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Ocean Wave Studies

EROSION is eating away at the beaches of this country at a net average rate of one foot a year over the entire coastline. At some points the rate of erosion or fill is much more rapid than this, and it is seriously affecting coastal structures, harbors, recreational beaches, commercial fishing operations, and naval installations.

Records show that the land area of Sandy Hook, New Jersey, has been quadrupled since it was first mapped around 1700, by the constant inflow of sand transported northward along the Jersey coast by the action of ocean waves on the beaches. The Beach Erosion Board of the Corps of Engineers, United States Army, estimates that 700,000 cubic yards of sand move northward annually toward Sandy Hook. In this instance, the wave action is beneficial; but other parts of the coast are destroyed by the wave action that furnishes the material annually deposited in this spit.

Although erosion cannot be halted, local protective structures can be designed to work harmoniously with wave forces in order to preserve valuable beaches and coastal contours, and to safeguard coastal structures. For this reason, the Beach Erosion Board is interested in learning more about ocean waves—how they are generated in a storm over the ocean, and how they travel to the shore.

In addition to conducting its own extensive research on this problem, the board is also supporting research by universities. The Department of Meteorology at New York University, for example, is investigating methods of forecasting waves on the eastern coast of the United States. Meteorologists in the NYU Engineering Research Division have made a study of the accuracy of present methods of wave forecasting. Although these methods were found to work fairly well for rescue operations at sea, they proved of

questionable value for forecasting the rate of repetition of waves and the rate of flow of energy toward the shore—two essential considerations in the design of shore protection structures.

Theoretical investigations were then begun to find better ways to analyze wave records and to forecast the complex wave patterns occurring at beaches and on the open sea. These investigations ultimately led to identification of the factors which must be measured in a storm in order to forecast the waves traveling out of the storm area.

Waves from a completely realistic model storm have been constructed mathematically. They show all the properties of storm waves in nature, actually transforming into swell as they travel along. A paper on a simpler—and therefore less realistic—model storm was presented at a Symposium on Gravity Waves arranged by the National Bureau of Standards, and a paper on the more realistic model storm is still in preparation.

It has been shown that the characteristics of storm waves depend upon the dimensions of the storm area, the duration of the storm, and the characteristics of the turbulent eddies. Different storms have different turbulent characteristics, because air masses differ in their stability. For example, for a given average velocity, winds from the north buffet the sea surfaces about more than winds from the south.

The next step is to develop inexpensive and practical ways to measure the factors involved in wave formation. Then, by the application of theories developed by J. W. Tukey, of Princeton, and by an extension of the statistical methods of Wadsworth and the late H. R. Seiwel, of Woods Hole, it should be possible to develop adequate wave forecasting parameters.

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