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How significant is chlorine activation on cold binary aerosol?

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Chlorine activation on cold binary aerosol is evaluated with the Chemical Lagrangian Model of the Stratosphere (CLaMS) exploring its sensitivity to factors such as temperature and PSC microphysics.
We assess the potential of the background aerosol to activate chlorine by examining the reaction rates for idealized conditions, for vortex wide satellite observations and high resolution in situ data. In all three cases heterogeneous processing on cold binary aerosol can be regarded as the controlling mechanism for chlorine activation.
The sensitivity of the reaction rates is examined in regard to temperature, microphysics and parameterization schemes. Heterogeneous reaction rates on NAT particles are very sensitive to the parameterization used and the number density, with the uncertainty spanning several orders of magnitude. Reactions on liquid aerosols, on the other hand, are most sensitive to temperature because the uptake of HNO3 and the accompanying tenfold increase in reactivity occur within 1 K.
Vortex wide satellite observations by MLS are used to constrain HCl loss rates in different winters. In the beginning of polar winter, the HCl loss rate can be assumed to be equivalent to ClONO2 loss. This allows to calculate the temperature needed for heterogeneous processing to match the observed loss rates and constrain initial HCl/ClONO2 partitioning.
High active chlorine concentrations were observed during a flight of M55 Geophysica on 7th March 2005 with backtrajectories indicating reactivation just 40 hours prior to the flight and temperatures around the PSC formation threshold.
Chemistry Simulations along these trajectories suggest that the observed levels of active chlorine are best explained by heterogeneous processing on cold binary aerosol, with the model results being most sensitive to temperature but insensitive to NAT microphysics.
Continuing the simulation along the trajectories until end of March shows the impact of such a late reactivation event on overall ozone depletion.