

## HAIL STORMS IN KAKHETI (GEORGIA) IN 2014-2018

\*Beglarashvili N., \*\*Janelidze I., \*Pipia M., \*\*Varamashvili N.

*\*Institute of Hydrometeorology of Technical University of Georgia, Tbilisi, Georgia*

*\*\*Mikheil Nodia Institute of Geophysics of Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia*

*\*\*\* Georgian Technical University, Tbilisi, Georgia*

[m.pipia@gtu.ge](mailto:m.pipia@gtu.ge)

**Summary:** The analysis of the data of the Georgian Environment Agency on the incidents of hail in Kakheti (Georgia) and damage from them in 2014-2018 is presented. The greatest number of days with hail for the indicated five years was recorded in municipality of Telavi (17 days with hail, 38 locations subjected to hail), the smallest - in municipality of Dedoplistskaro (2 day with hail, 2 locations subjected to hail). A map of hail cases has been built.

**Key Words:** Hail storm, dangerous meteorological phenomena, geoinformation map

### Introduction

Hailstorm is one of the most common meteorological phenomena. Often its manifestation is catastrophic and causes an emergency. In such cases, hail can cause significant damage to the economy, especially in agriculture, partially destroying, and sometimes completely, crops, vineyards, annual and perennial plants, destroying poultry and animals, damaging infrastructure and transport in the disaster area, threatening the health of people.

In Georgia, especially in the Kakheti region, the study of the climatic characteristics of the hailstorm is very important to prevent adverse events. Numerous literature is devoted to the problem of hail in Georgia, research in this direction covers a wide range of issues, including numerous articles devoted to the study of the climatology of hail[1-14].

One of the most important characteristics of hail is the number of hail days. The distribution of the number of hail days in the Kakheti region largely depends on the physical and geographical conditions of the region, especially its orography. Mountains, plateaus, and highlands have a great influence on the development of complex meteorological and convective processes. In mountainous and alpine regions, turbulence in the surface air layers increases when resistance is overcome, and convective cloudiness increases, which affects the distribution of the number of hail days.

### Results

Based on the materials available to us, on the hail and the damage it caused, which covers 2014–2018, a table was compiled (Table 1.), which shows data on the damage caused by hail for the Kakheti region of Georgia. It also indicates the number of hail days, and locations subjected to hail, duration, grain diameter, damage process and affected municipalities.

Analysis of Table 1. shows that hail processes in 2014-2018 were significantly active in the Kakheti region, especially in municipalities of Telavi and Gurjaani (17 and 16 days), where hail was observed in all territories these regions. It was also shown that hail is more common and destructive during the Western processes. Eastern and Intramass processes were relatively less destructive shown.

This trend of the hail is not new and was mentioned in some literary sources and scientific articles, including in our studies [4-8]. It should also be noted that the damage caused by hail 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 [3].

Table 1. Hail Damage in Kakheti Region of Georgia (2014-2018).

Municipalities	Number of days (locations)	Damage	Duration	Process	Grain diameter
Telavi	17 (38)	The hail damaged plots of land, plants, and vegetables, poultry destroyed, the gorge of the village was flooded by heavy rains that flooded the first floor of several houses. 100 hectares of vineyards in the village of Napareuli were damaged; Vineyards and nearly 50 percent of the crop were flooded and destroyed. The hail was accompanied by strong winds that knocked down trees on the Telavi-Napareuli highway; The villages of Shalauri, Vardisubani, Kurdgelauri 70% of the vineyards were destroyed.	10-20 min.	Western process - wind speed 23 m/s; Eastern process; Intramass process; Convection process.	(8-15) mm
Akhmeta	7 (20)	In the villages of Akhshani, Kistauri, Zemo Khodasheni, Chabinaani, hail caused damage to 80% of vineyards and arable land; The hail struck the villages of Kistauri, Khorkheli, Akhshani, Matani, most of the vineyards and annual crops were almost destroyed.	20 min.	Western process; Eastern process - wind speed 20 m/s; Intramass process.	
Gurjaani	16 (43)	The hail destroyed an annual and perennial crop planted on an area of more than 500 hectares in Velistsikhe, a natural disaster destroyed almost 80% of the crop. In the village of Chalaubani, up to 150 hectares were damaged, and in the villages of Darketi and Naniani, the hail destroyed a crop of strawberries and vegetables; Approximately 550 hectares of vineyards and orchards in some villages are 100% destroyed.	10-30 min.	Western process; Eastern process; Intramass process; Convection process.	(7- 20) mm
Kvareli	10 (20)	The hail damaged 400 hectares of vineyards, flooded the fields; The village of Chikaani destroyed dozens of hectares of vineyards, watermelon and melon orchards. Houses were damaged, vineyards were damaged, birds were killed. 1,500 - 2,000 hectares of vineyards were 100% destroyed. Besides vineyards, hail also destroyed corn, sunflower, and watermelon plants.	5-30 min.	Eastern process; Intramass process; Convection process.	20 mm
Dedoplistskaro	2 (2)	The hail damaged the vine; Village In Arboshik 10 hectares of vineyards were damaged, the hail hit the fields.	8 min.	Convection process	6 mm
Lagodekhi	5 (14)	The hail was accompanied by heavy rainfall (20 mm); Gardens and vineyards in the villages of Chaduniani and Sakobo were destroyed.	5-10 min.	Intramass process	20 mm
Sagarejo	7 (13)	In the villages of Kandaure and Badiauri, hail and storms damaged vineyards on 40 hectares, watermelon gardens and tomato plants, the degree of damage in some places is 80-90%; In the village of Didi Chalaure villages, annual and perennial crops were damaged, and up to 300 hectares of vineyards were destroyed by 80%; Hail equal to hazelnuts came to the village of Giorgitsminda, arable land was destroyed.	20 min.	Eastern process; Intramass process.	8 mm

