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On the Wave Energy Resource in the Mid-Atlantic from Numerical Hindcast Data

Osinowo Adekunle Ayodotun
Federal University of Technology, Nigeria

By using the WAVEWATCH-III (WW3) wind-wave model, this work has investigated the wave energy potentials in the mid-Atlantic by utilizing a 37 year (1980-2016) significant wave height (SWH) and mean wave period (T_m) data which were got from the analysis of wave climate predictions. The spatiotemporal variations of the wave energy resource are discussed. Results showed that wave energy is richest (11.5-14k W/m) in the extreme northwestern mid-Atlantic and is therefore an excellent region for the installation of wave power plants for electrical energy generation. Temporal variation showed that 1992 was a year of relatively rich wave energy in the Ocean. From analysis, the wave energy groups 0≤wp≤5 and 5≤wp≤10 had the highest frequencies in the Ocean. Furthermore, spatial trend analysis of the annual and summer averaged wave power revealed that stronger trends (0.03-0.1 kW/m/year) in both cases, distribute in the southern part of the Ocean, while stronger trends (0.04-0.085 kW/m/year) dominate the northern part during winter. The Ocean exhibits an overall trend of approximately 0.022 kW/m/year all through the years and seasons.

Statement of the Problem: In wave power assessment, the development and exploitation of oceanic energy play a key role in easing the global energy crisis. The ocean energy offers the advantage of fresh, renewable, enormous reserves and extensive distribution but its instability reduces development. The choice of the wave power site selection over any oceanic region relies on the spatial stability of wave power density. A better acquisition and conversion of wave energy is achieved by a better stability in wave power. The conversion efficiency of the ocean energy conversion transpose is greatly reduced by instability in the wave energy density thereby, damaging the power equipment. Also, the distribution of relative rich energy regions of wave power density in the sea identifies ideal locations for wave power plants. In all, the characteristic wave energy resource in the sea is analyzed in order to supply references for the wave energy resources growth, navigation, oceanic engineering, catastrophe avoidance and decrease.

At present, little or no studies have been carried out on wave energy potential in the mid-Atlantic. By using a 37-year, 6-hour, SWH and T_m data obtained from ECMWF and computed by WW3 model, this study extends the work by Osinowo et al. (2016) by categorizing the wave energy particular to the mid Atlantic for different ranges of wave power density. Also, the distribution and spatio-temporal trends of wave energy will be evaluated. Furthermore, investigation will be made to identify sites of relative rich wave energy, ideal for the installation of wave power plants for electrical energy generation.

Image related to

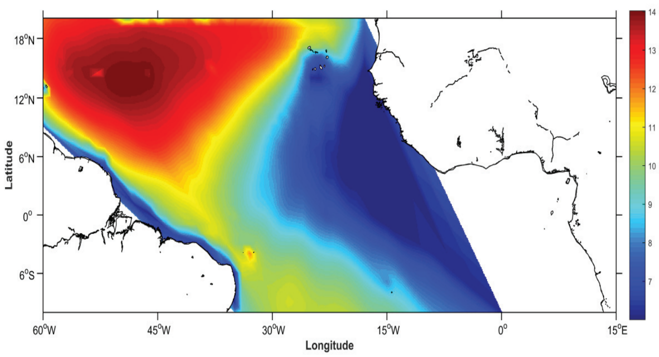

Fig. 1 Annual mean wave power in relative rich-energy regions. Unit: kW/m.

Biography:

Dr. Osinowo Adekunle Ayodotun had received a Ph.D and D.sc degrees in Physical Oceanography (Marine Meteorology Option) from the Ocean University of China. He is currently a researcher and a lecturer in the Department of Marine Science and Technology, Faculty of Earth and Mineral Sciences, Federal University of Technology, Akure, Ondo State, Nigeria. His research interests include Ocean wave simulations and climatology and wind-wave energy resources in oceanic basins.