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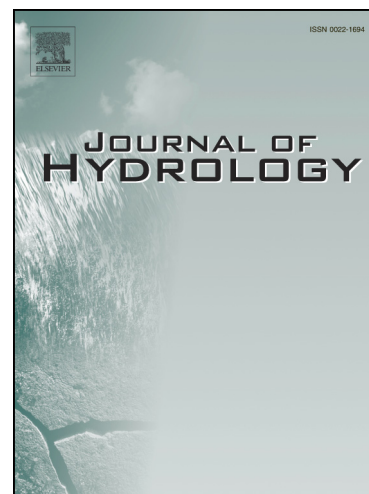
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Urban flooding risk assessment based on an integrated k-means cluster algorithm and improved entropy weight method in the region of Haikou, China

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Abstract

Floods are considered as one of the most frequently occurring natural hazards worldwide and are occurring increasingly frequent in recent decades. Flood risk assessment is an important tool for flood prevention and involves significant practical applications in flood risk management and flood disaster reduction. In the study, an integrated methodology is proposed by incorporating urban flood inundation model, improved entropy weight method and k-means cluster algorithm to evaluate urban flood risk. The proposed approach is data driven without considering classification standard of different risk levels, and thus provides a more reasonable and objective result. A region in Haikou, China is adopted to test the applicability of the proposed approach. Seven evaluation indices are selected by coupling the natural hazard index system and hydrological models. The index weights are calculated by an improved entropy weight method that integrates the entropy weight method and analytic hierarchy process (AHP) method. Subsequently, the k-means cluster algorithm is used to develop the flood risk map in the study area. The results indicate that high risk zones cover 13.7% of total area, which generally exhibit higher inundation depth and lower elevations. The assessment result matches well with the historical data of flood events. The traditional cluster algorithm and technique for order of preference by similarity to ideal solution (TOPSIS) methods are used for comparison with the improved entropy-cluster algorithm so as to validate the proposed approach for risk management. The result demonstrates that the proposed approach is feasible and exhibits the most reasonable classification result. The study outcomes provide a novel approach for flood risk assessment and can provide valuable information for urban flood management.

Keywords Urban flood management; Risk assessment; Cluster algorithm; Improved entropy weight

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