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PECULIARITY OF ATMOSPHERE PRECIPITATION DISTRIBUTION IN GEORGIA TERRITORY

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ABSTRACT:

The distribution of territorial precipitation in Georgia is contrastively characterized which is caused by interaction of the circularity process of atmosphere and relief. Some parts of territory become more humid by atmosphere precipitation; others, on the contrary become less (see Fig.1.).

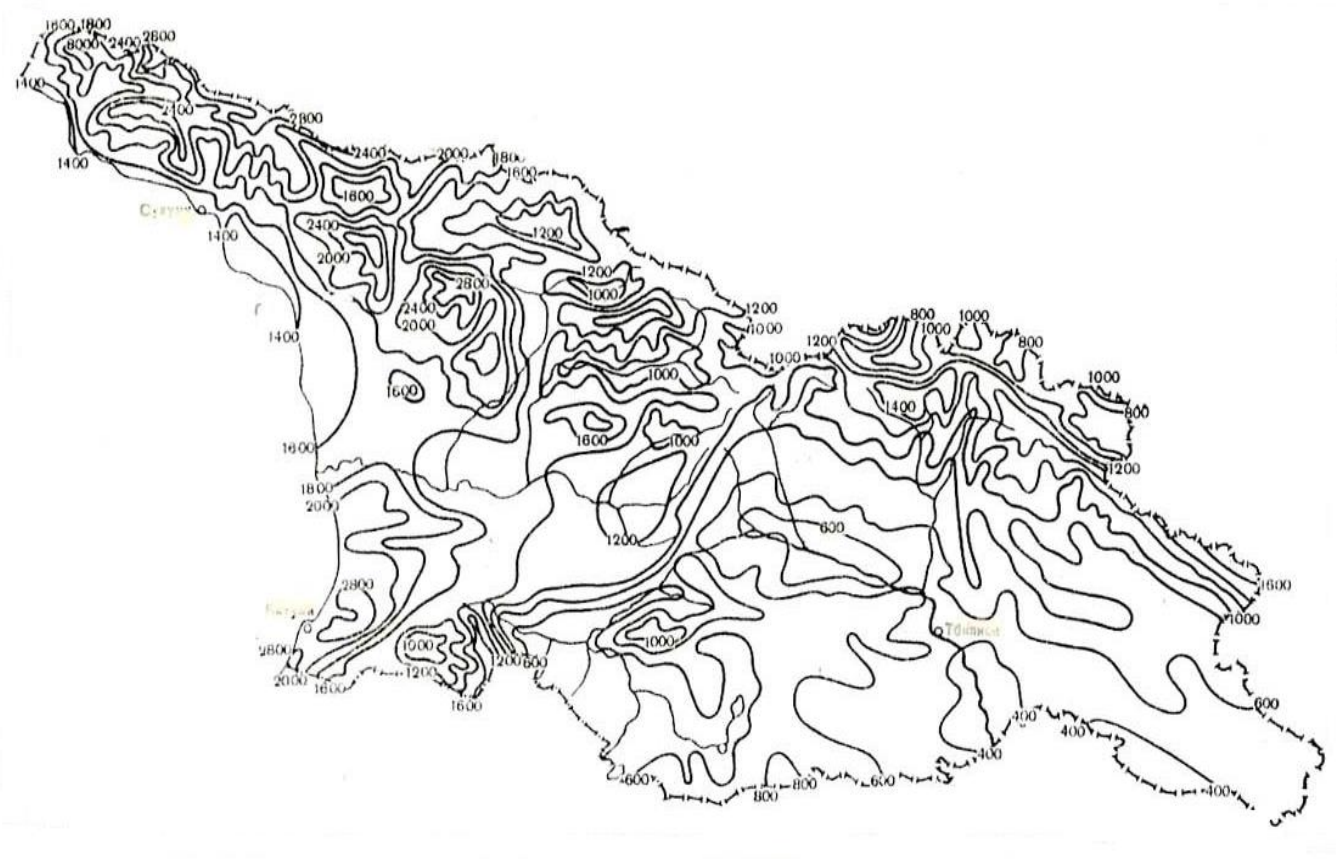

Fig.1. Atmospheric precipitation. mm.year

The influence of relief shape, location of gorge or slope's exposure is well expressed in distribution of amount of precipitation. For solving practical questions, the calculation of meteorological elements possible maximums has a great importance, for which it is necessary to investigate the empirical distribution function of meteorological line, its approximation with some known theoretical function and carrying out a number of theoretical calculations on the basis of it.

For the description of climatic lines distribution functions it is used the theoretical functions - binomial, Puason's, normal, Gama's, Gumbel's and other distributions, Of which Gumbel's law has multilateral practical use:

$$p(x) = e^{-e^{-y}}, \qquad (1)$$

Where y= α (x-q) – is the normalized moving from the mode, $\alpha > 0$, q – is the constant.

