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Modelling of space-time rainfall for System based Analysis and Management of urban flood risks (SAM).

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Floods are a matter of great concern, especially in urban areas where a high proportion of the rain becomes effective and produces runoff and the spatial and temporal variability of rainfall constitutes a significant source of uncertainty for hydrological, and in particular, urban drainage modeling. In the UK, the current practice is to use event-based or continuous single-site rainfall inputs, which are then applied uniformly across the catchment. Models of urban drainage systems are becoming very sophisticated and now tend to cover large areas. The extent to which a single stationary design storm, or even continuous single-site rainfall inputs can be used to predict drainage performance is questionable for larger catchments.

This paper reports on one element of a wider project (SAM) funded by the UK Department of Trade and Industry. In this project, a long time series of spatially-varying rainfall data is being developed, making use of characteristics of real rainfall events measured by UK weather radars.

To achieve this, the Gaussian displacement spatial-temporal model (GDSTM) of Northrop (1998), which is based on a Poisson-cluster point process in space and time (Cox and Isham, 1988), is used. This makes the assumption that storms arrive according to a Poisson process in space and time, triggering another Poisson process of cell arrivals over the storm duration. These cells are displaced from the storm centre according to a Normal distribution. Historic rainfall events are identified from a 3.5 year record of Met Office weather radar data from 3 different radars and the characteristics of the interior of each event are represented by 11 parameters. The process of event arrival is described by 6 additional parameters. For each month within the radar data record, a library of model parameters is obtained and used to develop simulations of

100 years of continuous, spatially varying rainfall at 5 minute intervals and 1km spatial resolution over three regions: London, Bradford and Glasgow. The objective is to use the synthetic data as input to existing urban drainage models to examine system performance.

An initial examination of the rainfall model performance is positive, showing that it is possible to reproduce standard statistics across several space-time scales, though limitations in simulating extreme values exist when compared with statistics from the Flood Estimation Handbook.