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The mathematical modeling of the Shatura lakes ecological state

Elena Debolskaya (1) and Evgeny Yakushev (2)

(1) Water Problems Institute, Russian Academy of Sciences, Moscow, Russian Federation (e_debolskaya@yahoo.com, +7(499)1357201), (2) Norwegian Institute for Water Research, Oslo, Norway

In this study we used three-dimensional hydrodynamic model GETM to simulate the hydrodynamical, thermal and biogeochemical regime of the Shatura Lakes over summer and winter periods. The situated in the Central European Russia Shatura Lakes are used as the lake-coolers of the State District Power Station. The goal of this work was to study the influence of the weather conditions and Station thermal dumps parameters on the Lakes thermal regime, water circulation and the distributions of the basic biogeochemical characteristics, which are responsible for the lakes system ecological state.

This model biogeochemical block (OxyDep) has 4 state variables: dissolved oxygen (DO), total organic matter (OM), biota (BIO) and inorganic nutrient (NUT). Such a simple model allowed to parameterize the main processes responsible for the water column oxygen regime, i.e. synthesis and decay of organic matter and the processes at the boundaries (sea-water exchange and consumption by the sediments). The main goal of OxyDep was to study the processes of the oxygen depletion resulting in the observed formation of suboxic and anoxic conditions in the certain water volumes of the studied lakes.

The application of the model allowed to demonstrate that the thermal dumps regime is the main factor affecting the formation of currents structure, the thermal conditions and the ecological state. The growth of water temperature caused by thermal dump, considerably shifts date of the bloom beginning and its intensity and can lead to intensification of eutrophication and to formation of hypoxic zones.