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STUDY OF CHANGES IN THE QUALITY OF THE SURFACE WATER BODY

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Surface water bodies are a strategic, vital natural resource of particular importance. Ukraine's integration into the European Economic Cooperation and the World Trade Organization provides for the formation and implementation of a balanced policy of Ukraine's transition to sustainable development. That is why providing our citizens and industries with good quality water is one of the priorities of socio-economic policy for Ukraine.

To date, various approaches to the calculation of surface water quality indicators are being developed. To obtain a dynamic forecast describing the change in performance over a period of time, simulation models are usually used, which are based on models of runoff formation from the catchment area, supplemented by blocks of removal of associated pollutants (hereinafter - PT) [1, 2]. Models of inland water processes have been developed, which are aimed at calculating the dynamics of phytoplankton and nutrients. At the same time, for the tasks of forecasting changes in water quality, as well as the content of PT in surface water bodies, due to man-made loads dangerous to aquatic ecosystems, it is advisable to use large-scale models that cover the catchment as a whole and contain parameters that depend on catchment structures [3].

Studies to determine the adequacy of the forecast mathematical model for predicting changes in the total content of anions in the Dnieper basin, were conducted according to samples of control water intake of the Dnieper River within the Basin Water Management at 12 posts, for the period 2010-2019. Environmental assessment of water resources of Ukraine of the State Agency of Water Resources of Ukraine.

The balance of a substance contained in the water of a surface water body generally consists of external and internal sources (effluents are considered as negative sources). The group of external sources includes inflows with lateral inflow, with atmospheric precipitation, allocation or absorption by bottom sediments attached by flora (macrophytes, periphyton). The group of internal sources includes: separation of PT into water or its extraction from water by phytoplankton and other aquatic organisms carried by the flow, sorption of the substance by suspension particles and their sedimentation to the bottom of a surface water body, chemical transformation in water volume, leading to formation, decay or decontamination of PT. This classification of sources is due to the fact that each group can be equally considered in the model. The total effect of external sources is characterized by the value of m - the intensity of the flow of PT (by mass). By definition, $m\ (l)\ dl$ is the mass of a substance entering a river in a section ($l,\ l + dl$) per unit time,

where l is the horizontal coordinate along the surface of the surface water body. The action of internal sources depends on the concentration of PT in the surface water body. The rate of increase in the concentration of substance c due to internal sources in the simplest case is given by the value of *kc*, where k is the total rate constant of the process; at $k > 0$ there is the formation of PT, and at $k < 0$ - its decay.

The water of a watercourse transfers per unit time the mass of a substance $M = cQ$, where Q is the flow rate of the watercourse. Next, the transfer is considered within the Lagrangian description. The movement of the allocated volume of water by the flow of water with velocity v by the distance vdt is accompanied by an increase in the amount of transfer of PT due to external sources by mvdt, and due to internal sources - by $kc\,Qdt$, so that the total increase in mass of PT $dM = mvdt + kcQdt$ (will be constant in this section of the watercourse).

For further analysis of the data, the most interesting is the case when the predominant contribution to the change in the concentration of PT is made by an internal source (with a negative source $k < 0$ corresponds to the runoff of PT, for example due to its decay). On the basis of the available, in the system of monitoring and ecological assessment of water resources of Ukraine, real average long-term data, research of time series of indicators of quality of water of Dnieper, on available posts of supervision is carried out. Studies of the change in the amount of water anions were performed after a preliminary retrospective analysis based on the theoretical dependences obtained above.

Let us check the assumption, which means that the time of water reaching from the initial line of the considered section of the watercourse to its final line is much less than the time of filling the living section with water from the side inflow. 12 sections along the Dnieper watercourse ≈ 12 km long were considered. At an average flow velocity of ≈ 1 m/s we obtain a run time of ≈ 3.3 hours. To calculate the time, we use ordinal estimates of the live cross-section of the watercourse and the intensity of the lateral inflow. Thus, you can use the obtained theoretical distributions.

The time series (Fig. 1) shows an increase in the concentration of the sum of anions over the past 10 years. Perennial highs and lows at 12 observation posts. The horizontal line in fig. 1, conducted by values.

Figure 2 shows that in the considered surface water body during the observation the change in the amount of anions occurred in the range of 0.96-1.22. It is divided into two subintervals, which are divided by the value of the sum of anions 1.1, each of which has a normal distribution, but with different values of the parameters.

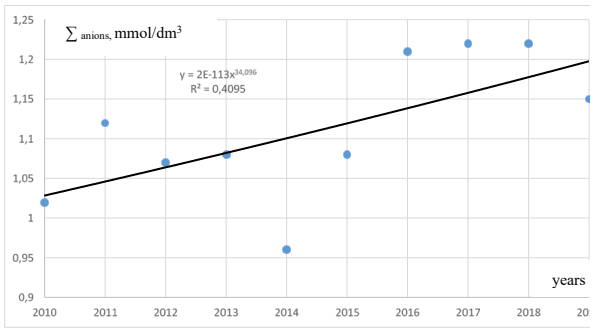

Figure 1. Time series of the concentration of the sum of anions.

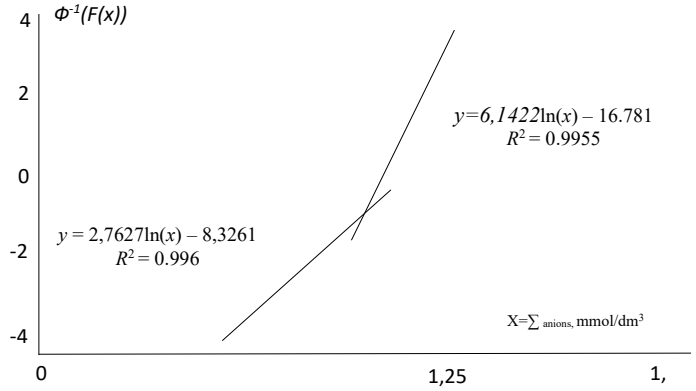

Figure 2. The function of the distribution of the concentration of the sum of anions.

The advantages of the proposed approach are the possibility of simple and fast derivation of the stochastic equation of the balance of CL and construction of the equation for the density distribution of their concentrations. As a disadvantage, however, it is fair to point out the need to use computer technology when using the proposed model.

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