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Applications of flood depth from rapid post-event footprint generation

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Immediately following large flood events, an indication of the area flooded (i.e. the flood footprint) can be extremely useful for evaluating potential impacts on exposed property and infrastructure. Specifically, such information can help insurance companies estimate overall potential losses, deploy claims adjusters and ultimately assists the timely payment of due compensation to the public. Developing these datasets from remotely sensed products seems like an obvious choice. However, there are a number of important drawbacks which limit their utility in the context of flood risk studies. For example, external agencies have no control over the region that is surveyed, the time at which it is surveyed (which is important as the maximum extent would ideally be captured), and how freely accessible the outputs are. Moreover, the spatial resolution of these datasets can be low, and considerable uncertainties in the flood extents exist where dry surfaces give similar return signals to water. Most importantly of all, flood depths are required to estimate potential damages, but generally cannot be estimated from satellite imagery alone.

In response to these problems, we have developed an alternative methodology for developing high-resolution footprints of maximum flood extent which do contain depth information. For a particular event, once reports of heavy rainfall are received, we begin monitoring real-time flow data and extracting peak values across affected areas. Next, using statistical extreme value analyses of historic flow records at the same measured locations, the return periods of the maximum event flow at each gauged location are estimated. These return periods are then interpolated along each river and matched to JBA's high-resolution hazard maps, which already exist for a series of design return periods. The extent and depth of flooding associated with the event flow is extracted from the hazard maps to create a flood footprint. Georeferenced ground, aerial and satellite images are used to establish defence integrity, highlight breach locations and validate our footprint.

We have implemented this method to create seven flood footprints, including river flooding in central Europe and coastal flooding associated with Storm Xaver in the UK (both in 2013). The inclusion of depth information allows damages to be simulated and compared to actual damage and resultant loss which become available after the event. In this way, we can evaluate depth-damage functions used in catastrophe models and reduce their associated uncertainty. In further studies, the depth data could be used at an individual property level to calibrate property type specific depth-damage functions.