Strongly coherent dynamics of stochastic waves causes abnormal sea states

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The dynamic kurtosis (i.e., produced by the free wave component) is shown to contribute essentially to the abnormally large values of the full kurtosis of the surface displacement, according to the direct numerical simulations of realistic directional sea waves within the HOSM framework. In this situation the free wave stochastic dynamics is strongly non-Gaussian, and the kinetic approach is inapplicable. Traces of coherent wave patterns are found in the Fourier transform of the directional irregular sea waves. They strongly violate the classic dispersion relation and hence lead to a greater spread of the actual wave frequencies for given wavenumbers.

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