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The Dynamic Likelihood Filtering Approach

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A Bayesian data assimilation scheme is developed to address advection-dominated or hyperbolic evolutionary problems, and observations. It uses the physics to dynamically update the likelihood in order to extend the impact of the likelihood on the posterior, a strategy that would be particularly useful when the the observation network is sparse in space and time and the associated measurement uncertainties are low.

The filter is applied to a problem with linear dynamics and Gaussian statistics, and compared to the exact estimate, a model outcome, and the Kalman filter estimate. By comparing to the exact estimate the dynamic likelihood filter is shown to be superior to model outcomes and to the Kalman estimate, when the observation system is sparse. The added computational expense of the method is linear in the number of observations and thus computationally efficient, suggesting that the method is practical even if the space dimensions of the physical problem are large.