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Industrial-era decline in Arctic methanesulfonic acid is offset by increased biogenic sulfate aerosol

Content

Marine phytoplankton are primary producers in ocean ecosystems and influence climate in part by emitting dimethyl sulfide (DMS) to the atmosphere. DMS is oxidized to methanesulfonic acid (MSA) and sulfate. Ice core records of MSA are used to reconstruct past DMS emissions under the assumption that the relative yield of MSA vs. sulfate from DMS remains constant. Here we quantify MSA and DMS-derived biogenic sulfate concentration in Greenland ice core samples from 1200 to 2007 C.E. While MSA is $0.2 \mu\text{g S kg}^{-1}$ lower in the industrial era relative to the preindustrial, biogenic sulfate increases by $0.8 \mu\text{g S kg}^{-1}$. The fractional contribution of biogenic sulfate to total ice core sulfate has varied due to anthropogenic sulfur emissions, but total biogenic sulfur concentration (MSA plus biogenic sulfate) is not significantly different in the present day compared to the the preindustrial, contradicting inferred primary productivity decline based on declining MSA concentrations.

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