

Application of geographic weighted regression to establish flood-damage functions reflecting spatial variation

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Abstract

Flood damage functions are necessary to ensure comprehensive flood-risk management. This study attempts to establish a residential flood-damage function through interviewing the residents living in the region where flood disasters occur frequently. Keelung River basin, near Taipei Metropolitan in Taiwan was selected as study area. Flood damages are related to the flood depths, which are the most commonly considered factor in previously published work. Ordinary least squares (OLS) regression was used to construct the flood-damage function at the beginning. Analytical results indicate that flood depth is the significant variable, but the spatial pattern of the residuals shows that residuals exhibit spatial autocorrelation. The Geographically Weighted Regression (GWR) Model was then applied to modify the traditional regression model, which cannot capture spatial variations, and to reduce the problem of spatial autocorrelation. The *R*-square value was found to increase from 0.15 to 0.24, and the spatial autocorrelation in the residuals was no longer evident. A modified OLS model with a dummy variable to capture the spatial autocorrelation pattern was also proposed for future applications. In conclusion, the residential flood damage is determined by flood depth and zone, and the GWR model not only captures the spatial variations of the affecting factors, but also helps to discover the independent variable to modify the traditional regression model.

Keywords: flood damage, flood depth, OLS, GWR, spatial autocorrelation