საერთაშორისო სამეცნიერო კონფერენცია „ეკოლოგიის თანამედროვე პრობლემები“
შრომები, ISSN 1512-1976, ტ. 7, თბილისი-თელავი, საქართველო, 26-28 სექტემბერი, 2020
International Scientific Conference „Modern Problems of Ecology“
Proceedings, ISSN 1512-1976, v. 7, Tbilisi-Telavi, Georgia, 26-28 September, 2020
Международная научная конференция „Современные проблемы экологии“
Труды, ISSN 1512-1976, т. 7, Тбилиси-Телави, Грузия, 26-28 сентября, 2020

HEAVY RAINFALL, FLOODS AND FLOODINGS IN KAKHETI (GEORGIA) IN 2014-2018

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Summary: The analysis of the data of the Georgian Environment Agency on the incidents of heavy rainfall, floods and floodings in Kakheti (Georgia) and damage from them in 2014-2018 is presented. The greatest number of days with heavy rainfall, floods and floodings for the indicated five years was recorded in municipality of Lagodekhi (10 day), the smallest - in municipality of Sighnaghi (2 day). And in Dedoplistskaro municipality in 2014-2018 no incidents were reported. A map of these cases has been built.
Key Words: Heavy rainfall, floods, floodings, dangerous meteorological phenomena, geoinformation map.

Introduction

The atmospheric precipitation regime is one of the most important climate-forming factors that have a significant impact on the ecological situation of the area, agriculture and other areas of the economy. Often their manifestation is catastrophic and causes an emergency. In such cases, precipitation, as well as the accompanying floods and floodingss, can cause significant damage to the economy, especially in agriculture, can destroy the animal world, threaten the lives of people, etc. [1-4].

Therefore, in Georgia, as in other countries, special attention has always been paid to the study of precipitation patterns [1-4]. Due to climate change, interest in these studies has especially increased in recent decades, both for the whole territory of Georgia and for its individual regions [5-10].

In particular, in the work [7] the statistical analysis of data on monthly and seasonal values of precipitation in Tbilisi from 1844 to 2018 was carried out. Comparison of monthly and seasonal mean values of air precipitations in two thirty years of time (1844-1873 and 1989-2018) was carried out. It was found that their growth is observed in October and November, and a decrease in July and September. In the work [10] it is shown, that in Kutaisi in last years the repeatability of the days with precipitations of 30 millimeters are somehow elevated.

In Kakheti, one of the leading agricultural regions of Georgia, in period from 1956 to 2015 in various months of the year at different six points of observations the variability of precipitation is quite heterogeneous. So, in 1986-2015, compared with 1956-1985, the regime of precipitations in warm season of year changed as follows: in Telavi, in the second period of time compared to the first, the monthly precipitation decreased in June and July; in Sagarejo – a decrease in precipitation from June to August; in Gurjaani and Dedoplstskaro – a decrease in rainfall in June [8]. In Tianeti (several tens km from Kakheti) for the same period of time from May to September, negative linear trends of monthly sum of precipitation are observed [9].

Note that since 2015, the anti-hail system has been operating in Kakheti and it is planned to expand it to other regions of Georgia. It is also planned to carry out other work on weather modification (regulation

of precipitation, etc.). Therefore, the results of these studies [8,9] will be useful for planning these works [11]. It is also planned to use the anti-hail service radar for monitoring and forecasting intense precipitation that creates dangerous hydrometeorological and geophysical phenomena (floods, floodings, landslides, etc.). In particular, in paper [12] according to data 2016-2018 provides a map of points with recurring floods during rainfall in Eastern Georgia and examples of comparing radar data on precipitation intensity with flood data at these points. The authors note that the accumulation of this information will allow creating an algorithm for flood forecasting in Eastern Georgia based on the results of radar monitoring of the precipitation intensity.

In this work, which presents the continuation of the foregoing studies [12], some results on the incidents of heavy rainfall, floods and floodings in Kakheti (Georgia) and damage from them in 2014-2018 is presented.

