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A Framework for Identifying Vulnerability Hotspots due to Tropical Cyclones & Floods: Case of a Coastal District of West Bengal, India

Subhas Bera, Arup Das, and Taraknath Mazumder
Architecture and Regional Planning, Indian Institute of Technology Kharagpur, KHARAGPUR, India (sbera17@gmail.com)

Hotspots due to tropical cyclones and floods are commonly identified using vulnerability indices. A hotspot refers to the smallest administrative unit addressed in a study (in the context of vulnerability assessment). Various indicators/components are frequently aggregated together to compute vulnerability indices. The aggregator functions used in vulnerability studies can be broadly classified into four categories – additive functions, additive functions with weights, multiplicative functions and weighted multiplicative functions. Though such functions are prevalently used, they have two basic problems of aggregation namely, ambiguity (overestimation) and eclipsing (underestimation). The objective of this study is to demonstrate a framework for the assessment of multidimensional vulnerability that avoids the problem. The study computes various indices for each dimension of vulnerability using a proposed aggregator function and also checks for its consistency through sensitivity analysis. The proposed framework is free from problems like overestimation and underestimation in composite indices, which are the main weaknesses of conventional vulnerability assessment methods. As a case study, South 24-Parganas district of West Bengal, India is selected. The area is highly vulnerable to extreme weather events such as tropical cyclone, floods and comprised of most threatened Sundarbans mangrove forest. The proposed aggregator function is applied to compute physical, social and economic vulnerability indices (PVI, SVI, EVI) for the study. A Multi-criteria Decision Making (MCDM) tool is used to compute the values of multidimensional vulnerability and to identify the vulnerable hotspots due to tropical cyclones and floods. The proposed framework can be of immense help to disaster management official/agencies in identifying the vulnerable hotspot areas and make necessary preventive/curative measures and other policies.