Earth Syst. Sci. Data Discuss., referee comment RC3
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Comment on essd-2021-470

Anonymous Referee #3

Referee comment on "High-resolution water level and storage variation datasets for 338 reservoirs in China during 2010–2021" by Youjiang Shen et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-470-RC3, 2022

The authors used altimetry data and Landsat-derived water extent product to estimate water storage changes between 2010-2020 for hundreds of reservoirs in China. They validated satellite-derived water level and storage time series against in situ data. I think the authors did great work validating altimetry data while the extent and storage validation parts are relatively weak. As some recent studies on reservoir water dynamics have already covered the same reservoirs in this study, I would not suggest this dataset can be valuable in this research area. In addition, I have several major concerns about this study. Please see my comments below.

Major Comments:

- Monthly surface water extent and storage time series have been estimated for nearly all reservoirs from the GRanD in Zhao and Gao (2018) and Hou et al. (2022). As these global studies have covered the same Chinese reservoirs in this study, I was wondering what it is the novelty of this data product. I think it may be worthwhile if you could extend to more Chinese reservoirs, e.g., delineated by Song et al (2022). It provides nearly 100 000 reservoir polygons in China, which has not yet been achieved in the GRanD. You will find more overlapped altimetry data for these reservoirs.
- I do not think you can estimate reservoir storage when the correlation between elevation and extent is poor. Please refer to Busker et al. (2019). Therefore, the total number of reservoirs whose storage can be estimated using remote sensing should be lower than 338. Could you also provide statistics on the robustness of the elevation-extent relationships for all reservoirs you analyzed?
- Jason 1/2/3 and Topex/Poseidon together provide higher temporal (10-day) surface water elevation observations over the past three decades. Why did the authors choose low-frequency SARAL/AltiKa, Sentinel-3 A and B, and CroySat-2? Especially CroySat-2 has only one observation per year. And Sentinel-3 and SARAL/AltiKa do not fully cover your study period (2010-2022).
- The structure of the Data and Methods section is very poor. It is very difficult to distinguish the methods you developed for your study from the methods embedded in

the published dataset you used. I would recommend separating data and method description. And include another subsection to describe in-situ data that you highlight in the introduction. I think you also need to introduce more about JRC-GSWD data, which is one of the main datasets you used for your study.

- Zhao and Gao (2018) have produced monthly surface water extent time series for all reservoirs from the GRanD using JRC-GSWD. Why do you need to use their method again to derive reservoir water extents using the same input data source JRC-GSWD? It does not make sense to me. The reservoir monthly time series can be accessed via https://dataverse.tdl.org/dataset.xhtml?persistentId=doi:10.18738/T8/DF80WG.
- Please include the reservoir name for all your analysis, which would be very important information in this m/s. For example, you only show GRanD ID in Figure 5 but I am keen to know which reservoir it is in China.
- I did not find any validation on your reservoir water extent data. As there are many published satellite-derived surface water extent products, I think you can compare yours against some of them.
- As you mentioned that the accuracy of altimetry data is poor in some large reservoirs (P12L255-256), you should provide more analysis on the influence of reservoir size on the accuracy of altimetry data.

Specific Comments:

- P2L54-56: The hypsometry relationship is developed by the overlapped measurements of elevation and extent. Are these two steps to calculate storage or two approaches? Please clarify.
- P2L61-P3L1: Can you provide any references about the limited number (approx. 30) of available Chinese reservoir data from Hydroweb, G-REALM and DAHITI?
- P3L68: Please clarify "large observations"
- P3L78: Can you introduce the Hydrostat as well and add a reference to it?
- Table1: It was a great work to summarize relevant studies in Table 1 but it looks quite messy. I would suggest to simply this summary, highlight important points and divide information (e.g., time, temporal resolution, altimetry data, validation data, etc.) into a few more columns. Does "/" mean unknown or not applicable? Please name satellite sources for altimetry data rather than say "online databases".
- P6L112: "these missions" is not relevant to the context here.
- P6L112-113: Please explain why altimetry data show highest values in ungauged or poorly gauged areas?
- P6L116-119: It is not clear here. Please put the cover period and capacity information into a table.
- Section 2.1: Please carefully check this section about the description of different satellite instruments. I am not 100% sure if all the information here is correct or not. For example, "Hz" or "GHz"; Sentinel-3 SRAL have Ku-band and C-band with different frequencies, two radar modes and two tracking modes, I am not sure which mode or band do you refer to.
- P7L133: please clarify "higher data availability" and why Ka-band leads to that?
- P8L175-177: Did you do the analysis on counting no-valid data between Jan and Dec by yourself or cited from previous studies?
- P8L177-178: what do you refer to by "over 12% of contamination pixels"? Do you mean all JRC-GSWD data or in Zhao and Gao (2018) study?
- P8L180-181: Please check. I am not sure if this statement is correct or not. As far as I know, the GRanD reservoir polygon is derived not only from SRTM Water Body Database, but also from Global Lakes and Wetlands Database and some other studies.

- P9L187-188: What does this sentence try to explain?
- Figure 2: All these evaluation metrics should be mentioned and explained in the data and method sections.
- P11L245-248: Please explain the criteria to filter out any reservoir in the method section.
- Figure 7: It is difficult to see observed variations (red line) in the figure.
- Sections 4.1 and 4.2 are all your results (data comparison and application in modelling). Please move these to the Results section.

References:

[1] Busker, T., de Roo, A., Gelati, E., Schwatke, C., Adamovic, M., Bisselink, B., ... & Cottam, A. (2019). A global lake and reservoir volume analysis using a surface water dataset and satellite altimetry. Hydrology and Earth System Sciences, 23(2), 669-690.

[2] Hou, J., van Dijk, A. I., Beck, H. E., Renzullo, L. J., & Wada, Y. (2022). Remotely sensed reservoir water storage dynamics (1984–2015) and the influence of climate variability and management at a global scale. Hydrology and Earth System Sciences, 26(14), 3785-3803.

[3] Song, C., Fan, C., Zhu, J., Wang, J., Sheng, Y., Liu, K., ... & Ke, L. (2022). A comprehensive geospatial database of nearly 100 000 reservoirs in China. Earth System Science Data, 14(9), 4017-4034.

[4] Zhao, G., & Gao, H. (2018). Automatic correction of contaminated images for assessment of reservoir surface area dynamics. Geophysical Research Letters, 45(12), 6092-6099.