EGU21-8547, updated on 30 Jul 2021
https://doi.org/10.5194/egusphere-egu21-8547
EGU General Assembly 2021

The sensitivity of chemical loss of Arctic ozone to future levels of GHGs

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The chemical loss of ozone during Arctic winter and spring due to anthropogenic halogens is driven by temperature at high latitudes, with more loss occurring during cold years with meteorological conditions that are favourable for formation of polar stratospheric clouds (PSCs). We show that a positive, statistically significant rise in the local maxima of PSC formation potential (PFP^{LM}), i.e. seasonal integrals of the fraction of the vortex volume below the formation temperature of PSCs, within the Northern Hemisphere polar vortex over the past four decades is apparent in data from four meteorological centres. Output from numerous General Circulation Models (GCMs) that submitted results to the CMIP5 and CMIP6 archives also exhibits positive trends in PFP^{LM} over 1950 to 2100, with the highest values occurring at end of century for model runs driven by increasing radiative forcing of climate due to greenhouse gases (GHGs) (i.e., the RCP 8.5 scenario for CMIP5 and the SSP5-8.5 scenario for CMIP6). We combine projections of the future decline in stratospheric halogen loading and possible future increases in stratospheric humidity with GCM-based forecasts of PFP to suggest that conditions favourable for large, seasonal loss of Arctic column O_3 could persist until the end of this century, especially for GCM simulations constrained by either the RCP 8.5 or SSP5-8.5 GHG scenario. Conversely, if future GHG loading follow the SSP1-2.6 scenario, conditions favourable for chemical loss of Arctic O3 are projected to decline throughout the rest of this century.