Tatiana G Talipova et al., J Astrophys Aerospace Technol 2017, 5:3 (Suppl)
DOI: 10.4172/2329-6542-C1-010

Tatiana G Talipova and Efim N Pelinovsky

Institute of Applied Physics and Nizhny Novgorod State Technical University n.a. Alekseev, Russia

Breather-like wave dynamics in a stratified fluid

The existence of the long breathers of internal waves in a density stratified fluid, as for the existence of internal solitary waves, has been predicted by the asymptotic KdV-like theory. The long-time breather-like wave evolution in the framework of the Euler equations has been obtained numerically confirming the predictions of weakly nonlinear theory. Recently the observations of the long-wave internal breather-like waves in the Celtic Sea were published and were confirmed in numerical modeling. So the investigation of the internal breather dynamics is now hot-spot problem of the physical oceanography. Here, we address the propagation and transformation of long internal breather-like wave in an idealized but close to realistic stratification and in the conditions matching the average summer stratification in the southern part of the Baltic Sea. The focus is on changes in the properties of the breather when the water depth increases and the coefficient of the cubic nonlinear term changes its sign. Equivalently, the breather cannot exist anymore. The simulations are performed in parallel in the framework of the weakly nonlinear Gardner equation (quadratic-cubic Korteweg-de Vries equation) and using fully nonlinear Euler equations. The amplitudes of breathers in these frameworks have slightly different courses in idealized conditions (when Earth's rotation is neglected) whereas a decrease in the amplitude is faster in the fully nonlinear simulation. The impact of the background (Earth's) rotation substantially depends on the spectrum of the initial breather and the internal wave group modulation instability is studied. Fig.1 demonstrates the process of the breather generation in the three-layer fluid by transformation of the second-mode Solitons on the bottom step.

Biography

Tatiana G Talipova is a PhD, Dr. Sc. Holder and holds a position of Head Scientist at the Institute of Applied Physics and State Technical University. She works in the theory of nonlinear waves in hydrodynamics, ocean physics and plasma physics. She is an author of 5 books and 180 papers. Her h-index is 20 (WoS) and 23 (Scopus). Her main results are: Model of the transformation of nonlinear internal waves in the horizontal-variable media, study of the internal breather-like waves, mechanisms of the freak wave phenomenon, and elastic properties of the surface-active marine films.

tgtalipova@mail.ru

Efim Pelinovsky is a PhD, and Dr. Sc. Holder. He is a Professor of Chief Scientist at the Institute of Applied Physics and State Technical University, and also Professor at Higher School of Economics. He works in the theory of nonlinear waves in hydrodynamics, ocean physics and plasma physics. He is an author of more 1o books and 500 papers. His h-index is 30 (WoS) and 32 (Scopus). His main results are: Asymptotic method for non-sinusoidal waves in dispersive media, adiabatic theory of soliton evolution in inhomogeneous medium, nonlinear sea wave run up on a coast, evaluation of coastal wave hazards, mechanisms of the freak wave phenomenon. He is a Laureate of the Russian State Prize (1997), Soloviev Medal from European Geoscience Union (2006) and award from Int. Tsunami Society (2012).

pelinovsky@gmail.com

Notes: