ABSOLUTE EXTREME AIR TEMPERATURES IN THE AREA OF ORADEA, BIHOR COUNTY

Pereş Ana Cornelia*, Borza Ioana*, **Mintaş Olimpia*, Domuţa Cristian***, **Köteles Nandor*, Bajo Janos***

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048 Oradea, Romania, e-mail: peresana35@yahoo.com; borzaioanamaria@yahoo.com; buzasiu@yahoo.com; cristian_domuta@yahoo.com; kotelesnandor@yahoo.com; janosbajo@yahoo.com

Abstract

The study of extreme air temperatures in the area of Oradea is based on data recorded at the Oradea weather station. The analysis of the thermal regime in the area of Oradea covered a period of 51 years The data were extracted from the archives of the National Meteorological Administration (ANM).

The analysis of the air temperature regime was based on the extraction of extreme values (absolute minimums and maximums), which represent the possible variation limits of the element.

The absolute maximum air temperature at the Oradea weather station was 40.4ºC, it was recorded on 20 July 2007. The annual absolute maximum occurs mainly in July, 41.7% of the cases, which means 24 years out of the 51 included in the study. The absolute minimum air temperature value was -22,5ºC and it was recorded on 13 January 1987. The annual absolute minimum occurred in Jnanuary in most years included in the study, with a frequency of 51%.

Key words: air temperature, absolute maximum, absolute minimum

INTRODUCTION

Located on Crişul Repede river, the city of Oradea lies in an area where the Bihariei Plain, Borşului Plain (parts of the Crişurilor Plains), Oradea Hills and Tăşadului Hills (parts of the Crişene Hills) meet. The Crişurilor Plains and the Crişene Hills belong to a transition area from the Someşului Plain to the Silvano-Someşene Hills in the north, towards the Banatului Plain and Hills in the south, which result in a large diversity of geographical aspects (Posea, 1977; Berindei et al., 1977).

MATERIAL AND METHOD

Analysis of extreme temperatures in the area of Oradea was conducted using data recorded in meteorological observation tables at Oradea weather station. The air temperature data used in the study were recorded over a period of 51 years (1970 – 2020) during instrumental observations performed at the weather station.

RESULTS AND DISCUSSION

Air temperature is one of the most important climatic parameters which undergoes spatial-temporal changes as a result of the interaction of climatogenic factors (Pereş, Köteles, 2011, 2013, 2015).

The average of daily maximum values in Oradea calculated for a period of 51 years, 1970 – 2020, is 16.4ºC.

The montly averages of daily maximum temperatures are positive over the whole year, beginning with March the maximum temperature averages start to increase gradually, due to the increase in the intensity of solar radiation, the averages reach the highest values in July and August, after which they decrease gradually until December. In the period included in the study there were also months with negative averages of the maximum temperatures, in some of the winter months, but this did not happen on a regular basis. Thus, the lowest average of daily maximums was -3.2ºC, it was recorded in February 1985. The highest average of daily maximums for winter months was recorded in February 1998, a value of 11.0ºC.

The annual values of maximum averages fluctuated from one year to another, the lowest value being recorded in 1978, 14.0ºC, and the highest one, 18.7ºC, in 2000, which gives a multiannual amplitude of 4,7ºC.

In the area of Oradea the average of multiannual thermal minimums is 5.9ºC. The average of multiannual monthly minimum temperatures is negative from December to February.

The annual values of minimum averages fluctuated from one year to another, the lowest value being recorded in 1979, 0.5ºC, and the highest in 2014, 8.1ºC, which gives a multiannual amplitude of 7.6ºC.

Absolute extreme air temperatures

Althoug they occur randomly, extreme temperatures have a significant practical and theoretical importance, as they show the possible limits within which temperatures can vary from the warm season of the year to the cold one (Costea M., 2014). These temperatures have a relative character, that is, they depend on the length of the monitoring interval and they are determined by the circulation of air masses, as well as the local conditions (Dragotă, Gaceu, 2002; Cristea, 2003; Köteles, Pereş, 2010).

Absolute maximum temperature

It represents the maximum value recorded during the entire monitoring period, at a certain moment. Just like the minimum temperature, it occurs randomly, showing the air temperature value which can be reached or even exceeded.

The absolute maximum temperature at the Oradea weather station was recorded on 20 July 2007, the value of 40.4ºC (Table 1).

Table 1

Variation of monthly and annual absolute maximum temperatures in Oradea, 1970 – 2020

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
tºC	17.4	19.0	26.4	31.0	32.9	37.8	40.4	40.0	36.6	30.5	26.0	17.9	40.4
Date	07.01	25.77	22.74	30.12	28.00	23.00	20.07	21.00	07.08	01.12	08.97	09.06	20.07.2007

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

At the Oradea weather station the annual absolute maximum temperature is recorded primarily in July, with a frequency of 47.1%, which means 24 years out of the 51 included in the study. A high frequency can be seen in August too, 43.1%, (22 years), the frequency in June is 7.8%, and in September 2.0% (Table 2).

