

**THE IMPORTANCE OF THE CLIMATE INDEX FOR
CHARACTERIZE TOURISM FAVORABILITY IN THE CINDREL
MOUNTAINS**

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Abstract

In determining the climate's favourability for tourism in Păltiniș resort and its surrounding areas, it is necessary to know the values of the bioclimatic indices. The most often used climatic parameters are temperature, air humidity and wind speed. They are used in different combinations and formulas and the targeted result are the same every time – determining the degree of climatic comfort for the touristic activities' participants, and the main types of topo climates, favourable or less favourable for performing touristic activities or human activities in general.

Key words: *tourism, climate index, bioclimate, Păltiniș resort*

JEL Classification: Q26, Q27, Q56

1. Introduction

Climate is an important constituent of tourism's natural potential, promoting or inhibiting the organization and conduct of tourism activities. Climate often imposes how to conduct tourism activities. Many types of recreational activities are dependent on climate: heliotherapy depends on the sunshine duration, skiing depends on the thickness and duration of the snow cover, etc.

In terms of touristic potential, the climate must be viewed in two ways: as a landscape factor and as the influence exerted by it on the human body. The impact of climatic elements manifests very differently on the

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people's bodies that participate in the phenomenon of tourism, causing a "selection" of the categories of people who can benefit from a stay in the ambience of various natural regions from a physiological point of view.

There is a local climate for every place, characterized by a certain regime of meteorological factors to which the natives' bodies are acclimated. For those people that come for treatment or for rest in a balneary resort, the weather acts on their bodies in the first days by adaptation and acclimatization reactions, more or less intense, depending on the geographical area from which the subject is coming. In determining the climate's favourability for tourism in Păltiniș resort and its surrounding areas, it is necessary to know the values of the bioclimatic indices. The most often used climatic parameters are temperature, air humidity and wind speed. They are used in different combinations and formulas and the targeted result are the same every time – determining the degree of climatic comfort for the touristic activities' participants, and the main types of topo climates, favourable or less favourable for performing touristic activities or human activities in general.

The state of comfort is stimulative for rest and practicing various touristic activities. The state of discomfort - depends on the intensity of the climatic factors' actions – this can translate into stress that can be reduced, stimulative, of adaptation and acclimatization, but also an increased long lasting stress, that can induce danger for human health or as in this instance for tourists.

In analysing the bioclimatic characteristics of Păltiniș resort and the near rural areas, several indicators were selected (resulted from combining several climatic factors), relevant to point out the level of the climatic favorability of the studied area: the thermal comfort index (also called the Missenard index) or TEE, the temperature-humidity index (THI) and the bioclimatic stress index, cutaneous, pulmonary and global.

We consider that the monthly multiannual averages from the last 10 years are enough for highlighting the dynamics of climatic phenomena and their influence on activities and types of tourism, a period in which there are more arguments in terms of climate indicating favourability of climate for tourism in the Cindrel Massif.

2. Favourable climatic indices for tourism in the Cindrel mountains

For the tourism operator it is worthy of note that some extreme values of climatic elements can be stressful for tourists (long exposure to strong

radiation, cold, heat, dryness, moisture, strong wind, low pressure). Also, some excessive weather variations produced in a short, sudden time are considered stressful for the body. Bioclimates form the basis for the climatotherapy's existence and development, the climatic treatments and tourism.

The Missenard index or the temperature effective equivalent index ($^{\circ}$ TEE) reflects the actual temperature felt by the body at a time, under certain conditions of temperature, degree of humidity and air movement in the atmosphere. This index allows the weather conditions of the moment, to dose the indicated heat capacity of air for the tourists' bodies, so that at the end of the treatment to obtain a trained and a tough body, from a thermic point of view. It is considered that the thermal comfort zone (neutral zone) is between $16,8^{\circ}$ and the effective equivalent temperature of $20,6^{\circ}\text{C}$ ($^{\circ}$ TEE). Between this temperature range, under normal conditions and a relaxed dress code, whose albedo is an average one in a position of rest, the body does not register significant gains or losses of heat. Below or above this range, the body has the feeling of cold or heat, which brings metabolic changes in order to maintain internal body temperature (thermal homeostasis) constant (Becancenot, 1974). The Classification of air baths according to the TEE includes as follows:

- cold air baths 1° - $8,9^{\circ}$ TEE;
- moderate cold air baths 9° - $16,8^{\circ}$ TEE;
- comfortable air baths $16,9^{\circ}$ - $20,8^{\circ}$ TEE;
- moderate warm air baths $20,9^{\circ}$ - $22,9^{\circ}$ TEE;
- hot air baths 23 - 27° TEE;
- very hot air baths $> 27^{\circ}$ TEE.

