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Freak wave with deep trough in the sea

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The term of freak wave with deep trough (FWWDT) in the sea or 'holes in the ocean' (or abnormal waves, killer waves, freak waves) pertains to individual asymmetric waves with a crest of an extremely high slope, in front of which appears a longer and deeper trough than compared with ordinary wind waves. The trough looks like a hole in the sea. The total height of such waves can reach 15-20 m and more. Due to presence of usual wind waves it is enough difficult to observe such a hole at some distance from a ship. It is why it is practically impossible for a ship's crew to take any precautions beforehand.

Field observations of FWWDT are described. They were observed for shallow water case in presence of strong wind.

Two-dimensional long wave nonlinear model is developed to simulate the generation and propagation of FWWDT. It is shown that the simplest model being described by nonlinear integro-differential equation with a term of the Kadomtsev-Petviashvili type. The equation is able to produce soliton's solution taking into account the influence of the atmosphere movement and the ocean current. The mechanism of the rogue wave formation is proposed on the basis of the model equation solution as a single two-dimensionally localized wave having the pit shape.

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