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Numerical simulations of the interaction between rogue waves and current

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Rogue wave generation can be explained on the basis of spatio-temporal focusing concept. Experiments of the interaction between a freak wave and wind have been conducted in the Large Air-Sea Interaction Facility (LASIF) in IRPHE, Marseille, Luminy (see Giovanangeli, Kharif & Pelinovsky, Proceedings of Rogue Waves, Brest, 2004). These experiments showed a shift of the focal point, which could be explained by the wind induced current.

The paper reports on a series of numerical simulations based on a BIEM method, designed to investigate the interaction between freak waves and current. The model is briefly verified, and numerical experiments are then presented. The modulated wave trains are numerically generated by a paddle on a uniform current of constant velocity. The time-variable frequency of the paddle is chosen to produce a rogue wave (due to spatio-temporal focusing) at a given fetch. Numerical simulations are performed for different values of current velocity ($u_c = 0, 20, 25, 30, 40, 50 cm.s^{-1}$), corresponding to the experimental values of wind speed ($U = 0, 4, 5, 6, 8, 10 m.s^{-1}$). It is shown that the shift of the focal point increases as u_c^2, as predicted theoretically by these authors A spreading of the focusing area and a weak decrease of the rogue wave amplification are observed as the current speed increases.