Geophysical Research Abstracts,
Vol. 11, EGU2009-1958, 2009
EGU General Assembly 2009

Bayesian calibration of fluvial flood models using Gaussian processes to estimate the model inadequacy

L.J. Manning (1), J.W. Hall (2), and D. Walshaw (3)

(1) School of Civil Engineering and Geosciences, Newcastle University, UK (lucy.manning@ncl.ac.uk), (2) School of Civil Engineering and Geosciences, Newcastle University, UK (jim.hall@ncl.ac.uk), (3) School of Mathematics and Statistics, Newcastle University, UK (david.walshaw@ncl.ac.uk)

In order to estimate fluvial flood risk, it is essential to be able to predict flood depth in a wide variety of flow conditions, along with associated uncertainties. The uncertainties in flood model predictions arise as a result of inadequacies in the model representation of the physical processes, as well as uncertainties in the choice of model parameters. To date no general calibration method for hydrodynamic models has been developed which is at once statistically coherent, and acceptable to the user community. Pre-existing practical methods used for parameterisation of hydrodynamic models do not distinguish between sources of errors, lumping them all together.

We present a Bayesian flood model calibration methodology which simultaneously estimates the model parameters and structural errors, by the introduction of a Gaussian process representation for the model inadequacy. This methodology is suitable for risk-based decision making, is workable in practice, able to accommodate a variety of flood models and different data sources, and to take into account different sources of errors in the flood modelling process. The methodology is demonstrated for a steady state flood extent model, a transient flood depth model, and rating curve estimation.