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Extreme Atmospheric Precipitations on the Territory of Georgia

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[Challenges in meteorology 6](#)

Advanced technology for solving the meteorological challenges

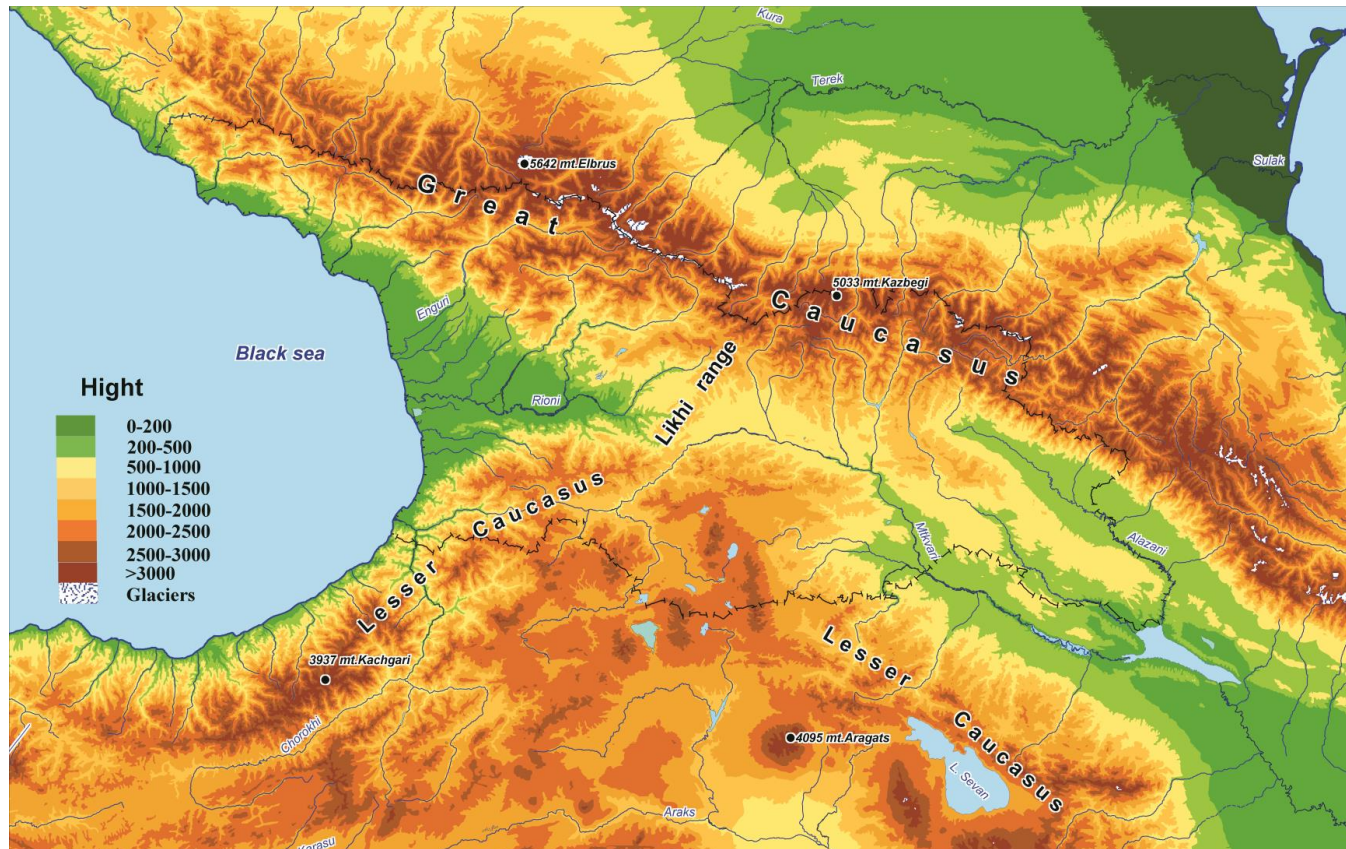
Scientific-professional conference with international participation

15-16 November 2018 | Zagreb, Croatia

Georgia is the mountainous country located in the south-western part of the Caucasus. From the west it is washed by The Black Sea, from south it borders with Turkey and Armenia, from south-east- with Azerbaijan and from north- with the Russian Federation. Its area is 69.875 km² at all. Mountains cover a significant part of the territory: 54% of it is located at an altitude of 1,000 m above sea level.



