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Understanding global flood model predictions and how these vary with location

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Today, there are multiple global flood models producing continental-scale flood hazard maps. These models can exhibit significant variation in the modelled hazard extent. However, this variation is largely unexplained except for general statements about differences in the modelling structures. Understanding the behaviour of these global flood models is necessary to determine why they are different and how they can be further developed. To begin this process, we aim to develop the first detailed understanding of how one global flood model responds to its parameterisation.

Preliminary sensitivity analysis was performed using Morris method on the Bristol global flood model at the California-Nevada border, which has 37 parameters, spread through a modelling chain which processes basic remotely sensed data (e.g. topography and land use) and terrestrial data (e.g. river gauges) through to the hydrodynamic inundation model. In terms of flood modelling, this number of parameters is uncharacteristically high because of the long processing chain but also implies overparameterisation. The analysis shows that predictions of total flooded extent are highly sensitive to a small grouping of parameters. We also find that some parameters exhibit a high degree of interaction with each other, and whilst hydraulic parameters are expectedly important, there are other highly important parameters which we did not expect to find so important. Variability in climate, topography, and other geoclimatic features across the globe mean the conclusions of the preliminary analysis are contextual rather than general. Sensitivity analyses at further locations were performed to solidify the results of the preliminary site analysis. This approach found there are a group of parameters which are always insignificant, hence can be removed.

Next, we examine how sensitivities change with respect to geoclimatic features. This is applied first with respect to insensitive parameters, to assess if at any location a parameter becomes significant and what domain feature this is due to. This correlation analysis will then be extended to the highly ranked parameters From this work, we find the main influences on flood hazard prediction at the global scale for the used model structure. We anticipate that our understanding of the dominant influences on inundation simulation from this model are transferable to the other global flood models.