INVESTIGATION ON WAVE ENERGY CHARACTERISTICS IN SOUTH-WESTERN COASTLINE OF SRI LANKA

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Ocean wave power is an abundant and promising renewable energy source with limited environmental impact and high energy density. The distribution of wave energy varies spatially and temporally, attributed to bathymetric and seasonal effects. Therefore, a proper wave energy resource assessment is required in order to find optimum sites which have higher wave energy potential so that the energy produced from Wave Energy Converters (WECs) can be maximised.

The aim of this study was to investigate the wave power potential around the south-western coast of Sri Lanka and its spatio-temporal and directional distribution based on 5 years (1999 to 2003) of wave data simulated using SWAN (Simulating WAves Nearshore). The results of the analysis indicated that the annual mean wave power in the region is exceeding 10 kW/m while the possible monthly mean wave power values are higher than 5 kW/m throughout the year. A significant increase in the monthly mean wave power was observed from May to September months because of the influence of the tropical south-west monsoon.

Sixteen study points were selected along the nearshore and offshore around the west coast (from Colombo to Beruwala) and south-west coast (from Beruwala to Matara) for a detailed assessment and numerical modelling was done using DELFT3D for high resolution nearshore bathymetry. The calculated annual and monthly mean wave power values at the selected nearshore points showed that the south-west coast has higher potential than the west coast except near Matara area. The temporal and directional variations were also assessed at selected points using statistical indices and wave power roses, and those revealed that the region has moderately stable wave power with narrow directionality.

The annual electric power output that can be extracted from three commercially available wave energy converters; Oyster, Wave Star and Wave Dragon were estimated at all nearshore points using wave scatter diagrams and publicly available power matrices. Accordingly, the nearshore area from Galle to Weligama found to be most suitable for wave energy harvesting. Further, the performance of the selected devices was evaluated based on their capacity factors, and the Oyster and Wave Star converters were found to be most suited to the prevailing wave conditions in the region.

Keywords: renewable energy; wave power; nearshore; wave energy converters

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