Improving Estimates of Flood Magnitude using better Information on Spatial and Temporal Variability of Rainfall

*Giulia Giani[1], Miguel Angel Rico-Ramirez[1], Ross Woods[1]

1. University of Bristol

Flood forecasting and flood estimation commonly rely on catchment-average rainfall estimates. Reasons for the use of coarse-resolution data include (i) a lack of information about the specific conditions in which higher resolution data provide useful information (ii) the prevalence of lumped conceptual hydrological models which cannot fully exploit spatially-varying rainfall data.

However, rainfall variability has been identified to be one of the most influential factors in shaping flood magnitude. Therefore, ignoring rainfall variability can cause significant bias in the resulting flood estimates for some catchments.

High-resolution rainfall data in both space and time are now routinely available on a national scale, based on weather radar, satellite products and interpolated rain gauge data. Yet some of these data (e.g. radar rainfall) are not routinely used in operational hydrology. In fact, the rainfall-catchment interactions for which high resolution radar rainfall data can produce a significant improvement in flood magnitude estimates are still unclear.

In this study we analyse the impact of different spatial resolutions of rainfall data on flood estimates. We use a set of 137 catchments across the UK with different characteristics, and two different rainfall datasets from the UK national weather radar network and spatially-interpolated rain gauge data, both at 1km-1hr resolutions.

We compute a set of spatial rainfall statistics to estimate the variability of rainfall on each catchment for individual rainfall events that occurred during the period 2006-2015. To do so, an innovative methodology for identification of individual rain events from continuous rainfall timeseries based on catchment response time is proposed.

This paper discusses the preliminary results of this analysis and the implications of the results in terms of hydrological modelling. The final purpose of this work is to help flood forecasters in decision making process when flood estimates computed by lumped and distributed models are both available: hydrologists tend to stick to the model they have experience with, which are usually very well calibrated lumped models, but in some catchments, if the variability of rainfall is high, a distributed might be more reliable, or at least provide additional useful information.

Keywords: Rain event identification, Rainfall spatial statistics, Hydrological modelling, Flood forecasting