

## ***Interactive comment on “River monitoring from satellite radar altimetry in the Zambezi River Basin” by C. I. Michailovsky et al.***

**C. I. Michailovsky et al.**

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We would like to thank Anonymous Referee # 2 for reviewing the paper. This reply will address the comments and questions provided.

Referee # 2: What retracker was eventually used?

Reply: No single retracker was used. The most appropriate retracker was chosen for each waveform. We will clarify this in the revised submission.

Referee #2: this paragraph needs more explanation. It is not clear where this information on dB comes from. Is this another data set that was used here?

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Reply: The dB information is included in the same dataset, it is determined in the course of the processing of the waveforms. We will include this explanation in the revised submission.

Referee #2: 3. P 3209 L 4: the authors need to justify better why they chose to apply outlier removal for flows. Also, what method (test) was used to decide on outliers?

Reply: The outlier removal is applied to the water level time series. While there is an assumption of normally distributed measurements behind the choice of the  $3\sigma$  cutoff value, we understand that the measurements are not in fact normally distributed. However, the  $3\sigma$  value is quite large making the risk of erroneous rejections acceptably small in our opinion. This method allows is a pragmatic solution to the outlier removal problem without requiring visual inspection.

Referee #2: 4. P 3211 L 14: I do not understand this last sentence: how can you compare levels from instruments using two different vertical data? If I understand correctly, the RMSE adjusted just means that it compares the in-situ with altimetry that was accounted for it not being at the same location. This still leaves you with very different vertical data and presumably the in-situ ones are most of the time local datum?

Reply: The in situ data is indeed relative to an unknown local datum. Therefore, in order to compare the in situ and altimetry datasets, a common datum needs to be determined. In the adjusted case which accounts for the different location, the difference in datum is taken into account in the  $\beta$  fitting parameter. In the unfitted case, the difference in datum is taken into account by the subtraction of the mean value from each time series (ie. assuming the difference in datum of the levels is equal to the difference in mean level).

Referee #2: 5. P 3212 L 2-3: You need to explain or justify why you assume a kinematic approximation.

Reply: We assume the kinematic approximation because of the coarse spatial and

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temporal resolutions. There is also no evidence of looped rating curves in the in situ data. We will include the justification in the revised manuscript.

Referee #2: 6. P 3214 L 20: dlow is of course not the real depth; it is rather the water level at low flow, so how does this impact your results? As far as I can see this was not taken into account in the uncertainty analysis...

Reply: Assuming equation 12 and a rectangular cross section, dlow is the low flow depth. hlow, the low flow water level is then obtained and used to determine depths from water levels at all measurement times. The uncertainty on dlow is taken into account through the uncertainty on the historical low flow value which is used in its computation.

Referee #2: This comment above relates also to my major concern of this study which is that the authors claim to be able to measure discharge from altimetry but with the presented methods this is very much restricted to very favourable three conditions that need to be met and as such the methods are not applicable globally. The authors should discuss this limitation and be more upfront about it. The three conditions that need to be met are: 1) field data need to be available or 2) a rating curve needs to be available or 3) the river needs to run practically dry for some months

Reply: We agree that there are limitations to the application of the methods globally and these are addressed for each method in the discussion section of the manuscript. We do think that there is potential for global applicability, especially for method 2 where only one field visit to each VS location is needed making the condition accessibility of the VS and resources for one field visit.

Referee #2: 7. P 3215 L 19: 10 m in width is rather optimistic.

Reply: The discharge will be recomputed using a higher standard deviation on average river widths depending on the yearly widths variations at the different VS for the revised submission.

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Referee #2: 8. I think the discussion and conclusion should be two separate sections.

Reply: The last paragraph of the manuscript will be moved to a specific conclusion section in the revised manuscript.

Referee #2: 9. The two thick black lines in Figure 6 are not distinguishable.

Reply: Color will be added in the revised manuscript.

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Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, 9, 3203, 2012.

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9, C1310–C1313, 2012

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