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SOME RESULTS OF ANALYSIS OF HEAVY PRECIPITATION IN TBILISI ON JULY 7, 2024 BASED ON GROUND -LEVEL AND SATELLITE MEASUREMENTS

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Abstract: *In the work some results of heavy precipitation analysis in Tbilisi on July 7, 2024 based on ground-level and satellite measurements are presented.*

Key Words: *atmospheric precipitation, flooding, flood.*

Introduction

Precipitation is one of the most important climate-forming factors directly affecting the vital activity of the environment. Therefore, as in other countries, special attention has always been paid to the study of the intensity and spatial-temporal distribution of precipitation in Georgia [1-5]. The relevance of these studies has increased even more against the background of the ongoing process of global warming [6]. Heavy precipitation leads to floods, landslides, mudflows, damage to vegetation, etc. [7-12]. Precipitation deficiency contributes to droughts, desertification, decreased crop yields and other negative processes [6,7]. Floods and landslides due to heavy precipitation most often occur in Western Georgia, although in its eastern part, including Tbilisi, these processes are not so rare [7-12]. Thus, heavy rainfall over several days led to a landslide with casualties in Nergeeti (Imereti) on February 7, 2024 [13]. Heavy rainfall in Tbilisi on August 29, 2023 (more than 100 mm) led to flooding of significant areas of the city and damage to its infrastructure [14].

This work is a continuation of previous traditional studies. Some results of heavy precipitation analysis in Tbilisi on July 7, 2024 based on ground-level and satellite measurements are presented below.

Study area, material and methods

Study area – Georgia and Tbilisi. The following information are used.

Data of Georgian National Environmental Agency and satellite observation data [https://neo.gsfc.nasa.gov/view.php?datasetId=GPM_3IMERGM] about the daily sum of atmospheric precipitation. Satellite measurement resolution is 0.1˚X0.1˚ (≈90 km^2). Accordingly, for the territory of Georgia there are satellite data on precipitation for 768 points.

Lightning data from [https://www.blitzortung.org/ru/live_lightning_maps.php?map=42].

In the proposed work the analysis of data is carried out with the use of the standard statistical analysis methods.

Results and discussion

Results in Fig. 1-4 and Table are presented.

On July 7, 2024 thunderstorms with heavy precipitation were observed over various parts of the territory of Georgia (including Tbilisi).

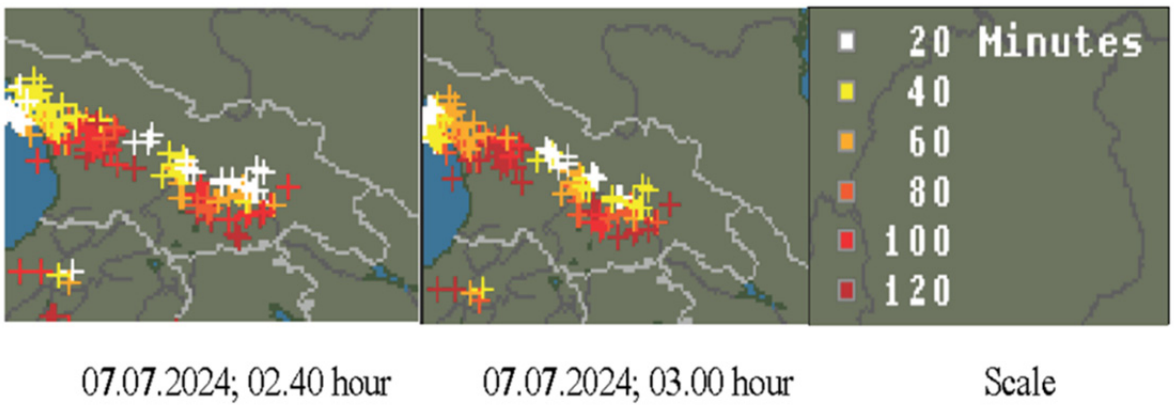

Fig. 1. An example of the distribution of lightning discharges over the territory of Georgia on July 7, 2024 at 02.40 and 03.00 hours.

In Fig. 1 an example of the distribution of lightning discharges over the territory of Georgia (including Tbilisi) on July 7, 2024 at 02.40 and 03.00 hours.

