

4.032 Molecular Halogens in the Arctic: Fluxes, Diurnal Variations, and Implications.

Early Career Scientist

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Abstract:

High levels of reactive bromine and chlorine species have been frequently observed in the Polar boundary layer, which lead to ozone depletion events and mercury oxidation and deposition. Recent studies reported Arctic snowpack photochemical production of Br₂ and Cl₂, yet mechanisms remain poorly understood and largely untested. In this work we use a zero-dimensional multi-phase model to examine the reactive bromine and chlorine chemistry observed during the 2012 BRomine, Ozone, and Mercury EXperiment (BROMEX), focusing on the production and removal of molecular halogens near Barrow, Alaska. The roles of primary snowpack production, gas-phase recycling, and heterogeneous recycling are examined for Br₂ and Cl₂ observations. Nitrogen-containing halogens, such as ClONO₂, BrONO₂ and BrNO₂, may be potentially important in gas-phase and heterogeneous recycling, although these species have never been directly measured. The results of this study highlight the important need for improved understanding of snow chemistry and microphysics.