Results

Based on the analysis of the data of the Georgian Environment Agency on the incidents of the heavy rainfall, floods and floodings and the damage it caused, which covers 2014–2018, a table was compiled (Table 1.), which shows data on the damage caused by these hidrometeorologycal phenomena for the Kakheti region of Georgia.

Analysis of Table 1. shows that processes related to heavy rainfall, floods and floodings in 2014-2018 were significantly active in the municipality of Lagodekhi (10day). It was also shown that this processes is more common and destructive during the Western and eastern processes and also during the convection processes.

It should also be noted that the damage caused by heavy rainfall, floods and floodings in the Kakheti region over the past five years has reached tens of millions of dollars, which is a huge loss for the Georgian economy.

Table 1. Damage by heavy rainfall, floods and floodings in Kakheti (2014-2018)

Municipalities	Number of days	Damage	Disaster	Process	Precipitation (mm)
Telavi	3	The rivers overflowed; Water from Sioni overflowed a ravine in the village of Kisiskhevi.	Heavy rain; Flood.	Eastern process - wind speed 23 m/s; Western process.	39
Akhmeta	6	Damaged crops; Agricultural lands were flooded; Destroyed the road; As a result of heavy rains at night, several sections of the Pshaveli-Abano-Omalo highway were Landslides. The road section of up to 500 meters was damaged. The helicopters transported 350 people from the disaster zone; As a result of prolonged rain, the river. Alazani flooded. Agricultural lands in 5 villages of Pankisi were flooded. Disrupted bridge, road gabions; As a result of the continuous rain and flood river. Alazani, crops and vineyards were flooded, and domestic animals and birds drowned. Cattle were killed and infrastructure was damaged, hundreds of subscribers were not provided with electricity for several hours.	hail; Heavy rain; Flooding; Flood.	Western process; Eastern process.	

Gurjaani	7	About 40 houses were flooded in the village of Akhasheni. Due to heavy rains, the Khashni River gorge overflowed its banks and flooded part of the village. A boulder brought from a ravine blocked a railway line leading to the village; In the village of Arshanda, the water level on the Latbi suburb increased by 5-6 m, as a result of which the roads were flooded; In Gurjaani the flooded river Cherebi, results of heavy rains damaged the road connecting with the village of Cherebi and cut off the village from the outside world, damaged the power lines.	Heavy hail and rain; Flooding; Flood; Heavy rain.	Convection process; Eastern process.	
Kvareli	3	Villages have been affected, 400 hectares of vineyards have been damaged, lands have been flooded; The rivers overflowed; Heavy rains in village Gavaz flooded 30 houses and yards.	Heavy rain; Flooding	Convection process; Eastern process; Western process.	51-53
Lagodekhi	10	The lands villege Apheni were flooded; The basements of the house were flooded; The rivers overflowed; The disaster affected Lagodekhi district. As a result of heavy rainfall, the first floor of the 10th house in the village of Baisubani was flooded.	Heavy hail and rain; Heavy rain; Flooding.	Convection process; Eastern process; Western process.	30-80
Sagarejo	6	The rivers overflowed; Residential houses were flooded in the villages of Chailuri, Kakabeti and Burdiani; Yards, roads, streets were flooded in Sagarejo, asphalt cover was damaged as a result of heavy rain; In the villages of Sagarejo Municipality, ravines in Tokhliauri and Antoka overflowed, as a result, about 12 public catering facilities in the village of Tokhliauri were flooded. Inventory and equipment were damaged. After heavy rains in the mountains, stones and rubble accumulated on the Sagarejo-Tbilisi highway, which hindered the movement of vehicles.	Heavy rain; Flooding.	Western process.	28-35
Sighnaghi	2	The rivers overflowed; Basements and yards were flooded, agricultural crops and plants were destroyed, poultry were killed, villages: Anaga, Magharo, Hereti Gate were damaged.	Heavy rain.	Western process.	44

Table 1 also shows that the amount of precipitation in the Kakheti region during each process is 28-80 mm.