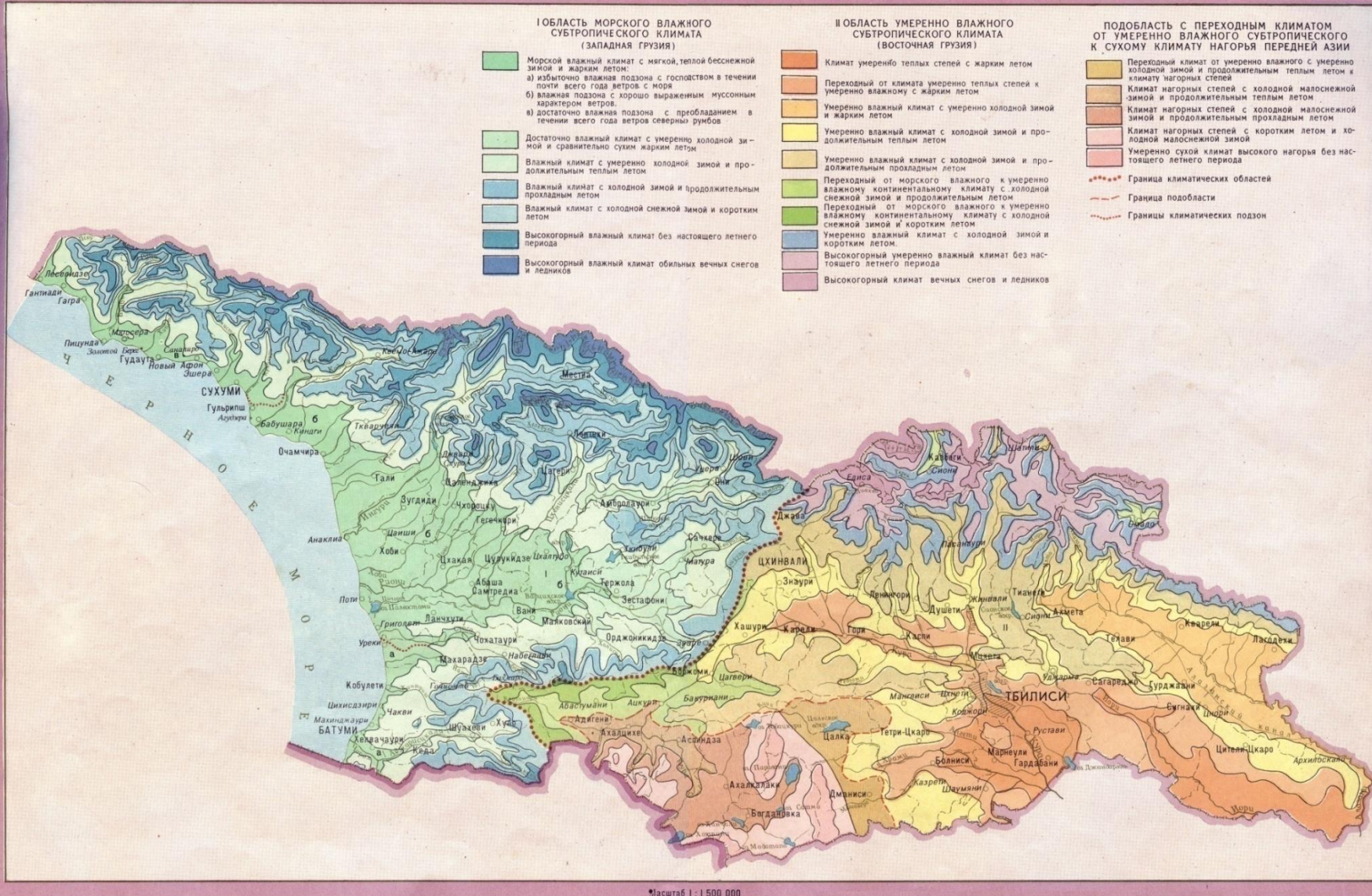
In the northern part of the territory from north-west to south-east stretches the Main Caucasian ridge. The Lesser Caucasus range runs parallel to the Turkish and Armenian borders in the southern part of Georgia. The Likhi Range stretching from the north to the south connecting the Greater Caucasus and the Lesser Caucasus mountains divides the country into two distinct climatic zones - humid subtropical west and continental east.



Climatic peculiarities in Georgia are largely conditioned by the Greater Caucasus mountain range to the north and the Black Sea to the west. The Greater Caucasus range serves as a barrier against cold air from the north. Warm, moist air from the Black Sea moves easily into the coastal lowlands from the west. Climatic zones are determined by distance from the Black Sea and by altitude.

