DISTRIBUTION AND ANNUAL REGIME OF THERMO-HYGROMETRIC INDEX IN THE WEST OF CURVATURE CARPATHIANS

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Abstract

Western region of Curvature Carpathians is recognized as a tourist area, which through tourism activity and infrastructure presents national and international interest. The present analysis is intended as an overview of bioclimatic potential of the region, in our case one of mountain. This highlights the synthetic picture of the event which provides a synthetic and suggestive picture of the degree of spatial extension and the evolution over the years of thermo-hygrometric index (1971-2010). The analyzed index is an important indicator in evaluating the real climatic perception and effective of human body, in this case the body of a tourist being on holiday in the studied area. Thus, through the steps presented the study ensures to the wide bioclimatic variability an optimal model of quick understanding of the information transmitted.

***Keywords**: bioclimatic index, comfort, discomfort, THI, mountain.*

1. Introduction

Curvature Carpathians runs between the valley of the Oituz River and that of Prahova River. The West of this region consists of the groups of the mountains: Teleajenului - Doftanei and Timişului (*Geografia României, vol. III*, 1987). The area under study represents, for more than 90 years, an attractive area in terms of tourism, due to natural conditions, but also in terms of access opportunities, that led to the intensification of tourism activities. Thereby, many settlements on the rivers Teleajen, Doftana and Prahova became recognized spas nationally as well as internationally.

[1] Over time, both the analysis of environmental factors, and weather condition and various environmental conditions revealed fact that they influenced both the man as well as his activity, his health and human efficiency being affected. It was found that of all physiological stress factors

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(atmospheric,hydrologic, geologic etc.), climatic stress is rampant in manifestation, due to variations in time and space of climatic conditions, affecting the human body, who cannot avoid the influence of weather, in particular, the character of hot, cold, wet etc. Thereby, different perception of the state of bioclimatic comfort or discomfort of the human body, due to environmental conditions (*Ionac Nicoleta, 2004*), imposed the presentation of climatic conditions expressed quantitatively and qualitatively through biometeorological / bioclimatic indexes, highlighting their influence on the health of the population.

2. Data and research methodology

Western region of Curvature Carpathians through its particularities, that distinguish it from neighboring relief units, first, through mountain peaks that have a general orientation in north-south cardinal direction, imposed the analysis of thermo-hygrometric index also in terms of the manifestation of these particularities. THI index is an important indicator in evaluating the real effective climate perception by the human body, in our case the body of a tourist on holiday in the mountainous area. In general, this index presents an applicability throughout the year (12 months), the calculation being facilitated by the fact that the analyzed territory is in an area characterized in varying climatic influences. For this study the applied research method was based on meteorological data processing and interpretation (*Ciulache S., 2004*), obtained from the five weather stations in the analyzed area, respectively: Braşov, Predeal, Cheia, Sinaia and Câmpina (*Fig.1*), then bioclimatic data obtained by applying the specific calculation formula of THI index.

Figure 1: Geographical position of meteorological stations in the western Curvature Carpathians

The researcher Kyle W.J., in 1994, launched the specific formula of thermo-hygrometric index, expressing real ambient effective temperature perceived by the human body:

$$\mathbf{THI\ (°C) = T_{usc} - (0{,}55 - 0{,}0055 \times UR) \times (T_{usc} - 14{,}5)}$$

Where: T_{usc}= air temperature (°C) measured on dry thermometer; UR = relative air humidity (%).

To apply the calculation formula there are required values of temperature (°C) and relative humidity (%) of air, being known, the fact that optimum values of the effective temperature characteristic of the human body varies

between 15°C and 20°C (outside this range climatic discomfort installs by hyperthermia, respectively hyperthermia). Thereby, several thresholds of THI values were identified, indicating the types of bioclimate, respectively bioclimatic areas (*Ionac Nicoleta, Ciulache S., 2008*).

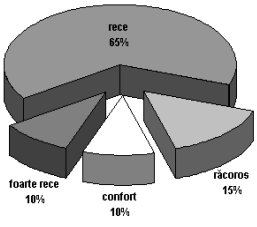
Also, useful in presenting the final results was the method of graphic and cartographic representation, being made, in the first phase, a synoptic table for annual regime, followed by specific bioclimatic map making with a highlight of the spatial distribution of THI index. Thereby, through these stages of presentation, to the wide bioclimatic variability it has been ensured an optimal model of quick understanding of transmitted information (*Grigore Elena, 2012 and 2013*). This study provides a synthetic and suggestive image of the degree of spatial extension and evolution over the years of the THI index, respectively the period of 1971-2010.

