonic acid (MSA). The promotion of iron dissolution happens through the photo-reduction dissolution of Fe(III) by MSA condensation on Fe-bearing dust. This possible mechanism could increase the iron solubility in mineral dust, maybe also initiating a feedback loop whereby the input of dust of increased solubility would result in stronger marine biogenic emissions to the atmosphere. The study provides new insights into the mechanisms controlling iron solubility in Namibian dust, revealing the interplay between the input of atmospheric iron from transported dust and the marine biogenic emissions from the Benguela oceanic upwelling system.

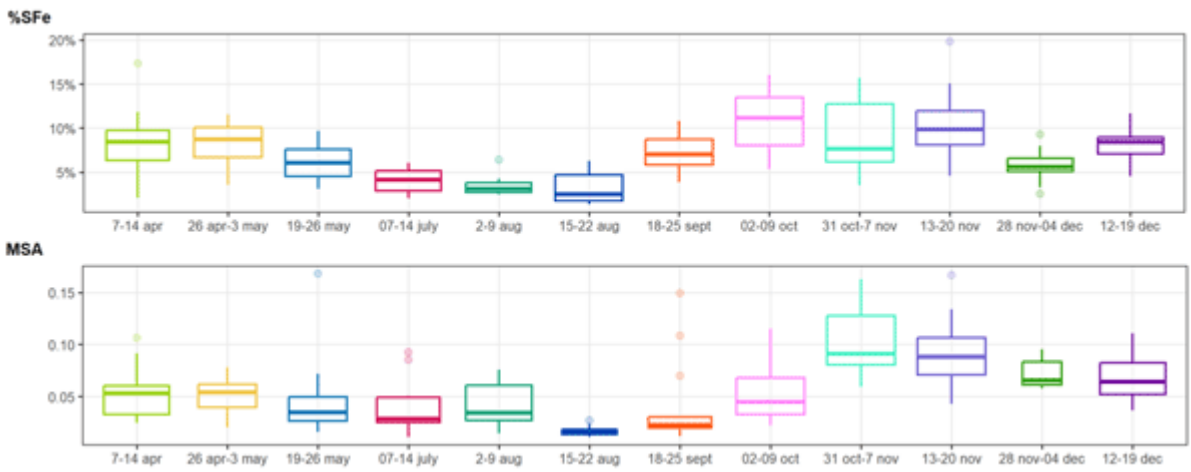

Figure: Box-plots of the averages of %SFe and MSA concentrations (µg m-3) for the sampling periods including all the samples (dust + background).

Citation: Desboeufs, K., Formenti, P., et al.: Fractional solubility of iron in mineral dust aerosols over coastal Namibia: a link to marine biogenic emissions?, Atmos. Chem. Phys., 24, 1525–1541, https://doi.org/10.5194/acp-24-1525-2024, 2024.

Highlight 4 (Core Theme 4): Modeling the contribution of leads to sea spray aerosol in the high Arctic

Elongated open-water areas in sea ice (leads) release sea spray particles to the atmosphere. However, there is limited knowledge on the amount, properties and drivers of sea spray emitted from leads, and no existing parameterization of this process is available for use in models. In this work, we use measurements of aerosol fluxes from Nilsson et al. (2001) to produce an estimate of the location, timing and amount of sea spray emissions from leads at the scale of the Arctic Ocean for 1 year. Lead fractions are derived using sea ice data sets from numerical models and satellite detection. The proposed parameterization estimates that leads account for 0.3 %–9.8 % of the annual sea salt aerosol number emissions in the Arctic Ocean regions where sea ice concentration is greater than 80 %. Assuming similar size distributions to those from emissions from the open ocean, leads account for 30 %–85 % of mass emissions in sea ice regions. The total annual mass of sea salt emitted from leads, 0.1–2.1 Tg yr^{-1}, is comparable to the mass of sea salt aerosol transported above sea ice from the open ocean, according to the MERRA-2 reanalysis. In addition to providing the first estimates of possible upper and lower bounds of sea spray emissions from leads, the conceptual model developed in this work is implemented and tested in the regional atmospheric chemistry model WRF-Chem. Given the estimates obtained in this work, the impact of sea spray from leads on Arctic clouds and radiative budget needs to be further explored.