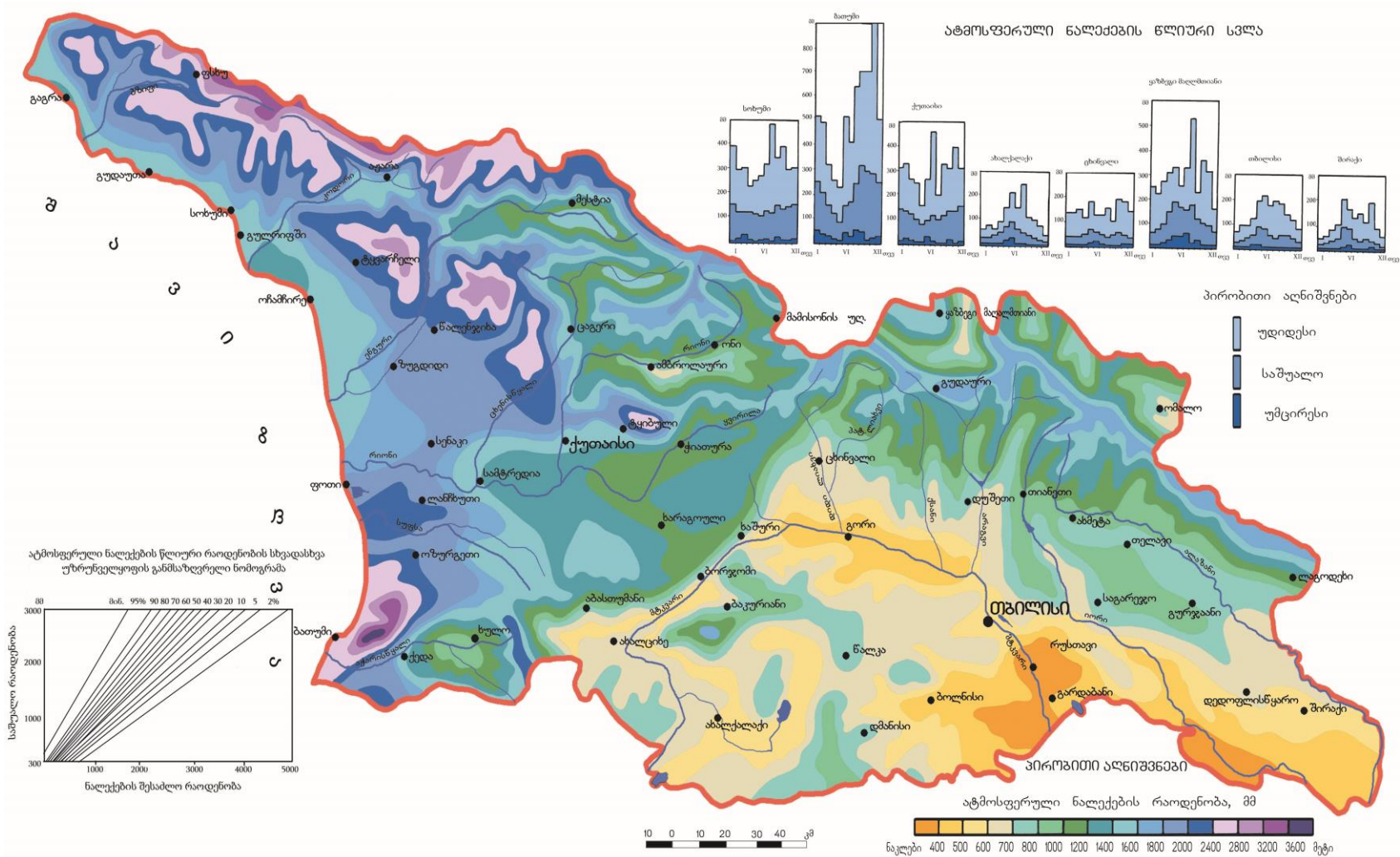
Climatic zones of Georgia

КЛИМАТИЧЕСКОЕ РАЙОНИРОВАНИЕ

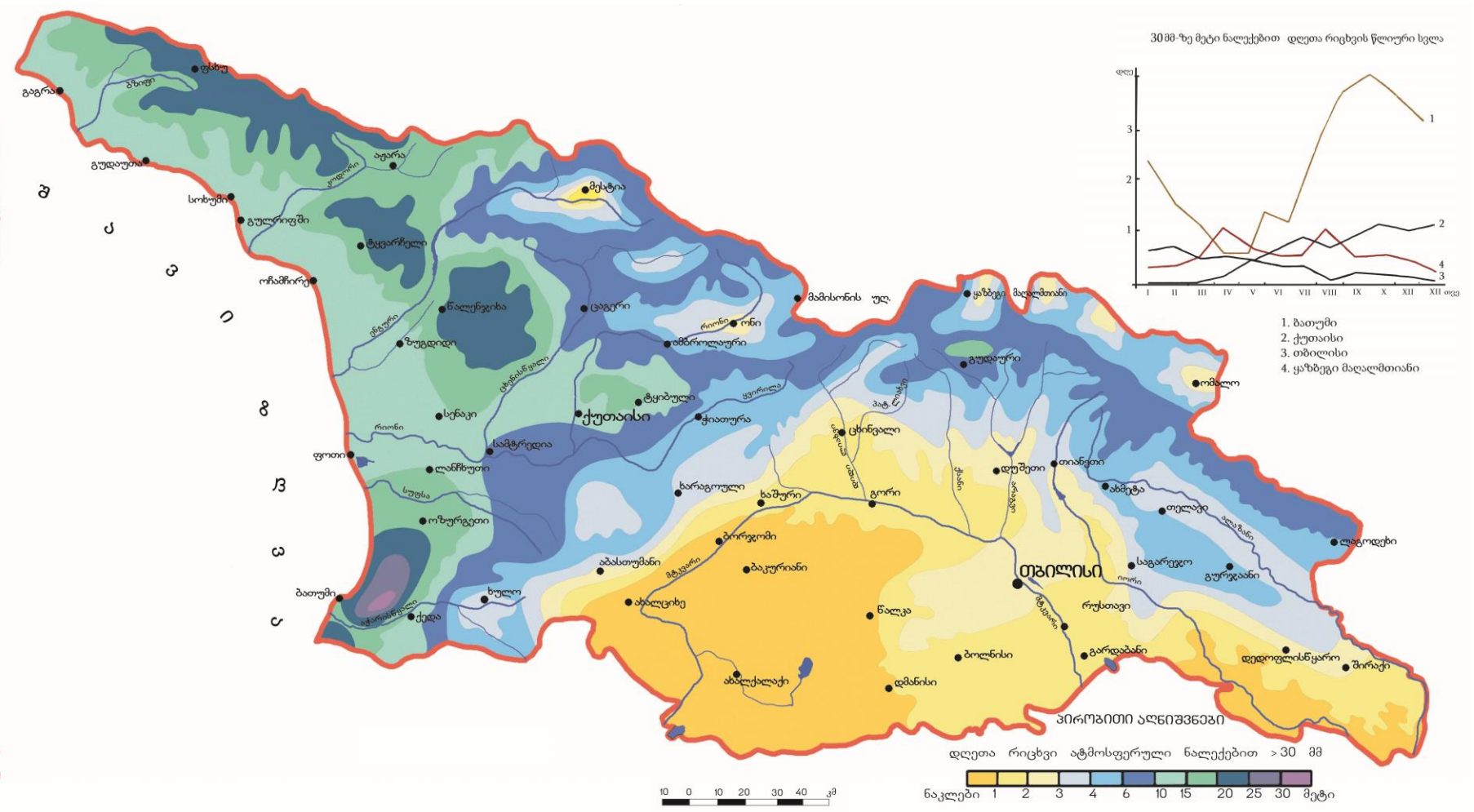


A**B****C****D**

A - A clear example of anthropogenic stress (Intensive sheep breeding) and Global warming (Desertification). Dedoplistkaro area. **B** - Gergeti glacier at the slopes of mount Kazbegi 5033 m., Stefantsminda. **C** - Rare survivals of high mountain forests in Javakheti highland at about 1900 m above sea level. **D** - Kolkheti wetland, marshes. Black Sea shore.



Sums of Atmospheric precipitation. Year



Number of days with precipitation above 30 mm

Extreme precipitations

There is a general agreement that Global warming intensification causes the increase in frequency and intensity of extreme phenomena of weather and climate. Extreme phenomena have a serious impact on society, agriculture, economics, and human health and even on the security of the country. Therefore, the study of extreme phenomena is of great importance to the country. Extreme precipitations and also the sum of significant precipitations fallen for several days lead to strong floods, mudflows, snow avalanches and other natural disasters, which eventually leads to emergency situations.



July 2012 in Telavi during 3 hours - 72 mm precipitation, more than one month climatological norm. In May 2012 in Tbilisi 90 mm precipitation in less than one day . 2015 , 13 June.



We have distinguished 5 gradations of precipitation intensities with a daily amount of 50 mm and more, which can cause corresponding negative effects: weak, average, strong, very strong and super strong.

