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THE CLIMATIC CHARACTERISTICS OF THE BALNEO-CLIMATIC STÂNA DE VALE RESORT WHICH AIM AT TOURISTIC EXPLOITATION

Ovidiu GACEU
University of Oradea, Department of Geography, Tourism and Territorial Planning
1 Universităţii St., 410087 Oradea, Romania, e-mail: gaceu@yahoo.com

Abstract: The balneo-climatic Stâna de Vale resort, situated in the homonym depression from the Bihor-Vlădeasa Mountains has a favourable climate for the touristic activities throughout the year, fact which was proved by the meteorological data measured between 1979-2000, which highlight the soft wind and calm, the long-lasting of the snow stratum and its significant consistency, the cool and wet air, the significant shining of the Sun and the stratified nebulosity which prevents the excessive cooling through the night.

Key words: climate, balneo-climatic resort, tourism, Stâna de Vale

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Situated in the middle of the Western Mountains (Munţii Apuseni), at the contact point between Bihor and Vlădeasa Mountains in the homonym depression at 1108 m altitude, the balneo-climatic resort Stâna de Vale has a sheltered climate because it is surrounded by peaks 200-600 m tall which prevents the appearance of strong winds.

In order to characterize the climate of this resort, there have been analysed the data resulted from the meteorological observations from Stâna de Vale between the years 1979-2000.

The air temperature registers an average annual value of 3.9ºC, and the monthly values vary between -28.9ºC on 31.01.1987 and 30.6ºC on 20.08.2000.

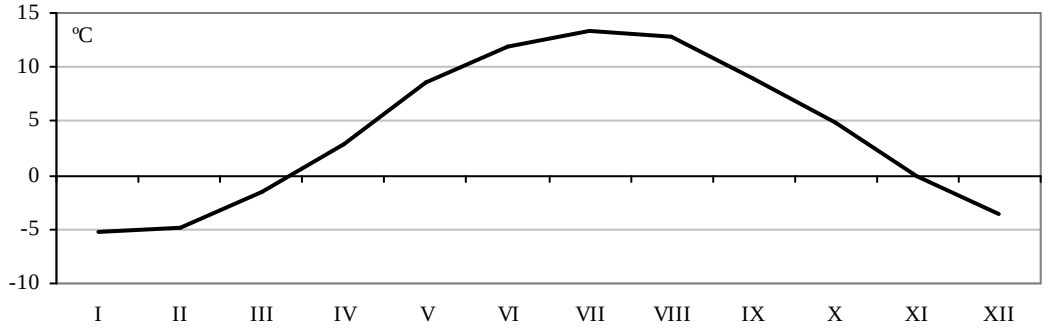

Figure 1. The average monthly temperature in Stâna de Vale

The frequency of days with different temperature values register: a number of 52,5 frosty nights (the minimum temperature ≤ -10ºC) (figure 3), out of which 15.1 nights in January and 10.6 nights in December; a number of 183.8 frosty days (figure 3), out of which 29.6 days in January, 28.3 days in December, 27.4 days in February and March, such frosty days (the minimum temperature ≤ 0ºC) could occur even in the summer (0.1 days in July, 0.4 days in August) (figure 2); a number of 48.9 winter days (figure 3) (days in which the maximum temperature ≤ 0°C), out of which 14.4 days in January, 12.0 days in December and 10.8 days in February (figure 2); and a number of 8.5 summer days (days in which the maximum temperature ≥ 25ºC) (figure 3), out of which 0.8 days in August, 0.6 days in July, 0.1 days in June (figure 2) (Gaceu, 2007) .

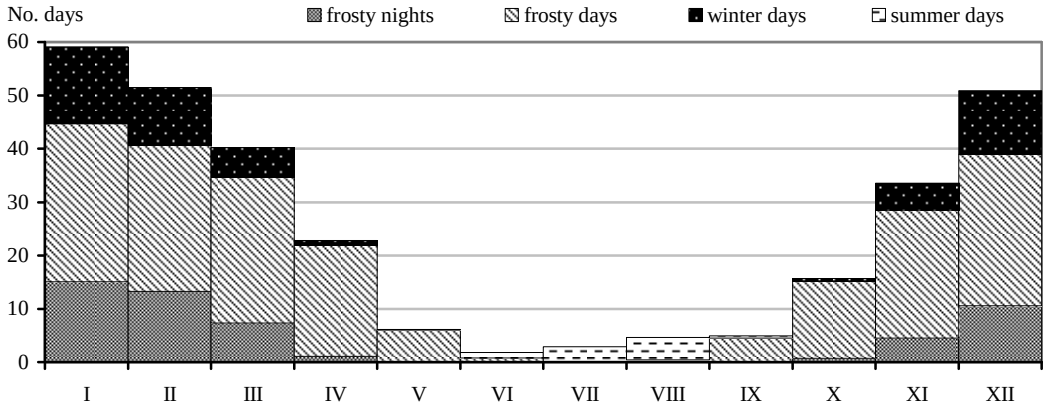

Figure 2. The monthly frequency of the days with different temperature values in Stâna de Vale

