Impact of urbanization on flood peak flow and runoff coefficient: a quantitative perspective

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Land use/cover(LUC) change is the direct impact of urbanization on watersheds, which in turn changes the flood response of watershed, in this study which is described by the change of flood peak and runoff coefficient of the watershed flood process. In the past decades, significant LUC changes occurred in watersheds worldwide, particularly where rapid urbanization has been observed. China is one of these countries, Pearl River Delta Area is the rapidest urbanization area in China, and there appeared lots of highly urbanized watersheds. Flood response change in this area has not been studied yet. In this study, 3 typical watersheds in this area are selected to study the impact of LUC change on flood responses. First, the LUC changes of the studied watersheds from 1987 to 2015 are estimated by using Landsat satellite remote sensing imageries at a 3 year-interval, and 11 LUCs in different years have been prepared. The SVM classification algorithm is employed to do this work automatically. The LUC changes in these watersheds indicate that these watersheds had a rapid urbanization rate, and the watersheds have been highly urbanized. Then the Liuxihe Model, a physically based distributed hydrological model proposed for watershed flood forecasting is set up for these watersheds, which derives model parameters physically based on the terrain properties, including the LUCs estimated in this study. LUC changes represent the changes of model parameters, thus the flood responses. Precipitation data from three flood events has been collected, including heavy, medium and light scale. This precipitation is used to drive the Liuxihe Model to simulate the watershed flood processes. The results show that the flood hydrographs simulated changes significantly with the LUC changes, including both the peak flow and runoff coefficient. Quantitative relationship between the food peak flow, runoff coefficient and the urbanization rate has been analyzed and regressed, and it has been found there exists very good functional relationship between the food peak flow, runoff coefficient and the urbanization rate.