

***Interactive comment on “Refinements in the use of equivalent latitude for assimilating sporadic inhomogeneous stratospheric tracer observations, 2: Precise altitude-resolved information about transport of Pinatubo aerosol to very high latitude” by P. Good and J. Pyle***

**Anonymous Referee #2**

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General comments:

This paper presents an analysis of aerosol-derived tracer as a function of equivalent latitude and potential temperature, to examine a quasi-vertical profile of the tracer at the highest equivalent latitudes. This work constitutes a good, original contribution to the literature. The paper is well-organized; the authors do a good job of establishing their goal, showing how the most straightforward use of equivalent latitude is thwarted by the sizable errors, and then working around those errors to obtain their profile.

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There are a few points, however, which should be addressed, particularly in Section 3.1. I recommend publication with minor revisions.

Specific comments:

The authors describe the calculation of equivalent latitude by running their model between 380 to 520 K. But Figure 1 shows scatter plots of tracer vs equivalent latitude down to 350 K. Where do the equivalent latitudes below 380 K come from? Also, running the model isentropically for 5 days below 380 K may well be problematic because neglected diabatic effects may not be small at those levels.

In Section 3.1, how would the results be affected by a systematic altitude-dependent bias in one or more of the lidar stations, as is sometimes found?

Also in Section 3.1, it is stated that for  $vR$  above (below)  $vR(i)$ ,  $vR$  at 355 K is not large (can be large). Do they mean this in some kind of average sense? When I look at Figure 3, I see  $vR$  at 355 K ranging from 0.25 to 1.6 for small  $vR$  at 430, and  $vR$  at 355 ranging from 0.15 to 1.2 for large  $vR$  at 430. This does not seem to be a large enough difference to discriminate between the two cases.

In the next paragraph, it is mentioned that "near 355 K  $vR$  is lower at lower equivalent latitudes." But while this is clear in Figure 1 for equivalent latitudes less than 70, it is not at all clear for the equivalent latitudes greater than 70 which are being discussed here. Am I misinterpreting this?

In Section 3.2, what happens near theta values where two of the three methods of finding  $vR(h)$  overlap? Do the authors get similar answers?

Technical corrections:

p. 2, column 2, line 31: "The effects of water vapor uptake...was estimated..." Change "was" to "were".

p. 4, column 1, line 35 and following: fix the broken italics.

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p. 5, column 1, line 5: "above this potential temperature levels" should be "above these potential temperature levels"

p. 5, column 2, line 42: "vortex mid-down period" should be "vortex mix-down period"

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Interactive comment on Atmos. Chem. Phys. Discuss., 4, 667, 2004.

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