2.093 Distribution of oceanic dimethyl sulfide in the Arctic Ocean and the Southern Ocean made by membrane inlet mass spectrometry.

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Abstract:

Dimethyl sulfide (DMS) plays a pivotal role in the climate change-related biogeochemical cycles. Because the oxidation of DMS contribute to the formation and growth of aerosol, it is an important precursor of cloud condensation nuclei (CCN), and thus essential to understand the change of global radiative forcing budget. The oceanic emission is a dominant natural source of atmospheric DMS. The oceanic DMS is produced by biological processes while its production rate is widely varied by the ocean's biological environmental characteristics.

In the polar region, the oceanic DMS is essential to understand and predict climate variability. In the Southern Ocean, DMS has been significantly underestimated. Also, high productivity of Antarctic coastal polynyas implies strong DMS emissions from the Antarctic polynyas. In the Arctic Ocean, rapid sea ice decline will clearly impact ocean environment including biological productivity, and thus alter DMS emission strength as well. Therefore, monitoring DMS in the polar oceans are essential to understand climate change processes. However, its observations are significantly lacked due to the limited accessibility of polar oceans.

Membrane inlet mass spectrometry (MIMS) technique directly samples analyte gases from the aqueous phase gases in seawater through a semi-permeable membrane. Since this method does not require headspace equilibration, MIMS enables us to make a near-real time continuous observation of dissolved gases. Thus, it is especially useful to capture environmental changes in oceanic waters showing a significant concentration variation or occurring an active physical, chemical and biological processes.

We have made continuous high frequency DMS observations in the Southern Ocean (Jan. ~ Feb. 2016) and the Arctic Ocean (Aug. 2016) using MIMS on the Korean icebreaker R/V Araon. Here, we will present the results of oceanic DMS measurements from the two research cruises as a beginning of our effort to understand climate change and polar ocean environment change.