FREQUENCY OF DAYS WITH VARIOUS CHARACTERISTIC TEMPERATURES IN THE AREA OF ORADEA CITY

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Abstract

The geographical position of Oradea city, located perpendicularly on the direction of movement of air masses from the West, location in the West Field, in the West of Apuseni Mountains and of West Hills, having a large opening, on the valley of Crişul Repede, towards the field, gives to this area a moderated thermal regime, illustrated through multi-yearly average temperatures of 11ºC.

It is of special practical importance the analysis of frequency of days with various characteristic temperatures. Next to the variations of other climate elements, this thermal parameter emphasizes the high variability of climate conditions from the area of Oradea city. The temporal succession of air masses with various thermal features is also emphasized by the frequency of days in which the air's temperature reaches a certain thermal limit, this succession influencing, in its turn, also the variability from one year to another of days with various temperatures.

Key words: air's temperature, thermal limits, frosty nights.

INTRODUCTION

The air's temperature is one of the main meteorological elements which affect the human activity and which, when its values reach the extreme variation limits, they cause a skin bioclimate stress on the skin. This takes place in the extreme seasons, during the winter, when incomfort days occur due to cool weather and during the summer when the skin stress is due to excessive heating of air.

The numerous profile researches done in various regions of the world allowed to draw certain general conclusions on the yearly average thermal superiority of the city.

One conclusion would be that the thermal differences beteen the city and the surroundings are directly proportional to the respective city's size. Of course, deviations from this rule were notices, but in most of the cases, the methodologies of measurement were responsible.

The thermal differences between the city and the surroundings appear more clearly in the number of days with characteristic temperatures.

The highest differences (up to 30%) occur in case of the number of frosty days (temperature min $\leq$ 0ºC), this especially due to the fact that during the sprins and the summer, during a clear sky, in rural localities frequently take place night radiative frosts which cannot take place in the city due to the mist or artificial heatening.

The winter days (maximum temperature of $\leq$ 0ºC) usually follow the invasion of cold air from polar regions, so that the influence of the city cannot significantly compensate the important decreases of temperature which thus ocurr.

The number of summer days (temperature max. $\geq$ 25ºC) is generally higher in the cities, as it may be concluded if we take into account the specific of calorific balance of urban active surfaces.

MATERIAL AND METHODS

In order to emphasize the variations in time of frequencies of days with characteristic temperatures, in the area of Oradea city the data from instrumental observations from the weather forecast station were used, on a period of 11 years, respectively for the interval 1998-2008. The data was processed with the help of statistical – mathematical methods, and the results obtained were then graphically transposed in order to clearly emphasize the variability in time of days with various temperatures.

RESULTS AND DISCUSSION

Frosty nights, with minimum temperatures of ≤ - 10°C

Frosty nights, minimum temperatures ≤ - 10°C, are registered in the area of Oradea city in the cold season, especially in the month of February, when their maximum number is also registered. Due to frequent advections of cold air from the North, North-West and especially North-East of the continent, characteristic to anti-cyclone regimes, the frosty nights may also be registered at the beginning of transitions seasons. Thus, in the month of March, such cases were also registered.

In the month of January, the multi-yearly average number of frosty nights is of 3.5, the maximum number being registered in the year 2003 when 8 such nights were registered. In the month of February, the multi-yearly average of frosty nights is of 3.5, the maximum number registered being of 17 days, in the year 2003. During the month of December an average number of 3.2 days is registered, the maximum number being of 12 days in the year 1998 (see figure 1).

An especially practical significance is represented by the knowledge of the number of frosty nights from the transition seasons, these representing risk factors for fields such as agriculture, constructions, transportation, and not the least for the human health. The number of frosty nights in the month of March is, in average, of 0.5 days a year, and at the level of the year 2005 registered 3 cases were in which the minimum temperature decreased under -10°C.

The yearly maximum number of frosty nights in Oradea, for the period 1998-2008 was of 27 frosty nights in the year 2003. We have to notice that in the area of Oradea city there are years when these frosty nights may not ocurr, as the case of the year 2007, when the minimum temperature did not decrease below -10°C in any days.

