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Vertical Distribution of the Monthly Mean Values of the Air Temperature above the Territory of Kakheti (Georgia) in the Central Months of the Year 2012-2016

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ABSTRACT

The data about the changeability of the mean five-year values of the daily values of the air temperature above Kakheti for the central months of year for the period from 2012 through 2016 are cited. The statistical characteristics of the air temperature at the different levels in the range of heights from 0.54 to 27 km are represented. In particular, are cited: the data about the vertical distribution of the average monthly values of the air temperature during January, April, July and October; the mean value of the gradient of air temperature for the indicated months in the layer of the atmosphere from 0.54 to 8.5 km; the average monthly values of height of zero isotherm. It is noted, that heights of zero isotherm for July and October into 2012-2016 respectively by 0.215 and 0.506 km are higher than the same values in 1958-1961.

Key words: aerological sounding of atmosphere, air temperature vertical distribution.

Introduction

Studies of the vertical distribution of the air temperature in the atmosphere have great value for the solution of different problems of meteorology and climatology (meteorological forecast of showers, thunderstorms and hail [1-3], the determination of different characteristics of clouds according to the data of radar measurements [1, 4-7], weather modification [1, 8-11], estimation of climate change [12], etc.). From the end of May 2015 in Kakheti after 25- year interruption the work of anti-hail service was restored [13,14]. Therefore, in connection with climate change, the need for the detailed study of the contemporary regime of the vertical distribution of the air temperature above this territory arose [12,15-17]. These studies were begun in 2015 year [18].

In this work the results of investigating the vertical distribution of the average monthly values of air temperature above the territory of Kakheti in 2012-2016 during January, April, July and October in the range of heights from 0.543 to 27 km above sea level are given.

Material and methods

At present in Georgia the aerological sounding of the atmosphere is not conducted. Therefore, for the solution of the problem presented was carried out information processing about the daily vertical profiles of the air temperature in the atmosphere from the earth's surface to the height of 27 km above Kakheti (Telavi) for four periods of observations (4, 10, 16 and 22 hours on the local time, https://www.ready.noaa.gov/READYcmet.phpand https://rp5.ru/Weather_in_Georgia).

Results and discussion

The results of studies in tables 1-3 and figures 1-4 are clearly demonstrated.

Table 1

Statistical characteristics of the five years mean of diurnal values of the air temperature on the different heights above Kakheti during January and April 2012-2016

Param.	January					Param.	April				
H, km	Mean	Min	Max	Range	St Dev	H, km	Mean	Min	Max	Range	St Dev
0.54	2.5	-0.3	5.8	6.1	1.50	0.54	12.9	8.1	16.9	8.8	2.11
1.5	-2.5	-4.5	-0.8	3.7	1.14	1.5	6.7	1.5	10.6	9.1	2.27
2.0	-4.5	-6.9	-2.0	5.0	1.29	2.0	3.6	-1.1	7.3	8.4	2.18
2.5	-6.6	-9.3	-3.9	5.4	1.30	2.5	0.7	-3.6	4.1	7.6	2.04
3.0	-9.1	-12.0	-6.6	5.4	1.28	3.1	-2.4	-6.5	0.6	7.1	1.91
3.6	-12.3	-15.3	-9.9	5.4	1.29	3.6	-6.0	-10.0	-3.2	6.7	1.78
4.2	-16.0	-19.2	-13.7	5.5	1.32	4.3	-10.0	-13.8	-7.4	6.4	1.64
4.8	-20.2	-23.5	-18.1	5.4	1.33	4.9	-14.4	-18.0	-12.1	5.8	1.51
5.5	-25.2	-28.3	-23.0	5.3	1.34	5.6	-19.4	-22.7	-17.4	5.3	1.42
6.3	-31.0	-33.6	-28.6	5.0	1.33	6.4	-25.2	-28.2	-23.1	5.1	1.34
7.1	-37.4	-39.7	-35.2	4.5	1.30	7.3	-31.8	-34.7	-29.7	4.9	1.25
8.0	-44.6	-47.0	-42.5	4.4	1.20	8.2	-39.2	-42.1	-37.2	4.8	1.15
9.0	-51.7	-53.3	-49.3	4.0	0.98	9.2	-47.3	-49.8	-45.7	4.2	0.97
10.2	-57.1	-59.0	-54.4	4.6	1.22	10.4	-54.6	-56.4	-52.2	4.2	1.07
11.6	-57.9	-62.4	-53.6	8.8	1.98	11.8	-56.9	-60.2	-54.2	6.0	1.53
13.4	-56.7	-59.8	-54.3	5.5	1.37	13.7	-55.5	-57.4	-53.6	3.9	1.10
16.0	-58.9	-61.5	-57.7	3.8	1.12	16.2	-58.3	-59.9	-56.5	3.4	0.95
20.3	-60.8	-64.1	-56.5	7.6	1.80	20.6	-59.4	-60.8	-58.2	2.7	0.66
26.0	-57.6	-64.4	-50.4	14.0	3.79	26.3	-53.8	-56.7	-50.9	5.8	1.46

