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DATA ON THE HEIGHT OF ZERO ISOTHERM AND ISOTHERM OF -6 ° C IN THE ATMOSPHERE ABOVE THE TERRITORY OF SHIDA KARTLI (GEORGIA) DURING THE ANTI-HAIL SEASON

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Summary: In the work the data of statistical analysis of the daily and monthly average values of the height of zero izotherm and isotherm -6°C above the territory of Shida Kartli (Gori) for the period from 1 April to 31 October 2016 is presented. The results of the work will find practical application in the organization of the anti-hail system in this region.
Key words: aerological sounding of atmosphere, zero isotherm, isotherm -6°C, weather modification.

Introduction

Practical and scientific works on the weather modification (increase and decrease of atmospheric precipitation, protection from the hail, etc.) is conducted in many countries of world. The anti-hail works is reached almost in 50 countries of world over the total area of approximately 90 million hectares (Argentina, Bulgaria, China, Georgia, Macedonia, Moldova, Russian Federation, Spain, etc.) [1,2; https://map.geoengineeringmonitor.org/].

Experimental, experimental-production and production anti-hail work on Georgia conducted in 1960-1990 in the regions of Kakheti and southern Georgia over the total area approximately 1.2 million hectares (Kakheti – 800 thousand hectares, southern Georgia - 400 thousand hectares). In 1989 these works were stopped. The restoration of these works in Kakheti occurred in 2015 [2-5].

In the future, it is planned to expand anti-hail operations and other weather modification works throughout Georgia. In the near future, it is planned to restore anti-hail operations in South Georgia, as well as the creation of a new anti-hail service in Shida Kartli [4].

Information about the vertical distribution of meteorological elements in the atmosphere is necessary for the normal functioning of anti-hail service. In particular, the data about the level of the zero isotherm and isotherm -6°C are necessary for the planning and realization of the operations of action on hail clouds, evaluating the sizes of hail stones, which falling from clouds to the earth's surface, etc. [2, 6-10].

Some results of the studies of the changeability of the levels of the zero isotherm and isotherm -6°C under the conditions of Kakheti into the season of anti-hail works are represented in [7-9]. This work is the continuation of the foregoing studies. Results of the statistical analysis of the data about heights of zero isotherm and isotherm -6°C under the conditions of Shida Kartli, where the organization of anti-hail works is planned, are represented below.

Material and methods

For investigating the thermal regime in the free atmosphere above the territory of Shida Kartli (Gori) as in [7-9] the resources of http://ready.arl.noaa.gov/READYcmet.php were used.

Work gives the statistical data about the daily and monthly average values of the height of zero isotherm {H(0°C)} and isotherm -6°C {H(-6°C)} from 1 April to 31 October 2016. The daily values of the indicated parameters were averaged according to data for four periods of measurements of the vertical profile of air temperature (04, 10, 16 and 22 hours on the Tbilisi time).

The analysis of data with the use of the standard statistical analysis methods is carried out. The following designations will be used below: Min – minimal values, Max - maximal values, Mean – average values, St Dev - standard deviation, St Err – standard error, Cv (%) - coefficient of variation, 99%(+/-) - 99% of confidence interval.

Results and discussion

Results in fig. 1-4 and table1,2 are presented.