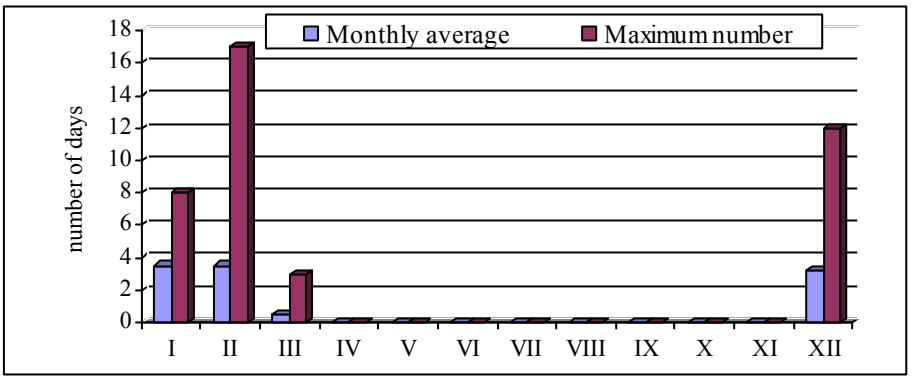

Figure 1 The evolution of monthly maximum and average number of frosty nights in Oradea, during 1998-2008

Winter nights, with maximum temperatures ≤ 0°C

The winter days, with maximum temperatures ≤ 0°C have in the area of Oradea city a higher frequency than the frosty nights. The presence of days in which the air's temperature has only negative values is determined by advections of air masses from the North and, especially from the North-East of the continent, cold and dry air masses, characterized by a high stability, fact which allows the stagnation during a longer period on a territory, where the cooling process through radiation phenomena continues.

The winter days are present not only during the cold season, in the months of December, January and February, but also in the transition seasons. From the months of winter, the highest number of winter days is registered in January, with an appearence average of 9.5 days, the largest number of winter days being registered in the month of January of the year 2000, when there were 18 days in which the air's temperature registered only negative values. For the month of February, the yearly average number of winter days is of 5.5 days, with a maximum number registered in the year 2003, when there were 17 days of winter (see figure 2). A larger frequency is registered in the month of December, when the average number of winter days is of 7.5, the maximum number being registered in the year 2001, when there were 18 days in which the daily maximum temperature was negative.

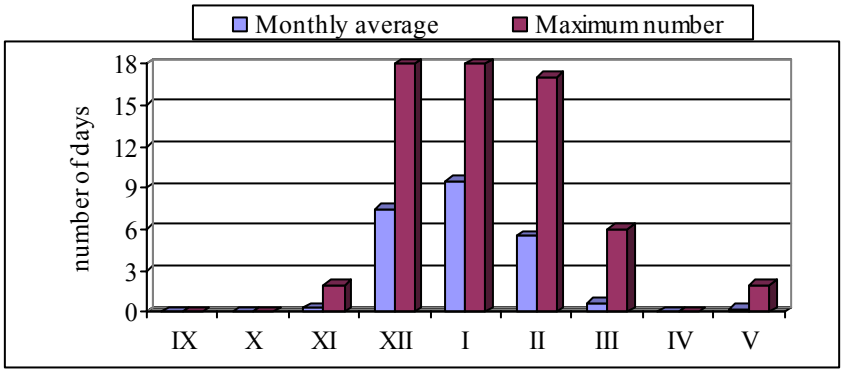

Figure 2 The evolution of monthly maximum and average number of winter days, in Oradea, during 1998-2008

In the transition seasons, winter days may be encountered in March, May and November. For the month of March, the multi-yearly average number of winter days is of 0.7, with a maximum registered in the year 2005 (6 winter days). In the month of May, the multi-yearly average number of winter days is of 0.2, the maximum number of such days being of 2 (2007). In the month of November, the multi-yearly average number is of 0.3, the maximum number being of 2 days (2001).

Days with frost, with minimum temperatures of ≤ 0°C

The days with frost, minimim temperatures of ≤ 0°C, are more frequent in the area of Oradea city, being also registered during September-October. Their maximum frequency is registered during the winter months, with a multi-yearly average of 21.9 days in January, 18.8 days in February and 21.6 days in December.

The data on frosty days registered in the transition seasons have practical importance, because the registration of temperatures below 0°C, represents a risk factor for some agricultural cultures.

