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Modelling the Diurnal Variation of Lower Stratospheric ClO in the Arctic Vortex and Comparison with Airborne Observations

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The kinetics of the ClO dimer cycle plays a major role for ozone loss in the polar vortices in winter/spring. Our understanding of polar ozone loss and the diurnal variation of ClO and O3 rely on reaction-kinetics derived from laboratory studies, in particular with respect to the thermal equilibrium between ClO and Cl_2O_2 and the photolysis of Cl_2O_2. The aim of this study is to investigate the diurnal variation of modelled ClO in the Arctic lower stratosphere during winter/spring and to test the latest kinetics data which have become available from recent studies and the effects of their potential errors.

In this study, the ClO mixing ratio profiles from a photochemical model and observational data from an aircraft measurement have been compared. The ASUR (Airborne Submillimeter SIS Radiometer) instrument, operated on a FALCON airplane, detects thermal emission of ClO in the Arctic vortex. The project was a cooperation of the University of Bremen (Germany) and the Space Research Organization of Netherlands (SRON Groningen). The measurement flights were made from Kiruna, Sweden inside the Arctic vortex, during February and March 1996 and 1997. The model calculations were carried out with a photochemical box model (MISU1D) that calculates the diurnal variation of trace species in the middle atmosphere using radiative transfer and chemical reaction rate data. The rates and uncertainties from the latest laboratory measurements have been combined and the model results have been compared with the observations to evaluate the best combinations.