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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Stratospheric water vapour as tracer for vortex filamentation in the Arctic winter 2002/2003" *by* M. Müller et al.

Anonymous Referee #2

Received and published: 18 August 2003

Overall Evaluation

This paper provides an analysis of three water vapour profiles above Ny-Alesund, Spitsbergen. The key finding is a "bite-out" in the profile on 11 February 2003, where the sonde encountered the edge of the lower stratospheric vortex. The low water vapor (and low ozone) observed in the bite-out are attributed to a mid-latitudinal filament that is nicely simulated with high resolution particle advection calculations. The temperatures in the profile and in back trajectories are too high for the bite-out to be caused by PSC sedimentation. The results do not provide any strikingly new advances in science, but they do provide a clean, concise examination of sonde profiles, which will provide useful guidance for analysis of future profiles. I recommend below that the authors consider some minor additional analysis (see below), which would help support the conclusions being drawn and provide the reader with important additional information.

Individual Scientific Questions

In the introduction you state ”As water vapour is considered a long-lived tracer, its distribution provides insights into stratospheric dynamics and transport.” Can you be more specific regarding the conservative properties of water vapor? Where/when do you expect it to behave like a passive tracer? What is its approximate photochemical lifetime?

In section 2.1 you provide a nice summary of the Arctic winter 2002/2003. It would be more satisfying, however, if you could provide a few synoptic plots of geopotential height and/or potential vorticity to illustrate the vortex evolution. It would be particularly helpful to provide these maps for the sonde dates, in order to see how Spitzbergen was situated relative to the polar vortex.

For the analysis of the 17 January profile, do you know if there are any coincident data from HALOE and/or POAM that you could use for comparison?

In Figure 2, you might want to overlay the temperature from 17 January in the same way you did for H2O. This will help highlight the temperature differences along these profiles.

In Figure 2, can you explain why the H2O is much higher below 12 km on 11 February? Is this a significant feature?

In Figure 2, you might want to consider adding a profile of freezing temperature.

In Figure 3, it would be nice to have the vertical scale the same as in Figures 1 and 2, for easier visual comparison.

In the discussion of Figure 3, you mention that the ECMWF analyses show the large-scale vortex movement. It would be helpful to show those analyses here.

It would be helpful to do the MIMOSA calculations for one of the earlier profiles, too. Do those calculations show the sonde well inside the vortex edge? Contrasting the two

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Interactive Comment

cases would help bring home your main point.

Technical Corrections/Suggestions

For the reverse domain filling technique, you may also want to reference Sutton et al., J. Atmospheric Sciences, 1994.

Page 7, paragraph 3: I am not sure ”hauntingly” is an appropriate term here.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 4393, 2003.