GIS for Studying Internal Gravity Waves

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The phenomenon of internal gravity waves (IGW) in stratified waters is very complex and important object in geophysical studies. At the present time the modeling of IGW is carried out using the theoretical and numerical models of different levels universally recognized in the scientific society (see, for example, Pelinovsky et al., 2007). But the practical use of these models for the applications is complicated due to the absence of uniform modeling environment, visualization and data manipulation tools. All the existing models are separate, disconnected, realized for particular situations (in geographical and physical sense), available only locally. It's worth noting that these models are quite complex, and their usage requires sophisticated preliminary processing of the input data.

Here we present the new developed software "IGW research GIS" combining different models of IGW and input data from different hydrological sources (international atlases) for the automatization of IGW research tasks as well as for removal a rut of preparation and comparison of input data for these models. It solves the full cycle of problems which are usually solved during the study of IGW in the framework of linear and extended weakly nonlinear models. The software can be used in a great variety of tasks connected to analysis and forecasting of the IGW phenomena in the world ocean. In this program complex we use numerical arrays containing bathymetry, temperature, salinity, density, linear vertical mode, kinematic and nonlinear parameters of IGW in the weakly-nonlinear approach. These arrays are constructed on a base of data from public international hydrological data sources: World Ocean Atlas 2005 by NOAA and Generalized Digital Environmental Model (GDEM V 3.0), and from digital bathymetric atlas GEBCO.

The GIS allows the researcher to select the data source, season and geographic area, build interactive maps of the fields of different kinematics and nonlinear parameters, perform the analysis of these data, setup, initialize the problems with different parameters and make forecasts using different mathematical models and then estimate the possible effects. And all these can be done within a modern user-friendly interface.

IGW Research GIS is indispensable when one needs to export the result of the research to other software formats to share the results with colleagues. All the maps, charts and histograms can be exported both to bitmap and special formats (such as GRD) to be displayed by third-party software.
For the moment IGW Research GIS if the only all-in-one solution ready both to perform the visualization of IGW parameter maps in the ocean and carrying out different mathematical models to describe linear and nonlinear dynamics of these waves.

The IGW Research GIS is distributed free of charge through the official website (http://oceandata.info/). And we plan to expand the number implemented mathematical models with full nonlinear models in near future.

E. Pelinovsky, O. Polukhina, A. Slunyaev & T. Talipova Internal solitary waves // Chapter 4 in the book "Solitary Waves in Fluids". WIT Press. Southampton, Boston. 2007. P. 85 – 110.