

Review of “Structural changes in the shallow and transition branch of the Brewer-Dobson circulation induced by El Nino” by Diallo et al.

General Comments:

This paper investigates the influences of ENSO on lower stratospheric ozone distribution and BDC strength using a chemical transport model and satellite observations. The ENSO-induced variability in the BDC is thoroughly studied with detailed analysis of the mean age of air, age spectrum, residual circulation, and residual circulation transit time. The authors argue that ENSO causes a structural change of the lower stratospheric BDC, with an increase of the shallow branch and a decrease of the transition branch. Overall the paper is well written. There are some very interesting results. I recommend publication after the authors address my comments.

Specific Comments:

1. The major conclusion of the paper is that ENSO induces structural changes in the BDC. This conclusion needs to be quantified. I suggest that the authors calculate changes in the strength of the transition and shallow branches using the definitions of Lin and Fu (2013).
2. Page 8, line 27-32: These are very interesting results. However, the explanation is not complete. One can also argue that, from the Lagrangian view, an increased downwelling in the extratropics will lead to a decrease of the mean age there, because it takes less time for an air parcel to reach the extratropics. Indeed, many studies have shown that an enhanced downwelling due to global warming is associated with mean age decrease in the extratropics. I am very interested in why the mean age responses to ENSO differ from its responses to global warming.
3. Page 9, line 14-17: Quantify the changes in the transition and shallow branches. See my comment 1.
4. Page 9, line 17-20: Please explain what do you mean by “the upward shift of the strengthening shallow branch”.
5. Page 11, line 10-21: The authors appear to suggest that the positive EP flux divergence anomalies near the tropopause are due to the equatorward and upward shift of the jet. Please explain in more detail.
6. Page 11, last paragraph: Is it possible to examine ENSO induced changes in gravity wave drag?