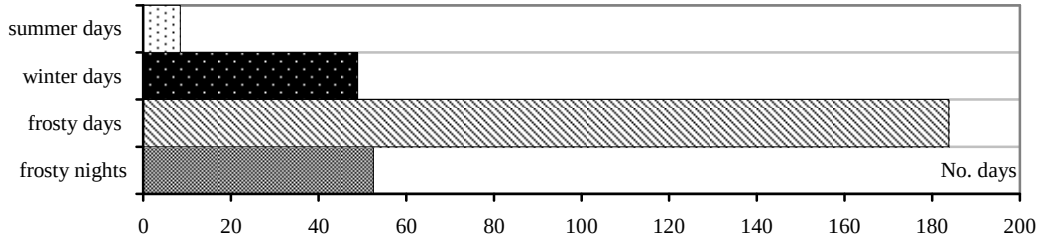

Figure 3. The annual frequency of the days with different temperature values in Stâna de Vale

The air humidity presents significant values because of the resort altitude (over 1000 m) and of the west-oriented position towards the Atlantic air masses. Thus, *the water vapors tension* registers an average annual value of 8 mb, with a maximum of 13.2 mb in July and a minimum of 4mb in February (figure 4).

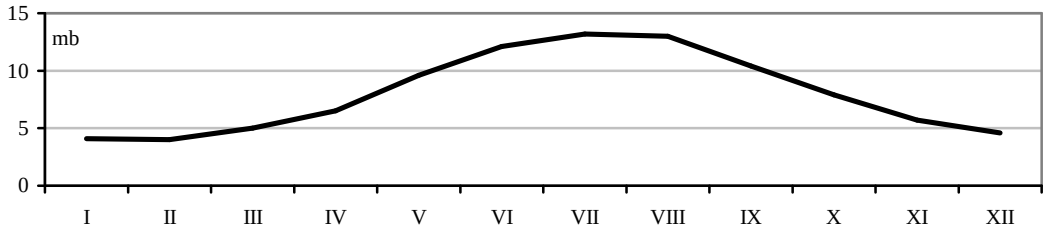

Figure 4. An average monthly tension in Stâna de Vale

The saturation deficit is reduced and it presents a resembling course to the the water vapors tension, with an annual average of 1.5 mb, with a maximum of 2.8 mb in July and a minimum of 0.5 mb in December and January (figure 5).

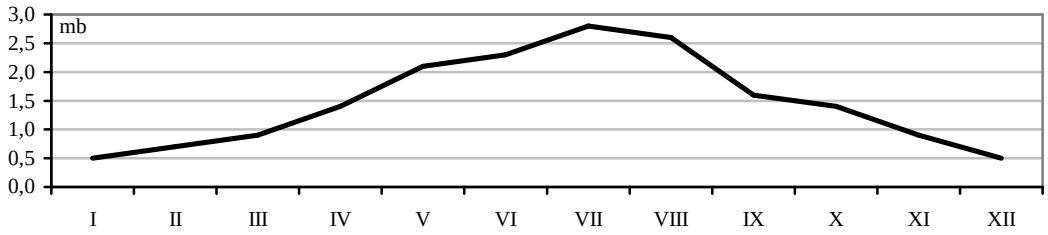

Figure 5. The monthly saturation deficit in Stâna de Vale

The relative air humidity presents big values, the annual average is 89.2 % (figure 6), bigger than in Vlădeasa 1800 (85.8 %) due to the position against the western winds of the Stâna de Vale station, at the level of optimum of condensation, unlike the Vlădeasa 1,800 station mostly situated, especially in the winter, above the strati form clouds which maintain a high humidity. Throughout the year there can be noticed two maximums and two minimums. The main maximum is produced in winter, in December, 93 % because of the warmer and wetter air masses which come from the Mediterranean Sea, and the secondary maximum is produced in June, 88 %, due to the high frequency of the days with precipitations. The minimum values are produced in May (86 %), and July (87 %) due to the drier air masses and the high temperatures (figure 6).

