Flood hazard risk prediction and assessment of Guangdong Hong Kong Macao Greater Bay Area based on random forest model

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Abstract

Against the backdrop of global climate change and rapid urbanization, climate disaster events are frequent. In highly urbanized areas, floods pose the greatest threat and destruction. Therefore, evaluating and predicting the risk distribution of flood disasters through appropriate methods can minimize the loss and damage of disasters, which is of great significance. In this study, based on the Random Forest (RF) algorithm, a model is constructed to evaluate and predict a flood disaster process in the Guangdong-Hong Kong-Macao Greater Bay Area (GBA) of China. We use remote sensing (RS) images and GIS tools to extract the area submerged by the flood when the disaster occur, select 15 risk indicators, create 221975 samples to train and test the model and obtain the importance of each indicator to the prediction results. In addition, we select two machine learning algorithm models for accuracy comparison with the RF model. The results show that: (1) High flood areas are mainly distributed in urban agglomerations in the central and southern parts of GBA, including Guangzhou, Foshan, Dongguan, Shenzhen, Macau etc. (2) Flood risk prediction and evaluation methods using RS and GIS, combined with RF models, are easy to analyze the spatial pattern and influencing factors of flood risk, and have good applicability. Compared with other models, it has higher prediction accuracy and reliability. The overfitting phenomenon is also not obvious. (3) The maximum 1/3/6/9 and DEM elevation indicators are the most important five of the 15 risk indicators, and the Relative Position Index (RPI) is the least important, while other indicators are of general importance. This study provides a new method for evaluating and predicting flood disaster risks, and the evaluation results provide a reference for flood risk management, prevention, reduction of life and property losses in the study area.

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