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On the possible cause of recent increases in NH total ozone

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Global total ozone measurements from various satellite instruments such as SBUV, TOMS, and GOME show increases in zonal mean total ozone at NH mid- to high latitudes since the mid-nineties. This could be expected from the peaking and starting decline in the effective stratospheric halogen loading, but the rather rapid increases observed in NH zonal mean total ozone suggests that other physical mechanism may also contribute. Following the cold Arctic stratospheric winters of the mid nineties, winter planetary wave activity has increased that lead to higher stratospheric temperature and enhanced ozone transport into higher latitudes as part of the residual circulation. From a multi-variate linear regression with explanatory variables such as polar ozone loss (PSC volume), planetary wave driving (eddy heat flux) as well as stratospheric aerosol loading, QBO, and solar cycle it can be shown that the strongest contribution to the recent total ozone increases are from solar activity (increasing branch of solar cycle 23) and planetary wave driving. Replacing the linear term (accounting for unexplained ozone loss on the order of -2% per decade in spring until 2003) with the estimated effective stratospheric chlorine loading (EESC), the role of planetary wave driving gets smaller without change in overall statistical significance. It is clear that more years of data are needed to uniquely attribute the cause of the observed recent increase in NH total ozone. In addition the question remains, if the current increase in planetary wave driving is part of natural variability on decadal time scale or a persisting trend that could be interpreted as a possible signature of climate change.