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Recent, unprecedented, arctic ozone losses: climate change or large interannual variability?

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The record ozone loss over the Arctic in the spring of 2011 [e.g., Manney et al., 2011] highlights the importance of a detailed understanding of the connection between cold polar temperatures, polar stratospheric clouds (PSCs) and column ozone. Several studies have analyzed the empirical relationship between PSC volume (Vpsc) and ozone loss in the Arctic [e.g., Rex et al., 2006], and put forward the hypothesis that the coldest Arctic winters are getting colder and therefore anomalous ozone losses in the Arctic are likely to increase in the coming decades. In the present study we analyze trends and variability in polar temperatures, Vpsc and column ozone, using both reanalysis products (ERA40, MERRA) and numerical model output (from selected models participating in the Chemistry-Climate Model Validation Activity). Beyond considering mean values, we employ a variety of statistical measures for extremes (i.e. high quantiles) in order to identify possible changes in the frequency distribution of polar temperatures and Vpsc, and attempt to determine whether the recent occurrences of record ozone loss are indicative of statistically significant trends or simply a reflection of large natural variability.

References:

Manney, G. L., et al. (2011), Unprecedented Arctic ozone loss in 2011, Nature, 478(7370), 469-U465.
Rex, M., et al. (2006), Arctic winter 2005: Implications for stratospheric ozone loss and climate change, Geophysical Research Letters, 33(23).