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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A Tropospheric Emission Spectrometer HDO/H_2O retrieval simulator for climate models" *by* R. D. Field et al.

Anonymous Referee #1

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Review

R. D. Field and colleagues present in their manuscript a novel approach for comparing the isotopic composition of water vapor retrieved from the Aura Tropospheric Emission Spectrometer (TES) with results from isotope-enabled atmospheric model (AGCM) simulations. Their results are based on TES isotope profiles retrieved for tropical regions (15°S - 15°N) during the period 2006-2009 and an AGCM simulation using the GISS ModelE in nudged mode, covering the same period. The authors compare in detail the TES data with raw model output, as well as improvements to the simulation results based on the application of either the direct instrument operator or by applying an alternative new "categorical" approach. The latter takes into account that real atmospheric conditions during a specific retrieval time interval and the corresponding

atmospheric model conditions might be different, even for a nudged simulation.

In my opinion the authors present a very good and interesting study on this subject, and I highly recommend a publication of the manuscript in ACP. The newly developed categorical approach for the comparison of satellite data with isotope-enabled AGCM results is an innovative idea to the research field of water isotope modelling, trying to improve the comparison of global climate model results with available satellite products. The presented results appear robust and are surely of great interest to the wider scientific community.

After reading the manuscript, several questions came immediately on my mind: (1) Why are the improvements by the categorical substantial less convincing over land than over ocean? (2) Why does the categorical approach yield rather poor results if applied for extra-tropical regions? (3) How strongly will the GISSE results with the categorical approach change if model results from a free (non-nudged) simulation are used? (4) How well will the categorical approach work for other isotope-enabled AGCMs? The authors have briefly addressed more or less all of these questions in the manuscript, but a more detailed discussion of any of these topics would be welcomed and even further improve the paper. However, I realize that such detailed discussion might require new extensive analyses or even a complete new set of isotope simulations, beyond the original scope of this study. Therefor I do not ask for such extension before publication but would highly welcome it if one or several of these questions are addressed in some more detail in the final version of this paper.

Minor suggestions / corrections: none

- page 13845, line 6: delete first "in" after "regions" - page 13846, first paragraph: The results for T_s (Fig. 11g-j) should be explained here, too - Fig. 11 and Fig. 13 are too small

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