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Interactive comment on "Climatological features of stratospheric streamers in the FUB-CMAM with increased horizontal resolution" *by* K. Krüger et al.

Anonymous Referee #1

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———General comments

The paper "Climatological features of stratospheric streamers in the FUB-CMAM with increased horizontal resolution" by K.Krueger, U.Langematz, L.Grenfell and K.Labitzke assesses the occurrence of wintertime northern hemispheric stratospheric 'streamers' - large scale 'tounge-like' structures, drawn off from either the polar vortex or the tropics. The basic tool is an idealised passive tracer advected by a GCM. Streamers are detected using a new algorithm, which, usefully, separates polar vortex streamers from tropical-subtropical streamers. A streamer climatology as a function of time and location is shown, with stronger emphasis on tropical-subtropical streamers. Qualitative comparison with observed data and other streamer climatologies is made. The importance of such transport to climate studies is noted. Assessing such transport is interesting and highly relevant. I recommend publication after revisions addressing the following comments.

The paper tackles a very difficult area, and any new technique giving an alternative perspective is valuable. However, the validation of the detection method does need tightening up. The paper shows some interesting results for tropical streamers in particular, but could benefit from more focus. Components involved are: GCM validation (in terms of streamer simulation), streamer detection validation (tropical and/or polar), assessment of (tropical and/or polar) streamer climatology. Detection of polar streamers needs to be either investigated and discussed in rather more detail or, perhaps, left out. Also, the context of the paper within the literature needs more attention.

————Specific comments

(abstract, line 2) T42 is certainly not high resolution in terms of passive tracer transport studies, but is routine for chemical-transport studies, and global climate models are starting to approach this. Therefore, it can be said to be a resolution relevant to chemical and climate modelling.

(p.6794, l.6) It is not true to say that previous transport studies have neglected such features . Rather, the work is useful because it provides a new perspective on climatologies of such transport.

Below are some comments and suggestions regarding the method. It is not expected that all of the suggestions are carried out in detail, but some discussion in all cases is needed.

First, the authors say (abstract l 15) that their zonal anomaly method performs better in this study than two other methods. However, no results using the other methods with these model data are shown. Also, would it be possible to combine the methods somehow, for a more reliable detection (just some discussion here, perhaps)?

My impression from figure 4 is that there are an equal number of polar and tropical-subtropical streamers, but that the polar streamers are detected less readily. It could be argued that the polar streamers are weaker. However, it doesn't seem clear to what extent the method allows an objective comparison between the occurence of the two streamer types. This may be helped with a more rigorous calibration of the two streamer thresholds. However, it is probably better to focus on treating the two types separately.

Detection of polar streamers seems rather limited, largely, perhaps, by the use of the zonal mean. The authors already focus more on tropical streamer results, and it may be best to emphasise the tropical streamer results further. Reversible distortions of the polar vortex clearly strongly affect the zonal mean at upper mid latitudes, reducing zonal anomalies of polar streamers and increasing those of tropical streamers. The zonal anomaly field shows substantial structure inside the vortex (e.g. day 74). Indeed, in figure 3, day 69, a strong distortion of the vortex is flagged as a streamer. Figure 6 seems to imply that polar streamers are only found south of 30N. Figure 7 shows polar streamers occurring only before (the start of?) December, while the vortex breakup doesn't appear at all. This may be related to vortex distortion or detection calibration (see below). On the other hand, the results for tropical streamers seem much more convincing and show interesting structures.

The passive tracer initialised once a year on October 1. I wonder whether the meridional distribution of this tracer is sufficiently stable to use a constant threshold for streamer detection. This could cause the behaviour in figure 7 pointed out earlier. One option might be an on-going re-calibration. Try calculating equivalent latitude from the passive tracer. Then plot the passive tracer mixing ratio against it's equivalent latitude. If this (single valued) function changes substantially during the winter, some re-calibration of the tracer or streamer threshold might be needed, or at least more discussion of what the algorithm is actually detecting.

Regarding the problems with using the zonal mean in the vicinity of the vortex, it may

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make some sense to use equivalent latitude, this time calculated from PV (not from the passive tracer), as an alternative coordinate for averaging. This certainly has its own problems, but could at least make polar streamers much more detectable. It may make for a more convincing comparison between the occurrence of polar streamers at different altitudes (since the distortion of the polar vortex varies with altitude). An alternative might be to focus on the southern hemisphere, where the vortex is much more zonally symmetric.

Technical point: figures 3 and 4 show different latitude ranges, making them very hard to compare. Also, the numbers on the colour bars are rather small on most plots.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6789, 2004.

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Interactive Comment