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Variational assimilation of streamflow into the three-parameter Muskingum routing model for improved operational river flow forecasting

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The U.S. National Weather Service, (NWS) Office of Hydrologic Development has developed a procedure to improve the accuracy of river flow forecasts based on variational assimilation of streamflow data into the 3-parameter Muskingum flood routing method, herein referred to as 1D-VAR. Compared to the Lag and K hydrologic routing method widely used in current NWS operations for channel routing, 1D-VAR offers various advantages, such as allowing for online parameter estimation and streamflow assimilation, accounting of the impact of lateral inflow, and accounting for manual run-time modifications by human forecasters. Application of 1D-VAR to four channel reaches in Texas showed that assimilating streamflow data into the model significantly improved flow estimates at downstream locations for the lead times of 20 hours in terms of Root Mean Squared Error (RMSE) of streamflow, on average, 80 and 10% RMSE reduction at the prediction time and at the 20-hr lead time, respectively. In the poster, we inter-compare the performance of 1D-VAR with results from the Lag and K method from an operational flood forecasting perspective. We describe how 1D-VAR has been implemented into the Community Hydrologic Prediction System (CHPS), the new open architecture forecasting system of the NWS. The implementation takes advantage of the Open-source Data Assimilation (OpenDA) system developed by Deltares (http://www.openda.org/joomla/index.php). We also discuss planned enhancements of 1D-VAR to realize its maximum value in operational ensemble hydrologic forecasting.