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MUMS Program Opening Workshop
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SPEAKER TITLES/ABSTRACTS

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"Inferring Release Characteristics from an Atmospheric Dispersion Model using Bayesian Adaptive Splines"

Atmospheric particle dispersion simulators are developed to predict the path of a plume of material released accidentally or intentionally, based on characteristics of the release (location, amount and duration) and meteorological condition. Since release characteristics and meteorological conditions are often unknown, the inverse problem is of great interest that is, based on all the observations of the plume so far, what can be inferred about the release characteristics? This is the question we seek to answer using plume observations from a controlled release at the Diablo Canyon Nuclear Power Plant in Central California. With access to a large number of evaluations of an expensive particle dispersion simulator that includes continuous and categorical inputs and spatio-temporal output, building a fast statistical surrogate model presents many statistical challenges, but is an essential tool for inverse modeling and sensitivity analysis. We achieve accurate emulation using Bayesian adaptive splines to model weights on empirical orthogonal functions. We use this emulator as well as appropriately identifiable simulator discrepancy and observational error models to calibrate the simulator, thus finding a posterior distribution of the release characteristics. The assessment of the calibration is performed using the predictive distributions of the particle concentrations,that blend information from both the observations and simulations, for a comparison with the observed particle counts. In addition, as the release was controlled, its characteristics are known, making it possible to compare our findings to the truth.