

CASE STUDY REGARDING SOIL TEMPERATURE IN THE PLAIN OF THE CRIȘ RIVERS

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Abstract

Located between the rivers Barcău and Crișul Alb, the Plain of the Criș Rivers is home to a variety of soil types and classes. Depending on their morphological nature, texture, and caloric properties they have the capacity to retain or disperse heat. The processes of absorption and reflection generate a caloric effect, which makes the soil surface the main source of thermal energy.

The soil has a much greater heating potential if compared to the atmosphere, simply because the transition of heat towards its center is realized in most part through thermal conductivity. Knowing the soil temperature has practical importance in different fields of activity, such as agriculture, construction, piping, road communications, etc. The temperature of the soil's active surface is an important genetic factor in the formation of topo and micro climates, depending on the local topographic and orographic features.

Key words: soil, temperature, Plain of the Criș Rivers

INTRODUCTION

Soil temperature is an important climatic element, as it impacts other major environmental constituents, plants and soil organisms in particular.

MATERIAL AND METHOD

The data for this study was acquired from the national meteorology database, property of ANM Bucharest. This study will be focusing on the analysis of soil temperature variation in the Plain of the Criș Rivers. The period encompassed between 1971 and 2008 will represent the main time frame for this study, while the weather stations of Oradea, Holod, and Chișineu Criș, the main locations.

RESULTS AND DISCUSSIONS

The soil has a much greater heating potential if compared to the atmosphere, simply because the transition of heat towards its center is realized in most part through thermal conductivity, which is quite poor, especially in the case of dry soils. This explains why during summer time, under the influence of solar radiation, the soil surface reaches very high temperatures ($\geq 60^{\circ}\text{C}$). The temperature transition to the air layer is realized

mostly through radiation and convection. On the other hand, during the night time when solar radiation is absent, the loss of heat occurs rapidly, generating very significant diurnal variations in the soil temperature. The annual average soil temperature is the most synthetic parameter relating to this aspect. It points out its most important feature – it embodies a heat source. The highest value of an annual average soil temperature in Romania reached 15.5°C , recorded in 1977 within the Chişineu Criş weather station. The annual average air temperature for the same period was measured at 10.2°C . The lowest value of an annual average soil temperature was of 9.3°C , recorded in 1973 within the Chişineu Criş weather station. The annual average air temperature for the same period showed 9.8°C .

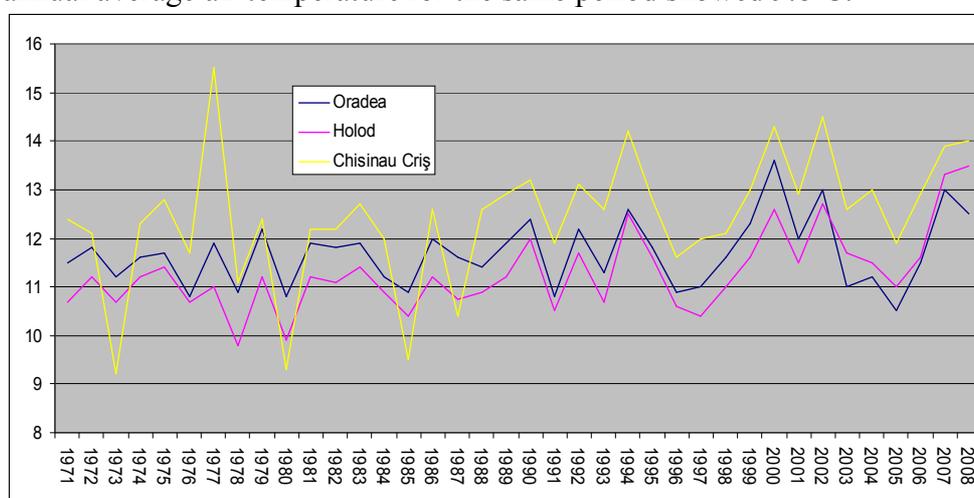


Fig. 1 The multi annual evolution of the average temperature of the soil surface, 1971-2008

The monthly average temperatures of the soil surface

The lowest values of a monthly average temperature were -1.3°C , recorded in January within the Holod weather station, and -1.1°C measured within the weather stations of Oradea and Chişineu Criş, when the solar radiation is weaker than in the rest of the months, and the baric field favors the advection of the cold air masses. The presence of the snow layer, which takes the role of active surface, is also a contributing factor to the appearance of thermal inversions. As a result, the difference between soil and air temperature in terms of monthly average values is considerably reduced. The maximum values regarding monthly averages of soil temperature have been recorded in the month of July within the Chişineu Criş weather station (26.7°C), the weather stations of Oradea (24.6°C), and Holod (23.7°C).

