Integrated topics

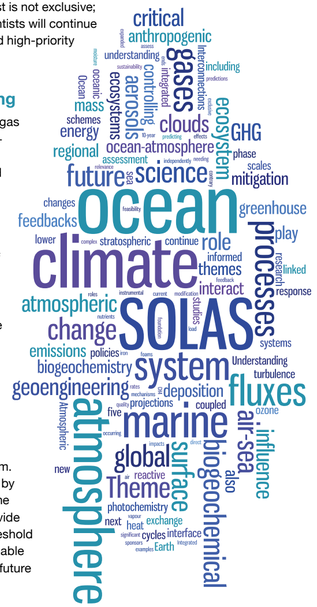
In the complex, non-linear system of the surface ocean and lower atmosphere, the five SOLAS themes interact and influence each other, while also responding to multiple stressors. Understanding the processes involved and making predictions will not be possible by studying these themes independently. Upwelling, sea ice, and coastal waters are examples of systems where integrated studies are particularly urgent, needing to be either initiated or expanded. This list is not exclusive; quite to the contrary, we expect that SOLAS scientists will continue to identify additional regional, high-sensitivity, and high-priority systems for integrated studies.

SOLAS science and geoengineering

Climate mitigation policies based on greenhouse gas budgets must take into account the role of ocean-atmosphere fluxes for future projections. Several of the geoengineering schemes currently debated for climate mitigation are directly linked to the ocean-atmosphere system, including ocean iron fertilization, sea spray generators, ocean foams, and modification of the ocean upwelling. SOLAS science will contribute to informed assessment of the feasibility, efficacy and potentially unintended effects of geoengineering. SOLAS will also be instrumental to examine the effectiveness of policies for sustainability by providing quantitative assessment on regional to global scales.

SOLAS science and society

The exchange of energy, momentum, and mass (including heat, moisture, pollutants, trace gases, and particles) between surface ocean and lower atmosphere play critical roles in the climate system. Human activity has modified this coupled system by altering the composition of the atmosphere and the health of the ocean. SOLAS research aims to provide critical understanding, predictive capabilities, threshold identification, informed assessments, and sustainable solutions to the challenges posed by current and future changes in the ocean-atmosphere system.



SOLAS Sponsors:

GLOBAL CHANGE IGBP International Geosphere-Biosphere Programme **

iCACGP

SCOR International Council for Science Scientific Committee on Oceanic Research

WCRP World Climate Research Programme

futureearth* research for global sustainability

International Project Office Sponsors:

GEOMAR

IMBER IMBRAIN **

Federal Ministry of Education and Research **

* starting 2015

**until January 2016

Ocean-Atmosphere Interactions of Gases and Particles

Series: Springer Earth System Sciences

P. S. Liss and M. T. Johnson,
University of East Anglia, Norwich, United Kingdom (Eds.)

Buy a hard copy at:
www.springer.com/shop

Note that the book is open access.

SOLAS International Project Office
GEOMAR Helmholtz-Centre for Ocean Research Kiel
Duesternbrooker Weg 20,
24105 Kiel, Germany
Tel: +49 431 600 4153 | Fax: -4202
Email: solas@geomar.de

www.solas-int.org

surface ocean solas lower atmosphere study

The **International Surface Ocean – Lower Atmosphere Study** project is an international, large scale and multidisciplinary research initiative aiming to understand the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere. It also aims to understand how this coupled system affects and is affected by environmental change.

SOLAS provides a framework to encourage and facilitate coordination of multinational, regional, and national efforts in science activities.

Join our mailing list to receive SOLAS-related news and to get involved.

www.solas-int.org/community/join.html

What is SOLAS?

