Discussion Sessions

The discussion sessions are intended to provide an informal opportunity for round table discussions of hot topics, with the aim of fostering collaborations and furthering research. 4 sessions will take place in parallel each afternoon (see Programme).

Sessions will be 1h30min with a short (maximum 20 min) introduction. This introductory slot may include several short (1 slide) presentations, although these sessions are not intended as an arena for formal presentations. The remainder will be allocated to discussion.

A rapporteur will take minutes during each session and submit a report to SOLAS after the conference detailing the discussion and outcomes of the session for inclusion in the SOLAS Newsletter.

In the following abstracts, reference is made to the SOLAS white papers. These were produced by the SOLAS Scientific Steering Committee with the aim to stimulate research and international cooperation within specific hot topics. Abstracts and full details can be downloaded by following the "Mid-term strategy" link on the SOLAS homepage (www.solas-int.org).

Monday 16TH NOVEMBER, 14.30-16.00

Note: The 4 discussion sessions proposed below will take place in parallel.

Identifying SOLAS scientific requirements for a new joint ESA-SOLAS activity

convened by Diego Fernandez Prieto
ESA-ESRIN, Via Galileo Galilei, Frascati, Italy

Background and motivation
In 2008 the European Space Agency (ESA) launched a new program, the STSE (Support To Science Element) dedicated to develop novel mission concepts, enhanced products and new applications that may respond directly to the needs of the scientific community. One of the main action lines of the program is dedicated to establish closer links between the agency and the major international scientific groups such as SOLAS. In this context, the purpose of the proposed discussion session is to explore and to identify what are the main scientific needs and requirements that may be the basis for a new dedicated ESA-SOLAS joint activity funded under the STSE.

Intended outcome, action or product following the discussion session
The expected output of the project is a preliminary assessment of the main areas of research and scientific priorities of the SOLAS communities in terms of novel observations, products and models, where EO and ESA data may contribute. This may be the basis for further define a more concrete collaborative action between ESA and SOLAS.

Ocean-derived aerosols: Production, evolution, and impacts

convened by David Kieber
State University of New York, College of Env Science and Forestry, Syracuse, USA

Background and motivation
The oceans are the largest global source of aerosol by mass to the atmosphere. Produced by breaking waves and bursting bubbles, freshly produced marine aerosol is mass dominated by super-µm particles composed primarily of sea salt and number dominated by submicron aerosol composed of a mixture of sea salt and organic matter. Ocean-derived aerosols affect atmospheric chemistry and are thought to play an important role in controlling cloud formation and properties thereby affecting the Earth's radiation balance.

Nonetheless, primary marine aerosol composition, evolution and atmospheric impact are poorly constrained owing to several salient unanswered questions: 1) What is the chemical composition of ocean-derived aerosols? 2) How do upper-ocean biogeochemical processes affect the fluxes, and physical and chemical properties of marine aerosols, and how do these fluxes and properties vary seasonally and spatially? 3) What is the significance of submicron ocean- derived aerosols relative to continental emissions transported out over the oceans and emissions from marine vessels? 4) Do ocean-derived aerosols affect cloud properties?

Intended outcome, action or product following the discussion session
The goal of our session is to explore potential international collaborations and opportunities in the form of integrated field and modeling studies to address some fundamental yet unresolved questions regarding marine aerosols that will allow us to assess their impact on radiative transfer and tropospheric chemistry. White paper available.

Large-scale experiments for SOLAS

convened by Peter Liss
University of East Anglia, Norwich, UK

Background and motivation
The SOLAS Scientific Steering Committee (SSC) has recently been reviewing a number of proposals for large-scale air-sea exchange experiments. The idea is to launch one or more of them as international coordinated activities in the next few years. The concepts proposed will be discussed at this session with a view to assessing which of them should be taken forward. The discussion will be from the point of view of scientific value and novelty in the context of SOLAS, considering also practical and logistic factors.

Intended outcome, action or product following the discussion session
The outcome will be a short report to the SOLAS SSC on the conclusions of the discussion session. This may well lead to a 'future perspectives' article for publication in the SOLAS Newsletter, as well as in EOS or similar.