Table 1

Monthly average temperatures of the soil surface, 1971-2008

| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|--------------------------|------|-----|-----|------|------|------|------|------|------|------|-----|-----|
| ORADEA | -1.1 | 0.4 | 5.5 | 11.9 | 19.2 | 23 | 24.6 | 23.5 | 17.2 | 10.8 | 4.4 | 0.3 |
| CHIȘINEU CRIȘ | -1.1 | 0.6 | 6.4 | 13 | 20.8 | 24.5 | 26.7 | 25.1 | 18.4 | 11.5 | 4.8 | 0.5 |
| HOLOD | -1.3 | 0.7 | 5.5 | 11.3 | 17.5 | 21.7 | 23.7 | 22.8 | 16.4 | 11 | 5 | 0.4 |

Source: data acquired from the A.N.M archive

The highest monthly average temperatures of the soil surface

The highest monthly average temperatures of the soil surface range between 53.1⁰C, and -9.5⁰C. The highest value, 53.1⁰C, was recorded in July at the Oradea weather station, while the lowest, -9.5⁰C, was recorded in January, also in Oradea.

Table 2

The highest monthly average temperatures of the soil surface, 1971-2008

| Station/ month | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| ORADEA | 9.5 | 13.8 | 27.4 | 38.2 | 46.8 | 51.4 | 53.1 | 51.2 | 41.8 | 32.5 | 18.2 | 12.3 |
| CHIȘINEU CRIȘ | 9.8 | 14.7 | 28.5 | 37.8 | 45.6 | 49.3 | 50.9 | 48.9 | 41.1 | 31.9 | 19 | 11.4 |
| HOLOD | 12.2 | 16.5 | 27.1 | 36.7 | 45.6 | 51 | 52.5 | 51.3 | 42.8 | 34.1 | 21.7 | 13.3 |

Source: data acquired from the A.N.M archive

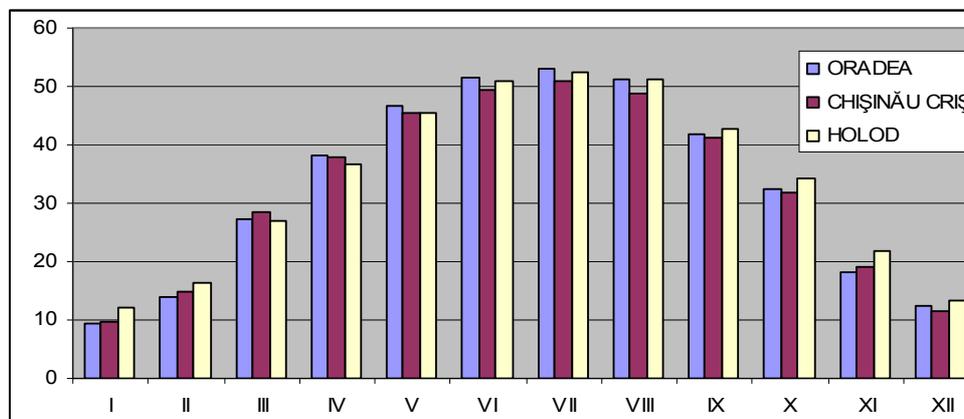


Fig. 2 The highest monthly average temperatures of the soil surface, 1971-2008

The lowest monthly average temperatures of the soil surface

The lowest monthly average temperature of the soil surface was recorded within the Chișineu Criș weather station in the month of January; a negative value of -15.5⁰C, while the maximum lowest temperature average was recorded in the month of July, also within the Chișineu Criș weather station – a positive value of 11⁰C.

Table 3

The lowest monthly average temperatures of the soil surface, 1971-2008

| Station/ month | I | II | III | IV | V | VI | VII | VII I | IX | X | XI | XII |
|--------------------------|-------|-------|------|------|-----|-----|------|----------|-----|------|------|-------|
| ORADEA | -13.9 | -11.4 | -6.9 | -1.2 | 3.9 | 8.2 | 10.6 | 9.6 | 4.7 | -2.2 | -5.5 | -12 |
| CHIȘINEU CRIȘ | -15.5 | -12.6 | -7.1 | -1 | 4.1 | 8.7 | 11 | 9.7 | 4.4 | -2.7 | -5.5 | -12 |
| HOLOD | -14.7 | -12.0 | -7.1 | -2.1 | 2.2 | 6.7 | 8.9 | 7.8 | 3.2 | -2.9 | -6.5 | -12.0 |