Table 1. Classification of intense precipitation

| Intensity, points | Daily maximum of precipitation, mm | Effect |
|--------------------------|---|---------------------|
| 1 | 50—100 | Weak |
| 2 | 101—150 | Average |
| 3 | 151—200 | Strong |
| 4 | 201—250 | Very strong |
| 5 | More than 250 | Super strong |

Table 2. Climatic characteristics of extreme daily precipitation with daily intensity of 50 mm and more, and five-day sums of precipitation

| Region | Point | R50 Days | R50 Max. days | RX1 mm | RX1 Max. mm | Imax Points | RX5 mm | RX5 Max, mm | Applied materials, years |
|---|---------------|-------------|---------------------|-----------|-------------------|----------------|-----------|----------------|--------------------------------|
| The Black Sea coast and Kolkheti Lowland | Batumi | 5.2 | 15 | 66 | 239 | 4 | 220 | 339 | 1936- 2010 |
| | Anaseuli | 3.6 | 11 | 71 | 205 | 4 | 192 | 292 | 1957-1992 |
| | Poti | 3.6 | 12 | 72 | 268 | 5 | 194 | 374 | 1957- 2010 |
| | Jurkveti | - | - | - | 350 | 5 | - | - | 1948-1990 |
| | Sokhumi | 2.4 | 6 | 67 | 169 | 3 | - | - | 1957- 1993 |
| | Kutaisi | 1.4 | 6 | 58 | 126 | 2 | 134 | 279 | 1936- 2010 |
| Likhi and Achara- Imereti Ranges | Mount Sabueti | 0.5 | 2 | 57 | 89 | 1 | - | - | 1959-2010 |
| | Bakhmaro | 1.8 | 4 | 60 | 115 | 2 | 138 | 265 | 1936-2010 |
| | Khulo | 1.9 | 6 | 61 | 133 | 2 | 143 | 256 | 1957-2010 |
| Plains and foothills of Eastern Georgia | Tbilisi | 0.4 | 3 | 67 | 147 | 3 | 68 | 175 | 1936- 2010 |
| | Telavi | 0.7 | 3 | 60 | 116 | 2 | - | - | 1956-2010 |
| Greater Caucasus | Pasanauri | 0.6 | 4 | 64 | 149 | 3 | - | - | 1936- 2010 |
| | Kazbegi | 0.8 | 4 | 60 | 129 | 2 | - | - | 1957-1992 |
| | Mamisoni pass | 0.1 | 1 | 103 | 185 | 3 | - | - | 1957-1992 |

