Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC3
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Comment on gmd-2022-59

Anonymous Referee #3

Referee comment on "Water balance model (WBM) v.1.0.0: a scalable gridded global hydrologic model with water-tracking functionality" by Danielle S. Grogan et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-59-RC3, 2022

General comments

The paper describes the WBM global hydrological model in detail. WBM is one of the earliest global hydrological models which contributed to the establishing the field of global hydrology. This paper provides the full description of the model together with the development history which will be quite useful for the modeling community. In particular, the water source tracking function is novel and very interesting. The paper is well prepared and mostly very readable. I have only minor technical comments.

Specific comments

Line 189 “Soil moisture balance calculations for natural landcovers are fully described in (Wisser et al., 2010a) and crop landcovers in (Grogan, 2016).”: Better to show the essence here because soil moisture balance calculation is the most fundamental function of any hydrological models.

Line 270 “PyGEM’s standard output format is not gridded; rather, post-processed PyGEM output is required as input for WBM (Prusevich, et al., 2021).”: How frequently is the glacier fraction updated (e.g. daily, monthly, annually)?

Line 358 “Rather, they collect rainwater and surface runoff, storing it on the land surface and preventing it from reaching the rivers system”: How are these processes formulated? What are the key inputs and parameters?

Line 368 “WBM’s inter-basin transfer methods were first developed and described in (Zaveri et al., 2016) and described again in (Liu et al., 2017).”: Can this inter-basin transfer scheme be applied to global simulations? If so, how the parameters were set (i.e. is such information available)?

Line 400 “Stream water available for extraction is estimated as 80% of water retained in river and reservoir storage following routing during the previous time-step ð□□□ð□□□−1, plus the volume, Vstream, represented by flow through the reach during the previous time-step:” A bit hard to read and associate with Equation 26. What is Vstream? Is this representing the available surface water?

Line 621 “The global simulations described above used a grid cell resolution of 0.5 degrees.”: This should be mentioned in the previous paragraph.

Line 629 “These continental-scale simulations of India used the same 0.5 degree spatial resolution as the global simulations.”: What were the input meteorological data used in these simulations? The performance of river discharge simulation is largely dependent on the quality of input meteorological data (e.g. Hanasaki et al. 2022, HESS).

Line 721 “We also calculate the Index of Agreement, d, (Willmott, 1981)”: Why was this indicator chosen? I recall that most of the earlier works used NSE.

Line 740 “Despite the global average good agreement, there is significant spatial variability, with lower MBE values across much of South America and East Asia (Figs. 5c and 6c).”: When one looks at the absolute MBE, the performance of river discharge simulations in arid or semi-arid regions always appears to be "good" because the runoff is very small. This needs to be pointed out in the text.

Line 750 Figure 6: What is the difference between Figure 5 (c) and 6 (c)? Only the unit is different?

References

Hanasaki, N., Matsuda, H., Fujiwara, M., Hirabayashi, Y., Seto, S., Kanae, S., and Oki, T.: Toward hyper-resolution global hydrological models including human activities: application to Kyushu Island, Japan, Hydrol. Earth Syst. Sci, https://doi.org/10.5194/hess-2021-484, accepted, 2022.