Table 1. The Frequency (%) of the equivalent effective temperatures ($^{\circ}$ TEE) in Păltiniș Resort for the period 2005-2014 at 1 PM)

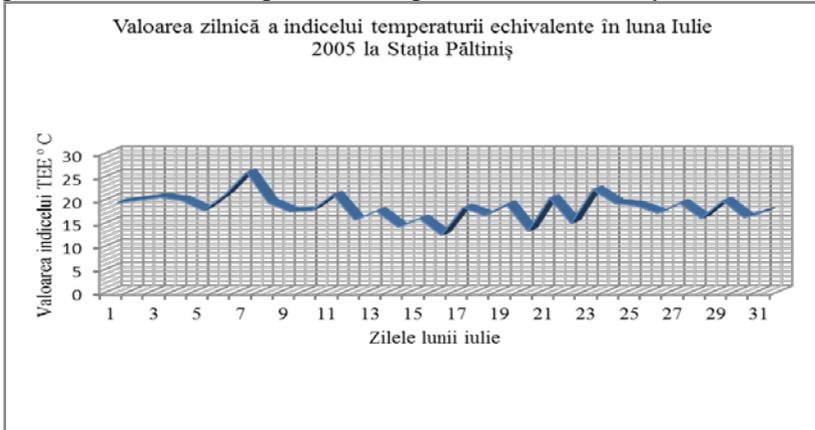
Months	Thermal comfort	Discomfort-Heating	Discomfort-Cooling
June	0,1	-	29,9
July	2,0	-	29,0
August	2,8	-	28,2
September	0,8	-	29,2

Source: processed weather forecast data

From the analysis of data string climate stations in the studied area, located at an altitude of 1453 m (Paltinis meteorological station) and at an altitude of 430 m (Sibiu meteorological station in Sibiu's Depression),

between 2005-2014 for June, July, August and September at 1 PM (when tourism activity is particularly intense), the conclusions are: thermal comfort in Păltiniș (even at lunch hours) is performed with low frequency in all summer months.

Fig. 1. The value of the equivalent temperature index in July 2005 in Păltiniș



Source: processed weather forecast data

Thus, in July, thermal comfort is recorded at Paltinis with a frequency of 2%, while in Sibiu it achieves a rate of 10.6%; heat discomfort is not reached as a monthly average in Paltinis (just as a daily average) and discomfort by cooling achieves very high values: 29% in July, while in Sibiu is only 11.9%. The highest monthly average equivalent temperature was registered in July 2005 when discomfort heat was reached on 6, 7, 11 and July 23.

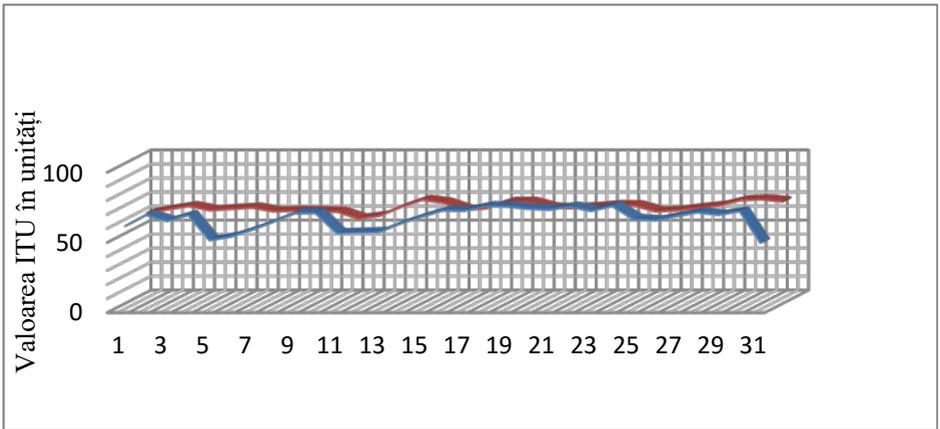
The existent situation in Păltiniș is due largely to relatively low air temperature, and wind speeds above 3.5 m / s. At speeds above this value, wind is an unfavourable element of thermoregulation.

The temperature – humidity Index (ITU) is calculated dimensionless (in units) taking into account the temperature and the relative humidity of the air. Significant values start from the threshold where the discomfort is high (80 units respectively 40°C). Depending on the values obtained by calculations for ITU (expressed in value units) the following states may be established: ≤ 65 - state of comfort; 66-79 – state of alert; ≥ 80 – state of discomfort.

ITU values, that range from <40 to > 85 reflect the physiological sensations of thermal comfort felt by the human body through the combination of the physical processes of heat transmission by radiation, convection and evaporation of water from the skin.

