Abstract View

Volume 8, Issue 5 (September 1978)

Journal of Physical Oceanography
Article: pp. 888–909 | Abstract | PDF (1.67M)

The directional Spectra and Kinematics of Surface Gravity Waves in Tropical Storm Delia

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(Manuscript received January 31, 1978, in final form May 17, 1978)

DOI: 10.1175/1520-0485(1978)008<0888:TDSAKO>2.0.CO;2

ABSTRACT

Knowledge of the kinematics of the flow beneath surface waves is vital for the design of offshore structures. Due to the technical of making pertinent measurement in storm conditions, knowledge of the kinematics of storm has been based almost entirely on theoretical considerations. Now measurements made with electromagnetic current meters during Tropical Storm Delia have permitted verification of the theories.

There was considerable scatter between the measured velocities and the predictions of unidirectional wave theories, with a clear bias toward overprediction. Use of higher order and irregular unidirectional theories did not substantially improve the comparison. A good fit with the data could, however, be obtained by using the concept of a directional wave spectrum based on linear wave theory.

The simultaneous wave and particle velocity measurements were used to estimate the directional spectrum through an analysis procedure which took into account the presence of a strong current. The directional spectrum was also hindcast using a numerical model and the comparison of the hindcast with data was good.

The fact that velocity spectra in confused storm seas can be accurately calculated will be directly important in some design problems. In other cases, it is necessary to know the probability distribution of the extreme events. Using the

assumption of a Gaussian sea surface, it was possible to satisfactorily predict the distribution of the magnitudes of velocity. All of the comparisons lead to the conclusion that a proper description of storm wave kinematics is dependent on correctly accounting for the directional spreading of the wave energy.

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