According to Table 1. and based on statistical data for 2014-2018, we have prepared a geoinformation map of the heavy rainfall, floods and floodings on the territory for the Kakheti region(fig.1.). The map shows all the locations in the Kakheti region where the disasters processes listed above took place for the study period.

Fig. 1. also shows that the heavy rainfall, floods and floodings very damages the Kakheti region especially causes damage to the municipalitiy of Lagodekhy. The smallest damages hail is observed in the

municipality of Sighnaghi. As for Dedoplistskaro Municipality, no incidents were reported during the study period.

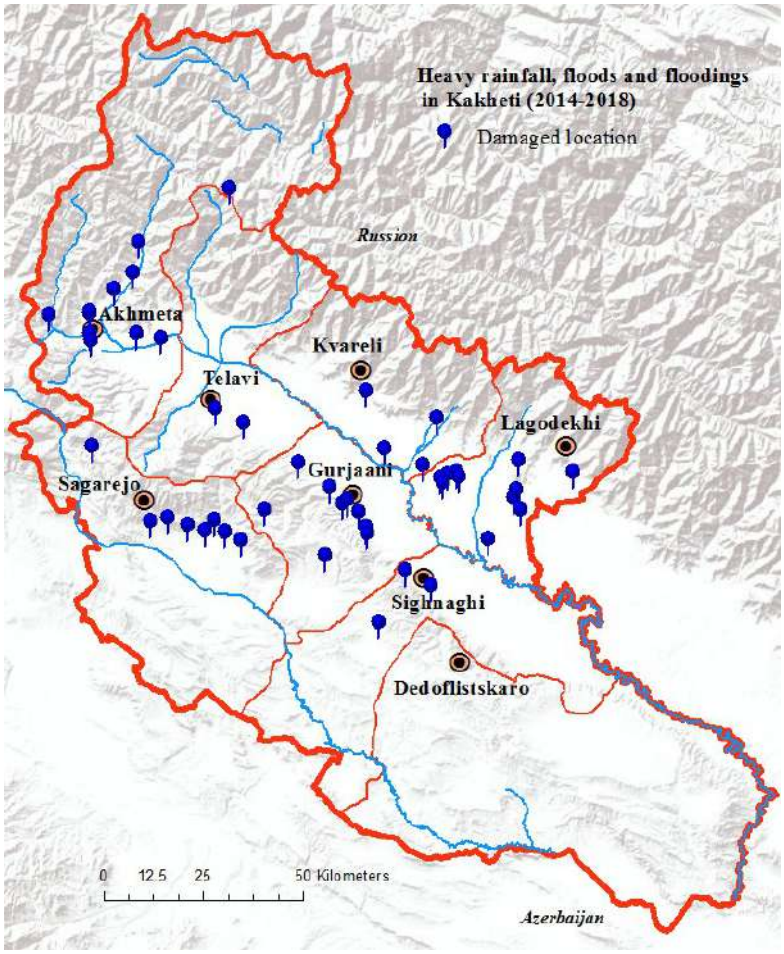

Fig. 1. Distribution of Heavy Rainfall, Floods and Floodings on the Territory of Georgia in 2014-2018.

Over the five years(2014-2018), the number of days heavy rainfall, floods and floodings in Kakheti was 37. As a result, more than 60 settlements were severely damaged - rivers overflowed, flooding agricultural lands and the basements of houses. Heavy rains swept away roads and bridges, domestic animals and birds drowned and e.t.

Conclusion

The study shows that heavy rainfall, floods and floodings in the Kakheti region has been a frequent occurrence in recent years, which has caused significant damage to the infrastructure and agrarian sector of the region.

The heavy rainfall, floods and floodings in the Kakheti region is characterized by a With abundant atmospheric precipitation, and the largest precipitation reaches 80 mm. in one case.

Acknowledgement

The authors are grateful to the chief of the atmospheric physics department of M. Nodia Institute of Geophysics A. Amiranashvili for assistance in the fulfillment of this work.

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