Table 2

Statistical characteristics of the five years mean of diurnal values of the air temperature on the different heights above Kakheti during July and October 2012-2016

Param.	July					Param.	October				
H, km	Mean	Min	Max	Range	St Dev	H, km	Mean	Min	Max	Range	St Dev
0.54	23.5	21.9	25.6	3.7	0.87	0.54	13.1	8.8	17.7	8.9	2.34
1.5	17.7	16.2	19.3	3.1	0.81	1.5	6.7	2.5	11.1	8.6	2.17
2.0	13.9	12.6	15.5	3.0	0.80	2.0	4.0	0.4	8.4	8.0	2.11
2.6	10.5	9.1	12.2	3.1	0.80	2.5	1.7	-1.7	6.3	8.0	2.12
3.1	7.6	6.4	9.4	3.0	0.77	3.1	-0.9	-4.1	3.7	7.8	2.04
3.7	4.3	3.1	5.8	2.8	0.76	3.7	-4.1	-7.2	0.4	7.6	1.95
4.4	0.4	-0.7	1.8	2.5	0.76	4.3	-7.8	-10.5	-3.3	7.2	1.87
5.1	-4.0	-5.2	-2.5	2.7	0.80	5.0	-11.8	-14.6	-7.6	7.0	1.82
5.8	-8.7	-10.1	-7.0	3.1	0.88	5.7	-16.6	-19.6	-12.4	7.2	1.81
6.6	-13.9	-15.4	-11.9	3.5	0.93	6.5	-22.2	-25.5	-17.9	7.6	1.82
7.5	-19.5	-21.3	-16.9	4.4	1.10	7.4	-28.6	-32.1	-24.2	7.9	1.86
8.5	-25.6	-28.0	-22.5	5.5	1.46	8.3	-36.0	-39.7	-31.6	8.1	1.87
9.6	-32.2	-35.7	-28.1	7.5	1.97	9.3	-44.2	-47.8	-40.4	7.5	1.81
10.9	-38.4	-41.3	-35.1	6.3	1.50	10.5	-52.1	-54.4	-48.9	5.5	1.75
12.4	-45.7	-47.0	-44.9	2.1	0.58	12.0	-57.4	-62.4	-53.7	8.7	2.18
14.2	-55.8	-57.9	-54.5	3.4	0.84	13.8	-59.0	-63.5	-55.5	7.9	1.98
16.8	-64.7	-66.8	-62.0	4.8	1.22	16.3	-61.2	-63.2	-58.7	4.5	1.18
21.0	-58.7	-59.5	-57.4	2.1	0.57	20.6	-60.8	-63.0	-59.2	3.8	0.98
26.9	-47.5	-47.9	-47.1	0.8	0.21	26.4	-53.4	-55.5	-50.1	5.4	1.28

