Geophysical Research Abstracts
Vol. 16, EGU2014-14935, 2014
EGU General Assembly 2014

Marine Primary and Secondary Aerosol emissions related to seawater biogeochemistry

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Marine aerosol contributes significantly to the global aerosol load and consequently has an important impact on both the Earth's albedo and climate. Different factors influence the way they are produced from the sea water and transferred to the atmosphere. The sea state (whitecap coverage) and sea temperature influence the size and concentration of primarily produced particles but also biogeochemical characteristics of the sea water may influence both the physical and chemical fluxes. In order to study marine emissions, one approach is to use semicontrolled environments such as mesocosms.
Within the SAM project (Sources of marine Aerosol in the Mediterranean), we characterize the primary Sea Salt Aerosol (SSA) and Secondary aerosol formation by nucleation during mesocosms experiments performed in May 2013 at the Oceanographic and Marine Station STARESO in western Corsica. We followed both water and air characteristics of three mesocosms containing an immerged part filled with 3,3 m3 of sea water and an emerged part filled with filtered natural air. Mesocosms were equipped with a pack of optical and physicochemical sensors and received different treatments: one of these mesocosms was left unchanged as control and the two others were enriched by addition of nitrates and phosphates respecting Redfield ratio (N:P = 16) in order to create different levels of phytoplanctonic activities. The set of sensors in each mesocosm was allowed to monitor the water temperature, conductivity, pH, incident light, fluorescence of chlorophyll a, and dissolved oxygen concentration. The mesocosms waters were daily sampled for chemical and biological (dissolved organic matter (i.e. DOC and CDOM), particulate matter and related polar compounds, transparent polysaccharides and nutrients concentration) and biological (chlorophyll a, virus, bacteria, phytoplankton and zooplankton concentrations) analyses. Secondary new particle formation was followed on-line in the emerged parts of the mesocosms, while a primary production by bubble bursting was simulated from a sample of sea water in a dedicated set-up every day. The size segregated aerosol number fluxes, cloud condensation nuclei (CCN) fluxes, and biological and organic contents were determined as a function of the sea water characteristics.