PEnum and PEmass

Website: https://www.bco-dmo.org/dataset/999300
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Project
» Collaborative Research: Seasonal Variability in refractory dissolved organic carbon fluxes associated with primary marine aerosol emitted from the oceans (Carbon Flux and Aerosol Emissions)

Programs
» United States Surface Ocean Lower Atmosphere Study (U.S. SOLAS)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **Lat**:0 **Lon**:0

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Collaborative Research: Seasonal Variability in refractory dissolved organic carbon fluxes associated with primary marine aerosol emitted from the oceans (Carbon Flux and Aerosol Emissions)

Coverage: Bermuda Atlantic Time-series Study (BATS) station

NSF Award Abstract:

The oceans hold a massive quantity of organic carbon that is greater than all terrestrial organic carbon biomass combined. Nearly all marine organic carbon is dissolved. On average, it is thousands of years old, chemically stable, and carried throughout the entire ocean several times before complete removal. However, little is known about the processes that produce and remove this old carbon, referred to as refractory dissolved organic carbon (RDOC). One potential removal pathway involves RDOC adhering onto the surfaces of rising bubbles produced by breaking waves. The bubbles ultimately burst at the sea surface, ejecting tiny particles (primary marine aerosol, “PMA”) that carry the RDOC into the atmosphere. Most of this PMA organic carbon is associated with the smallest particles (less than 1 µm diameter) that drift in the atmosphere for

several days to weeks. During this time, RDOC in these particles can be degraded photochemically (by sunlight), partially transported landward, and/or returned to the sea. When this RDOC is converted to inorganic carbon (e.g., carbon dioxide) or degraded to more reactive constituents in the atmosphere, it is effectively removed from the marine RDOC reservoir. Based on preliminary results, the annual rate at which RDOC is removed from the ocean by this process is similar to all other known RDOC losses (interactions with particles, biological degradation, and hydrothermal circulation), except for photochemical degradation in seawater. Building on this prior research, this project will identify seasonal changes in the removal of RDOC from the oceans through this process during three research cruises to the northwestern Atlantic Ocean. Results from this project will provide important findings about the coupled ocean-atmosphere loss of RDOC and improve understanding of the role of RDOC in the global carbon cycle and Earth's climate. The research will involve two early career faculty, and will provide training for undergraduate, graduate, and postdoctoral researchers.

Radiocarbon (C-14) measurements indicate that RDOC comprises 19 to 40 % of the organic carbon associated with PMA produced by bursting bubbles at the sea surface. Injection of RDOC into the atmosphere in association with PMA is a potentially important process that removes as much as 2 to 20 Tg RDOC yr-1 from the oceans. This project will measure seasonal variations in the PMA-mediated emission of marine RDOC to the atmosphere by quantifying: (1) the fraction of RDOC in PMA OC and (2) its relationship to the abundance of biologically produced labile and semi-labile dissolved organic matter in near surface seawater. These relationships will be evaluated at the Bermuda Atlantic Time-series Station during three research cruises (one in July, two in January). During the cruises, the investigators will measure: (1) the natural abundance C-14 values for PMA and its organic source materials in seawater; (2) the dynamic and equilibrium surface tension and physical properties of seawater, including bubble size distributions; (3) concentrations of major ions, organic carbon, carbohydrates, peptides and proteins, and surfactants in PMA; and (4) chromophoric dissolved organic matter (CDOM) and the concentrations of dissolved organic carbon, chlorophyll a, major ions, carbohydrates, peptides and proteins, and surfactants in near-surface seawater and in the sea-surface microlayer. Based on these chemical measurements and physical properties, this study will reveal the magnitude and potential controls on RDOC inputs into the atmosphere as a component of PMA.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Program Information

United States Surface Ocean Lower Atmosphere Study (U.S. SOLAS)

Website: http://www.us-solas.org/

Coverage: Global

The Surface Ocean Lower Atmosphere Study (SOLAS) program is designed to enable researchers from different disciplines to interact and investigate the multitude of processes and interactions between the coupled ocean and atmosphere.

Oceanographers and atmospheric scientists are working together to improve understanding of the fate, transport, and feedbacks of climate relevant compounds, and also weather and hazards that are affected by processes at the surface ocean.

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Physical, chemical, and biological research near the ocean-atmosphere interface must be performed in synergy to extend our current knowledge to adequately understand and forecast changes on short and long time frames and over local and global spatial scales.

The findings obtained from SOLAS are used to improve knowledge at process scale that will lead to better quantification of fluxes of climate relevant compounds such as CO2, sulfur and nitrogen compounds, hydrocarbons and halocarbons, as well as dust, energy and momentum. This activity facilitates a fundamental

understanding to assist the societal needs for climate change, environmental health, weather prediction, and national security.

The US SOLAS program is a component of the International SOLAS program where collaborations are forged with investigators around the world to examine SOLAS issues ubiquitous to the world's oceans and atmosphere.

Â» International SOLAS Web site

Science Implementation Strategy Reports

US-SOLAS (4 MB PDF file)
Other SOLAS reports are available for download from the US SOLAS Web site

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023110

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