У роботі були розглянуті та проаналізовані деякі сучасні методи відбору найбільш інформативних спектральних каналів, а саме: кореляційний аналіз та метод головних компонент.

Запропоновано нову критеріальну функцію інформативності для визначення найбільш інформативних спектральних каналів, яка враховує кількість об'єктів кожного класу. Було детально розглянуто числовий приклад розрахунку нової критеріальної функції інформативності для 2 каналів та проведено відбір найбільш інформативного спектрального каналу. Запропонований метод відбору спектральних каналів із використанням критеріальної функції інформативності може бути застосований при вирішенні числинних екологічних та природно-ресурсних задач [6-8].

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IMPACT ON THE AGRICULTURAL SECTOR OF CHANGES IN THE AIR MOISTURE REGIME CAUSED BY THE COLLAPSE OF THE KAKHOVKA DAM

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The presence of moisture in the air and soil at a certain temperature is the main factor for creating favorable and optimal conditions for growing crops. Conducting a study of the moisture content of arable soils proved that less than half of the moisture contained in these soils is available for plants [1]. But the humid air regime plays a significant role in the cultivation of agricultural crops as a component of the microclimate created in certain territories. During the existence of the Kakhovka Reservoir, 31 irrigation systems of the fields of Dnipropetrovsk, Kherson, and Zaporizhzhya regions were supplied with water; in June 2023, only 13 systems were working to provide water to the territories on the right bank of the Dnieper. Currently, 94% of irrigation systems in the Kherson region, 74% in the Zaporizhzhya region, and 30% in the Dnipropetrovsk region remain without water supply [2]. Some specialists believe that almost 65% of the lands of Ukraine used for agricultural crops are already in the zone of risky agriculture, and this is confirmed by repeated studies on the management of the water regime.

The result of the loss of a huge amount of water after the destruction of the Kakhovka Dam may be climate change. At the average depth of the reservoir of 8.4 m (the total height of the surface above sea level is 16 m), an "artificial" support was created to maintain a sufficient height of groundwater. At the site of the Kakhovka Reservoir, after the restoration of the Dnipro riverbed, the groundwater level has significantly decreased. This led to the dehydration of large areas. The humid air regime has changed for a while, but only slightly. The explanation for this is that the area of the dehydrated areas continues to contain moisture, and the process of evaporation continues. But there is a threat of drought in the near future in this territory, especially in the dry period of the year. We assume that during the wet period, the reservoirs will be filled with water at the reservoir site. This will help to increase the humidity in the air. That is, there will be a kind of "swing" in the amount of moisture in the air and in the soil.

The European Space Agency, using the Sentinel-2A satellite, took pictures of the territory of the Kakhovka Reservoir. Scientists of the Ukrainian Hydrometeorological Institute received these images and performed spectrozonal processing [3]. Based on these pictures, we draw conclusions about the return of the Dnipro River to its historical course over time. That is, we can expect the return of the climatic conditions that were observed in this area in the period before the reservoir was created. But global warming should be taken into account, which will also affect the formation of air masses with low moisture content.

Satellite images prove that the Kakhovka reservoir actually no longer exists. Only the Dnipro River, several tributaries and several small lakes in the area remain (Figure 1).

Fig. 1. Satellite images of the reservoir from the service Copernicus Sentinel [4]

The purpose of a careful analysis of changes in the humid air regime in the territories near the Kakhovka Reservoir during the period of existence and after the destruction of the dam is to find the consequences.

The data that characterized the main parameters of the air in the period before the construction of the dam and the gradual filling of the reservoir from 1955 to 1958 were analyzed.

Calculations were made of the amount of moisture that actively evaporated from the surface of the water of the Kakhovka Reservoir. Evaporation calculations are based on empirical formulas that have a structure proposed by Dalton in 1802:

$$E=\varepsilon_0(e_0-e_2), \quad (1)$$

where ε_0 - coefficient is depending on the wind speed. A large number of formulas of this type are mainly related to proposals for determining the wind coefficient ε_0;

e_0 and e_2 – pressure of saturated water vapor and partial pressure of water vapor, respectively, at a height of 2 m from the water surface, GPa.

Of all the previously proposed calculation methods in hydrological practice, it is the calculation using empirical methods that is considered the most convenient and accessible.

Scientists at the State Hydrological Institute checked the accuracy of various formulas for estimating evaporation from the water surface. Based on the results of the verification, the optimal calculation formula was selected [5]:

$$E=0,14(1+0,72u_2)(e_0 - e_2), \qquad (2)$$

where u_2 – wind speed at a height of 2 m from the water surface, m/s;

E is the evaporated water layer, mm per day.

