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THE DYNAMICS OF AVERAGE ANNUAL AIR TEMPERATURE  
CHANGES IN THE REPUBLIC OF ARMENIA

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In the article temporal and spatial variability of average air temperature in Armenia in 1961–2012 are analyzed. The long-term measurements data of air temperature from 41 stations of national meteorological services of RA have been studied and compared with baseline period (1961–1990). A graph of the change of mean temperature is built and a map of distribution of temperature changes is compiled.

**Keywords:** climate change, annual temperature, baseline period, deviation.

**Introduction.** The impact of climate change on annual temperature has received a great deal of attention by scholars widespread. Scientific evidence shows that climate change has begun to manifest itself, globally, in the form of increased downpours and storms, decreasing precipitation, rising temperature and sea level, retreating glaciers, etc. There are a lot of mathematical and statistical methods to analyze and evaluate the air temperature changes and one of them, which is very common and worldwide accepted, is comparison with “the baseline period (BP)”.

The World Meteorological Organization (WMO) accepted “the BP” conception, which includes the 1961–1990 period, for all meteorological elements for the purpose of carrying out climate change researches [1–6].

**Research Methods and Discussion.** In Armenia the dynamics of long-term average annual air temperature changes for the period 1961–2012 have been studied and evaluated not only graphically (Fig. 1), but also in absolute values (see Table). In order to illustrate the difference of changes we have divided the whole studying (1961–2012) period into 2 parts; the BP (1961–1990) and after that (1990–2012).

It has been surveyed and assessed the average annual air temperature data taken from 41 meteorological stations and prepared the graph in accordance with the results. We have attempted the average annual air temperature not only to compare with BP, but also to accomplish the graphical analyses following the trend of the Fig. 1.

It is obvious (Fig. 1) that from the beginning of the studied period till 1994 the temperature deviations are constantly changeable, but mostly having negative deviations (for instance, the negative deviations are observed in 1992 and 1993,

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–1.4 and –1.0°C respectively), but in last decade, since 1994 the norm deviations have been increased, while the maximum observed in 2010 (2.0°C) (Fig. 1).

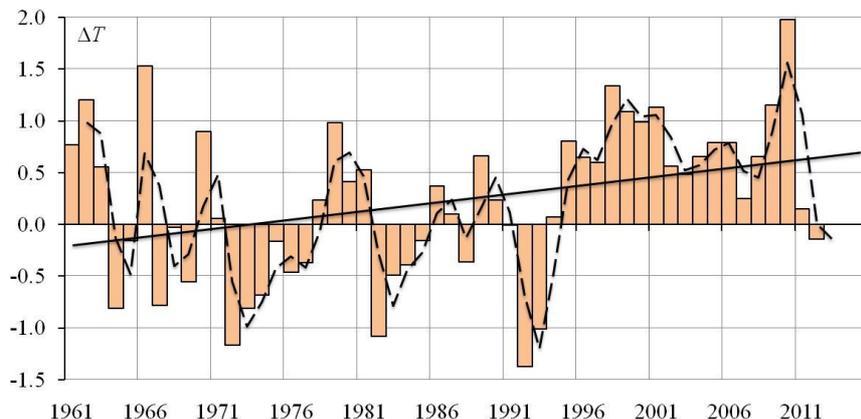


Fig. 1. The average annual air temperature (1961–2012) deviations comparing with baseline (1961–1990).

In Armenia according to the average trend (Fig. 1) (for period 1961–2012) the average air temperature has increased by 0.9°C comparing with the BP (the difference between the initial and final points of the line values).

*The differences of average air temperature of 41 meteorological stations in the RA*

Name	Periods		ΔT
	1961–1990	1991–2012	
The average air temperature, °C	7.5	8.1	0.6

The outcome has demonstrated that the average air temperature for studied period is 8.1°C in the territory of Armenia, while for the BP it is 7.5°C. The difference of these values can be defined as a temperature deviation, equal to 0.6°C (see Table).

The deviation is negative only for Ambert station (–0.2°C) located at 2000 m above. Positive deviations vary from 0 to 1.2°C. According to these results, it can be said that the average air temperature deviation (compared with the BP) is 0.5°C and higher in about 63% of the territory of Armenia, while for about 34% of the territory the average one is 0.3°C (Fig. 2).

From the studied stations only for three ones the deviations are viewed from 0 to 0.2°C (Hrazdan, Sevan and Gyumri). In the SW of Aragats massif (Talin and Aragats h/m) and Voghji Valley (Kajaran, Kapan) the deviations are between 0.2–0.4°C. For the remaining 33 stations the big deviations are obtained (which are higher than 0.4°C). In Ararat Valley it is 0.4–0.6°C, moreover, in Yerevan it is higher (0.5–0.8°C). For 4 stations the results are higher than 0.8°C (2 of them are located in the Ararat Valley (Yerevan “Arabkir” and Urtsadzor), and the other 2 are located in the north part of the country (Ashotsq and Bagratashen). The highest value is observed in Bagratashen (1.2°C), which has the lowest absolute height copairing with others.