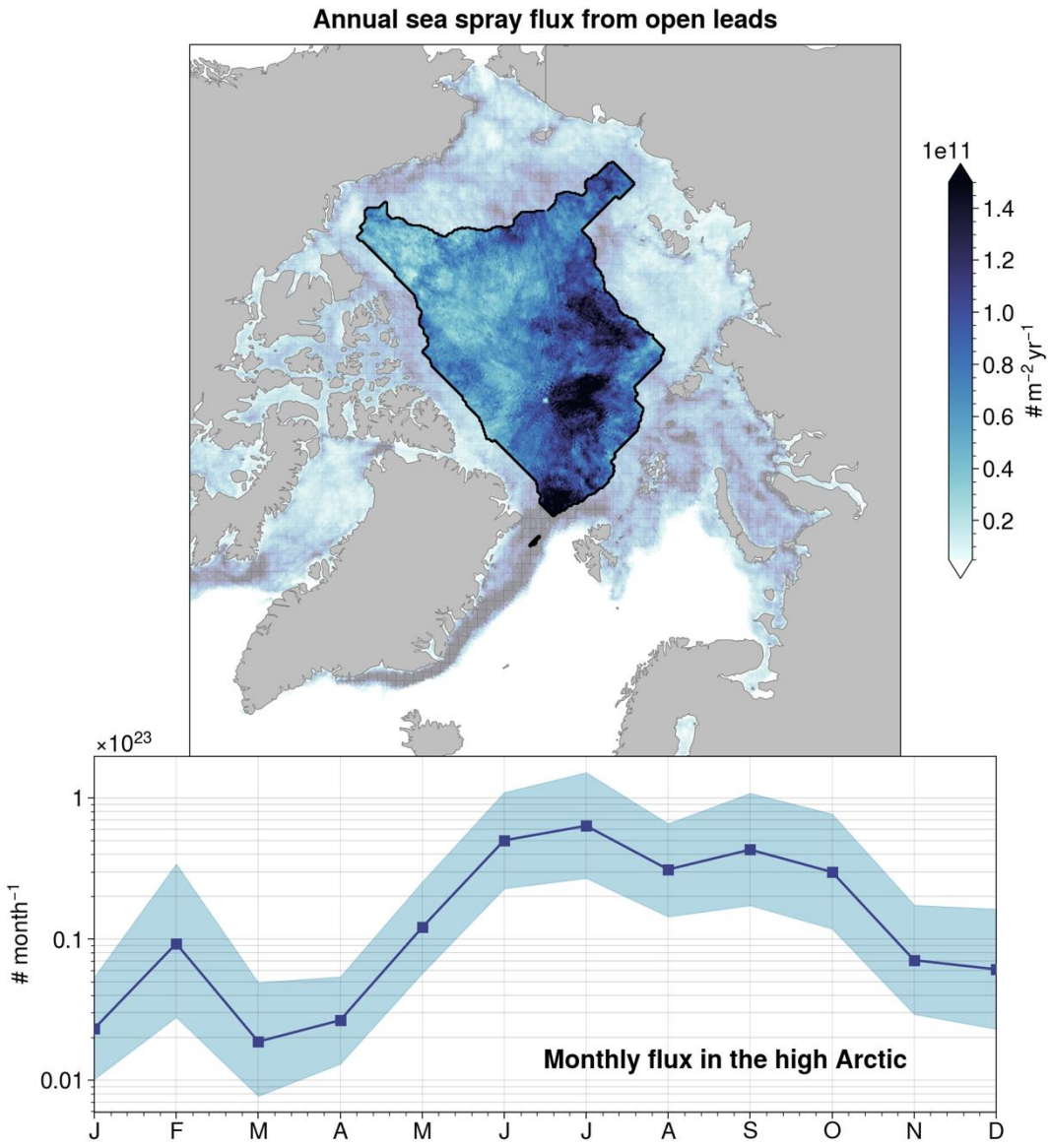

Figure: Modelled annual mean (top) and seasonal cycle (bottom) of the number of sea spray particles emitted from sea-ice leads in the high Arctic, for the year 2018. Shades in the bottom panel indicate the range of possible values depending on parameterization choices.

