

Comment on hess-2021-360

Anonymous Referee #4

Referee comment on "Satellite observations reveal 13 years of reservoir filling strategies, operating rules, and hydrological alterations in the Upper Mekong River basin" by Dung Trung Vu et al., Hydrol. Earth Syst. Sci. Discuss.,
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The manuscript titled "Satellite observations reveal thirteen years of reservoir filling strategies, operating rules, and hydrological alterations in the Upper Mekong River Basin" by Vu et al., simulated the cascade reservoir operation in Upper Mekong River using satellite observations. This study applied the SRTM-DEM, Landsat and Jason Altimetry observations over the study area and inferred the storages variations of two largest reservoirs to assess the reservoir operations against meteorological changes. The manuscript is generally well structured, however, there are concerns regarding the validation of the models/results, which would hinder the reliability of the conclusions made. My main comments are as follows:

- SRTM-DEM was used in calculating the reservoir water storage. As stated in the manuscript, the reservoir constructions happened after the year of 2000 whereas SRTM bathymetry measurements was conducted in 2000. Such SRTM-DEM measurements may miss out the potential bathymetry changes caused by local reservoir constructions. The spatial resolution of SRTM-DEM is 30m, however, the authors calculate "the surface area corresponding to each 1-m elevation of the DEM" (Page 7), Please explain in more details for the processing procedure.
- Landsat dataset is another key to solve water surface area in the article. The biggest challenge for the image interpretation is to distinguish water-covered cells from the non-water areas impacted by cloud and other contributors. Water regions suffered from or chlorophyll concentration or aquatic plants are not inclined to adopt NDWI as the water index is sensitive to vegetation. Matching to the maximum water extent from Pekel et al., (2016) may be caused by the aqua-vegetated problem. Meanwhile, for the water regions with narrow width, some other researchers are inclined to use MNDWI (Li et al. 2019). This deserves the authors a careful investigation for the local reservoir conditions.
- For the water area extraction with cloudlessness, although the pixels are free from cloud, they may still be affected by ground conditions, such as vegetation, deep or shallow bottom, or water turbidity. Setting the water index threshold as a constant 'zero' value may not be reasonable enough to deal with the aforementioned problem.

Additionally, the operations of [1.4] and [1.5] tend to artificially increase the water coverage and would cause the total water storage larger than it potential might be. Such operations are lack of a solid theory to support. It might be a little bold to be directly applied over an ungauged basin without observations taken as validation. I would expect the authors could provide more reasons for doing so.

- For the water area extraction with cloud and other disturbances, this article "resorts to k-means clustering". This is interesting approach but its reliability in ungauged area is unsure. Since there lacks a solid theory to support and needs manually adjustments. I would recommend the authors try OSTU index (a method dynamically obtain a threshold) to compare the difference they may result in threshold calculation as well as in water storage. By doing this, an uncertainty estimation can be given to the reservoir water storage.
- In Section 3.2, the author sates that NDWI is better than MNDWI to infer water surface area of reservoir. However, stating that based on the Xiaowan Reservoir only is insufficient. Could the author explain the reason why the maximum water extent were validated on two reservoirs instead of the ten?
- Regarding the WSA estimation algorithm in Figure 4, why were cloudy images taken into account in NDWI calculation to obtain the NDWI Layer? Please specify and explain this.
- Validation of the results (Section 4) is too weak. The author only validated water level from the Radar Altimetry data and only two reservoirs have Radar Altimetry data. Furthermore, there is no validation of reservoir storage. This makes the results inconvincible.
- The author tried to estimate monthly reservoir storage of the ten reservoirs. However, from the results part, we only see the results of the Nuozuo and Xiaowan (Figure 9). Results of other reservoirs are shown in 8 reservoirs. Why didn't the author illustrate monthly reservoir storage of other 8 reservoirs? Please specify and explain.
- In section 4.3.2, the author used VIC-Res, a hydrological model to simulate the inflow of the reservoir. Could the authors explain in more details on the details of the simulation to justify the performance of the model, i.e. input of the model, parameters, calibration and validation of the results.