

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2  
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## Comment on hess-2021-104

Anonymous Referee #2

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Referee comment on "Information content of soil hydrology in a West Amazon watershed as informed by GRACE" by Elias C. Massoud et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-104-RC2>, 2021

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The article is well written and all the concepts are explained in required details. However, the inference drawn from the study need more clarifications and probably a major revision. After writing this review, I happened to check the review comments from reviewer 1 and I had exactly the same comments as their comment no 1, 2, 3 and 10. I am not repeating them here. My additional concerns are:

- Authors have stated, in the title and in the introduction (line 65 to 69) that they are able to identify and estimate the processes responsible for TWS variability. Explicitly they have stated their aims as: a) "inform and reduce uncertainties of terrestrial hydrologic processes regulating the seasonal and inter-annual variability of TWS in the western Amazon, the Gavião watershed" b) Develop a model to represent the first order controls on seasonal-to-decadal soil moisture dynamics, and c) employ a Bayesian model-data fusion approach to constrain model parameters (namely initial states and time-invariant process variables), such that differences between GRACE and simulated TWS anomalies are statistically minimized

Therefore the first impression is that the study will help us understand the cause and drivers of variability in the water storage. However, the results and summary lack discussion on the parameters and physical processes that drive the dry season or wet season, and why?

- The calculation of basin average TWS from GRACE data is not clearly explained. Did the authors use mascon data or spherical harmonic data? How do they combine these three solutions? How do they tackle the limitations of the coarse spatial resolution of GRACE data and the different spatial resolution of the three data products.
- Can authors comment or compute their model for an arid or semi-arid region or a river catchment with trends (such as the Great Basin in the USA)? What do they expect to obtain from such a model at global scale?
- Please mention the catchment name in the title instead of 'Amazon' or compute the

model for whole Amazon.

- Line 361: Authors state “GRACE-informed model parameters can be used for predicting seasonal and inter-annual soil water hydrology in the absence of concurrent GRACE measurements. We showed that using a 5-year data record of TWS allows the parameter inference to still be applicable to the remaining 5-year data record, which is simulated without the use of information from GRACE”. If the evapotranspiration product was obtained using GRACE, then the simulated part is not completely free from GRACE.