Abstract View

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A New Coastal Wave Model. Part V: Five-Wave Interactions

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ABSTRACT

The authors study the action flux associated with three-dimensional wave–wave interactions of ocean surface waves. Over deep water, two-dimensional wave–wave interactions are dominant: the three-dimensional five-wave interactions are two orders of magnitude smaller than the two-dimensional four-wave interactions. However, the five-wave interactions become increasingly important as the water depth decreases. Because of the effects of finite depth, three-dimensional five-wave interactions, involving steep finite-amplitude waves, dominate over two-dimensional four-wave interactions. Specifically, when the water depth h is less than 10 m, or nondimensionalizing with the spectral peak wavenumber K_p when $K_p h \leq 3.6$ and nonlinearity, $\epsilon = Ka(3 + \tanh^2 Kh)/4 \tanh^3 Kh \geq 0.3$, the five-wave interactions completely dominate. Results are consistent with the instability study by McLean.