We aimed to investigate the empirical distribution function of maximal meanings of daily precipitations for the stations, located in different physical-geographical conditions of Georgia. The observation materials of 1936-2006 years were used for the following stations: Telavi (East Georgia),Tbilisi (Mtkvari Gorge), Lentekhi (West Kavkasioni), Sokhumi (Black Sea beach) and Sakara (Kolkheti Plain).

The carried out tests showed, that together with increasing the daily maximums of precipitations its probability decreases with the exponential law, which refers to, that the empirical distribution functions of precipitations daily maximums have the exponential form.

In a number of meteorological researches it is established, that in case of exponential nature of empirical function, the calculation of the greatest precipitations is expedient by using the Gumbel's law:

$$P(x) = \exp(-e^{-y}), \quad (2)$$

Where x-is the maximum of precipitations, y-is the auxiliary variable, which is connected to the initial data with the rectilinear subordination:

$$y = 1{,}283(x - x_{mid})/\sigma + 0{,}577 \quad (3)$$

Here x_{mid} – is the middle meaning of precipitations maximums, and σ-its middle square moving.

The usage of Gumbel's law for studying the extreme meanings of meteorological magnitudes has a history of a long time. This law is called the extreme meanings law. It was used successfully towards the temperature maximums in USA, in Norway, towards the maximums of precipitations – in England, in Salamanka State and towards other elements. Also, it was a trial to calculate the greatest daily maximum of precipitations with this law for Tbilisi.

In the schedule 1, it is shown the statistic research results of precipitations daily maximums distribution in Telavi and Lentekhi.

Schedule 1. characteristics of precipitations daily maximums Telavi

k	gradation mm centre mm	p=n/N	T=1/p	y	P(x)
1	35-49	41,5	0,37	2,7	-0,417	0,21
2	49,1-63	55,5	0,35	2,8	0,48	0,54
3	63,1-77	69,5	0,15	6,7	1,202	0,74
4	77,1-91	83,5	0,12	8,3	1,902	0,86
5	91,1	97,5	0,02	40	2,602	0,93

Lentekhi

k	gradation mm centre mm	p=n/N	T=1/p	y	P(x)	
1	36-71	53,5	0,52	2	-0,105	0,33
2	71,1-106	88,5	0,42	2,4	1,145	0,42
3	106,1-141	123,5	0,025	40	2,395	0,9
4	141,1	158,5	0,025	40	3,645	0,97

In the schedule the daily maximums of precipitations is given with the form of gradations, n-is the absolute frequency of getting into each gradation, p-appropriate probability, N- is the observation line length, T-periodicity, which shows if in how many years is possible to get into the mentioned gradation. y-is the auxiliary variable, and P(x)-an integral function.

Rectilinearity of empirical distribution occurs on y-axis, or on the special meshes of P(x)-axis. Below are shown the subordinations between the precipitations maximum(x) and auxiliary variable (y), or rectilinearity of precipitations daily maximums according to Gumbel's law:

$$\begin{aligned} &\text{Telavi: } x = 19y + 43 \\ &\text{Lentekhi: } x = 28y + 50 \\ &\text{Tbilisi: } x = 24y + 37 \\ &\text{Sokhumi: } x = 42y + 49 \\ &\text{Sakara: } x = 15y + 54 \end{aligned} \quad (4)$$

(4)-type formulas give us an opportunity to calculate the precipitations daily maximum, which may come with any foretell maintenance. We've calculated the possible precipitations with 100 and 200 years periodicity. Mainly, for 100-year period P(x)=0,99, and its appropriate y, which is calculated from special schedules, or from

meshes it is equal to 4,5. For 200 year period conformably we have – P(x)=0,995 and y=5,2.

In schedule 2 is given theoretical (4) calculated with the formula and also the factual data, which are published in official reference books.

Schedule 2. Theoretical and factual data of maximal precipitations

Station	With the periodicity of 100 year		With the periodicity of 200 year	
	Theoretical	Factual	Theoretical	Factual
Telavi	127	116	142	uknown
Lentekhi	176	169	196	"
Tbilisi	145	147	165	"
Sokhumi	238	222	267	"
Sakara	121	120	132	"

The received theoretical data is reliable, as it is in good conformity with the data of factual observations, the difference isn't more than 8% (Telavi), in another case it's even less. The good coincidence of factual and theoretical data is confirmed by the statistic criterions of conformity too.

So, we can conclude, that in different geographical conditions of Georgia, the empirical distribution of precipitations daily maximums is conformable to Gumbel's distribution, on the basis of which we can make all following calculations. For this theoretical calculation the observation massifs aren't necessary, it's enough to know only the middle meaning of precipitations maximums and the middle square moving, which is easier to search and very often is published in different reference books.

RESUME:

It is investigated the empirical distribution of atmosphere precipitations maximal meanings on the territory of Georgia, which is described by Gumbel's law. Also, it is calculated the daily maximum characteristics of precipitations for different period of time.

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