RAPID: Impact of Gulf Oil Surface Films on Atmosphere-Ocean Exchange

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Intellectual Merit

A fundamental scientific study of the impact of surfactants on air-sea exchange is proposed, taking advantage of the widespread dispersal of surface films caused by the Gulf of Mexico oil spill. Prior research, predominantly in laboratory settings, has demonstrated that air-water fluxes of momentum, heat and gases are sharply reduced by surfactants. The goal is to extend these studies to an oceanic environment by making *in situ* measurements of surfactant concentrations and air-sea exchange fluxes. Moreover, deliberate surfactant addition field studies were necessarily small-scale in time and space. The widespread and persistent surface oil in the Gulf has produced a large natural system to explore the integrated effect of surfactants on the surface ocean heat budget, atmospheric heat and moisture, ocean biogeochemistry, and possible system feedbacks.

The study includes: (1) *in situ* characterization of surfactant concentrations; (2) air-sea exchange of momentum, water vapor, heat, carbon dioxide (CO_2), and methane (CH_4) measurements; (3) quantifying the subsequent impact of these fluxes on the surface ocean heat budget and biogeochemstry; and (4) investigating the impact on thermal coupling between the atmosphere and ocean. A survey vessel and an anchored autonomous air-sea exchange sampling platform will be used to study these processes at a mid-shelf study site offshore from Mobile Bay, where strong temporal variability of oil surfactants has been observed. The study is facilitated by collaborations with Professor Ron Kiene, who provides access to Dauphin Island Sea Lab research vessels and laboratory facilities on the Gulf Coast.

Broader Impacts

The proposed quantification of atmosphere-ocean exchange also has many applications related to understanding the Gulf oil spill and its consequences. Modified air-sea exchanges of heat, moisture and momentum could impact the sea- and land-breeze system, atmospheric delivery of moisture to the Southeastern United States, oil spill transport, surface ocean heat content and tropical storm behavior. Modified air-sea exchanges of gases could impact oxygen, CH_4 and CO_2 transport and as a result, ocean biogeochemistry. The mentorship of a postdoctoral associate and women graduate students are additional elements of this project's broader impacts.