Field research of the level of the Novosibirsk reservoir

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Abstract. *The article discusses the study of the hydrological regime of the reservoir. The purpose of the study is to obtain data on the change in water level fluctuations. The tasks of studying the process of filling the reservoir due to the temporary hydropode device are solved and the results are presented on schedules. Conclusions are shown.*

Keywords: *Reservoir; hydropost; level fluctuations; Hydrological forecasts.*

The Novosibirsk reservoir is the largest artificial reservoir in the south of Western Siberia, created in 1957 on Ob 20 km above Novosibirsk. The area of the water mirror of this reservoir is 1070 km^2, the total volume is 8.8 km^3, useful volume is 4.4 km^3. The largest width of the reservoir is 22 km, the length is 185 km, the maximum depth is 29 m, the average 9 m; The essential part (about half each) of the reservoir of shallow water (with depths of less than 5 m). The reservoir accumulates on average a small part of the volume of the annual flow of water Ob and carries out a shallow seasonal flow regulation.

In recent years, due to the decrease in water and essential reservoir, over a period of long-term use, the regulatory capacity of the hydraulio is reduced. This causes an increase in the accuracy of water balance calculations and short-term forecast forecasts for its operation. When calculating the water balance of the reservoir, many parameters must be taken into account, including the level mode. For scientifically based recommendations on the effects of fluctuations in water levels in the reservoir; Calculations and forecasts should address the tasks that include the creation of a database for the Novosibirsk reservoir.

The purpose of this work is to obtain data on the level of the regime in the target of the village of Kirza of the Ordynsky district. In this regard, the tasks are set:

- Device of temporary hydropode;
- Observations and measurement levels;
- Observations of meteorological elements.

For more accurate tracking of the nature of the level mode, mathematical models are used. Mathematical models are able to reflect only a part of the existing causal relationships. The main task in constructing mathematical models of natural processes is the use of all available information [1]. Of particular value are the data of natural research. The use of the latter allows you to increase the reliability of hydrological models and on their basis - forecasts.

When planning a flood pass through the Novosibirsk reservoir and performing calculations by the equation of the water balance, data are used by the levels of the upper beef, obtained on hydrological posts (fig. 1).

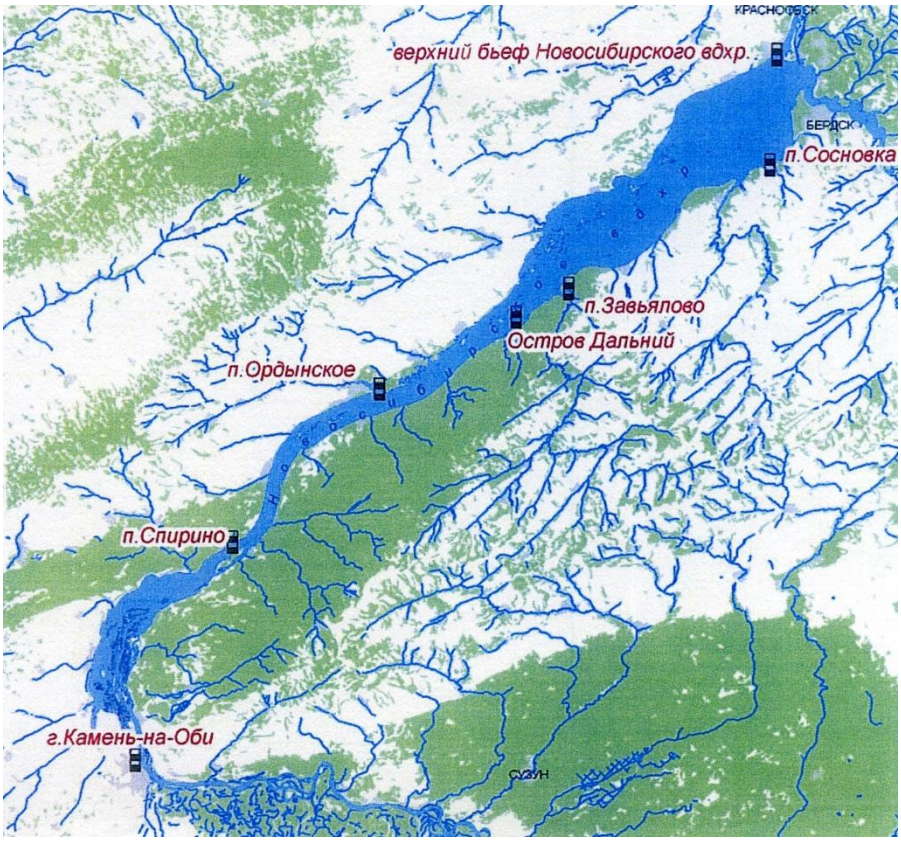

Figure 1. Scheme of the location of water-contained posts on the Novosibirsk reservoir

