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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivities of modelled water vapour in the lower stratosphere: temperature uncertainty, effects of horizontal transport and small-scale mixing" *by* Liubov Poshyvailo et al.

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We thank P. J. Nowack for the helpful comment. We give a point-by-point reply below, where the reviewer comments are repeated in italics. The positions of the corrected sentences in the revised version are noted in the brackets, and the revised text is also given in the quotation marks point-by-point below.

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Discussion paper

Specific Comments

1. *The authors discuss transport and feedback processes that modulate stratospheric water vapour changes and the related uncertainties. Could the authors discuss the potential importance of ozone in this context both for the seasonal cycle and climate change projections...*

   Thank you for this suggestion. Although this paper focusses on processes controlling stratospheric H2O, we added a brief discussion on stratospheric ozone (p3, L21).

   "...Furthermore, it has been pointed out that the coupling between ozone, the tropospheric circulation, and climate variability plays an important role in climate change (Nowack et al., 2017). Recent studies have shown that stratospheric ozone changes may cause an increase in global mean surface warming, mostly induced by changes in long-wave radiative feedbacks due to the tropical LS ozone and related stratospheric H2O and cirrus cloud changes (e.g., Nowack et al., 2015; Dietmüller et al., 2014). Seasonal variations of LS ozone lead to a magnification of the seasonal temperature cycle in the tropics (Fueglistaler et al., 2011). Investigation of these additional effects of stratospheric ozone is an important topic of future research focussed on stratospheric H2O feedbacks..."

2. *Could the authors extend their discussion to include the implications of their transport and small-scale mixing work for trace gases more generally, in particular for the distribution of ozone in the TTL, which will feedback onto stratospheric water vapour?*

   Thank you for this question. It is answered partially above. As an ozone-focused analysis is beyond the scope of this study, we do not think that it is necessary to extend the discussion of the transport and small-scale mixing effects to other trace gases more generally (as the paper is focused on stratospheric H2O). An assessment of feedbacks from ozone on H2O is unfortunately not feasible in a

pure transport model like CLaMS. We are working on coupling CLaMS into the climate model EMAC to enable such analysis, but this development is beyond the scope of this paper.

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