Atmos. Chem. Phys. Discuss., 3, S738–S740, 2003
www.atmos-chem-phys.org/acpd/3/S738/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Detailed modeling of mountain wave PSCs" *by* S. Fueglistaler et al.

S. Fueglistaler et al.

Received and published: 4 June 2003

General comments

We emphasize that the combination of nucleation rates and the temperature history of the air parcels leads to ice number densities in very good agreement with those obtained from an interpretation of the lidar data with the help of T-Matrix calculations. It is true that in many cases the final ice activation is close to 100 percent of the liquid droplets, and hence is relatively insensitive to errors in the ice nucleation rate. In fact, we did some sensitivity calculations where we arbitrarly varied the ice nucleation rate by one or two orders of magnitude. The resulting ice number densities did not significantly differ. Consequently, we do not claim to be able with this study to prove or reject the ice nucleation rates given by Koop et al. Rather, as stated in the beginning, we demonstrate that the combination of these rates and trajectories obtained from mesoscale modeling yields very accurate results, similar to earlier studies (e.g. Carslaw et al., Tsias et al.), which had to use fixed ice and NAT number densities and

Full Screen / Esc
Print Version
Interactive Discussion
Discussion Paper

manually adjusted trajectories.

Specific comments

All suggestions are incorporated into the revised manuscript. Suggestions/questions requiring a reply:

255/9 changed to: '... which slows the transfer of active chlorine into CLONO2 and hence further promotes ozone destruction ...'

262/6 changed to: The simulations were started every 24 hours for integration periods of 36 hours. The first 12 hours of each simulation were discarded before starting trajectory calculations (i.e. trajectories were calculated in the time window 12-36 hours of each simulation).

268/2-4 As stated, the ECMWF based simulation fails to produce both ice clouds. In addition, the second cloud is entirely missing in the ECMWF based simulation.

268/12 Yes, the presence of ice does matter, since it controls the water partial pressure over the surface of the particle, which in turn determines the HNO3 vapor pressure over NAT (the decreased water partial pressure requires higher HNO3 vapor pressure, i.e. leads to decreased SNAT).

269/2 In our model we assume the ice nucleation rate (dimension of inverse time) to be proportional to particle volume, similar to homogeneous classical nucleation. In our study we do not discuss the issue of nucleation mechanism itself, and we cannot contribute to the recent discussion of volume versus surface nucleation (Tabazadeh, J. Phys. Chem. A, 2002; and related discussion in ACPD: Tabazadeh, ACPD, 2003; Koop, ACPD, 2003).

269/10 In most cases of mountain wave induced PSC formation, the maximum cooling rates (of up to 50 K/h) occur while the temperatures are still above the ice frost point. Ice nucleation usually sets in only when the trajectories are approaching their maximum altitude, at a time when the cooling rates are again lower.

ACPD

3, S738–S740, 2003

273/16 added ’(not shown)’

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 253, 2003.