At the level of the months of March and November, the days with frost have a multi-yearly average of ocurrence of 12.2 and, respectively 10.5 days, in the period studied being registered each year days with frost in both months. The maximum number of days with frost in the month of March was of 23 days in 1998, and during the month of November, the maximum number of days with frost was of 18, registered in the year 2001 (see figure 3).
Certain cases in which the daily minimum temperature decreased below 0°C were registered also in the months of April and October. These have a casual character, their frequency being more reduced, existing the probability of their ocurrence when over the West part of Romania cold air masses of polar-arctic origin appear. In the month of April, the ocurrence average of days with frost is of 1.7. The multi-yearly average number of days with frost in the month of October is of 2.

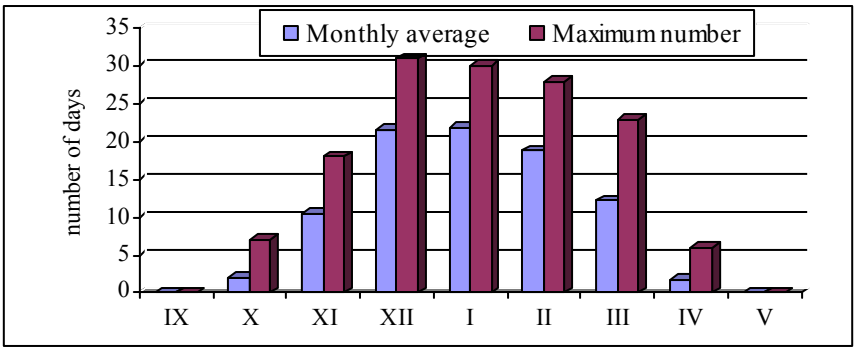

Figure 3 The evolution of monthly maximum and average number of days with frost in Oradea, during 1998-2008

The highest number of days with frost in Oradea was registered in the year 2003 when there were 115 such days. The minimum number of days with frost is of 61, registered in the year 2007.

Days of summer, with maximum temperatures of ≥ 25°C
The days of summer, with maximum temperatures of ≥ 25°C, are registered in the area of Oradea city from April until October. The maximum frequency of these days is registered in the warm season of the year. The knowledge of number of days in which the air's temperature is higher than 25°C, has a practical importance, especially in agriculture, but also in the field of human health, especially when these ocurr in the transition seasons, alternatively with the cooler periods.
The monthly maximum number of summer days is registered in the month of July with a multi-yearly average number of 25 summer days and in the month of August with a multi-yearly average number of 24.7. The minimum number of summer days for the month of July was of 20 such days registered in the year 1998, and for the month of August, the monthly minimum number was of 15 days of summer registered in the year 2006 (see figure 4).

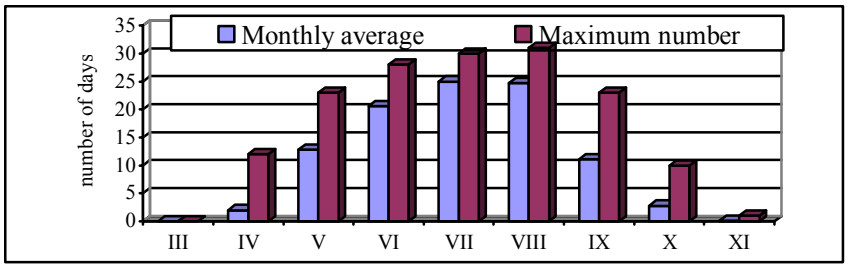

Figure 4 The evolution of maximum and average number of summer days in Oradea, during 1998-2008

For the months of transition period, their frequency is more reduced. In the month of April, the average number of summer days is of 2, and the maximum is of 12 days, registered in the year 2000. An extremely reduced frequency is registered in the month of November only when in the year 2008 only one summer day was registered.

We also notice that during the year 2000 a record value for the area of Oradea city took place, the yearly number of summer days being of 122. This fact is due to advections of hot air masses, with tropical-maritime and tropical-continental origin, which had a high frequency during the entire period of the year.

Days with maximum temperature ≥ 30°C (tropical days)

The frequency of tropical days is maximum in the warm season, the monthly interval in which these days may occur ranging between the months of May and September. The main cause of ocurrence of daily maximum temperatures higher than 30°C is the advection of warm air masses from the South of continent, masses of tropical origin.

The highest monthly average number is registered in the month of July with a multi-yearly frequency of 10.8 zile. The highest number of tropical days in the month of July belongs to the year 2006 when 21 such days were registered. In the month of August, the average multi-yearly number registers a value of 9.9 days, and the largest number of tropical days ocurred in the year 2003 when there were 20 such days. In the months of May and September, the average number of tropical days is of 2.5, respectively 0.7. Cthe highest number of tropical days in the month of May belongs to the year 2003, when 10 tropical days were registered. For the month of September, the highest number of tropical days was registered in the year 2008, respectively 5 tropical days (see figure 5).