Citation: Lapere, R., Marelle, L., Rampal, P., Brodeau, L., Melsheimer, C., Spreen, G., and Thomas, J. L.: Modeling the contribution of leads to sea spray aerosol in the high Arctic, Atmos. Chem. Phys., 24, 12107–12132, https://doi.org/10.5194/acp-24-12107-2024, 2024.

2. Activities/main accomplishments in 2024 (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).

- **SOPHYAC cruise (Core Theme 4 and 5)**

Ship campaign on board the *R.V. Marion Dufresne* during December 2024-February 2025 to the Terres Australes et Antarctiques Francaises (TAAF) and beyond, from La Réunion. The main objective was to investigate the impact of UV light on marine microorganisms in the subtropics and Southern Ocean, and the subsequent release of VOCs and precursor gases to nucleation in the marine atmosphere, using deck-

born large enclosures of the air-sea interface. Involved LaMP, IPGP, LEMAR, LOCEAN, MIO, LOV, SBR (France), GEOMAR (Germany), ULB (Belgium), ULPGC (Spain) and UCSD (USA).

Contact: boye@ipgp.fr and karine.sellegri@uca.fr

Reference: Boye, M., and the cruise participants, 2025. Cruise Report SOPHYAC (MD247/OBS AUSTRAL 2025). https://archimer.ifremer.fr/doc/00940/105185/).

- Project **INTERREG POCTEFA Ostreobila (Core theme 4 and cross-cutting Science and Society)**: study of the sea air transfer of toxic microalgal cells and their metabolites in littoral areas Field sampling was performed in 2024 in the south-western part of France (Basque country) during a short and extreme bloom of the dinoflagellate species Ostreopsis spp.. Sampling for the chemical and biological diversity of coastal sea spray aerosols

Contact: Eva Ternon (eva.ternon@imev-mer.fr)

- **Discussion session** entitled "SOLAS processes missing from coupled models" at the SOLAS conference in Goa, India, 10-14 of November, 2024. This session was co-organized by SOLAS (Maria Kanakidou) and ESMO (Susann Tegtmeier, Boris Dewitte)

Main outcomes accessible from mariak@uoc.gr, susann.tegtmeier@usask.ca, boris.dewitte@ceaza.cl

- **Presentation of the activities of the French SOLAS community** at the SOLAS Open Science Conference 2024 in Goa, India, 10-14 of November, 2024. *Contact: Marie Boye (boye@ipgp.fr)*

- **SOLAS Europe Regional Panel**

The Regional Panel is established to structure and bring to life an interactive SOLAS network in Europe, identify possibilities and coordinated methods to foster research collaboration among SOLAS-related researchers in Europe, encourage early career scientists, and promote the mobility among SOLAS-related laboratories in Europe.
Contact: Marie Boye (boye@ipgp.fr) and Manuela van Pinxteren (manuela@tropos.de)

- Organization of the **International Polar Year 2032-33 planning workshop** on "Chemical, biogeochemical, and physical drivers of the coupled polar atmosphere and climate", held in Aussois, France, November 2024 (https://indico.psi.ch/event/15591/).

Contact: J. Thomas, jennie.thomas@univ-grenoble-alpes.fr

- Organization of the "**Atmospheric chemistry in cold environments Faraday Discussion**", held in London, UK, 17-19 February 2025 (https://www.rsc.org/events/detail/77611/atmospheric-chemistry-in-cold-environments-faraday-discussion). Among others, exchange processes through and in snow and sea-ice and ice nucleating particles and growth were key topics.

