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The analysis of heterogeneity and frequency of extreme storms under urban settings: A case study in Shanghai City

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Cities are increasingly vulnerable to extreme hydro-meteorological disasters, like rainfall-generated flooding. The urban floods lead to devastating damage to property and loss of human life. Extreme storms, which is the major trigger of urban flooding, thus need to be carefully examined. Our previous studies have found an increase of large rainfall intensity and variability in Shanghai City, China. In this study, we will further explore: 1) the change of spatio-temporal heterogeneity and frequency of extreme storms over decades; 2) the association between urbanization and these changes. We first extract the extreme storm catalogs for various time scales. The characteristics of space-time structure of storms in these storm catalogs are examined by using spatial analysis methods. The interannual variation of rainfall space-time structure are investigated. By using the strategy of Stochastic Storm Transposition (SST), extreme storm frequencies are generated. Various storm frequencies with different storms catalogs are then compared to show the change of magnitude of extreme storms frequencies. The correlation between the process of urbanization and the change of extreme storms is analyzed from the statistical perspective. From these results, we will have a clearer understanding of urban extreme storms and provide important implementations for assessment of flood risks in urban areas.