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Atmospheric Measurement Techniques Discussions

Interactive comment on "Improvement in tropospheric moisture retrievals from VIIRS through the use of infrared absorption bands constructed from VIIRS and CrIS data fusion" *by* E. Eva Borbas et al.

Anonymous Referee #2

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The manuscript titled: "1. Improvement in tropospheric moisture retrievals from VIIRS through the use of infrared absorption bands constructed from VIIRS and CrIS data fusion" by E. Borbas et al. reads well, the methodology is sound and the results are clearly explained. I strongly suggest that this manuscript is accepted for publication, pending minor revisions outlined below.

To make the manuscript science question more urgent, I would like to suggest that the authors added more text in the introduction to describe why this data fusion product is important. For example, could the authors say a few more words on the need for such a

data fusion product rather than just using water vapor estimates from the CrIS sensor? Can they provide a reference to similar existing products from MODIS in support of the applicability and/or user request of this product? The author could simply add a few sentences on the benefit of TPW estimates at a high spatial resolution (750m) versus the coarser spatial resolution of the CrIS sensor and state why high spatial resolution TPW is important for end- users' applications. Continuity of the MODIS data record is also important, but the authors only mention it in the conclusion remarks. It would be useful to state it upfront, in the introduction section as well. This is a minor addition but would make the paper a lot more relevant in the framework of TPW near real time or long-term applications.

Page 2, line 2. "estimates" should replace "determination" Page 3, line 2: a definition of "split-windows" could help non-expert readers. Page 3, line 2: what is a k-d tree search algorithm?

Was the data fusion technique applied to clear sky only pixels or all-sky scenes? Page 4, line 10 says: "the scene must be high confidence clear" Is it just the way the validation was done, that is a clear-sky only validation? Same question for the scan angles: "must be less than 50 degrees". Or is it because the data fusion technique only applies to clear-sky, less then 50 degrees pixels?

Figure 2 (a) and (b). What do these differences mean? Can the author provide a comparison, on the same figures, with respect to the instrument noise of the VIIRS and MODIS instrument?

Page 8, line 3: This sentence: "A clear sky regression relationship is established between TPW and VIIRS IR window brightness temperatures (BTs) and the NUCAPS TPW soundings calculated from a global training radiosonde-based profile data set." might not be entirely not clear. What is the training ensemble, what are the predictors?

Page 8, line 5. Can the author provide more description on the use of the surface emissivity database, when they state: "A high spatial resolution surface emissivity database

(Borbas et al, 2018) is used to help differentiate surface emission and atmospheric moisture absorption."

Page 16, line 10: "CO2 absorption IR spectral bands" is this part of the sentence necessary to the extent of moisture retrieval products?

A general comment about Figure 6. The VIIRS+CrIS product improves significantly over the VIIRS only and VIIRS+NUCAPS, in terms of both mean and sdv when compared to the MODIS product. Can the authors explain the impact of this improvement in terms of continuity of the data record. Are there specificities requirements? This remark would strengthen the value of figure 6 and, more importantly, the very final conclusion remark.

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