Positive thermal anomalies from winter 2019-2020 in the Bâc river basin (Republic of Moldova)

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ABSTRACT: The purpose of our work is to highlight the warm character of winter 2019-2020, from the perspective of the spatial area of the Bâc river basin. The data regarding the temperature for the winter months (2019-2020) were extracted from the official website of the State Hydrometeorological Service. In order to determine the thermal characteristics, the daily temperatures of December (2019), January and February (2020) were analyzed from the four basin weather stations. The average air temperature for the winter season 2019-2020 constituted in the basin +1.6 - +3.3°C, being 4.3 - 5.4°C higher than the multiannual average and is reported for the first time during the entire observation period. According to the data of the Chişinău weather station (125 years observation period), the average air temperature for the winter 2019-2020 was +3.1°C (5.2°C higher than the norm) and placed on the 1st place in the range of years with high average temperatures for the respective season. In December 2019, the maximum air temperature rose in the basin to +18°C (December 18, Codrii Meteorological Station, Strășeni district), which in this decade is reported on average every 30 years. Very hot weather was reported in January and February (2020). Analogous winter after the thermal regime was 2006-07.

KEY WORDS: winter, thermal anomaly, Bâc river basin, warm weather, precipitation deficit.

1. Introduction

Air temperature is an important index of the weather regime. The oscillations of the flow of solar radiant energy corroborated with the oscillations of the other processes, which contribute to the heating of the underlying surface and the lower air layer, result in variations in time and space, particularly large, of temperature and pressure, depending on the non-periodic variations of precipitation (Mihăilă, 2014). The values measured at a height of 2 m above the ground (the instruments for determining the temperature are placed, according to WMO international norms, in meteorological shelters, so that the determinations on the entire surface of the Earth are comparable), give the characteristics of the distribution and the air temperature regime, specific to the territory of the Republic of Moldova (Ciulache, 2004; Constantinova, 1972).

The winter season 2019-2020 in the Republic of Moldova and including in the Bâc river basin, was abnormally hot and with a deficit of precipitation. The stable passage of the average daily air temperature through 0°C, that is the beginning and end of the meteorological winter, in this season was not observed, which is reported on average once in 5-10 years (http://old.meteo.md/newsait/iarna2020.htm). The high thermal regime, as well as the accentuated rainfall deficit, determined modest crops to cereals in the agricultural year 2020 (Meteorological statistics of the State Hydrometeorological Service).

2. Study area

This article reffers to the analisys of positive thermal anomalies from winter 2019-2020 in the Bâc river basin (Republic of Moldova). For obtaining these data there were used meteorological statistics of 4 basin stations: Cornești, Codrii, Chișinău and Bălțata (Fig. 1).

