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STATISTICS OF WAVE KINEMATICS IN RANDOM DIRECTIONAL WAVE FIELDS

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We present an analysis of long-term wave simulations performed using a fully nonlinear potential deep water wave model. The results of the simulations are compared with the spectra obtained using a variety of directional methods and are discussed in the context of their applications. Further investigation of the numerical model is conducted by comparing the predicted development of Gaussian wave spectra with that detected previously using other methods. The instabilities of unidirectional waves with noisy initial spectra resulting in a lateral modulation of wave crests are discussed. The short-crestedness of a wave field is investigated in terms of the three-dimensional steepness defined as the vector whose magnitude is equal to the average steepness calculated along the vector direction in a horizontal plane. Several statistical characteristics of the surface elevation field and the wave spectrum development such as a nonuniformity of the wave spectrum and a migration of its peaks are discussed. The appearance of coherent structures on the ocean surface closely related to the tendency of high waves to occur in groups is analysed. Various features of the identified groups such as velocity of the groups, their lengths, lifetime and steepness are studied. A general analysis of the number of detected groups is also performed for the computed wave fields. In order to quantify the spatial and temporal wave group characteristics, the space–time autocorrelation functions of the surface elevation envelopes are constructed and discussed.

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