Contact: J. Thomas, jennie.thomas@univ-grenoble-alpes.fr

- **Model inter-comparison on Br in the Arctic (Core Theme 5)** (https://github.com/Arctic-Bromine-Model-Intercomparison/arctic-bromine-model-intercomp). The plan is to compare and evaluate 3D atmospheric models which include polar halogen sources and reproduce surface ozone depletion.

Contact: J. Thomas, jennie.thomas@univ-grenoble-alpes.fr, R. Lapere, L. Marelle

- Organization of the **webinar "Aerosols from Sea Ice Sources: Does the Climate Care?"** on September 18, 2024.

- Installation of the new atmospheric station for aerosol measurements on Amsterdam Island (TAAF) – Measurements started march 2024 (CPC, SMPS, NAIS, ACSM, WIBS, nephelometer) (**Core Theme 4)**

Contact: karine.sellegri@uca.fr

- SCOR WG 167 is hosting a special issue on Aerosol trace element deposition to the ocean (Copernicus journal involved: BG, ACP, AMT and AR) (**Core Theme 3)**

https://acp.copernicus.org/articles/special_issue400_1291.html

3. Publications in 2024 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.

Almendra I., B. Dewitte, V. Garçon, P. Muñoz, C. Parada, I. Montes, O. Duteil, A. Paulmier, O. Pizarro, M. Ramos, W. Koeve and A. Oschlies, 2024: Emergent constraint on oxygenation of the upper South Eastern Pacific Oxygen Minimum Zone in the twenty-first century, Communications Earth & Environment, DOI 10.1038/s43247-024-01427-2 [This paper led by a Master student shows that the OMZ off Peru and Chile is more likely to shrink in its upper part than to expand in the future climate, which provides an alternative narrative of the fate of the OMZs in the warming climate]

Audoux, T., Laurent, B., Chevaillier, S., and Desboeufs, K.: Trace element solubility in wet deposition: Investigating the evolution at the intra-event scale, Science of The Total Environment, 962, 178308, https://doi.org/10.1016/j.scitotenv.2024.178308, 2025

Bazantay Clément, Olivier Jourdan, Guillaume Mioche, Julia Uitz, Julien Delanoë, Quitterie Cazenave, Raphaëlle Sauzède, Alain Protat, and Karine Sellegri, Ocean biogeochemistry and low-level cloud properties over the southern oceans, Geophysical Research letters, https://doi.org/10.1029/2024GL108309, 2024

Buck C.S., S. Fietz, D.S. Hamilton, T-Y. Ho, M.M.G. Perron, R.U. Shelley. GEOTRACES: Fifteen years of progress in marine aerosol research. Oceanography 37 (2024). doi.org/10.5670/oceanog.2024.409.

Concha E., B. Dewitte, C. Martinez-Villalobos, F. Solmon and E. Sanchez-Gomez, 2024: Chile Niño/Niña in the Coupled Model Intercomparison Project Phases 5 and 6. Climate Dynamics, https://doi.org/10.1007/s00382-024-07434-5. [This paper investigates air-sea interactions in the upwelling system off central Chile and their role on long-lasting Marine Heat Waves called Chile El Niño]

Desboeufs, K., Formenti, P., Torres-Sánchez, R., Schepanski, K., Chaboureau, J.-P., Andersen, H., Cermak, J., Feuerstein, S., Laurent, B., Klopper, D., Namwoonde, A., Cazaunau, M., Chevaillier, S., Feron, A., Mirande-Bret, C., Triquet, S., and Piketh, S. J.: Fractional solubility of iron in mineral dust aerosols over coastal Namibia: a link to marine biogenic emissions?, Atmos. Chem. Phys., 24, 1525–1541, https://doi.org/10.5194/acp-24-1525-2024, 2024

Demasy C., Boye M., Lai B., Burckel P., Feng Y., Losno R., Borensztajn S. and Besson P. (2024) Iron dissolution from Patagonian dust in the Southern Ocean: under present and future conditions. Front. Mar. Sci. 11:1363088. doi: 10.3389/fmars.2024.1363088

Dinasquet, J., D.S. Hamilton, I.M. Leyba, J. Llort, T. Marshall, R.R. de Oliveira, M.M.G. Perron, L. Tinel, V. Garçon, C. Marandino, N. Steiner, D. Wallace, and L. Li. 2025. Thriving through synergy: Fostering a SOLAS science community built on equity, international connections, and the integration of early career scientists. Oceanography 38(1), https://doi.org/10.5670/oceanog.2025.140.