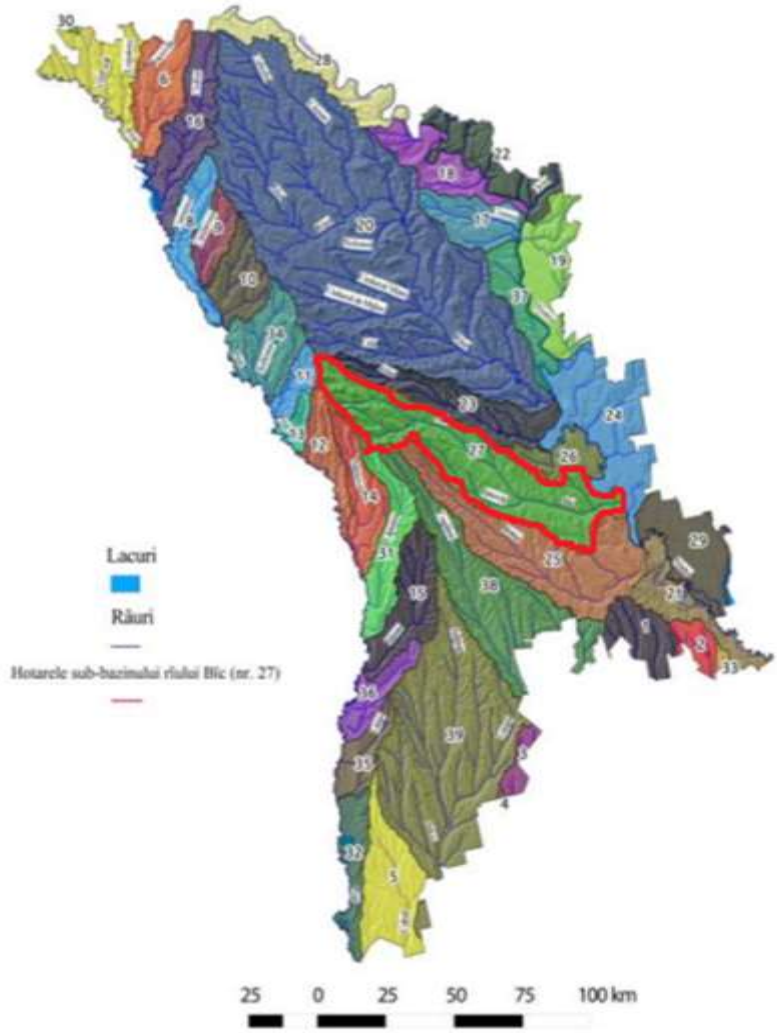

Figure 1 Geographical location of the Bac River Basin on the map of the Republic of Moldova (https://environment.md/ro/managementul_resurselor_de_apa).

3. Methods

The need to approach the thermal regime on the Bâc river basin derives from the fact that in 2020, through competition, funding was obtained for the research project of the State Program entitled: "Changes and spatio-temporal trends of environmental components in the Bâc river basin under anthropogenic impact", with the cipher 20.80009.7007.24. Thus, 4 meteorological stations were selected that are found in the respective river basin (SM - Cornești, Codri, Chişinău and Bălțata), in order to research the evolution of the thermal regime, according to the following climatic indices: diurnal average, maximum and minimum. For the analysis of thermal variations (deviations from the multiannual average, usually called norm), the multiannual average values of the mentioned indicators were used, for the period 1960-2019 (Meteorological statistics of the State Hydrometeorological Service). The temperature data for the winter months (2019-2020) were extracted from the official website of the State Hydrometeorological Service, www.meteo.md, archive section.

4. Results and discussion

From a meteorological point of view, the beginning of the winter season in the Republic of Moldova is considered the stable passage of the average daily air temperature by 0°C in the direction of its decrease, which is reported on average between November 28 (Briceni) - December 13 (Cahul) (Meteorological statistics of the State Hydrometeorological Service). However, depending on the particularities of the synoptic processes, in some years the date of winter establishment may deviate essentially from the average date. There are years in which there is no stable passage of air temperature through 0°C in the direction of its decrease, this phenomenon being observed in the north of the country on average once in 10 years, and in the rest of the territory - on average once in 4 years (Meteorological statistics of the State Hydrometeorological Service). The earliest winter for the entire period of instrumental observations on most of the territory was established on November 9, 1988. The average duration of the winter season ranges throughout the republic from 80 days in the south to 100 days in the north.

The processing and analysis of the values of the daily average temperature for the three months (December, January and February), gives us the opportunity to say that the monthly averages in winter 2019-2020, were positive, for example, in December 2019, the monthly average ranged from +3.05°C (SM Cornești, Ungheni District) to 2.48°C (SM Codrii, Strășeni District), in January 2020, the monthly average varied from 0.18°C (SM Bălțata, Călărași District) to 0.83°C (SM - Chişinău), and in February 2020 between 3.55°C (SM Codrii) and 3.82°C (SM Chişinău, Bălțata) (see figures no. 2, 3, 4). In general, for the winter 2019-2020, the diurnal thermal averages varied from 2.48°C (SM Chişinău) to 2.08°C (SM Codrii).

