MURI Proposal:
Integration and Visualization of Multi-Source Information for Mesoscale Meteorology:
Statistical and Cognitive Approaches to Visualizing Uncertainty

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Abstract

Current methods of meteorological forecasting produce predictions with unknown levels of uncertainty, particularly in regions with few observational assets. Forecast errors and uncertainties also arise from shortcomings in model physics. With the ability to estimate the uncertainty in predictions, forecasters would have a powerful tool to make decisions and to judge the likelihood of mission success.

The goals of our proposed project are to develop methods for evaluating the uncertainty of mesoscale meteorological model predictions, and to create methods for the integration and visualization of multi-source information derived from model output, observations and expert knowledge. We will do this by extending the recently developed Bayesian melding approach. We will also develop statistical methods for using results from model ensembles, taking account of model uncertainty. This will build on the general idea of Bayesian model averaging. We will also develop tools and methods for visualizing predictions of quantities of interest and the uncertainty about them by (i) choosing appropriate quantities of interest for display based on cognitive factors, and (ii) developing appropriate plots, maps, three-dimensional displays, and video displays for decision support.