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Constraints on $J_{N_2O_5}$ from balloon-borne limb scanning measurements of NO_2 in the tropics

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The NO_x ozone cycle (NO_x = NO + NO_2) is of great importance for the budget of stratospheric ozone and in future may even become more important due to increasing stratospheric N_2O concentrations (Ravishankara et al., 2009). A regulating process for the amount of stratospheric NO_x and thus for the efficiency of the NO_x mediated ozone loss cycle is photolytic release of N_2O_5 at daytime since N_2O_5 acts as a nighttime reservoir gas for stratospheric NO_x radicals.
Observations of UV/vis scattered skylight by balloon-borne limb scanning spectrometry support the detection of time dependent trace gas and radical profiles, in particular of NO_2. Here we present balloon borne measurements of time dependent NO_2 profiles from the tropical stratosphere - taken at north-eastern Brazil (5° S, 43° W) in June 2005 - where excess stratospheric ozone is produced and transported to higher latitudes by the Brewer-Dobson circulation.
The photolysis rate of N_2O_5 – uncertain by a factor of 2 (JPL-2006) - is constrained from the comparison of the measured and modelled diurnal variation of NO_2. For the photochemical model initial conditions are based on our own observations of O_3 and NO_2, MIPAS-B measurements and on output of the 3-D SLIMCAT model. The kinetic and thermodynamic parameters and absorption cross-sections are taken from the JPL-2006 compilation (Sander et. al, 2006). Overall it is found that, the observed rate of diurnal NO_2 increase requires a N_2O_5 photolysis frequency at the upper limit of values possible according to the uncertainty range given by the JPL-2006 compilation. In conclusion it suggested that the NO_x mediated ozone loss in the tropical stratosphere is probably larger than assumed by many photochemical models, and in future may even relatively become more important.