

Interactive comment on “Niger discharge from radar altimetry: Bridging gaps between gauge and altimetry time series” by Stefan Schröder et al.

Anonymous Referee #2

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Reviewer comment on manuscript Niger discharge from Radar altimetry : Bridging gaps between gauge and Altimetry time series presented by Schroder at al.

This stud aims at priving tools for predicting discharge from altimetry data in absence of gauge data. In order to achieve this goal, authors : 1- process the raw radar echoes distributed for satellite altimetry missions, 2- run rain-discharge models in various configurations 3- compute the Height - Discharge relationships, the so-called rating curves for al the model options, 4- select the best rating curves in the dataset provided by the previous step

Actually, this work is interesting and might be published but not in the present form, mostly because of significant lacks in bibliogrpahy, and consequently, lack of comparison of their results and methods with previous ones. Also, many inaccurate statements

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have to be rewritten. Introduction in particular needs an in-depth rewriting :

Specific comments :

Introduction : line 13 : wrong citation. There have been tens of paper dedicated to "developping techniques" (some of them cited in the manuscript). Biancamaria is not one of them. May be acceptable as "see review in Biancamaria et al., 2017)" ... Line 14 : Radar altimetry is not "hampered" by the groundtrack spacing of the orbits. Indeed, in many basins, the number of crossings between the satellite orbit and the river drainage network is larger that the number of gauges that have ever existed in these bassins. the fact that one cannot choose the location of the measurements is hampering radar altimetry. Radar altimetry is not "hampered" by the large footprint of the altimeters, strictly speaking. For sure, punctual measurements as the ones gained by laser technology (ICESAT) are much easier to process. The size of the footprint has drawbacks, for sure, but it also has significant advantages (the hooking effect for example as it is recalled in the present study, or the averaging effect over a large surface) Line 15 : LRM altimetry has been used to produce hundreds of series over narrow reaches, up to a few tens of meters wide (see for example those in the Amazon bassin distributed by hydroweb). I may have missed the publications (and none is given to support the statement) but I did not read that either Cryosat-2 or S3A did much better, up to now. SAR just enables sampling more small reaches than LR Mode does. Line 21 : "... it is generally required ...". "generally" is such a vague wording that one cannot say it is wrong but "a real gauge near the virtual gauge" is not required. Water levels have been converted into discharges in many studies, using a variety of méthodologies, including the present one. Line 29-30 : From the sentence "However ...", I understand that the rating curves cannot be applied to the Niger river. Yet, it is the focus of the study ??? I guess that the sentence should be rewritten (maybe stating that "single-polynom" rating curves cannot be applied ... ?? Line 34 : What about the works in Penidotti et al. (HESS, 2012), Casé et al. (HESS, 2016), Tourian et al. (HESS 2017) or Fleishman et al. (JoH, 2018) ?? These models are fully available, in particular the discharge se-

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ries recently computed by Fleichman et al. (2018) using MGB and satellite altimetry in exactly the same area Page 2, line 4 : that "radar retracking is key for obtaining meaningful time series..." has been shown in many publications over more than a decade ...

Methods and Data Page 5 line 5 : Capability in retrieving water levels has considerably evolved from TP, Jason1 to Jason 2. Hence, they cannot be qualified by a single "70-80 cm RMSE". Note that much better results than those by Tourian et al. (2016) can be found in the literature for Jason 2 (see for instance Seyler et al., 2012) Line 8: Tourian et al. (2016) estimated their biases over the ocean, which is of limited meaning for rivers because the echoes are too different. other estimates are available in the literature Linbe 9-10 : "biases [...] reference systems effects". Could the authors explain which "reference system " may turn into significant bias effect ?? Page 6 lines 4-5 : Roscher et al. (2017) retracked altimetry data on the coastal domain. I may have missed the publication but I am not aware of any publication showing that their STAR retracking performs better over rivers (both in height accuracy and number of data) than the other -usual- algorithms, such as ICE1, ICE3, If so, authors should add a reference. Line 8 : Berry presented the hooking effect extensively in meetings in the early 2000's but as far as I know, the first publication presenting the use of these parabolas to gain accuracy in retrieving water levels is Frappart et al. (RSE 2006). Line 8: "which masks water levels". Actually, since the onboard tracking is locked on the river echo, the bank topography is masked by the river, not the opposite. Page 7 line 8 : "... even over narrow river crossing ...". It may be a question of my own limitations in english but I think that "even" should be replaced by "in particular" sine the hooking effect is particularly visible -and useful- over the narrow reaches. Line 20 : Authors mention that the S3A data are distributed with 2 retracking algorithms, the OCOG and the Samosa ones. I suggest that both algorithms will be tested in their study. Line 26 : Authors should mention that the unit of a is $m^{4/3}/s$ only if $b=5/3$ (if b is different from $5/3$, the units would not equilibrate on both sides of Eq 1 Line 30 : "river width is difficult to observe from space". This sentence should be reworded since river width is definitely

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not difficult to observe from space and it is commonly derived from existing satellite imagery products Page 8, line 1 : "assuming gauge and virtual gauge data [...] are available...". Replace "gauge" by "discharge" ?? Page 9 Eq 3 : I suggest that authors mention that Guetirana & Peters-Lidar (HESS 2013) showed that this methodology based on minimum of squared residuals of Log regressions can converge towards physically meaningless values (which may explain the final results in terms of rating curves found in the present study Line 9 : I suggest that the authors present an example of "break point" in a figure. Page 17 : all these results, although interesting, lack analysis with respect to literature, in particular with respect to the recent study by Tourian et al. (HESS 2017) and by Fleishman et al. (JoH, 2018). Page 18: Figure 8 is quite difficult to read and I suggest that authors redo it. Actually, it would be more clear to plot the discharge versus the true altimetric height instead of versus the water depth (given that, in addition, no information is provided about the Z_0 parameters). Plotted this way one would have only 2 discharge values for a given altimetric height. Also, information about the Z_0 parameters could be presented simply by the intersection of the rating curves with the height axes. Page 21, line 21 : Sentence "we find that simulated discharge may aid..." is really over-selling the findings of the present study since many studies already showed such a result. The sentence has to be reworded. Line 28 : "... most likely...". In absence of any evidence presented in the study, I think that "presumably" would be better adapted.

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