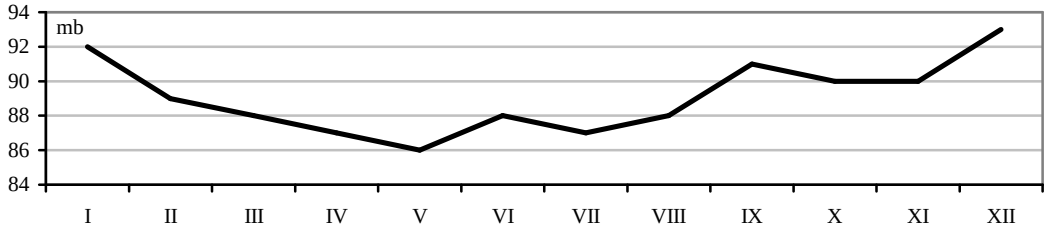

Figure 6. The average monthly relative humidity in Stâna de Vale

The frequency of days with different characteristic values of the relative humidity present a spatial-temporal variation. Thus, *the very dry days in which the relative humidity has values ≤ 30 %* at one of the observation hours are very few at Stâna de Vale, 2.7 days per year, and during one year they occur more frequently in the winter, 0.5 days in January, and seldom in the summer, at most 0.2 days in August (figure 7).

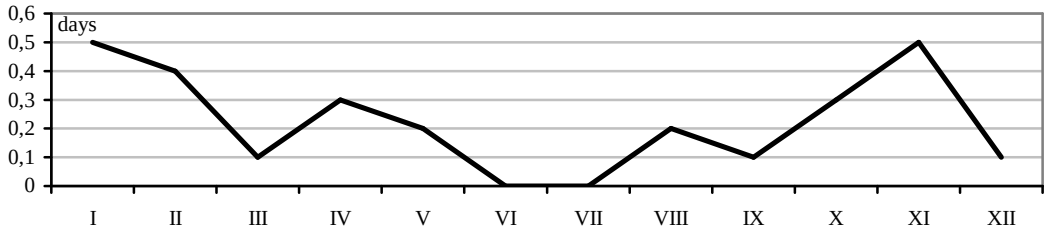

Figure 7. The average monthly frequency of the days with relative humidity ≤ 30 %
at one of the observation hours in Stâna de Vale

The very humid days in which the relative humidity exceeds 80 % in the afternoon, that is at the hour of the thermic maximum, are much more significant: 135.1 days per year, of which the most are registered in November, 18.2 days, because of the higher frequency of Mediterranean humid air and low temperatures, and the fewest appear in August, 3.6 days, when the air temperature is higher and the anticyclonic regime predominates (figure 8).

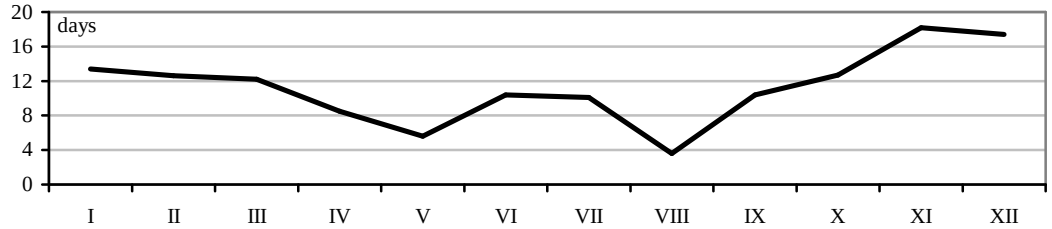

Figure 8. The average monthly frequency of days with relative humidity ≥ 80 % at 1 pm in Stâna de Vale

The average number of days with relative humidity ≤ 50 % at at least one of the observation hours is of 47.5 days, and during one year it presents two monthly maximums and two monthly minimums: a main maximum in April (7.0 days) and a secondary maximum in August (4.3 days), and a main minimum in December, 1.5 days and a secondary one in June 3.1 days (figure 9).

