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Development and Application of a Large-Scale Flood Risk and Financial Impact

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Flood risk models as developed for the insurance sector are typically comprised of three major components: i) a hazard module describing where flooding may occur and what the inundation will be, ii) an exposure module describing the value of properties at a particular location, and iii) a vulnerability module which, based on a particular property type and property use (e.g., residential, industrial) describes the relationship between flood depth and the fraction of the building value that is affected or lost. Return period of losses can be determined from combining results from the three components.

For the insurance sector it is of great relevance to be able to estimate the type of losses that happen frequently, but also those that happen infrequently: the former is determinant for insurance pricing, and the latter is more important for reinsurance purchasing and solvency issues. To estimate the infrequent (i.e., severe) events, long simulation times are required. Moreover, the sector puts a specific requirement on the scale on which flood modelling should occur: insurers typically have insured properties across a larger area and are interested in losses locally, but also in spatial and temporal correlation of losses. Both these requirements (i.e., long simulation times and assessment of spatio-temporal correlation of losses) make that factors such as model runtime often put constraints on the model choice and modelling resolution. Furthermore, it also limits the calibration and validation data that can be used, given that they have to be consistently available over a large area and preferably over a long time period.

In this work we will present the different model components for the flood model that was developed for the UK by Risk Management Solutions (RMS). We will mainly focus on the hazard module components that were used and developed (i.e., the hydrological, hydraulic and river defence models), and we will discuss input data used in this type of large-scale flood modelling (e.g., the stochastic representation of precipitation data and other meteorological forcings), and the calibration data used (e.g., river flow data and existing flood maps). Finally, we will show some of the model results obtained from the RMS flood model in the UK.