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How to improve the water balance error to obtain robust streamflow simulation: a comparative approach using three hydrological models

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Hydrological models complexity difference does not necessarily reduce the uncertainties or enhance its reliability. The hydrological conditions and variables are proven to be the main controlling factors affecting the performance (Orth et al., 2015). Because of the various opinions on the rainfall-runoff process and data requirements, selecting the appropriate models for impact studies is challenging.

In this study, three hydrological models were applied to assess their robustness for streamflow simulation in a small mountainous catchment located in South Korea. The CAT (Kim et al., 2012; Miller et al., 2014; Jang et al., 2016), GR4H (Perrin et al., 2003) and TPHM (Kim and Jang, 2017) models calibration and validation were carried out using observed streamflow and actual evapotranspiration (AET) data from flux tower. Furthermore, the models were assessed by introducing the monthly crop coefficient (Kc) and leaf area index (LAI) in the original models to improve AET simulation. The calibration is renewed for newly introduced values (original model, with Kc and with LAI) to reduce the water balance error.

The results indicated that the introduction of Kc and LAI to the original models significantly improves the AET simulation by reducing the water balance errors. However, the three models performance for streamflow simulation were quite similar to the original model.

Based on the findings of this study it is recommended to give more emphasizes to reduce the water balance errors to decrease the uncertainties of hydrological models and to build the credibility for impact studies and projections in the future.

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