Hird, C., Perron, M. M. G., Holmes, T. M., Meyerink, S., Nielsen, C., Townsend, A. T., de Caritat, P., Strzelec, M., and Bowie, A. R.: On the use of lithogenic tracer measurements in aerosols to constrain dust deposition fluxes to the ocean southeast of Australia, Aerosol Research, 2, 315–327 (2024), doi.org/10.5194/ar-2-315-2024.

Jones, M.W., D.I. Kelley, C.A. Burton, F. Di Giuseppe, M.L.F. Barbosa, E. Brambleby, A.J. Hartley, A. Lombardi, G. Mataveli, J.R. McNorton, F.R. Spuler, J.B. Wessel, J.T. Abatzoglou, L.O. Anderson, N. Andela, S. Archibald, D. Armenteras, E. Burke, R. Carmenta, E. Chuvieco, H. Clarke, S.H. Doerr, P.M. Fernandes, L. Giglio, D.S. Hamilton, S. Hantson, S. Harris, P. Jain, C.A. Kolden, T. Kurvits, S. Lampe, S. Meier, S. New, M. Parrington, M.M.G. Perron, Y. Qu, N.S. Ribeiro, B.H. Saharjo, J. San-Miguel-Ayanz, J.K. Shuman, V. Tanpipat , G.R. van der Werf , S. Veraverbeke , and G. Xanthopoulos. State of Wildfire 2023-24. Earth Syst. Sci. Data. 16 (2024). doi.org/10.5194/essd-16-3601-2024

Kojoj, J., Freitas, G.P., Muilwijk, M., Granskog, M.A., Naakka, T., Ekman, A.M.L., Heutte, B., Schmale, J., Da Silva, A., Lapere, R., Marelle, L., Thomas, J.L., Melsheimer, C., Murray, B.J. and Zieger, P.: An Arctic Marine Source of Fluorescent Primary Biological Aerosol Particles During the Transition from Summer to Autumn at the North Pole. Tellus B: Chemical and Physical Meteorology 76(1), 47–70, https://doi. org/10.16993/tellusb.1880, 2024.

Lachkar Z., M. Cornejo-D'Ottone, A. Singh, J. Arístegui, B. Dewitte, S. Fawcett, V. Garçon, E. Lovecchio, V. Molina, and P. Vinayachandran, 2024: Biogeochemical cycling of nutrients and greenhouse gases in boundary upwelling systems: processes and sensitivity to global change. Elementa: Science of the Anthropocene, https://doi.org/10.1525/elementa.2023.00088 [This review paper involved members of the SOLAS Upwelling Implementation Team]

Lapere, R., Marelle, L., Rampal, P., Brodeau, L., Melsheimer, C., Spreen, G., and Thomas, J. L.: Modeling the contribution of leads to sea spray aerosol in the high Arctic, Atmos. Chem. Phys., 24, 12107–12132, https://doi.org/10.5194/acp-24-12107-2024, 2024

Médieu, A., Point, D., Sonke, J. E., Angot, H., Allain, V., Bodin, N., Adams, D. H., Bignert, A., Streets, D. G., Buchanan, P. B., Heimbürger-Boavida, L.-E., Pethybridge, H., Gillikin, D. P., Ménard, F., Choy, C. A., Itai, T., Bustamante, P., Dhurmeea, Z., Ferriss, B. E., Bourlès, B., Habasque, J., Verheyden, A., Munaron, J.-M., Laffont, L., Gauthier, O., Lorrain, A.: Stable tuna mercury concentrations since 1971 illustrate marine inertia and the need for strong emission reductions under the Minamata Convention,

Environmental Science & Technology Letters, 11, 3, 250–258, 2024, https://pubs.acs.org/doi/10.1021/acs.estlett.3c00949.

