Improving the Initial Conditions of Hydrological Model with Reanalysis Soil Moisture Data

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May 12, 2022

Abstract

The initial conditions (e.g., soil moisture content) of the hydrological model, which is usually obtained from the warm-up of the hydrological modeling, significantly impact the simulation efficiency. However, spending the valuable data in warm-up instead of calibration and validation is luxurious. In order to improve hydrological simulation efficiency in the case of no warm-up phase, this paper proposes a methodology to fill the gap via improving the initial conditions of the hydrological model using an alternative global soil moisture dataset. Specifically, three soil moisture (SM) variables of the initial conditions from the Block-wise use of the TOPMODEL (BTOP) model and EAR5-Land reanalysis data were adopted and conducted correlation analysis. Several traditional curve-fitting functions and the state-of-art technical, long-short term memory (LSTM), were applied to develop the relationship between BTOP and EAR5-Land SM variables in the Fuji and Shinano River Basin, Japan. Furthermore, four configured hydrological simulations evaluated the benefits of the proposed methodology for improving the initial conditions. As a result, LSTM outperforms the traditional curve-fitting method in constructing the relationship between variables in time and space. Moreover, the hydrological simulation cases using the initial conditions related to the SM from the ERA5-land performs better than the case without the warm-up phase, and the simulated discharge process approaches the "optimal" case with the warm-up phase. It is confirmed that the proposed methodology helps improve the initial conditions of the hydrological model using reanalysis soil moisture data.

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