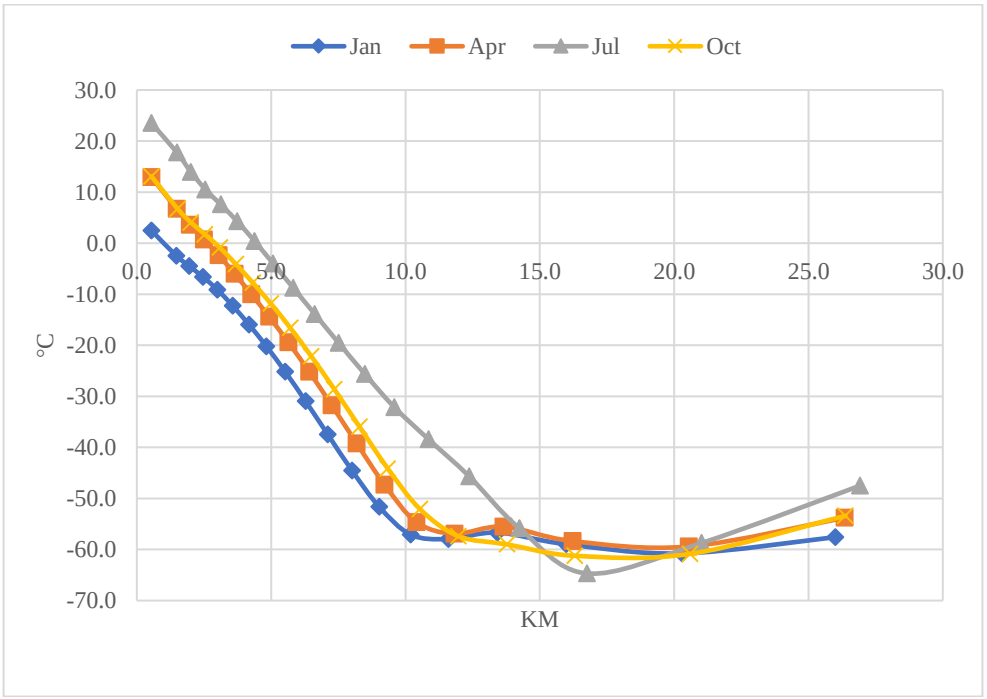

Fig. 1. Vertical distribution of the mean monthly values of the air temperature above the territory of Kakheti during January, April, July and October 2012-2016.