Sighnaghi	6 (13)	In the village of Kvemo Bodbe, about 15 families lost 80% of their 50 hectares of vineyards; Over 1200 hectares of vineyards were damaged, fruit orchards and orchards in some villages were 100% destroyed; The villages of Jugaani, Tibaani and Bodbiskhevi were flooded, and 70-80% of the vegetables and vineyards were destroyed.	5-30 min.	Eastern process; Convection process.	
-----------	-----------	--	-----------	---	--

Table 1. also shows that the duration of hail in the Kakheti region lasts from 5 to 30 minutes, and the diameter of hailstones is in the range of 6-20 mm.

According to Table 1. and based on statistical data for 2014-2018, we have prepared a geoinformation map of the hail on the territory for the Kakheti region(fig.1.). The map shows all the locations in the Kakheti region where the hailstorms took place for the study period.

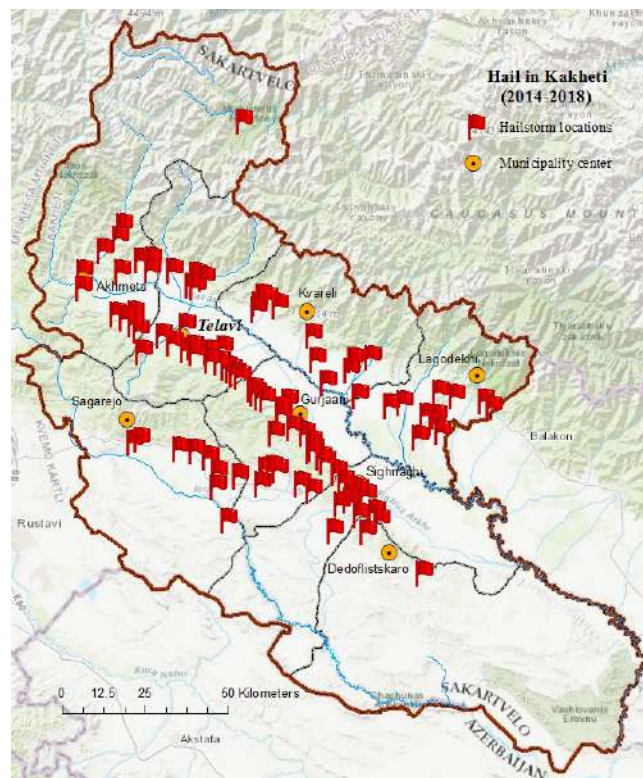


Fig. 1. Hail According to 2014-2018 Data in Kakheti (Georgia)

Fig. 1. also shows that the hail very damages the Kakheti region especially causes damage to the municipalities of Telavi, Gurjaani, and Kvareli. The smallest damages hail is observed in the municipality of Dedoflistskaro.

Over the five years(2014-2018), the number of hail days in Kakheti was 50, which was recorded in 163 locations in the region, this is the highest indicator hail in Georgia. The lowest indicator hail is in the municipality of Dedoflistskaro, where the number of hail days is 2 in 2 locations During the study period.

### Conclusion

The study shows that hail in the Kakheti region has been a frequent occurrence in recent years, which has caused significant damage to the agrarian sector of the region.

The hail in the Kakheti region is characterized by a duration of 30 min, and the largest diameter the hail grain reaches 20 mm.

