Geophysical Research Abstracts
Vol. 16, EGU2014-16212, 2014
EGU General Assembly 2014
© Author(s) 2014. CC Attribution 3.0 License.

Unraveling the empirical relationship between Arctic stratospheric ozone loss and temperature

Marc von Hobe, Jens-Uwe Grooß, and Rolf Müller
Forschungszentrum Jülich GmbH, IEK-7, Jülich, Germany (m.von.hobe@fz-juelich.de, +49-2461-615346)

Ever since the discovery of the Antarctic ozone hole it has been recognized that cold temperatures play a key role in fostering strong ozone depletion in the polar stratosphere. Compact negative correlations between total winter ozone loss and vortex area exposed to temperatures below certain threshold values have been demonstrated (e.g. Harris et al., 2010; Rex et al., 2006; Rex et al., 2004). The most commonly used threshold is the NAT equilibrium temperature, but other choices have been suggested, such as the temperature when the rate of chlorine activation on liquid aerosols exceeds a certain limit. Interestingly, both thresholds relate to critical temperatures in the context of heterogeneous chlorine activation, and Harris et al., 2010, stated that original activation (i.e. the activation in early winter) is the most important factor influencing ozone loss. But at least two other key processes – catalytic ozone loss and denitrification – depend directly on temperature, and temperature also controls the stability and therefore the persistence of the polar vortex.

Here, we investigate such "vortex area" correlations for a number of different temperature thresholds, as well as direct correlations with vortex mean temperature and with the date of the final warming. We also carry out sensitivity studies using the Chemical Lagrangian Model of the Stratosphere (CLaMS) to investigate the response of ozone loss to temperature modifications for particle formation and growth, surface reaction probabilities and gas phase reactivity separately.

Rex et al., Arctic ozone loss and climate change, Geophys. Res. Lett., 31, L04116, 2004.

Rex et al., Arctic winter 2005: Implications for stratospheric ozone loss and climate change, Geophys. Res. Lett., 33, L23808, 2006.

Harris et al., A closer look at Arctic ozone loss and polar stratospheric clouds, Atmos. Chem. Phys., 10, 8499–8510, 2010.