

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

Anonymous Referee #1

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This manuscript presents observations from three different balloon platforms that show the presence of mesospheric air inside the polar vortex in January and March 2003. Furthermore, these observations are used together with a model simulation to estimate the fraction of mesospheric air in the vortex. Quantifying the amount of mesospheric air inside the vortex is important for understanding / quantifying polar ozone loss, and this manuscript makes an important contribution to addressing this issue. I think this paper will be of interest to readers of ACPD and the contents are suitable for publication. However, several modifications are required before it can be published (see Specific Comments).

Specific Comments:

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1. There needs to be more references to other studies that have addressed some of the issues discussed here. For example:

Other groups have measured CO₂ and SF₆ and shown good agreement in age calculations outside the vortex (e.g. NASA ER2 and OMS platforms, e.g. Andrews et al. 2001) but differences inside the vortex (SOLVE) or vortex fragments (POLARIS measurements, see Waugh and Hall 2002). These measurements / studies need to be referenced.

The impact of mesospheric loss on age from SF₆ was I think first discussed in Hall and Waugh (1997), and I think this study should be referenced. There is also discussion on Waugh and Hall (2002).

With regards to the trajectory calculations in Section 4.3, you should reference Rosenfield and Schoeberl (2001).

2. A more detailed model-data comparison is needed, especially as the model is used in the estimation of fraction of mesospheric air.

Rather than just showing a height-latitude plot for March 6 you need to show vertical profiles for the different dates when there are measurements. Even if no SF₆ for some dates you could still compare low SF₆ with observed tracers of mesospheric air.

3. I think the discussion could be more concise in several places.

Most of discussion of the meteorological / dynamical conditions (sections 4.4 and 5.2) could be greatly reduced, making use of other papers that discuss this winter.

A lot of Sections 5.1 and 5.2 is just repeating what is said earlier (and in some cases repeated again in Conclusion section). I think these subsection could be greatly reduced, or even removed.

I think it might be better to separate the description of the instruments from the discussion of the actual measurements. Maybe the instruments could be described in an

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appendix, and leave just the observations in Section 3.

Minor Comments:

1. I think the title would be better if "On the observation" was replaced with "Observations".
2. When discussing the tracers in Reddman et al. in Section 4.1 I think it might help to make it clear that the tracers were all "SF6-like".
3. Add instruments that made the measurements in captions of figs 1 to 4. Combining figs 1,2 and 4 into 6 panel figure might make the downward movement of mesospheric air clearer.
4. Why do the profile plots show height from 0 to 40 km when measurements are between 10 and 30km. Similarly for mesospheric fraction in fig 11.

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

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