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$_2$O 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$_2$O$_5$ at daytime since N$_2$O$_5$ 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$_2$O$_5$ - 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$_2$O$_5$ 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.