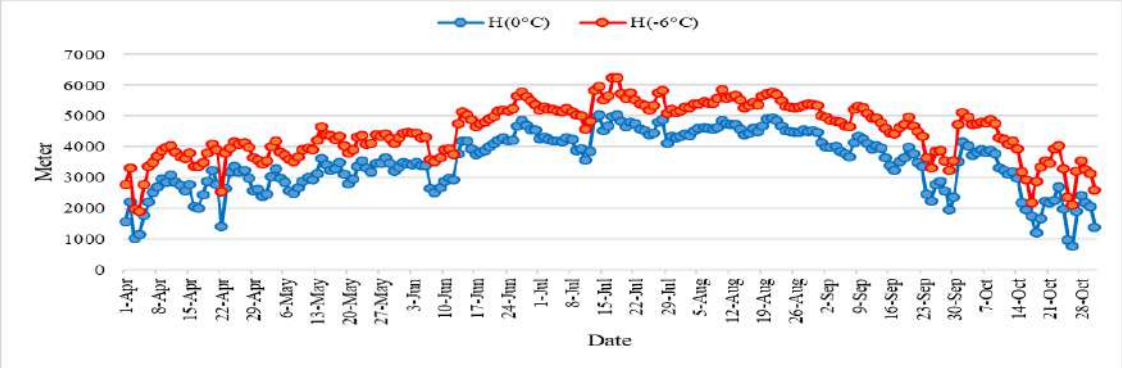

Fig. 1. Daily average values of height of izotherms 0°C and -6° C from 1 April to 31 October above Gori.

Table 1. Statistical characteristics of daily mean values of hight of izotherm 0°C above Gori from April to October.

Parameter	April	May	June	July	August	September	October
Min	1018	2380	2513	3580	4328	1948	768
Max	3363	3640	4858	5033	4938	4340	4170
Mean	2514	3114	3768	4440	4586	3512	2651
St Dev	629	352	650	375	157	660	987
Cv,%	62	15	26	10	4	34	129
St Err	117	64	121	68	29	123	180
99%(+/-)	301	166	311	176	74	316	464

Table 2. Statistical characteristics of daily mean values of hight of izotherm -6°C above Gori from April to October.

Parameter	April	May	June	July	August	September	October
Min	1888	3428	3518	4583	5170	3238	2095
Max	4150	4640	5770	6253	5843	5313	5105
Mean	3528	4058	4709	5393	5453	4520	3779
St Dev	594	313	641	388	172	590	881
Cv,%	31	9	18	8	3	18	42
F St Err	110	57	119	71	31	110	161
99%(+/-)	284	147	307	182	81	282	414

As follows from fig. 1 and table 1 daily mean values of H(0°C) above Gori changes from 768 m (October) to 5033 m (July). The largest variations of values of H(0°C) in October is observed (Cv=129 %), the smallest - in August (Cv=4 %).

From fig. 1 and table 2 follows, what daily mean values of H(-6°C) above Gori changes from 1888 m (April) to 6253 m (July). The largest variations of values of H(-6°C) in October is observed (Cv=42 %), the smallest - in August (Cv=3 %).

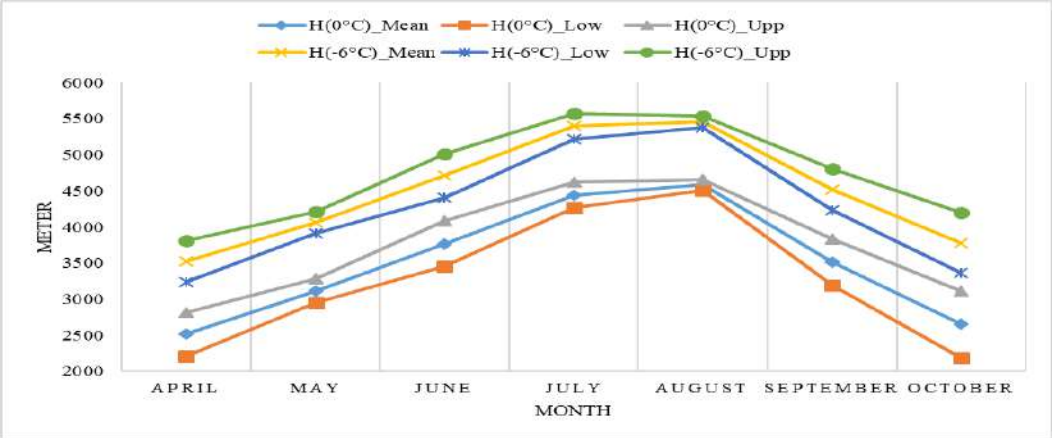

Fig. 2. Monthly variations of daily mean values of height of zero izotherm and izotherm -6°C and them 99% confidence intervals above Gori.

