Modelling of Coastal Sediment Dynamics on the Northeastern Coast of Sri Lanka

R.M.R.M. Jayathilaka*

National Aquatic Resources Research and development Agency (NARA), Crow Island, Colombo 15, Sri Lanka

Coastal sand dunes act as an important natural barrier against coastal erosion and storm surges by protecting life and property within the coastal zone. Manalkadu, the Sri Lanka's longest chain of sand dunes is lying between coastal stretches between Point Pedro and Chundikkulam in Jaffna District. Coastal sediment transport plays an important role in the supply and sediment transport into the back-beach environment by formation of dunes via Aeolian process. This study quantifies the variations in wave characteristics and the resulting variations in potential sediment transport rate along the coastal stretches of natural sand dunes between Point Pedro to Chundikkulam. Lack of available field data found in such coast lines yield numerical modelling which 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 long-shore sediment transport rates and related morpho-dynamics using input reduction and morphological acceleration techniques. Analysis of wave climate data indicates that the significant wave height varies between 0.25 m to 2.0 m having most probable wave heights around 1.25 m. The distribution of wave direction is mostly from 40-80 degrees (Northeastern) and from 200-240 degrees (Southwestern). Overall, the numerical results of the net alongshore sediment transports are directed Northward between Chundikkulam and Thalayadi with the transport capacity between 30,000-45,000 m^3/year. Afterwards, the transport direction changed in magnitude along the coastline up to Point Pedro.

Keywords: sediment transport, ERA Interim, SWAN, morphological acceleration, morpho-dynamics

*Corresponding author - email: ruchira@nara.ac.lk