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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying transport into the lowermost stratosphere using simultaneous in-situ measurements of SF_6 and CO_2" *by* H. Bönisch et al.

Anonymous Referee #2

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General comment:

The manuscript describes the seasonality of the mass balance and age distribution in lowermost stratosphere (LMS) based on SF6 and CO2 measurements during the SPURT campaigns. The paper is well written. The technique used and the results on the mass balance and transit time in the LMS are new. This paper makes a significant contribution to the stratosphere troposphere exchange topic, and I recommend this paper for publication subject to minor revisions.:

Minor points:

Recent studies have been carried out by Brioude et al. (2008) based on ozone and CO MOZAIC data and by Sawa et al. (2008) based on CO2 CONTRAIL data; on the extratropical tropopause layer, its vertical structure and seasonal cycles in the lowermost stratosphere. Sawa et al. (2008) have shown also seasonal variations of CO2 near the tropopause. Please include a reference of these works and discuss their relevance for your paper.

Brioude, J., J.-P. Cammas, O. R. Cooper, and P. Nedelec (2008), Characterization of the composition, structure, and seasonal variation of the mixing layer above the extratropical tropopause as revealed by MOZAIC measurements, J. Geophys. Res., 113, D00B01, doi:10.1029/2007JD009184.

Sawa, Y., T. Machida, and H. Matsueda (2008), Seasonal variations of CO2 near the tropopause observed by commercial aircraft, J. Geophys. Res., 113, D23301, doi:10.1029/2008JD010568.

p21231, line 6: "It is not only important to understand net fluxes across the tropopause but also net exchange rates ...". To me, "net fluxes across" and "net exchange rates" mean the same. I understand that you are talking about the STE net flux and STT and TST fluxes, but your sentence is a little bit confusing. you should say "net flux across the tropopause" and "exchange rates", or reword this sentence to make it clearer.

p21236, line 6: "... show monotonously increasing or decreasing mixing ratio X in the troposphere". you should add "with time"

p21237, line 11: "... negative values for gamma are sometimes derived". I would say that negative values are **always** derived for PV values lower than 4pvu and even 6pvu. line 17 and 18 you say that those negative values indicate the area and the extent where extratropical STE influences the LMS. I would say "predominantly influences" because this is not because your mean age class is positive that there are no negative data in your distribution. Furthermore I am doubtful that the subtropical jet is responsible for the negative values at a equivalent latitude north of say 50N in the lower part of

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the LMS (below of what you called the free LMS). The polar jet has a stronger impact in this region. You should also mention in your paper the influence of the polar jet below the free LMS (for instance p21238, line 6 to 10), and not exclusively the subtropical jet.

p21242 line 6 and 23: How sensitive are the results due to the thresholds that you are using here? I suggest to have a plot with the meridional variability of SF6 and CO2 at the surface.

p21242 line 16 to 18: "There the TST ... for the LMS". This sentence is misleading. You should reword your sentence and clearly say that you are excluding here the region of the LMS where the TST through the extratropical tropopause influence the composition.

figure 7: The missing data between figures 6 and 7 are probably the theta/equivalent latitude intervals where the assumption that the TST across the extratropical tropopause can be excluded is not valid. Please specify it in the text. Otherwise, explain why there are missing data between figure 6 and 7.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 21229, 2008.