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## Reply on RC1

Robin van der Schalie et al.

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Author comment on "Characterizing natural variability in complex hydrological systems using passive microwave-based climate data records: a case study for the Okavango Delta" by Robin van der Schalie et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-637-AC1>, 2022

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Dear anonymous referee #1,

Many thanks for your efforts in reviewing the paper, we are pleased to read the positive and constructive response. Below we will reply to the minor comments, either by clarifying our choices or by providing a plan to resolve issues in the revision.

Kind Regards,

The authors

Minor comments:

*Line 143 : indicate millions of m<sup>3</sup> instead of Mm<sup>3</sup> (or E6 m<sup>3</sup>). Best would be to indicate also the mean annual river discharge. I guess this is around 300 m<sup>3</sup>/s.*

Thank you for the advice, in the revision we will adjust the text according to state "millions of m<sup>3</sup>" and add that this is per year to put it in the right temporal perspective. That would indeed mean ~300 m<sup>3</sup>/s.

*Line 177: Explain why only descending TB are used in this study.*

For passive microwave retrievals (e.g. the soil moisture, land surface temperature and vegetation optical depth) the night time retrievals are of higher quality (e.g. Owe et al., 2008; Van der Schalie et al., 2021). This is caused by the thermal equilibrium during nighttime and the model assumption that the vegetation temperature is equal to that of the land surface temperature. This is not achieved during daytime, which in reality has a much higher variability over time (e.g minutes to hours). This is reflected back in the data quality, being more noisy. Especially as we include TRMM in the analysis, which does not have a stable local overpass time due to its non-polar orbit. Also, because of the timescale of the evaluation being monthly/seasonal, the daytime is not necessary to reach the goal of the study. We will clarify this better in the revised manuscript.

*Line 184: Indicate the AMSR-2 orbital hours (Asc/Desc), same than AMSR-E ?*

That is correct, AMSR2 and AMSR-E have similar overpass times. This will be clarified in the new revision of the manuscript.

*Line 192: Isn't any local overpass of TRMM closer than AMSR (1:30 pm/am)? Explain better why 10:30 pm and 4:30 am are the best orbits.*

The orbital characteristics of TRMM cause the local overpass time to vary over time. So if you would only choose overpasses close to 1:30, there would be large temporal gaps in the dataset. Therefore, we have chosen to loosen this time constraint to include observations between 10:30 pm and 4:30 am. Of course, when available, we always choose the one that is closest to the AMSR2 time of overpass. One of the assumptions, supported by the paper of Van der Schalie et al. (2021) on using a similarly merged dataset for L-band retrieval input, is that especially for the soil moisture and vegetation optical depth these time differences have little impact. For the land surface temperature, in the short term (e.g. a few days) this can have an impact, however this is assumed to be smoothed out when looking at the timescales we look at within this paper. We will make sure to highlight these choices in the revision.

*Line 217-220: What does MD means ?*

We noticed that we indeed did not properly introduce that abbreviation. It is for MODIS and will be properly introduced in the revised version.

*Line 224: Can authors give more details about the "E-type gauge plates" ?*

Unfortunately at the moment this is all the information that can be found on the instrument used to do the measurements. We have reached out to the Okavango

Research Institute of the University of Botswana for extra information and will add it as soon as we know more. (<http://okavangodata.ub.bw/ori/monitoring/water/#>)

*Line 451: It is interesting to introduce a second set of precipitation data (IMERG). However, it would be interesting to show its co-evolution with ERA-PR for example in figure 5. How does the better correlation obtained with PR-E5 indicate a better rainfall product than IMERG?*

Perhaps “better rainfall product” is a bit too general of a statement made. This relates to the results in the table that show that with a combination of PR<sub>E5</sub> and the ODIA<sub>MD</sub> or ORD, we find a stronger fit to SSM<sub>MW</sub> than when we use PR<sub>IM</sub>. So here we assume that the best rainfall product would logically support a better fit with SSM. We understand that it might not be as straightforward as this, therefore we will clarify this assumption in the revised paper.

*Line 464: indicate in the figure caption 6 that this is ROI2*

Thank you for noticing this, we will adjust this in the revision.

*Line 533: indicate “(not shown)” after “This for example could also cause the difference in LST-MW and LST-E5 in 2010 and 2011”*

We will adjust this accordingly, or add these images in an appendix (under discussion).

*Line 554: the end of the sentence is missing.*

This mistake will be corrected in the new revision of the paper.