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Assessment of wave climate change and its impact on littoral drift along the coastline of Sri Lanka

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Climate change became a major research topic due to the consequent impact on the environment. Coastal erosion is one of its major environmental impacts in Sri Lanka and it is considered as a major socio-economic issue as well. However, the scientific evidence is limited on wave climate change and its impact on littoral drift. The purpose of this study was to identify the patterns of the change in wave climate and find its relation to beach erosion in different coastlines of Sri Lanka. Firstly, we analyzed the long-term wave climate (peak wave periods, significant wave heights and mean wave direction); secondly, we identified the patterns of the change in wave climate; and thirdly we estimated the sediment transport rates using the CERC equation. Re-analyzed wave data was obtained from a recent study. Sediment transport rates were estimated by defining 73 coastal cells covering the entire coastline of Sri Lanka. Open-source analytical tools such as Panoply, Python Pandas, OriginPro, and Oriana were used to extract and analyze wave data at each cell from the re-analyzed data. This study showed that the coastline of Sri Lanka has a tendency towards erosion due to changes in significant wave heights and mean wave directions. In general, the mean wave direction and the peak wave period were not significantly affected during last 3 decades and the wave direction ranged between 135° and 275°. Moreover, the significant wave height has slightly increasing trend according to time series analysis. The littoral drift and its direction are mainly governed by Southwest monsoon and Northeast monsoon, and the highest sediment transport rate takes place during the Southwest monsoon season. As a result, some locations such as Panadura, Dondara, Vankalai, Mullaitivu in the southwest, northeast, and northwest respectively could pose severe long-term erosion. The annual net sediment transport rate is ranged between 0.8 and 4.5×10^5 m³/year along the western coast and is the highest. This study identified an erosion trend due to change in pattern of littoral drift and showed the vulnerable coasts for erosion of Sri Lanka.

Keywords: Coastal erosion, wave climate change, coastline, sediment transport rate

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