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Mathematical modeling of the thermal and hydrodynamic structure of the cooling reservoir

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Hydrothermal conditions of the cooling reservoir is determined by the heat and mass transfer from the water surface to the atmosphere and the processes of heat transfer directly in the water mass of the reservoir. As the capacity of power plants, the corresponding increase in the volume of heated water and the use of deep lakes and reservoirs as coolers there is a need to develop new, more accurate, and the application of existing methods for the numerical simulation. In calculating the hydrothermal regime it must take into account the effect of wind, density (buoyancy) forces, and other data of the cooling reservoir. In addition to solving practical problems it is important to know not only the magnitude of the average temperature, but also its area and depth distribution. A successful solution can be achieved through mathematical modeling of general systems of equations of transport processes and the correct formulation of the problem, based on appropriate initial data. The purpose of the work is application of software package GETM for simulating the hydrothermal regime of cooling reservoir with an estimate of three-dimensional structure of transfer processes, the effects of wind, the friction of the water surface. Three-dimensional models are rarely applied, especially for far-field problems. If such models are required, experts in the field must develop and apply them. Primary physical processes included are surface heat transfer, short-wave and long-wave radiation and penetration, convective mixing, wind and flow induced mixing, entrainment of ambient water by pumped-storage inflows, inflow density stratification as impacted by temperature and dissolved and suspended solids. The model forcing data consists of the system bathymetry developed into the model grid; the boundary condition flow and temperature; the tributary and flow and temperature; and the system meteorology. Ivankovskoe reservoir belongs to the reservoirs of valley type (Tver region, Russia). It is used as a cooling reservoir for Konakovskaya power plant. It dumps the heated water in the Moshkovichevsky bay. Thermal and hydrodynamic structure of the Moshkovichevsky Bay is particular interest as the object of direct influence of heated water discharge. To study the effect of thermal discharge into the Ivankovskoe reservoir the model of the Moshkovichevsky Bay was built, which is subject to the largest thermal pollution. Step of the calculation grid is 25 meters. For further verification of the model field investigations were conducted in August-September 2011. The modeling results satisfactorily describe the thermal and hydrodynamic structure of the Moshkovichevsky Bay.