

Interactive comment on
**“Stratosphere-troposphere exchange from the
Lagrangian perspective: a case study and method
sensitivities” by M. S. Bourqui**

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This paper follows on the trajectory-based studies of stratosphere-troposphere exchange developed by Wernli and co-workers, looking at the sensitivity of estimated STE to various assumed parameters in the computation. It is basically a worthwhile study but there are a number of points that need addressing before the paper can be accepted. The most serious are:

a) there have been a number of other studies investigating the effects of model resolution; only that of Gray (2003) is referred to here. The conclusion that 1° resolution is the coarsest acceptable resolution to study STE in a model is not new, nor is the fact that the nature, as well as the magnitude of STE is different at 5 PVU to that at 2 PVU

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(which is no real surprise after all). Equally, the ‘important consequences for chemistry’ (i) and (ii) are obvious. The paper needs to relate its conclusions more clearly to previous work in this area and draw out what is really novel here.

b) I would like to see more discussion of the nature of TST across 2 PVU. Looking at Fig. 4, the overwhelming impression is of far more STT than TST, except for the region around the subtropical jetstream in (h) which is not referred to at all in the paper. Nevertheless, on p. 8 we are given (for the 4-day period) an overall mass exchange of 763 Gtonnes for STT and 554 Gtonnes for TST – they are in fact very close to one another. This presumably means there is a widespread, small TST everywhere outside the ‘streamer’. What is the physics of this? Is it real?

Minor points:

1. p. 2 col. 1 l. 10 ‘in the absence of clouds’
2. p. 2 col. 1 l. 7 here the trajectory method is described as type 2 yet it is type 3 in the para above.
3. p. 2 col. 2 l. 9 ‘found to be noisier’
4. p. 2 col. 2 last 4 lines ‘the model’s explicit advection, with a maximum. . . convection and less than this to parameterised. . . mixing. She showed. . .’
5. p. 3 caption to Fig. 2, ‘A trajectory’
6. p. 3 col. 1 l. 5. What do you mean by ‘derivation of PV’? Do you mean differentiation? Or do you mean interpolation/calculation of PV? I don’t think derivation is the right word.
7. p. 3 col. 1 l. 10 ‘they suggested filtering out.’
8. p. 3 col. 1 l. 12 ‘TST on the’

9. p. 3 col. 1 l. 14. 'within a range of residence times of x days' (state x)
10. p. 3 col. 1 l. 15 'study' rather than 'work'
11. p. 3. col. 1 l. 17 'in the absence'
12. p. 3 col. 1 last two sentences. I'm not really sure what these sentences mean. Is it 'They concluded that as the residence time decreased to zero in a system with no scale limitation the mass flux estimates became infinite, becoming completely dominated by infinitesimally brief exchanges. With finite data resolution, the fluxes were dominated by the smallest scales resolved'?
13. p. 3 col. 2 l. 12 'rapidly'
14. p. 3 col. 2 l. 6 'residence time 964;* on both sides of the tropopause (see schematic...)'
15. p. 6 col. 1 l. 4 'conservative'
16. p. 6 col. 1 l. 4 and 16. I don't think there's such a word as prolonged (not in my dictionary anyway). Extended is what you mean I think.
17. p. 6 col. 1 l. 19. The paper uses the term 'time period' many times. This is unnecessary – either 'time' or 'period' is sufficient. Here the word 'period' is preferable.
18. p. 6 col. 2 l. 9 'most of the irreversible deformation of the tropopause'
19. p. 6 col. 2 l. 1 'disappears'
20. p. 6 col. 2 l. 7. the term 'child intrusion' does not make sense
21. p. 9 caption to Fig. 9 'spatial'
22. p. 10 col. 1 l. 8 'troposphere'
23. p. 10 col. 2 para 3. One of the problems with this method of estimating STE is that the results are sensitive to the residence time, which is an arbitrary parameter.

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The paper does make this point clear, but in this paragraph it is claimed that ‘spurious events can be removed to a large extent by setting a residence time larger than 8 hours’. This conclusion is based on the convergence of the lines in Fig. 10, which I think should be explicitly pointed out in this paragraph: it is the first time I have seen such a clear demonstration of this effect.

24. p. 10 col. 2 last para. I have read this many times and am still not clear what it means, especially the last sentence.

25. p. 11 col. 1 l. 4 ‘similar’ not ‘dissimulated’

26. p. 11 col. 2 l. 2 ‘significantly’

27. p. 12 first sentence ‘...mass flux decreases monotonically with PV level, but the way the flux changes over time is clearly different at different heights’.

28. p. 12 col. 1 l. 6 ‘flatter’

29. p. 12 col. 1 para. 2. Why is the 4.5 PVU line in Fig. 12 anomalous?

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