The calculation of the water balance can be performed according to the following formula [2]

$$N = (P_0 + P_s + O) - (C + A_b + E), \quad (1)$$

where P_0 – the main tributary,

P_s – side tributary.,

O – the amount of precipitation on the reservoir water management,

C – discard through hydrousel,

A_b – accumulation in the bed of the reservoir,

E – evaporation from the surface of the reservoir,

N – insome balance.

According to the proposed method [2, 3], calculations of the components of the water balance were performed; For which the site of Ob Kamen-na-Obi - the upper beaten of the

Novosibirsk reservoir was broken into three pitfalls with borders in Spirino and Ordynskoye. As a result, conclusions were made that it is possible to use the proposed model of the water balance of the reservoir under the condition of the operation of the input hydrograph [4].

The adequacy of the representation of the hydrological regime of reservoirs is determined by many factors: calculations of the water balance described above and the formation of flow; passing the wave of flood and its transformation; level ; temperature and ice regimes and so on [5]. Always important and relevant remains to study water level fluctuations. This is due to the provision of water users and drafting.

The technique presented in this article of inventory studies is based on the instructions of hydrometeorological posts and includes measurements of the following characteristics:

- Air temperature;
- Water temperature;
- Observations of the atmosphere;
- Water level.

The hydrological post for the planned personnel studies was arranged on the banks of the reservoir in the village of Kirza, Ordynsky district of the Novosibirsk Oblast. This post is temporary for the period of expeditionary studies (fig.2).

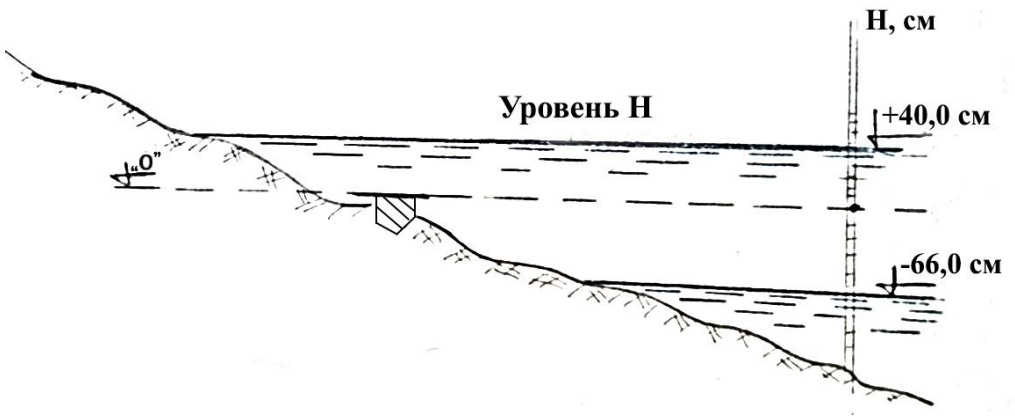

Figure 2. Water pole design

Fig.3. Using levels at low water levels

In the first days of research, the level "H" was below the selected "0", and the level of level was measured using levels and levels (fig. 3). In the future, the water level in the reservoir rose and the measurements were carried out using a water renik. All results were recorded in the table. Measurements of water and air temperature were measured using a mercury thermometer and watered weather and cloud observation [5].

The measurement results are placed in table 1.