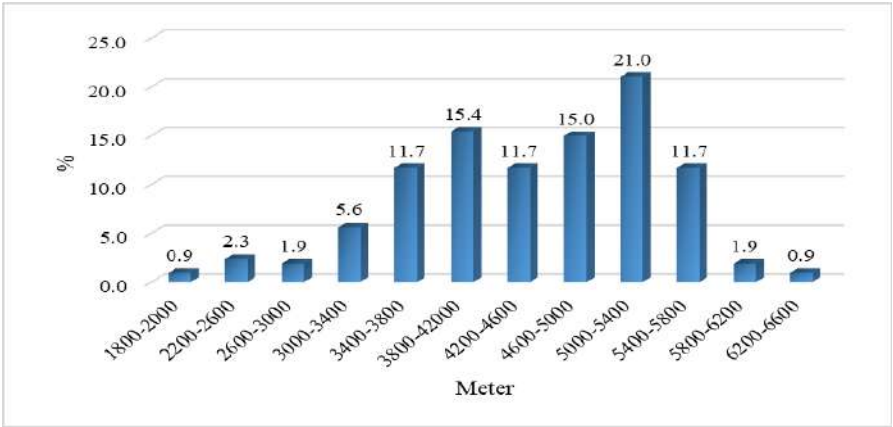

Fig.3. Repetition of daily mean values of height of izotherm - 6°C above Gori from 1 April to 31 October.

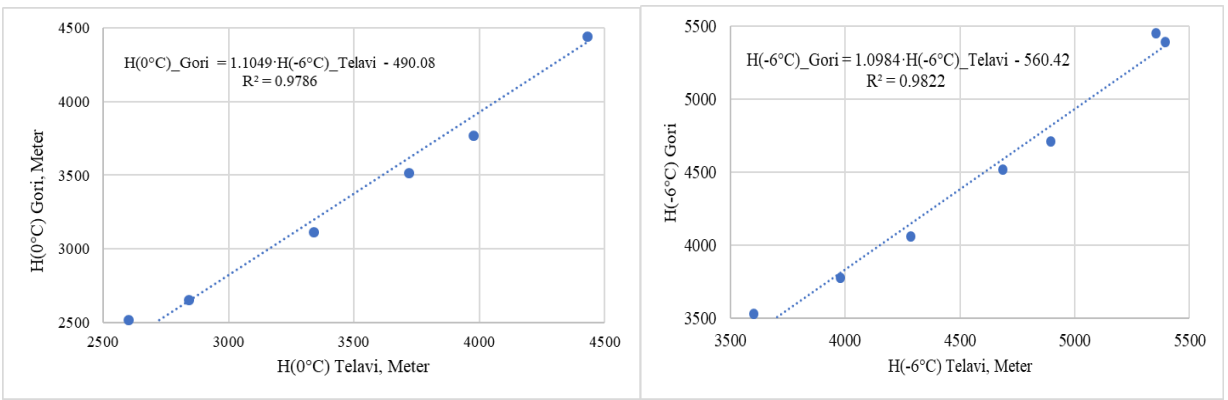

Fig.4. Linear correlation and regresion between H(0°C) and H(-6°C) above Telavi and Gori.

As follows from fig. 2 and table 1,2 monthly mean values of H(0°C) above Gori changes from 2514 m (April) to 4586 m (August) and monthly mean values of H(-6°C) – from 3528 m (April) to 5453 m (August). 99% confidence interval of mean values of H(0°C) changes from ±74 m (August) to ±464 m (October), and 99% confidence interval of mean values of H(-6°C) changes from ±81 m (August) to ±414 m (October).

The highest frequency of H(-6°C) values is in the range of 5000-5400 m (21.0%), the smallest - in the ranges of 1800-2000 m and 6200-6600 m (0.9% respectively), fig. 3.

Between H(0°C) and H(-6°C) above Telavi and Gori the high level of linear correlation and regresion are observed (fig. 4).

Conclusion

In the future, similar studies are planned for other regions of Georgia.

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