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A Tracer Experiment to Study Flow Paths of Water in a Forest Soil

Takahiro Hosono*

Laboratory of Hydrological Science, University of Tsukuba, Japan

Editorial

Fluency such responses (e.g. rainfall–runoff process) is arguably the foremost fundamental problem in hydrology. Generalization with regard to 'appropriate' modelling approach or model structure for catchments is next to impossible, since catchment responses not only depend upon a number of meteorological and catchment factors but also change with reference to space and time. However, regardless of the modelling approach, the model's formulation, calibration and validation must be performed supported the info observed at the catchments. Hydrologic research over the years, alongside mathematical and technological advances, has contributed to the event of a spread of techniques and tools for data collection, analysis, learning and extrapolation.

Remote sensing and GIS technologies, statistical and nonlinear statistic techniques, parameter optimization procedures, and AI methods are just a couple of examples. In spite of those developments, our ability to model and forecast catchment responses (even for gaged catchments, including ungagged ones) remains not convincing, against the wants for implementing effective and efficient short-term emergency measures and long-term management strategies. An examination of hydrologic literature would reveal that our models often fail to supply reliable extrapolations (forecasts) to match against the specified (i.e. actual) ones. This is often particularly the case, when the specified extrapolations are extremes (e.g. very high and really low runoffs). Unfortunately, it's these extremes that we are far more curious about than others, since they often have catastrophic effects on our lives and environment (e.g. floods and droughts). Keeping aside, within the present context, the restrictions of knowledge available (e.g. quantity and quality), I think that our inability to get reliable extrapolations may largely be attributed to the procedures (e.g. optimization) and data utilized in our calibrations. This might be supported using the results reported by, as an example, a couple of of the past studies, as follows. In their study to model the rainfall–runoff process within the Leaf basin, use a nonlinear ANN (artificial neural networks) model, a linear ARMAX (autoregressive moving average with exogenous inputs) model and a conceptual SAC-SMA (Sacramento soil moisture accounting) model for comparison purposes. All three models perform 'reasonably well' for the validation data set, it's clear that the model results are much poorer for very low (to medium) runoffs in comparison to those of (medium to) very high runoffs.

This, in my opinion thanks to the 'bias' (towards high runoffs) within the 'optimization' procedure adopted for the calibration set (probably intended to capture the very high values) study the snow accumulation process within the Upper Sheep Creek in south-western Idaho, employing a distributed hydrologic model. Their results show that the model overestimates snow water equivalent for locations with moderate to high values, but underestimates snow cover where there's little snow. It's difficult, without watching the scatter plots for the calibration set, to discuss possible bias within the calibration procedure; however, the scatter plots for the validation set seem to point that the calibration may have bias towards the typical values (probably intended to capture the general mean).

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***Address for Correspondence:** Takahiro Hosono, Laboratory of Hydrological Science, University of Tsukuba, Japan E-mail: hosono.ta@gmail.com*

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