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Stochastic optimization algorithm for inverse modeling of air pollution KYONGMIN YEO, YOUNGDEOK HWANG, XIAO LIU, JAYANT KALAGNANAM, IBM Research — A stochastic optimization algorithm to estimate a smooth source function from a limited number of observations is proposed in the context of air pollution, where the source-receptor relation is given by an advection-diffusion equation. First, a smooth source function is approximated by a set of Gaussian kernels on a rectangular mesh system. Then, the generalized polynomial chaos (gPC) expansion is used to represent the model uncertainty due to the choice of the mesh system. It is shown that the convolution of gPC basis and the Gaussian kernel provides hierarchical basis functions for a spectral function estimation. The spectral inverse model is formulated as a stochastic optimization problem. We propose a regularization strategy based on the hierarchical nature of the basis polynomials. It is shown that the spectral inverse model is capable of providing a good estimate of the source function even when the number of unknown parameters (m) is much larger the number of data (n), m/n ¿ 50.

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