Extreme soliton groups in the field of irregular unidirectional sea waves

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It is shown by means of direct numerical simulations of the Euler equations that large-amplitude soliton-like groups can naturally occur in realistic states of unidirectional deep sea waves characterized by the JONSWAP spectrum with a moderate peakedness factor [1]. Such groups represent extraordinary cases, which are able to increase noticeably the probability of high waves even in moderately rough sea conditions. Results of the probabilistic analysis of the stochastic numerical simulations are discussed. The ensemble of wave realizations should be large enough to take the rare events into account. The long-living dynamics of the extreme coherent structures is tracked with the help of the windowed Fourier transform, and also with the use of nonlinear analysis based on the Inverse Scattering Technique.

[1]. A.V. Slunyaev, A.V. Kokorina, Soliton groups as the reason for extreme statistics of unidirectional sea waves. J. Ocean Eng. Marine Energy 3, 395-408 (2017).