

## ***Interactive comment on “Quantifying transport into the Arctic lowermost stratosphere” by A. Werner et al.***

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This study uses in situ trace gas measurements in the polar region to derive the relative contribution of tropospheric and stratospheric air inside and outside the vortex to the composition of lowermost stratosphere air masses. The suite of measured long-lived trace gases is suitable for such a study and the results are quite interesting. There are inherent limitations to working with aircraft and balloon data and the authors do a nice job in explaining and dealing with the errors involved in the analysis. Although there are limitations, it is the high quality of the measurements that allows this unique kind of calculation to be performed. The topic of this study is relevant to ACPD and I recommend publication with consideration of the comments below.

Specific Comments:

S683

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Section 4.2: Since N<sub>2</sub>O was used to define the vortex and non-vortex data it would be useful to see a profile of N<sub>2</sub>O similar to Fig. 3 or refer to Fig. 7 in this section.

Section 6: It would be interesting to see the average profiles from Figs. 8 and 9 overlaid on each other to more clearly see the progression over the winter.

In 3 out of 4 cases shown the majority of tropospheric fractions above 370 K are negative. This seems to be a flag that you need to adjust your tropospheric boundary condition. You could either separate the boundary condition as a function of theta for all species as you did for H<sub>2</sub>O, or you could make an adjustment for all theta. Perhaps your latitudinal sampling in the troposphere wasn't sufficient to establish the boundary condition. I realize that you mention earlier the troposphere is assumed to be well mixed and the variations are small compared to the difference between the stratosphere and troposphere boundary conditions, but there is clearly something that needs to be adjusted to avoid all of the negative results.

Section 7: I was expecting a comparison of your results with the model studies that examined mixing of vortex air into the midlatitude stratosphere mentioned in the introduction. Have you done comparisons with model studies?

Detail Comments:

Pg. 1412, lines 2-7: You say the same thing just below this paragraph so it doesn't seem necessary here.

Pg. 1415, line 19: the "K" should be removed from "60 K ppb".

Pg. 1416, line 16: "exemplarily" should be removed.

Pg. 1420, line 3: This is an awkward sentence and I would suggest removing "As the tracer data were gathered" and begin with "In the vortex..."

Pg. 1425, line 7: "lead" should be "led".

Pg. 1429, line 10: "criterium" should be "criterion".

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Pg. 1429, line 12: How as the vortex edge located below 400K of 67N chosen?

Figures 8 and 9: It would be useful to use the same x-axis scale on all of the plots in order to more easily see the relative contributions from each region.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 1407, 2009.

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