It has also been revealed that the deviation is getting smaller from low altitudes to higher ones (for example, Shorja and Semyonovka stations).

Thus, in lowlands the deviation is bigger (Bagratashen and Yerevan “Arabkir” stations). This shows that the lower regions of the RA are much more vulnerable to the average air temperature changes.

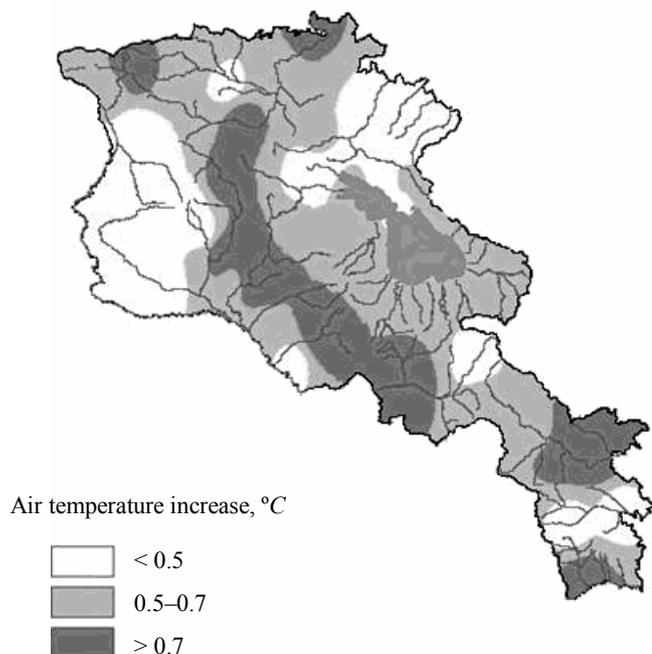


Fig. 2. The Schematic distribution map of the average annual air temperature (1991–2012) deviations comparing with BP (1961–1990).

This analysis allows us to have a clear idea about what is happening in the territory of Armenia. The results once again show that the long-term average air temperature has increased. If we compare this with the changes in global scale, this change almost coincides with the observed in average air temperature increase in the world, which increased by  $0.6 \pm 0.2^\circ\text{C}$  in the XX century [6].

**Conclusion.** According to our survey, in Armenia (for 1961–2012 period) the average air temperature has increased by  $0.9^\circ\text{C}$  comparing with the BP (the difference between the initial and final points of the line values). The average temperature has been increased by  $0.6^\circ\text{C}$  during 1990–2012 period comparing with baseline (1961–1990) period. According to the study, for 40 stations out of 41 ones are viewed definitely growing trends.

Furthermore, the deviation is getting smaller from low altitudes to higher ones. Thus, in lowlands the deviation is bigger. Obviously the lower regions of the RA are much more vulnerable to the average air temperature changes.

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ՕԳԻ ՏԱՐԵԿԱՆ ՄԻՋԻՆ ՋԵՐՄԱՍՏԻՃԱՆՆԵՐԻ  
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Ա մ փ ո փ ո մ

Հոդվածում քննարկվել են օդի միջին տարեկան ջերմաստիճանների տարածաժամանակային փոփոխությունները ՀՀ տարածքում: Ուսումնասիրվել են 41 օդերևութաբանական կայանների բազմամյա (1961–2012 թթ.) օդի միջին տարեկան ջերմաստիճանների շեղումների դինամիկան բազիսային ժամանակահատվածի (1961–1990 թթ.) նկատմամբ: Կառուցվել, վերլուծվել և գնահատվել են տրենդի գծերը, կազմվել է ՀՀ տարածքում օդի միջին տարեկան ջերմաստիճանների փոփոխությունների բաշխման սխեմատիկ քարտեզ:

Г. С. ГАЛСТЯН, Т. Г. ВАРДАНЯН

ДИНАМИКА ИЗМЕНЕНИЯ СРЕДНЕГОДОВЫХ ТЕМПЕРАТУР ВОЗДУХА  
В РЕСПУБЛИКЕ АРМЕНИЯ

Резюме

В статье обсуждены пространственно-временные изменения среднегодовых температур воздуха на территории РА за 1961–2012 гг. Выявлена динамика и оценен тренд отклонений многолетних среднегодовых температур воздуха от базисного периода (1961–1990 гг.) на 41 метеорологической станции. Составлена схематическая карта распределения изменений среднегодовых температур воздуха на территории РА.