EGU21-8892
https://doi.org/10.5194/egusphere-egu21-8892
EGU General Assembly 2021

Record springtime stratospheric ozone depletion at 80°N in 2020

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The Arctic winter of 2019-2020 was characterized by an unusually persistent polar vortex and temperatures in the lower stratosphere that were consistently below the threshold for the formation of polar stratospheric clouds (PSCs). These conditions led to ozone loss that is comparable to the Antarctic ozone hole. Ground-based measurements from a suite of instruments at the Polar Environment Atmospheric Research Laboratory (PEARL) in Eureka, Canada (80.05°N, 86.42°W) were used to investigate chemical ozone depletion. The vortex was located above Eureka longer than in any previous year in the 20-year dataset and lidar measurements provided evidence of polar stratospheric clouds (PSCs) above Eureka. Additionally, UV-visible zenith-sky Differential Optical Absorption Spectroscopy (DOAS) measurements showed record ozone loss in the 20-year dataset, evidence of denitrification along with the slowest increase of NO_2 during spring, as well as enhanced reactive halogen species (OClO and BrO). Complementary measurements of HCl and $ClONO_2$ (chlorine reservoir species) from a Fourier transform infrared (FTIR) spectrometer showed unusually low columns that were comparable to 2011, the previous year with significant chemical ozone depletion. Record low values of HNO_3 in the FTIR dataset are in accordance with the evidence of PSCs and a denitrified atmosphere. Estimates of chemical ozone loss were derived using passive ozone from the SLIMCAT offline chemical transport model to account for dynamical contributions to the stratospheric ozone budget.