Effect of temporal resolution of hydrological data on calibrated model parameters and its removal

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When the time interval of hydrological data, the temporal resolution, is longer than the time scale of the hydrological system, the calibrated model parameters may be different with their "true values" and include uncertainty caused by the poor temporal resolution. The removal of such uncertainties is crucial for most hydrological research, for example, the synthesization of model parameters. The objective of this study is to investigate the effect of temporal resolution on calibrated model parameters, and to find a way to remove them.

Hydrological data with different temporal resolutions are generated from hydrological data of finest temporal resolution. They are used to calibrate model parameters by comparing their model outputs to proxy model output generated from input data of finest resolution and known model parameters. The difference between known parameters and calibrated parameters is considered as the effect of temporal resolution. In this study, this approach is applied to an interception model and a simple storage-function routing model widely used in Japan. For both of these models, the effects are very significant.

For the interception model, poor temporal resolution makes the rainfall data be temporally averaged, and shortens the non-rainy periods. They overestimates the interception losses. In model calibration, calibrated parameters tend to compensate this overestimation, and will not equal to its true value. For the storage-function model, calibrated parameters tend to compensate the underestimation of simulated peak flow caused by temporally averaged rainfall data. For both models, calibrated model parameters are formulated by their true values and temporal resolution. These formulas make it possible to estimate "true parameter values invariant to temporal resolution" from calibrated values and their corresponding temporal resolution. Also model parameters referred as operational parameters which eliminate the effect due to temporal resolution can be obtained from their true values and the temporal resolution.