A Comparison of Two- and Three-Dimensional Wave Breaking

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ABSTRACT

The influence of directionality on wave-packet evolution and in particular on the onset of breaking was explored through laboratory experiment. Lateral tapering was applied to the input signal to produce a range of crest lengths, with greater directionality created by diffraction for the shorter crests. The wave shape, local and global wave steepness, and surface displacement spectra were used to characterize the wave fields. The observations suggest that directionality can accelerate or suppress the onset of breaking, and additionally can influence both the local wave steepness at breaking as well as the breaking severity. Directionality, however, did not alter the observed up-frequency energy transfer associated with wave focusing. When no breaking occurred this energy shift was completely reversed. With breaking the shifted energy was lost, that is, passed from the wave to the turbulent energy field. The short-crested wave packet lost 16% of its energy as a result of breaking, while a comparable two-dimensional breaker lost 22%.