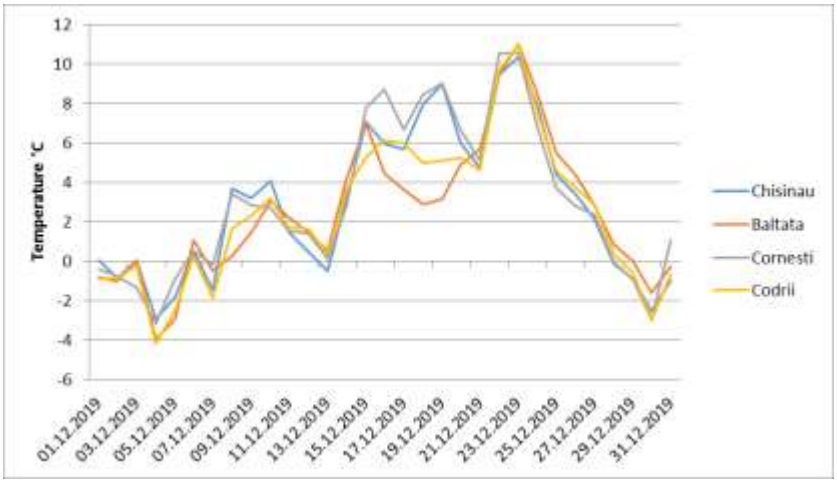

Figure 2 Diurnal thermal averages of December 2019, in the Bâc river basin.

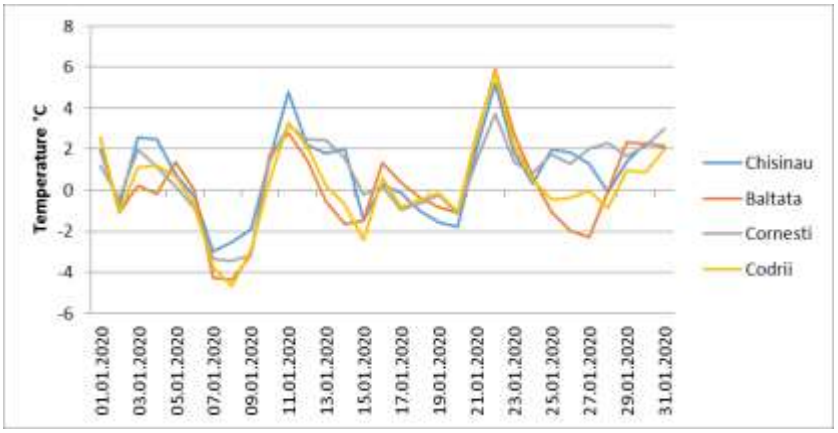

Figure 3 Diurnal thermal averages of January 2020, in the Bâc river basin.

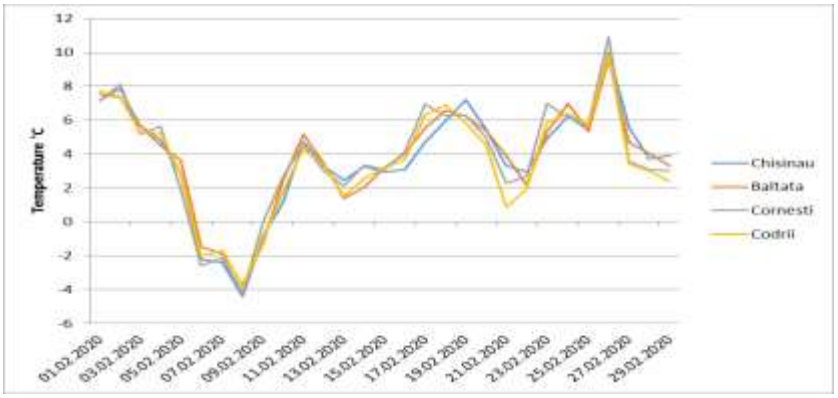

Figure 4 Diurnal thermal averages of February 2020, in the Bâc river basin.

The analysis of the maximum diurnal temperature from December 2019 established that they ranged between 13.8°C (SM - Bălțata on 22.12.2019) to 15.6°C (SM - Codrii on 18.12.2019) (Fig. 5).

