

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

Anonymous Referee #1

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Review of 'Stratosphere-troposphere exchange from the Lagrangian perspective: a case study and method sensitivities' submitted to Atmospheric Chemistry and Physics discussions by M. S. Bourqui

General comments

In this paper the author uses trajectories applied to a case of a breakup of a stratospheric streamer of high PV to examine the sensitivity of cross-tropopause transport, diagnosed using this method, to key parameters. These parameters are data resolution, the residence time of the trajectories in the stratosphere or troposphere after crossing the tropopause and the definition of the tropopause. These results will be of value to those researchers performing future studies of cross-tropopause transport

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using a trajectory method. Some interesting details of the processes leading to exchange during the breakup of the streamer are also revealed although these are not fully explored.

The paper is well-written and the results interesting, generally useful and well-presented. I would personally like to see a more detailed analysis of the exchange processes occurring in this case although the author states this is beyond the scope of this paper. My one general concern regarding the usefulness of the results relates to the sensitivity of the cross-tropopause transport to data resolution. The author investigates this by degrading the original data to coarser resolution. In practice, of course, this is not done and what happens is that different studies use models of different resolution. The sensitivity to the use of degraded model data is not necessarily related to the sensitivity to the use of a coarser model. This caveat should be noted.

I recommend that the paper be published with minor corrections

Specific comments

p3250, l7: intrinsic parameters of methods - this is a bit vague

p3257, l4: please justify the use of the times chosen for the maximum transition time and residence time

p3257, l9: An increased temporal data resolution is mentioned relative to the Wernli and Bourqui paper - what was the temporal resolution of their data and what is the temporal resolution of the data in this study (stated on p3261, l5 but should also be included here) ?

p3258, l6: See paper by Griffiths, Thorpe, and Browning (2000) for more information on how a PV streamer can trigger convection on its leading edge.

p3258, l9: Sentence beginning 'Then, from 2 September...' doesn't appear to make sense due to the presence of 2 dates.

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p3258, I12: Note that the figures are not shown for 0Z on the 5th September

p3259, I5: Transport is related to a locally raised tropopause above cloud: (1) what is the evidence that the tropopause is raised - presumably the author is referring to the locally high theta on 2PVU shown in fig 3c ? (2) is the transport a result of resolved convection or due to erosion of the raised tropopause ? It is not clear whether the exchange referred to is STT or TST since a dipole appears to exist in the region of the cloud. Similarly, how does the 'thin tropospheric streamer' lead to transport ?

p3260, I28: It is stated that nearly no exchange events take place above the cloud. However, in fig 7 it looks as though TST is occurring above the cloud (at least there are several green lines).

p3261, I20: It is not clear to me why the degradation of the fields leads to large variability in w particularly in the troposphere. Can you add some more explanation.

p3262, I10: Can you prove that the spurious exchange events are a result of the smoothed tropopause and not the large variability in w discussed in section 4.1 ?

p3262, I18: I don't understand why there is one set of forward and one set of backward trajectories covering the time period and how they have been used. Please add some more explanation.

p3263, I20: what is 'normal' ?

section 4.2: Is the time used for the maximum transition time kept constant for these experiments at 6 h ?

p3264, I17: The author states that STT in the tip of the streamer occurs exclusively at levels below 4 PVU but it looks to me as though it is still occurring at 5 PVU (fig 13 h).

p3266, I20: while point (ii) may well be true it does not follow directly from the results of this study.

Technical corrections

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p3250, l6: put on -> put into

p3250, l6: remain on the sensitivities to methods intrinsic parameters -> remain in the sensitivities to the intrinsic parameters of methods

p3250, l23: earth's -> Earth's

p3254, l20: suggesting to filter out -> suggesting filtering out

p3254, l27: Don't start sentence with 'And'

p3255, l9: rapidly -> briefly (probably a better word)

p3258, l4: Septtember -> September

p3260, l17: Fig 6 should be fig 7 I think.

p3260, l24: cell relatively to -> cell relative to

p3261, l22: troposphere -> troposphere

p3262, l18: data resolutions -> data resolution

p3263, l13: residence time -> residence times

p3263, l17: fluxes with -> fluxes on

p3264, l7: along the time -> in time

p3264, l8 and l15: the synoptics -> the synoptic detail

p3264, l10: flater -> flatter

fig 3: grey scale is difficult to read and interpret (far too many grey shades)

fig 8: meaning of blue/green shading on lower boundary ? It might be useful to use the same projection as used in fig 7b

fig 9 caption: spacial -> spatial

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fig 12: too many different lines - very difficult to read. Are all of these necessary ?

General comment: There are several very short (even 1 sentence) paragraphs. These should be amalgamated with other paragraphs

References

Convective destabilization by a tropopause fold diagnosed using potential-vorticity inversion Griffiths M, Thorpe AJ, Browning KA QUARTERLY JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY 126 (562): 125-144 Part A JAN 2000

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