Mathematical modelling of the impact range of sewage discharge on the Vistula water quality in the region of Włocławek

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ABSTRACT

The paper presents results of analysis of the industrial sewage discharge influence at km 688+250 of the Vistula River on water quality. During the analysis two-dimensional models of flow, impurities and temperature transport were used. Hydrological conditions of the analyzed section of the river, characteristic flows and bathymetry of the riverbed in the first instance were defined. Calculations of velocity distribution at steady flow conditions were carried out for the mean of the observed low discharges MLQ = 293 m3/s. For this purpose, a simplified two-dimensional kinematic model for variable depth of flow was used. The analysis of the impact of the discharge of impurities in steady flow conditions was performed by solving an equation of unsteady transport of pollution. Numerical simulations were carried out for pollution in the form of a non-degradable substance (tracer) and water temperature higher than measured in summer and winter conditions. The analysis included distribution of concentration of contaminants at the discharge site, as well as its range along the river bank.