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## Forecasting surface water flooding hazard and impact in real-time

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Across the world, there is increasing demand for more robust and timely forecast and alert information on Surface Water Flooding (SWF). Within a UK context, the government Pitt Review into the Summer 2007 floods provided recommendations and impetus to improve the understanding of SWF risk for both off-line design and real-time forecasting and warning. Ongoing development and trial of an end-to-end real-time SWF system is being progressed through the recently formed Natural Hazards Partnership (NHP) with delivery to the Flood Forecasting Centre (FFC) providing coverage over England & Wales. The NHP is a unique forum that aims to deliver coordinated assessments, research and advice on natural hazards for governments and resilience communities across the UK. Within the NHP, a real-time Hazard Impact Model (HIM) framework has been developed that includes SWF as one of three hazards chosen for initial trialling.

The trial SWF HIM system uses dynamic gridded surface-runoff estimates from the Grid-to-Grid (G2G) hydrological model to estimate the SWF hazard. National datasets on population, infrastructure, property and transport are available to assess impact severity for a given rarity of SWF hazard. Whilst the SWF hazard footprint is calculated in real-time using 1, 3 and 6 hour accumulations of G2G surface runoff on a 1 km grid, it has been possible to associate these with the effective rainfall design profiles (at 250m resolution) used as input to a detailed flood inundation model (JFlow+) run offline to produce hazard information resolved to 2m resolution. This information is contained in the updated Flood Map for Surface Water (uFMfSW) held by the Environment Agency. The national impact datasets can then be used with the uFMfSW SWF hazard dataset to assess impacts at this scale and severity levels of potential impact assigned at 1km and for aggregated county areas in real-time. The impact component is being led by the Health and Safety Laboratory (HSL) within the NHP.

Flood Guidance within the FFC employs the national Flood Risk Matrix, which categorises potential impacts into minimal, minor, significant and severe, and Likelihood, into very low, low, medium and high classes, and the matrix entries then define the Overall Flood Risk as very low, low, medium and high. Likelihood is quantified by running G2G with Met Office ensemble rainfall inputs that in turn allows a probability to be assigned to the SWF hazard and associated impact.

This overall procedure is being trialled and refined off-line by CEH and HSL using case study data, and at the same time implemented as a pre-operational test system at the Met Office for evaluation by FFC (a joint Environment Agency and Met Office centre for flood forecasting) in 2016.