CALCULATION METHODS FOR DETERMINATION OF MAIN CHARACTERISTIC OF THE MOUNTAIN WATER OBJECTS

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Quite recently 28-30 November, 2006 in Almaty (Kazakhstan) held Regional Workshop on "Assessment of Snow-Glacier and Water Resources in Asia". Participants in the Workshop experts and professionals affiliated with national and sub-national governments, academic institution from Central Asia Region together with international expert nothing that changes in glaciers in the world's largest and highest mountain system will have significant effects on nearly 1,5 billion people. They recognize that glaciers are key indicators in monitoring and detecting global warming and climate change. Tajikistan is mountain country which 93% of his territory occupied by mountains. Under the available now items of information, in Tajikistan there are more 8400 glaciers by the total area of 8476, 2 km^2, or about 6% of all territory of the Tajikistan. The main area of glaciations is in mountains of North-West Pamir the center of which is Fedchenko glacier - the largest mountain glacier in the world. The glacier was investigated and put on map only at the end of the twentieth and in the thirtieth of 20 centuries by the expeditions of the Academy of Sciences of the USSR. It was one of last large geographical opening on our planet. Thus Fedchenko glacier has lost almost all its right inflow- they became independent glaciers. Only for forty years from mountain range of Academy of Sciences, Zaallay and Kaindi have disappeared 14 not large glaciers the general area of 7,6 km^2. Average speed of movement of glacier in connection with loss of weight has decreased from 72 up to 69 cm daily. In total for 20-th century the glacier has lost about 12-15 km^3 of ice. The next expedition on glacier Fedchenko has been organized in September, 2006 after an eighteen-year break. It was observed, that glacier Fedchenko continues to be reduced non-uniformly with speed of 8-10 meters per year. In the eightieth years of the twentieth century the glacier reduced on twenty meters a year. On a cross-section structure in seven kilometers the glacier is higher than tongue settles 1,5 meters annually though twenty years ago intensity of subsidence made 2,0 - 2,5 meters per year.

For conditions of Tajikistan which territory basically is presented by mountains, data on temperature, precipitation and other characteristics in remote mountain tops have great value. It is a problem it became actual after disintegration of the USSR when the national states yet in a condition to rehabilitate meteorological stations existing earlier. Now in conditions of global climate change the monitoring and the control of a condition upstream of river formation very important. For example, discharge of the rivers originating from glaciers essentially depends on temperature of district of glacier location at different heights, and observation posts are located at the bases of mountains at low heights.

For definition of some basic meteorological characteristics of heights mountain glaciers on the basis of corresponding meteorological data from observation post located at the around of glaciers on more low heights we offer method corresponding to assumed that the investigated district in three-dimensional system of coordinates is represented in the form (Figure 1).

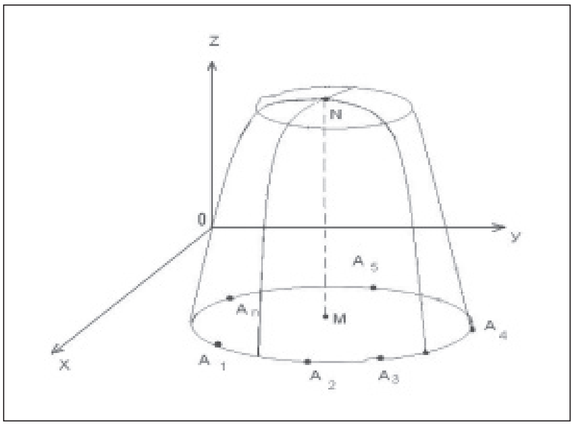

Figure 1. Present of the investigated object in three-dimensional systems

Let, $A_k=(x_k{\cdot}y_k)$ k=1, 2,… n – observation point of meteorological characteristics, for example, temperatures T_k. It is required to define temperature in point N with known coordinates(x_0, y_0). Application the linear functions to the description of temperatures fields. Without taking into account height of point N and in the assumption, what all observation points are located at identical heights above sea level, temperature in a point of the M as orthogonal projection of point N to planes passing through points A_1, A_2,…An will be define by used of next dependence:

