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Abstract

Little is known regarding the distribution of naturally produced volatile halogenated organic compounds, halocarbons, in Antarctic waters and the contribution of these waters to the global atmospheric load of halogens. In the atmosphere, halocarbons are degraded by photolysis, and form reactive halogen radicals. These radicals are thereafter involved in the catalytic degradation of ozone and formation of aerosols. Ozone degradation mainly occurs over the poles, and the process is most prominent during the springtime in the stratosphere at the South Pole.

Biogenic halocarbons are formed by algae during photosynthesis. As such, the formation of halocarbons takes place in all oceans, but with large spatial and temporal variations. To determine the source strength of the oceans, it is essential to establish reliable estimates of the air-sea exchange, as well as production and degradation rates of halocarbons in the assessment of the role the oceans play in the destruction of ozone.

In this work, the major aim has been to broaden the knowledge of the distribution of biogenic halocarbons in the Pacific sector of the Southern. Studies of the relationship between halocarbon distributions and biophysical variables indicated sea ice as the main regulating factor. The production and degradation rates in sea ice were therefore established, and the net production was found to be able to sustain concentration gradients in the ice. High resolution measurements of halocarbons in surface water and air were conducted to establish the air-sea exchange of halocarbons, and the results showed that the cold waters acted as a sink (100 days of minimum sea ice extent), with an uptake of 0.04 Gmol Br for bromoform, in contrast to earlier findings. A three year study during the austral summer in the Amundsen Sea was conducted, and the distributions and fluxes of halocarbons were found to be consistent. A novel approach utilising transposed-orthogonal projections to latent structures T-OPLS, indicated that biogenic halocarbons could be used to study the circulation of water masses on the shelf in the Amundsen Sea.

Keywords: Volatile biogenic halocarbons, Antarctica, Southern Ocean, Sea ice, snow, air-sea exchange

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On Biogenic Halocarbons in Antarctic Waters

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Akademisk avhandling för filosofie doktorexamen i Naturvetenskap, inriktning kemi, som med tillstånd från Naturvetenskapliga fakulteten kommer att offentligt försvaras den 8 november 2013 kl 10.00 i KC, Institutionen för kemi och molekylärbiologi, Kemigården 4, Göteborg.

Fakultetsopponent: Professor William Sturges, The School of Environmental Science, University of East Anglia, Norwich.

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