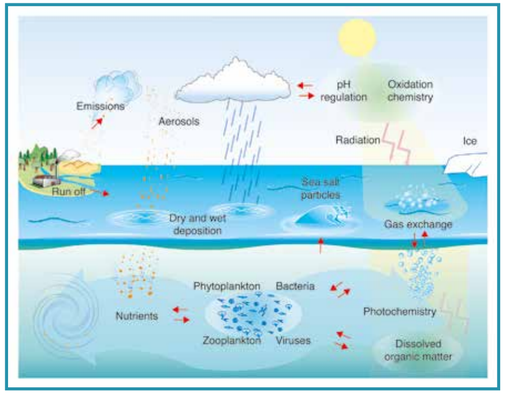
Connections between the ocean and atmosphere are crucial to climate, determining the global distributions of heat, freshwater, and greenhouse gases.

As SOLAS launches a new 10-year phase (2015-2025), the following five research themes form the foundation of the new Science Plan.

- Theme 1: Greenhouse gases and the oceans
- Theme 2: Air-sea interface and fluxes of mass and energy
- Theme 3: Atmospheric deposition and ocean biogeochemistry
- Theme 4: Interconnections between aerosols, clouds, and ecosystems
- Theme 5: Ocean biogeochemical control on atmospheric chemistry

The scope and goals of the next phase also encompass the connection between SOLAS science and geoengineering and address the societal relevance of SOLAS research.

During its next decade, SOLAS will continue its relationship with sponsors SCOR, WCRP, iCACGP, and Future Earth, once IGBP ends.

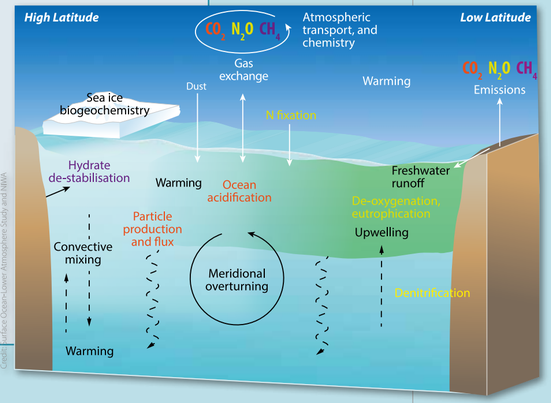


Reference: SOLAS IPO

Theme 1: Greenhouse gases and the oceans

After water vapour, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are the most significant long-lived greenhouse gases (GHG) in the atmosphere. Physical and biogeochemical processes in the surface ocean play an important role in controlling GHG fluxes to the atmosphere. Understanding sensitivities of these processes to climate and environmental change is of direct importance for mitigation of and adaptation to climate change.

- What surface ocean processes are controlling GHG cycling at regional to global scales?
- What are the feedback mechanisms between climate change and oceanic GHG emissions?
- How can we assess future oceanic fluxes of GHGs in a changing ocean and atmosphere?

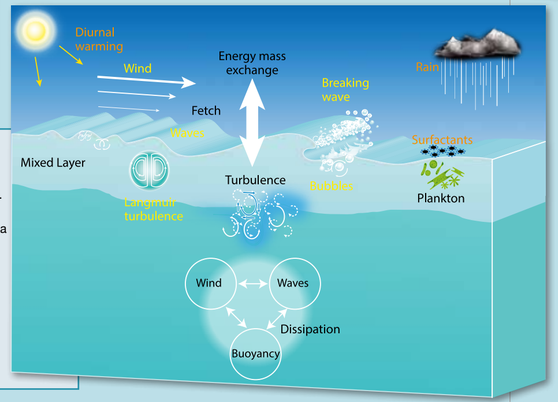


Credit: Surface Ocean–Lower Atmosphere Study and NIWA

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

Ocean-atmosphere fluxes play a critical role in the regulation of climate. A process-based understanding of physical and biogeochemical interactions occurring at the air-sea interface is key for predicting air-sea exchange rates.

