



# Various experimental wave statistics emerging from a single energy spectrum

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As it strongly impacts the design of offshore structures, the accurate control of experimental wave fields is of great importance. A significant majority of sea keeping tests are based on the stochastic approach. Long duration runs of irregular design sea or experimental wavetanks. The run duration is carefully chosen to observe the emergence of extreme events. The quality is assessed thanks to i) the wave energy spectrum and ii) the crest height distribution. The accurate reproduction of those two complex phenomena such as wave breaking or Benjamin Feir (modulational) instabilities strongly impact the wave field. The crest height distributions significantly evolve along the tank depending i) the wave steepness, ii) the spectral width, iii) the directional sea states) [1, 2, 3].

The vast majority of the work in this area has focused on reproducing realistic wave energy spectra at the location of interest. The present study intends to question such a characterization of a sea state. We address the problem within the waves generated in an experimental wave tank. In this respect, using the Ecole Centrale de Nantes (ECN) towing tank (14C) generated at several locations of a long domain. The shape of the spectrum is accurately controlled thanks to a procedure [4]. For such nonlinear wave conditions the statistics along the wave propagation in the tank are known to be enhanced. Configurations characterized by strictly identical wave spectra lead to the emergence of strongly different crest distributions. Convincing evidence that the characterization of the wave field using the sole energy spectrum is insufficient. Particular attention is given to the wave field in order to control the wave statistics.

[1] Janssen, P. A. (2003). Nonlinear four-wave interactions and freak waves. *Journal of Physical Oceanography*, 33(4), 863-88

[2] Shemer, L., Sergeeva, A., & Liberzon, D. (2010). Effect of the initial spectrum on the spatial evolution of statistics of u. *Geophysical Research: Oceans*, 115(C12).

[3] Onorato, M., Cavaleri, L., Fouques, S., Gramstad, O., Janssen, P. A., Monbaliu, J., ... & Trulsen, K. (2009). Statistical properties of waves: a laboratory experiment in a three-dimensional wave basin.

[4] Canard, M., Ducrozet, G., & Bouscasse, B. (2020, August). Generation of 3-hr Long-Crested Waves of Extreme Sea. *Conference on Offshore Mechanics and Arctic Engineering* (Vol. 84386, p. V06BT06A064). American Society of Mechanical Engineers.

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