The Temperature-humidity index was calculated at 1 PM (in June, July, August and September 2005-2014) for Păltiniș station and there was only recorded a state of comfort.

Fig. 2. The daily value of the temperature-humidity index in Păltiniș Station in July 2013 and August 2008



Source: processed weather forecast data

From the analysis of the data resulted from calculations in the studied region, it appears that almost the entire period of the year falls into a state of thermal comfort. In two months, July 2013 and August 2008, there were quite high average values and in any of those days the critical threshold of 80 units was not reached, but only the alert status (Teodoreanu Elena, 2002).

The use of this index reveals that, in the studied territory, the periods which induce positive effects on the human body are throughout the year. This allows tourist activities throughout the year, with their differentiation depending on the season and the participants' preferences.

The wind chill index IR is called the equivalent temperature of wind chill power- IR. This is the temperature that air would reach at some certain values of the wind speed.

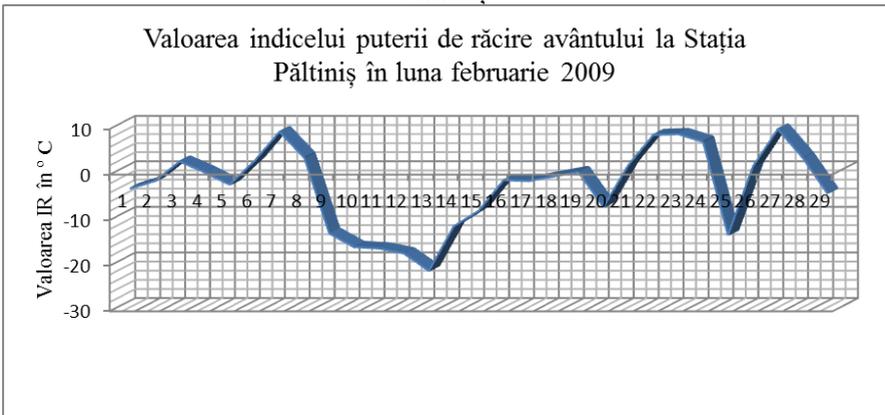
Table 2 The wind chill power, the equivalent temperature of the wind chill power and the induced physiological effects of the latter

Wind Chill Power P(W/M ²)	Equivalent temperature of wind chill IR (° C)	Physiological effects
P = 200-399	IR>+10	No discomfort
P = 400-599	+9,9>IR>-0,9	Slight discomfort
P = 600-799	-1>IR>-9,9	Emphasized Discomfort
P = 800-999	-10>IR>-17,9	Very cold
P = 1000-1199	-18>IR>-28,9	Hypocaloric stress
P = 1200-1399	-29>IR>-49,9	Frostbite discomfort in prolonged exposure conditions
P>1400	IR<-50	The risk of instant frostbite

Source: processed after Ionac N. 2008

P value's intervals correspond to certain interval values of IR. The effects of P (and the related IR) on human physiology depend on the intensity of caloric losses suffered by the human body.

Fig. 3. Daily value index of wind chill power IR (° C) in February 2009 in Păltiniș



Source: processed weather forecast data

The temperature-wind index was calculated at 1PM (in all months of the year, although the effects are negative during winter) in the period 2005-2014 for Paltinis station. It was found that the monthly average values

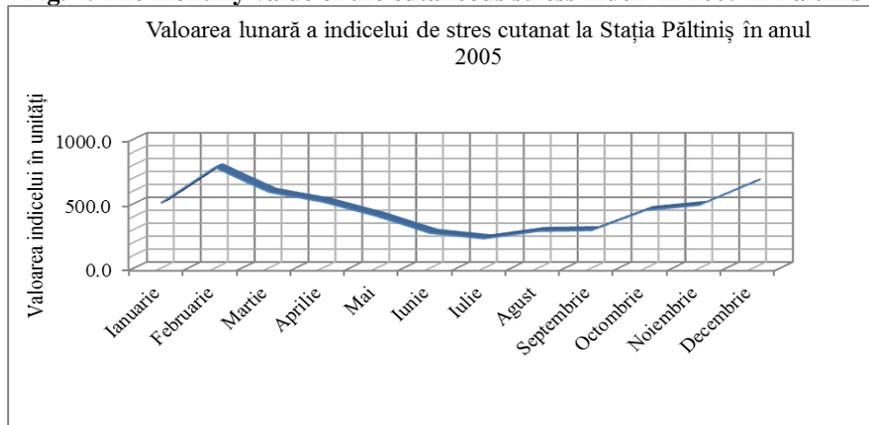
recorded only the state of comfort and light discomfort (in January, February, March, April, November, December), but there were days when the index recorded negative values. Thus, on February 2009 the lowest average value was registered ($-3,5^{\circ}\text{C}$, increased discomfort) and hypocaloric stress in days 12 and 13.