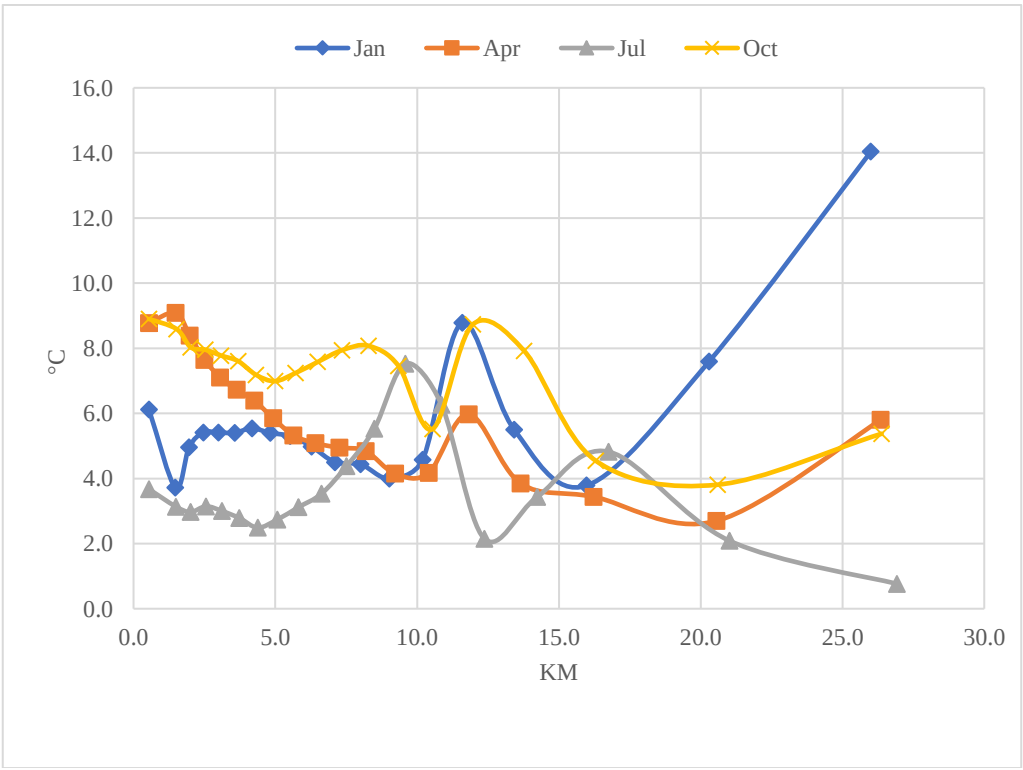

Fig. 2. Vertical distribution of a difference of the maximum and minimum mean diurnal values of the air temperature above the territory of Kakheti during January, April, July and October 2012-2016.

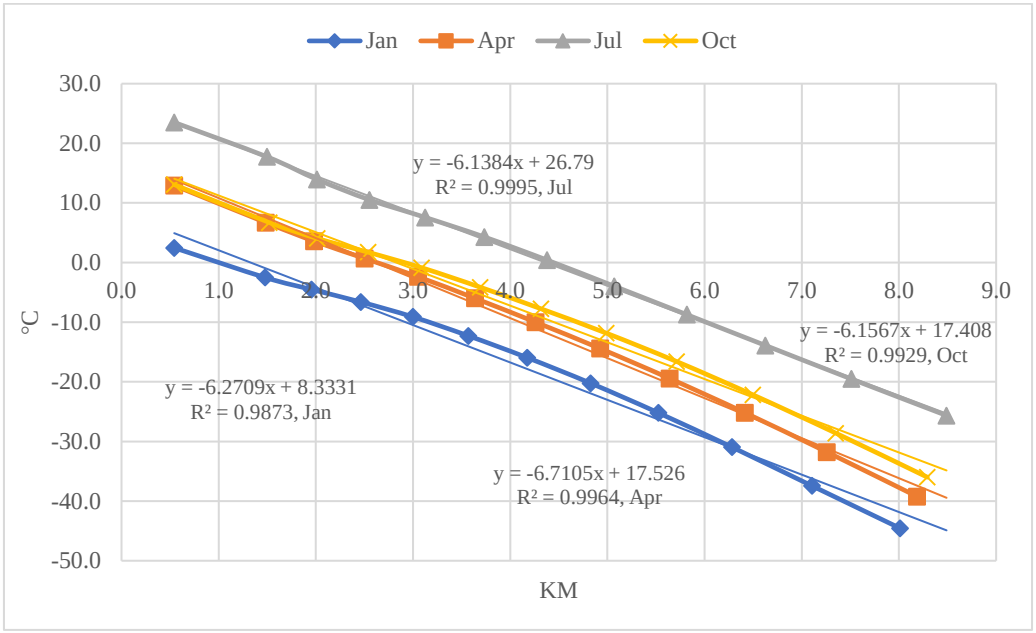

Fig. 3. Gradient of the vertical distribution of the average monthly values of the air temperature of above the territory of Kakheti during January, April, July and October 2012-2016.

