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Numerical Analysis of Hydrophysical Fields in Lake Shira

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Salt stratified Lake Shira has been the subject of an extensive body of research because of its central role in existence of the resort area of Khakassia. The aim of previous research has been directed at water quality issues (e.g. Aquatic ecology). Studies of Lake Shira physical dynamics relevant to the present work include: general observations of wind, currents; 3-d numerical modeling of hydrophysical fields and investigations of internal waves on the basis of field experiments in 2011-2013 (e.g. V.I. Baranov).

Lake Shira, as is shown in Fig. 1, has the north-south length 5 km, east-west width 9 km, and the maximum depth is 25 m.

A typical distribution of temperature, salinity, density in the lake in summer is shown in Fig. 2 and 3.

The presence of density stratification creates the conditions for the presence of internal waves. Strong wind as well as summer stratification allows field studies of

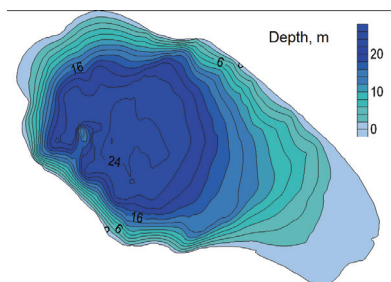


Fig. 1. Lake Shira bathymetry at present

internal wave motion. The analysis of the 2011 field data shows peaks in the isotherm displacement near 6 h.

However, the nature of these waves has not been identified and their investigation is represented in the 3-d numerical model. The model is hydrostatic and Boussinesq. An algorithm of high order approximation is opted for calculating the equations of heat and salt transfer. The variable wind allows us to simulate the appearance of internal waves (Fig. 4).

Key words: numerical analysis, stratified salt lake, hydrophysical fields.

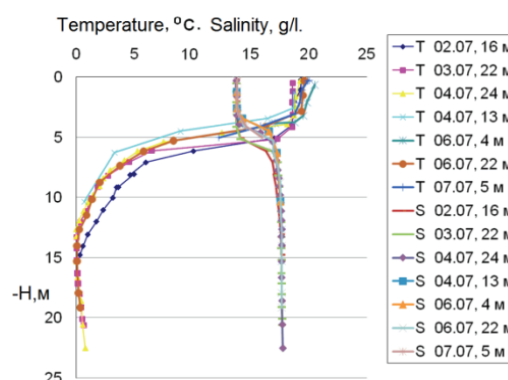


Fig. 2. Typical distribution of water temperature and salinity depending on the depth, in Lake Shira in summer

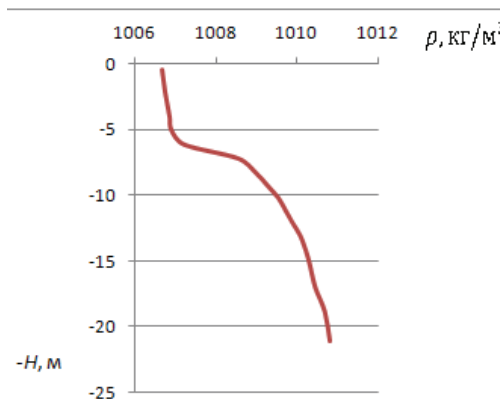


Fig. 3. Typical distribution of water density depending on the depth, in Lake Shira in summer

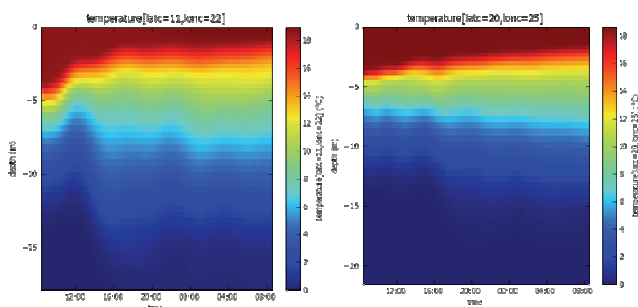


Fig. 4. Isotherm fluctuations obtained by numerical calculations in shallow (left) and deep (right) part of the basin with the bathymetry of Lake Shira under variable wind stress

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