

Interactive comment on “Improved Water Vapour retrieval from AMSU-B/MHS in polar regions” by Arantxa M. Triana-Gómez et al.

Anonymous Referee #2

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This paper expands on previous work of creating a TWV retrieval in the Arctic by adding some improvements and extending from AMSU-B to MHS. I find this paper sufficient for publication after the following comments are addressed.

General Comments

It's unclear to me which platforms of MHS and AMSU-B you are using in this analysis. On Page 3, line 17 you only mention NOAA16, NOAA17, NOAA18, and the Metop (both A and B?) satellites. Are those the only platforms you're using? What about NOAA15 (AMSU-B) and NOAA19 (MHS)? When evaluating your retrieval in Section 3, you mention using an overlap period of 2008-2009, so are you combining all the MHS and AMSU-B platforms together? What about potential differences among the similar sensors? While the MHS sensors are fairly similar to one another, the AMSU-B

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sensors have been shown to have very significant calibration differences (see for example, Chung et al, 2013: "Intercalibrating microwave satellite observations for monitoring long-term variations in upper- and midtropospheric water vapor" and Moradi et al, 2018: "Radiometric correction of observations from microwave humidity sounders"). It would be helpful to include a description of where the AMSU-B/MHS data are from and if there are any calibration corrections or intercalibration applied. As shown in the papers I previously listed, NOAA15 and NOAA16 show some significant calibration issues in the 183 GHz channels later in life, so the 2008-2009 time range selected for Section 3 would be impacted, unless you can show that the calibration differences between the sensors do not matter for your retrieval.

Also in regards to the AMSU-B/MHS dataset, it would be nice to see a better description of the data availability and the instrument characteristics. You have the frequencies listed in Table 1, but you don't reference this table until late in the text when it would be helpful to know these details earlier as you are referencing channel numbers. Also, it would be helpful to include a plot or table showing data availability of the instruments. You mention using an overlap year of 2008-2009 in Section 3, but an overlap of which platforms? Without prior knowledge of the sensors this wouldn't make sense. Showing the period of time each sensor was active would help with this.

Specific Comments

Page 6, line 26. "The worst slope... unexpectedly small amount of data". I'm confused about this statement. According to the table, December does not have the lowest number of data points, so it doesn't seem appropriate to say this lowest correlation may be related to the number of data points. And why is the number of data points "unexpected"? It's not clear to me why you say that.

In Figure 8, it appears that you do get a lot of overlap between the AMSRE and AMSU retrievals for July, while in Figure 7 the case that you show has no overlap. It was a little confusing to go from your statement on Page 7, line 26 saying "in summer the overlap

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area is zero" and just a few sentences later you show overlap in the summer in Figure 8. Did you apply the ice cloud mask to Figure 7 and that's why there's no overlap? I realize that Figure 7 is just a day and a different year, but it might be better to show a case where there is some overlap just to be more consistent with Figure 8. Also, it appears in Figure 8 that there are double the number of overlap points in the summer as in the winter (left column) which would also seem to contradict Figure 7.

Page 7, lines 22 and 31. In line 22 you say that the upper limit is 15 kg/m^2 , but then in line 31 you say the upper limit is 7 kg/m^2 . Which one is it?

Technical Corrections

Define AMSU-B and MHS the first time they are used.

Please include the references currently marked with a "?" on Page 6, line 10 and Page 7, line 10.

Page 6, line 15. Do you mean $+/-7$ instead of $+/-1$? Channel 20 is $183+/-7 \text{ GHz}$.

Page 7, line 25. "red area" - should say "orange".

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