

## THE MONTHLY AND ANNUAL AIR TEMPERATURE REGIMES IN THE VAD-BOROD DEPRESSION

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### **Abstract**

*The study of air temperature in the Vad-Borod depression is based on data recorded at the weather station located in the depression, that is, the Borod station. The data were obtained from the Archives of the National Meteorological Administration (ANM). The analysis of the thermal regime in the Vad-Borod depression covered a period of 50 years.*

*The multiannual mean of air temperature in the Vad-Borod depression is 9.6°C.*

*The highest annual mean air temperature value was recorded in 2019, 11.4°C, and the lowest was 8.1°C, recorded in 1985, which gives an amplitude of 3.3°C.*

*Over the year, the lowest monthly mean value is recorded in January, -1.1°C, and the highest in July, when it reaches 19.6°C, which gives an amplitude of 20.7°C.*

*Over the 50 years included in the study, negative deviation was recorded in 56% of the cases, while positive deviation was reported in 36% of the years.*

**Key words:** air temperature, negative deviations, positive deviations

### **INTRODUCTION**

The Vad-Borod depression is an intermontane depression in the north-west of the Apuseni Mountains, along the upper course of the Crișul Repede river. In the north-east the depression is surrounded by the Plopișului Mountains (Șes), in the south-east the Pădurea Craiului Mountains can be found, while in the west it opens wide towards the Western Plains (Posea, 1977; Pereș et al., 2019).

### **MATERIAL AND METHOD**

The analysis of the air temperature regimes in the Vad-Borod depression was conducted using the air temperature data recorded at the Borod weather station over a period of 50 years, between 1970 and 2019.

The Borod weather station was established on 1<sup>st</sup> December 1967 and it is located on a terrace of the Crișul Repede river in the Vad-Borod depression, at an altitude of 333 m, having the following geographical coordinates: north latitude 46° 59' and east longitude 22° 36' (Pereș et al., 2019).

## RESULTS AND DISCUSSION

### Annual mean air temperature

The thermal regime of air in the Vad-Borod depression is determined by the particularities of air circulation, of the radiative factors and of the subjacent surface (Pereş, Köteles, 2011, 2013, 2015).

The multiannual mean of air temperature for the 1970-2019 period in Borod is 9.6°C.

The particularities of the subjacent active surface, the differences in altitude between the intermontane depression and the high peaks it is surrounded by result in spacial variations of the multiannual mean of air temperature in the area included in the study (Dragotă, Gaceu, 2002; Ciulache, 2002; Cristea, 2003; Dumiter, 2007; Köteles, Pereş, 2010).

The highest annual mean air temperature value in the period included in the study was recorded in 2019, 11.4°C, in 2014 the mean was close, 11.3°C, while in 2018 the annual mean was 11.2°C. The lowest annual mean temperature was 8.1°C and it was recorded in 1985, a value close to this one was recorded in 1980 too, 8.2°C (Fig. 1).

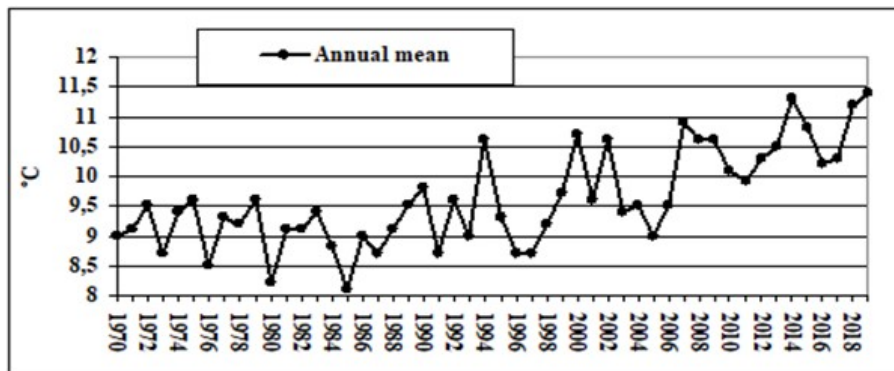


Fig. 1. Annual mean air temperature evolution in Borod, 1970-2019

According to the above data, over the entire area of the depression the variations of the annual mean temperatures are low, 3.3°C, a value which results from the difference between the highest annual mean temperature, (11.4°C in 2019) and the lowest annual mean temperature (8.1°C in 1985). This value is due to the moderating action of the peaks surrounding the depression.

### Deviations of annual mean air temperatures from the multiannual mean

The annual mean temperatures for the 1970-2019 period represent the „normal” or the multiannual middleness of temperature at the Borod

weather station, against which it is possible to show the direction and the value of deviations from one year to another. In order to highlight that, the deviations of annual values against the multiannual mean were calculated for the 1970-2019 period

Values higher than the multiannual mean were recorded in 36% of the years included in the study, the deviation values varied between 0.1°C and 1.8°C, the highest positive deviation being recorded in 2019, and the lowest in 1999 (Fig. 2).

