

Abstract Submitted
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Effect of the presence of long waves on the wave growth rate of short waves TAO CAO, LIAN SHEN, University of Minnesota — We performed a DNS study of the turbulent wind over two slowly progressive water waves with different wave lengths. It is shown that the presence of the long wave results in a significant reduction of the form drag on the short wave. To explain the underlying physical mechanism, we obtained the momentum equations for the wave-coherent motions induced by the long wave and the short wave, respectively. We first showed that the asymmetric wave-induced pressure across the surface wave crest is responsible for the form drag on the wave surface and is mainly caused by the wave-induced advection associated with the vertical wave-induced velocity that is in-phase with the surface elevation. It is further found that in the presence of the long wave, the wave-induced advection corresponding to the short wave is significantly reduced, which results in a smaller asymmetric pressure on the short wave, and thereby a lower form drag. Moreover, we observed that the extent of the reduction of the form drag on the short wave depends on the wave age of the long wave. The smaller the wave age of the long wave, the larger the reduction of the form drag on the short wave.

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