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PROBABILISTIC-STOCHASTIC MODELING OF THE SPRING FLOOD MAXIMUM RUNOFF AS A PART OF THE CLIMATE SERVICE IN THE WATER MANAGEMENT OF UKRAINE

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Water services or agencies and professionals are dealing with the impact of human interventions and climate variability and change on flow regimes. Water is a key driver of economic and social development while it also has a basic function in maintaining the integrity of the natural environment. However water is only one of a number of vital natural resources and it is imperative that water issues are not considered in isolation. Managers, whether in the government or private sectors, have to make difficult decisions on water allocation. More and more they have to apportion diminishing supplies between ever-increasing demands. Drivers such as demography and climate change further increase the stress on water resources.

As a result, the Integrated Water Resources Management (IWRM) approach, a more holistic approach to water management, has now been accepted internationally as the way forward for efficient, equitable and sustainable development and management of the world's limited water resources and for coping with conflicting demands.

The water community has a need for a range of services to support decisions relating to a range of uses related to IWRM planning, which include:

- Identification of extreme weather and climate hazards that pose water-related risks;
- Identification of populations vulnerable to weather and climate hazards, including those in the coastal zone;
- Allocation and re-allocation of water resources;
- Design and placement of infrastructure and personnel (i.e. water management organizations, structures and facilities);
- Implementation of risk management and emergency preparedness practices and procedures;
- Dissemination of information to users, including the public, i.e. Public Service forecasts and alerts;
- Development and implementation of water and environmental policy;
- Development and implementation of water and flood management policies and strategies;
- Development and implementation of water management regulations and laws.

The water-related priorities and activities articulated in this Water UIP implementation plan will inform and benefit from the developments made in the

other pillars of the Framework, Climate Services Information System (CSIS), Observations and Monitoring (OBS), Research, Modelling and Prediction (RMP), and particularly, Capacity Development (CD)[1].

Probabilistic-stochastic modeling of individual phases of the water regime of rivers refers to water-related priorities Research, Modeling and Prediction (RMP). Most of the lowland rivers of Ukraine receive their main nourishment from the inflow of water during the spring flood. The volume of spring river runoff forms a supply of fresh water for the entire agro-industrial complex of the region and contributes to an increase in the efficiency of management decisions with the rational use of water resources. On the other hand, with the formation of catastrophic floods, there is a threat of water coming out to the floodplain, flooding of industrial and populated areas, cultural heritage sites and the emergence of economic losses, threats to human life. At the same time, the runoff of small rivers is also significantly influenced by the inflow of flood waters in summer and autumn. The author proposed a new modified version of the operator model for determining the maximum runoff of spring flood, which allows taking into account the possible impact of climate change on the estimated values of the maximum modules 1% probability of exceeding. Climate change is taken into account by introducing a separate coefficient, based on a comparison of the main parameters of the method obtained on the basis of current data (maximum snow supply at the beginning of the spring flood, precipitation during the spring flood and runoff coefficients), and similar values obtained from climatic modeling data.

For the plain rivers of Ukraine the author's modified version of the calculating method for determining the characteristics of spring flood in climate change conditions has implement. The implementation of the proposed calculation option using different models and scenarios has shown that the results differ significantly, but in practically all cases up to 2050. It is forecasted a significant decrease in the runoff of spring flood (from 10-20% in the north and 40-50% in the south Ukraine). At the same time, there is a possibility of high local rain floods during the warm period of the year, which can lead to significant losses and sometimes to human losses [2].

The results of modeling the maximum runoff of rivers taking into account data on climate change should become an important component of the climate service system that is being created in Ukraine.

REFERENCES

1. Water Exemplar to the User Interface Platform of the Global Framework for Climate Services, World Meteorological Organization, 2014, 46 p.
2. Ovcharuk, V.A., Ye.D. Hopchenko. The modern method of maximum spring flood runoff characteristics valuation for the plain rivers of Ukraine Ukr. Geogr. Z. 2018, N2:26-33 https://doi.org/10.15407/ugz2018.02.026