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Sub-Daily Runoff Simulations with Parameters Inferred at the Daily Time Scale: Impacts of the temporal distribution of rainfall in parameter inference.

Jose Eduardo Reynolds Puga (1,2), Sven Halldin (1,2), Chong-Yu Xu (1,3), Jan Seibert (1,4,5)

(1) Department of Earth Sciences, Uppsala University, Uppsala, Sweden (eduardo.reynolds@geo.uu.se), (2) Centre for Natural Disaster Science (CNDS), Uppsala, Sweden, (3) Department of Geosciences, University of Oslo, Oslo, Norway, (4) Department of Physical Geography, Stockholm University, Stockholm, Sweden, (5) Department of Geography, University of Zurich, Zurich, Switzerland

Flood forecasting at sub-daily time scales are commonly required in regions where sub-daily observational data are not available. This has led to approaches to estimate model parameters at sub-daily time scales from data with a lower time resolution. Reynolds et al. (2015) show that parameters inferred at one time scale (e.g., daily) may be used directly for runoff simulations at other time scales (e.g., 1 h) when the modelling time step is the same and sufficiently small during calibration and simulation periods. Their approach produced parameter distributions at daily and sub-daily time scales that were similar and relatively constant across the time scales. The transfer of parameter values across time scales resulted in small model-performance decrease as opposed to when the parameter sets inferred at their respective time scale were used. This decrease in performance may be attributed to the degree of information lost, in terms of the physical processes occurring at short time scales, when the rainfall-runoff data used during the parameter-inference phase become coarser. It is not yet fully understood how the aggregation (or disaggregation) of the rainfall-runoff data affects parameter inference.
In this study we analyse the impacts of the temporal distribution of rainfall for inferring model parameters at a coarse time scale and their effects in model performance when they are used at finer time scales, where data may not be available for calibration. The motivation is to improve runoff predictions and model performance at sub-daily time scales when parameters inferred at the daily scale are used for simulating at these scales. First, we calibrated the HBV-light conceptual hydrological model at the daily scale, but modelled discharge internally in 1-h time steps using 3 disaggregation procedures of the rainfall data. This was done in an attempt to maximise the information content of the input data used for calibration at the daily scale. One disaggregation procedure was based on the long-term daily distribution of rainfall, another on the long-term daily distribution of rainfall per month, and the last procedure assumed constant rainfall intensities during the day as in Reynolds et al. (2015). Finally, the parameter sets inferred from the 3 disaggregation procedures were compared and used to simulate runoff at the 1-h time scale to identify their impact on performance and their ability to reproduce discharge dynamics.

REFERENCE

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