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Use of Hydrodynamics for the Prediction of Shoreline Changes

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STATEMENT

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ABSTRACT

Beach erosion has become a chronic problem along most open-sea shores. Shore protection works are constructed at many locations along the northern coast of Egypt to protect this coast from successive erosion or decreasing wave energy near the shore. A geographic information system (GIS) is being used as an essential pre-processing tool for the analysis of the shoreline changes. Accurate simulation of the two-dimensional hydrodynamics and shoreline changes is essential for the planning and design of structures for shore protection. In this research, three different multi-component numerical modeling techniques were constructed. The one-line technique, spectral wave technique, and the complex technique were the three alternatives used for simulating the 2D depth averaged hydrodynamics and shoreline changes in coastal areas.

Mathematical models of NMLONG, RMA2, STWAVE, GENESIS, were applied to study waves, currents and shoreline changes within the study area and to get the environmental impact of the different proposed solutions. Data collected in the period from 1988 to 2007 for El-Alamein Marina resort (as a case study) was used to calibrate sensitive parameters in each multi-component modeling technique. The results showed that the spectral wave technique can be applied to simulate hydrodynamics and shoreline changes in coastal areas. The verified multi-component technique was applied to study different solutions for erosion reduction in (Zone A) of El-Alamein Marina Resort. A statistical assessment methodology was developed as an objective function to assess the different solutions. The results showed that the optimum solution to significantly reduce the amount of erosion was achieved by adding four segmented detached breakwaters parallel to the existing shoreline with a length of 200 m each and with a gap difference of length 100 m in water depths 3 to 4 m at an offshore distance of 200 m from the shoreline. The erosion reduction was predicted to be about 74% of the present erosion.

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