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Staged uncertainty and sensitivity analysis within flood risk analysis

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Modelling flood risk is complex and associated with many sources of uncertainty. Models that are unable to capture the full physical processes that they are intended to represent are widely used and some physical processes, like breach formation, for example, are poorly understood. Furthermore, statistical modelling of extreme events is often based on relatively short periods of observed data and knowledge of basic parameters within the flood system, such as defence crest level or floodplain property, is subject to inaccuracies. Uncertainty analysis is intrinsically linked to flood risk analysis and it is increasingly becoming acknowledged as an important component to explicitly include within the decision making process. Whilst methods for uncertainty analysis have been available for many years, these typically become computationally intensive and impractical when applied to flood system risk analysis.

Variance based sensitivity analysis is a robust approach for assessing the contribution that individual input parameters and variables make to the output uncertainty of a model. This can be important for prioritising future data gathering exercises or model refinement research, where the variables contributing most to the uncertainty are prioritised for attention. In essence, this approach involves repeated uncertainty analyses to gauge the relative importance of a specific input variable in influencing the output uncertainty and can hence be extremely computationally demanding.

This paper details how the structure of a flood risk model can be reduced to a series of stages and how this can significantly reduce the computational burden of uncertainty and sensitivity analyses, yet still provide robust assessment. The methods are demonstrated on a case study.

Keywords: Flood risk, uncertainty, sensitivity

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