

Interactive  
Comment

## ***Interactive comment on “A Tropospheric Emission Spectrometer HDO/H<sub>2</sub>O retrieval simulator for climate models” by R. D. Field et al.***

### **Anonymous Referee #2**

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### Summary

The authors describe a method how to compare satellite observations, in particular TES, to model output (NASA GISS ModelE) for tropical observations between 2006 and 2009. The basic new idea is a categorized approach that maps only retrieval results and model results that exist under the same pre-defined meteorological parameters.

In the idea of a categorized filter is good. The true value of this paper is its general potential for similar studies, therefore it should be published but it has to be made somewhat clearer in order to unlock the full potential for other applications.

The manuscript however has some issues I would like to adress.

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## General remarks

The manuscript very often refers to "high quality" retrievals, but they are never defined. What exactly do you consider a "high quality" retrieval? On p6 l22 onwards you refer to the "sensitivity" of the retrieval.

The observational data stems from TES, therefore it would be helpful to have brief description of the instrument.

The paper only addresses TES or in general nadir looking instruments, that should be made clear somewhere as not everyone knows what TES is.

Specific remarks/questions p6 l6: The "unit" of volume mixing ratio usually is ppm/ppb. Mole fraction is not a concentration. The unit of concentration is something related to volume (molar concentration, number concentration etc.). Which of the quantities do you mean on p6 l6?

p6 l22: Are the references also true for the particular dimensions that are used in the paper?

p7 l7: Why do you use 825-510 hPa as borders?

p7 l11: What is lower retrieval quality?

p8 l21: How large are the errors on the two quantities in the respective figures? Have you fitted the correlations including the errors of the individual quantities?

p8 l22: I cannot take "low quality points" or high-temperature points from the pictures.

p9 l11: I don't understand this sentence. Is there a global measure for scatter? Is the reader supposed to know about the scatter of TES? Please be more specific here i.e. add explanation, appendix or reference.

p12 l15: Here we learn suddenly that there is a "TES simulator" in the model. Please explain how it works or give a reference to a description.

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p14 I1-I2: How do you calculate the mean retrieval quality? What is a mean Averaging Kernel? Please explain how you average Averaging Kernels.

p14 Sec. 5.2: I did not get a good impression how the categories are justified. The explanations here are a little bit bottom-up because you show the effects of boundaries of categories on the Averaging Kernels. But I am sure there were considerations to size the categories independently from their Averaging Kernel relations. Otherwise it could be assumed that you solely tuned your retrieval (which for sure was not the motivation for this study).

p17 Sec. 5.2: Another question in this section is how the number of remaining TES observations is related to the kind of categories you are using? What is the total number of TES observations?

p20 Sec. 6.1: After reading this section I still could not answer what really causes the improvement? The "resolution" of the quantities that are categorized is downsized. Is using categories then not just a kind of additional smoothing?

p25 Sec. 6.1: The discussion is a little weak. Because from the colored overview plots it is actually hard to judge where there are significant differences between the figures. This could be quantified better by shown residual plots (as done for section 6.3)

p21 I23: What is the accuracy of TES dD? I think it should be around 3% (according to Wordens 2011 paper), so I would guess the uncertainty should be between 3 and 30 permil. Thus, discussing differences of 1 permil sounds useless to me.

p24 Sec. 6.3: How were the quantities used for categorization detected in the TES product? Does TES provide a CF product? If so that should be stated somewhere (or I missed it)

p25 Sec. 7: The general importance for other species should be emphasized more strongly, the benefit for the dD fields is to my opinion very limited although maybe important.

## Typos

p 5, l13: replace "modeled" with "model" ? p18, l11: remove "in" ? p21 l1-l2: I don't understand the sentence beginning with "The changes ...". Probably it could be re-phrased? p23 l7: "... we examine degreee to...", not a sentence?

## Figures

No comments, only size could be improved.

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Interactive comment on Atmos. Chem. Phys. Discuss., 12, 13827, 2012.

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