

Comment on hess-2021-104

Anonymous Referee #1

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-RC1>, 2021

This study applied the Markov Chain Monte Carlo algorithm to calibrate a simple water balance model using GRACE TWS observations. The posterior model parameters, model states and simulated TWS for one watershed were shown in this study. The results suggested the potential of using GRACE to constrain model parameters. The topic is relevant for reader of HESS. However, I believe some critical points need to be clarified and supported by additional results.

1. It was mentioned that the ET in the model was derived from the satellite observations of precipitation and TWS and ground-based river runoff (L138). I assumed that it must be GRACE TWS here. If so, the GRACE data has been used in the modelling and resued in the model calibration through MCMC. The GRACE data was not independent to the model simulations. Please clarify.
2. The results for one watershed is not convincing. In particular, it was mentioned that additional testing over other watershed has been done in L369. Results for few more watersheds can help supporting this study. Since the inputs for the model are satellite rainfall, TWS and in-situ river runoff, it would be surprise there is no other watershed has enough river runoff data over Amazon.
3. Results of model simulations without MCMC should be compared with the posterior TWS to demonstrate the improved performance.
4. L76: Is the model proposed by the authors for the first time? Or any reference for the model?

5. L138: Was the satellite precipitation from TRMM here as well?

6. L173: Spherical harmonic solutions here?

7. L260: The information about each variable for each subfigure has been included in the figure caption. More discussion about the results instead would be helpful.

8. L285-290: could you include the r^2 for the model simulated TWS and de-seasonalized TWS without MCMC as a comparison? Also plot the time-series together in Fig6?

9. The sensitivity results from figure 8 would make more sense to mentioned in the beginning of the section since the results were summarised in Table1.

10. Changing the x-axis to years for Figure 4 and 8 like the other plots would be more reader-friendly.