

Measurements of size-resolved sub-micron sea spray particle flux onboard *Hi'ialakai*

Summary of Proposed Work

The objective of this proposal is to gain support for size-and composition-resolved aerosol flux measurements and data analysis over the North Atlantic Ocean to facilitate the study of the interactions between ocean physicochemical/biological state, sea spray aerosol and climate. This research activity is designed to take advantage of an exciting opportunity provided through the NOAA Ship *Hi'ialakai* and the WHOTS project campaign that will allow collaboration with other researchers involved in measurements of air-sea fluxes of trace gases and water vapor. A quick decision on the funding is required to take advantage of the upcoming field campaign that is scheduled for July 2016. The aerosol flux measurements proposed here open new and exciting opportunities for the existing NSF project "*New constraints on size-resolved submicron sea-salt particle production from ocean breaking waves.*" An immediate benefit of conducting size-resolved flux measurements over the open ocean would be a breakthrough in direct measurements of size-resolved sea spray particle fluxes. The diverse suite of supporting on-board data available through WHOTS project would help advancing the core scientific objectives of the existing NSF study and allow the process-level understanding of linkages between sea spray aerosol fluxes and marine boundary layer Cloud Condensation Nuclei (CCN) number concentration.

The principal objective of this supplemental funding request is to extend the current NSF funded project to making the measurements over the open ocean. Our studies show, that while a perfect place for future instrument testing and development, the 560 m long U.S. Army Corps of Engineers Field Research Facility in Duck, NC is not an ideal place for making sea-spray aerosol flux measurements. Over five weeks of the field campaign, we seldom encountered meteorological conditions satisfying both criteria: having surface wind speeds of $> 8 \text{ m s}^{-1}$ and air masses being of true marine origin. Therefore, to make future progress, flux measurements must be conducted over the open ocean. However, extensive shipborne measurements are associated with large amounts of resources and are not typically feasible for a single investigation. By taking advantage of the collaborative opportunity and diverse suite of supporting measurements available through already funded WHOTS project, the proposed study will help us carry out measurements over fully developed marine boundary layer. This new opportunity will provide crucial information to the community interested in development/refinement of sea spray production parameterizations for climate models at a fraction of the cost required for a stand-alone investigation. The WHOTS field campaigns will commence in less than 6 months, which is insufficient time to both secure funding for this project through other upcoming funding opportunities and complete necessary preparations for the campaign. The supplemental support provides a means to capitalize on the unique opportunity provided by WHOTS.