Use of LiDAR data and multispectral images for urban flood modelling: State of Art

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Abstract

The European Parliament Directive 2007/60/EC on the assessment and management of flood risks defines that the states shall prepare flood hazard maps at the most appropriate scale, for the areas with potential significant flood risks.

Flood modelling requires several types of input data like topographic data and friction coefficient values. These are considered to be the key data sets for flow drainage and flood modelling in urban areas.

The Airborne Laser Scanning (ALS) or LiDAR (Light Detection And Ranging) is one technique used to obtain the topographic data of flood areas and cross sections of a river. This data source can be used to produce high-resolution Digital Terrain Model (DTM).

The integration of DTM generated from laser scanning altimetry into flood modelling is yet a research topic, because the LiDAR data require a considerable pre-processing effort before their use within hydraulic modelling. Furthermore, it is also necessary to determine the optimal spatial resolution and the most adequate gridding method. The topographical complexity of urban areas and the computational restrictions of high-resolution grids require a compromise between terrain detail representation and model runtime.

The integration of airborne laser scanning altimetry data, high-resolution multispectral images and large scale cartography provide, in urban environments, accurate geographic database of the land cover, as well as information about objects such as height of the vegetation and the buildings. These data may be provided in a wide range of spatial resolutions and present the possibility of developing methods for generating automatically spatially-distributed friction coefficients.

Surface friction affects the movement of the flood wave and, particularly, the timing of inundation across the floodplain. Very few studies on urban flood modelling have used spatially-distributed friction coefficients. The main reason for the lack of research work on this area is that the selection of appropriate friction coefficients is difficult and the assessment of results complicated. It is recognised that floodplain friction coefficients have impact on the uncertainty of the produced inundation maps and on the flood model sensitivity.

The information about floodplain outline provided by aerial photography and satellite image are an important source of validation data. Uncertainty occurs at all levels in the modelling process, and propagates through the final model predictions. Therefore, it is also necessary to evaluate the uncertainty. The sources of uncertainty in model predictions are the uncertainty in input data and the uncertainty caused by domain discretisation (spatial resolution).

This paper will present the characterization of different techniques in flood inundation modelling in urban environments under the point of view of the data source (resolution and precision).

Keywords

DTM; Flood Modelling; Friction Coefficients.

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