A wave crest distribution of random directional wave fields

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A wave crest distribution represents an important input to design of marine structures. In current design practice the second-order theory-based crest distributions suggested by Forristall (2000) are commonly used. In the present study laboratory data of random directional wave fields have been used to investigate the combined effect of higher order nonlinearity and directional spreading on the wave crest distribution. Different seas states with a variety of combination of steepness and directional spreading have been considered, from long to short crested wave fields. The investigations have been supported by numerical simulations based on the potential Euler equations. A two-parameter Weibull distribution has been fitted to the experimental data. The Weibull parameters have been parameterized as a function of a general version of the Benjamin-Feir Index (BFI) for directional sea states recently presented by Mori et al. (2011). Long-term distributions of the one and two dimensional Benjamin-Feir Index as well as joint distributions of BFI and wave steepness and directional spreading have been proposed based on the hindcast data from the North Atlantic. Uncertainties related to the fits are discussed.