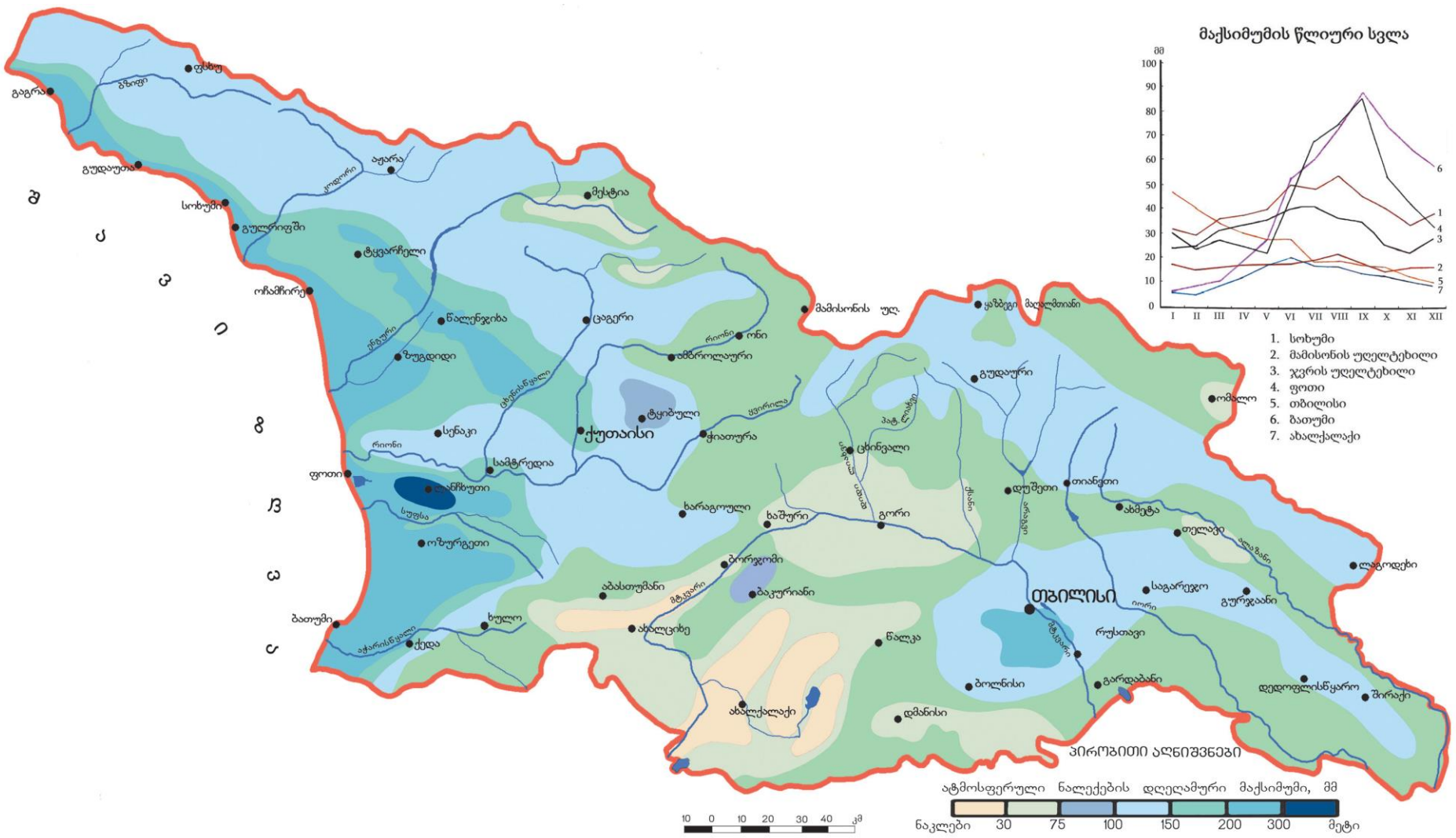
- **R50** –the average number of days with precipitation of 50 mm and more.
- **R50 max** – the highest number of days with precipitation of 50mm and more.
- **RX1** – average daily maximum of precipitation with an intensity of 50 mm/day and more.
- **RX1 max** –the highest daily maximum of precipitation with an intensity of 50mm/day and more.
- **Imax** – is the maximum intensity of precipitation, calculated in accordance with the classification of intense precipitation, presented in the Table 1.
- **RX5** –the average amount of extreme five-day sums of precipitation.
- **RX5 max** –the highest amount of extreme five-day sums of precipitation.

Table 3. The probability of falling extremely intense precipitation (50 mm/day and more), %

