

Comments to the paper by Triana-Gomez et al.

The retrieval of water vapour in polar regions is on the one hand highly challenging and on the other hand of high interest for various reasons, among others, due to the highly sensitive response of at least the Arctic to climate change. Thus, the overall topic and objectives of the paper are highly relevant. Retrieval improvements and enhanced applicability are presented and evaluated. Thus, the paper fits into the scope of AMT. However, in my view point the paper requires a few substantial improvements.

From my view perspective the following major points need to be addressed:

1) Section 2.6 introduces one of the new features of the retrieval. Unfortunately references are not properly linked or missing. But even when available it is likely not possible for me to understand the filtering method. I think this method needs to be explained in more detail. I further propose to show spatial maps which display the impact of the mask for one or two days in ,e.g., January and/or July. The objective is to showcase the impact of the screening in product space, other approaches for this are welcome.

It would be very helpful to explicitly mention the conditions (TCWV threshold, surface type) when the retrieval can be applied in, e.g., section 2.5 (i.e., extend the last sentence of section 2.3).

Section 2 introduces a switch between retrievals at 7 kg/m² and an upper application limit of 15 kg/m². However, figs 1 and 8 exhibit features at 6 kg/m² and figs 1 and 3 values above 15 kg/m². Figure 1 also shows that the majority of values in summer are around and above 15 kg/m². Please clarify this (seeming) contradiction.

2) It is clear that the availability of ground truth data hampers the evaluation of TWV in the Arctic. However, three GRUAN, a few more GUAN and maybe other WMO stations are within the area of interest (and were partly used for retrieval development). I can imagine that data from some stations might exhibit too large values even in winter. Nevertheless, I propose to assess the utilisation of radiosonde data from these sources for evaluation of MHS and AMSU-B over a common period and given sufficient collocations use it in addition to N-ICE data. The joint evaluation of AMSU-B and MHS and the application of the new ice cloud masking using ground-based or in-situ data is currently lacking but would strongly support one of the main objectives of the paper.

3) To me, the current presentation of evaluation results requires rephrasing: I am not a validation expert for the polar regions. However, the interpretation of evaluation results/performances as “good” seems to go too far. I propose to not interpret the results this way and just summarise the results (which might be termed as indicative of successful application to MHS and improvements). Alternatively, a brief summary of existing results from other evaluation efforts in the Arctic can be provided. Given superior quality such statements might be adequate. Depending on results from 1) a successful application to MHS and an improvement via ice cloud masking might have been proven as well.

I don't think that the terminology "benchmark" is adequate for a satellite based TWV product in the Arctic. Please speak of "comparisons" instead.

4) The paper requires careful cross-reading for various reasons. Among them are: partly units are not provided, a few references are not properly linked or missing and various formulations don't seem to be correct. Some of the latter are mentioned below. I am not a native speaker and propose that a native speaker is cross-reading the paper.

In addition I have the following minor comments, partly linked to the comments above:

#) The evaluation results exhibit features caused by changes between retrieval algorithms. A brief discussion on expected impacts of reprocessed products would be adequate. E.g., the application of thresholds can easily lead to temporal and spatial inhomogeneities. I propose that the team can find a more physical solution than the one mentioned in the conclusions to overcome this issue. I recommend to reformulate such potential future plans.

#) Page 1, line 17: Overall TWV increases due to increases in temperature. I propose to rephrase accordingly.

#) p 2, l4: Usually a frozen retrieval is applied consistently. However, various other factors are important in this context as well. Please rephrase, i.e., delete "analysis method" and add others, e.g., instrument degradation.

#) p2, l23: Please delete "successfully" and briefly mention the results (i.e., quality indicators as used in this paper).

#) p2, l28-29: Please cross-read.

#) p3, l14, l16, 17: Please delete "will" and remove definition of abbreviation here. Please mention Metop-A and Metop-B explicitly.

#) Section 2.2: Please mention briefly how the two retrievals are defined (or give reference to Appendix).

#) Section 2.5: A brief discussion of where - in TWV space - these transitions occur in a climatological sense would be helpful.

#) Section 2.6: Various references are missing (i.e., appear as "?"). Please provide them.

#) I propose to change the order of sections 2.5 and 2.4.

#) p6, l26: "unexpectedly small" – other months have only half of the amount of data. Maybe the feature has other reasons. Please explain.

#) p6, l29, l30: Please provide unit for RMSD and delete "really".

#) Section 3, last paragraph: In addition to 3) please mention a systematic high bias plus fairly large outliers.

#) Would it be better to have two sections: the first paragraph could be section 5 on first discussions towards full spatial coverage? I am not sure if the second paragraph is needed. At least it needs to be rephrased.

#) p7, l19: It seems to me that “artefacts to be removed” are not discussed subsequently. Please rephrase.

#) Abstract, conclusions: please note 3).

#) p8, l11+12: please remove this sentence.

#) p8, l14: It has not been proven yet if a stable time series can be generated. Please rephrase accordingly.

#) Fig 6: Are the large areas of values close to 0 kg/m² realistic? Please adapt color scale such that structures in summer months can be seen.

#) Fig. 8: Can you explain the feature at ~3.5 kg/m² in the top right panel? Please define the solid and dashed lines in the caption.