Geophysical Research Abstracts
Vol. 18, EGU2016-3193, 2016
EGU General Assembly 2016

The shape of extreme waves on the open ocean

Thomas A. A. Adcock (1), Paul H. Taylor (1), and Scott Draper (2)

(1) Department of Engineering Science, University of Oxford. UK., (2) School of Civil, Environmental and Mining Engineering, University of Western Australia, Perth, Australia.

This study investigates how non-linear physics modifies the largest waves in random seas relative to linear evolution. Our method follows that described in [1]. We start with random simulations of extreme waves in linear sea-states with realistic spectra and directional spreading. Each wave-group, with the surrounding waves, is propagated backwards in time under linear evolution for ten periods. This is then used as initial conditions for non-linear simulations. We compare the maximum of the wave-group in the non-linear simulation with that in the linear case. We do this multiple times for different randomly generated extreme events.

We find that, on average, there is relatively little extra elevation in the non-linear case — although in a few cases there is significant amplification. However, there are significant changes to the average shape of the group. For moderate wave steepness there is an expansion of the wave-group in the lateral direction forming a broader crest than predicted by linear evolution. For the most severe sea-states there is a significant contraction of the wave-group in the mean wave direction. There is also a movement of the largest wave to the front of the wave-group, suggesting that the largest waves will be preceded by relatively small waves.

Reference

[1] ADCOCK, T.A.A., TAYLOR, P.H. & DRAPER, S. (2015) Non-linear dynamics of wave-groups in random seas: Unexpected walls of water in the open ocean, Proceedings of the Royal Society A 471(2184).