ABSTRACT

Tropical cyclone is a phenomena linked with intense air-sea interaction that causes enormous amount of destruction along coastal belt during landfall episode. Storm surge and coastal inundation associated with the tropical cyclone contributes to the utmost proportion of devastation along coastal belts. In context to risk and vulnerability, it is a matter of major concern, and therefore more focused study in this direction has immense socio-economic implication around the globe. In this regard, number of methodologies has been developed to forecast the state of atmosphere and ocean state which assist the planners and coastal zone management authorities to broadcast timely warnings to the coastal community and to initiate appropriate preparedness measures. Following this, researchers have succeeded in developing ensemble models with high computational power and reasonably good forecast efficiency. In addition, the information on storm surge and coastal inundation characteristics are indispensable for emergency preparedness measures. In context to the Bay of Bengal basin, the states bordering the East coast of India are highly susceptible from the impacts of tropical cyclones. Also, in the recent past, the Bay of Bengal basin had witnessed tropical cyclones of increased intensity as a consequence of climate change. Impact of storm surge and coastal flooding along Indian coast is higher compared to other global coastal belts. The present study investigates the tropical cyclone characteristics such as cyclone frequency, cyclogenesis, cyclone energy and their trends in a changing climate scenario. Rapid increase in cyclone energy estimated in terms of Power Dissipation Index (PDI) reveals the severity of threat along the East coast of India. The study constructed synthetic cyclone tracks for each of the maritime states located along the East coast of India for pre- and post- monsoon seasons which are used to compute multiple scenarios of storm surge and coastal inundation using the state-of-art Advanced Circulation (ADCIRC) model. The pre-computed scenarios of storm surge and coastal inundation decipher information regarding their modulation with reference to cyclone intensity, angle of approach, translational speed and coastal geomorphology. Detailed analysis on the comprehensive dataset of storm surge and coastal inundation thereby provides a wider scope of connection in coastal vulnerability assessment and emergency forecast methodologies. Using physical, socio-economic, and environmental parameters, the study prepares vulnerability maps in response to multi-hazard scenario for the coastal districts of Odisha along East coast of India during a tropical cyclone landfall. The comprehensive dataset of storm surge and coastal inundation is further used to train soft computing techniques such as Artificial Neural Network (ANN), Genetic Algorithm (GA), and Genetic Programing (GP) to demonstrate their applicability and robustness in a real-time forecasting system along Indian coast.

***Keywords*:** Tropical Cyclones, Synthetic tracks, Storm Surge, Coastal Inundation, Indian coast, Coastal Vulnerability, Artificial Intelligence.