Table 2

Absolute maximum values and the dates when they were recorded in Oradea (1970 – 2020)

Month	June	July	August	September
Annual absolute maximum (ºC)	37.8	40.4	40.0	36.6
Date	23.2000	20.2007	21.2000	07.2008
Frequency (%)	7.8%	47.1%	43.1%	2.0%

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

In the case of winter months, the absolute maximum temperatures are positive in each year. Thus, the absolute maximum value for the cold season was recorded in February, when the temperature in Oradea reached 19.0ºC on 25 February 1977. The winter month with the highest number of years (26) in which the air temperature reaches the highest values is February, which gives a frequency of 51%, followed by December with a frequency of 39.2%.

In spring, the absolute maximum seasonal temperatures are recorded in most cases in May, with a number of 47 years out of the years included in the study, which gives a frequency of 92.2%. The highest air temperature value recorded in a spring month was 32.9ºC, on 28 May 2000. In April, the absolute maximum values occurred in 3 years, with a frequency of 5.9%, and in March their frequency is 2%.

In autumn, the highest air temperatures are recorded in September, when they reach a frequency of 94.1% (48 years). In September the annual absolute maximum value, 36.6ºC, is recorded on 7 September 2008. Maximum temperatures occur in October too, but with a much lower frequency, 5.9% (3 years).

A comparative analysis of the monthly absolute maximum air temperature values and of the monthly average values reveals that there are big differences between them, which shows that the absolute maximum values occur randomly.

The highest air temperature values were determined by the random invasion of the dry hot continental tropical air carried here as a result of the extension of the North African Anticlyone or that of the Arabian Penisula (Ciulache S., 2002; Dumiter A. F., 2007; Moza A. C., 2009; Pereş A. C., et al., 2020).

Absolute minimum temperature

It represents the lowest air temperature value recorded during the monitoring period of the weather station.

In the case of the Oradea weather station, the absolute minimum air temperature value was -22.5ºC, and it was recorded on 13 January 1987 (Table 3).

Table 3

Variation of monthly and annual absolute minimum temperatures in Oradea, 1970 – 2020

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
tºC	-22.5	-21.6	-16.0	-6.2	-0.6	1.9	6.1	4.4	-1.9	-12.1	-18.9	-21.2	-22.5
Date	13.87	23.83	05.96	09.97	01.76	04.77	20.96	26.80	29.70	13.71	29.95	25.01	13.01.1987

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

The absolute minimum temperatures show negative values in the cold season and in the transitional one, while in the summer these values are positive. The values vary between -22.5ºC, a value recorded on 13 January 1987 and 6,1ºC, recorded on 20 July 1996.

In the summer, the absolute minimum value over the 51 years included in the study was recorded in June, that is, 4 June 1977, 1.9ºC. The highest absolute minimum value of the summer occurred in July, that is, 20 July 1996, 6.1ºC.

In wintertime, the absolute minimum occurred on 13 January 1987, -22.5ºC, in February this value was -21.6ºC, while in December the absolute minimum was -21.2ºC (Table 3).

In spring, the absolute minimum was -16ºC, it was recorded on 5 March 1996.

At the Oradea weather station, the annual absolute minimum was recorded primarily in January, with a frequency of 51%. Thus, in January during the 51 years included in the study the annual absolute minimum occurred in 26 years. In February and December the frequency is 19.6%, which means 10 years, while in November their frequency is 7.8% (Table 4).

Table 4

Absolute minimum values and the dates when they were recorded in Oradea, 1970 – 2020

Month	I	II	III	XI	XII
Annual absolute minimum (ºC)	-22.5	-21.6	-16.0	-18.9	-21.2
Date	13.1987	23.1983	05.96	29.1995	25.2001
Frecquency (%)	51%	19.6%	2%	7.8%	19.6%

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

The lowest thermal values occur due to the invasion of the cold Arctic air, carried by anticyclones: the East-European or the Scandinavian Anticyclone, synoptic situations during which the sky clears up, which favours nocturnal radiation, helped to a great extent by the snow (Măhăra Gh., 2001, 2006; Gaceu O., 2005; Pereş A. C., 2012; Pereş A. C., et al., 2019).

CONCLUSIONS

The absolute maximum temperature at the Oradea weather station was recorded on 20 July 2007, the value of 40.4ºC. The annual absolute maximum is recorded mainly in July, with a frequency of 47.1%.

