Atmos. Chem. Phys. Discuss., 4, S521–S524, 2004
www.atmos-chem-phys.org/acpd/4/S521/

Atmospheric Chemistry and Physics Discussions

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

P. Good and J. Pyle

Received and published: 15 April 2004

Again, we would like to thank the reviewer for his/her time and most useful comments.

———referee comment

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 some 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.

———author response

Indeed, the model was run below 380K - the typo in method description will be corrected. We agree that large errors in modelled equivalent latitude will arise from isentropic model transport at these low levels. Similar large equivalent latitude errors occur because the vortex becomes progressively much weaker, more disturbed and hence more difficult to model below about 475K. However, the analysis in the very low stratosphere was designed specifically with large equivalent latitude errors in mind, and therefore is based very heavily on the observed tracer.

———referee comment

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?

———author response

In order to address this question, the data were examined on a station by station basis. The clustering of points, as reported in section 3.1, can be seen clearly for the Ny-Aalesund data for days 40-80. Clearly, station-specific bias cannot explain this, and large equivalent latitude error remains as the likely reason. This point will be elaborated in a revised manuscript.

———referee comment

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.

———author response

ACPD

4, S521–S524, 2004

We argue that the distributions are different. The particular panel to which the reviewer refers (fig. 3zzz) is probably the least convincing, although it is not intended to stand on its own, and when the same plot is produced for Ny-Aalesund data only (as mentioned above), the clustering is very much clear. This will be reported in a revised manuscript.

———referee comment

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?

———author response

The intended argument is that we can say from Figure 1 that _true_ midlatitude air has lower vR than _true_ high latitude air. Clearly, for EQ5$>$70 the error in EQ5 compared to true equivalent latitude air is very high, and some _true_ midlatitude air is included in this region. However, since we have found that true midlatitude air has lower vR than high latitude air, then the maximum vR values at high EQ5 must be representative of high latitude air. It is quite possible that near 355K the very highest true equivalent latitudes have slightly lower vR than, say at true equivalent latitude 70 degrees. However, due to the strong horizontal mixing that appears likely in this region the difference is expected to be small; and in any case the error bars of the quoted result are large in this region. This will be clarified in a revised manuscript.

———referee comment

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?

———author response

The results from the two method do converge. The upper part of the error band does show some difference, but the largest estimated error of the two methods is plotted.

ACPD

4, S521–S524, 2004

Interactive Comment

That is, this point is included in the error estimates. This will be clarified in a revised manuscript.

The technical corrections will also be addressed.

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