

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

M. Müller et al.

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We thank reviewer #2 for his constructive comments which helped us to improve the manuscript. As we believe that the former presentation of the paper did not highlight the main results in the appropriate way, we changed the structure of the paper. For details please also refer to our response to Reviewer #1. Our response to the individual scientific questions is given below.

Individual Scientific Questions:

1. The main source (methane oxidation) and sink (photolysis by Lyman- α) for stratospheric water vapour are found in the upper stratosphere and mesosphere. Here we analyse the distribution of water vapour in the lower stratosphere, where its photochemical lifetime is on the order of years (Brasseur and Solomon, 1984), exceeding by far the timescale of the analysed transport processes. In the absence of condensation

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- or freezing processes, we therefore consider the properties of a long-lived tracer given.
- The text has been changed accordingly.
 - 2. We feel that adding a series of synoptic maps would overload the paper. Instead, we decided to insert a figure of the PV evolution above the station, which illustrates the evolution of the vortex throughout the winter and at the same time shows the location of the station relative to the vortex. A paragraph referring to this figure has been added.
 - 3. To our knowledge there are no HALOE or POAM data at northern high latitudes available for the given dates.
 - 4. We already added the frost-point temperature (see #6) and did not overlay the temperature profile of Jan. 17 in Figure 2 since the figure would have become too complex.
 - 5. On 11 February 2003, the tropopause is about 1 km higher (9.5 km) than on 17 January 2003 (8.7 km). The hygropause is found at a higher altitude as well.
 - 6. We added the measured frost-point temperature to Figure 1 and 2.
 - 7. Figure 3 has been changed, applying the same vertical scale as in Figures 1 and 2, now also using partial pressure for the O₃ measurements both by lidar and sonde.
 - 8. The large scale movement of the vortex is now highlighted by the PV evolution that is added as new Figure 1. (see above, #2)
 - 9. Additional plots of MIMOSA high-resolution calculations for earlier profiles do not seem appropriate to us, as the H₂O sondes detected air deep inside the vortex.

Technical Corrections / Suggestions:

1. The reference has been added.
2. The sentence has been changed.

References: Brasseur, G., S. Solomon : Aeronomy of the Middle Atmosphere. D.

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Reidel Publishing Company, Dordrecht, 1984.

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