The absolute minimum air temperature value was -22.5ºC, it was recorded on 13 January 1987. In the years included in the study, the annual absolute minimum was recorded primarily in January, with a frequency of 51%.

REFERENCES

1. Berindei O., Pop Gr., Măhăra Gh., Posea A., 1977, Câmpia Crişurilor, Crişul Repede, Ţara Beiuşului, Cercetări în geografia României, Editura Ştiinţifică şi Enciclopedică, Bucureşti.
2. Ciulache S., 2002, Meteorologie şi climatologie, Editura Universitară Bucureşti.
3. Costea M., 2014, Analiza statistică pentru ştiinţele mediului, Editura Universităţii din Oradea
4. Cristea M., 2003, Temperatura aerului în bazinul hidrografic al Crişurilor, Analele Universităţii din Oradea, Seria Geografie, Tom. XIII, pag.77-80.
5. Dragotă C., 1995, Tendinţa de evoluţie şi probabilitatea de producere a îngheţului în Câmpia Crişurilor, Analele Universităţii din Oradea, Seria Geografie, Tom.V, pag. 98-104.
6. Dragotă C., Gaceu O., 2002, Consideraţii asupra temperaturilor extreme în Munţii Bihor şi Vlădeasa, Universitatea „Ovidius" Constanţa.
7. Dumiter A. F., 2007, Clima şi topoclimatele oraşului Oradea, Editura Universităţii din Oradea.
8. Gaceu O., 2005, Clima şi riscurile climatice din Munţii Bihor şi Vlădeasa, Editura Universităţii din Oradea.
9. Köteles N., Pereş A. C., 2010, Air's temperature at surface of the soil (level 0 m), in the area of Oradea city. Analele Universităţii din Oradea, Fascicula Protecţia Mediului, Vol. XIV, Anul 15, International Symposium "Risk Factors for

Environment and Food Safety", Faculty of Environmental Protection, November 5 - 6, Oradea 2010, Editura din Oradea, 2010, ISSN 1583-4301, pag. 821-828.
10. Măhăra Gh., 2001, Meteorologie, Editura Universităţii din Oradea.
11. Măhăra Gh., 2006, Variabilităţi şi schimbări climatice, Editura Universităţii din Oradea.
12. Moza A. C., 2009, Clima şi poluarea aerului în bazinul hidrografic Crişul Repede, Editura Universităţii din Oradea.
13. Pereş A. C., Köteles N., 2011, The Yearly and Monthly Average Temperature of the Air in Borod Depression, Analele Universităţii din Oradea, Fascicula Protecţia Mediului, Vol. XVII, Anul 16, Editura Universităţii din Oradea, 2011, ISSN 1224-6255, pag. 809-814.
14. Pereş A. C., 2012, Meteorologie şi climatologie, Editura Universităţii din Oradea.
15. Pereş A. C., Köteles N., 2013, The Thermic Regime of the Crişurilor Plain, Natural Resources and Sustainable Development, University of Oradea Publishing House Oradea, ISBN 978-3-902938-02-2; ISSN 2066-6276, pp. 399-404.
16. Pereş A. C., Köteles N., 2013, The frequency of the days with different temperature values from Holod inter hillock hollow area, Analele Universităţii din Oradea, Fascicula Protecţia Mediului Vol. XXI, Anul 18, Editura Universităţii din Oradea 2013, ISSN 1224-6255, pag. 671-676.
17. Pereş A. C., Köteles N., 2015, Extreme Temperatures in the City of Oradea, Analele Universităţii din Oradea, Fascicula Protecţia Mediului Vol. XXV, Anul 20, Editura Universităţii din Oradea 2015, ISSN 1224-6255, pag. 261-266.
18. Pereş A. C., Costea M., Amarie S., Bodi R., 2019, Absolute Extreme Air Temperatures in the Vad-Borod Depression, Analele Universităţii din Oradea, Fascicula: Protecţia Mediului Vol. XXXIII, Anul 24, Editura Universităţii din Oradea, ISSN 1224-6255, pag. 207-210.
19. Pereş A. C., Köteles N., Domuţa C., Amarie S., 2020, The Monthly and Annual Air Temperature Regimes in the Vad-Borod Depression, Analele Universităţii din Oradea, Fascicula: Protecţia Mediului, doi.org/10.5281/zenodo.4362307, Vol. XXXV, Anul 25, Editura Universităţii din Oradea 2020, ISSN 1224-6255, pag.229-234
20. Posea A., 1977, Crişul Repede, în vol. „Câmpia Crişurilor, Crişul Repede, Ţara Beiuşului". Cercetări în Geografia României, Editura Ştiinţifică şi Enciclopedică, Bucureşti.