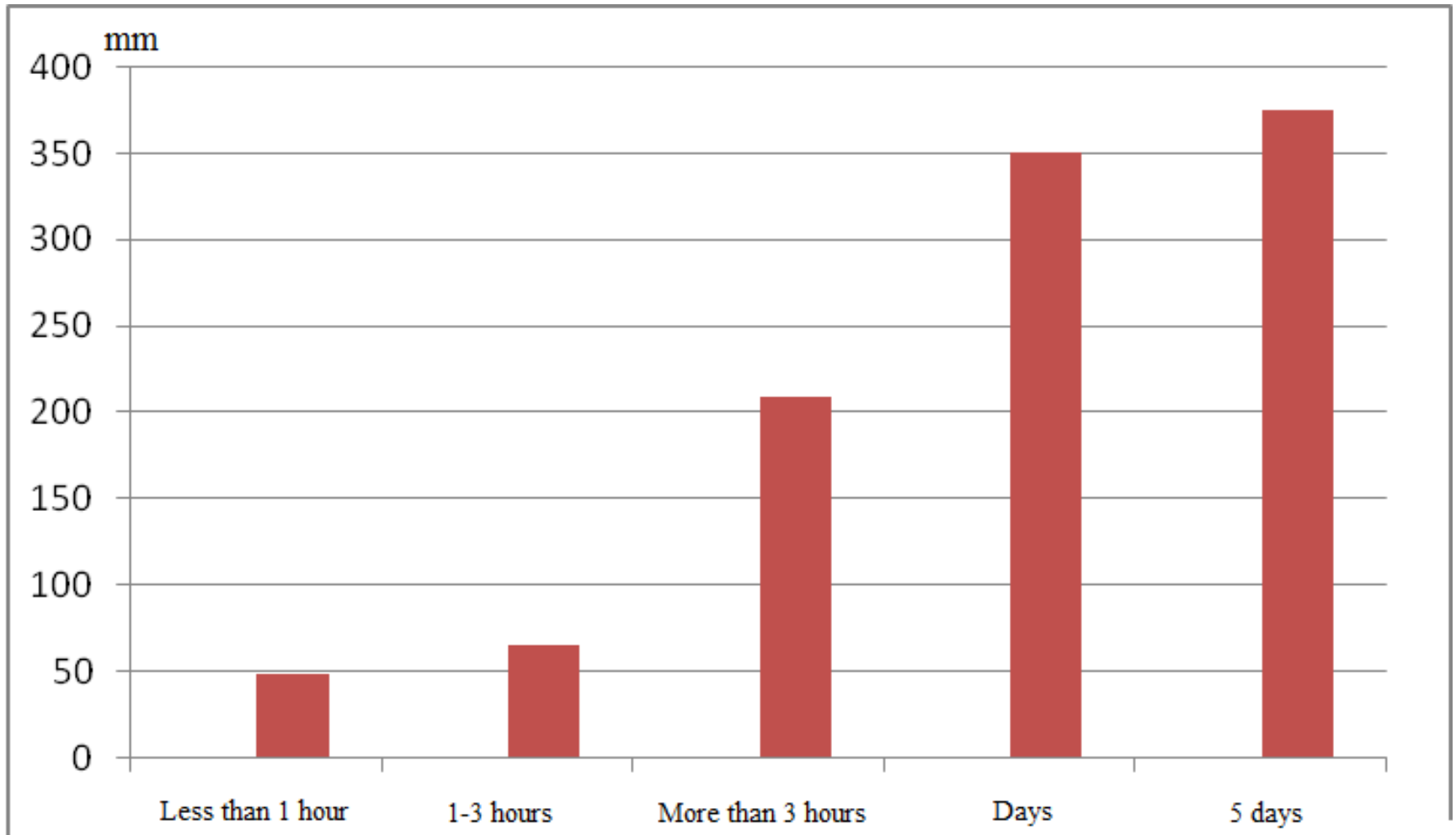
| Region | Point | Months | | | | | | | | | | | |
|--|---------------|--------|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
| The Black Sea coast and Kolkheti Lowland | Batumi | 1.3 | 1.0 | 0.6 | 0.8 | 0.8 | 1.7 | 1.5 | 2.2 | 3.3 | 2.9 | 2.5 | 2.6 |
| | Anaseuli | 0.7 | 0.9 | 0.3 | 0.2 | 0.1 | 1.1 | 1.6 | 1.1 | 2.1 | 2.2 | 1.4 | 1.7 |
| | Poti | 0.4 | 0.1 | 0.1 | 0.1 | 0.1 | 1.3 | 2.0 | 2.0 | 2.6 | 1.8 | 1.0 | 0.5 |
| | Kutaisi | 0.3 | 0.1 | 0.3 | 0.1 | 0.2 | 0.7 | 0.6 | 0.6 | 0.6 | 0.9 | 0.5 | 0.7 |
| Likhi and Achara-Imereti Ranges | Mount Sabueti | 0 | 0 | 0 | 0.1 | 0.1 | 0.3 | 0.2 | 0.1 | 0.1 | 0.3 | 0.1 | 0.2 |
| | Bakhmaro | 0.3 | 0.5 | 0.1 | 0 | 0 | 0 | 0.1 | 0.3 | 0.9 | 1.2 | 0.7 | 0.7 |
| | Khulo | 0.5 | 0.6 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.6 | 1.1 | 0.7 | 0.8 |
| Plains and foothills of Eastern Georgia | Tbilisi | 0 | 0 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 | 0 |
| | Telavi | 0 | 0 | 0.1 | 0.1 | 0.5 | 1.0 | 0.3 | 0.3 | 0.3 | 0.1 | 0.2 | 0 |
| Greater Caucasus | Pasanauri | 0 | 0 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.1 | 0.3 | 0.3 | 0.2 | 0.1 |
| | Kazbegi | 0.1 | 0.2 | 0.1 | 0.2 | 0.3 | 0.4 | 0.2 | 0.5 | 0.2 | 0.2 | 0.1 | 0 |

Table 4. Decadal rates of changes in the number of days with precipitation of 50 mm or more (**R50**), daily maximums of precipitation with an intensity of 50 mm/day or more (**RX1**), the sum of extreme five-day precipitation (**RX5**) and corresponding statistical significance levels **p**

