Marine Aerosol Hygroscopicity and Volatility, Measured on the Chatham Rise (New Zealand)

L. Cravigan[1], M. Mallet[1], Z.D. Ristovski[1], P. Vaattovaara[2], N. Talbot[4], G. Olivares[4], M. Harvey[3], C. Law[3]

[1]ILAQH, Queensland University of Technology, Brisbane, 4000, Australia
[2]Department of Applied Physics, University of Eastern Finland, Kuopio, FI-70211, Finland
[3]National Institute of Water and Atmospheric Research, Auckland,1010, New Zealand
[4]National Institute of Water and Atmospheric Research, Wellington, 6021, New Zealand
Keywords: Marine Aerosols, Volatility, Hygroscopic Growth
Presenting author e-mail: z.ristovski@ qut.edu.au

Composition of the abundant Aitken and accumulation mode remote marine aerosol has important direct and indirect climate influences (Andrea and Rosenfeld 2008). Modeling indicates that the marine organic aerosol parameterization has a significant impact on the aerosol indirect forcing (Gantt *et al* 2012). Despite the importance of this aerosol source there are significant uncertainties surrounding the production mechanisms, processing and resulting ultrafine marine aerosol composition.

This study considers the composition of Aitken and accumulation mode remote marine particles observed at the Chatham Rise (East of New Zealand; latitude 42°S- 44°S, longitude 174°E-177°E). These observations were undertaken during the IGBP- SOLAS Surface Ocean Aerosol Production (SOAP) voyage in February/March 2012 on board the research vessel RV-Tangaroa (NIWA, Wellington, New Zealand). The Chatham Rise is located in the southern Pacific Ocean and is characterized by intensive summer phytoplankton blooms. These blooms lead to high organic concentration in the water and high dimethyl sulfide concentrations in the water and gas phase.

Atmospheric ultrafine particles (30-150nm) were studied using a Volatility Hygroscopicity Tandem Differential Mobility Analyser (VH-TDMA) (Johnson *et al* 2008). The VH-TDMA uses parallel SMPS's to examine particles of a pre-selected size that have been conditioned to high humidity and/or high temperature. Compositional information was obtained by exposing particles to a controlled relative humidity (20-90%) and observing the resultant hygroscopic growth. Further information is obtained from changes in the size and hygroscopic growth as particles are exposed to high temperature (25-550°C). The VH-TDMA was also capable of conducting deliquescence measurements were the relative humidity was ramped from 50-90%.

In addition the remote marine aerosol distribution and concentration was characterized using an SMPS and 2 condensation particle counters (CPC3007, CPC3010 and WCPC3781). Black carbon measurements were taken with an Aetholometer as a marker for ship pollution. Complementing the VH-TDMA measurements are observations from an ultra-fine organic TDMA (UFO-TDMA). This instrument examines the change in preselected particle size (<50nm) after being exposed to alcohol vapor, providing information on the organic content.

In addition to the atmospheric observation a number of experiments were conducted using a bubble bursting chamber. The aim of these experiments were to analyse the influence of the sea water composition on the production of primary marine aerosols. Same detailed analysis of the particle properties as for the atmospheric particles was conducted for the particles from the bubble bursting chamber.

The RV-Tangaroa route was designed to maximize the time spent in waters with high biological productivity (see Figure 1.) and efforts were made to minimize the influence of ship pollution on atmospheric measurements. This resulted in the examination of areas with a broad range of water biology and chemistry under a variety of meteorological conditions.

Results will be presented on both the remote marine aerosols as well as the primary aerosols generated from the bubble bursting chamber.

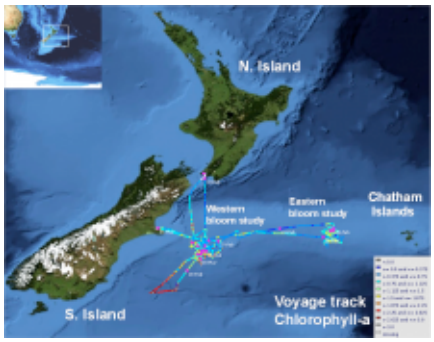

Figure1. :SOAP voyage track showing the concentration of Chlorophyll-a.

The SOLAS-SOAP experiment was funded by the NIWA program on Oceanic Control of Atmospheric Composition and supported by funding from NZ Ministry of Primary Industries. Logistic support to enable these measurements was provided by the Royal Society of New Zealand International Mobility Fund Contract IMF11A-70. QUT participation was partly funded by the NZ RS&T 2011-12 International Mobility Fund. PV was also supported by the Center of Excellence of Finnish Academy.

Andreae, M. O. and Rosenfeld, D. (2008) *Earth-Science Reviews,* **89**, 13–41.

Gantt, B., et al. (2012) *Atmos. Chem. Phys.* **12**, 6555–6563.

Johnson, G. R., et al. (2008) *J. Aero. Sci.* **39**, 850–861.