

Distributions of volatile organic iodine compounds in the western Arctic Ocean (Chukchi Sea and Canada Basin) in summer 2012 –a possibility of production in relation to the degradation of organic matter

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We conducted a shipboard observation over the Chukchi Sea and the Canada Basin in the western Arctic Ocean in September and October 2012 to obtain vertical distributions of four volatile organic iodine compounds (VOIs) in seawater. The VOIs observed in this study were iodomethane (CH₃I), iodoethane (C₂H₅I), diiodomethane (CH₂I₂), and chloriodomethane (CH₂ClI). Maximum concentrations of the four VOIs were found in the bottom layer water over the Chukchi Sea shelf, in which layer the maximum concentration of ammonium (NH₄⁺) also occurred. A significant correlation was observed between C₂H₅I and NH₄⁺ (correlation coefficient R = 0.93, P < 0.01, n = 64) and between CH₃I and NH₄⁺ (R = 0.77, P < 0.01, n = 64), suggesting that the production of these VOIs increased with the degradation of organic matter. Over the northern Chukchi Sea shelf-slope area, concentration maxima of CH₂I₂, CH₂ClI, and CH₃I were found in the subsurface cold, dense water (CDW). A large nitrogen deficit (N deficit = NH₄⁺ + NO₂⁻ + NO₃⁻ - 16PO₃⁻) occurred simultaneously in this water, suggesting the production of the three VOIs in the sediment or the bottom layer water over the shelf, probably in association with the degradation of organic matter. We conclude that VOI production over the Chukchi Sea shelf can be largely attributed to the degradation of organic matter that is produced in the highly productive shelf water. High concentrations of CH₂ClI were also found in the Alaskan Coastal Water (ACW) from the Bering Strait to the surface of the northern Chukchi slope. The VOIs that originated at the Chukchi Sea shelf are expected to be laterally transported to the Arctic Ocean basin through the CDW and the surface ACW. The Chukchi Sea shelf was found to have the largest sea-to-air flux of CH₂ClI in the global ocean from tropical – polar ocean areas. Degradation of organic matter over the shallow continental shelf would have a great impact on iodine flux to the air, which might affect atmospheric ozone level.

Reference

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