NUMERICAL INVESTIGATION OF THE INTERNAL-WAVE TRANSFORMATION DURING EXPANSION OF THE DEEP WATER FROM THE OPEN SEA TO THE SHELF BY M2 TIDAL FORCING

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To investigate the internal wave transformation during expansion of the deep water from the open sea to the shelf by M2 tidal forcing the 3-D model of marginal sea have been used. The model includes non-hydrostatic system of primitive equations of motion, equations of continuity, temperature, salinity, and constructed from them equation for pressure with co-called “artificial compressibility” and is completed with equation of state and *k-e* closure. The last one is a modification of Mellor' turbulent model with equation for fluctuations of temperature. Numerical approximation of the equations of the model is based on tetrahedron finite element mesh and has the 2-nd order of accuracy in time and space both. Near the shelf zone the nest grid was thickened up to 4 m in the horizontal and 1 m in the vertical direction.

Here, we present some results of a numerical experiment with an 80^0 angle of the shelf plateau declination. In Fig.1, vertical sections of the salinity field are drawn. They correspond to 0.5 and 0.95 moments of the M2 period (T). These situations are marked in Fig. 2, where salinity and kinetic energy timeserias at two different levels obtained in the numerical experiment are presented. On the contrary, in Fig.1 are marked the points where these timeserias were obtained.

Both figures illustrate a very asymmetrical picture of the deep water expansion toward the plateau in time. Its maximum coincides with the last part of the M2 period (see Fig. 1). In Fig. 2a, near the surface, after an abrupt decrease of the salinity in the middle of the M2 period, the salinity monotonically arises during all of the other part of the period. A more complex situation exists in the middle of the above plateau volume. Here, after an abrupt decrease in salinity, nearly the same abrupt increase of it follows. For the most part of the M2 period the salinity irregularly oscillates slightly above its mean value for this level. In Fig. 2b, after abrupt increase of the kinetic energy in the middle of the period its fluent decrease follows.

An additional point is to emphasize that in numerical experiments with a coarse resolution nest grid (about 50 m) the complex feature of this curve diminishes and, what is especially important, the situation on the right-hand outflows is different.

For a more precise investigation of the process of the internal wave breaking, which coincides with abrupt changes of the salinity during the M2 period, spectral analysis of the timeserias of salinity, kinetic energy, turbulent kinetic energy and its dissipation rate are fulfilled.

