

Urban flooding risk mapping using hydrodynamic and GIS models

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Rapid urbanization and unpreventable climate change have resulted in severe urban flooding events that hit worldwide cities more frequently and heavily. An instructive and up-to-date monitoring and evaluation on the distribution of flooding risks in cities is necessary and valuable for urban planning. This research applied two major approaches in current urban flooding studies: hydrodynamic and GIS models in a case study in London, ON, Canada. From the hydrological view, hydrodynamic models employ a series of hydraulic equations to calculate the motion of water from fluvial/pluvial-based sources. The inputs of such hydrodynamic models are often composed of detailed hydrological parameters (e.g. river crossing section), which need to be inputted by experienced hydrodynamic experts. Besides the high standard of hydrological expertise, hydrodynamic models involve heavy calculation and are often difficult to run with high spatial resolution data. For end-users who do not have hydrological background, the two features impede the easy access to hydrodynamic models. On the other hand, GIS models can be easily equipped with multiple high spatial resolution GIS layers. But in GIS models, hydrodynamic physics does not apply and the key parameters are often generated from historical flooding events or empirical models. Therefore, a bond between hydrodynamic and GIS models needs to be made in urban flooding studies, in order to take advantage of both models strength. This study used the water level result derived from one open-source hydrodynamic model (PCSWMM) as a known flooding event. According to the hydrodynamic model result, the parameters that the GIS model requires were decided. In this way, the GIS model can be considered as a simplification of the used hydrodynamic model. The used GIS layers in this study include DEM (digital elevation model), slope, curvature, landuse/landcover, and road system density. As a result, an urban flooding risk map is generated using the hydrodynamic-model-trained GIS model.

Keywords: Urban flooding, GIS model