Atmospheric
Measurement
Techniques
Discussions

Interactive comment on "CloudSat-constrained cloud ice water path and cloud top height retrievals from MHS 157 and 183.3 GHz radiances" by J. Gong and D. L. Wu

Anonymous Referee #2

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The approach to retrieving IWP from operational microwave sensors is innovative. This paper should be published after some revising. The authors show in a convincing way that the new IWP product is likely to be much more accurate or at least more similar to a CloudSat measurement than the existing NOAA operational IWP product. I am assuming of coarse that the CloudSat ice measurement is the best and most accurate available. The idea that the authors have exploited is using CloudSat ice measurements co-located with MHS (NOAA-18) cloud induced radiance measurements to establish monotonic relationships between ice water path and measured radiances. In effect the CloudSat and co-located MHS radiance correlations are being used in lieu of

a radiative transfer model and serve as a training set in a neural network sense. The authors find that in addition to IWP, there is also a correlation with cloud top height. Therefore in effect they train on these two variables. The authors demonstrate that the new data set potentially will be more useful for some applications than either CloudSat or the NOAA product and the end result will simulate in an imaging sort of way, what CloudSat might provide if it could measure swaths. The major issue with the paper is that as presented, it is a demonstration of an approach as opposed to description of a scientific product.

These are some things that need to be addressed if this approach were to be used to produce a scientifically useful data set.

1) the product needs to have estimates of uncertainties. I think two simple things that could be done here is to include CloudSat's estimate of 40% plus the scatter of a correlation function derived from the MHS/IWP scatter plots taking into account the cloud top dependence. This would be a minimum error budget but it is a starting place.

2) IWP (or more specifically pIWP) needs to be defined, that is where does the column integration start.

3) The cloud top height product needs to be dropped from the title as in the current form it is mostly a parameter used to improve the IWP retrieval. Respect what is said in line 13 page 8208.

4) Is this a product that will be produced for public use. If so it probably should only have data from +/- 30 degrees because the paper states that the retrieval is not good for higher latitudes.

Minor comments:

8189 line 15 assumption –> assumptions 8195 line 4 (after sec 2.1.2) change to to into 8196 line 12 (sec 2.1.3) statistically to statistical 8197 line 5 (sec 2.1.3) readily to ready 8197 line 16 the pdf peak would still be broadened by radiance noise right? 8201 line

17 showed to shown 8202 line 23 For a given channel TAB is the same... As what? 8202 line 22 I would say beneath/below rather than behind 8206 line 2 rests –> rest 8206 line 20 delete hour 8207 line 16 I think the term slightly is optimistic given that the disagreement approaches a factor of two. 8207 line 27 Maybe the noise level is set too high if the algorithm is detecting features at the sub noise level. 8208 lines 7–10. If the Ht is off by 5 km would that adversely affect the IWP retrieval. 8209 line 5 The day night difference is not so obvious to me in the figure. But this might be expected because the day night sampling times of the CloudSat orbit are very poor for observing the temporal behavior of tropical land convection. 8209 line 20 change to maritime continent 8210 line 26 change 0K to 273 K or 0C. 8213 line 15 adviced to advised 8214 line 5 change still has issues in to is not accurate for. 8214 line 17 a statement saying we found our results closer to CloudSat IWP, closer than what, the NOAA product? 8214 line 18 change substituting with replacing. 8216 line 15 I would replace corridendum with errors.

Figure 7. Where CloudSat measures IWP below the MHS IWP I would color white rather than black so it does not contrast with the MHS measurement, but keep a thin black cross to show the measurement track. I would also say Cuba is the island to the left of the plot. Figure 10 I would remove the 1:1 line as it has no physical relevance here. I found it impossible to distinguish the assortment of black symbols from each other.