Does a halogen-ozone exchange feedback exist and dominate MBL reactive iodine atom sources?

convened by Stephen Archer [1] and Laurens Ganzeveld [2]
[1]Plymouth Marine Laboratory, Plymouth, UK
[2]Wageningen University, Wageningen, The Netherlands

Background and motivation
Reactive iodine atoms are thought to influence tropospheric ozone levels, atmospheric oxidising capacity and new particle formation. Recently a feedback mechanism involving halogen- and ozone exchange at the air-sea interface has been proposed. This mechanism may be driven by 1) direct oxidation of iodide in the microlayer by ozone, producing organoiodine compounds 2) halogen anions oxidation by photosensitisers, e.g. chlorophyll, being enhanced in the presence of ozone, promoting the photosensitiser cationic form. Process-based global modelling studies confirm that ozone deposition to high chlorophyll regions may be greater than previously thought. These processes put into question traditional views of photochemical and biological production of volatile organoiodine compounds in the water column as principal sources of reactive iodine in the MBL. We will discuss the evidence and consequences of such a feedback, the role that water-column sources of reactive iodine atoms play in MBL chemistry and what's needed to progress this topic.

Intended outcome, action or product following the discussion session
1) Report for SOLAS, detailing present understanding of the feedback mechanism and identifying key issues for future study.
2) Guidance on experimental and modelling approaches to improve our understanding of the halogen-ozone feedback and relative importance of water column sources of reactive iodine in the MBL.

Discussions

Discussion Sessions

Tuesday 17TH NOVEMBER, 14.30-16.00

Note: The 4 discussion sessions proposed below will take place in parallel.

Air-sea gas fluxes at Eastern Boundary upwelling systems

convened by Véronique Garçon
CNRS/LEGOS, Toulouse, France

Background and motivation

Oxygen Minimum Zones (OMZs), known as suboxic layers, play a crucial role in climate evolution (greenhouse gas production) and in marine ecosystems (respiratory barrier, nitrogen loss through denitrification and anammox). However feedbacks effects of OMZs are complex and remain to be quantified. The project will focus in the OMZ of the East Pacific, namely in the East Tropical South Pacific.

- Are emissions of the most important long-lived radiatively active gases N_2O, CO_2 and CH_4 coupled or decoupled during upwelling events, and which is the net greenhouse effect of the OMZs?
- Have the OMZs a significant role on the atmospheric cycle for the tropospheric and stratospheric ozone (O_3) through halogen compounds and N_2O, respectively?
- Is it possible to determine and assess the full influence of OMZs on climatic change considering their impact on greenhouse gases, clouds formation (DMS consumption) and control of O_3 and O_2?
- What is the role, in the greenhouse gases production, of the shift between an O_2-respiration (aerobic remineralization) towards a NO_3^-, NO_2^-, N_2O^- and SO_4^- "respiration", even to methanogenesis and to anaerobic mechanisms using other electrons acceptors (e.g. IO_3, Mn, Fe)?

Intended outcome, action or product following the discussion session

It is hoped that this white paper for SOLAS mid-term strategy planning will yield an enthusiastic response from our community and will develop into an articulated international project combining *in situ* data acquisition, laboratory experimentations, and coupled biogeochemical/physical modeling. The overarching outcome being a complete understanding of the OMZs role in the present ocean.

Towards a better representation of ocean DMS emissions in global climate models - status of measurement issues and model parameterisations

convened by Nadja Steiner
University of Victoria, Canada

Background and motivation

Over the past decade significant effort has been put into the development of DMS models, but a mechanistic representation of DMS in global climate models is still in its infancy. The large variability in specific parameters controlling the dynamics of DMS and related compounds has been a limiting factor. Likewise, issues with measurement techniques and spatially and temporally limited measurement data sets have left many questions unanswered. Environmental factors expected to change in the near future such as ocean stratification; iron delivery and acidification have the potential to affect ocean ecosystems and DMS emissions. To better represent DMS in climate models we would like to use this session to address the following questions and issues: 1) Mechanistic versus semi-empirical approaches: what is needed for global climate models?; 2) DMS dynamics at high versus low latitudes; 3) Are DMS and DMSP measurements reliable; 4) DMS production pathways and rates: what do we know?; 5) Flux parameterizations and atmospheric reactions.

