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Tsunami impact mitigation by coastal vegetation: steady flow resistance

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In the aftermath of the Indian Ocean Tsunami (IOT), the protection offered by coastal vegetation became evident in many countries affected, and the role of coastal green belts in mitigating tsunami impacts has now been clearly recognized. In order to assess the effectiveness of coastal vegetation in tsunami impact mitigation, experimental studies were carried out to investigate the energy dissipation characteristics of the flow through vegetation.

The impact mitigation by vegetation is caused by the forces resisting the flow which would depend on the individual plant characteristics as well as the overall characteristics of the green belt. A variety of vegetation exists along the coastline of the country and three distinct components of a plant structure, namely, aerial root system, near vertical stem and the branch structure, which may offer varying degree of resistance, can be identified. A coastal green belt can be characterized by its location, extent, density, pattern and the type of plants. Small scale physical model tests were carried out in a hydraulic flume in which the coastal vegetation was represented by geometrically similar models. The tests were limited to the modeling of inundation of the stem of plants without aerial roots. Water was allowed flow at a steady rate through vegetation models and energy dissipation was estimated due to the presence of vegetation.

The effectiveness of coastal green belts was assessed by the percentage energy reduction for various forms of vegetation. Reduction levels in the range of 3.8 to 28.1% were obtained in the experiments indicating the possibility of achieving significant levels of energy reduction of tsunami inundation by coastal green belts. In spite of the restrictions imposed by the small scale used in the tests and the limited range of flow and vegetation conditions simulated, the results are expected to provide useful guidance on the effective use of coastal green belts as a possible tsunami impact mitigation measure.

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