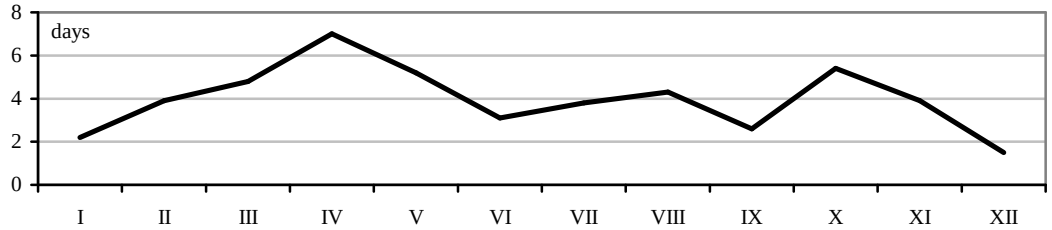

Figure 9. The average monthly frequency of the days with relative humidity ≤ 50 %
at least one of the observation hours in Stâna de Vale

The cloudiness presents significant values at Stâna de Vale (Gaceu, 2005). Thus, the value of the *entire average annual cloudiness* can reach 6.0 tenths, and during one year the highest values are registered in April, 6.8 tenths, when the western circulation becomes predominant and the thermic convection intensifies itself determining an intense evaporation process at the surface of the humid soil. The lowest average values of the total cloudiness is registered in August when the anticyclonic regime predominates and when the strong solarization determines the evaporation of condensed products, thus the sky being mostly clear: 4.7 tenths (figure 10).

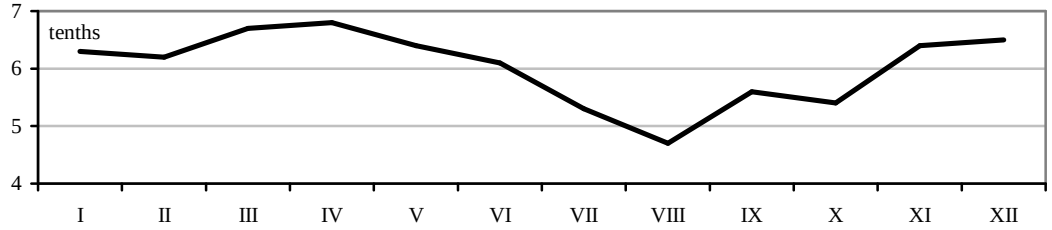

Figure 10. The average monthly cloudiness in Stâna de Vale

The number of days with clear and covered sky is another important parameter which characterises cloudiness. Thus, every year in Stâna de Vale an important number of days with clear sky is registered, 52.5 days, with a maximum in October, 7 days, because of the anticyclonic regime predominance from the end of summer and the beginning of fall and a minimum number in May, 1.8 days, due to the intensifying of thermodynamic convection (figure 11).

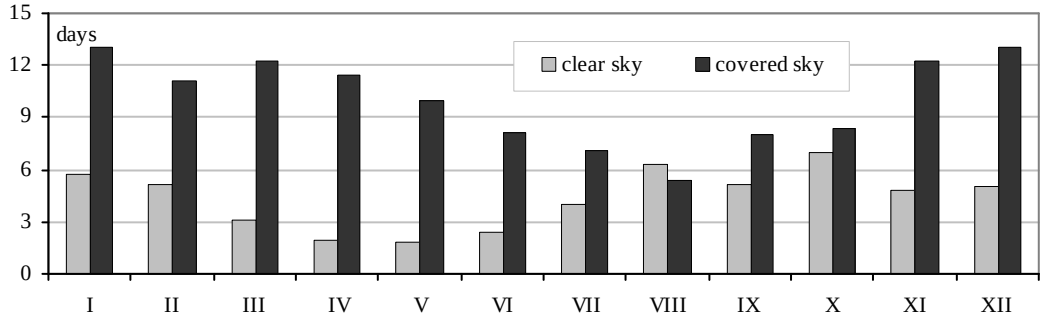

Figure 11. The average monthly number of days with clear and covered sky in Stâna de Vale

The days with covered sky (days in which the sum of cloudiness registered at the four observation terms is of at least 32) are much more numerous than those with clear sky (the sum of cloudiness registered at the four observation terms does not exceed 4 tenths): 120.2 days per year out of which the most frequent are in December, 13.1 days when the strati-form clouds predominate, and the fewest in August, 5.4 days, when the anticyclonic regime with clear sky predominates (figure 11).

The frequency of different types of clouds constitute one of the most important parameters which highlights the climato-touristic potential of an area. Annually, the most frequent clouds in Stâna de Vale are Altocumulus, 45.4 %, followed by Altostratus with 23.6 %, Stratocumulus with 22 %, Cumulonimbus 18 %, Cumulus 16.7 %, Cirrus 15 %, Nimbostratus 13.7 %, Cirrostratus 5.8 %, Stratus 1.6 % and Cirrocumulus 0.4 % (figure 12).

