Impact of Ocean Surface Waves on Air-Sea Momentum Flux

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In this study, we investigated the structure of turbulent air flow over ocean waves. Observations of wind and waves were retrieved by air-sea interaction spar (ASIS) buoys during the shoaling waves experiment (SHOWEX) in Duck, NC in 1999. It is shown that the turbulent velocity spectra and co-spectra for pure wind sea conditions follow the universal forms estimated by Miyake et al [1970]. In the presence of strong swells, the wave boundary layer was extended and the universal spectral scaling of u'w' broke down [Drennan et al, 1999]. On the other hand, the use of the peak wave frequency (fp) to reproduce the "universal spectra" succeeded at explaining the spectral structure of turbulent flow field. The u'w' co-spectra become negative near the fp, which suggests the upward momentum transport (i.e., negative wind stress) induced by ocean waves. Finally, we show the relationship between the turbulent flow structures and roughness of the sea surface.

