RISKS OF WATER RESOURCES DEPLETION IN SOUTHERN UKRAINE AND THEIR CONSEQUENCES ACCORDING TO CLIMATE SCENARIOS

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The assessment of changes in water resources in southern Ukraine in the context of warming is based on the climate-runoff model, which uses meteorological data of climate scenarios and quantitative indicators of water management transformations in catchments as input [1]. Natural water resources under given climatic conditions are determined by the components of the water-heat balance of a catchment. The assessment of heat and moisture resources is based on long-term data on air temperatures and precipitation. The result of the calculations is the average long-term value of annual runoff, calculated from the data of meteorological stations or in the data grid nodes of the selected climate scenario [2].

Expected climate conditions in the near future (2021-2050) were determined based on the results of the Euro-CORDEX project for two climate change scenarios RCP4.5 and RCP8.5. From an ensemble of 14 simulations using different regional climate models, one regional model (CLMcom-CCLM4-8-17 with the global model MPI-ESM-LR) was selected as the best match for the ensemble average [3].

The risk of a natural hazard can be calculated based on a probabilistic approach

$$R_{q.r.}=p(N.H.)\cdot P \qquad (1)$$

where $R_{q.r}$ - is a quantitative risk indicator;

p - probability of a hazardous event *(N.H.)*

P - percentage of damage caused by a hazardous climate event

In this paper, the depletion of water resources as a result of climate change is considered a dangerous phenomenon. According to the UN recommendations, a decrease in water resources by more than 10% means statistically significant changes, a decrease in water resources by more than 50% indicates the destruction of water resources, and more than 70% - irreversible destruction.

The following approach to assessing the climate risk of water resources depletion is proposed in [4]:

- percentage of damage P due to climate change was estimated through the degree of water resources reduction (10%, 50%, 70%);

- the probability of occurrence of a hazardous event (p) was set by the ratio of the number of weather stations n (grid nodes) where this event was established to the total number of weather stations N (grid nodes)

$$p=n/N. \quad (2)$$

It is established that for the next thirty-year period (2021-2050), the empirical probability p of a satisfactory state (decrease to 10%) of water resources will be 34% for the RCP4.5 scenario and only 2% for the RCP8.5 scenario. The empirical probability p of the occurrence of a stressed state of water resources (their decrease from 10% to 50%) will be 56% for the RCP4.5 scenario and 76% for the RCP8.5 scenario.

The highest risk factors R' of water resources depletion will be possible in the intervals of changes from -20 to -30% (R'=5.25) and from -30 to -40% (R'=4.55) for the RCP4.5 scenario. For the RCP8.5 scenario, the highest values of the risk coefficients were found in the intervals from -30 to -40% (R'=9.80); from -40 to -50%% (R'=13.0); from -50 to -60% (R'=8.25).

The high risks of water resource depletion identified by observations and predicted by climate scenarios indicate real prospects for the destruction of local water resources in southern Ukraine and, in particular, in the Northwest Black Sea region, which has been preserved as the main center of irrigated agriculture in the face of Russian aggression. Increasing deficits in the annual freshwater balance of the ‘closed’ estuaries of the northwestern Black Sea region may pose a threat of salinisation and subsequent disappearance [4].

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