Parc, L., H. Bellenger, L. Bopp, X. Perrot, D. T. Ho : Global ocean carbon uptake enhanced by rainfall.Nat. Geosci. 17, 851–857 (2024). https://doi.org/10.1038/s41561-024-01517-y

Salignat, R., Rissanen, M., Iyer, S., Baray, J.-L., Tulet, P., Metzger, J.-M., Brioude, J., Sellegri, K., and Rose, C.: Measurement report: Insights into the chemical composition and origin of molecular clusters and potential precursor molecules present in the free troposphere over the southern Indian Ocean: observations from the Maïdo Observatory (2150 m a.s.l., Réunion), Atmos. Chem. Phys., 24, 3785–3812, https://doi.org/10.5194/acp-24-3785-2024, 2024.

Shelley R., M.M.G. Perron, D.S. Hamilton, A. Ito. The open ocean, aerosols, and every other breath you take, Eos 105 (2024). doi.org/10.1029/2024EO240091.

Sellegri K., R. Simó, B. Wang, P. A. Alpert, K. Altieri, S. Burrows, F. E. Hopkins, I. Koren, I. L. McCoy, J. Ovadnevaite, M. Salter and J. Schmale Influence of open ocean biogeochemistry on aerosol and clouds: Recent findings and perspectives, Elem Sci Anth, 12: 1. DOI: https://doi.org/10.1525/elementa.2023.00058, 2024.

Stevens H., L.A. Barmuta, Z. Chase, K.M. Saunders, A. Zawadzki, A.R. Bowie, M.M.G. Perron, E. Sanz Rodriguez, B. Paull, D.P. Child, M.A.C. Hotchkis, B.C. Proemse. Comparing levoglucosan and mannosan ratios in sediments and corresponding aerosols from recent Australian fires. STOTEN 945 (2024). doi.org/10.1016/j.scitotenv.2024.174068.

Ternon E., Dinasquet J., Cancelada L., Rico B., Moore A., Trytten E., Prather K.A., Gerwick W.H., Lemée R 2024. Sea-Air Transfer of Ostreopsis Phycotoxins Is Driven by the Chemical Diversity of the Particulate Fraction in the Surface Microlayer. Environ. Sci. Technol. 58: 18969–18979. doi:10.1021/acs.est.4c06691

Tulet Pierre, Joel Van Baelen, Pierre Bosser, Jérome Brioude, Aurelie Colomb, Philippe Goloub, Andrea Pazmino, Thierry Portafaix, Michel Ramonet, Karine Sellegri, Melilotus Thyssen, Lea Gest, Nicolas Marquestaut, Dominique Mékiés, Jean-Marc Metzger, Gilles Athier, Luc Blarel, Marc Delmotte, Guillaume Desprairies, Meredith Dournaux, Gaël Dubois, Valentin Duflot, Kevin Lamy, Lionel Gardes, Jean-Fran√ßois Guillemot, Valérie Gros, Joanna Kolasinski, Morgan Lopez, Olivier Magand, Erwan Noury, Manuel Nunes-Pinharanda, Guillaume Payen, Joris Pianezze, Olivier Picard, Sandrine Prunier, François Rigaud-Louise, Michael Sicard, and Benjamin Torres, MAP-IO, an atmospheric and marine observatory program onboard Marion Dufresne over the Southern Ocean, MS type: Data description paper, essd-2023-531

Violaki, K., Panagiotopoulos, C., Avalos, C.E. et al. Solid-state 31P NMR reveals the biological organophosphorus compounds as the dominant phosphorus species in Saharan dust aerosols. Commun Earth Environ 6, 225 (2025). https://doi.org/10.1038/s43247-025-02164-w

Codes

WRF-Chem code including sea spray emissions from Arctic leads (https://doi.org/10.5281/zenodo.10782398)

4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2024? If yes, who? How did you engage?

