Review of Lindstrot et al. (2014) “A Global Climatology of Total Columnar Water Vapour from SSM/I and MERIS”

General Comments

Lindstrot et al. describe the imputs and construction of a new total column water vapour dataset derived from MERIS and SSM/I spanning 2003-2008. MERIS covers the cloud-free land and SSM/I the oceans, in the forenoon period only since daylight is required for the MERIS retrieval. The approach is novel because MERIS has not typically been combined with SSM/I. The authors detail the retrieval of TCWV from each sensor.

Some additional details about the retrievals and linkages to other sensors and work are required to fulfill the standards of ESSD. With a timespan of only six years (with the potential to add four more up to 2012), it is debatable whether the article should titled “A Global Climatology”, it could just as well be called “A Global Demonstration…”. The use of only one MERIS sensor in cloud-free conditions results in 50% or more of the land not being sampled on any given day. The authors need to place the work into the framework of other similar datasets, and no mention is ever made of the similar NASA MODIS sensor which is on two spacecraft with a longer time period, and the related AIRS water vapor products dating back to 2002. Similarly, there are several SSM/I-only datasets, so the introduction of a somewhat new retrieval method was not needed, but probably doesn’t harm the results. The MERIS component of the work is the novel and innovative component. In the future, a unified dataset using all of these sensors is a worthwhile objective of the community.

The work is of high quality, and especially the MERIS portion could be an input to future datasets using more instrumentation. The data is gridded and no advanced spatial fusion (e.g. kriging) is used. The paper represents a solid advance once the authors provide some clarifications listed in my specific comments. I view this paper as a proof-of-concept and demonstration rather than a complete climatology. The paper is well-written and generally clear, I recommend it for publication in ESSD after the minor revisions below.

Specific Comments

P 61 L 9: Omit “in recent years”, state the specific years. Also, the work was published over six years ago so is not extremely recent.

P 61 L22: “also referred to as TCWV”. Note that there are too many terms / acronyms for this variable in the field (TCWV, TPW, IPW, IWV, PWV, IPWV… –- TPW itself gets 139 hits in the the AMS journal search engine). I would add a sentence to say that this variable goes by many names in the literature, with a few acronyms to help future researchers search.

P 61 L21: I disagree that accurate measurements of TCWV are needed. They are great and helpful, but for water vapour feedback the profile, especially at upper levels, is important. You could have drying at low levels and moistening at high levels which would enhance feedback under less TCWV.

P 62 L12: Omit foreseen to be extended into 2020s and 2030s. This is very speculative. You could mention the successful launch on Feb 27 of the GPM core sensor, GMI is quite SSM/I-like.

P 64 L 8: How much (if any) orbital drift occurred with ENVISAT?

Section 2.1 should mention the quite similar MODIS instrument, I was quite surprised to see no reference in the paper.

Section 2.2 should cite:

Sapiano, Mathew RP, et al. "Toward an intercalibrated fundamental climate data record of the SSM/I sensors." Geoscience and Remote Sensing, IEEE Transactions on 51.3 (2013): 1492-1503.

Berg, Wesley, et al. "Improved geolocation and Earth incidence angle information for a fundamental climate data record of the SSM/I sensors." Geoscience and Remote Sensing, IEEE Transactions on 51.3 (2013): 1504-1513.

P 65 1st para: Use the word "nominal" before the altitude and zenith angle. The works cited above discuss variability and its impact on TCWV retrievals.

P 65 L17: Add new sentence "Data is available at http://...".

P 65 L20: All references pretty old. Mention the two works above, and:

Elsaesser, Gregory S., and Christian D. Kummerow. "Toward a fully parametric retrieval of the nonraining parameters over the global oceans." Journal of Applied Meteorology & Climatology 47.6 (2008).

P 66 L6: Elaborate further on what "almost all" means.

P 66 L24: What is the source / resolution of surface pressure? Is it static or dynamic?

P 67 1st Para: Has there been any independent validation of the cloud mask? I found this not compelling. A reference would help, or create a map of your cloud frequency from your processing. For instance, are aerosols sometimes being typed as water clouds?

P 67 L6: What is the justification for the 0.2 threshold? Do your results change significantly if it's changed?

P 67 L23: Again, more detail on the source of the surface pressure data. What is the resolution mismatch between MERIS and the data used? Is this a static surface pressure, or does it change?

P 68 L1: More details about the "pre-defined threshold". Does it change spatially or seasonally?

L7 "aerosol optical depth" and other variables. Again, do these vary in time or space? How are the uncertainties you used in your retrieval found? This is quite weak.

Section 3.2:

I found this section not compelling. It could just reference the earlier method and be very short, or you could go into detail to describe your new retrieval. I found it to be in the middle and not particularly satisfying. For the application here, I think any existing SSM/I record would work to show the merged product. It left me confused as to whether you used Deblonde, 2001 or just used the ideas from it.

I was left with the question – why did the group modify this SSM/I retrieval, they could have just downloaded widely used retrievals. The "standard" SSM/I portion of the paper left me with more questions, while the new MERIS part seemed better described.

P 68 L15: "is based on". So is it or isn't it this retrieval?

P 69 L3: Where is your covariance matrix from?

P69 L6: Uses ERA-I as background information – What is the time period used? Morning only? What are these climatological averages, what time period, resolution and where are they from?

There is no mention of how precipitation and ice are screened or detected.

P 69 L14: Did you sample or average the MERIS retrievals to get to 0.05 degree resolution? Also, replace spatial resolution is 0.5 to "was chosen to be 0.5".

P 69 L 23: What is the drift in ECT during these years? Sapiano et al have this figure.

P 72 L 13: "can exceed 10%". Does this imply your cloud screen is failing (see comment above about cloud screen).

P 73 L2: I suggest omitting "The MERIS retrieval…high accuracy and precision". This is very user dependent. Ground-based GPS is much more accurate for instance.

P 73 L13: Fig 5. Would be easier to understand if it just had MERIS / GUAN matchups, can you redo this?

P 73 L11: Is set to 0.1. How reasonable is this assumption? AOT can vary downwind of source regions such as Africa in the Atlantic and east of Asia.

P 75 L21: Please remove the "furthermore, …" sentence. There are significant cloud / clear sampling biases which affect the MERIS portion. For instance, consider the movement of the ITCZ over Africa. Much sampling in some months, none in others.

P 76 L4: I disagree with the process studies claim. This dataset looks to be mainly useful for monthly means. From Fig. 1, it appears over half of land is missed each day. This would make it difficult to track moisture plumes over land.

P 76 L10: Rather than rely on SSM/I, mention other conical MW instruments like GPM core. Again, what about combining MODIS into this record?

Fig 3: Why is MERIS uncertainty over S. America so high? Is this because of missed clouds, or the dark background?

Fig 4: Explicitly define the colors. Saying “low” and “high” is not precise.

Fig 5: What time / space mathing criteria were used?

Fig 7: What is the date / time of this pass?

Fig 8: This is an interesting result.

Technical Corrections

P 62 L8: revise to “open ocean and for assimilating”…

P 63 L13: Define DUE

P 69 L 17. Can omit sentence “Note that…”, you just said it above.

P 72 L 8: remove “Exemplarily”, incorrect use of this word.

P 74 L3: signifant typo

Fig 1 Caption: Remove “Exemplary”