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Interactive comment on “A global climatology of stratosphere-troposphere exchange using the ERA-interim dataset from 1979 to 2011” by B. Skerlak et al.

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The authors present a comprehensive global analysis of transport and exchange across the 2 pvu boundary (extratropics) and 380 K potential temperature surface (tropics) from ERA-Interim data. There are several new interesting results that require further attention, such as potential trends in the net transport direction between the troposphere and stratosphere. I would especially like to complement the authors on the quality of the figures in the paper. In general, I have some concerns and comments on the methods used in the paper that were not mentioned in the discussion. In addition, I think the paper would benefit from a reduced emphasis on the discussion of

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ozone fluxes given the limitations of such an analysis outlined directly in Section 4 and an increased emphasis on the overall transport characteristics given by the trajectory analysis. A bit more detail on the method itself, rather than leaving the reader to search in the cited papers, would also be helpful.

Page 11541, lines 14-16 I worry about the sensitivity of your transport calculations to holding the trajectory particle spacing fixed in pressure. I assume this was done for simple mass flux calculations. Since large amounts of TST are typically found in Rossby wavebreaking events that transport air horizontally from the tropical tropopause layer to the extratropical lower stratosphere near the subtropical jet, do you expect to have representative estimates of the transport when you are resolving the dynamics at scales much larger than your primary STT events? For example, the vertical resolution of your 30 hPa grid applied to latitudes poleward of 30 degrees is represented by the included figure. Transport associated with stratospheric intrusions in the middle and upper troposphere is resolved at vertical scales near 500 m, while horizontal transport between the TTL and extratropics is resolved at vertical scales between 1 and 2 km. Since the subtropical jet and tropopause break are typically near 35N, it seems that your 30 hPa grid would preferentially be resolving the horizontal transport at these levels and consequently at much lower vertical resolution. What is the sensitivity of your transport estimates to the vertical spacing used (i.e., even in altitude versus even in mass)? The distribution of potential temperatures for exchange events shown in Figure 10 would suggest that the sensitivity may be significant, especially when considering the net flux.

Page 11543, line 15 “every trajectory represents. . . 6.52×10^{11} kg of air” Is this really true for every trajectory? Isn't the particle vertical resolution 10 hPa from 30S to 30N and 30 hPa otherwise?

Page 11562, lines 24-27 The asymmetry in reduced fluxes between STT and TST suggests that the net flux may be nearer zero or has potentially reversed sign for $PV = \pm 3.5$ pvu. What is the PV value that most coincides with the lapse-rate tropopause?

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Many studies of in situ data have shown that the chemical changes (e.g., O₃ and CO) are largest in relative altitude to the lapse-rate tropopause (see L. L. Pan et al, JGR, 2004 and others). Because your methods require the use of some dynamical quantity (PV in this case), it may be more meaningful to identify the PV surface that represents the most likely boundary between tropospheric and stratospheric air for ERA-Interim. C. R. Homeyer & K. P. Bowman, JAS, 2013 have shown similar sensitivity in net transport for analyses of Rossby wave breaking events.

Figures 8 & 9 It may make more sense to shift the southern hemisphere annual cycle 6 months so that the seasonality is directly comparable to the northern hemisphere.

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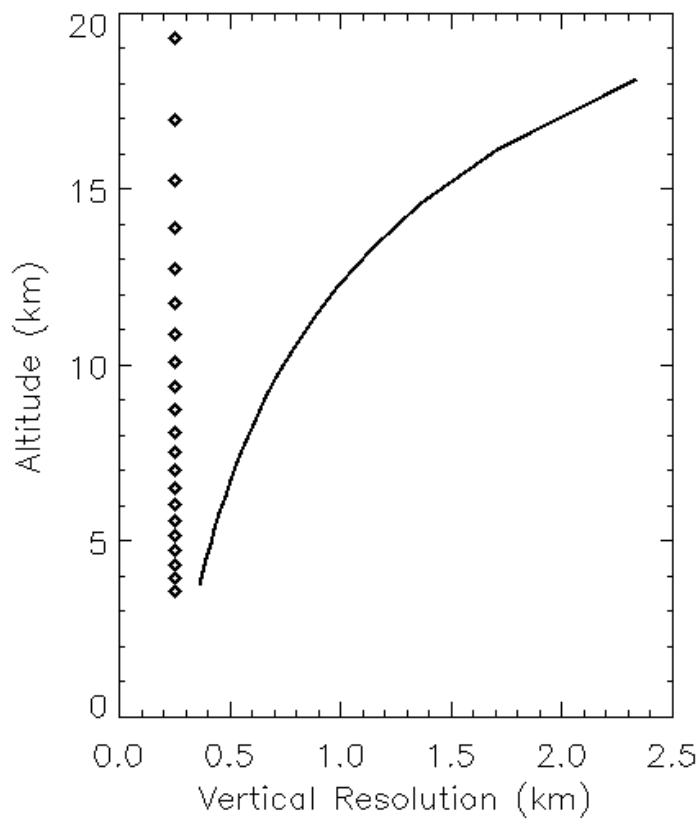
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Fig. 1. Trajectory vertical resolution

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