

Referee Report

of the manuscript by N. Makarenko, J. Maltseva, E. Morozov, R. Tarakanov, and K. Ivanova
“Internal waves in marginally stable abyssal stratified flows”

The authors suggest a mathematical model of nonlinear internal waves with dispersion in a fluid with two weakly stratified layers. The model is tested by comparing it with the field measurements. The novelty of the problem formulation is in the account for the peculiarities of the density stratification characteristics of abyssal currents. The key hypothesis applies the assumption that the small density jump of the fluid at the interface between two layers is of the same order of magnitude as the density gradients within the layers. Derivation of the model equation uses the long wave approximation, which is applied to the system of nonlinear equations for inviscid stratified fluid. Construction of the solution of the solitary wave type is reduced to quadrature. A chart of the wave regimes is constructed on the plane of densimetric Froude numbers. The authors conclude that the parametric domain of the solitary waves is close to the boundary of the Kelvin-Helmholtz instability zone of the main stream. This conclusion agrees qualitatively with the data of measurements of marginally stable flows of Antarctic Bottom Water in the abyssal fracture zones of the Atlantic, in which long series of strongly nonlinear internal waves with separation of the Kelvin-Helmholtz vortices are observed.

The results of the research are new and interesting. They clarify one of the possible hydrodynamic effects of intense mixing of bottom waters in deep channels. The text is logically structured. Cumbersome formulas are given in the appendices. The manuscript corresponds to the theme of the special NPG issue dedicated to internal waves. The paper can be accepted and published after a few improvements.

Remarks

1. Characteristic values of the Boussinesq parameters for abyssal currents that the authors use for comparison would complement and improve the text if they are added to the text. They will make the analysis more complete and characterize the domains of applicability of the new model.
2. Figure caption of Fig. 2 requires explanation for the right panel related to the indication of instability zone. There are comments in the text but it is highly desirable to include them into the figure caption. Many readers prefer analyzing the figures without referring to the text.