

Interactive comment on “Sentinel-3 radar altimetry for river monitoring – a catchment-scale evaluation of satellite water surface elevation from Sentinel-3A and Sentinel-3B” by Cecile M. M. Kittel et al.

Anonymous Referee #2

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The paper describes the computation and exploitation of satellite altimetry water level time series in the Zambezi basin. According to the authors, the aim of the study is “to assess the potential of the Sentinel-3 mission in hydrological applications”. For that purpose, they compare different satellite altimetry pre-processing options (from two different databases) and they analyze the impact of open loop processing. Moreover, a validation by comparison with (few) in-situ ground stations is performed. For three different wetlands within the study basin, the potential of Sentinel-3 for monitoring the interaction of river and floodplain is shown.

C1

General comments:

This is an interesting topic worth publishing. However, some aspects of the paper are not innovative and had been published before by some of the same authors (e.g. OLTC impact by Jiang et al., 2020). Moreover, some parts of the manuscript are quite technically without providing the (less experienced) readers a recommendation on which processing option to use. In my opinion, the most interesting and innovative part of the study is the approach of automatically processing all possible VS of both satellites in the entire basin with the aim to use these time series for assessment of wetland-river interactions. Thus, my recommendation would be to focus on this part of the study by adding a bit more statistics (how many potential VS, how many valid VS, how many VS gained by OLTC, . . .) and some citations of existing work on wetlands based on satellite altimetry (e.g. Zakharova et al., 2014; Dettmering et al., 2016; Park, 2020). In addition, a (at least theoretical) comparison to classical missions can be added discussing the benefit of the dual satellite constellation (with respect to spatial and temporal coverage) and the measurement mode (SAR/OLTC).

Specific comments:

Line 5: If the objective of the study is to “evaluate the density of valuable observations”, you should add some more statistics on the number of VS (see general comment).

Line 18: In my opinion, the paper is not showing the benefits of SAR (with respect to what? LRM?). The denser track network is due to the orbit configuration not the measurement mode, and there is not comparison to LRM data. The RMSD values are similar to those from LRM missions. So, how is the benefit demonstrated?

Line 44: Sentinel-3 is not only an ESA mission => Copernicus

Section 2.2: What about adding additional information on in-situ validation observations and OLTC targets?

Line 104/105: Please add some more information on the stream burning. I'm not sure

C2

what is meant here.

Section 2.3.3: Some detailed info on the corrections is missing (e.g. which models).

Line 171: σ_0 == backscatter?

Section 2.3: I recommend to provide also the web addresses of GPOD and SciHub (in the text or alternatively in Refs or Acknowledgements).

Line 174/175: Are these DEMs good enough to be used in this context. My personal experience is that at least ACE2 includes really large outliers in some regions.

Line 200: "are processed" => how? Median/mean?

Line 204: "six". Where are these stations located. Maybe you can reference to a figure.

Line 210: RMSD or $D_{\{RMS\}}$? Please make consistent

Line 231: "two the" => "the" or "the two"

Figure 2: I can't find any black cycle in the plot. On the other hand blue lines (which I assume to be rivers) not covered by data. The black lines are a bit confusing here. I guess these are sub-basin borders. Please indicate or remove. The additional maps seems to be in the Annex, not in the supplementary material.

Title of 3.1: This is quite technically. What about using a title indicating the aim of this section, e.g. comparison of different L1b pre-processing

Figure 3: What does OLTC stands for here (black and orange)? Before/after OLTC update? Please clarify.

Table 3: Please provide the sum over the entire basin. Include description of GPOD/SciHub version for VS no (I guess it should be 2x, 3x?)

Section 3.3.1. What about adding a discussion on the impact of low number and distribution of the validation sites. Are the validation numbers representative for the entire basin?

C3

Figure 5: in-situ (black) lines are not visible. Are they always available for the whole period? Are there more than one observation available per epoch (=> single along-track measurements instead of mean/median?) Can you add RMSD here?

Line 288: OGOC => OCOG

Table 4: is the difference only due to the retracker? Might the pre-processing play a role? Is the Relative RMSD == WRMSD?

Figure 6: I can not find any orange lines here. . .

3.3.3: What about adding some more information and interpretation here.

Line 323-324 (and in some other parts of the manuscript): I'm not sure whether it is fair to compare with global WSE databases. Since these databases aim in providing input for hydrological research, the focus is on long time-series. For sure, they are also able to process these VS - however, this has no priority given the short time series of less than 2 years.

Line 342: Is there any statistics available on the percentage of improvement/degradation by OLTC in this region?

Line 349ff: "mams1": all other heights are provided with respect to a geoid. Why not these ones? At least you should explain the abbreviation.

Line 369: options to mitigate: Do you have any recommendation for the users? What preprocessing should I use?

Figure 12: Is there any color change in c) and d) depending on waveform misfit?

Line 385/386: Are there no unique track numbers?

Figure 13: What are the vertical blue lines in crossing tracks 741 and 498? Where are the VS located for tracks 498 and 085? What are the stars and cycles in the left hand plot?

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Figure 15: left and right?

4.4 This is more a summary than perspective... Moreover, perspective should be placed after conclusions...

Line 409: "first" => where is second?

Line 429-434: Please reformulate this paragraph: SWOT will provide much more information than S3, especially in cross-track direction. Also CS2 can already extract similar information in selected locations.

Line 441: "should"? => is or is not improving!

Line 446: I don't think that you should name that a "validation"

Line 447: Again: My feeling is, that this is not a fair comparison. Hydroweb is a global database not aiming in complete coverage of entire basins.

Line 452-458: I suggest shifting this paragraph to line 443 (as second paragraph of this section). This would make the paper end with the application, which is the overall focus of your paper according to line 69.

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