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Towards guided data assimilation for operational hydrologic forecasting in the US Tennessee River basin

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In the US, the forecasting approach used by the NWS River Forecast Centers and other regional organizations such as the Bonneville Power Administration (BPA) or Tennessee Valley Authority (TVA) has traditionally involved manual model input and state modifications made by forecasters in real-time. This process is time consuming and requires expert knowledge and experience. The benefits of automated data assimilation (DA) as a strategy for avoiding manual modification approaches have been demonstrated in research studies (eg. Seo et al., 2009).

This study explores the usage of various ensemble DA algorithms within the operational platform used by TVA. The final goal is to identify a DA algorithm that will guide the manual modification process used by TVA forecasters and realize considerable time gains (without loss of quality or even enhance the quality) within the forecast process.

We evaluate the usability of various popular algorithms for DA that have been applied on a limited basis for operational hydrology. To this end, Delft-FEWS was wrapped (via piwebservice) in OpenDA to enable execution of FEWS workflows (and the chained models within these workflows, including SACSMA, UNITHG and LAGK) in a DA framework. Within OpenDA, several filter methods are available. We considered 4 algorithms: particle filter (RRF), Ensemble Kalman Filter and Asynchronous Ensemble Kalman and Particle filter. The initial results are promising. We will present verification results for these methods (and possible more) for a variety of sub basins in the Tennessee River basin. Finally, we will offer recommendations for guided DA based on our results.

References

Seo, D.-J., L. Cajina, R. Corby and T. Howieson, 2009: Automatic State Updating for Operational Streamflow Forecasting via Variational Data Assimilation, 367, Journal of Hydrology, 255-275.