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High resolution remote sensing to support modelling of urban flooding.

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Global climate change is expected to cause more intense rainfall events in many parts of the world raising serious concern about urban flooding. Prediction of the extent of urban flooding and thereby taking necessary actions to reduce its impact requires more accurate simulation of urban flooding phenomena. The nature and cause of urban flooding are different from that of river flooding. Failure of the drainage capacity, especially the sewer system, flushes back the surcharge water through manholes on the street surface in case of extreme rainfall events. Street networks play an important role as water channels to retain and convey the water downstream. When the sewer systems are surcharged, they send the excess water back to the street surface or don't allow the water to enter via street inlets. The excess water starts to flow on the street surface and is routed in the adjacent topography. So a realistic 3D surface model consisting of street networks and its surrounding topography are important inputs to any detailed urban flooding simulation model. Airborne LiDAR (Light detection and ranging) sensor allows relatively precise and faster collection of topographic data with high resolution spatial information. Topographic objects such as buildings, trees and streets can be detected and modelled by integrating LiDAR derived elevation data and multispectral images. This objects influence the flow dynamics significantly when an urban area is flooded. The hydrologic properties of urban surfaces, i.e. the permeability of paved and unpaved surfaces play an important role in rainfall-runoff generation. While the paved areas contribute to the full conversion of effective rainfall into runoff, the unpaved surfaces initiate the process of infiltration and storage of water if there is a retention basin on the surface. The spectral information contained in the high resolution multispectral images and LiDAR derived intensity data are valuable data sources for detecting different types of surface properties in a complex urban scene. The integration of different sources of data with varying spatial resolution is a challenging task which requires special attention in data pre-processing and implementation of efficient algorithms. The purpose of this study is thus two folds. Firstly, to detect and model hydraulic and hydrologic properties of a complex urban area by integrating LiDAR data, multispectral images and GIS maps. Secondly, to achieve higher degree of automation in data processing and detailed 3D output map generation of a complex urban scene to simulate urban flooding phenomena.

Keywords: Urban flooding, LiDAR data, Object detection, surface characterization.