Intended outcome, action or product following the discussion session

The goal is to provide recommendations for future research in order to improve the representation of DMS in global climate models. We need to identify key players and processes most sensitive to global change, evaluate the reliability and availability of measurements and parameterizations, and consider new challenges such as how DMS dynamics and physiology respond to multiple-stress factors.

Atmospheric control of nutrient cycling and production in the surface ocean

convened by Cécile Guieu
CNRS, Villefranche sur mer, France

Background and motivation

Atmospheric deposition is an important pathway for nutrient delivery to the surface ocean that may increase in significance in response to climate change. Atmospheric nutrient supply modifies nutrient inventories and influences phytoplankton nutrient stoichiometry, with feedbacks to atmospheric CO_2 via air-sea exchange and the ocean carbon sink. Yet, despite major advances in determination of spatio-temporal variability of nutrient deposition and biological impacts, the links between atmospheric deposition, ocean productivity and nutrient cycling remain poorly understood. Consequently atmospheric nutrient supply is not well represented in budgets and models. This session will address key questions, including aerosol composition from uplift to deposition, the influence of different nutrient regimes on response to deposition, and future variation in atmospheric nutrient supply, with the aim of identifying new research directions and developing coordinated approaches to monitoring and testing surface ocean biota sensitivity to atmospheric deposition.

Intended outcome, action or product following the discussion session

Recommendations for future avenues of research to SOLAS Scientific Steering Committee (SCC), and SOLAS white paper.
Report to IGBP Synthesis, Integration and Exploration activity and Key questions for IGBP Fast Track Initiative. Report for SOLAS News

Ocean- atmosphere interactions in the Mediterranean Sea

convened by Marc Mallet[1] and Richard Sempéré[2]
[1] LA/CNRS, Toulouse, France [2] LMGEM/COM-CNRS, Marseille, France

Background and motivation

The Mediterranean basin is characterized by relatively high solar radiation levels due to its weak cloud cover that favor the accumulation of primary pollutants. Mediterranean waters present oligotrophic character that allows light penetration and surface photochemistry and typical bio-optical state that limit accuracy of primary production models. Mediterranean atmosphere is regularly modified by Saharan dusts, biomass burning and anthropogenic aerosol inputs from industrial activity, that play a role on incoming radiation budget as well as on photosynthetic available radiation. By contrast, atmospheric inputs may represent an important source of new nutrients to the system. Concerning the gas exchanges, Mediterranean Sea acts as a slight to medium sink for atmospheric CO_2 whereas global exchanges of others gas and volatile organic compounds are not well established. This session address key questions dealing with ocean-atmosphere interaction in the whole Mediterranean Sea with the aim of identifying new research directions, and appropriate observation.

Intended outcome, action or product following the discussion session

Recommendations for future SOLAS-type research and observation programme in Mediterranean Sea
Report to IGBP Synthesis, Integration and Exploration activity and Key questions for IGBP Fast Track Initiative. Report for SOLAS News.

Discussion Sessions

Wednesday 18TH NOVEMBER, 14.30-16.00

Note: The 4 discussion sessions proposed below will take place in parallel.

Ship plumes
convened by Roland von Glasow
University of East Anglia, Norwich, UK

Background and motivation
Emissions of gases and particles from ocean-going ships have major impacts on photochemistry in the marine boundary layer and are potentially important for the deposition of nutrients to the ocean. Throughout large regions of the ocean, ship emissions dominate the natural sulfur emissions, largely of DMS, and have therefore to be considered in estimates of climate forcing by sulfate aerosols which are also directly released from ships (Activity 1.3 of the SOLAS Science and Implementation Plan). Ship emissions are important sources of nitrogen and the input of nitrogen into marine ecosystems might affect marine productivity (Activity 1.5). Furthermore the fluxes of carbonaceous aerosol particles as well as hydrocarbons are also significant. The effects on atmospheric photochemistry (Activity 1.2) include the production of ozone in regions that are usually sinks for ozone and the pollution-induced release of reactive chlorine from sea salt, which has a lifetime of several days (due to multiphase cycling), so that it is significantly longer than the lifetime of the ship plume itself. Ship traffic has increased significantly in recent years and is projected to keep increasing.

