3.098 Factors determining the longitudinal distribution of biogenic sulfur compounds in aerosols over the subarctic North Pacific.

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Abstract:

Sulfur-containing aerosols are a significant source of cloud condensation nuclei (CCN). Biogenic sulfur compounds such as non-seasalt (nss-) sulfate and methanesulfonic acid (MSA) are formed by the oxidation of dimethylsulfide (DMS) which produced by marine phytoplankton. These compounds are important especially in the open ocean where are less impacted by anthropogenic pollutants. From a wide range of atmospheric observations over the subarctic North Pacific and chemical analyses of the aerosol samples, longitudinal distribution of atmospheric sulfur compounds were revealed. Furthermore, factors determining the distributions are discussed.
The concentrations of MSA in the eastern region of the international date line (IDL) were almost twice of those in the western region. The spatial variation of MSA concentration was similar to that of DMS in both seawater and atmosphere. The high concentrations of DMS in the atmosphere could be caused by high wind speed in the eastern region of IDL. Furthermore, composition of oceanic suspended particles including phytoplankton debris showed remarkable increase in coccoliths in the eastern region of IDL, indicating that dominant species of phytoplankton also influenced MSA formation.
Although about 80% of MSA was existed in fine mode aerosols, the coarse mode fraction of MSA were higher in the eastern region than the western region of IDL. On the other hand, size distribution of nss-sulfate was relatively constant regardless of oceanic regions, and their concentrations were lower in the eastern region of IDL. These results suggest that seasalts, which were mainly existed in coarse mode, increased due to the high wind speed, and a part of MSA and SO_2 adsorbed on the seasalt particles. Since the residence time of seasalt aerosols are much shorter than fine-mode aerosols, the contribution of biogenic sulfur compounds to CCN could be overestimated in the marine atmosphere with abundant seasalt aerosols.