Geophysical Research Abstracts
Vol. 20, EGU2018-15335, 2018
EGU General Assembly 2018

Effect of a linear shear current on nonlinear random waves and rogue waves formation

Marc Francius (1), Leandro Fernandez (1), Julien Touboul (1), and Christian Kharif (2)

(1) MIO - Université du Sud Toulon-Var, CNRS, La Garde Cedex, France (francius.marc@gmail.com), (2) Aix Marseille Université, CNRS, Centrale Marseille, IRPHE UMR 7342, 13384, Marseille, France

In this study, we present numerical results on the evolution of one-dimensional, random surface water waves, propagating on a constant depth both with and without a background constant vorticity. The numerical simulations are performed using the vor-HOSM, an extension of the well-known high-order spectral method (HOSM). In our numerical experiments, initial conditions for random wavefields were generated using a JONSWAP spectrum. The spectral shape was defined by a peak period $T_p = 10s$, significant wave steepness $k_p H_s/2 = 0.15$ and different values of the peak enhancement factor $\gamma = 1, 3$ and 6. The relative water depth $k_p h = 10$, where k_p is the wavenumber associated with the spectral peak. Under these circumstances, the initial surface are linear (and hence normally distributed) and the fields of the velocity potential function is calculated from the surface elevation in accordance with the linear wave theory for waves on constant vorticity. An adjustment procedure that eliminates the spurious generation of standing waves is used. To study the influence of vorticity, we have considered different values of the vorticity parameter $\overline{\Omega} = \Omega_0/\omega_p = 0, \pm 0.1, \pm 0.2, \pm 0.3$ and ± 0.4. When $\Omega_0 > 0$, these cases correspond to waves co-flowing with the linear shear current and negative vorticity.

The comparative analysis suggests that vorticity affect both the time scale of the evolution and the intensity of nonlinear wave-wave interactions, as well as the evolution of the statistical moments (skewness and kurtosis) of the surface. The effect of the shear current with $\overline{\Omega} > 0$ is to accelerate the transition of the initial wave fields to their final quasi-stationary stage, and also to increase the probability of occurrence of rogue waves. The opposite effects occur when $\overline{\Omega} < 0$.

Acknowledgments

This work was supported by the Direction Générale de l'Armement and funded by the ANR project n°. ANR-13-ASTR-0007.