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Sensitivity Analysis and Uncertainty in Groundwater Flow

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Sensitivity analysis and uncertainty quantification have long been considered complementary. In systems with spatially varying parameters, the Fréchet derivative provides a local measure of system sensitivity. We show how the spectral decomposition of the Fréchet operator leads naturally to a hierarchical ordering of local variations to which the the model output is most sensitive and use these to form families of physically meaningful reduced order models that can be used in uncertainty propagation as well as parameter estimation