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A NEW GIS-BASED MULTICRITERIA MODEL TO ENHANCE URBANFLOOD RISK ASSESSMENT UNDER CLIMATE CHANGE: THENSMAUTMETHOD

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ABSTRACT

The urge of climate crisis imposes policymakers to adopt a new perspective to combat its practical impacts on the urban functioning, especially with regard to the life quality under the occurrence of extreme events. Therefore, it must be highlighted the prominence of hydrological events worldwide, which climate indexes suggest this disaster to be more intense and frequent, particularly in urban spaces. Given this backdrop, this work seeks to model temporally and spatially the dynamic effects of both climate variability and demographic scenarios to enhance the flood risk management practices under a multidimensional viewpoint. From an in-depth analysis of the state-of-the-art regarding Multi-Criteria Decision Making/Aiding approach, this paper aims to insert the decision-maker's (DM's) preferences, in terms of expected utility (EU), by proposing a new method which we call the Non-Stationary Multi-Attribute Utility Theory (NSMAUT). This way, the new model was designed to tackle simultaneously with environmental, financial, human, mobility, and social impacts from floods, which climate and demographic scenarios have the potential to alter a proper risk prioritization to promote urban safety. So, the NSMAUT method represents an important methodological advance and it introduces the time dependence into the EU modeling with MAUT, thereby modeling the increasing impatience of the DM when stating his/her preference for receiving outcomes in the future. With the aid of climatic and demographic forecasting models, a numerical application in a Brazilian town was performed to validate the new approach and it provides, statistical, georeferencing, and graphical visualization tools that consolidate urban adaptation policies in short-, medium-, and long-term perspectives. As a result, the innovative contributions evidenced in this paper should promote not only financial impacts, thereby allocating properly financial resources to fund adaptation measures, but also social and environmental implications, once the findings share important evidence that supports public authorities in combating social inequalities and pessimistic climate projections from integrated urban adaptation planning under climate and urbanization effects. Additionally, useful insights are explored to investigate local needs and limitations, being replicable to any urban space.

Keywords: flood risk; climate change; multi-criteria decision making/aiding; MAUT; NSMAUT; decision analysis.

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