Source: data acquired from the A.N.M archive

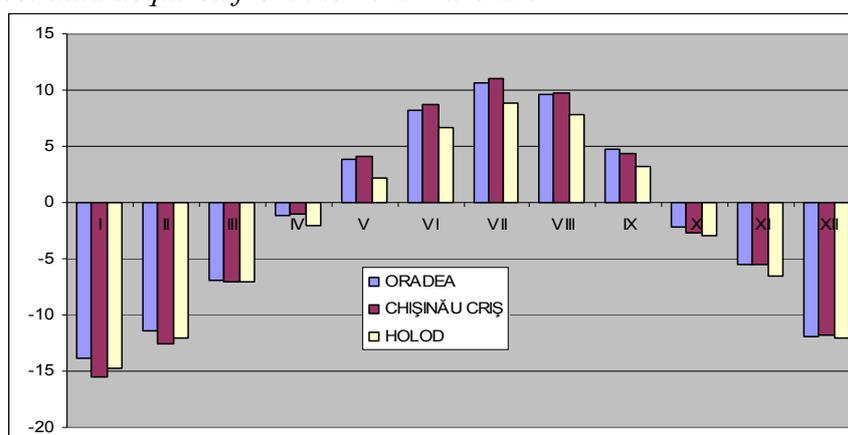


Fig. 3 The lowest monthly average temperatures of the soil surface, 1971-2008

The increase in the average temperature of the soil surface from a month to another during the spring season and its natural decrease during the autumn season, between 1971 and 2008

Table 4

| Station | SPRING | | | AUTUMN | | |
|--------------------------|--------|--------|------|--------|------|--------|
| | II-III | III-IV | IV-V | IX-X | X-XI | XI-XII |
| ORADEA | 2.9 | 8.7 | 15.5 | 14 | 7.6 | 2.3 |
| CHIȘINEU CRIȘ | 3.5 | 9.7 | 16.9 | 14.9 | 8.1 | 2.6 |
| HOLOD | 3.1 | 8.4 | 14.4 | 13.7 | 8 | 2.7 |

Source: data acquired from the A.N.M archive

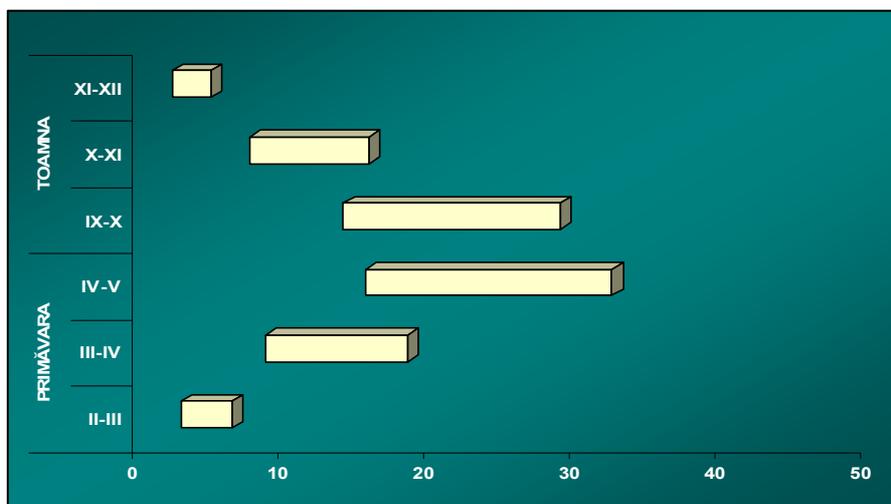


Fig. 4. Increase and decrease of the average temperature from a month to another for the spring-autumn period

The average temperature of the soil surface increases from a month to another, reaching in the months of April and May values up to 14.4°C , according to the measurements made within the Holod weather station. The average temperature of the soil surface decreases during the months of November and December, reaching a value of 2.6°C , according to the measurements made within the Chişineu Criş weather station.

CONCLUSIONS

The analysis of soil temperature is very important and useful in the field of agriculture, also in the performing of agricultural activities, and in the cycle of vegetal crops. The study realized in the Plain of the Criş Rivers for the period encompassed between 1971 and 2008, shows that the temperature parameters at the soil surface level closely follow the annual cycle of solar radiation. Therefore, in the month of July, a maximum value of 53.1°C has been recorded in Oradea, and a minimum value of 9.5°C , in the month of January, also in Oradea.

The lowest values of monthly average temperatures of the soil surface have been recorded in the month of January, ranging between -1.1 and -1.3°C , when the solar radiation is weaker than in the rest of the months. During the warm-season, under the influence of solar radiation, the average temperature of the soil surface reaches its highest values in the month of July (24.6 - 26.7°C).

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