- In 2024, CEAZA joined the Hub network of the MyClimateRisk project, a sub-project of WCRP, aimed at strengthening collaboration between the academic sector and local decision-makers to generate actionable climate information. The initiative focuses on developing

plausible, context-specific narratives of climate risks, impacts, and responses by integrating scientific data with stakeholder knowledge, particularly leveraging the latest advancements in regional modeling. Currently, the Hub is working closely with the scallop fishing community in Tongoy Bay. Throughout 2024, several workshops were held to better understand community resilience to extreme events such as El Niño and hypoxia. The results of the analysis of these surveys are due to be published in the Environmental Research Climate Special issue "Focus on Bottom-up Construction of Climate Risk Information" https://iopscience.iop.org/collections/ercl-250113-756

Contact: B. Dewitt, boris.dewitte@ceaza.cl

- IGE participated in a CRiceS stakeholder workshop held on May 21, 2024, focused on "Establishing Collaborative Research and Communication with Arctic Communities Regarding Climate Change Science." Stakeholders from organizations such as AMAP, EU Polar Net, CMIP, NBI, C3S, and the EEA contributed insights on aligning climate models with Indigenous knowledge, enhancing communication on environmental changes, and assessing their impacts. Additionally, IGE is actively engaged in the following initiatives:

  - The Open-Ended Scientific Group (OESG) on the Minamata Convention: Contributing to the effectiveness evaluation of the convention, particularly in the context of mercury pollution and its environmental impact.

  - The Multi-Compartment Hg Modeling and Analysis Project (MCHgMAP): A mercury modeling initiative aimed at supporting international environmental policy. This project investigates key processes driving the global mercury cycle, including ocean-atmosphere interactions and biogeochemical transformations.

Contacts: J. Thomas, H. Angot

PART 2 - Planned activities for 2025 and 2026

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

- **CaledoNia campaign**
  A field campaign on land and at sea will be carried out by an IPGP team in collaboration with IRD at Nouméa in May-June 2025 to study the island mass effect of New Caledonia on marine biogeochemistry and phytoplankton assemblages.

Contact: boye@ipgp.fr

- **CLAP project**: Maintenance of the COMOS mooring (https://oceandecade.org/actions/research-program-for-climate-action-planning/)
  Continuing the long-term monitoring of the Oxygen Minimum Zone (OMZ) variability off central Chile through the maintenance of the COSMOS deep mooring. It provides data on water mass transport and variability and offers critical insights into the dynamics of bay systems that support the Chilean scallop industry. In addition to biannual maintenance, targeted seasonal campaigns are conducted to collect biological, geochemical, and molecular data along the OMZ's redox gradient. A new campaign starting on March 19 2025 will focus on environmental RNA collection, aiming to assess the expression of genes linked to key biogeochemical processes. This effort has been coordinated by Claudia Maturana, a CLAP

postdoc, and Alex Galán (CIEAM - Universidad Católica del Maule), a CLAP PI. The mooring will be also maintained in July 2025.

Contact: B. Dewitt, boris.dewitte@ceaza.cl

- Project ERC HAVEN (High above the ocean: unexplored molecular processes, P.I. Clémence Rose) Field campaign at Maido Observatory for the study of aerosol nucleation in the marine free troposphere of the Indian Ocean planned March-April 2026

Contact: clemence.rose@uca.fr

- Project INTERREG POCTEFA Ostreobila: study of the sea air transfer of toxic microalgal cells and their metabolites in littoral areas. Field campaign is scheduled in summer 2025, with in situ and generated sea spray aerosols.

Contact Eva Ternon, (eva.ternon@imev-mer.fr)

- **VACOA**: VOC and Aerosol Chemistry at the Ocean-Atmosphere interface in the indian and southern oceans)
  Characterize VOC concentrations and sources, physical and chemical properties of the particulate phase (size, number, chemical composition) in tropical, subtropical, and sub-Austral oceans through measurements conducted aborad *Marion Dufresne II* instrumental site in Jan-Feb 2026.

