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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Is our dynamical understanding of the circulation changes associated with the Antarctic ozone hole sensitive to the choice of reanalysis dataset?" *by* Andrew Orr et al.

Anonymous Referee #2

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The study examines differences among four reanalyses in the representation of the circulation response to the ozone hole in Austral spring and summer. The results show overall good consistency in the circulation trends, slightly worse in the Eliassen-Palm flux divergence and eddy heat and momentum fluxes. The CFSR reanalysis is shown to diverge most from the other three reanalyses.

The paper is well written and results are consistent with previous works, and a valuable contribution to S-RIP activity. Nevertheless, I consider that the following comments should be addressed before publication.

General comments:

- The paper would be more complete if all terms in the momentum balance (Eq. 1) were evaluated. As mentioned in the discussion with reference to Orr et al. 2012, the balance is mainly between the Coriolis torque and the wave drag terms. Therefore, including these additional terms would provide interesting information for the S-RIP activity regarding the representation of the residual circulation trends in response to the ozone hole across reanalyses, as well as non-resolved waves and the role of assimilation increments (included in the residual).

- In the Data Section, it would be helpful to discuss which reanalyses assimilate ozone observations into the model, that is, if the radiative code 'sees' the ozone hole and therefore the described feedbacks are captured in the model, or if in contrast the response is artificially forced by the assimilation increments. This is only briefly mentioned in the discussion (L377-378). Based on your results, is this an important factor?

- Statistical significance of the trends is not discussed anywhere in the paper. A statistical analysis should be added, not only about the trend significance, but also on the significance of the differences among reanalyses.

Specific comments:

- L27: what is the justification for using the quasi-geostrophic version of the EP flux?

- 133-134: It is fine to show only the fluxes, since they contain the information that you want to discuss. However I find the argument given here not satisfactory, because theta(p) is likely changing substantially due to the lower stratospheric cooling, so it could be important for the divergence (and I assume the full term is used to calculate it).

- L235: alternating stripes are also seen in the temperature trends (Fig. A1), although at different levels. I wonder if these indicate a more fundamental issue with vertical model levels or assimilation. Are these features described in previous S-RIP papers? -

L264-265: “persistent negative values from December to February,” except in November at tropopause levels, as you describe briefly in L300-301. Since this is a robust feature, I believe it should be discussed a bit more. Note that there is some spread among reanalyses in the location and strength of these positive momentum flux trends.

- L403-404: but there are stripes in temperature trends (see comment on L235)

Technical corrections:

- CFSR is misspelled (CSFR) in several occasions throughout the paper

- L164: easterly winds → easterly wind trends

- L242: overbar missing over v’T’

- L261: add (i.e. poleward momentum transfer) after SH to avoid confusion when comparing to your results.

- L270: upward → upward-propagating?

-L272: fluxes → flux

- L335: exhibit missing an ‘i’

- L398: “It is found that,” (add comma)

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