Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
https://doi.org/10.5194/gmd-2022-182-RC1, 2022

Comment on gmd-2022-182

Anonymous Referee #1

Referee comment on "Wflow_sbm v0.7.3, a spatially distributed hydrological model: from global data to local applications" by Willem J. van Verseveld et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-182-RC1, 2022

General comments

The manuscript is a model description paper that presents the Wflow_sbm v0.6.1 hydrological model developed by Deltares. The model structure and equations are presented in detail followed by case studies of its application in various catchments across the world. The presented model has a great potential in contributing to large scale and high resolution hydrological modelling. Overall, the paper is well written, the model is presented in detail and the applications demonstrate the capability of the model to simulate major hydrological processes in different regions. I appreciate the effort of the authors to make it public and provide transparency in the model functioning. I have enjoyed the paper, but I am missing a key component when it comes to "spatially fully distributed" hydrological models, which concerns the Wflow_sbm ability to be spatially calibrated and evaluated with gridded data (not catchment average) and its performance in representing the spatial patterns, which is the major feature of grid-based models, as compared to lumped or semi-distributed models. Therefore, I urge the authors to demonstrate the performance of their model in reproducing the spatial patterns of major hydrological processes like actual evapotranspiration, soil moisture, and terrestrial water storage and snow accumulation as global data exist to do so.

Specific comments

Major Comments

The key strength for spatially distributed hydrological models is the ability to simulate

hydrological processes in space and provide their spatial variations. I strongly recommend demonstrating that your model can be calibrated and evaluated on spatial patterns as it is becoming the state-of-the-art in this field (e.g. Dembele et al. 2020, Demirel et al. 2018, Zink et al 2018).

L672-674: Why the use of ERA5 for Europe and other products for other regions (e.g. CHIRPS for Oueme in Africa)? Were these datasets evaluated or previously found suitable for hydrological modelling in these regions?

Minor comments

What are the available objective functions for model calibration? Is multivariate calibration supported by the model?

Be consistent with the use of the term "hydrological" or "hydrologic" (see e.g. lines 1 and 783). Choose one and keep it throughout the paper.

L10-11: Mention clearly that this is the model performance for discharge.

L511: A variable name should not have several meanings. Here P is defined as the wetted perimeter while it refers to precipitation in Table A1. Please correct this.

L382: is f_canopygap time dependent? There is no exponent t in the name in Table A2.

Technical corrections

L73: "most gauging" ---> "most discharge gauging"

L127: “then” ---> “than”

L135: “water when” ---> “water occurs when”

L136: “in” ---> “from”

L137: “river” ---> “river routing”

L155: “extendig” ---> “extending”

L203: delete the duplicated “is”

L348, 366, 383, 388, 396: “bucket” ---> “unsaturated soil bucket ”

L564: “expresses” ---> “expressed”

L569: In the second part of the equation 103 (i.e. if SI_lake <=…), “A” should be “A_lake” in the numerator of the fraction.

L585: Give the definition of “I/O”.

L607: “orginal” ---> “original”

L681, 704, 726, 755: “avalance” ---> “avalanche”

L720: “hydrometeorlogical” ---> “hydrometeorological”

L733: “1630” ---> “station 1630”

L774: “yearly average rainfall” ---> “annual average daily rainfall”

L776: “disables” ---> “disabled”

L776: “scores” ---> “scores of discharge”

L800: “function” ---> “functions”

Figure 11: In the caption: “average” ---> “catchment-average”

Figure 13: In the caption: “scores” ---> “scores of discharge”

Table A1: No Wflow.jl name for E_act,soil?

Table A1: Should the unit of R_input be mm/t?

Table A1: Should the unit of Q_in,res be m3/t?

Table A2: It would be better to separate the list of the parameters from the forcing.

Table A2: Is this mean air temperature? Say it explicitly.

Table A2: For f_paved, should read “compacted” in the description.

Table A2: Add f_river to the table.

References

Dembélé, M., Ceperley, N., Zwart, S. J., Salvadore, E., Mariethoz, G., & Schaefli, B. (2020). Potential of satellite and reanalysis evaporation datasets for hydrological modelling under various model calibration strategies. Advances in Water Resources, 143, 103667.

Demirel, M. C., J. Mai, G. Mendiguren, J. Koch, L. Samaniego, and S. Stisen (2018), Combining satellite data and appropriate objective functions for improved spatial pattern performance of a distributed hydrologic model, *Hydrology and Earth System Sciences*, *22*(2), 1299-1315, https://doi.org/10.5194/hess-22-1299-2018.

Zink, M., J. Mai, M. Cuntz, and L. Samaniego (2018), Conditioning a Hydrologic Model Using Patterns of Remotely Sensed Land Surface Temperature, *Water Resources Research*, *54*(4), 2976-2998, https://doi.org/10.1002/2017wr021346.