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The impact of mixing across the polar vortex edge on ozone loss estimates

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Methods of quantification of polar chemical ozone loss are investigated with respect to the impact of mixing across the vortex edge onto these estimates. Typically, mixing across the vortex edge is not considered by most common methods. We show for the winter 2002/03 that mixing across the vortex edge did occur and that it can be modeled accurately by the Chemical Lagrangian Model of the Stratosphere. Observations of inert tracers in-situ from HAGAR on the Geophysica aircraft and also remote from MIPAS (IMK) on ENVISAT can be reproduced well. The model is even able to reproduce a small vortex remnant that was isolated until June 2003 and was observed in-situ by a balloon-borne whole air sampler.

From this simulation, the impact of mixing across the vortex edge on ozone loss estimates is evaluated. The impact may be two-fold. (1) If the ozone loss rate is determined correctly, the time integration of the ozone loss must be corrected for the export of ozone-depleted air into mid latitudes. A neglect of this correction yields an overestimation of the vortex average column ozone loss by 39% in the winter 2002/03. (2) A continuous import of air masses with lower ozone mixing ratios can mimic enlarged ozone loss rates for the Vortex Average estimate, but also for the Match approach eventhough it aims to avoid air masses which are influenced by mixing.