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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.

A. Getirana (Referee)

acvg11@msn.com

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The study evaluates the potential of using Envisat radar altimetry for water discharge forecasts in the Zambezi River basin, which is the largest river basin in Southern Africa. Three methods are used to estimate discharges from water levels in river sections as narrow as 80-meter width. Errors of discharge estimates range from 4.6% to 23.4%. The topic addressed by this study is of relevance for hydrologists, specially those working on radar altimetry applications and modeling of poorly-gauged basins. The text is well written, with a good literature review and is appropriate for publication in Hydrology and Earth System Sciences. In my point of view, no major review is necessary prior to publication. However, I have a few minor comments that I expect to improve the quality of the paper.

Minor comments:

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.

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.

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.

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. The authors should consider siting this reference. 3.2. Eq. (4): what does C mean? Is it a function of both slopes and roughness coefficients? 3.3. p.3214, l. 18: Do you mean Eq. (12) by "flow equation"? Please clarify. 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. 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. 3.6. p.3218, l.11: what's field-derived? Please rephrase. 3.7. p.3220, l. 28-29: Same as comment 2.1.

Results: 4.1. p.3215, l. 24 to p.3216, l. 7: The first paragraph of this section should be

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shifted to the “Materials and methods” 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.

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

References: Roux E, Cauhope M, Bonnet M-P, Calmant S, Vauchel P, Seyler F. 2008. Daily water stage estimated from satellite altimetric data for large river basin monitoring. Hydrological Sciences Journal 53(1): 81–99. Roux, E., Silva, J.S., Getirana, A.C.V., Bonnet, M.-P., Calmant, S., Seyler, F., 2010. Producing time-series of river water height by means of satellite radar altimetry – Comparison of methods. Hydrological Sciences Journal 55 (1), 104–120. doi:10.1080/02626660903529023.

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