

Interactive comment on “The Advanced Infra-Red WATER Vapour Estimator (AIRWAVE) version 2: algorithm evolution, dataset description and performance improvements” by E. Castelli et al.

Anonymous Referee #1

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General Comments

This paper outlines updates made to the AIRWAVE algorithm that exploit the dual view of the ATSR series of IR radiometers to retrieve TCWV using the split window technique. The authors present seasonal maps of TCWV and present results from inter-comparisons with an established SSM/I TCWV product and ARSA radiosondes. The general comments were written after completing the specific and technical comments. When reviewing the results section the reader is redirected to a previous paper by the same group from 2018 for comparison of results. After downloading Papandrea et al. (2018) it becomes immediately apparent that the 2 manuscripts are very similar in lay-

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out and appearance. The results from the earlier manuscript have practically identical figures, in the same order, with the only difference being Papandrea et al. (2018) validates the version 1 product whereas this study uses the new version 2 data. This study fails to show enough independence from the previously published work to warrant a new publication at this stage. Also, missing from the analysis/discussion is a quantification of the improvements between version 1 and 2 of the algorithm. Overall the study is of value due to the legacy of the ATSR series, and the FCDR the radiances represent. I would recommend this for publication only after all the issues that I have highlighted are addressed.

Specific Comments

1. Introduction lines 24-39: You mention microwave and near-infrared sensors, but what about water vapour from infrared sensors? TCWV estimates using the split window technique have been done with HIRS, AVHRR and MODIS to my knowledge. There is also no mention of challenges of ocean vs. land retrievals using IR window channels. What are the benefits of using the ATSR series?
2. Introduction line 42: Quantify 'general good quality' from previous assessment of version 1.
3. Section 2.1: Equation 1 it is unclear how λ_1 & λ_2 are being used here. Is it referring to the 10.8 and 12 micron channels? How is it being used in the superscript notation? What is being multiplied with the optical depths? Also what is F ? Further clarity is needed here.
4. Section 2.1 Line 96: Can you state the accuracy? Has this already been shown with AIRWAVE-v1?
5. Section 2.1 Line 136: Do the reported effects have an equal impact on retrieval precision for scan angles in the swath?
6. Section 2.2 line 156: So what year do you use and why?

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7. Section 2.2 line 165: Why do you use ECMWF SSTs instead of the ARC/ESA CCI SST data products which are from the same instruments?
8. Section 3 line 194: Do you also retrieve TCWV over lakes?
9. Section 3 line 198: Are the uncertainties aggregated to the 0.25x0.25 grid? If so how are they propagated?
10. Figures 1-4: Too many sub-figures with replication of information. These should be combined into a single figure, removing either the 1b, 2b, 3b and 4b plots or the standard deviation maps to allow the reader to compare them side-by-side.
11. Section 3 line 223: Is this the RSS or HOAPS SSM/I product?
12. Section 3 line 234: Figure 7 is introduced before figure 6. Also you switch between Fig and Figure - please be consistent.
13. Figure 5: There is approximately 3 orders of magnitude more collocations with SSM/I than there are with ARSA. What impact does this have on the reported biases? Also the legends have different labels, the right-hand figure has bias while the left-hand figure says mean. Which is it? Ideally these should also be labelled a) and b).
14. Figure 6: If using colour filled regions that sit on top of one another then the alpha value needs to be lowered to add transparency so that both regions can be seen. Alternatively replace one with error bars.
15. Section 3 line 250: Do you require the reader to physically compare the table from Papandrea et al. 2018 with table 2 in this paper? From looking at the publication there is no table 2 but a table 1 and is this paper the validation of AIRWAVE-v1? This should be added to the discussion section if you want to make this comparison and discuss the improvements rather make the reader search them out.
16. Section 4: This section seems very empty especially as results from what assume to be the AIRWAVE-v1 product were only published earlier this year. There is a lack of

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quantified improvements in the algorithm discussed or shown, especially as this is key to the title of the paper. Reads like a summary at best.

Technical Comments

1. Abstract line 1: First sentence doesn't read well. Suggested change to: "Total Column Water Vapour (TCWV) is a key atmospheric variable which is generally evaluated at global scales through the use of satellite data."
2. Introduction line 19: Remove the word 'the' after 'Actually,'
3. Introduction line 20: Full stop after Allen et al (2014) reference, begin new sentence with 'For this reason, ...'
4. Introduction line 44: Incorrect spelling: 'thesee' (1 to many 'e')
5. The AIRWAVE v2 line 55: Delete the 'general' from 'general high quality'
6. The AIRWAVE v2 lines 55-63: You switch between AIRWAVE-v1, AIRWAVEv1 and v1
7. Section 2.1: Inconsistency in how AIRWAVE is referenced between v1 and v2 throughout section.
8. Section 2.1 Lines 95-96: 'is envisaged' suggests an aspirational future outcome. If this was done in AIRWAVE-v1 then it should be known whether this is true. The 2 sentences don not read well as the second sentence states that the known linear dependence allows for accurate retrievals. This is a little confusing to read, needs rewording.
9. Section 3 Line 192-193: Inconsistency in how AIRWAVE is referenced, here it is AIRWAVE V2 rather than AIRWAVE-v2 or V2. Need to settle on a single style.
10. Section 3 line 201: Same as above but now you use AIRWAVEv2
11. Section 3 line 224: DMSP already defined in Introduction

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12. Section 3 line 239: incorrect spelling: 'radiosoundes' (no 'u')

13. Introduction & section 3: Acronym SSMI should be SSM/I.

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