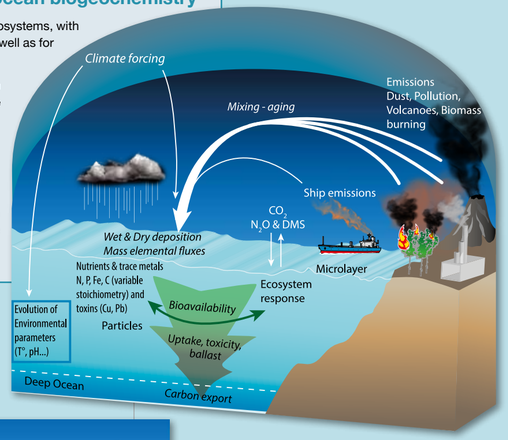
- What processes influence the turbulence at the surface ocean boundary layer?
- How can turbulence be incorporated into parameterisation schemes describing the air-sea fluxes of mass and energy?
- What are the feedbacks between the processes governing air-sea fluxes and climate?



Theme 3: Atmospheric deposition and ocean biogeochemistry

Atmospheric deposition plays a fundamental role in marine ecosystems, with consequences for local and global biogeochemical cycles, as well as for the climate system.

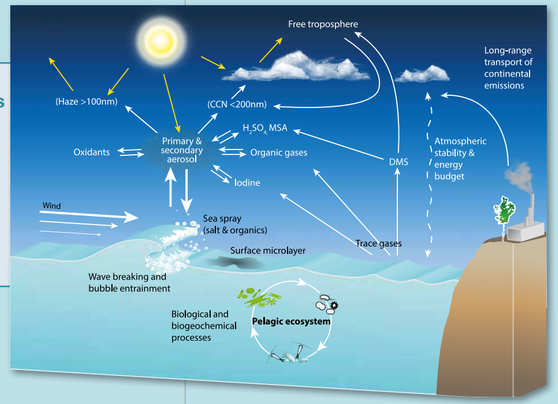
- How do biogeochemistry and ecosystem process interact in response to natural or anthropogenic material input from the atmosphere?
- How do on-going climate change and anthropogenic pressures modify the uptake of atmospheric nutrients and metals by marine biota, and the spatial variability of the ecosystem response?
- What are the large-scale impacts of atmospheric deposition to the ocean on global elemental cycles (C, N…) and climate change feedbacks in major marine biomes?



Theme 4: Interconnections between aerosols, clouds, and ecosystems

Interconnections between aerosols, clouds, and marine ecosystems are one of the largest sources of uncertainty in future climate projections.

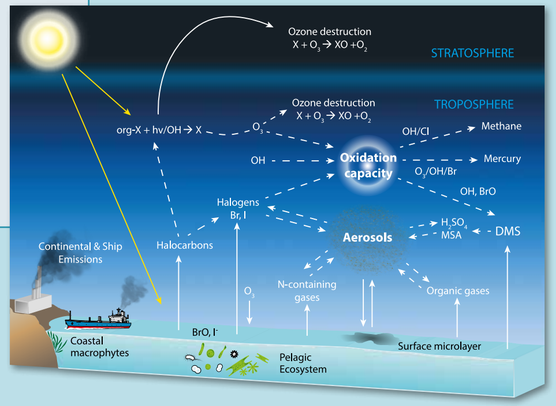
- How are aerosol load and properties linked to the marine ecosystem?
- How do aerosols affect marine clouds?
- What are the feedbacks between clouds and the marine ecosystem?



Theme 5: Ocean biogeochemical control on atmospheric chemistry

Ocean emissions of reactive gases and aerosols influence atmospheric photochemistry, air quality, and stratospheric ozone.

- What are the marine biogeochemical controls on the release of photochemically reactive gases into the atmosphere?
- How will future changes in ocean biogeochemistry and anthropogenic emissions (NOx, VOCs) interact to influence tropospheric photochemistry and stratospheric ozone?



All illustrations credit:
Surface Ocean-Lower Atmosphere Study and NIWA.

We thank Eri Mackay, Cliff Law and support from the NIWA Climate and Atmosphere Centre, for production of the concept diagrams.

Brochure layout/design: Hilarie Cutler