Bioclimatic stress indices outline the influence of the main meteorological factors on the human body and how it reacts to maintain steady heat (warm-blooded), meaning the constant temperature of the human body. Bioclimatic stress has three components: cutaneous stress, pulmonary stress and global stress.

To calculate these indices, the following diurnal average values are used for the following climatic parameters: temperature ($^{\circ}\text{C}$), atmospheric water vapour pressure (hPa) and wind speed (m / s).

The cutaneous bioclimatic stress index gives the feeling of cold or heat produced in the skin's mechanism to maintain constant body temperature (thermoregulation), by the process of thermogenesis (heat production) or by the process of thermolysis (heat loss).

Fig. 4. The monthly value of the cutaneous stress index in 2005 in Paltinis



Source: processed weather forecast data

Depending on the values obtained by calculating the chill index, the following ranges were established: 0-299 - hypotonic index, during summer, requests triggering thermolysis during summer; 300-599 - relaxing index,

optimal treatment of the weather; 600 - 1500 –hypertonic index, during winter, requires triggering thermogenesis during the cold season (Gaveu O., 2003).

For Păltiniș, monthly average values of the cutaneous stress were obtained, values that reveal a bioclimate with hypertonic stress in January, February and December, and a balanced one in the rest of the year. In 2005 in June, July, August and September hypotonic stress was recorded.

The pulmonary bioclimatic stress index comprises three steps, depending on the values of the vapor pressure water. When $e < 7,5\text{mb}$ stress is manifested by the tendency of dehydration or molecular concentration of blood (usually in winter), and when $e > 11,7\text{mb}$ stress is manifested by a tendency of hydration or plasma dilution (in summer). When it is between 7.5 to 11.6 mb stress is balanced (tab. 5). When the values of $e > 31,3\text{mb}$, breathing difficulties arise.

In our country, this stress is conventionally expressed by values ranging between 0 and 40 (Omu Peak). For Păltiniș, its value is 20. On the basis of the daily values' analysis of vapor pressure at 1 PM, in the range from 2005 to 2014, it was showed that Păltiniș in January, February, March and April recorded desiccant stress; in May , June, September, October, November and December recorded balanced stress, and moisturizing stress in July and August.

The Global bioclimatic stress index is the result of the previous two stresses, and a more accurate element of reference, because it attempts to present the request of global bio-climate over the body, attacked simultaneously on the skin and lungs, in the changed conditions of the natural environment by moving from one geographical area to another. In Păltiniș the value of this index is 42.

3. Conclusions

In terms of climate change, the adaptation of the product offered by weather conditions in vulnerable areas is of great importance, as it is the case of mountainous areas. From a bioclimatic point of view the characterization through bioclimatic indexes (the equivalent temperature index, the temperature-humidity index and the temperature-wind and bioclimatic stress index) from Păltiniș resort and limitrophe areas highlights that there is a very favourable bio-climate for practicing tourism. Thus, in terms of a cutaneous aspect, the stress index is quite low compared to that from high altitudes (in Omu Peak, the value of this index is 140). Five months of the year (April-June and September-October) are relaxing with a tonic, stimulant, and training

effect and the opportunity to spend time outdoors through specific touristic activities (hiking, cycling). Regarding the pulmonary aspect the stress index is also low, 20 (compared to that of the Omu Peak which is 40), varying less than the altitude compared to the cutaneous index. The Balanced months of the year are May-June and September-October. The interval from November to April recorded a desiccant index, positive, having a stimulating action, of drive and practice of winter sports.

So far, Păltiniș has been shaped primarily for recreation, for tourism, except the period from the beginning, when the resort had a balneary aspect as well. Strong lightedn small values of cloudiness and air pressure, moderate bioclimatic indices may be exploited for treatment and prophylactic cures in the resort, particularly in the treatment of the respiratory tract, endocrine, asthenic neurosis, rickets and growth disorders in children, and some skin diseases as well. Păltiniș resort's bioclimate and the one from the touristic villages on Cindrel Mountains frame can be utilized in a prophylactic and therapeutic way to treat rickets and growth disorders in children (in this sense organizing holiday camps is benefice). It is even recommended the establishment of a sanatorium for children and for people who suffer from asthma in the place where the intersection with Șanta occurs. Păltiniș Resort is recommended for some dermatological diseases through the cure of heliotherapy and aero therapy.

With a high bioclimatic potential, the Păltiniș resort and the adjacent area may become not only places of touristic interest, but places of a balneary interest, regaining in this manner their place in the national touristic circuit.

4. References

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