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STATISTICAL ANALYSIS OF EXTREME OCEAN WAVES IN GALLE, SRI LANKA

Thevasiyani Theiventhiram¹, Kanthi Perera², Nalin Wikramanayake³

¹Postgraduate Institute of Science, University of Peradeniya

*²Department of Engineering Mathematics, Faculty of Engineering,
University of Peradeniya*

³Department of Civil Engineering, The Open University of Sri Lanka

The study of the extreme values of wave height is vital for the design of coastal structures. These structures are designed to withstand waves of a selected return period. The purpose of this study is to estimate the wave heights for several return periods in order to use them in coastal construction.

Wave height measurements collected by a directional wave buoy installed at 70 m depth off Galle was used for the extreme value analysis. Analysis was separately performed for sea and swell wave, season wise. Peak over threshold method (POT) was used for sample selection, because the dataset was available only for a limited number of years (5 ½ years). The possible range of threshold values was identified by using the Mean residual life plot. The specific threshold value 2.5 m was selected using the Generalized Pareto Distribution (GPD), the value which showed stable behavior of scale and shape parameters of the distribution. Sample data were obtained above the selected specific threshold value. Using the POT method the GPD was fitted for the sampled data and the special type of GPD was identified using the Likelihood ratio test and also using the profile likelihood confidence interval. Further diagnostic plots were obtained to ensure validity of the distribution. Return levels were calculated for several return periods and the confidence intervals were constructed for the return levels.

A special case of GPD, the exponential distribution, fitted well with the extreme wave heights during the South-West monsoon and the first inter monsoon period for sea waves, while those fitted well with beta distribution for swell waves. Analysis was omitted for the second inter monsoon and the North-East monsoon periods, as they did not have any significant extreme values. In south-west monsoon, predicted sea wave height return value was 5.58 metres for 100 years return period with the probability of 0.01 and confidence interval of (5.009, 6.149), while it was 3.03 metres for swell waves with the same probability and confidence interval of (2.956, 3.228). It was found that, the return levels for sea waves were comparatively higher than the swell waves for the South-West monsoon.