Contact: manon.rocco@univ-amu.fr; julien.kammer@univ-amu.fr; olivier.magand@univ-reunion.fr

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

- The 3rd edition of the Iron at the air-sea interface workshop will be held this coming summer in Asheville (NC, USA) with an online component available. This is co-hosted by the SCOR WG RUSTED

https://nicholasmeskhidze.com/iron-at-the-air-sea-interaction-workshop-joint-with-rusted-2025/

- A policy event is being organized for June 2025 with four projects (CRiceS, PolarRES, PROTECT, OCEAN:ICE). In the morning, researchers, project advisors, climate negotiators, and other key stakeholders will gather for roundtable discussions. Participants will be assigned to thematic tables, each focusing on a specific aspect of polar climate research and its policy implications. In the afternoon, a one-hour session, likely held at the European Parliament, will feature a panel discussion on the critical needs for future research-driven climate policies.

- CRiceS stakeholder workshop on Informing Observational Strategies Using Modeling at Different Scales.

- Continued contribution to the effectiveness evaluation of the Minamata Convention, with results to be discussed at the next Conference of the Parties (COP). Further development of mercury modeling, including improved representation of ocean-atmosphere interactions and biogeochemical processes, with findings to inform international environmental policy at the upcoming COP (November 2025, Geneva)

- A transdisciplinary research course on polar science at IPSL, for PhD and Masters students, is planned for March 2026 and will be organized by LATMOS. This 3-day course will cover all the components of the Arctic system, including the ocean-ice-atmosphere

interactions.

3. Funded national and international projects/activities underway.

- H2020 CRiceS project (Climate Relevant interactions and feedbacks: the key role of sea ice and Snow in the polar and global climate system - https://www.crices-h2020.eu/ - 2022–2026) and Horizon Europe CERTAINTY project (Cloud-aERosol inTeractions & their impActs IN The earth sYstem - https://certainty-aci.eu/ - 2024–2027) *Contact: J. Thomas*
- ANR ATOX (Dec 2024–Dec 2028; https://www.newarctictoxic.fr/) on the Arctic mercury cycle and mercury exchange processes at the ocean-sea ice-atmosphere interface *Contact: H. Angot*.
- ANR BUBBLEPLAST (Transfer through air bubble bursting of micro and nanoplastics from the ocean to the atmosphere) *Contact: H. Angot*
- AMLET Albatros Microsensor fLEeT (2025-2028): Crozet Albatros for a mobile network of the Southern Ocean atmospheric properties. *Contact: karine.sellegri@uca.fr*
- CaledoNia (2024-2025): the project funded by LEFE-EC2CO programs of INSU-CNRS in 2024 and 2025 aims to study the island mass effect of New Caledonia on marine biogeochemistry and phytoplankton assemblages. *Contact: Marie Boye (boye@ipgp.fr)*

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.

- SOLAS-ESMO collaboration: This topic will be addressed at the upcoming EMSO SSG meeting at Brown University from December 7-12, 2025. While the specific approach—whether through a Task Team, White Paper, or coordinated experiments—has yet to be determined, the discussion sparked at the SOLAS conference has provided valuable momentum.
- LATMOS is involved in the international initiative SAS ECR, which aims at designing and promoting ECR engagement during the next phase of the Synoptic Arctic Survey (SAS). SAS is a researcher-driven international effort to collect pan-Arctic empirical data that first took place in 2020-2022. The next phase (SAS2) is planned for ~2030 and a workshop will be organized in 2026 to draft the contours of ECR involvement in SAS2.
- SCOR 166 - DMS-PRO (2023-2027): Developing resources for the study of Methylated Sulfur compound cycling PROcesses in the ocean (https://scor-int.org/group/developing-resources-for-the-study-of-methylated-sulfur-compound-cycling-processes-in-the-ocean-dms-pro/). *Contact: Eva.Bucciarelli@univ-brest.fr*
- OASIS (https://airseaobs.org/). *Contact: boye@ipgp.fr*

Comments