Abstract View

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A Similarity Analysis of the Structure of Airflow over Surface Waves

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ABSTRACT

Previous field investigations of the wave-induced pressure field have focused on determination of the momentum input from wind to the surface waves. This is useful for the estimation of wave growth rate and, in particular, the wave growth parameter β. Due to the difficult nature of experimental study of airflow very close to the wave surface, it has been necessary to extrapolate elevated measurements of the wave-induced pressure field to the surface. This practice may be incorrect without adequate knowledge of the complex vertical structure of the pressure field. In addition, the wave-induced pressure and velocity fields are coupled to the near-surface turbulence. Hence, understanding the nature of the wave-induced flow fields is critical for modeling of the near-surface wind and wave fields.

Utilizing a simple similarity hypothesis, detailed vertical structure of the wave-induced pressure and velocity components is examined. Results of this analysis are presented using data obtained in the spring and fall of 1994 during the Risø Air–Sea Experiment program. These results demonstrate that, when compared to theory, simple extrapolation of measurements of the wave-induced pressure field from a fixed height above the surface may contribute to the uncertainty of measured growth rates. In addition, it is demonstrated that an analogous similarity relationship for the wave-induced vertical velocity field yields results that

are consistent with previous laboratory studies.

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