

JUSTIFICATION OF HYDROLOGICAL OBSERVATION AUTOMATION IN THE CHERNIHIV REGION

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In many regions there is an increase in the number of catastrophic floods in the last decade, including the Dnipro river basin, flowing through the territory of Ukraine and Belarus. Floods are one of the most frequent spontaneous phenomena. They often outnumber all other emergencies by the areas and the damage.

In Ukraine over the few years up to 50 rural settlements on the territory of Bakhmach, Borzna, Kozelets, Korop, Kulikovka, Mena, Novgorod-Siversky, Ripky, Sosnitsa, Chernihiv districts can be submerged in the territory of the Chernihiv region. It is depending on the climatic conditions, as well as lowered places of the city of Chernihiv (river port, buildings of the city sewage system) [1].

Not only large rivers can cause significant damage. The Strizhen River, which was raging in Chernihiv on April 2, 2018, flooded several dozen meters of the coast and many buildings (Fig. 1). People were not ready for this and this event caused great material losses. The main reason for this is the lack of timely informing the population and the relevant services.



Fig. 1. The flow of the river Strizhen in Chernihiv

The state registration of water is carried out in order to systematize data on the use of water, discharge of water and pollutants, the availability of circulating water supply systems and their capacity, wastewater treatment systems and their efficiency, etc. [2].

The state register of surface waters is carried out by the specially authorized central executive body on hydrometeorological issues by conducting permanent hydrometric, hydrochemical monitoring of the quantitative and qualitative characteristics of surface waters.

The monitoring of surface water in the territory of Ukraine, Belarus is carried out at hydrological stations (HS). In the Chernihiv region HS on the Dnipro river are placed in Nedanchichi and Dniprovske. HS in Dniprovske is located at the entrance to the Kiev reservoir, so its data are not sufficiently informative in terms of the water regime analysis.

The annual change in water levels in the upper reaches of the Dnieper in the territory of Ukraine is characterized by usually spring high water and a fairly low mean water. During the flood period, when the highest elevation of water levels in the rivers of Chernihiv region is observed, the amplitude of the water levels fluctuations in most of the rivers reaches 3–4 m, in the lower reaches of larger rivers – from 5 to 8 m (on the Dnipro River). In the spring, a flood discharge of the Dnipro, Desna, Seym, and Snow with the increase of water levels up to 8 m can be flooded. The area of potential flooding along the Dnipro River may amount to 630 km² [3].

Data on the values of maximum flood water levels recorded at the HS Nedanchichi the are given in the table.

Data on the values of maximum flood water levels at the HS Nedanchichi

Maximum water level flood, cm above zero post					Long-term characteristics of maximum water levels of spring water, cm above zero post			
2012	2013	2014	2016	2017	Number of observation years	highest	average	lowest
632	719	464	419	466	44	900	610	376

At HS Nedanchichi controlled only few parameters of water, the methods of measurement and control are obsolete and executed manually, which in case of emergency makes low their efficiency.

Therefore, the actual task is to create an autonomous automatic complex for the implementation of hydrological observations.

The modern automation complex should contain a number of sensors that will control a lot of different parameters (Fig. 2).

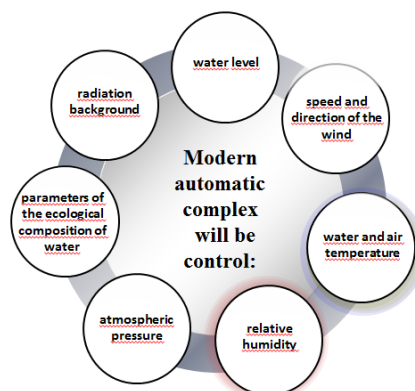


Fig. 2. Parameters that will control the automated system of hydrological observations

Advantages of this complex are:

- Modern and technologically advanced (Modern technologies allow the implementation of integrated sensors (capable of controlling several parameters in one case at a time) of small overall dimensions with low power consumption).
- Autonomy. (The rapid development of non-traditional energy sources has led to a significant increase in the efficiency of photoelectric converters with energy storage and reduction of their cost).
- Efficiency in collecting, processing and transmitting information. (Using modern digital electronics allows you to make several reference samples of controlled parameters every second, digital interfaces of modern sensors allow to quickly transmit the results of measurement within the complex, store them on the hard disk, group and transmit the necessary data with GSM / GPRS modem to the central server, where Further processing and creation of the database will take place. In the future it is expedient to create WEB-application, which will be displayed as the results of current measurements, so will be kept archive, which could take away the necessary data for the study of the dynamics of change certain parameters).

Modern automated hydro-meteorological complexes, in addition to hydrological and meteorological parameters, can measure various ecological indicators of water pollution and radiation background. These options are of particular importance for the border (transboundary) water bodies, which are the upper reaches of the Dnieper River. Since automatic stations are able to detect pollution in the initial phase, promptly inform the relevant services and prevent the development of an ecological disaster. In addition, if such complexes are installed as close as possible to the border and will be merged into a single network, this will allow to resolve more quickly the possible conflicts related to the definition of a source of pollution.

Consequently, placing in the upper reaches of the Dnieper modern, automated measuring complexes will increase the efficiency of the monitoring system for the hydrological, metrological and environmental parameters of the Dnipro River, increase the awareness and consciousness of the population regarding the rational use of water resources. The implementation of the project will promote awareness of citizens about international problems in the field of water resources and their impact on living conditions and economic activities in the transboundary areas of the Dnipro Basin. This is the objective pursued by the international project «Theorems-Dnipro» (Transborder system of hydrometeorological and environmental monitoring of the Dnipro River) [4], which is being implemented with the *Chernihiv National University of Technology, Educational Institution «Sukhoi State Technical University of Gomel»*, *Desna Basin Administration of Water Resources, Centre for social welfare «Dobrochyn», Association of children and youth and Belhydromet*. The project is co-funded by the European Union.



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