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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A condensed-mass advection based model for the simulation of liquid polar stratospheric clouds" *by* D. Lowe et al.

Anonymous Referee #2

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This paper presents results of a condensed-mass advection based model. It addresses an important problem of the community of the global atmospheric modelling when cloud/aerosol particles are involved. However, the conclusions of this paper are weak. Major revisions and even additional calculations are necessary to make this paper acceptable for ACP.

I want see the revised version before the final acceptance.

Major comments:

1) The major motivation of the authors were to derive the composition of STS at non-equilibrium conditions. The authors mentioned that higher HNO3 concentration could lead to NAT formation. A recent paper by Knopf et al (ACP, 2002) shows that the homogeneous nucleation rate from the liquid phase is much too low to explain the

number density of large NAT particles observed by Fahey et al. (Science, 2000). Thus, this makes the desire of the such treatment much weaker. The authors may stress the need of such model, maybe in other context. 2) For the implementation of MADVEC into a 3D-modle extra efforts (e.g. the proper parameterisation of the mountain wave activities) are required (see also remark 3). This should be stated clearly in MS.

3) This model shows the evolution of size distribution due to condensation/vaporization only. However, how can the particles be transported in a 3D-model is not discussed here. This is a crucial problem, in particular for the solid clouds (e.g. PSC-1a-enh and mountain-wave ice clouds), because the clouds could be very patchy and have strong number density gradient in space. How can one transport a PSC-clouds from one grid-box to another box with an affordable CPU time in 3D-models avoiding artificial numeric diffusion? The suitability of MADVEC model for 3D models depends strongly how this problem can be solved. This problem should be addressed in the MS.

4) The applicability of the MADVEC to mesoscale or global depends critical on the CPU-time required. This should be discussed in the MS. A summary of accuracy concerning numeric diffusion, composition, and CPU time expense of different schemes (e.g., simple Eulean forward integration, SVODE etc.) would to useful for the 3D community and increase the scientific output of the paper.

Minor comments:

Fig.4: The same colour bars for panel a) and b) should be used.

Fig.5: The maximum of the HNO3 wt% from MADVEC is about 4% lower than the Lagrangian solution. This disagreement is to high for the nucleation as it is a strong function of composition (in this case, the nucleation rate is too low anyhow). MADVEC underestimates the HNO3 content almost all the time (fig.4,5). This should be improved, or at least be understood.

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 689, 2002.