

## ***Interactive comment on “Mesoscale fine structure of a tropopause fold over mountains” by Wolfgang Woiwode et al.***

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Review of “Mesoscale fine structure of a tropopause fold over mountains”

General comments:

This is an excellent paper, presenting new observations with very high vertical and horizontal resolution of a tropopause fold over the Alps. The observations obtained by the GLORIA spectrometer on the HALO aircraft yielded temperature, water vapor and ozone data as a function of distance along the flight path. The observations were particularly good because GLORIA viewed perpendicular to the flight direction, and nearly along the jet stream and the fold, so that the effects of horizontal smoothing were small, and very clear cross-sections across the jet stream were obtained. These

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were shown to agree with previous work on tropopause folds but provide much more detail because of the tracers of stratospheric and tropospheric air. The effects of mixing in and near the fold are clearly shown. The effects of gravity waves on mixing are also seen. They also showed that the ECMWF Integrated Forecast System (IFS) run at high resolution reproduced many of these features, but best agreement requires application of the GLORIA observational filter. The IFS did not reproduce some of the fine scale filaments observed, nor the gravity waves that appeared to facilitate mixing. The results are clearly and logically presented.

Specific scientific comments:

The title reflects the contents of the paper, and the abstract provides a complete summary. The methods are clearly spelled out, in clear and fluent English. Appropriate references are given to previous work. No parts of the paper should be eliminated. Some clarification is suggested in places.

Particular comments: p.1, l. 14; For those of us who do not immediately know which is the cyclonic or anticyclonic v side of the jet, at the initial mention, either here or in the text, please state which is north and south of the jet. This is done now, but should occur sooner. p. 5, l. 4; Explain what is meant by “linear limb observations”. p.6, l. 11; how are clouds detected and their effects removed? l. 23; clarify- is temperature retrieved as a function of pressure, then put on an altitude scale using IFS data, or something else? l. 25; Please comment on the use of these frequencies for the temperature retrieval; they are considerably higher than often used p.7, l. 13; what is the vertical coordinate? p.9, l. 26ff; The plots in Figure 2 are very interesting, but not intuitively obvious. It would be useful if the authors could provide more of a physical explanation of what they are showing. Is it that if there is more water vapor in the layer above the tangent layer, the retrieval over-corrects, putting more water vapor in that layer, and less in the tangent layer? Is it the result of the perturbation being narrower than the vertical weighting function? Or something elses? p. 19, l. 27ff; How are the perturbations defined? Perturbed relative to what? p.21, ll 1 ff; The tracer-tracer plots are interesting

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and appropriate Fig. 11a- difficult to make much out of the 3-D plot- is this primarily meant for people to look at online? l. 12: looks like H<sub>2</sub>O values < 310 K (red) are low, not enhanced; l. 24; looks like between 320 K and 340 K (green & blue), not higher l. 26; interpretation would be aided greatly if the location of a contour of the core of the jet stream winds were shown, as in Figs. 10c,d.

p. 23, l.28; As noted above, the figures seem to show 310 to 340 K.

Minor technical points:

p.1, l. 23: "used" not needed. p.3, l. 7; diagnostics applied l.16; all vertical viewing angles p. 4, l.13; "Admittedly" not needed p.6, l. 23. "each" not needed l. 27ff; Is "data" a plural word? Some say so, in which case data are or were p.8, l.18; within the microwindows used p. 10, l. 10; originate p. 13, l.13/14. In the period considered p. 15 l. 23; a gray line p.18, l.18; Fig. 8b,d l. 20; alleviated is not the right word; do you mean reproduced? p. 23, l.28; do you mean identified carefully? Conscientiously not the right word.

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