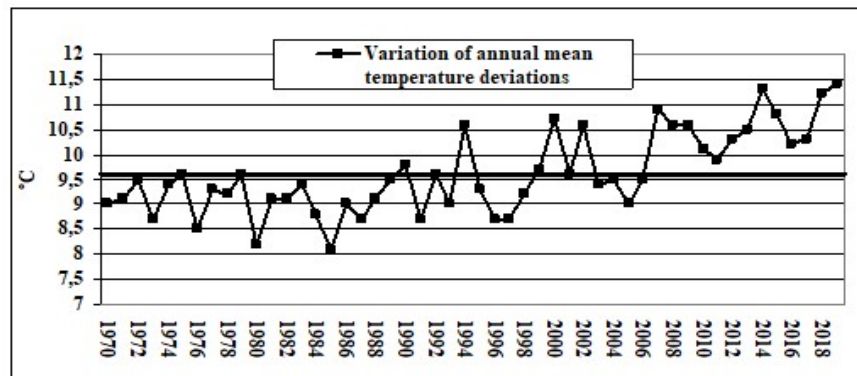


Fig. 2. Variation of annual mean temperature deviations against the multiannual mean in Borod, 1970-2019

Table 1

Multiannual mean temperature and the deviations of annual mean temperatures against the multiannual mean in Borod, 1970-2019

Multiannual mean temperature	Deviation
9.6°C	18 years – Positive deviations - 36%
	28 years – Negative deviations - 56%
	4 years – No deviations - 8%

Source: data provided for processing by the A.N.M. Archives

The years with negative deviations give the majority, 56% of the cases, and the negative deviations varied between -0.1°C and -1.5°C. The highest negative deviation was recorded in 1985 (the annual mean was 8.1°C), and the lowest 1972, 1989, 2004 and 2006 (with annual means of 9.5°C) (Fig. 2).

There were four years 1975, 1979, 1992 and 2001, when the annual mean value was equal to the multiannual mean, that is, 9.6°C (these were four years without deviations).

The four years give 8% of the cases, they are the ones with no deviations from the multiannual mean (9.6°C).

### Monthly mean air temperature

The monthly mean temperature varies according to the amount of solar energy reaching the surface of the Earth during a year.

The monthly mean temperature follows a natural pattern, it increases beginning with January, when the lowest monthly thermal mean is recorded, until July, a month with the highest monthly mean temperature, after which the monthly mean air temperature pattern is a decreasing one until the end of the year. So, the lowest monthly air temperature in Borod is recorded in January, with a mean value of  $-1.1^{\circ}\text{C}$ , and the highest in July, when it reaches  $19.6^{\circ}\text{C}$ , which gives an amplitude of  $20.7^{\circ}\text{C}$  (Fig. 3).

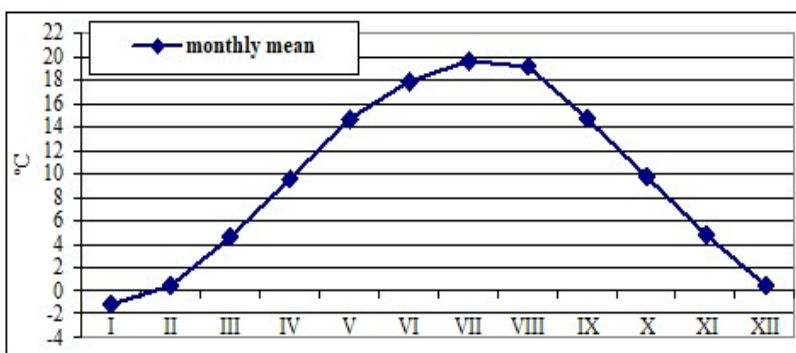


Fig. 3. Monthly pattern of air temperature in the Borod area, 1970-2019

Looking at the monthly mean thermal values in Borod, it can be seen that after reaching the lowest mean value in January, the temperatures start to increase beginning with February, when they become positive, then they reach the maximum in July, after which they will decrease until December.

The annual mean thermal amplitude of  $20.7^{\circ}\text{C}$  shows a lower degree of continentalism as compared with the eastern part of the country, where this value exceeds  $24 - 25^{\circ}\text{C}$ , and last but not least, the thermal moderator role of the landforms.

In winter, the mean temperature is negative only in January, while in December and February as compared to January the temperatures are higher by approximately  $1^{\circ}\text{C}$ , which is due to an intense cyclonic circulation. In January the cyclonic circulation is less active, while the anticyclonic circulation from north-east becomes stronger and the invasion of arctic or polar cold air leads to the lowest mean air temperature.

The winters in the Borod Depression are usually moderate, without strong frosts, due to the western circulation and due to the fact that it is more protected from the invasions of the polar air – continental from east and north-east (Gaceu, 2005).

In spring, due to the influence of the western circulation and the spreading of the ridge of the Azores High over the south of Europe, spring comes faster than in the depressions from the eastern part of the country, but later than in the plain areas, which is shown by the mean value of April: 9.6°C in Borod, as compared to 10.7°C in Oradea (Măhăr, 2001, 2006; Moza, 2009; Pereş, 2012).

In the summer, due to western influences and to the altitude of landforms, the air temperature is not too high, 19.6°C, as compared to 21.4°C in Oradea.

In autumn, beginning with September, the temperature decreases sharply, the annual means of these months vary between 14.6°C in September and 4.8°C in November. This cooling of the air temperature is due to the intensification of air cooling through radiative processes and to the increase of cold air advection as a result of the influence of the Siberian anticyclon.

The analysis of the months' thermal differences shows that the changes of mean temperature values from one month to another happen slowly in the summer and winter months (1-2°C), more obvious thermal contrasts occur in the months of the transition seasons (10°C).

## CONCLUSIONS

The multiannual mean of air temperature for the period included in the study is 9.6°C. The highest annual mean air temperature value was recorded in 2019, 11.4°C, and the lowest in 1985, 8.1°C. The variations of annual mean temperatures are relatively small, their amplitude is 3.3°C, which is the difference between the highest annual mean temperature (11.4°C in 2019) and the lowest annual mean temperature (8.1°C in 1985) for the period studied. This value is due to the moderating action of the peaks surrounding the depression.

The monthly mean temperature follows a natural pattern over the year, thus, the lowest mean air temperature in the Borod depression is recorded in January, a value of -1.1°C, and the highest in *July*, when it reaches 19.6°C, which gives an amplitude of 20.7°C.

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