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Integrating socio-economic and infrastructural dimension to reveal hazard vulnerability of coastal districts

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Losses of life and property due to natural hazards have intensified in the past decade, motivating an alteration of disaster management away from simple post event resettlement and rehabilitation. The degree of exposure to hazard for a homogeneous population is not entirely reliant upon nearness to the source of hazard event. Socio-economic factors and infrastructural capability play an important role in determining the vulnerability of a place. This study investigates the vulnerability of eastern coastal states of India from tropical cyclones. The record of past hundred years shows that the physical vulnerability of eastern coastal states is four times as compared to the western coastal states in terms of frequency and intensity of tropical cyclones. Nevertheless, these physical factors played an imperative role in determining the vulnerability of eastern coast. However, the socio-economic and infrastructural factors influence the risk of exposure exponentially. Inclusion of these indicators would provide better insight regarding the preparedness and resilience of settlements to hazard events. In this regard, the present study is an effort to develop an Integrated Vulnerability Model (IVM) based on socio-economic and infrastructural factors for the districts of eastern coastal states of India. A method is proposed for quantifying the socio-economic and infrastructural vulnerability to tropical cyclone in these districts. The variables included in the study are extracted from Census of India, 2011 at district level administrative unit. In the analysis, a large number of variables are reduced to a smaller number of factors by using principal component analysis that represents the socio-economic and infrastructure vulnerability to tropical cyclone. Subsequently, the factor scores in socio-economic Vulnerability Index (SeVI) and Infrastructure Vulnerability Index (InVI) are standardized from 0 to 1, indicating the range from low to high vulnerability. The factor scores are then mapped for spatial analysis. Utilizing SeVI and InVI, the highly vulnerable districts are demonstrated that are likely to face significant challenges in coping with tropical cyclone and require strategies to address the various aspects of socio-economic and infrastructural vulnerability. Moreover, this model can be incorporated not only for multi-level governance but also to integrate it with the real-time weather forecasts to identify the predictive areas of vulnerability.