

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-142

Anonymous Referee #1

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Referee comment on "Interhemispheric differences of mesosphere–lower thermosphere winds and tides investigated from three whole-atmosphere models and meteor radar observations" by Gunter Stober et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-142-RC1>, 2021

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This study compares model simulations with meteor radar (MR) observations. It presents the first systematic investigation of interhemispheric differences of mean winds and atmospheric tides at conjugate latitudes from observations and comprehensive models applying a unified diagnostic. It is a much needed study. While I appreciate the heroic effort of the authors, I am troubled by the lack of similarity between the model simulations described here and the MR observations. Previous studies - as properly discussed in this manuscript - revealed a much closer match between MR data and NAVGEM-HA. I am troubled by how badly the models are doing here.

The authors discuss the different behavior of the gravity wave drag parameterization in these models, arguing that the mean circulation is different to partially explain the differences, I believe. I don't disagree in general, however such discrepancies seem to point to a fundamental flaw in these models: the lack of observations at MLT altitudes. Isn't that the take-home-message of this study?

Moreover, some of the models use atmospheric specifications (like MERRA): what is the time cadence of these atmospheric specifications? Typically these data are provided 6-hourly, which would not resolve semidiurnal variability, and in such case the comparison is between observations and the model's own climatology. In the same spirit, what is the nudging time scale? A long time scale would prevent the model to be tightly associated with the atmospheric analysis.

Specific comments:

Page 3, bottom: Why McCormack et al. (2015). That's a QBO paper. I think you want to use McCormack et al. (2017) as in the rest of the manuscript.

Figure 3 and similar figures. The authors really need to add contours: the color palette has a very large dynamic range and for the reader it is impossible to discern contours, especially when the largest values are at the edges of the panels and the vast majority of the figure is a bland uniform color. Also, I think would it help explaining the figures (and for us the readers, understanding it) if one hemisphere (say the SH) is rotate by 6 months, so that the same season is always in the middle.

Page 10, middle. Why is it expected that conjugate latitudes see almost the same behavior?