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New methods to assess severity and likelihood of urban flood risk from intense rainfall

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Flooding from intense local rainfall can contribute a significant proportion of total damages and losses experienced, particularly in urban areas, where sewerage overcharging, localised river flooding, and overland flow, can conspire to cause significant loss potential to concentrations of assets and populations. Events such as the Summer 2007 floods in the UK have shown that there is a significant risk to key urban centres. However, current approaches to the quantitative assessment of flood risk, and the estimation of the potential frequency and severity of events, poorly represent flood risk from intense, localised rainfall. This causes problems not only for insurers and reinsurers, but also for urban planners, local authorities and emergency services where assessment of localised impacts from intense rainfall flooding form a key component of risk assessment needs.

The localised nature of pluvial flooding, and the importance of complex terrain, drainage and pathways in determining water ponding within urban areas, makes the modelling of urban pluvial flood risk particularly problematic. Current approaches, usually through statistical means, or simple flood risk 'maps' based on conventional topographic information, provide some information to assist risk decisions, but lack the level of detail necessary for accurate representation of the flood extents and depths in relation to the properties and other assets exposed.

New techniques including ground based lasers-canner (LIDAR) provide a potential source for ultra-high resolution (centimetre) terrain information, which can be incorporated within urban scale hydrological-hydraulic model to provide appropriate resolution flood models. The corresponding development of new, efficient hydraulic models [Paul, Tim to add a bit here] with the ability to handle the high spatial and temporal resolutions required of urban flood provides a new modelling environment with which to tackle urban flood risk assessment, including the construction of appropriate probabilistic flood models.

This paper will describe new research being undertaken to assess the practicality of ultra-high resolution, ground based laser-scanner data for flood modelling in urban centres, using new hydraulic propagation methods to determine the feasibility of such data to be applied within stochastic event models.

Results from the collection of 'point cloud' data collected from a mobile terrestrial laser-scanner system in a key urban centre, combined with appropriate datasets, will be summarized here and an initial assessment of the potential for the use of such data in stochastic event sets will be made.

Conclusions are drawn from comparisons with previous studies and underlying DEM products of similar resolutions in terms of computational time, flood extent and flood depth. Based on the above, the study provides some current recommendations on the most appropriate resolution of input data for urban hydraulic modelling.