The average multi-yearly number of tropical days is of 31.7 days, the yearly maximum number of days in which the maximum temperature reached 30°C being of 58, in the year 2003, and the lowest number of these registered days in a year was of 4 days, in the year 2000.

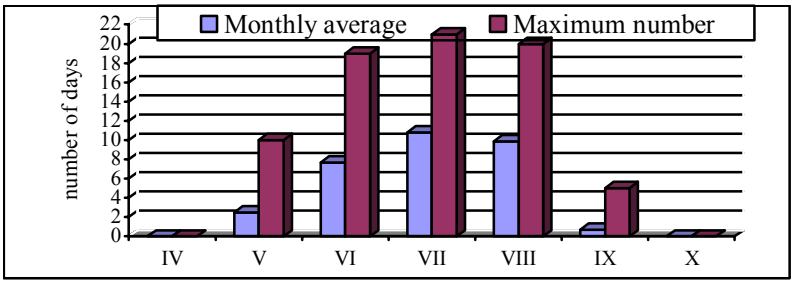

Figure 5 The evolution of monthly maximum and average number of tropical days, in Oradea, during 1998-2008

CONCLUSION

The nights with frost, minimum temperatures of ≤ - 10°C, are registered in the area of Oradea city in the cold season, especially in the month of February, when their maximum number is registered, respectively the multi-yearly average is of 3.5, and the maximum number registered was of 17 days, in the year 2003.

The days of winter register a higher frequency than in the nights with frost. These are presented not only in the cold season, but also in the transition seasons. The largest number is registered in January, with an average of ocurrence of 9.5 days, and the maximum number was registered in the month of January of the year 2000, when there were 18 days in which the air's temperature registered only negative values.

In the area of Oradea city, the days with frost may be also registered in the period September-October. Their maximum frequency is registered in the winter months, with a multi-yearly average of 21.9 days in January.

The days of summer, with maximum temperatures ≥ 25°C are registered from April to October. The maximum frequency is registered in the hot season of the year, respectively in the month of July, with a multi-yearly average number of 25 days.

The frequency of tropical days is maximum in the hot season, the monthly period in which these days may ocurr ranging between the months of May and September. The largest monthly averafe number is registered in the month of July with a mult-yearly frequency of 10.8 days.

REFERENCES

1. Berindei O., Gr. Pop, Gh. Măhăra, A. Posea, 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. Cristea Maria, 2003, Temperatura aerului în bazinul hidrografic al Crişurilor, Analele Universităţii din Oradea, Seria Geografie, Tom.XIII, pag.77-80.
4. Dumiter Aurelia Florina, 2007, Clima şi topoclimatele oraşului Oradea, Editura Universităţii din Oradea.
5. Gaceu O., 2002, Elemete de climatologie practică, Editura Universităţii din Oradea.
6. Gaceu O., 2005, Clima şi riscurile climatice din Munţii Bihor şi Vlădeasa, Editura Universităţii din Oradea.
7. Măhăra Gh., 1967, Contribuţii la studiul climei oraşului Oradea, Lucr. Ştiinţifice, nr.1, Oradea.
8. Măhăra Gh., 1979, Circulaţia aerului pe glob, Editura Ştiinţifică şi Enciclopedică, Bucureşti.
9. Măhăra Gh., 2001, Meteorologie, Editura Universităţii din Oradea.
10. Moza Ana Cornelia, 2007, The frequency of days with different temperatures in the Crişul Repede hydrographical basin, Joint International Conference on Long-term Experiments, Agricultural Research and Natural Resources, Debrecen Nyírlugos 31st May – 1st June, 2007, Published by: University of Debrecen Centre of Agricultural Sciences 4032 Debrecen Böszörményi út 138, pag. 509-515.
11. Moza Ana Cornelia, 2009 Clima şi poluarea aerului în bazinul hidrografic Crişul Repede, Editura Universităţii din Oradea, ISBN 978-973-759-775-5.
12. *** 1995, Instrucţiuni pentru staţiile meteorologice, I.N.M.H., Bucureşti.
13. www.inmh.ro.