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Chlorine activation in the dark polar vortices

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Simulations of polar stratospheric chemistry have been performed with the state-of-the-art Lagrangian Chemistry Transport Model CLaMS for both Antarctic and Arctic winters. CLaMS includes a Lagrangian sedimentation scheme that is able to successfully simulate the vertical NO_y redistribution due to the sedimentation of large NAT particles. In general, observations of stratospheric trace species are very well reproduced by the model.

However, during the time of the onset of chlorine activation, the simulations significantly over-estimate the HCl mixing ratio inside the polar vortex core where little sunlight is available. This discrepancy is seen in both hemispheres and points to some unrecognized process in stratospheric chemistry. The spatial and temporal development of the discrepancy is investigated in detail in order to search for possible processes missing in the model. HCl depletion rates derived from MLS observations correlate well with ice PSC detections derived from MIPAS. Possible reasons for this discrepancy in chlorine activation will be discussed.

Since the discrepancy is mainly seen during the beginning of the chlorine activation period where the ozone loss rates are low, the impact on the overall ozone loss over the course of the winter and spring is rather low.