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Assessing the value of variational assimilation of streamflow data into distributed hydrologic models for improved streamflow monitoring and prediction at ungauged and gauged locations in the catchment

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State updating of distributed hydrologic models via assimilation of streamflow data is subject to "overfitting" because large dimensionality of the state space of the model may render the assimilation problem seriously underdetermined. To examine the issue in the context of operational hydrology, we carried out a set of real-world experiments in which we assimilate streamflow data at interior and/or outlet locations into gridded SAC and kinematic-wave routing models of the U.S. National Weather Service (NWS) Research Distributed Hydrologic Model (RDHM). We used for the experiments nine basins in the southern plains of the U.S. The experiments consist of selectively assimilating streamflow at different gauge locations, outlet and/or interior, and carrying out both dependent and independent validation. To assess the sensitivity of the quality of assimilation-aided streamflow simulation to the reduced dimensionality of the state space, we carried out data assimilation at spatially semi-distributed or lumped scale and by adjusting biases in precipitation and potential evaporation at a 6-hourly or larger scale. In this talk, we present the results and findings.