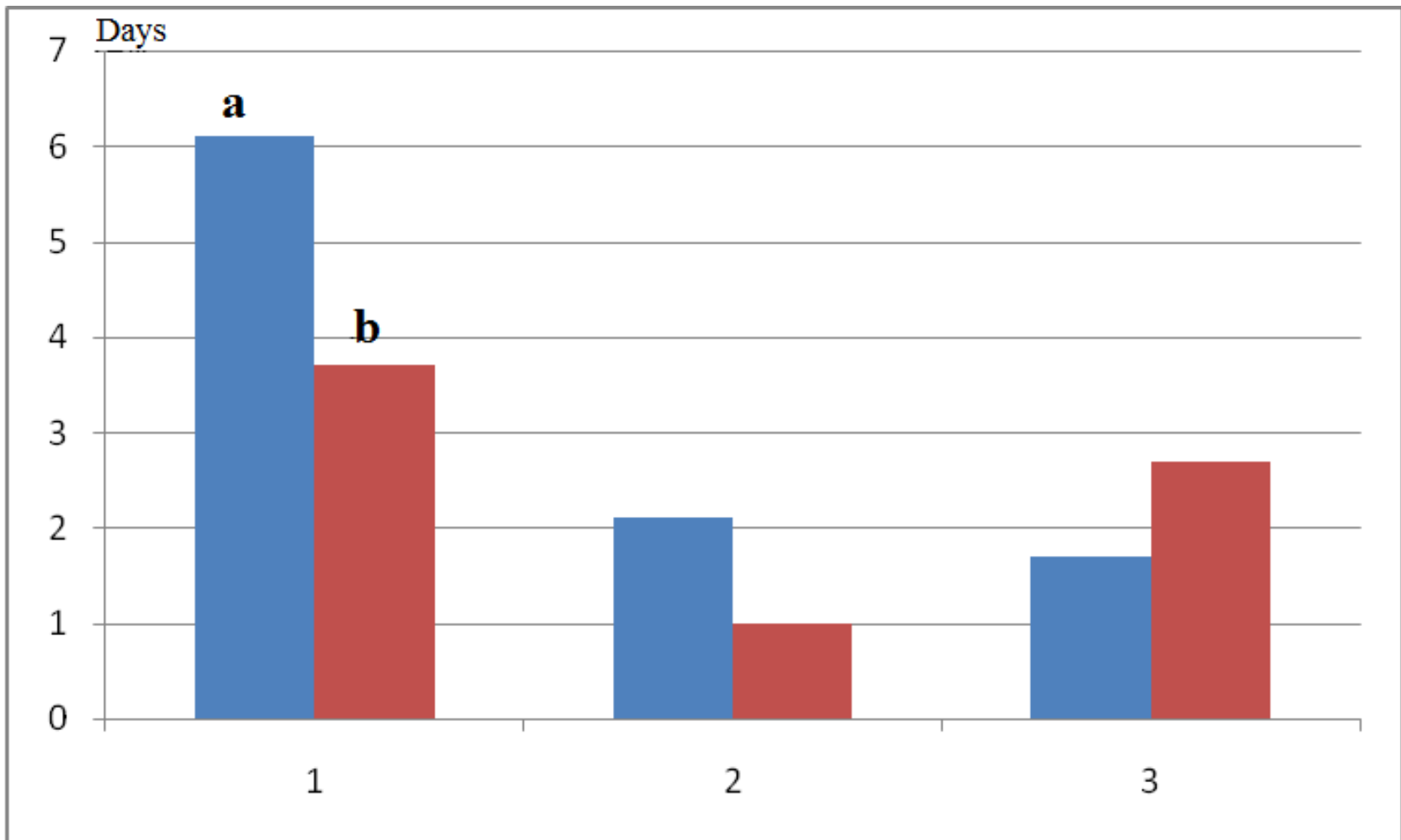
| Point | R50 | | RX1 | | RX5 | |
|---------------|------|-------|------|-------|-------|------|
| | Rate | p | Rate | p | Rate | p |
| Mount Sabueti | -0.2 | 0.002 | -3.7 | 0.002 | -1.7 | 0.56 |
| Bakhmaro | -0.3 | 0.02 | -2.8 | 0.01 | -3.2 | 0.20 |
| Khulo | 0.57 | 0.005 | 3.4 | 0.11 | 6.9 | 0.11 |
| Kazbegi | -0.5 | 0.15 | -11 | 0.05 | -16.7 | 0.1 |



Daily maximum of atmospheric precipitation, mm



The maximum amount of precipitation falling out at different time averaging intervals



Comparison of the average value of number of days with extremely intense precipitation over two periods of averaging:

a) 1961-1990; b) 1991-2016;

1- Batumi, 2- Bakhmaro, 3 -Khulo

Thank you