Hydrology and Earth System Sciences Discussions

Hydrol. Earth Syst. Sci. Discuss., community comment CC1
https://doi.org/10.5194/hess-2022-113-CC1, 2022

Comment on hess-2022-113

John Ding

Community comment on "The Great Lakes Runoff Intercomparison Project Phase 4: the Great Lakes (GRIP-GL)" by Juliane Mai et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-113-CC1, 2022

Comparing a LSTM model and a one-step-ahead river forecast model

The study team reaches a most profound conclusion that the Machine Learning LSTM-lumped model outperforms 12 other physically based models for Great Lakes - Ottawa River region (Lines 14-16, Abstract, Main Result (1)).

I'm curious how the LSTM model (Sect. 2.4.1, S.2.1) compare with a simple one-step-ahead forecast model, AR(2), a second-order autoregressive process of the streamflow (only). The latter is constructed as follows (e.g., Ding, 2018):

$Q[t+1]=0+O[t]+(O[t]-O[t-1])=2O[t]-O[t-1]$,

in which:

O[t] and Q[t] are the observed and simulated discharge, respectively, at current timestep t. This pre-defined AR(2) has a constant of zero, and lag 1 and 2 coefficients of 2 and -1, thus having a fixed variance for an observed hydrograph.

A comparison between the two on one of their study watersheds will help demonstrate their performances. One candidate could be Gauge ID 02GA047 - Speed River at Cambridge which has been used for validation purposes (Table S15). This is located on the east side of the Grand River, Ontario, opposite to the University of Waterloo campus, and has a drainage area of 782 sq. km.

On the Speed River, does a LSTM model that has been calibrated globally for the Great Lakes-Ottawa River region outperform an AR(2) too?

References

Ding, J. : Interactive comment on "On the choice of calibration metrics for "high flow" estimation using hydrologic models" by Naoki Mizukami et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2018-391-SC1, 2018.