2D numerical modeling of flow and sediment transport using wave climate schematization method - a case study of West coast of Sri Lanka

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This study quantifies the variations in wave characteristics and the resulting variations in potential longshore sediment transport rate along the coastline between Mount Lavinia and Negombo, Sri Lanka. Over the last 25 years, this coastal belt has been subjected to dramatic interventions due to the influence of rapid social-economic development in the country. Construction of Colombo south harbour jetty, extensive adjacent river sand mining, ongoing Colombo Port City Project and mega sand dreading off Negombo coast for reclaiming purposes are examples of human interventions in this coastal zone. Lack of available field data found in such a coastlines yield numerical modelling is a promising method to derive a qualitative regional sediment transport. Wind fields and deep-water wave climates were obtained from National Centre for Atmospheric Research Final (NCEP FNL) and ERA interim from European Centre for Medium-Range Weather Forecasts (ECMWF) respectively. For the wave transformation, Simulating WAves Nearshore (SWAN) numerical model was applied, forced by offshore wave/wind. The Delft3D-FLOW model was used to estimate the longshore sediment transport rates and related morphodynamics using input reduction and morphological acceleration techniques. Results of the alongshore sediment transport capacity computations clearly indicate the variable characteristics of different parts of the study zone. The annual alongshore sediment transport capacity computed in the study area oriented northward comply very well with the observations. Coastal belt between Mount Lavinia and Colombo, the wave climate and, subsequently, the annual alongshore transport reach the highest values indicating a relative dynamic environment and then found to decrease with a strong gradient northward. The explanation of these negative steep gradients and the environmental forcing/human interventions that govern the regional sediment transport are discussed in this paper.

Keywords: sediment transport, ERA Interim, SWAN, Morphological, acceleration, morphodynamics

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