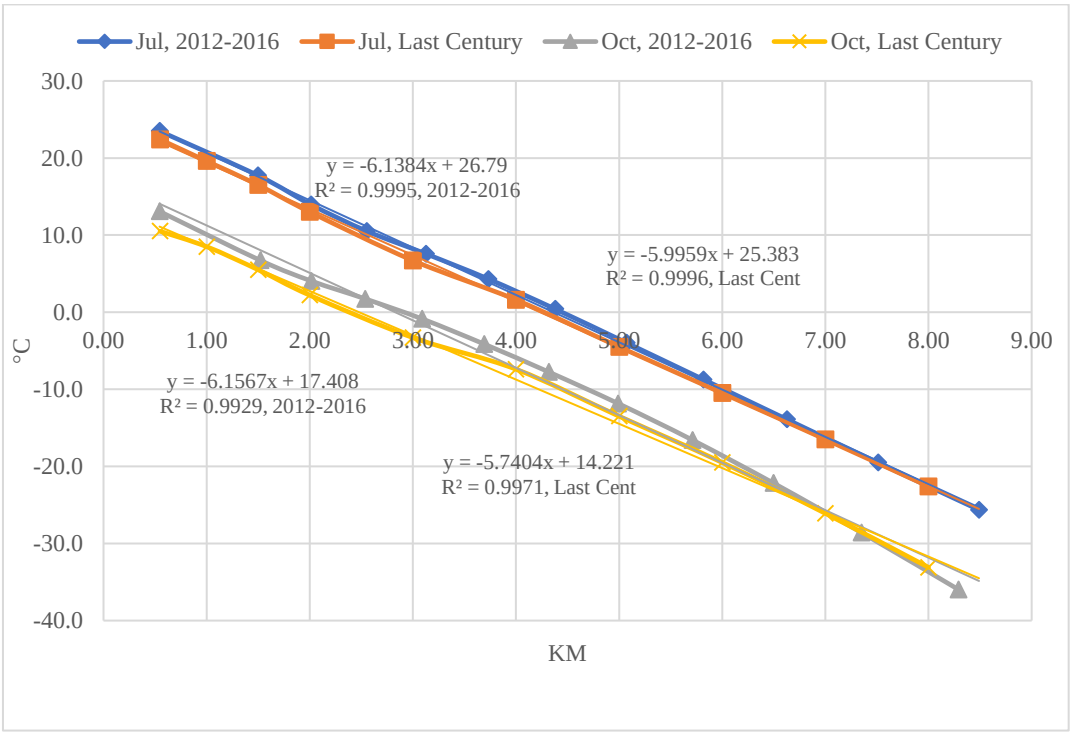

Fig. 4. Gradient of the vertical distribution of the average monthly values of the air temperature of above the territory of Kakheti during July and October 2012-2016 and 1958-1961 [2, 16].

As it follows from Table 1 and Fig. 1 during January the monthly average air temperature (T) linearly diminishes with 2.5 °C (range from -0.3 to 5.8 °C) on the earth's surface to -57.1 °C (range: -59.0 - -54.4°C) at the height of 10.2 km, then little it changes up to the height of 26 km (T = -57.6 °C, range: -64.4 -

-50.4 °C). In April the values of T linearly diminishes with 12.9 °C (range from 8.1 to 16.9°C) on the earth's surface to -54.6 °C (range: -56.4 - -52.2°C) at the height of 10.4 km, then little it changes up to the height of 26.3 km (T = -53.8 °C, range: -56.7 - -50.9°C).

As it follows from Table 2 and Fig. 1 in July the values of T linearly diminishes with 23.5 °C (range from 21.9 to 25.6°C) to -64.7 °C (range: -66.8- -62.0°C) at the height of 16.8 km, then it grows to -47.5 °C (range: -47.9 - -47.1°C) at the height of 26.9 km. In October the values of T linearly diminishes with 13.1 °C (range from 8.8 to 17.7°C) on the earth's surface to -57.4 °C (range: -62.4 - -53.7°C) at the height of 12.0 km, then little it changes up to the height of 20.6 km (T= -60.8 °C, range: -63.0 --59.2°C) °C) and then it grows to -53.4 °C (range: -55.5- -50.1°C) at the height of 26.4 km.

Vertical distribution of a difference of the maximum and minimum mean diurnal values of the air temperature above the territory of Kakheti in Fig. 2 are presented. As it follows from this figure maximum variations in the air temperature during January at the height of 26 km (14.0 °C), and minimum – in July at the height of 26.9 km (0.8°C) are observed.

