

Interactive comment on “On the observation of mesospheric air inside the arctic stratospheric polar vortex in early 2003” by A. Engel et al.

A. Engel et al.

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The comments of the referees on the manuscript were very helpful. There was no major scientific questioning of our interpretation. However, the referees, in particular referee #1 made some very helpful suggestion on the structuring and presentation of the data and the discussion. This has led to some considerable restructuring of the manuscript, which is explained in details below. Further, four more figures have been added on demand of the referees and a comment posted by Rolf Müller. Also as a reaction to the reviewers comments three figures have been dropped.

Referee # 1 makes a few important suggestions on (1) missing references, (2) the model data intercomparison and (3) on the structure of the discussion in the paper.

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(1) The referee is correct in pointing out that these references should have been included. They have been added at the appropriate places (section 1, Introduction and section 4.4., Trajectory calculations). The reference by Rosenfield and Schoeberl has in addition been used for comparison with our calculations. We have pointed out that these calculations showed a lower fraction of tropical air masses in Arctic winters prior to 2002/2003.

(2) Concerning the model data intercomparison: we have included direct model-data intercomparison. As already pointed out by the referee, these are a little ambiguous due to the different mesospheric tracers. The direct comparison is now included in section 4.2. Figure 5 has been removed and instead individual intercomparisons for all flights have been included. This has led to some changes in the text (see also below) and also the fact that different mesospheric tracers will have different vertical structure has been pointed out at the end of section 2. The direct interpolation to the observations on March 6 also showed that the model and the observation give a consistent altitude range for the mesospheric layer (24-25 km, instead of 27 km for the model). This has been mentioned in the text (end of section 4.3).

(3) Concerning the structure of the paper the referee suggest being more concise, e.g. by removing redundancies in chapters 4.4 (I suppose 4.5. is meant) and 5.2, as well as 5.1. The referee also suggests separating the description of the instruments from the presentation of the data. Subsection 5.1. has been eliminated and only a few sentences have been left as an introduction to Section 5, summarising the consistency in the observations Chapter 4.5. has been considerably shortened and included in chapter 5.2 (now 5.1.). The new Subsection 5.1. has been renamed to “downward transport of mesospheric air” (instead of Comparison with model calculation and meteorological situation) and accordingly, chapter 4 has been renamed to “model calculations and data intercomparison” (instead of model calculations and meteorological situation). The instrument descriptions in chapter 3 have been shortened, giving only the most relevant information for each instrument, e.g. measurement technique, measured species, ver-

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tical resolution and calibration/error information. We believe that all this has lead to a more concise presentation of the data and the discussion as suggested by the referee. The scientific content of the paper has not been changed due to this restructuring.

Minor comments: 1. The title has been changed according to the reviewers suggestion. 2. SF6 like tracer has been added. 3. as all instruments have slightly different mesospheric tracers, we have decided to leave the presentation as is, but add a figure showing the downward propagation of the mesospheric air in section 5.1. As the former Figures 9 and 10 from section 4.5. have been removed, as well as the former Figure 5, the total number of figures has not been increased (with the exception that an additional Figure for the N2O-ozone correlations has been added as a reaction to a comment by R. Müller). 4. the figures have been replotted using a 5-35 km axis range.

Referee # 2 makes two suggestions: (1) to discuss the water vapour observations on the TRIPLE flight from March 6, and (2) to derive a mesospheric fraction from the model. Both suggestions are interesting. Unfortunately the water vapour measurements on March 6 failed during most part of the flight, so that no useful observations are available. The suggested use of KASIMA to predict the mesospheric fraction is unfortunately not possible, as an artificial mesospheric tracer would be needed for this. Such a tracer is not included in the model, so we can not estimate the mesospheric fraction directly from the model. Referee#2 also suggested adding a colour bar to Figure 5. This Figure has been removed due to the restructuring of the paper.

Further, there was a comment by Rolf Mueller suggesting, to include a plot of the N2O - ozone correlation. We have included such a plot (Figure 12) with a short discussion as subsection 5.3., although the plot is no too conclusive. We have indicated that a thorough discussion of the possible influence of chemistry vs. dynamics on the observed correlation would need a full chemistry model run.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 7457, 2005.

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