Submitting your research for SOLAS endorsement *(* required fields)*

1. Summary

Title of the research project* SOAP (Surface Ocean Aerosol Production)

Status* ☒Funded ☐Submitted ☐Proposed

Is your project part of a larger national/regional programme?

If yes, please give details and outline any relation to other IGBP, SCOR, WCRP or iCACGP projects

Contributes to New Zealand MSI (Ministry of Science & Technology) funded research on Ocean-Atmosphere exchange

2. Contact Information

Principal Investigator* Cliff Law Institution (include address)* NIWA Phone* +64-43860478 Fax +64-43862153 Email* c.law@niwa.co.nz	Other Investigators (indicate institution in brackets) Mike Harvey, Murray Smith, Carolyn Walker, Kim Currie, Craig Stevens (NIWA, NZ), Eric Saltzman, Tom Bell (UCI , US), Warren de Bruyn (Chapman, US), Scott Miller (SUNY , US), Christa Marandinio (IFM_GEOMAR), Zoran Ristovski (QUT , Australia), Petri Vaatovaarra (UEF, Finland), Sarah Lawson, Melita Keywood (CSIRO, Australia)

3. Details of the Project

Summary / Abstract of Project*

Clouds and their radiative properties are partially influenced by the production of primary aerosols through mechanisms such as the generation of sea salt particles from bubble bursting associated with breaking waves. Theoretical and applied research has indicated that phytoplankton produce a range of compounds that exchange with the atmosphere, and also directly or indirectly influence aerosol via secondary aerosol production in the marine boundary layer. The CLAW hypothesis, which links the release of precursor compounds by phytoplankton and emission of dimethylsulphide to subsequent oxidation to sulphate aerosols and production of cloud condensation nuclei, is well-studied but still remains to be proven. More recently, other secondary aerosol production pathways and precursors associated with phytoplankton have been identified, including via volatile organic hydrocarbons such as isoprene and halocarbons, organic particles and ammonia.

New Zealand has a maritime climate that is dominated by the interaction between oceanic and weather systems. The frontal regions around New Zealand are highly productive, with the Sub-Tropical Front that runs eastwards along the Chatham Rise characterised by intensive phytoplankton blooms. A preliminary survey of this region in February 2011 during the PreSOAP voyage encountered blooms of different phytoplankton groups with differing DMS & CO2 signatures. Surface distributions of both gases were mapped and related to phytoplankton indicators, including chlorophyll & backscatter, and exchange of DMS & CO2 determined using sensors & collectors on the ship and at the sea surface using a free-floating catamaran. Particle production in the MBL was continuously monitored, with additional experiments in a bubble chamber to examine particle formation.

An international team will further determine the production of aerosol precursors by phytoplankton blooms, their subsequent emissions to the atmosphere, and the production and size distribution of aerosols in the overlying marine boundary layer (MBL) during the SOAP voyage in 2012. Initial mapping of phytoplankton blooms around the productive Sub-Tropical Front along the Chatham Rise will be followed by selection of sites for focussed studies. The surface mixed layer and microlayer will be characterised in terms of biological, trace gas and organic composition, to determine how these influence exchange, with the structure of the mixed layer determined by microstructure measurements and SPAR buoy-mounted sensors. Measurements in the MBL will establish the spatial variability in DMS and aerosol concentration and composition, with different approaches used to determine DMS & CO2 exchange for the development of gas exchange parameterisations. Aerosol size spectrum and composition will be related to the potential for aerosol production as determined by onboard experiments, with a focus on establishing the broader role of volatile organic emissions in aerosol production. Sampling will be augmented by measuring aerosol & gas gradients up and downwind of the foucus sites. The results will be interpreted in the context of seasonal variation in aerosols recorded at the Baring Head coastal sampling station.

Objectives

Do phytoplankton blooms influence aerosol production in the marine boundary layer?

1. Direct & indirect measurement of DMS, CO2 & aerosol flux;

2. Determination of physical controls on air sea exchange;

3. Determination of biogeochemical influences on DMS & other volatile organics on aerosol flux;

4. Examination of the role of the surface microlayer in influencing DMS & aerosol flux

Key words of project* Aerosols, DMS, phytoplankton, microlayer, flux, volatile organic compounds,

Relevant SOLAS Activities *(tick all that apply)**

FOCUS 1	FOCUS 2	FOCUS 3	CROSS-CUTTING ACTIVITIES
1.1 Marine Particle Emissions ☒ 1.2 Trace Gas Emissions ☐ 1.3 Dimethylsulphide & climate ☒ 1.4 Iron & Marine Productivity ☐ 1.5 Nitrogen cycling ☐	2.1 Air-Sea Interface ☒ 2.2 Oceanic Boundary Layer ☐ 2.3 Atmospheric Boundary Layer ☒	3.1 Air-Sea CO_2 Fluxes ☒ 3.2 Surface Laye Carbon ☐ 3.3 Air-Sea Flux of N_2O and CH_4 ☐	Modelling ☐ Remote Sensing ☒ Time Series ☐ Palaeo-SOLAS ☐

4. Data

Will new date be collected as part of this project?* Yes ☒ No ☐

Where will this data be reported / archived?* Yes

When will your data be submitted?* By 2014

5. Budget

Start date and end date of funding* July 2011 until July 2014

Total funding secured to date* N/A

Total proposed funding* N/A

Sources of funding* NZ MSI, US NSF

6. Submission

Please indicated whether you have contacted your national representative?

Yes ☒ No ☐

If no, are you happy for us to send the details that you submit to your national representative?

Yes ☐ No ☐

If not, please clarify why

If you do not have a national representative, please tick this box ☐

Please email this document with the 'Subject' as 'SOLAS Project Endorsement' to solas@uea.ac.uk