

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Comment on hess-2021-315

Paul Bates (Referee)

Referee comment on "A combined use of in situ and satellite-derived observations to characterize surface hydrology and its variability in the Congo River basin" by Benjamin Kitambo et al., Hydrol. Earth Syst. Sci. Discuss.,
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This paper presents a synthesis of multiple sources of altimetric water surface height and remotely sensed flood extent over the Congo basin and compares these to in-situ data. The data are then analysed to better understand the spatial variability of surface water hydraulics over the basin. This is a major piece of scholarship that will likely become to the 'go to' reference for such data for many years to come. Altimetric height data show a good fit to ground observations over the Congo, corroborating the findings obtained elsewhere, and are then related to water extent data from the GIEMS-2 product. I think the work will be suitable for publication in HESS with correction of the following issues:

- I think the paper would benefit from more carefully identifying what we learn as a result of this work that we didn't know before. Whilst assembling and quality controlling the various data sets is a major effort, they are somewhat under-exploited in the present work if I am being honest. I think the paper will be more highly cited if it were to first carefully outline what we currently understand about Congo surface water variability. In the results section and conclusions, the paper should then state where the presented results either corroborate existing knowledge or provide substantial new understanding. There is some attempt at doing this in the paper, but it could be made much more systematic and effective.
- A lot of the text on GIEMS-2 (e.g. Section 3.3) really just summarises previous work. What is new here is the correlation of GIEMS-2 basin total flood extent time series with various discharge measurements. I think the text on GIEMS-2 could therefore be significantly shortened to only cover the new results presented in this paper.
- I also think that a number of the statements about GIEMS-2 cannot be proven based on the research presented in the paper. For example, from line 359 onwards there is a statement that GIEMS-2 exhibits:

"very realistic spatial distributions of the major drainage systems, rivers and tributaries (Lualaba, Congo, Ubangui, Kasai) of CRB. The dataset captures well the associated wetlands and inundated areas even in regions with complex floodplains, characterized by

extensive flooding in the presence of dense vegetation cover, such as in the Cuvette Centrale"

There are two issues with this. First, there are no objective tests in the paper of the accuracy of the GIEMS-2 inundation patterns, so it is impossible to say what is realistic or not: the statements above are a subjective evaluation and not repeatable science. I think that at most you can only say that the GIEMS-2 patterns are plausible. Second, at 0.25 degree resolution I think the above statement overstate the level of detail that can be seen in GIEMS-2. I think these sections of the paper need correction to more accurately reflect what the paper is really able to show.

- The paper would be significantly improved (and citations would be higher) if the data sets were made available to download from a data repository such as Zenodo instead of just saying that the data are "are available upon request to the authors". This would also allow the data sets to have a DOI such that use of the data could be properly tracked by the authors.

A few more minor issues:

- Line 31. "Shows a good behaviour"? What exactly does this mean when there is no objective and repeatable test of the GIEMS-2 accuracy over the Congo?
- Line 277. "GIEMS-2 uncertainties are quantified to be about 10 %". Could you explain exactly what this uncertainty refers to. I'm assuming it is errors in total inundated area over a large domain, but please could you confirm. Also, what was the ground truth data that was used to calculate this error?
- Line 455. "The satisfactory behaviour of both SWH from radar altimetry and SWE from GIEMS-2"". Again, I don't think you can make this statement for GIEMS-2 at this site on the basis of the data you have presented. The data are quite low resolution and their evaluation is only subjective.
- The figures would be better as vector files rather than bitmaps.
- The text still needs further a proof read to catch a number of grammatical and typographic errors.

I hope these comments are useful

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