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State and Parameter Updating for Improved Streamflow Forecasting via Remotely Sensed Microwave Radiance Data Assimilation

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Accurate estimation of the quantity of water stored in seasonal snow cover and the streamflow resulting from snowmelt, particularly in the mountainous Western United States, is very important information for water resources managers. Challenges in the estimation of Snow Water Equivalent (SWE) arise from uncertain model forcing data, model structure/parameter error, poor spatial resolution of in-situ measurements and uncertainties in remotely sensed observations. Currently, the best method for quantifying SWE is to integrate both modeled and remotely sensed estimates of snow by accounting for the relative uncertainties associated with each estimate. Data assimilation techniques account for observed and modeled errors and sequentially update the state variables.

In this study, SWE, modeled with a distributed version of the National Weather Service's (NWS) SNOW-17 model, and model parameters are updated with remotely sensed brightness temperature (TB). The TB used in this study is produced by the AMSR-E instrument flown on the NASA Aqua satellite. In order to assimilate TB, the SNOW-17 model is coupled with the Microwave Emission Model for Layered Snowpack, as an observational operator.

The simulated snowmelt from SNOW-17 is run through the Sacramento Soil Moisture Accounting model (SAC-SMA) to determine the effectiveness for operational streamflow forecasting. To test the effectiveness of the assimilation, the three scenarios will be compared: no data assimilation, data assimilation just for state updating, and data assimilation with dual state-parameter updating.