## 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.

## References

1. Amiranashvili A.G., Nodia A.G., Toronjadze A.F., Khurodze T.V. Some Statistical Characteristics of the Number of Days with Hail into the Warm Half-Year in Georgia in 1974-1990. // Trans. of Institute of Geophysics of Acad. of Sc. of Georgia, ISSN 1512-1135, v. 58, 2004, pp. 133-141, (in Russian).
2. Elizbarashvili E.Sh., Elizbarashvili M. E. //Extreme weather events over the territory of Georgia, 2012, Tbilisi (in Russian).
3. Elizbarashvili E., Amiranashvili A., Varazanashvili O., Tsereteli N., Elizbarashvili M., Elizbarashvili Sh., Pipia M., //Hailstorms in the Territory of Georgia, European Geographical Studies, Vol. 2, No. 2, 2014. Tbilisi, pp. 55-69, (in Russian).
4. Amiranashvili A., Varazanashvili O., Pipia M., Tsereteli N., Elizbarashvili M., Elizbarashvili E. Some Data About Hail Damages in Eastern Georgia and Economic Losses From Them. // Reports, presented on the Scientific Conference “80 Years of the M. Nodia Institute of Geophysics”, 2014, Tbilisi, pp. 145-150. (in Russian).
5. Amiranashvili A.G., Bliadze T.G., Jamrshvili N.K., Khurodze T.V., Pipia M.G., Tavidashvili Kh. Z. Comparative Analysis of the Distribution of Number of Days with Hail Per Annum on the Territory of Kakheti According to the Data of the Meteorological Stations and State Insurance Service of Georgia. // Journal of the Georgian Geophysical Society, Issue A. Physics of Solid Earth, v.20A, 2017, Tbilisi, pp.44 -56.
6. Pipia M. Prospects for the development of anti-hail works in Kakheti region (Georgia) taking into account some climatic indices//Transactions of Mikheil Nodia Institute of Geophysics, vol. LXVI, 2016, Tbilisi, pp. 96-107. (in Georgia).
7. Pipia M. G., Beglarashvili N. G. Hail Hits in Eastern Georgia. //Journal of International Scientific Publications: Ecology and Safety, Volume 8,2014, Burgas, pp. 567-573.
8. Varazanashvili O., Tsereteli N., Amiranashvili A., Tsereteli E., Elizbarashvili E., Dolidze J., Qaldani L., Saluqvadze M., Adamia Sh., Arevadze N., Gventcadze A. Vulnerability, Hazards and Multiple Risk Assessment for Georgia. // Natural Hazards, Vol. 64, Number 3 (2012), 2021-2056, DOI: 10.1007/s11069-012-0374-3, <http://www.springerlink.com/content/9311p18582143662/fulltext.pdf>
9. Amiranashvili A., Varazanashvili O., Nodia A., Tsereteli N., Khurodze T. Statistical Characteristics of the Number of Days with Hail Per Annum in Georgia. // Trans. of the Institute of Hydrometeorology, ISSN 1512-0902, vol. 115, Tb., 2008, pp. 427 – 433, (in Russian).
10. Amiranashvili A. Influence of the Anthropogenic Pollution of Atmosphere on the Changeability of Hail Processes Intensity. // Trans. of Mikheil Nodia Institute of Geophysics, ISSN 1512-1135, vol. 64, Tb., 2013, pp. 160 – 177, (in Russian).
11. Amiranashvili A., Dzodzuashvili U., Lomtadze J., Sauri I., Chikhladze V. Some Characteristics of Hail Processes in Kakheti. // Trans. of Mikheil Nodia Institute of Geophysics, ISSN 1512-1135, vol. 65, Tb., 2015, pp. 77 – 100, (in Russian).
12. Amiranashvili A.G., Nodia A.G., Toronjadze A.F., Khurodze T.V. The Changeability of the Number of Days with the Hail in Georgia in 1941-1990. // Trans. of Institute of Geophysics of Acad. of Sc. of Georgia, ISSN 1512-1135, v. 58, 2004, pp. 127-132, (in Russian).
13. Amiranashvili A.G., Amiranashvili V.A., Nodia A.G., Khurodze T.V., Toronjadze A.F., Bibilashvili T.N. Spatial-Temporary Characteristics of Number of Days with a Hails in the Warm Period of Year in Georgia. // Proc. 14th International Conference on Clouds and Precipitation, Bologna, Italy, 18-July 2004, pp. 2\_2\_215. 1-2\_2\_215.2.
14. Janelidze I., Pipia M. Hail storms in Georgia in 2016-2018. // Int. Sc. Conf. “Natural Disasters in Georgia: Monitoring, Prevention, Mitigation”. Proc., ISBN 978-9941-13-899-7, Publish House of Iv. Javakhishvili Tbilisi State University, December 12-14, Tbilisi, 2019, pp. 144 -146.