

Search for Freak Waves in the Ocean

A. R. Osborne, M. Onorato and M. Serio

University of Torino / Office of Naval Research

Abstract for Rogue waves 2000 workshop, Brest, 29 - 30 November

We are approaching the study of freak waves in the ocean from a number of perspectives:

(1) The modelling of the waves from the point of view of the nonlinear Schroedinger equation and higher order extension in both 1+1 dimensions (x,t) and 2+1 dimensions (x,y,t), (2) Numerical modelling from the point of view of the Euler equations in 1+1 dimensions, (3) Theoretical formulations based upon the exact spectral solutions (from the inverse scattering transform) of the NLS equation in both 1+1 and 2+1, (4) Theoretical studies to higher order based upon Lie transforms, (5) laboratory studies in wave tanks and (6) oceanic experiments.

Inverse scattering theory is being applied as a tool for the nonlinear Fourier analysis of measured time series; in this approach the rogue waves (unstable modes of the NLS equation) are (nonlinear Fourier) spectral components in the theory. In this way we are able to filter out rogue modes from time series data.

One of the surprising results of our research is that previous studies of the unstable modes constitute only a very small part of the possible rogue modes of the NLS equation.

These ideas are illustrated by the nonlinear Fourier analysis of both laboratory and oceanic wave data.