3. Results and conclusions

The values obtained by applying the calculation formula were centralized in Table 1, synoptic table, that indicates the regime of the analyzed index, and for a better understanding and a bioclimatic warning of the reader cartographic representations were made, to express the evolution and monthly and annual distribution of bioclimatic THI index, across the entire mountain and surrounding area (*Fig. 2*). The presence of local physical-geographical factors and manifestation of radiative climatic and dynamic factors have a key role in diversification of climatic and bioclimatic conditions of the analyzed region, thereby, being possible to identify the areas of climate comfort and discomfort.

*Table 1*Annual regime of THI index in the west of Curvature Carpathians (1971-2010)

Month	Meteorological Station				
	Braşov	**Predeal**	**Cheia**	**Sinaia**	**Câmpina**
I	-3,6	-3,5	-3,0	-2,7	-0,5
II	-0,5	-2,6	-1,4	-3,2	1,0
III	4,2	0,7	0,0	-0,9	4,8
IV	9,0	5,4	6,3	4,1	10,1
V	13,4	9,7	10,3	7,9	14,6
VI	15,8	12,8	13,9	10,9	17,2
VII	17,3	14,5	15,0	12,8	18,9
VIII	16,9	14,3	14,9	12,9	18,4
IX	13,5	10,7	11,7	10,1	14,6
X	9,1	6,4	8,2	6,5	10,2
XI	3,2	2,2	3,0	2,2	5,6
XII	-1,0	-1,8	-1,0	-1,2	1,5
Anual	**8,1**	**5,7**	**6,4**	**4,9**	**9,7**



Bioclimatic frequency

Analyzing the average annual values of the THI index, for the area under study it is found that, these values present a variation between 4,9ºC, at Sinaia,

point located in the western part of the studied area and 9,7ºC, at Câmpina, point located in the southern mountainous area, in the contact area with Subcarpathians. Thereby, we can conclude, that the mountainous territory of the curvature and surrounding area, the period under review, alls within the *cold bioclimatic area* (Table 1), sensation felt by the human body being the climatic discomfort by cooling, given that the average annual temperature and relative air humidity varied in the period analyzed between 3,7ºC and 9,0ºC, respectively 76% and 86%. The annual average of THI index in the proper mountain area indicates an oscillation of 1,5ºC, in the surrounding area 1,6ºC, and the variation between the two regions is 3,3ºC.

Thereby, is highlighted a range of bioclimatic discomfort emphasized in the west region, in the central and eastern part a moderate discomfort, and in the northwest and southwest a slight discomfort.

Monthly calculated values for the THI index indicate that in the interval between June - August, bioclimatic comfort installs outside the mountain areal, while in the mountains prevails the bioclimatic discomfort by cooling, dominating the sensation of coolness, in July and August and the cold in June. Sensation of very cold appears only in January, exception being the area of Campina, and in February, only in Predeal and Sinaia areas. In the rest of the months corresponding to cold season, with small oscillations of the calculated values, sensation of cold is felt predominantly. There is a sharp increase in THI values from the winter season to the spring, respectively for March-April and a sharp drop in the months characteristic for autumn season, end of October and up mid-November. These variations indicate a sudden shift from the one state to another, presents a variability in the range of 5ºC - 6ºC.

Analysis of thermo-hygrometric index highlights the visible differences for the state of bioclimatic comfort from one place to another, being possible, thereby, to identify the actual physiological sensations perceived by the human body. Thereby, based on information provided to the reader, he can build his own picture of the way of manifestation of spatial extension and the evolution over the years, in an area of the country with varying climatic influences of thermo-hygrometric index. THI index values indicate that in the west of Curvature Carpathians, in the range under review 1971-2010, ***bioclimatic discomfort by cooling*** prevailed up to 90%, the cold bioclimate being dominant, with a frequency of 65%. The bioclimate felt as very cold has a frequency of 10%, and the cool one, in its turn, presents a frequency also of 10%. ***Bioclimatic comfort*** is felt throughout the whole analyzed territory, only in summer, having a manifestation with a frequency of 10%.

