The influence of different calibration criteria on a rainfall-runoff model's ability to predict biologically important flow metrics when transferred to ungaged basins

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Abstract. Hydrologic alternation caused by watershed urbanization is a growing concern as landscape changes and hydromodification increase with time. Potential mitigation of alterations exists, however ecological principles should be incorporated to maximize the probability of success. Native biological communities are known to respond to land-use changes, and, in the case of benthic macroinvertebrates, are relatively inexpensive and simple to field measure. Unfortunately, streamflow gages are not inexpensive or simple to install, and so a need exists to predict biologically important flow metrics in ungaged basins where biological data has been collected. Accurate flow metrics are needed in these ungaged basins to establish an ecologically-conscious hydrologic foundation within a management framework. For this study, 19 continuous HEC-HMS models were created in Southern California and were calibrated to USGS streamflow gages using three separate criteria: Nash-Sutcliffe Efficiency, Richards-Baker Flashiness Index (RBI), and percent of time when the flow is < 1 cfs (%<1). These last two criteria were chosen due to their established impact on benthic macroinvertebrate assemblage in the semi-arid region. The influence of calibration criteria is analyzed in the context of ungaged basins through a "round robin" analysis where each of the three calibrated parameter sets per basin are input into every other basin such that all basins are essentially treated as "ungaged". RBI and %<1 are calculated within "ungaged" basins and compared to their known values. This provides insight on the ability of each calibration method to predict biologically important flow metrics when the models are transferred to ungaged basins.