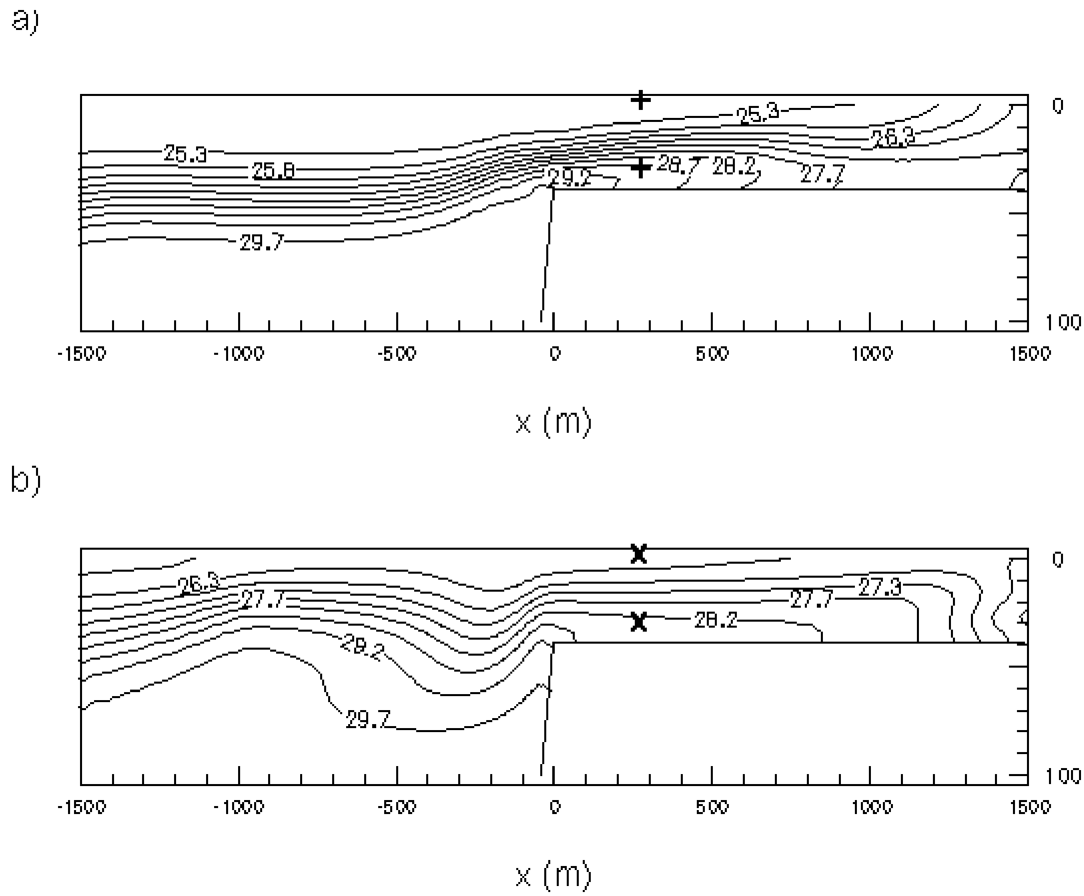

Figure 1. Vertical section of the salinity field: (a) 0.5 T; (b) 0.95 T.

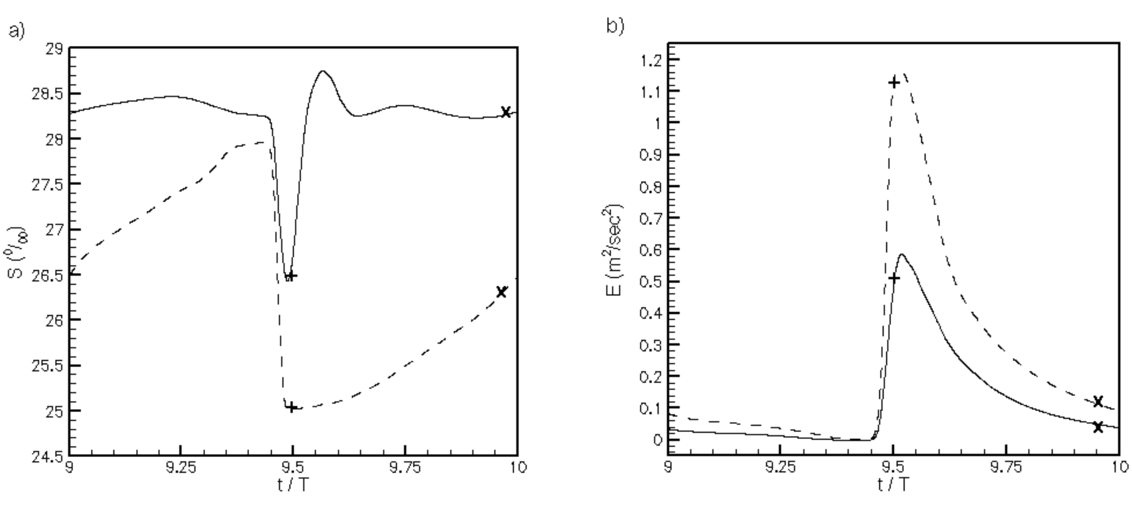

Figure 2. Time series of salinity (a) and kinetic energy (b).
— 26.9 m, - - - 3.84 m; + - 0.5 T, x – 0.95 T.