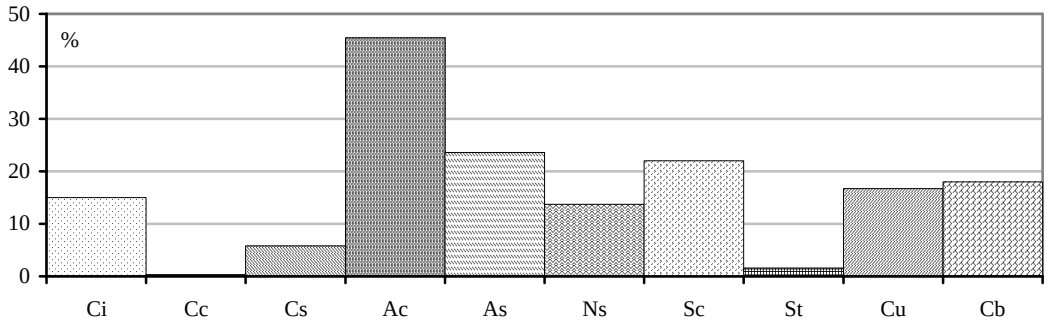

Figure 12. The annual frequency of different types of clouds in Stâna de Vale

Calculating the monthly frequency of the cloud types it was observed that the clouds with vertical development are predominant in the summer, in July, that is 38.2 % Cumulonimbus clouds and 35.2 % Cumulus clouds (figure 13).

The inferior clouds have a frequency between 18.5 % in June a nd 28 % in October for the Stratocumulus type and 0.4 % in June and 2.9 % in December for the Stratus type (low clouds which have their basis usually situated under the level of Stâna de Vale resort) (figure 13).

The middle clouds have a uniform repartition during all the months of the year. For example, the Altocumulus clouds have a frequency composed between 41.3 % in January and 52 % in October (figure 13).

The superior clouds have a similar repartition, out of which the most frequent are the Cirrus clouds: 10.1 % in December and 18.6 % in August, and the fewest are the Cirrocumulus clouds: 0.6 % in July and 0 % in November, December and January (figure 13).

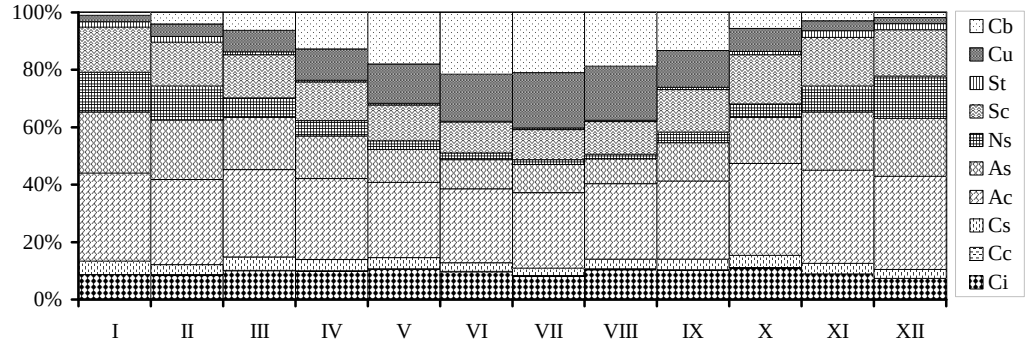

Figure 13.The monthly frequency of different types of clouds in Stâna de Vale

The period of Sun shine gathers 1578.7 hours per year, out of which, during one year, the most frequent are in August, 219.2 hours, due to the anticyclonic regime and the fewest are in December, 51.8 hours, due to the strati form clouds brought by the western circulation (fig.14). The period of Sun shine in Stâna de Vale is more reduced also because the shadowing of the horizon by the surrounding peaks, taller than the platform level with 200-600 m.

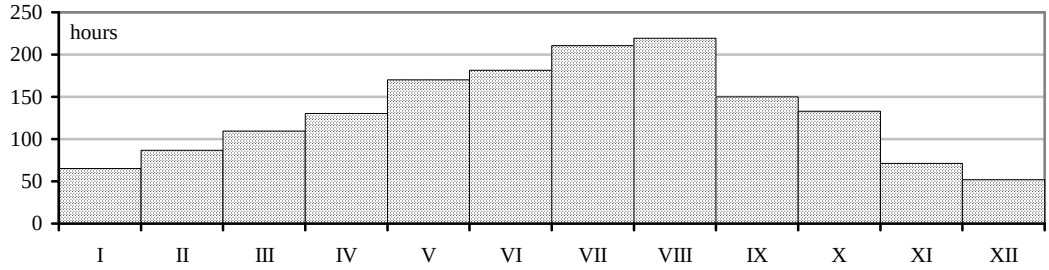

Figure 14. The monthly average period of Sun shine in Stâna de Vale

The average monthly and annually number of days with and without Sun is another useful parameter in the climatologic studies. Annually, in Stâna de Vale, there is registered a number of 289.3 days with Sun (by "day with Sun" we understand the day in which the period of Sun shine was of at least 0.1 hours), and 75.7 days without Sun.

