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Hydrology and Earth System Sciences Discussions

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.

cibm@env.dtu.dk

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We would like to thank Dr. Getirana for his review of the paper. The following response aims to address the comments provided.

A. Getirana: General question: why did the authors select those three methods? Why not to use the Manning equation or to build rating curves combining observed discharges (when available) and altimetric data? Please justify in the text.

Reply: The Manning equation was not used because of the difficulty of determining the roughness coefficient. Building rating curves from altimetry and observed discharge requires altimetry data and in situ data to overlap. In our case when discharge is

available at the same time as altimetry, rating curves were also available and relatively few coincident altimetry and in situ data points are available. Such a technique is however useful and will be implemented at locations where sufficient data is available.

A. Getirana: Abstract: 1.1. It looks clear to me what it was done in this paper. But the authors should include a phrase or two defining the objective of the study. 1.2. If possible, a phrase giving an overall conclusion about the best and worst methods used to estimate discharges should be given.

Reply: This will be added to the revised submission.

A. Getirana: Introduction: 2.1. p. 3204, l. 24-27: This is not exactly true. Even if this is the justification of several hydrological studies using remote sensing data, many times, it is just a matter of data access, i.e. the data exists but is not available at the time it is needed.

Reply: While we cannot speak for all regions, in Zambia where we obtained access to data from the Department of Water affairs, the number of active stations has in fact declined since 1980. We do however agree that data access is often the problem and will modify the manuscript to reflect this.

A. Getirana: Materials and methods: 3.1. "Altimetry data and extraction": Roux et al. (2010) compare different techniques to obtain water level time series from Envisat data.

Reply: The reference is relevant and will be included in the revised manuscript.

A. Getirana: 3.2. Eq. (4): what does C mean? Is it a function of both slopes and roughness coefficients?

Reply: Yes, and considering constant slope and roughness at each location, one constant C is determined for each VS. This will be clarified in the manuscript.

A. Getirana: 3.3. p.3214, l. 18: Do you mean Eq. (12) by "flow equation"? Please

clarify.

Reply: Yes. The equation number will be added in the revised manuscript.

A. Getirana: 3.4. p.3216, l. 12-17: I suggest the authors to have a look at Roux et al. (2008). This study proposes a linear model to obtain daily time series from Envisat data by using observed data from gauges downstream and upstream the virtual station. The proposed model takes into account the time delay between two points along the river, which is similar to the issue described in the present manuscript.

Reply: The study by Roux et al. (2008) has a different objective from ours. The method requires having a large amount of in situ data covering the same period as the altimetry with the objective of densifying an existing in situ gauging network while our approach is to try to deal with cases where the data available is limited. The reference is however relevant and will be included in the discussion regarding the limited temporal resolution of the altimetry data.

A. Getirana: 3.5. p.3216, l. 19-21: I believe this classification should be based on the normalized RMSE rather than absolute RMSE. If one compares VS 19, 109 and 153, RMSE values are nearly the same, but these errors have different impacts on the amplitude of water levels.

Reply: We think both indicators are useful depending on the goal of a specific study. The reason for the choice of the absolute rather than normalized RMSE as an indicator was to avoid having some VS classified as ”good” simply because of the magnitude of the seasonal flow variations at its location rather than because of the quality of the data itself.

A. Getirana: 3.6. p.3218, l.11: what’s field-derived? Please rephrase.

Reply: ”field-derived” refers to method 2. This will be clarified in the revised manuscript.

A. Getirana: Results: 4.1. p.3215, l. 24 to p.3216, l. 7: The first paragraph of this section should be shifted to the “Materials and methods”

Reply: The first half of paragraph will be moved in the revised manuscript.

A. Getirana: 4.2. “In situ and altimetric river level”: It should be mentioned in the text how significant those RMSE [m] values are. The authors present normalized RMSE [%] in Table one, but it would be nice to have it in the text as well.

Reply: The revised manuscript will include this in the results description.

A. Getirana: Tables: 5.1. Table 1: It would be nice to have the average values at the end of columns 2-6.

Reply: Average values will be added in the revised manuscript.

A. Getirana: 5.2. It is not clear to me the meaning of “RMSE % of high flow”. Why not to use % of mean flow or the amplitude? It would be interesting to see in these tables the mean discharge at virtual/gauging stations.

Reply: We agree that “RMSE % of high flow” may indeed not be the most descriptive statistic and will be replaced with % of amplitude in the revised manuscript. We will also add a column for mean discharge.

A. Getirana: 5.3. Table 3: At vs-222, the RMSE value obtained by method 2 is 2x the RMSE derived from method 1. But RMSE % does not agree. Please check.

Reply: Thank you for pointing this out, a mistake was indeed made in the table regarding the RMSE. This will be corrected in the revised manuscript.

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