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Quantitative flood disaster loss-resilience with the multilevel hybrid evaluation model

The severity of global flood disasters is increasing, leading to loss of life and property. Enhancing the resilience of social systems is a crucial approach to sustainable flood management. Many studies have assessed disaster resilience and explored the correlation between flood losses and intensity but have neglected to investigate the role of resilience building in reducing disaster losses. This study proposed a research route for linking flood losses and disaster resilience to quantify their relationship. Using Guangdong Province, China, as a case study, the mixed-effects (ME) model was developed to assess flood losses in cities. The multilevel hybrid evaluation model (MHEM) was proposed to evaluate resilience. Subsequently, resilience curves were constructed to quantitatively assess disaster resilience and corresponding losses. The results indicate that: (1) The ME model can simultaneously construct disaster intensity-loss curves for multiple cities with high fitting accuracy. The MHEM integrates multiple methods to determine the evaluation result with the highest consistency, demonstrating high reliability. (2) The central and southern regions of Guangdong Province exhibit lower disaster losses and higher resilience, whereas the northern regions experience higher disaster losses and lower resilience. (3) As disaster resilience increases, the reduction in flood loss gradually decreases. Cities with low resilience demonstrate greater randomness in disaster losses compared to highly resilient cities, and enhancing their resilience can more effectively reduce their levels of loss. This study provides a quantitative basis and practical methods for comprehensively addressing natural disasters and adapting to global climate change.

Keywords: flood loss, disaster resilience, mixed-effects model, multilevel hybrid evaluation model, climate change

Biography

Wu's research mainly focuses on the impacts and adaptation of climate change and risk of natural disasters. He undertakes national research projects, National Natural Foundation of China, etc. He has published (jointly published) more than 300 scientific research papers and books. He is a CLA of the IPCC-AR4, and LA of AR5; also a CLA of the second volume of the First to Fourth National Assessment Report on Climate Change.

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