Geophysical Research Abstracts, Vol. 8, 10934, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10934

Rogue Waves: Facts and Theories (Sergey Soloviev Medal Lecture)

Efim Pelinovsky
Institute of Applied Physics, Nizhny Novgorod, Russia (Pelinovsky@hydro.appl.sci-nnov.ru)

A review of physical mechanisms of the rogue wave phenomenon is given. The data of marine observations as well as laboratory experiments are briefly discussed. They demonstrate that freak waves may appear in deep and shallow waters. Simple statistical analysis of the rogue wave probability based on the assumption of a Gaussian wave field is reproduced. In the context of water wave theories the probabilistic approach shows that numerical simulations of freak waves should be made for very long times on large spatial domains and large number of realizations. The following mechanisms of the rogue wave formation are considered: dispersion enhancement of transient wave groups, geometrical focusing in basins of variable depth, wave-current interaction, nonlinear modulational instability (Benjamin–Feir instability), and wind flow action. Specific numerical simulations were performed in the framework of various mathematical models: the nonlinear Schrödinger equation, the Davey – Stewartson system, the Korteweg – de Vries equation, the Kadomtsev – Petviashvili equation, the Zakharov equation, the fully nonlinear potential equations, and their forcing versions. The results of the numerical experiments show the main features of the physical mechanisms of rogue wave phenomenon. They are used to estimate the rogue wave life-time and explain the observed data.