

Halogen-induced ozone depletions in industrial plant plumes in the Great Salt Lake region

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The Utah Winter Fine Particulate Study was a combined aircraft- and ground-based field campaign in northern Utah in 2017 measuring the build-up of ammonium nitrate aerosol pollution. During that campaign, the NOAA Twin Otter aircraft repeatedly intercepted halogen-rich and ozone-depleted plumes emanating from an industrial area on the west side of the Great Salt Lake. Halogens are known to catalytically destroy ozone, but this phenomenon has mostly been observed in the Arctic and the stratosphere, and rarely in the tropospheric midlatitudes. Here, we quantify the halogen emissions (Cl_2 , Br_2 , HCl , and BrCl) based on nighttime Twin Otter measurements with a iodide chemical ionization mass spectrometer (I-CIMS), and back-trajectories using Stochastic Time-Inverted Lagrangian Transport (STILT) modeling. We then use zero-dimensional chemical box modeling to investigate the mechanisms that lead to ozone depletion by the photolytically-produced halogen radicals. As westerly winds often brought these plumes into the populated areas east of the Great Salt Lake, we further analyze the affect that these plumes have on air quality and build-up of wintertime pollution.