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How to develop site-specific urban pluvial flooding mitigation strategies? A new approach to investigating the spatial heterogeneous driving forces of urban pluvial flooding

Qifei Zhang[1,2], Zhieng Wu[2], Guanhua Guo[2], and Paolo Tarolli[1]
[1]Department of Land, Environment, Agriculture and Forestry, University of Padova, Legnaro, PD, Italy
(qifei.zhang@studenti.unipd.it)
[2]School of Geographical Sciences and Remote Sensing, Guangzhou University, Guangzhou, Guangdong Province, China

With the acceleration of urbanization, urban pluvial flooding seriously threatens urban sustainable development and human life. It is widely accepted that various landscape elements contribute to the magnitude of urban pluvial flooding. Considerable efforts investigated the universal mechanism of urban pluvial flooding by regarding the whole study area as spatial homogeneous while ignoring its local specific mechanism. The spatially heterogeneous effects of landscape elements on urban pluvial flooding remain poorly understood. Additionally, it is still unclear how the interactive effects of landscape elements affect urban pluvial flooding. In most practical situations, urban pluvial flooding is affected by multiple factors, rather than by a single factor alone. These shortcomings make it impossible to formulate urban pluvial flooding mitigation measures based on the relative contribution of various landscape elements on urban pluvial flooding. To shed some light on this topic, an innovative method that integrated the all subsect regression model, cubist regression tree, and geographical detector model is presented to spatially explicit the heterogeneous forces driving urban pluvial flooding variation and identify the pluvial flooding dominant driving forces with different local conditions. By comparing with two other commonly used regression methods (global regression model, spatial lag model), the proposed method can fully quantify this spatial non-stationarity mechanism and spatially explicit the local driving forces. Urban pluvial flooding dominant driving factors and their contribution vary with the local site conditions. Even for the same dominant factor, its contribution to pluvial flooding varies considerably in different watersheds. Based on this, local authorities can develop site-specific urban pluvial flooding mitigation strategies according to the dominant factors in different areas. The results of this study extend our scientific understanding of the site-specific mechanism of urban pluvial flooding, providing useful information for formulating more targeted and effective urban pluvial flooding mitigation strategies with different local conditions, rather than a “one-size-fits-all” policy.