The formula of V. I. Babkin, which was obtained on the basis of the use of the molecular-kinetic theory of the movement of water molecules, can be proposed for calculation. The proposed formula is semi-empirical [5]:

$$E = \frac{E_{max} \cdot \Delta}{\Delta + \frac{h}{f(t) \cdot \delta \sqrt{\frac{RT}{6\pi\mu}}}} \qquad (3)$$

where E_{max} – maximum rate of evaporation;

Δ is a coefficient determined by the formula:

$$\Delta = \frac{e_0 - e}{e_0}, \qquad (4)$$

f(t) is a parameter determined by the graph;

δ is the coefficient of turbulent exchange;

h is the height at which the partial pressure of water vapor e is determined;

R is the gas constant, which is assigned to 1 mole;

T - absolute water temperature; appointed on the basis of in-situ observations for previous years at this reservoir or a similar reservoir; in some cases, it is calculated using the heat balance method;

μ is the relative molecular weight.

To calculate the amount of water that evaporates from the surface of the pool, we take into account the temperature of water and air, air humidity, and wind speed. Therefore, to calculate evaporation, we use data from continental weather stations, taking into account changes during the transition from land to the water surface. On average, during the ice-free period, 1 liter of water evaporates from one square meter of the surface every hour. Ice formation occurs on average for 4 months - from December to March. The most active evaporation is observed from May to October. The full volume of the reservoir as of May 2023 was 18.18 thousand m3. This volume of liquid slowly heats up in the spring and slowly cools down in the fall. If the air and water temperature difference is at least 10°C and the relative air humidity is 70%, fogs appear above the water surface. All this affects the relative humidity of the air not only above the surface of the water, but also in the area located nearby. It should be noted that the predominant direction of winds by month of the year, repeatability, speed of air movement play an important role in the distribution of humidity. Depending on the direction of the winds, the distribution of moist air is observed. When the air moves towards the reservoir, the area of one bank will be drained, and the other will be moistened. Humidification occurs due to the capture of moist air masses that dominate the reservoir. Therefore, the prevailing wind direction should be taken into account when growing crops. Wind speed is important, high speed leads to additional loss of moisture from the surface of plants and the formation of cracks in the soil.

As a result of the change in the water balance in the territories near the destroyed Kakhovskaya dam, significant changes in the physical characteristics of the air, in particular humidity, should be expected. We believe that significant changes in the composition of air masses will have an impact on the microclimate as a whole. Such changes may force farmers to reconsider the range of crops grown in these areas. In turn, the change in cultivated crops will affect the enterprises engaged in the processing of crops.

It should be noted that the conclusions are based on preliminary estimates only.

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ТЕХНОЛОГІЧНІ МЕТОДИ ОЧИЩЕННЯ ВОДИ В УМОВАХ НАДЗВИЧАЙНОЇ СИТУАЦІЇ ТА ВОЄННОГО СТАНУ

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Анотація: У надзвичайних ситуаціях, таких як природні катастрофи, війни, чи інші непередбачувані події, доступ до безпечної питної води стає життєво важливим для виживання людства. Часто у таких умовах інфраструктура водопостачання зазнає серйозних пошкоджень, а водні джерела стають схильними до забруднення хімічними та біологічними забруднювачами. В таких випадках використання портативних фільтрів для очищення води набуває надзвичайної ваги, допомагаючи захистити населення від хвороб, що передаються водою та забезпечити надійний доступ до питної води.

Ключові слова: Мобільна система очищення води, портативні фільтри, хімічне забруднення, біологічне забруднення.

Вступ. Відповідно до даних ЮНІСЕФ мільйони людей в Україні щодня борються за можливість мати питну воду, яка є однією з найважливіших потреб людини [1]. Військові дії призвели до руйнування мереж водопостачання, водовідведення та індивідуальних джерел – колодязів, свердловин, тощо, а також до забруднення водних ресурсів хімічними та біологічними речовинами.

Всі перелічені вище проблеми найчастіше ідуть одна за одною і загрожують здоров'ю як цивільних так і військових, які користуються забрудненою водою для пиття і приготування їжі. Крім негативного впливу на здоров’я людей токсичні речовини ще отруюють ґрунти та водні екосистеми, призводячи до масового вимирання флори та фауни і порушення екологічної рівноваги.