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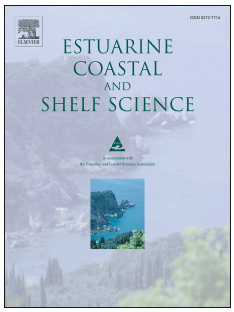

Numerical study of coastal hydrodynamics using a coupled model for Hudhud cyclone in the Bay of Bengal

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Numerical Study of Coastal Hydrodynamics using a Coupled Model for Hudhud Cyclone in the Bay of Bengal

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ABSTRACT

The past decade has witnessed an increased intensity of cyclones in the Bay of Bengal region. With higher winds spread over a larger area, the associated risk and coastal vulnerability have increased with wider destructive potential from high waves, storm surges, and associated coastal inundation. The very severe cyclones that made landfall over the Bay of Bengal in the past decade had strong winds in their outer cores, unlike those cyclones that made landfall in previous years. The original parametric wind formulation performs well for more compact cyclones, but at a radial distance far away from the cyclone centre, the winds are under-estimated. Hence, there is a need to revisit and modify this formula for practical applications, and this study attempts to provide a better representation of the overall radial distance in the wind field envelope. The study postulates a 3/5-power law fitted to the original wind formulae, which provides a reasonably good estimate for the surface wind field. The recent very severe cyclones that developed over the Bay of Bengal provided an excellent test-bed to verify this hypothesis, which is supported by validation from six in-situ buoys. The modified wind formula used with a coupled hydrodynamic model (ADCIRC+SWAN) simulated the storm surge and wave characteristics associated with a recent very severe cyclonic storm 'Hudhud' that made landfall in Andhra, located on the east coast of India in 2014. The study also investigated the dependence of coastal geomorphic features and beach slope on the variability of wave-induced setup. Computed significant wave height and storm surge show an excellent match with wave-rider buoy and tide gauge observations.

Keywords: Modified Jelesnianski Winds, Coupled Model, Storm Surge, Significant Wave Height, Wave Setup, Hudhud Cyclone