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Anomalous probability of strong waves

Classical wave turbulence (WT) theory deals with energy spectra of weak dispersive waves. We generalise WT theory to describe not only spectra but also probability density functions (PDF) of wave amplitudes. We show that solutions of such generalised WT closure predict a Gaussian core and a power-law tail for PDF. This corresponds to an anomolously high probability of occurence of strong waves. We present results of direct numerical simulations of the water surface equations which confirm that probability of strong waves can be orders of magnitude higher than in Gaussian distribution. We also show that k-space discreteness leads to strong variability of the energy flux similar to sandpile avalanches.

Abstract of talk given at ICMS Workshop on Rogue Waves December 2005.
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