The biggest *monthly average number of days with Sun* is produced in July, 29.3 days, when there is also registered the longest period of time with Sun shine, and the smallest monthly average number of days with Sun appears in winter, in December, 17.0 days, due to the great values of cloudiness (figure 15).

The days without Sun (the period of Sun shine was of 0.0 hours) present an inverse repartition compared to those with Sun shine. Thus, the greatest monthly average number of days without Sun are registered in December, 14.0 days, and the smallest I July and August, 1.7 days (figure 18).

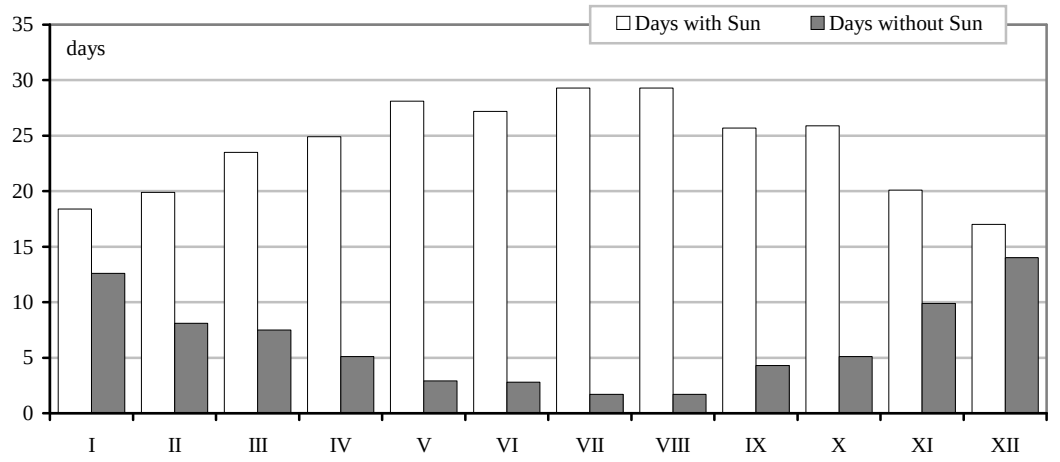

Figure 15. The average monthly number of days with and without Sun in Stâna de Vale

The atmospheric precipitations reach the highest values in Stâna de Vale, this being the pole of precipitations in Romania for the altitude of 1000 meters, with the value of 1631.8 mm. During one year, the most precipitations are registered in the summer, in June, 192.8 mm, due to the higher frequency of oceanic cyclones which travel to the northern periphery of the Azoric Anticyclone wedge, bringing cold and humid masses of air which favours the precipitations, as well as the convective processes which unstabilises the air through thermic and dynamic convection. The fewest precipitations are registered in the winter, 89.0 in February, due to the prevalence of the anticyclone regime which prevents the development of thermic convection (figure 16) (Măhăra, Măhăra, 1981; Gaceu, 1998).

