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Production of bromoform at the sea ice surface layer and emission to the atmosphere

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Bromoform (CHBr3) is one of the important bromine containing volatile halocarbons that are involved in ozone depletion in the atmosphere. Although the possible source of reactive bromine species from snow and sea ice has been discussed, mechanisms that control CHBr3 production within sea ice and emission to the atmosphere remain unclear. Here, we show evidence of massive CHBr3 production at sea ice surface-snow interfaces and its strong emission to the atmosphere from five field-campaigns to the Arctic Ocean, the Southern Ocean, and the Sea of Okhotsk in the winter and spring, in addition to supporting laboratory experiments. We found that the ice-related strong CHBr3 emission was linked to the production of the CHBr3 at the snow-sea ice interface through the haloform reaction. Our results suggest that sea ice acts as a strong CHBr3 source for the atmosphere, indicating a significant contribution to the atmospheric bromine cycle.