Intended outcome, action or product following the discussion session
1) Establishment of working group on ship plumes
2) Decide on how to improve the white paper and whether to make a peer-reviewed review paper out of it
3) Plan workshops to address points in white paper

Sea ice biogeochemistry and exchange with the atmosphere
convened by Jacqueline Stefels
University of Groningen, Haren, The Netherlands

Background and motivation
Near-future climate change is predicted to have its strongest impact in polar regions due to direct changes in surface area of polar oceans and ice sheets and to subsequent feedback processes. The currently observed reductions in ice extent and thickness appear to be ahead in time of model forecasts, illustrating both the rapidity of the observed changes and the difficulty of understanding and modeling all the feedbacks involved in the change. In current global models, sea ice's main impact is on Earth's radiative balance through its albedo, on deepwater formation and on air-sea-exchange processes of gases. The latter impact refers to sea ice as a "cap" on the ocean surface. Emerging views indicate, however, that sea ice itself plays an important role in the biogeochemical cycling and exchange of climate gases. Therefore, the main question for this discussion session is: What are the main climate-relevant compounds and processes associated with sea ice and can we quantify their impact?

Intended outcome, action or product following the discussion session
The intended outcome is to prioritize key questions that need to be solved in order to quantify the role of sea ice in global biogeochemical cycles and more specific in the production and fluxes of climate-relevant gases, both directly through ice/snow-atmosphere interactions and indirectly through impacts of ice melt on surface waters and subsequent sea-air fluxes. White paper available.

Future for the Asian Dust and Ocean EcoSystem (ADOES) with Asian SOLAS
convened by Mitsuo Uematsu
University of Tokyo, Tokyo, Japan

Background and motivation
The aim of this session is to further our understanding of the transport processes of Asian dust with a special focus on the changes in the physical and chemical properties of dust particles during their transport from source regions to the ocean, and their impacts on different marine ecosystems. New issues related to Asian dust will be discussed and we will explore the possibility to initiate an international cooperative research program. The following themes will be discussed:
- Physical and chemical variations of dust aerosols during their downwind transport
- Transport path and layer of dust and its deposition flux to the marginal seas and the northern Pacific Oceans
- Impacts of dust on biogeochemistry and ocean ecosystem
- Feedback of marine ecosystems to dust deposition

The comparative studies of the effects of Asian, Australian, Sahara and South American dust on the global ocean, and additionally the different effect of dust on open and coastal oceans should be promoted.

Intended outcome, action or product following the discussion session
Possibility to start an International cooperative experimental program in the North Pacific.
- Identify the scientific issues in the world oceans affected by dust deposition processes.
- Establish a network to exchange the information of dust impact to oceans.

Ocean fertilization: legislation, ethical considerations and the role of SOLAS
convened by Cliff Law
NIWA, Wellington, New Zealand

Background and motivation
Ocean fertilisation is receiving considerable attention as a potential geoengineering solution to increasing atmospheric CO_2. Commercial organisations promoting this option focus on the phytoplankton blooms stimulated in iron addition experiments and the perceived cost-effectiveness, whereas subsequent carbon sequestration, side-effects and verification remain major areas of uncertainty. The transition of iron addition from research-driven mesoscale experiments to potential large-scale commercial operations presents a range of challenges for scientists. International legislation currently under development prohibits fertilisation for carbon credit gain, but also requires assessment of the scientific legitimacy of nutrient addition experiments, with implications for future oceanographic research. Future addition experiments, regardless of whether research or commercially driven, present ethical dilemmas for scientists and research organisations, with potential issues of transparency and conflict of interest influencing media/public perception. This session will inform on the current legislation and associated issues, and provide a forum for discussion on the ethical issues and the role of SOLAS in future ocean fertilisation.

Intended outcome, action or product following the discussion session
Report to SOLAS Scientific Steering Committee, report for SOLAS News, potential amendment to the SOLAS Position Statement on Large-scale Ocean Fertilisation
(downloadable from http://tinyurl.com/solas-fe-statement).

Discussions