$$T = ax + by + c \tag{1}$$

where the choice of constants a, b, c is carried out by decision of system of the equations:

$$\begin{aligned}
&\left(\sum_{k=1}^{n} x_k^2\right)a + \left(\sum_{k=1}^{n} x_k y_k\right)b + \left(\sum_{k=1}^{n} x_k\right)c = \sum_{k=1}^{n} x_k \cdot T_k \\
&\left(\sum_{k=1}^{n} x_k y_k\right)a + \left(\sum_{k=1}^{n} y_k^2\right)b + \left(\sum_{k=1}^{n} y_k\right)c = \sum_{k=1}^{n} y_k \cdot T_k \\
&\left(\sum_{k=1}^{n} x_k\right)a + \left(\sum_{k=1}^{n} y_k\right)b + n \cdot c = \sum_{k=1}^{n} T_k
\end{aligned} \tag{2}$$

Coefficient a, b, c are calculated from system (2) are substituted in (1). Now it is obvious, that for definition of temperature T_0 in a point of M, in the right part (1) it is necessary to substitute its coordinates (x_0, y_0). Further by used of dependence of change of temperature on height:

$$T = \mathrm{T}\exp\left(-\frac{H - H_0}{H}\right) \tag{3}$$

were, T_0-temperature of a point of M, H-height of point N above sea level, H_0-the height of a point of M above sea level, is defined temperature at top in point N.

Nomografic representations of the formula (3). For this purpose the formula (3) is led to canonical forms:

$$f_{12}=f_3+f_4$$

where

$$f_3 = lnT_0$$
$$f_4 = -lnT$$

Scheme of nomogramms presented in figure 2.

The equations for elements of nomogramm, containing transformation parameters a_o, a, m and functions of transformation T_{12} will be written as:

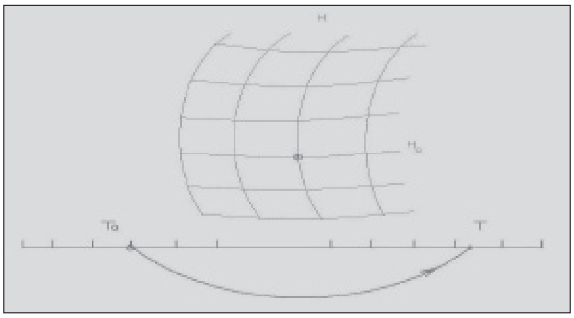

Figure 2. Scheme of nomograms for calculation change of temperature with height

$$x = a_0 + m \cdot \frac{H - H_0}{H} \qquad y=T_{12}$$

scale T_0:

$$x = a_0 - a + 2m\ell nT_0 \qquad y=0$$

scale T:

$$x = a_0 + a + 2m\ell nT, \qquad y=0$$

It is necessary to note, that short-term forecasting watershed of the rivers is important aspects for reduction of risk and effective planning of meliorative work in the irrigated grounds. We spent intermediate term forecasting the charge of water on r. Vakhsh on the basis of long-term observation (the Hydropost “Garm”) with calculation by use of pair correlation. On the basis of the given long-term observation (1960-1991) the table of pair correlation change of the charge of water in r. Vakhsh is made (Table 1).

Table 1. Pair correlation on column

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
I	1											
II	0.85	1										
III	0.53	0.66	1									
IV	-0.03	0.04	-0.06	1								
V	-0.04	0.14	0.15	0.10	1							
VI	0.11	0.17	0.21	-0.09	0.51	1						
VII	0.18	0.19	0.22	0.08	0.36	0.69	1					
VIII	0.18	0.11	0.13	0.05	0.24	0.59	0.75	1				
IX	0.21	0.19	0.27	0.01	0.42	0.71	0.60	0.58	1			
X	0.04	0.13	0.31	-0.01	0.41	0.69	0.59	0.63	0.63	1		
XI	0.15	0.29	0.50	0.01	0.40	0.67	0.60	0.54	0.61	0.83	1	
XII	0.21	0.28	0.42	0.03	0.23	0.58	0.60	0.51	0.48	0.69	0.85	1