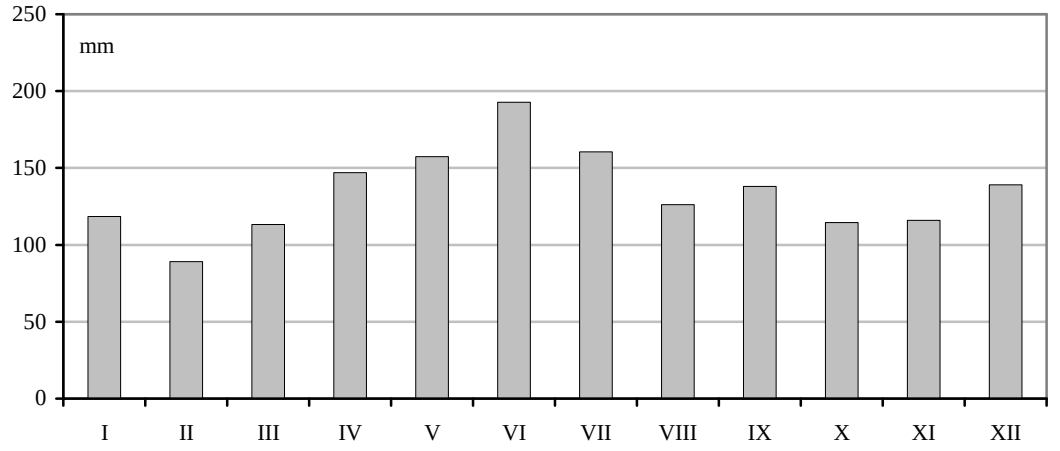

Figure 16. The monthly average quantities of precipitations in Stâna de Vale

The big quantities of precipitations in Stâna de Vale are doubled by a big number of days with precipitations: 191.9 days per year, relatively uniform distributed throughout an year, from 11.6 days in October to 19.4 days in May (by a day with precipitaions we understand the interval of 24 hours in which there were at least 0.1mm of precipitations).

A very important parameter for practising the winter sports in Stâna de Vale is the *snow stratum* (Bogdan, Iliescu, 1971, 1999) which presents significant values. Thus, it appears early in

Stâna de Vale, approximately around the date of October 29th, and the last snow stratum apeears around the date of May 7th , so as *the average possible period of snow stratum* in Stâna de Vale is of 190 days. In relation to these average values, *the extreme dates of snow stratum occurrence* in Stâna de Vale are much dephased: August 2nd for the first snow stratum and May 29th for the last, so the *maximum possible lasting of snow stratum* may reach 299 days per year.

For skiing, it is very important the *average date of appearance and disappearance of stable snow stratum*, which at Stâna de Vale is produced at November 1st, accordingly May 13th, which means a number of *194 days with stable snow stratum*.

Likewise, *the average thickness of snow stratum* is very big, reaching 86.1cm, and the limit of 10 cm necessary for the practising of winter sports starts in the second decade of December and it is maintained until the end of April.

The wind has low speeds at Stâna de Vale due to the hidden position of the station (Niculescu, 1993; Bogdan, Dragotă, 1997; Gaceu, 2005). Thus, *the annual average wind speed, regardless of its direction*, barely reaches 0.6 m/s and it has an uniform repartition throughout the year between 0.5 m/s in the summer months (June-September) and 0.8 m/s in spring (March-April).

Based on the cardinal directions, the annual average wind speed is between 2.8 m/s fron the eastern sector and 2.2 m/s from north-eastern sector, and t*he monthly average speed* is between 3.1 m/s in February and October from the eastern sector, or in January, April and December, when the wind blows from north-east (Table 1).

Table 1. The monthly and annual average wind speed (m/s) based on the cardinal directions in Stâna de Vale

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
N	2,3	2,3	2,2	2,1	2,5	2,3	2,2	2,0	2,1	2,2	2,4	2,5	2,3
NE	3,1	2,1	2,3	3,1	2,5	2,3	2,4	1,8	2,9	3,0	3,0	3,1	2,6
E	2,7	3,1	2,4	2,9	2,8	2,6	2,8	2,8	2,5	3,1	2,9	2,7	2,8
SE	2,8	2,9	2,9	2,7	2,6	2,6	2,5	2,5	2,6	2,6	3,1	3,0	2,7
S	2,8	3,1	2,8	2,2	2,5	2,5	3,0	2,5	2,9	2,7	2,7	2,7	2,7
SV	3,0	2,5	2,5	2,7	3,1	2,6	2,2	2,3	2,6	2,5	2,8	2,7	2,6
V	2,3	2,3	2,4	2,6	2,2	2,2	2,1	2,2	2,2	2,3	2,1	2,5	2,3
NV	2,1	2,3	2,1	2,2	2,3	2,3	2,1	2,0	2,1	2,4	2,2	2,1	2,2

The annual average wind frequency on cardinal directions is between 1.1 % from northern sector and 6.9 % from western sector, and *the monthly average wind frequency on cardinal directions* is between 8.6 % from western sector in September, 0.5 % from northern sector in September and December (Table 2).