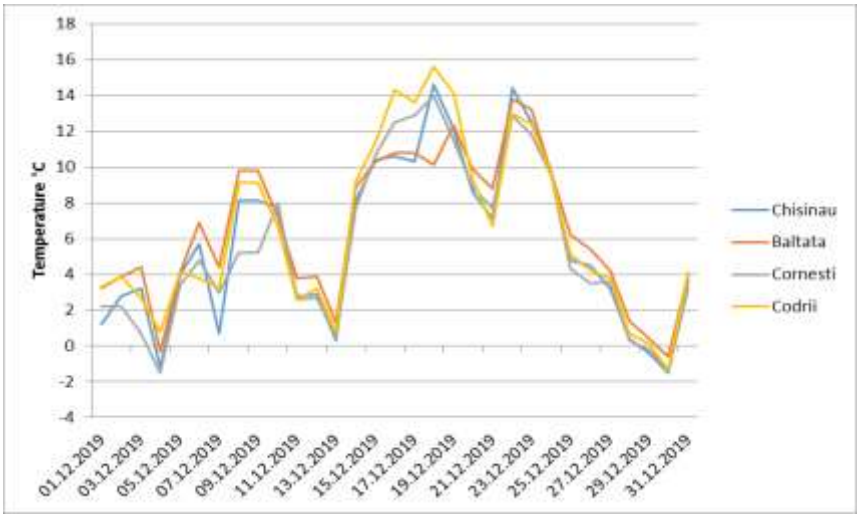

Figure 5 Maximum diurnal temperatures in December 2019.

The maximum diurnal temperature from January 2020 varied from 9.7°C (SM Cornești, on 22.01.2020) to 10.7°C (SM Bălțata and Codri on 22.01.2020). Negative values of the maximum temperature were recorded on January 7, 2020 and between January 18-20, 2020 (Fig. 6).

Figure 6 Maximum diurnal temperatures in January 2020.

The maximum diurnal temperature from February 2020 varied from 15.8°C (MS Chişinău on 26.02.2020) to 16.7°C (MS Codrii on 26.02.2020) (Fig. 7). The only negative values of the maximum temperature were reported on 06 and 08 February 2020.

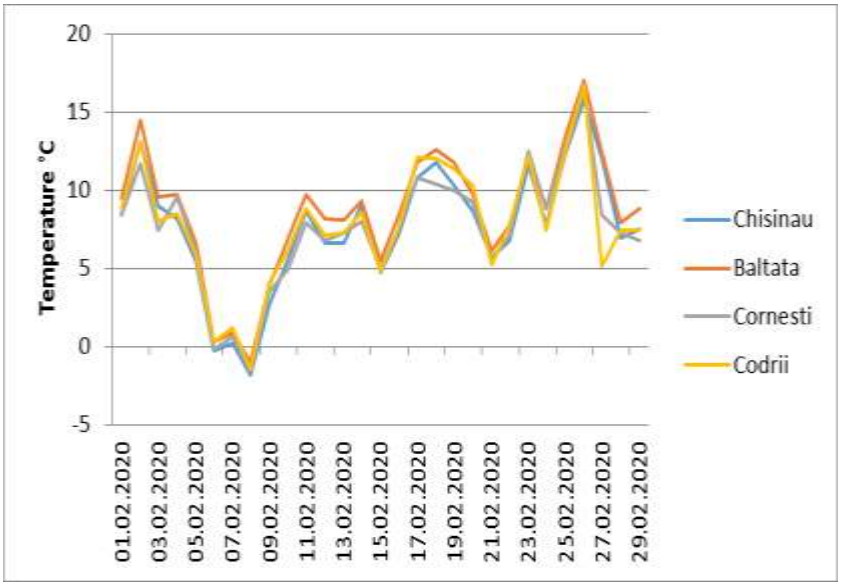

Figure 7 Maximum diurnal temperatures in February 2020.

If we analyse the values of the minimum diurnal temperature from December 2019, we find that they varied from -6.4°C (SM Cornești on 04.12.2019) to -9.2°C (SM Bălțata on 05.12.2019). In January 2020 they were between -5.5°C (SM Chişinău on 09.01.2020) and -9.4°C (SM Bălțata on 07.01.2020) (Fig. 8). The thermal minimums from February 2020 varying between -6.9°C (SM Codrii on 08.02.2020) and -7.9°C (SM Cornești on 08.02.2020).