Table 1– Investigative data in the summer of 2019 in Kirza

Date	t^0 of water, C	t^0 of air, C	Level, cm	Weather
06.06.2019	20.0	20.0	-66.0	windy
07.06.2019	19.8	18.0	-40.0	
13.06.2019	22.0	27.0	0.0	
14.06.2019	22.0	17.0	5.0	weak clouds
30.06.2019	19.2	19.4	28.5	weak clouds
01.07.2019	21.8	23.0	24.5	cloudy, Si
02.07.2019	20.4	21.8	24.0	cloudy, Sc
03.07.2019	21.0	19.9	23.0	weak clouds, Si
04.07.2019	22.0	25.0	23.0	clear
05.07.2019	21.6	23.0	17.0	weak clouds, Si
07.07.2019	24.4	20.0	15.5	weak clouds, Si
10.07.2019	21.4	23.3	19.0	partially cloudy, Si
11.07.2019	22.2	23.0	28.0	clear
12.07.2019	24.0	26.0	32.0	windy, Ci.
13.07.2019	24.0	27.0	40.0	clear, windy
14.07.2019	22.8	25.0	13.5	Ci
27.07.2019	24.0	25.0	17.0	weak clouds, Si
28.07.2019	25.0	27.0	2.0	clear
30.07.2019	24.6	30.0	0.0	haze
31.07.2019	26.2	30.0	-5.0	weak clouds
01.08.2019	25.8	30.0	-5.0	Ci
02.08.2019	26.8	30.0	0.0	clear

According to the results of studies, graphs of measurement of water levels in the Novosibirsk reservoir are built (post in Kirza) (fig. 4).

Figure 4. Water level fluctuations in Novosibirsk reservoir in the area of Kirza

In graphics drawings (fig. 5) shows the course of water temperature of the reservoir and air temperature in the area of research.

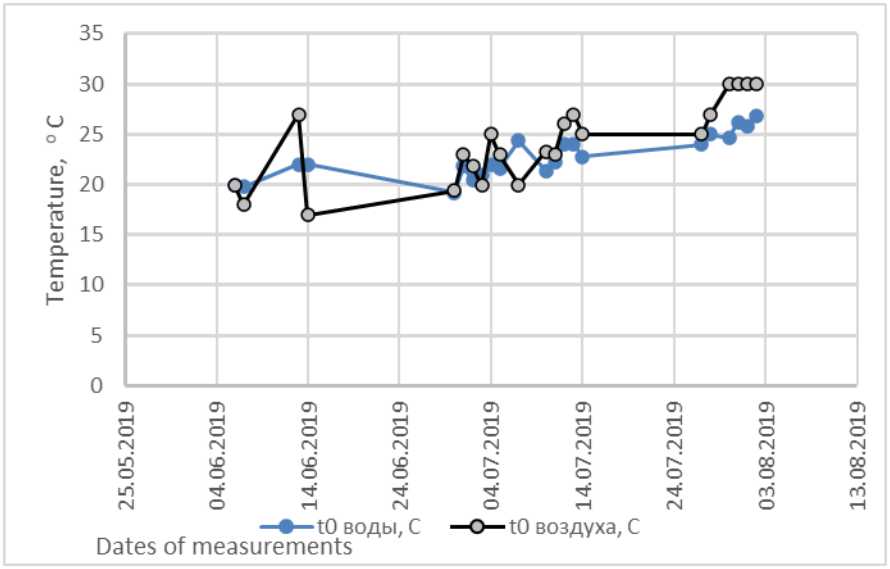

Figure 5. Graphs of changes in water and air temperature of Kirza

From the above graphs (fig. 5) it can be seen that with significant fluctuations in the air temperature, the amplitude of water temperature fluctuations are smaller, although it follows the

trend of the air temperature. This can be explained by the difference in the thermophysical properties of water and air.

It is of interest to study the hydrological regime of the observation of water level changes. On the graph (fig. 4) it can be seen that not only the wave of flooding is affected by the nature of the reservoir, but also factors such as precipitation, evaporation of water and the mode of operation of the HPP itself, and the discharge of water from the reservoir. Although, in general, managed to trace the entire level of lifting level to design values.

Conclusions

1. Expeditionary field studies have been completed at the Novosibirsk reservoir, covering the period 2017-2019.

2. The tasks were solved: measurements of meteo elements and fluctuations in water levels by the Novosibirsk reservoir were carried out.

3. Analysis of research results showed:

- water levels in the reservoir for the observation period changed from -66cm to + 40 cm, i.e. the increase in the level was more than one meter;
- the temperature of the water changed from 19.2°C to 26.8°C;
- air temperature in the area of research oscillated from 17.0°C to 30.0°C;
- the intensity of the filling of the reservoir for the period from June 6, 2019 to July 13, 2019 was approximately 2 cm per day. This nature of filling does not exceed the regulatory requirements (5÷10 cm per day).

4. The data obtained as a result of expeditionary studies at the Novosibirsk reservoir can be used when calculating the water balance of the reservoir and also to compile hydrological forecasts.

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