Snow-sourced bromine and its implications for polar tropospheric ozone

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In the last two decades, significant depletion of boundary layer ozone (ozone depletion events, ODEs) has been observed in both Arctic and Antarctic spring. ODEs are attributed to catalytic destruction by bromine radicals (Br plus BrO), especially during bromine explosion events (BEs), when high concentrations of BrO periodically occur. However, neither the exact source of bromine nor the mechanism for sustaining the observed high BrO concentrations is completely understood. Here, by considering the production of sea salt aerosol from snow lying on sea ice during blowing snow events and the subsequent release of bromine, we successfully simulate the BEs using a global chemistry transport model. We find that heterogeneous reactions play an important role in sustaining a high fraction of the total inorganic bromine as BrO. We also find that emissions of bromine associated with blowing snow contribute significantly to BrO at mid-latitudes. Modeled tropospheric BrO columns generally compare well with the tropospheric BrO columns retrieved from the GOME satellite instrument (Global Ozone Monitoring Experiment). The additional blowing snow bromine source, identified here, reduces modeled high latitude lower tropospheric ozone amounts by up to an average 8% in polar spring.

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