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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the structural changes in the Brewer-Dobson circulation after 2000" *by* H. Bönisch et al.

Anonymous Referee #3

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This manuscript presents an analysis of tracer observations and trajectories, and provides evidence there has been an increase in advection and mixing in the lower branch of the stratospheric B-D circulation after 2000, but little change in the upper branch. The evidence presented in not unambiguous, as there is uncertainty involved with the interpretation of each diagnostic. However, the fact that several independent diagnostics appear consistent with the hypothesized circulation change provides strong evidence for such a change.

The manuscript is generally well written, and presents a potentially an important result that will be of interest to a large number of readers of ACP. I think it will be suitable for publication in ACP once the issues described below are addressed.

MAJOR COMMENTS

1. Why are only Canadian ozone sondes shown? The changes shown could be due, for example, to a change in wave structure of the downwelling and no necessarily an increase in mean extratropical downwelling. To say anything about the change in extratropical downwelling linked to changes in tropical upwelling you need to use ozone sondes from all longitudes.

2. Why is there no change in the PDFs for May shown in fig 3? This needs to be discussed.

Also, what is the interannual variability in the PDFs within the pre-2000 or post-2000 periods, i.e., are the differences in PDFs shown much larger than differences within the pre or post-2000 periods.

3. The authors need to be careful with there comments regarding changes in middle atmosphere age. The comments on lines 10-14 on pg 28413 and lines 20-27 on pg 28415 are not consistent. In former it is stated that as residual circulation for upper branch is unchanged then mean age in middle stratosphere should not change, whereas the latter (correctly) acknowledges that an increase in tropical-extratropical mixing in the lower stratosphere will make the middle stratosphere mean age older (if no other changes). The former text needs to be changed so mixing is mentioned. The latter text also needs to be changed as ". . .regardless of change in the strength .." (line 26) is not correct.

MINOR COMMENTS

1. I think the second sentence of the abstract "For this purpose . . ." can be removed. All this information is in the following sentences.

2. In figures 2 and 6 the labels say "STREAM" and "SPURT" with individual years for each panel, but captions say "pre-2000" and data from several different campaigns. Which is it? Labels and captions should be consistent.

3. Figure 5 and 6 need to be swapped.

4. I think it would be very helpful for the reader if a figure was included showing the difference in trajectories for 45-60N and 60-90N trajectories, i.e. showing former are shallower than the latter. Even if in Birner and Bonisch (2000) it is needed here for completeness and to make this paper self-complete.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 28399, 2010.