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On the ability of chemical transport models to simulate the vertical structure of the N_2O, NO_2 and HNO_3 species in the mid-latitude stratosphere

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Abstract. In this paper we study the impact of the modelling of N_2O on the simulation of NO_2 and HNO_3 by comparing in situ vertical profiles measured at mid-latitudes with the results of the Reprobus 3-D CTM (Three-dimensional Chemical Transport Model) computed with the kinetic parameters from the JPL recommendation in 2002. The analysis of the measured in situ profile of N_2O shows particular features indicating different air mass origins. The measured N_2O, NO_2 and HNO_3 profiles are not satisfyingly reproduced by the CTM when computed using the current 6-hourly ECMWF operational analysis. Improving the simulation of N_2O transport allows us to calculate quantities of NO_2 and HNO_3 in reasonable agreement with observations. This is achieved using 3-hourly winds obtained from ECMWF forecasts. The best agreement is obtained by constraining a one-dimensional version of the model with the observed N_2O. This study shows that the modelling of the NO_y partitioning with better accuracy relies at least on a correct simulation of N_2O and thus of total NO_y.

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