Table 3

Average gradient of the vertical distribution of monthly values of the air temperature and mean height of zero isotherm above the territory of Kakheti

Parameter	January	April	July	October
Gradient, °/km	6.27	6.71	6.14	6.16
Ho, km	1.02	2.63	4.43	2.84

Average gradients of the vertical distribution of monthly values of the air temperature and mean height of zero isotherm above the territory of Kakheti in the Fig. 4 and Table 3 are presented. During July and October the monthly average height of zero isotherm is 4.43 and 2.84 km, which correspondingly is higher on 0.17 and 0.44 km than in 1958-1961. In July the average gradient of vertical distribution of monthly values of the air temperature during 2012-2016 is 6.14 °/km, and in 1958-1961 – 6.0 °/km. In October, these values respectively comprise 6.16 and 5.74 °/km. Thus, at present as at the end of the past century [12] also is observed the influence of the process of warming on the vertical distribution of the air temperature in eastern Georgia, on which on a small quantity of data it was noted in [18].

Conclusion

In the near future is planned conducting more detailed studies changeability of the vertical distribution of air temperature above Kakheti for all months of year, including decade, daily and hour variations. In particular, the indicated information is necessary for the optimum selection of rocket means with the works on the weather modification (fight with the hail, the regulation of atmospheric precipitations, etc.), construction of the detailed maps of the distribution of potential damage from the hail of agricultural crops, etc. taking into account the dimensions of hailstones in the clouds according to the data of radar measurements and height of locality.

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ჰაერის ტემპერატურის ვერტიკალური განაწილების საშუალოთვიური მნიშვნელობები 2012-2016 წლების ცენტრალურითვეებისთვის კახეთის (საქართველო) ტერიტორიაზე

ნ. ჯამრიშვილი, ხ. თავიდაშვილი

რეზიუმე

მოყვანილია მონაცემები კახეთის ტერიტორიაზე 2012-2016 წლების ცენტრალური თვეებისთვის ჰაერის ტემპერატურის დღე-ღამური სიდიდეების მნიშვნელობების ხუთწლიანი საშუალო მონაცემების ცვალებადობის შესახებ. წარმოდგენილია ჰაერის ტამპერატურის სტატისტიკური მახასიათებლები სხავადასხვა დონეზე 0.54კმ-დან 27კმ-მდე სიმაღლეთა დიაპაზონში. კერზოდ, მოყვანილია ჰაერის ტემპერატურის ვარტიკალური განაწილების საშუალოთვიური მონაცემები იანვარში, აპრილში, ივლისსი და ოქტომბერში; ჰაერის საშუალო ტემპერატურის გრადიენტის მნიშვნელობები მითითებული თვეებისთვის ატმოსფერის ფენაში 0.54კმ-დან 8,5კმ-მდე; ნულოვანი იზოთერმის სიმაღლის საშუალოთვიური მნიშვნელობა. შედეგად მივიღეთ, რომ 2012-2016 წლებში ივლისის და ოქტომბრის თვეებისთვის ნულოვანი იზოთერმის სიმაღლე შესაბამისად 0.215 და 0.506კმ-ით მაღლაა 1958-1961 წლებთან შედარებით.

Вертикальное распределение среднемесячных значений температуры воздуха над территорией Кахетии (Грузия) в центральные месяцы года 2012-2016 гг.

Н.К. Джамришвили, Х.З. Тавидашвили

Резюме

Приводятся данные об изменчивости средних пятилетних значений суточных величин температуры воздуха над Кахетией для центральных месяцев года для периода с 2012 по 2016 гг. Представлены статистические характеристики температуры воздуха на разных уровнях в диапазоне высот от 0.54 до 27 км. В частности, приведены данные о вертикальном распределении среднемесячных значений температуры воздуха в январе, апреле, июле и октябре; среднем значении градиента температуры воздуха для указанных месяцев в слое атмосферы от 0.54 до 8.5 км; среднемесячных значениях высоты нулевой изотермы. Отмечено, что высоты нулевой изотермы для июля и октября месяцев в 2012-2016 соответственно на 0.215 и 0.506 км выше тех же величин в 1958-1961 гг.