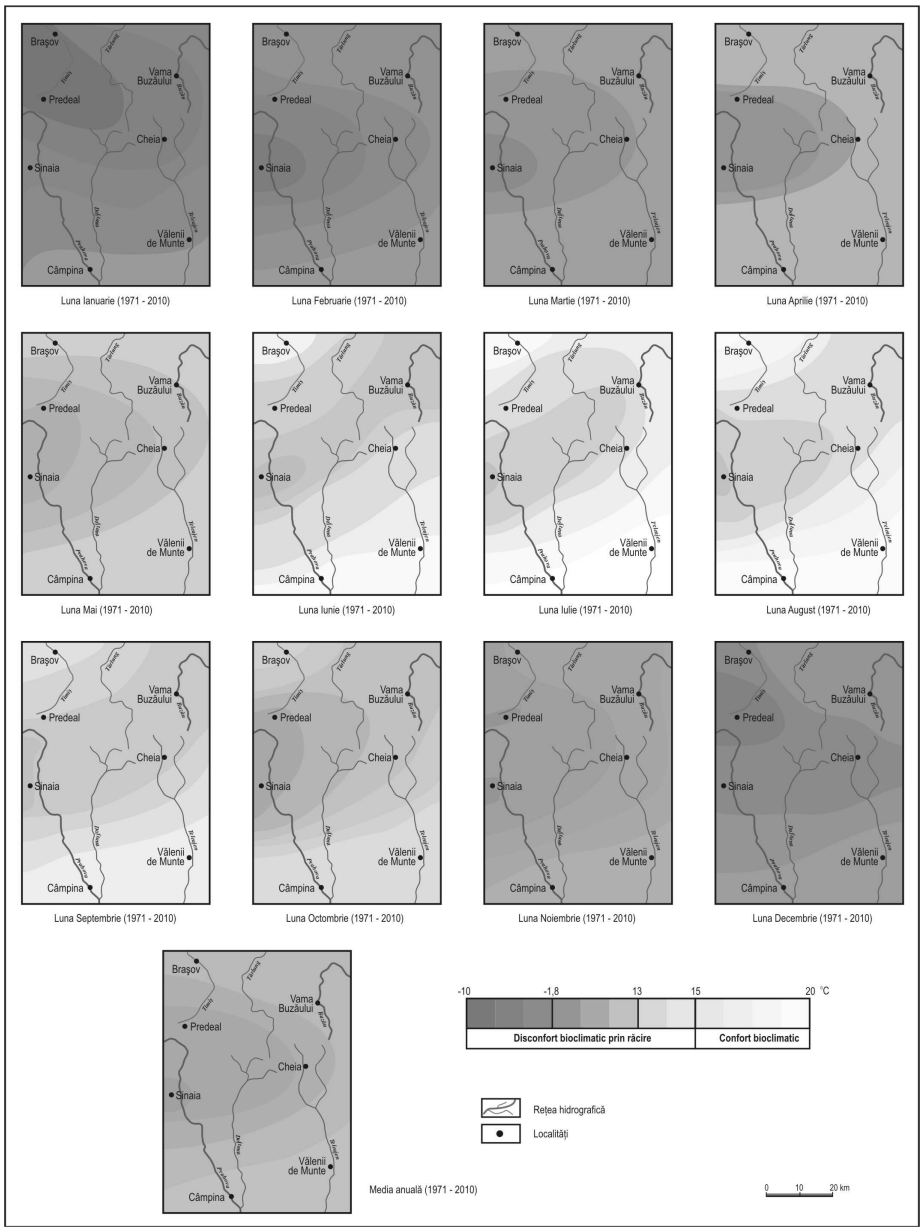


Figure nr.2 Spatial distribution of the THI index (ºC) in the west of Curvature Carpathians, during 1971-2010

REFERENCES:

Ciulache S., (2004) *Meteorologie şi Climatologie*, Editura Universitară Bucureşti, Bucureşti.
Grigore Elena, (2012), *Potențialul bioclimatic al Podişului Dobrogei de Sud*, Editura Universitară, Bucureşti.
Grigore Elena, (2013), *Interannual variation of the average values of thermo-hygrometer index on the south Dobrogea territory*, Rev. Present Environment and Sustainable Development, Vol.7, No. 2/2013, Ed. Universității "A.I. Cuza", Iaşi.
Ionac Nicoleta, (2004) *Riscul environmental în sănătate*, vol.„Riscuri şi catastrofe", nr.1/2004, Casa Cărții de Știință, Cluj-Napoca.
Ionac Nicoleta, Ciulache S., (2008), *Atlasul bioclimatic al României*, Editura Ars Docendi, Bucureşti.
Kyle, W.J., (1994), *The human bioclimate of Hong Kong*, Brazdil R, Kolář M. (eds.) Proceedings of the Contemporary Climatology Conference, Brno. TISK LITERA, Brno.
*** (1987), *Geografia României, vol. III, Carpații Românești şi Depresiunea Transilvaniei*, Ed. Academiei, Bucureşti.