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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Drivers of hemispheric differences in return dates of mid-latitude stratospheric ozone to historical levels" *by* H. Garny et al.

Anonymous Referee #1

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The paper by Garny et al. describes, or better attributes, the drivers of ozone return dates. In doing so it tries to explain the obvious asymmetry in hemispheric ozone return dates, with northern hemispheric return dates being earlier. The paper argues that the hemispheric asymmetry in the Brewer-Dobson circulation (BDC) alone is not enough to explain the modelled behaviour and argues for important chemical changes. This is an important point to be made. I conclude that the paper is a well written contribution suitable for publication in ACP. However, I would like to ask the authors some questions and hope that by receiving answers to those questions the paper will improve further:

Is all the statistical detail necessary? In the beginning a long argument is developed,

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that basically just says that it doesn't matter for the general hemispheric asymmetry how return dates are defined. For the sake of readability and having more space for the main point (chemistry matters), I would recommend to shorten this section and to put the details in an appendix.

What is the role of a possible tropopause height trend? Here, I have to admit, I got slightly confused. The authors state the importance of the ozone trend in the lowermost stratosphere (e.g. 32839, line 27). I am not sure how this would be reflected in the terms of their budget equation [2]. Certainly an increase/decrease in tropopause height could be linked to a general decrease/increase in partial column ozone, even though it would be neither direct transport nor change in chemistry (it would be more a question of which chemical regime is seen but what part of the atmosphere). More explanation here would be helpful for the reader.

What happens to water vapour? Water vapour, undergoing microphysical change and being sensitive to temperature, could change as well. Again, transport would not need to change much, but water vapour could change due to cold point temperature changes, with consequences for the chemistry. This term would presumably be reflected in the diagnosed chemical change?

What is the role of simple tropospheric chemistry schemes? Are the schemes too simple for a conclusive assessment? Please explain possible caveats.

Answering the questions above will strengthen the main message of the paper, namely that there is more to the asymmetry than BDC changes.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 32825, 2012.

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