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Analysis of Sea Waves Characteristics and Assessment of Potential Wave Power in Egyptian Mediterranean Waters

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Abstract : The generation of energy from marine energy became one of the most preferable resources since it is a clean source and friendly to environment. Egypt has long shores along Mediterranean with important cities that need energy resources with significant wave energy. No detailed studies have been done on wave energy distribution in the Egyptian waters. The objective of this paper is to assess the energy wave power available in the Egyptian waters for the choice of the most suitable devices to be used in this area. This paper deals the characteristics and power of the offshore waves in the Egyptian waters. Since the field observations of waves are not frequent and need much technical work, the European Centre for Medium-Range Weather Forecasts (ECMWF) interim reanalysis data in Mediterranean, with a grid size 0.75 degree, which is a relatively course grid, are considered in the present study for preliminary assessment of sea waves characteristics and power. The used data covers the period from 2012 to 2014. The data used are significant wave height (swh), mean wave period (mwp) and wave direction taken at six hourly intervals, at seven chosen stations, and at grid points covering the Egyptian waters. The wave power (wp) formula was used to calculate energy flux. Descriptive statistical analysis including monthly means and standard deviations of the swh, mwp, and wp. The percentiles of wave heights and their corresponding power are done, as a tool of choice of the best technology suitable for the site. The surfer is used to show spatial distributions of wp. The analysis of data at chosen 7 stations determined the potential of wp off important Egyptian cities. Offshore of Al Saloum and Marsa Matruh, the highest wp occurred in January and February (16.93-18.05) ± (18.08-22.12) kw/m while the lowest occurred in June and October (1.49-1.69) ± (1.45-1.74) kw/m. In front of Alexandria and Rashid, the highest wp occurred in January and February (16.93-18.05) ± (18.08-22.12) kw/m while the lowest occurred in June and September (1.29-2.01) ± (1.31-1.83) kw/m. In front of Damietta and Port Said, the highest wp occurred in February (14.29-17.61) ± (21.61-27.10) kw/m and the lowest occurred in June (0.94-0.96) ± (0.71-0.72) kw/m. In winter, the probabilities of waves higher than 0.8 m in percentage were, at Al Saloum and Marsa Matruh (76.56-80.33) ± (11.62-12.05), at Alexandria and Rashid (73.67-74.79) ± (16.21-18.59) and at Damietta and Port Said (66.28-68.69) ± (17.88-17.90). In spring, the percentiles were, at Al Saloum and Marsa Matruh, (48.17-50.92) ± (5.79-6.56), at Alexandria and Rashid, (39.38-43.59) ± (9.06-9.34) and at Damietta and Port Said, (31.59-33.61) ± (10.72-11.25). In summer, the probabilities were, at Al Saloum and Marsa Matruh (57.70-66.67) ± (4.87-6.83), at Alexandria and Rashid (59.96-65.13) ± (9.14-9.35) and at Damietta and Port Said (46.38-49.28) ± (10.89-11.47). In autumn, the probabilities were, at Al Saloum and Marsa Matruh (58.75-59.56) ± (2.55-5.84), at Alexandria and Rashid (47.78-52.13) ± (3.11-7.08) and at Damietta and Port Said (41.16-42.52) ± (7.52-8.34).

Keywords : distribution of sea waves energy, Egyptian Mediterranean waters, waves characteristics, waves power
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