Geophysical Research Abstracts, Vol. 8, 00344, 2006
SRef-ID: 1607-7962/gra/EGU06-A-00344

Solitons and breathers in the Euler equations for stratified waters

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The appearance of two kinds of stable-state nonlinear internal waves as solitons and breathers is predicted by asymptotic theory in the framework of the extended Korteweg – de Vries equation. It should be mentioned that solitons may appear for any signs of nonlinear coefficients in the extended Korteweg – de Vries equation and breathers may exist only for positive values of the cubic nonlinear coefficient. So, solitons are more usual stable-state nonlinear internal waves they may exist for each water stratification, and it is the reason why they appear on the oceanic shelves very often. The studying of hydrology on the various shelves in the World oceans demonstrates the wide variety in the density stratification profiles, a lot of them provide for positive cubic nonlinearity term in the extended Korteweg – de Vries equation and breathers may exist for such conditions. In the framework the Euler equation system for stratified waters it is impossible to study analytically the conditions of existence of nonlinear stable-state internal waves and to get their parameters. Today owing to developing computing such study may be done numerically. Internal solitons had been modeling in Euler equation system years ago and reported by Lamb(1994), Vlasenko (2003) and others. The forms of solitons in the Euler equation system for stratified water had been studied numerically and the difference with solitary wave in the extended Korteweg – de Vries equation) is discussed. Breathers were not observed in numerical modeling before. Here the first numerical run with internal breather appearance in the Euler equation numerical model is presented and results are discussed.

References

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