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Urban Flood Resilience Comprehensive Assessment of "720" Rainstorm in Zhengzhou Based on Multiple Factors

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Abstract : Under the background of global climate change and rapid development of modern urbanization, the frequency of climate disasters such as extreme precipitation in cities around the world is gradually increasing. In this paper, Hi-PIMS model is used to simulate the "720" flood in Zhengzhou, and the continuous stages of flood resilience are determined with the urban flood stages are divided. The flood resilience curve under the influence of multiple factors were determined and the urban flood toughness was evaluated by combining the results of resilience curves. The flood resilience of urban unit grid was evaluated based on economy, population, road network, hospital distribution and land use type. Firstly, the rainfall data of meteorological stations near Zhengzhou and the remote sensing rainfall data from July 17 to 22, 2021 were collected. The Kriging interpolation method was used to expand the rainfall data of Zhengzhou. According to the rainfall data, the flood process generated by four rainfall events in Zhengzhou was reproduced. Based on the results of the inundation range and inundation depth in different areas, the flood process was divided into four stages: absorption, resistance, overload and recovery based on the once in 50 years rainfall standard. At the same time, based on the levels of slope, GDP, population, hospital affected area, land use type, road network density and other aspects, the resilience curve was applied to evaluate the urban flood resilience of different regional units, and the difference of flood process of different precipitation in "720" rainstorm in Zhengzhou was analyzed. Faced with more than 1,000 years of rainstorm, most areas are quickly entering the stage of overload. The influence levels of factors in different areas are different, some areas with ramps or higher terrain have better resilience, and restore normal social order faster, that is, the recovery stage needs shorter time. Some low-lying areas or special terrain, such as tunnels, will enter the overload stage faster in the case of heavy rainfall. As a result, high levels of flood protection, water level warning systems and faster emergency response are needed in areas with low resilience and high risk. The building density of built-up area, population of densely populated area and road network density all have a certain negative impact on urban flood resistance, and the positive impact of slope on flood resilience is also very obvious. While hospitals can have positive effects on medical treatment, they also have negative effects such as population density and asset density when they encounter floods. The result of a separate comparison of the unit grid of hospitals shows that the resilience of hospitals in the distribution range is low when they encounter floods. Therefore, in addition to improving the flood resistance capacity of cities, through reasonable planning can also increase the flood response capacity of cities. Changes in these influencing factors can further improve urban flood resilience, such as raise design standards and the temporary water storage area when floods occur, train the response speed of emergency personnel and adjust emergency support equipment.

Keywords : urban flood resilience, resilience assessment, hydrodynamic model, resilience curve
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