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Progressive waves of final amplitude in ice conditions

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The differential equations in partial derivatives for solving a problem about space-time evolution of any initial elevation of the basin's surface covered with broken ice for three non-linear approximations are obtained on the basis of the equations of non-linear waves dynamics in a final depth liquid by the method of the multiple scales asymptotic expansions. They are received in view of a wave profile curvature at definition of velocity of surface horizontal wave currents and non-linearity of the floating floes' vertical acceleration.

The solutions of these equations as uniformly convergence expansions up to the third order terms for fluid's velocity potential and basin's surface elevation are received when propagation and non-linear interaction of final amplitude periodic waves. The analytical and numerical analysis of the received solutions is carried out. Structural peculiarities of nonlinear disturbance and the laws of their formation are revealed. The quantitative analysis of dependence of amplitude-phase characteristics and non-linear mass transport on a steepness and frequency of initial wave harmonics, ice thickness and non-linearity of its vertical acceleration is performed.

Comparison of solutions received with taking into account and neglect by time-space changes of wave profile in the expression of the velocity potential when obtaining boundary conditions at the basin's surface for the non-linear approximations is done. The opportunity of appreciable errors in definition of disturbance phase shift and displacement values of the basin's surface conditioned by profile deformation neglect is established.