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## Hydrological paradoxes of phytoplankton distribution in the Novosibirsk reservoir

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The ecosystem of the Novosibirsk reservoir - the largest in West Siberia, is the object of this research aimed at studying the mechanisms of water quality formation, which differs in various parts of the reservoir. The research novelty is in simulation of ecological processes occurring in various water areas and in the reservoir as a whole through reproduction of biogeochemical cycles of limiting elements.

The city of Novosibirsk is the administrative center of the Siberian Federal District, which occupies more than 25% of the territory of Russia. The Novosibirsk reservoir is major source of water supply in Novosibirsk. Still, some features of its water quality formation have been poorly explained.

For instance, it is believed that relatively shallow and low flow sites of water bodies are most susceptible to eutrophication. In such places, water warms up better and phytoplankton biomass is much higher. In the central part of the reservoir, depth at the left bank is much less than that at the right one, through which most riverbed flow passes (from the Ob river to the dam). However, according to long-term observations, in every August, phytoplankton biomass at the right bank is several times higher than at the left one.

One more paradox may be considered. Phytoplankton biomass in the surface water layer during the open water period is usually much abundant than at depth characterized by worse penetration of solar radiation. Nevertheless, in the studied period (August 1981), we observed the inverse ratio when phytoplankton biomass at depth significantly exceeded that in the surface layer.

For better understanding these phenomenon, a comparative assessment of mechanisms of in-water processes was performed through applying 3D simulation methods and reproducing the cycles of biogenic elements transformation.

Due to simulation and its results analysis, we revealed the following:

- the peculiarities of water exchange influenced by stable wind currents in August-September bring to phytoplankton biomass excess at depth near the right bank in contrast to relatively

- shallow water area near the left one of the Novosibirsk reservoir;
- “locking” by thermocline and subsequent fluctuations in vertical water exchange lead to abundant phytoplankton biomass in the water column as compared to the surface layer near the dam.

Thus, simulation demonstrates that the above mentioned paradoxes of phytoplankton development in the Novosibirsk reservoir are induced by specific hydrothermal processes.

The study importance goes beyond only giving insight into the causes of interesting natural phenomena. A detailed analysis of simulation results enables to explain nontrivial features of spatially distributed dynamic ecological processes. The possibilities of forecasting the reservoir ecosystem response to changes in different factors associated with varying external effects have been expanded. To mitigate negative impacts of eutrophication, you can change flow patterns at appropriate times, for example, by selecting a suitable operating mode of a hydro-station. The study demonstrates that contaminated water outflow from some water areas may be executed by directional energy use of natural phenomena.