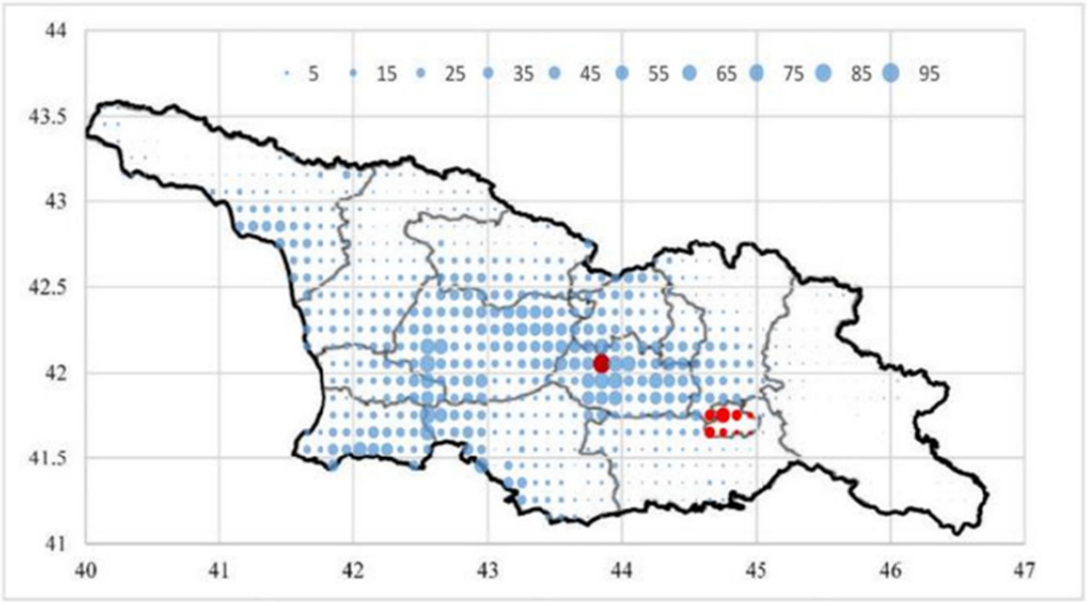

Fig. 2. Distribution of daily sum of atmospheric precipitations on the territory of Georgia at July 7, 2024 according to satellite measurement.

In Fig. 2 and Table data about daily sum of atmospheric precipitations on the territory of Georgia at July 7, 2024 according to satellite measurement are presented.

Table. Statistical characteristics of daily sum of atmospheric precipitations on the territory of Georgia at July 7, 2024 according to satellite measurement (Fig. 2).

Min	Max	Average	St Dev	St Err	Count
0.01	93.6	11.9	15.0	0.54	768

As follows from the Table, on the specified day, in accordance with satellite data, the precipitation amount varied from 0.01 mm to 93.6 mm (Doghlauri, Kareli Municipality, Shida Kartli, Georgia), with an average value of 11.9 mm. In Tbilisi and its environs, the daily precipitation amount varied from 3 to 60 mm (Fig. 3). It is important to note that in the area of the weather station in Digomi, the satellite measurement data were almost twice as high as the ground measurement data (60 mm and 32 mm, respectively, Fig. 3).

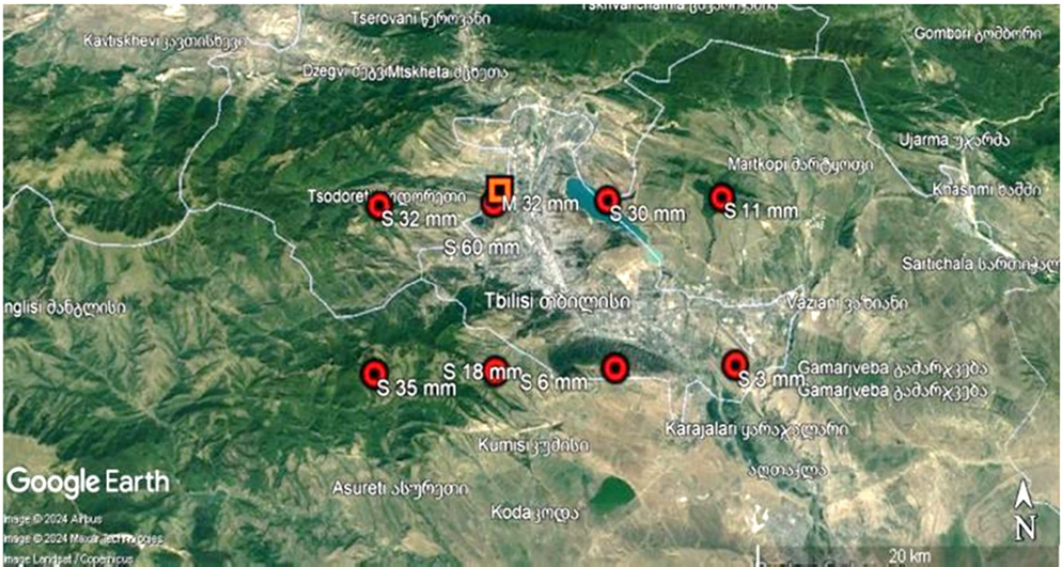

Fig. 3. Data on daily sum of atmospheric precipitations in Tbilisi at July 7, 2024 according to ground-level and satellite measurement. S – satellite data, M – data of meteorological station.

Fig. 4. An examples of the negative consequences of a heavy rainfall on two streets in Tbilisi on July 7, 2024. [https://www.interpressnews.ge/ru/article/161466-meriia-tbilisi-upavshie-v-rezultate-nepogody-derevia-povredili-doma-avtomobili-i-kommunikatsii-silnyi-veter-sorval-kryshi-s-domov-vedetsia-uchet-ushcherba; https://news.am/rus/news/832873.html#google_vignette].

Finally, we note that the heavy rain that hit Tbilisi late at night, accompanied by strong winds, created problems in the capital. The Samgori, Krtsanisi and Saburtalo districts were particularly hard hit. Trees that fell as a result of the storm damaged houses, cars and utilities. In several places, strong winds tore off roofs from residential buildings (Fig. 4). Representatives of the relevant government agencies were in all the problem areas all night long, dealing with the consequences of the storm [https://www.apsny.ge/2024/pol/1720357281.php].

Conclusion

In the future, we plan to continue similar studies for both Tbilisi and other regions of Georgia using ground-based and satellite measurement data against the backdrop of climate change.

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