



Processing of HCl in the Antarctic stratospheric polar vortex

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Since the discovery of Antarctic ozone hole in 1985, significant progress has been made in understanding how different processes (e.g. dynamics, transport, microphysics, photochemistry, radiation, etc.) control the extent of the observed ozone depletion. It is well accepted that this depletion is primarily caused by efficient catalytic loss through chemical cycles containing the ClO and BrO radicals. Stratospheric halogens exist in this form through heterogeneous processing on polar stratospheric clouds, which converts the reservoir species HCl and ClONO₂ to active chlorine. Although the main processes that lead to ozone depletion are generally well understood, there remain open questions such as the duration of chlorine activation and its dependence on the abundance of nitrogen oxides (Kühl et al., 2004; Feng et al., 2011). It is still problematic to fully parameterise PSC-related processes in global models (SPARC, 2015). Furthermore, satellite observations (e.g., MLS) show that HCl is essentially completely depleted inside the dark, midwinter Antarctic polar vortex but most models significantly overestimate HCl in this region (e.g., SPARC 2010; Grooß et al., ACP, 2018).

Here we have used two state-of-the-art global models (the TOMCAT/SLIMCAT chemical-transport model (Chipperfield et al., 2018) and the UM-UKCA chemistry-climate model (Morgenstern et al., 2009)) to revisit the processing of the stratospheric HCl in the wintertime Antarctic polar vortex. The models are forced (or nudged) with ECMWF ERA-Interim and ERA5 reanalysis datasets and have detailed stratospheric chemistry. Both models have been run from 1980 to 2018. We compare the model results with MLS measurements and assess the extent to which the models capture the observed processing of HCl under different meteorological conditions. The year-to-year variation of polar ozone depletion will also be discussed, in particular for the recent years of decreasing stratospheric chlorine loading.

References:

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