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Streszczenie w języku angielskim (abstract in English)

The lower part of Odra River creates very complicated system of river branches and channels close to its outlet to Szczecin Bay, called the Lower Odra river network. On the area of the hydrographic net many hydrological and meteorological phenomenon occur resulting in lack of any strict and direct relationship between river inflow and water stages at lower boundaries of the network.

The lower Odra region is characterized by the presence of so-called "Międzyodrze" (an area of lowland between two main branches of the river system, Eastern and Western Odra. Initially, Międzyodrze was used for agriculture, and for this purpose tens of channels had been dug and tens of hydrotechnical structures and facilities had been constructed, allowing for water exchange between the two main branches. However, years of neglect and lack of maintenance works in the 2th half of the XXth century resulted in complete devastation of all technical structures. Also, uncontrolled accumulation of sediment and silt made the internal channels shallow and, in some places, completely overgrown with vegetation, practically blocking the process of free flow through Międzyodrze. Currently, the water exchange in Międzyodrze is only possible during the high water events in that network.

Taking into account the size of Odra river network, its complicated structure and hydrodynamic flow regime, the only reasonable tools for investigating flows and water levels can be numerical flow models. Field researches could only give some indicative data for initial orientation in the flow conditions and can be used for verification purposes.

Over the years several numerical models have been applied for investigation flow dynamics in the Odra River network, but none of them include possibility of Międzyodrze hydrodynamic participation in flow through the network. This fact and current works on the Odra basin flood safety were basic reasons to choose the Międzyodrze as a main research area and include its functionality in hydraulic model of lower Odra river network.

The main purpose of the study was to determinate the influence of Międzyodrze on flows in the lower Odra river network. Author has applied the HEC-RAS modelling environment and built his own version of the network hydraulic model, including Międzyodrze in three different ways (model's variants). The first variant presents the current

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situation where Międzyodrze is treated as an uncontrolled storage area. The second variant treats the Międzyodrze as no-flow area in the network (just like the models used to date). The last variant allows free water flow in selected channels of Międzyodrze caused by hypothetical dredging and renovation of its all hydrotechnical infrastructure.

For the purpose of building the three model variants it was necessary to carry out measurements of the Międzyodrze bathymetry and inventory (channels and hydrotechnical structures). Measurements were quite difficult due to legal and technical restrictions for vessels wishing to flow in Międzyodrze channels. Based on the data gathered from measurements and from other available resources, the hydraulic river network model has been constructed in Hec-Ras software and successfully calibrated for measured data set. The verification of the model has also been made, based on another independent data set.

The calculation and analysis process was divided into two groups: steady flow and unsteady flow. For both groups the boundary conditions sets have been prepared as flow hydrographs in the input cross-section (upper one), and water level hydrographs in the model output cross-sections. Additionally, the method of the Widuchowa weir controlling was elaborated, treating this weir as an internal boundary condition.

In the steady flow group the following quantities have been investigated: flow distribution in Widuchowa bifurcation, reduction of the flow along the Eastern Odra, ratio of Skośnica flow to the input flow and ratio of flows in the output cross-sections. All of these analyzes were done depending on the way of including Międzyodrze into the network flow, boundary hydrological conditions assumed, Widuchowa weir opening and Manning's roughness value. In the unsteady flow, hypothetical flow and stage boundary hydrograms have been applied for analysis of changes of basic flow parameters in selected control cross sections, also as a function of model variant, weir opening method and the roughness coefficient used. The unsteady flow analysis also comprised estimation of wave transformation and dissipation along the Odra River network both for river-type forcing (flood wave) and sea-type one (storm surge). In each case water balance of the model's results has been confirmed.

The overall analysis of the modelling results and final conclusions confirm the thesis of dissertation that potentially planned dredging of channels and the renovation of Miedzyodrze hydrotechnical infrastructure will have a fundamental impact on flows in lower Odra river network.

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