Multifidelity Methods for Sensitivity Analysis of a Pollutant Dispersal Model

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Recent advances in computational mathematics have made it feasible to model some of the key processes contributing to air quality problems over a range of parameter values in order to gain some insight into the factors that influence pollutant concentration. Here we use a simple parametric differential equation as a pollutant dispersal model and assign probability distribution functions to model uncertainties associated with various input parameters. Sensitivity analysis techniques, such as variance-based Sobol' indices, can then be used to estimate how the uncertainty in model output can be attributed to different sources of uncertainty in the inputs.

For realistic problems, the cost of such modelling and sensitivity analysis can still be prohibitively high. To improve computational efficiency, we apply control variate methods based on a combination of high and low fidelity models. Issues such as the choice of numerical discretisation of the high fidelity model and low fidelity model selection strategies can play an important role in the feasibility and robustness of this process. In this talk, we will highlight some of these aspects with reference to a simple advection-diffusion model of pollution dispersal.