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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 #1

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General:
The paper presents a very comprehensive analysis of the the change of the Brower-Dobson circulation (BDC) after the year 2000. The strength of this paper is that this analysis is mainly based on experimental data. Another important point is the decomposition of the BDC into two branches that seems to agree more with the experimental data (mean age + tracer-tracer correlation) This well-written paper discusses all important aspects of the proposed interpretation. Thus, I would like to recommend this paper for publishing in ACP with a one major point, and some minor points listed below.

Major point:

- The authors postulate that after the year 2000 not only the downwelling from the

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stratosphere into the lowermost stratosphere increased (higher ozone in Fig 2 below 100 hPa) but, in addition, the 2-way isentropic transport from the tropics into the lowermost stratosphere has intensified. Fig 4 discusses these isentropic pathways of transport, but some information are still missed. Where does this isentropic transport occur? - below or above the subtropical jet ? The plotted isentropes (dotted line) do not have any numbers of their potential temperature values. So it is important to know if these isentropes are in the range 310-330 K (exchange mainly below the subtropical jet) or in the range 370-410 K (exchange mainly above the jet). Here also some more explanation about the pathway: "in-mixing of tropospheric air" (above or below the jet) would be desirable. This is important, because Fig. 4 provides the key explanation of the processes which changed after the year 2000.

Minor points:

- Introduction, L 10-15
  Maybe the authors should also state that the residual circulation, i.e. the transport of mass is driven by the velocity fields (or its representation in the model) and the tracer transport, i.e. the BDC is additionally driven by mixing that strongly depends on the horizontal and vertical gradients of such tracers.

- Section 3.3, L 14
  Discussion of the climatological slope equilibrium is not necessary at this place. Maybe you should remove this sentence.

- Section 3.3, L. 15
  Stratospheric character of air is defined by high O3 and low N2O. This is easier to understand than "flatter gradients". Maybe you want to reformulate this paragraph.

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- p. 28412, L. 8
  “to further this hypothesis ” - ???
- Section 5, L. 25
  “stratospheric circulation” - please replace it by BDC, i.e. please follow your original definitions..
- Section 5, L. 8
  “enhanced isentropic mixing” - following the author’s definition of the BDC, it is not clear, if the postulated isentropic transport after the year 2000 is due to enhanced advective isentropic transport from the tropics into the lowermost stratosphere (i.e. advective isentropic transport without mixing) or due to enhanced 2-way transport of the tracers (mixing). Here some clarification would be desirable. b

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