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Ensemble Data Assimilation for Channel Flow Routing to Improve Operational Hydrologic Forecasting

Yuqiong Liu[1,2], Haksu Lee[1,3], Dong-Jun Seo[1,3], James D. Brown[1,3], Robert Corby[4] and Tracy Howieson[4]

[1]*NOAA, National Weather Service, Office of Hydrologic Development, Silver Spring, Maryland 20910, USA*
[2]*Riverside Technology, inc., Fort Collins, Colorado 80525, USA*
[3]*University Corporation for Atmospheric Research, Boulder, Colorado 80307, USA*
[4]*NOAA, National Weather Service, West Gulf River Forecast Center, Fort Worth, Texas, 76137, USA*

Channel flow routing, which models water transit through a river channel, is a critical step in operational forecasting of floods and water resources. Like hydrologic modeling for headwater basins, routing modeling involves many kinds of uncertainties arising from observational data and the model itself. In addition to in-channel transformations, routing must also consider uncertainties from less-than-well-known sources and sinks along the channel. Data assimilation holds large potential in accounting for these different uncertainties in a dynamically and statistically consistent way. In this presentation, we describe an application of ensemble data assimilation for a hydrologic channel routing model based on the variable three-parameter Muskingum method, in which we consider errors in the inflow and outflow observations, and uncertainties in the initial conditions and Muskingum parameters. For data assimilation, we adopt the Maximum Likelihood Ensemble Filter (or MLEF, Zupanski 2005), which combines the strengths of variational data assimilation and ensemble filtering techniques. Results from applications to four river sections in Texas in the WGRFC's service area will be presented, along with issues from research and operational perspectives.