

**PREDICTION OF TIDAL ELEVATION ALONG EASTERN AND WESTERN COASTAL AREAS IN SRI LANKA**

**J.A.R.M. Perera, P.A.D.A.N. Appuhamy\* and E.M.P. Ekanayake**

*Department of Mathematical Sciences, Wayamba University of Sri Lanka, Kuliyaipitiya, Sri-Lanka*

*\*asankanidarshani@wyb.ac.lk*

Tidal height data provide vital information for the construction of ports, coastal buildings, development of the fisheries industry, and human activities. The conventional harmonic approach needs a significant volume of measurements to produce accurate predictions of tidal elevations. In order to overcome the difficulty in getting large volumes of data for conventional harmonic analysis, this research presents an Artificial Neural Network Technique called back-propagation procedure with a Stochastic Gradient Descent algorithm on limited data to forecast the tidal elevations in eastern and western coastal areas of Sri Lanka. Hourly tidal heights at Colombo and Trincomalee spanning from September 2020 to January 2021 were used for this study. The sine and cosine values of frequencies of significant tidal constituents at a particular hour were used as input neurons. Then the network structures were trained, validated, and tested for eight different periods *viz.*, 7, 10, 15 days, and 1, 2, 3, 4 and 5 months, with zero and one hidden layer up to 10 neurons to find the minimum data required for accurate predictions. Using the Mean Squared Error (MSE) and the coefficient of determination ( $R^2$ ) to measure the accuracy of predictions, it was found that tides in Colombo are dominated by the mixed semidiurnal type, which is in contrast to the semidiurnal type observed in Trincomalee and in equatorial countries. Moreover, there was a substantial difference in mean tidal elevations at both locations. Out of 69 constituents, five were identified as significant with two months of hourly tidal measurements, which were the same for both locations. This corresponds to about 15% of data generally required for conventional harmonic analysis to identify the significant constituents. The optimal neural network structures for Trincomalee and Colombo areas were attained from fifteen days of data with 8 neurons and two months of data with 5 neurons, respectively, in the hidden layer, each of which yielded the minimum MSE and the highest  $R^2$  value and thus efficiently predicting hourly tidal heights at each location.

**Keywords:** Artificial neural network, Back propagation, Constituent, Tide