Abstract View

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Measurement of the High-Frequency Spectrum of Ocean Surface Waves

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ABSTRACT

High-frequency spectra of wind-generated ocean waves were measured at an ocean research tower of Kyushu University using a fast-response wave recorder and an electronic differentiating circuit. Wind waves generated by a northeast wind (speed $U_{10.5}$=8 m s^{-1}, fetch F=2 km) were superimposed on the swell from the north and in a stationary state.

The equilibrium range of the wave spectrum, where the spectral form is given by was clearly observed in a frequency range $f_m<f\leq$ 4 Hz of the measured spectrum, where g is the acceleration of gravity and f_m the spectral peak frequency. The measured value of the equilibrium constant β was 0.016 for the dimensionless fetch $\hat{F}$ (=gF/U_*^2=1.3×10^5 (where U_* is the friction velocity of the wind), which was very close to the value obtained by Burling (1959).

However, the equilibrium spectrum of the gravity wave range occurred only below 4 Hz, and the spectral form in the gravity-capillary range (f>5 Hz) was given approximately by> where σ is the surface tension, ρw the density of water and k the wavenumber. The measured value of the dimensionless constant α_g was 0.012 for the frequency range 6 Hz$\leq f\leq$ 14 Hz of the measured spectrum, which was very close to the values measured in our laboratory experiment ($U_r\approx$40 cm s^{-1} at F=5.85 m and 8.26 m). The result confirmed that the spectral form in the gravity-capillary range is really independent of the fetch.

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