EGU21-8782
https://doi.org/10.5194/egusphere-egu21-8782
EGU General Assembly 2021

Parameter transferability between multiple gridded input datasets challenges hydrological model performance under changing climate

Moctar Dembélé[1,2,3], Bettina Schaefli[3,4], and Grégoire Mariéthoz[1]
[1]University of Lausanne, Institute of Earth Surface Dynamics (IDYST), Lausanne, Switzerland (moctar.dembele@unil.ch)
[2]International Water Management Institute (IWMI), Accra, Ghana
[3]Institute of Geography (GIUB), University of Bern, Switzerland
[4]Oeschger Centre for Climate Change Research (OCCR), University of Bern, Switzerland

The diversity of remotely sensed or reanalysis-based rainfall data steadily increases, which on one hand opens new perspectives for large scale hydrological modelling in data scarce regions, but on the other hand poses challenging question regarding parameter identification and transferability under multiple input datasets. This study analyzes the variability of hydrological model performance when (1) a set of parameters is transferred from the calibration input dataset to a different meteorological datasets and reversely, when (2) an input dataset is used with a parameter set, originally calibrated for a different input dataset.

The research objective is to highlight the uncertainties related to input data and the limitations of hydrological model parameter transferability across input datasets. An ensemble of 17 rainfall datasets and 6 temperature datasets from satellite and reanalysis sources (Dembélé et al., 2020), corresponding to 102 combinations of meteorological data, is used to force the fully distributed mesoscale Hydrologic Model (mHM). The mHM model is calibrated for each combination of meteorological datasets, thereby resulting in 102 calibrated parameter sets, which almost all give similar model performance. Each of the 102 parameter sets is used to run the mHM model with each of the 102 input datasets, yielding 10404 scenarios to that serve for the transferability tests. The experiment is carried out for a decade from 2003 to 2012 in the large and data-scarce Volta River basin (415600 km2) in West Africa.

The results show that there is a high variability in model performance for streamflow (mean CV=105%) when the parameters are transferred from the original input dataset to other input datasets (test 1 above). Moreover, the model performance is in general lower and can drop considerably when parameters obtained under all other input datasets are transferred to a selected input dataset (test 2 above). This underlines the need for model performance evaluation when different input datasets and parameter sets than those used during calibration are used to run a model. Our results represent a first step to tackle the question of parameter transferability to climate change scenarios. An in-depth analysis of the results at a later stage will shed light on which model parameterizations might be the main source of performance variability.

Dembélé, M., Schaefli, B., van de Giesen, N., & Mariéthoz, G. (2020). Suitability of 17 rainfall and temperature gridded datasets for large-scale hydrological modelling in West Africa. Hydrology and Earth System Sciences (HESS). https://doi.org/10.5194/hess-24-5379-2020