

Review for Earth System Science Data #: essd-2016-55

Title: A global water resources ensemble of hydrological models: the earthH2Observe Tier-1 dataset

Authors: Jaap Schellekens et al.

Overall Comment

The manuscript describes a set of multi-model simulation results which are outcomes of the earthH2Observe project. Although there have been several similar data archives, this is still valuable contribution to our community because such dataset, which provides base information for higher level (derivative) researches, should be updated with updates of observations and models. Also, adding additional spread allows us to have a better estimation of the uncertainty in the state-of-the-art assessments in energy-water cycles and associated processes. It provides a fancy interface to access dataset, and most of data points are alive. However, this work has serious shortcomings to be published:

- Main questions (P3 #6-9): As the authors also referred to previous researches (e.g., Dirmeyer et al., 2006), question (i) is too general, and has been answered and well-known sense already in our community. Of course, it would be no problem to reconfirm this, but current form, at least, would not be appropriate as a main question. Also, this manuscript does not even provide enough evidence to answer this question. Question (ii) is ambiguous, and it is not answered in the manuscript.
- Validation: The authors should put significant additional efforts to provide information on validations. Since this kind of dataset will be utilized to quantify information critical to society such as water resource availability and to investigate variability and interactions of associated processes, information related with quality of dataset should be carefully provided. Also, without direct comparison to observation, relative comparison (e.g., SNR here) even would not enough to reconfirm question (i) above. As a minimum effort, I recommend author to include basin-wise validation against in-situ discharge and GRACE TWSA, and to add validation in terms of seasonal variations for each variables. If additional tables which has evaluations in such RMSE, CC, NS are provide, it would be very helpful.

Therefore, I recommend the editorial board to ask the authors “major revision” to publish this manuscript in Earth Syst. Sci. Data.

Specific Comments

- P2 #20-21** : “optimizing” is not a right word. Does it mean bias-correction? Please make sure the WATCH forcing dataset is made by randomly resampling EAR40 and correcting bias referring to observations.
- P3 #7-9** : Questions should be revised.
- P4 Table 1** : Is Bulck should be Bulk? It would be nicer to include reference information for each model
- P6 #19-21** : Please put additional table to show models to availabilities of variables which should be a necessary information to interpret performance of ensemble mean and spread.
- P7 Table 2** : Please add meta-info (e.g., standard name) in cf-convention.
- P7 #9-11** : The mirror of THREDDS is not accessible.
- P8 Table 3** : This is incomplete. At least, it needs to add variables used in validation such as SWE and SC. Also, it is necessary to know each models’ averaging depth.
- P10 #24-25** : Why precipitation show different results from the models? I assume this is input dataset and should be identical to models.
- P10 #34** : Please provide more information on calculating TWSA and available storage components for each model.
- P13 #1-2** : Not clear.
- P13 #9-10** : It may imply systematic error in the models and/or missing components in analysis. For examples, appropriate treatment of river and groundwater would introduce additional delay and amplitude (e.g., Kim et al. 2009)
- P18 Figure 8:** Why it only shows AUST and SEAS? Why not global and other regions/basins? This comment should extend to the other variables. Overall, this manuscript is lacking a universal form and strategy of validations.
- P19 #6-11** : This part should be extensively revised with additional previous estimations (e.g., Trenberth et al. 2007; Syed et al. 2009; Rodell et al. 2015) Providing an intercomparison table of water balance components would be convenient to readers.

References

- Kim, H., P. J.-F. Yeh, T. Oki, and S. Kanae (2009), Role of rivers in the seasonal variations of terrestrial water storage over global basins, *Geophys. Res. Lett.*, 36, L17402, doi:10.1029/2009GL039006.

Syed, T. H., J. S. Famiglietti, and D. P. Chambers (2009), GRACE-based estimates of terrestrial freshwater discharge from basin to continental scales, *J. Hydrometeor.*, 10, 22–40.

Trenberth, K. E., L. Smith, T. Qian, A. Dai, and J. Fasullo (2007), Estimates of the global water budget and its annual cycle using observational and model data, *J. Hydrometeor.*, 8, 758–769.

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