Table 2. The monthly and annual calm and wind frequency on cardinal directions (%) in Stâna de Vale

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
N	1,3	1,5	1,5	1,3	1,3	1,1	0,8	0,7	0,5	1,2	0,9	0,5	1,1
NE	1,6	1,8	2,2	1,6	1,9	1,2	1,3	0,7	0,8	0,8	1,2	0,8	1,3
E	2,3	3,6	3,1	4,2	3,8	1,7	1,2	1,3	1,7	2,5	3,1	2,9	2,6
SE	4,5	6,3	6,2	8,2	5,1	2,7	2,3	2,2	3,3	6,2	7,2	6,5	5,1
S	2,7	1,8	3,3	1,8	1,6	1,4	1,5	1,2	1,3	2,9	2,7	3,0	2,1
SV	1,5	2,1	2,0	2,1	1,5	1,6	1,7	1,2	2,0	1,5	3,1	1,6	1,8
V	5,7	5,9	7,5	6,6	6,6	8,2	7,2	8,1	8,6	7,7	6,5	4,4	6,9
NV	2,9	3,5	4,5	4,2	4,3	4,8	5,6	5,2	4,2	3,5	2,1	1,3	3,8
Calm	77,5	73,5	69,6	70,0	73,9	77,3	78,4	79,4	77,6	73,7	74,2	79,0	75,3

Following *the annual calm frequency* it was observed that it represents very high values: 75.3 % (table 2), and *throughout one year* it is more frequent at the end of summer and the beginning of autumn when the anticyclonic regime predominates, 79.4 % in August and seldom in spring, due to the intensification of the convect processes and the unstable atmospheric circulation, so as in March 69.6 % of the cases are registered (figure 17).

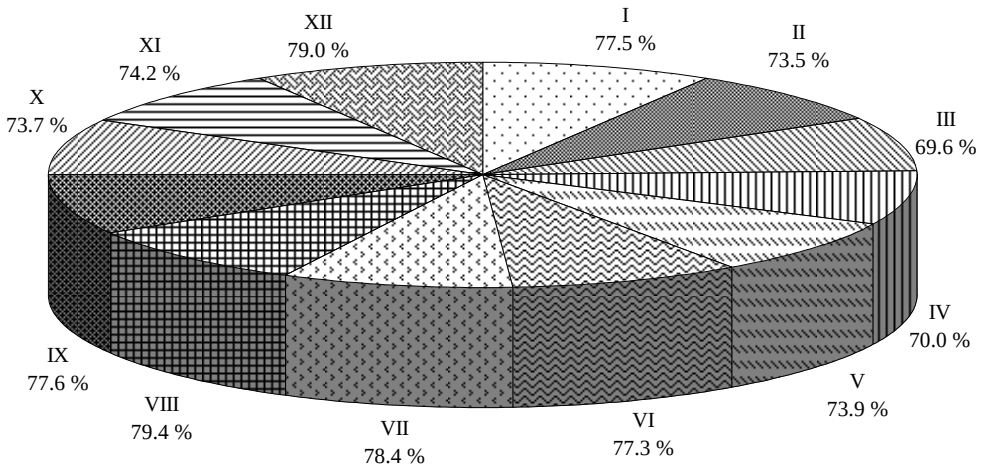

Figure 17. The monthly average calm frequency in Stâna de Vale

CONCLUSIONS

As a result of the study, we can distinguish the following conclusions:

a). The balneo-climatic Stâna de Vale resort has a hidden temperate-continental climate highlighted by the reduced annual average wind speed which reaches only 0.6 m/s and the predominance of atmospheric calm in 75.3 % of the cases per year.

b). The rich precipitations, especially snow, assures the Stâna de Vale resort an outstanding climato-touritic potential, especially during the winter season, when the thickness of the snow stratum reaches an average of 86.1 cm, the possible average lasting of snow stratum is of 190 days, and the stable snow stratum preserves itself approximately 194 days per year.

c). The low temperatures from the cold season assures a long lasting period of the snow stratum in Stâna de Vale resort, and in the hot season, the cool and humid air from the resort assures the thermo-hygrometric comfort so desired by the tourists who come from the suffocating atmosphere of the plain.

d). The relatively reduced number of clear sky days (62.5 days per year) and the increased number of days with covered sky (120.2 days per year) prevent the excessive radiative nocturne cooling and assures the resort a climate which favours trips, especially in the hot season, when the foot paths are not covered with snow.

e). The high duration of Sun shine, 1,600 hours per year, out of which more than 200 hours are registered in August, and the big number of days with clear sky, almost 290 days per year, out of which 29 in July, allow the tourists who come in the hot season to perform the helio-cure in the best conditions: not too high temperatures, humid air and soft wind.

f). The climatic characteristics highlighted in the study assures the resort a favourable climate for the touristic activities *throughout the entire year* (Teodoreanu, 1986; Dragotă *et al.*, 1999 a; Dragotă *et al*., 1999 b; Gaceu *et al.*, 2008).

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