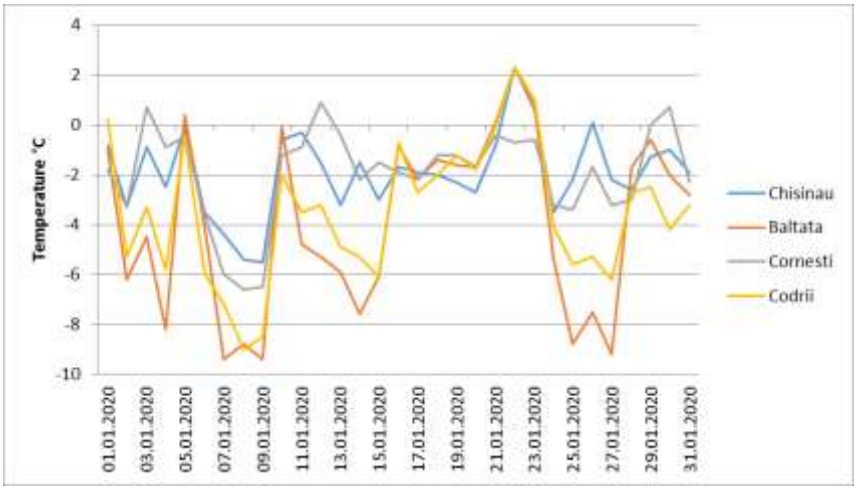

Figure 8 Minimum diurnal temperatures in January 2020.

According to the data of SM Chişinău (observation period 125 years) (Meteorological statistics of the State Hydrometeorological Service; http://old.meteo.md/arhivtemper.htm; Naucino-prikladnoi spravocinik po klimatu SSSR, 1990) the average air temperature for the winter season

2019-2020 was +3.1°C (5.2°C higher than the norm) and ranked 1st over the years with high average temperatures for the winter season (Fig. 9).

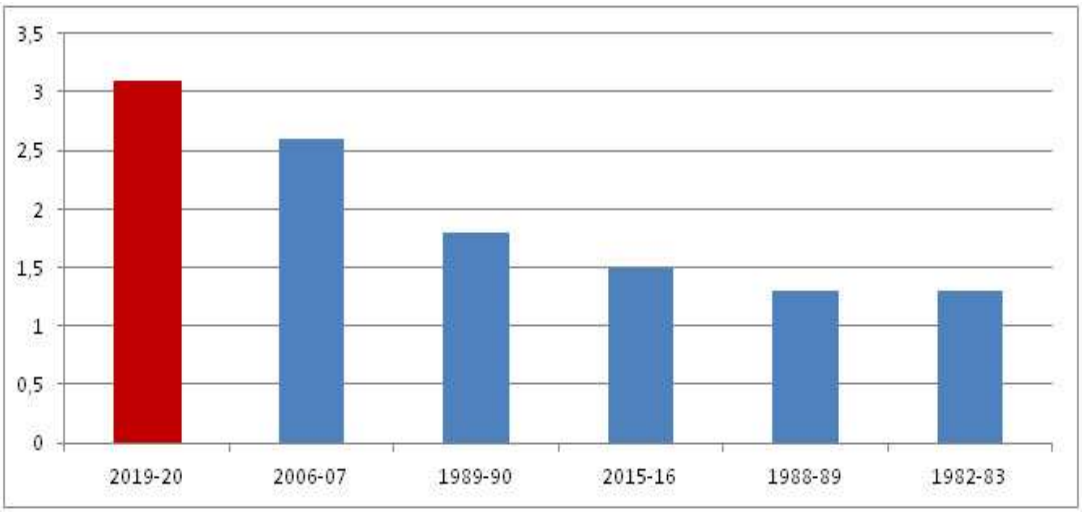

Figure 9 The range of years with high average temperatures for the winter season, SM Chişinău (after SHS, www.meteo.md).

Due to the high thermal regime on most of the Bâc river basin in the second and third decade of December, during the day, the weak vegetation of the autumn crops was reported. Autumn crops were in the third leaf and twinning phases. The decrease in the average daily air temperature at the end of December to +3°C and below interrupted the vegetation of autumn crops on most of the basin.

5. Conclusion

In the winter of 2019 - 2020 we could say that it is a direct effect of global warming. The measurements show that January 2020 was the warmest in the history instrumental measurements of the State Hydro meteorological Service of the Republic of Moldova. The general warm aspect of the weather, from that winter, is confirmed by the average temperature values, maximum and minimum. Thus, the average temperature of the three winter months, in the Bâc river basin, was 1.6-3.3°C, exceeding the multiannual average by 4.3-5.4°C. The population of the Bâc river basin, in the following decades will have to be aware and adapt to the respective thermal realities, especially those concerned with agriculture, which will have the opportunity to cultivate some thermophilic plants.

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