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# Calibration of Deterministic Streamflow Models in Ungaged Basins Using Statistically-Derived At-Site Streamflow Simulations

William Farmer (1,2), Lauren Hay (1), and Julie Kiang (2)

(1) U.S. Geological Survey, National Research Program, Denver, CO, United States, (2) U.S. Geological Survey, Office of Surface Water, Reston, VA, United States

The continental-scale streamflow network provides vital information for quantifying water resources in the U.S., however, large portions of the U.S. remain ungaged and require streamflow to be estimated. Validation of streamflow models in ungaged basins is difficult due to the lack of observed daily streamflow data for model calibration. This difficulty often leads researchers to rely on regional statistical models (regionalizations) that are limited to the time series of the streamflow variable of interest and offer limited additional hydrologic outputs beyond the variable of interest compared to deterministic streamflow models, which are capable of modeling multiple elements of the water budget simultaneously. This work combines statistically-derived streamflows at ungaged locations to calibrate a popular hydrologic model, PRMS (Precipitation-Runoff Modeling System). Combining this statistically-derived, at-site information with observations of other hydrologic variables, including evapotranspiration and snow covered area, produced simulations as reasonable as alternative approaches to ungaged calibration. Improvements from calibrating to statistical time series are limited by maximum performance of an idealized at-site calibration, i.e. if observed streamflows were known for calibration. The degree of performance when calibrated with observed data is correlated with the degree of performance when calibrated with statistically-derived alternatives. Regionally-varying hydrologic processes limit the applicability of deterministic models, statistical models and the combination thereof; coupled calibration may improve identification of these underlying processes. The advantages and disadvantages of statistically-informed calibration of deterministic models are discussed with emphasis on continental application across the conterminous United States.