4.082 Heterogeneous distribution of dimethyl sulfide (DMS) and dimethylsulfoniopropionate (DMSP) in melt pond and its impact to atmospheric sulfur compounds.

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Abstract:

The Arctic Ocean environment is experiencing rapid climate changes such as warming, ocean acidification and sea ice reduction, influencing ecosystem dynamics including biogeochemical cycling. Dimethyl sulfide (DMS) and its major precursor dimethylsulfoniopropionate (DMSP) are produced through physiological function of phytoplankton in marine environment. It has been suggested that oceanic DMS emissions could play a dominant role in climate regulation on a regional basis especially in the polar region. In this study, we investigated the characteristics of distribution of DMS and DMSP in melt pond during a cruise held in the Arctic Ocean. The increase of melt pond area in the Arctic has been documented over the past decade, but behavior of DMS and DMSP have rarely been studied in the melt pond. We collected water sample from the surface of 10 different melt ponds with different salinity conditions around an ice camp station (78.5°N, 179.2°E). We found large variation in both DMS and DMSP concentration among melt ponds, 0.1–18.6 nM and 0.5–5.1 nM, respectively, indicating heterogeneous distribution of DMS and DMSP in the melt ponds. There is no clear relationship between DMS and salinity or temperature, however, DMSP shows positive correlation with salinity ($r^2 = 0.58$). This relationship may indicate that the lower osmoregulation effect caused limitation of DMSP production in the lower salinity condition. This result shows that stratification of melt pond water and difference in biological activities in the stratified layer may induce the variation in DMS concentration. The concentration of DMS in melt ponds were relatively higher than those of ambient surface seawater (approximately 0.2 nM), suggesting that higher flux of DMS will occur when the whole sea ice will melt. We will discuss the impact of formation and spreading of melt pond and sea ice melting to the atmospheric sulfur amount.