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Природная водообеспеченность Грузии
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Natural water supply in Georgia
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abstract: On the instance of Eastern Georgia, a new approach towards generalization and numerical implementation of the runoff of the mountain rivers developed proceeding from the hydrological features of the landscapes has been brought.

Key Words: Hydrological features of landscapes

The subject of this research lies in developing a method of generalization and numerical implementation of the water balance elements specified proceeding from the values peculiar for a given landscape. This approach has not so far been envisaged by any of the methods traditionally used for determination of the runoff formation.

In order to solve the problem set forth herein, the long-years’ runoff equation was used: [1]

$$P-E=Q \qquad (1)$$

where P, E and Q are respectively the mean long-years’ precipitation, evapotranspiration, and runoff quantities (mm).

For determination of the values, both the cartographical and cartometrical approaches were applied.

The first approach implies identification, by the corresponding landscape maps, of those types of landscapes within which the runoff formation is represented by a quantitatively uniform process, the physical characteristics of which may be averaged proceeding from the spatial continuity of the landscapes.

When applying cartometrical data, the numerical implementation of the water balance equation (1) is carried out by means of a regular parallelogram geodetic network. Pitches between the network units as well as the scale of the map are to be selected according to the area occupied by the site under study as well as to the level it has been explored to and to the landscape pattern it will display.

Hence, the regular parallelogram network has been plotted upon the map showing the landscape types. For those points on the surface where the network units would coincide, elevation above sea level is specified. The elevation data are then clustered according to landscape types, and attributed to the latter. The number of the network units available within a landscape should correspond to the areas the landscapes are known to occupy. Otherwise, the density of the points to be plotted on the network should be increased. The areas surrounding the network units are got balanced, and the heat exchange and moisture exchange values to be observed within them are homogenous; the water balance constituent elements are accepted as constant values.

On being attributed the qualitative and quantitative characteristics of the area under research, the network units will become distinguished points for both the surrounding areas, the landscape types and the whole territory under study, and further calculations will be made for all the distinguished points.

By means of differentiated dependence diagrams, the precipitation and evapotranspiration, the water balance elements, will be got related to the distinguished points calculated at the observation stations. The values of the stream-flow layers will be determined by a balance difference of the precipitation minus evapotranspiration [2].

In the cases when the precipitation values would display evenly distribution within the given landscape type, an arithmetic mean of all the values fixed for the distinguished points will be derived whereas for the whole research area comprising different landscapes, a method of averaged weighting of the landscapes will be applied:

$$\overline{Q} = \frac{1}{F}\sum_{i=1}^{n} f_i Q_i , \qquad (2)$$

where $\overline{Q}$ is the long-years' stream-flow layer (mm), f_i is the area occupied by a landscape of the given type (km2), F is the total area of the research area (km2), *n* the number given to the landscape type.

In order to carry out a differentiated analysis of the hydrological balance throughout Eastern Georgia, a 1: 500000 th scale map with the long-years' precipitation, air temperature, humidity deficit data registered within the period of 1961-2000 at 90 observation stations plotted on was used. 9 main landscapes types were identified (Table 1), and a 10-pitch regular parallelogram network was plotted upon. The evapotranspiration values fixed for the observation stations were determined according to the recommendation [3].

Thus, we had the precipitation and evapotranpiration values specified for the observation points to the characteristic points related to the distinguished points by means of a chart diagram built on elevation basis [1]. The stream-flow layer in the distinguished points has been specified as a balance difference between the precipitation minus the evapotranspiration. Table 1 shows the pattern of water balance characteristic of Eastern Georgia.

The objectiveness of the runoff values thereby calculated was checked through comparing them with the stream-flow measured at the barrier section. The values proved to be in error by not more than 4-6 per cent.

Analysis of the water balance elements calculated at the distinguished points has shown that the elements present within the same landscape are characterized by definite shift amplitude

Table 1. Landscape Pattern of Water Balance in Eastern Georgia withinthePeriodof 1961-2000

Landscape Types	$\overline{H}$, m	F,km2	P,mm	E,mm	Q,mm	K=Q/P
Rocky-moraine	3800	84	1400	110	1290	0.92
Snow-glazier and moraine	3450	89	1620	120	1500	0.93
Alpine meadow	2925	2140	1300	350	950	0.73
Sub-alpine meadow	2380	6250	1150	400	750	0.65
Coniferous forests	1650	2377	825	515	340	0.41
Deciduous forests	1300	10126	800	500	300	0.38
Farmlands	1000	11205	680	480	200	0.29
Irrigated lands	750	3700	650	460	190	0.29
Settlements and roads	600	1130	750	450	300	0.40
Total:		37100				
Averages Values:			840	462	380	0.45

.Hence, the water balance equation drawn up according to landscape types as well as the numerical implementation by distinguished points provides an opportunity of an objective analysis of water balance. The newly developed method of determination of water balance is to be believed valid for different mountain regions.

The calculation results illustrate that some of the landscape types appear to have runoff perspectives. Therefore they may play a particular role in the water balance formation and should be considered to be of importance for planning hydro-economic actions to be based upon the potentialities offered by the landscapes.

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