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Distribution of biogenic volatile organic compounds over the Arctic Ocean

YOKOUCHI, Yoko[1*], Jun Inoue[2]

[1]National Institute for Environmental Studies, [2]Japan Marine Science and Technology Center

There are a variety of biogenic volatile organic compounds (BVOCs) in the atmosphere. They are believed to be playing an important role in the global environment through aerosol formation, ozone depletion, etc. We studied spatial/temporal distribution of selected BVOCs in the atmosphere over the Arctic Ocean, and found that their concentrations were likely to be affected by sea-ice type.

Air samples were collected during an Arctic cruise conducted by the R/V Mirai from 30 August to 21 October. Sampling was done with stainless steel canisters on board at the front of the uppermost deck, forward of potential contamination from stack. After transport to the laboratory, the samples were analyzed using a pre-concentration/capillary gas chromatograph - mass spectrometry (GC-MS).

Methyl iodide (CH_3I) is the most abundant organic iodine compound in the atmosphere, which is mostly emitted from the ocean. Methyl chloride (CH_3Cl) is the most abundant chlorine compound in the atmosphere, which is mostly emitted from tropical forests followed by warm ocean and biomass burning on a global scale. Both of them showed gradual decrease with latitude, but they showed quite different variation in the marginal ice zone. CH_3Cl concentration was higher at the sites surrounded by sea ice than at the open sea near the ice edge, while CH_3I concentration decreased over/near the sea ice. This finding would suggest CH_3Cl is absorbed by the cold seawater, but CH_3I is emitted even from the cold water. Among the other BVOCs, methyl bromide (CH_3Br) was similar to CH_3Cl in the relationship to sea ice. Bromoform ($CHBr_3$), which is mainly emitted from macroalgae, showed the third pattern: lowest over thin (new) sea ice and highest over thick (old) sea ice. This would be consistent with that ice-algae usually grow on the old sea ice.

Keywords: volatile organic compounds, Arctic, methyl iodide, methyl chloride, bromoform