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A Screening Method for Flash Flooding Risk using Instantaneous Unit Hydrographs Derived from High Resolution DEM data

Nalin Senevirathne (1) and Garry Willgoose (2)

(1) The University of Newcastle, Callaghan, Australia (c3152807@uon.edu.au), (2) The University of Newcastle, Callaghan, Australia (garry.Willgoose@newcastle.edu.au)

Flash flooding is considered a severe natural hazard and has had significant impact on human and infrastructure throughout the history. Modelling techniques and the understanding of flash flooding are getting improved with the availability of better quality data such as high resolution Digital Elevation Models (DEM). DEMs allow the automated characterization of the influence of geomorphology on the hydrologic response of catchments. They are particularly useful for small ungauged catchments where available hydrologic data (e.g. rainfall, runoff) are sparse and where site specific studies are rarely done unless some evidence of high risk is available.
In this paper, we present new risk indicators, derived directly from instantaneous unit hydrographs (IUH), which can be used to identify flash flooding risk areas within catchments. The study area includes 35 major river basins covering a 1700km long by 50km wide coastal strip of Eastern Australia. Standard terrain analysis methods (pit filling, flow direction, local slope, contributing area, flow velocity and travel time) were used to produce IUHs for every pixel in the study area using a high resolution (1 arc second) DEM. When computing the IUHs, each pixel was considered as the outlet of its own catchment bounded by its contributing area. This allows us to characterise the hydrological response at the finest scale possible for a DEM. Risk indicators related to rate of storm rise and catchment lag time were derived from IUHs. Flash flood risk maps were produced at the catchment scale and they are match well with the data of severe flash flooding that occurred around Toowoomba (at the northern end of the coastal strip studied) in January 2011.