Abstract View

Volume 13, Issue 11 (November 1983)

Journal of Physical Oceanography
Article: pp. 1988–1999 | Abstract | PDF (888K)

Wave-Turbulence Interactions in the Upper Ocean. Part II. Statistical Characteristics of Wave and Turbulent Components of the Random Velocity Field in the Marine Surface Layer

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(Manuscript received January 24, 1983, in final form July 30, 1983)

DOI: 10.1175/1520-0485(1983)013<1988:WTIITU>2.0.CO;2

ABSTRACT

We present the results of an analysis of field data collected by Donelan who used a miniature drag sphere to measure velocities beneath wind waves on Lake Ontario. Linear statistical techniques are used to separate the velocity into wave and turbulent parts. While we mostly aim at demonstrating the effects of surface wind waves on the statistical characteristics of the turbulent field in the upper mixed layer, we also interpret several features of the data on the hags of recent theoretical results.

One of the most intriguing features of the turbulent velocity spectra so obtained is a large peak near the dominant wave frequency. We review various possible explanation for this behavior although we prefer a model in which the turbulence is assumed frozen on the timescale of the Waves. This model requires no new dynamics and gives explicit formulae relating the dissipation rate to the magnitude of the spectral densities for high and low frequencies. On this basis we have determined a dissipation length from the data. The dependence of this quantity on depth is inconsistent with pure shear produced turbulence. Moreover the observed turbulent velocities shows a strong dependence on wave energy,. which cannot be explained solely within the framework of similarity theory for the inner (constant flux) layer.

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