

CLIMATE CHARACTERISTICS OF THE FOG PHENOMENON AND ITS INFLUENCE ON THE TOURISTS AND THE TOURIST ACTIVITIES IN THE APUSENI MOUNTAINS

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Abstract: *Climate characteristics of the fog phenomenon and its influence on the tourists and the tourist activities in the Apuseni Mountains.* This paper aims to emphasize the characteristics of the fog phenomenon and its influence upon tourist activities in the Apuseni Mountains, making use of meteorological data collected by 9 meteorological stations between 1961 and 2000. Observations regarding the medium and maximum monthly and yearly number of foggy days, the occurrence of fog during the day, monthly and yearly medium and maximum durations of fog. Based on calculations graphically described and interpreted it was concluded that fog is most frequent and persistent on the highest peaks, especially during winter as opposed to depressions where it is scarce and less persistent. In the last part of the paper both positive and negative effects of the fog on tourist activities in the Apuseni Mountains are presented.

Key words: climate characteristics, fog, influence, tourists, Apuseni Mountains.

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1. Introduction

The tourist potential of an area may be significantly affected by meteorological conditions and climate. It follows that fog is such a phenomena that may influence tourism both positively and negatively. The Apuseni Mountains benefit from such a special natural and humane potential that this study is a need in the context of the growing tourism in the area.

2. Data and methods

Data used in this paper are based on information collected between 1961 and 2000 by 9 meteorological stations situated in the Apuseni Mountains area : Vlădeasa 1800 (1836 m), Vlădeasa 1400 (1404 m), Băișoara (1360 m), Stâna de Vale (1108 m), Câmpeni (591 m), Huedin (560 m), Borod (333 m), Ștei (265 m) and Gurahonț (177 m). Data was processed according to classical climatology practices, by graphical representations accurately interpreted.

3. Definition and genetic causes

The fog is a meteorological phenomenon described as the agglomeration of a large number of fine water drops and ice crystals at the ground level (100-600 particles/cm³)

formed by condensation or sublimation of water vapors which reduce visibility at less than 1km. When visibility is reduced between 1 and 10 km the phenomenon is called foggy air (***, Instructions for Meteorological Stations, 1995).

Fog is formed by water vapours condensation , at temperatures between -5 and 5°C , relative humidity above 100% and light wind (less than 4 m/s) or at a relative humidity of 80 -100%, in the presence of numerous condensation or by water vapours sublimation at temperatures of -30°C and relative humidity below 80% (Cătelea, Sârbu, 1984). Fog can be formed only if the air is saturated in water vapours and if in air a sufficient number of condensation nuclei are present. The saturation of air takes place at a relative humidity of 100% and a decrease of air temperature to the level of dew point. (=) Condensation nuclei are microscopic particles, solid and liquid (very fine salt powders evaporated above seas and oceans by wave breaking, dust particles, soot, volcanic ash) water absorbing, found in suspension in the atmospheric air which allows formation of large drops with small curvature, requesting normal saturation. Therefore, if condensation nuclei did not exist, and drops would form directly by binding of water molecules, these would be small, would have large curvatures consequently evaporating rapidly unless enormous supersaturation values ($R = 400-600\%$), existed, which may not happen in nature (Măhăra, 2001; Gaceu, 2003, 2005).

4. Results

4.1. Monthly and yearly occurrence of foggy days

In the Apuseni Mountains the yearly occurrence of fog phenomena resembles to that of cloudiness because, in the mountainous area the fog coincides most times the clouds coming into direct contact with the slopes of the mountains or with the bottom of the valleys, most of fog occurrences being generated by the movement of air upward the slopes (slope fog).

During one year, at high altitudes (Vlădeasa 1800), the average occurrence of foggy days, takes high values in all the months, being between 18-19 days in August and October, when the anti-cyclone regime predominates and 23-24 days in December and March when the frequency of oceanic masses of air coming from west and those of humid mediteranean coming from south increases (chart 1, fig.1).

At medium altitudes, the highest frequency of foggy days is recorded in winter, with a maximum value in December, respectively 6,2 days at Stâna de Vale, 9 days at Băișoara and 14,6 days at Vlădeasa 1400. At the same stations, the number of foggy days is reduced to 50% during the summer months, respectively 3,2 days at Stâna de Vale, 3,1 days at Băișoara and 5,3 days at Vlădeasa 1400 during August, when a minimum value is recorded (chart, fig. 1).

The lowest value of the monthly average of foggy days is produced in low lands / depressions. During winter, in December a value of 6,0 days is registered at Gurahonț, 3,5 days at Ștei, 6,2 days at Borod and 9,4 days at Huedin, while summer, in June-July, when the high temperature maintains a low humidity at these stations, the occurrence of fog is reduced to 0 day during one month. (chart 1, fig.1).

Chart 1. The average monthly and yearly occurrence of foggy days in the Apuseni Mountains

Source: data provided by the National Agency of Meteorology archive

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Gurahonț (177 m)	6,1	2,9	1,8	0,9	1,3	1,2	1,7	2,1	2,9	3,7	4,0	6,0	34,6
Ștei (265 m)	3,8	2,5	0,8	0,4	0,1	0,1	0,1	0,2	0,3	0,7	2,0	3,5	14,4
Borod (333 m)	6,2	3,2	1,6	0,7	0,3	0,2	0,4	0,3	0,6	1,6	4,1	6,2	25,2
Huedin (560 m)	8,4	4,5	2,8	1,2	0,5	0,3	0,3	0,5	1,4	2,8	7,6	9,4	39,8
Câmpeni (591 m)	3,5	2,6	2,5	1,8	3,1	3,4	3,4	6,0	8,5	9,2	6,2	5,2	55,3
Stâna de Vale (1108 m)	4,7	3,3	5,0	4,4	2,7	3,4	3,0	3,2	4,5	3,7	5,3	6,2	49,2
Băișoara (1360 m)	7,5	8,3	7,4	6,8	5,8	3,8	3,5	3,1	4,6	5,7	8,0	9,0	73,2
Vlădeasa 1400 (1404 m)	13,4	12,4	11,6	9,3	8,3	6,0	4,9	5,3	9,8	9,9	12,1	14,6	117,7
Vlădeasa 1800 (1836 m)	22,2	21,1	23,5	20,6	20,2	20,2	19,5	18,3	20,0	19,1	21,6	23,7	249,9

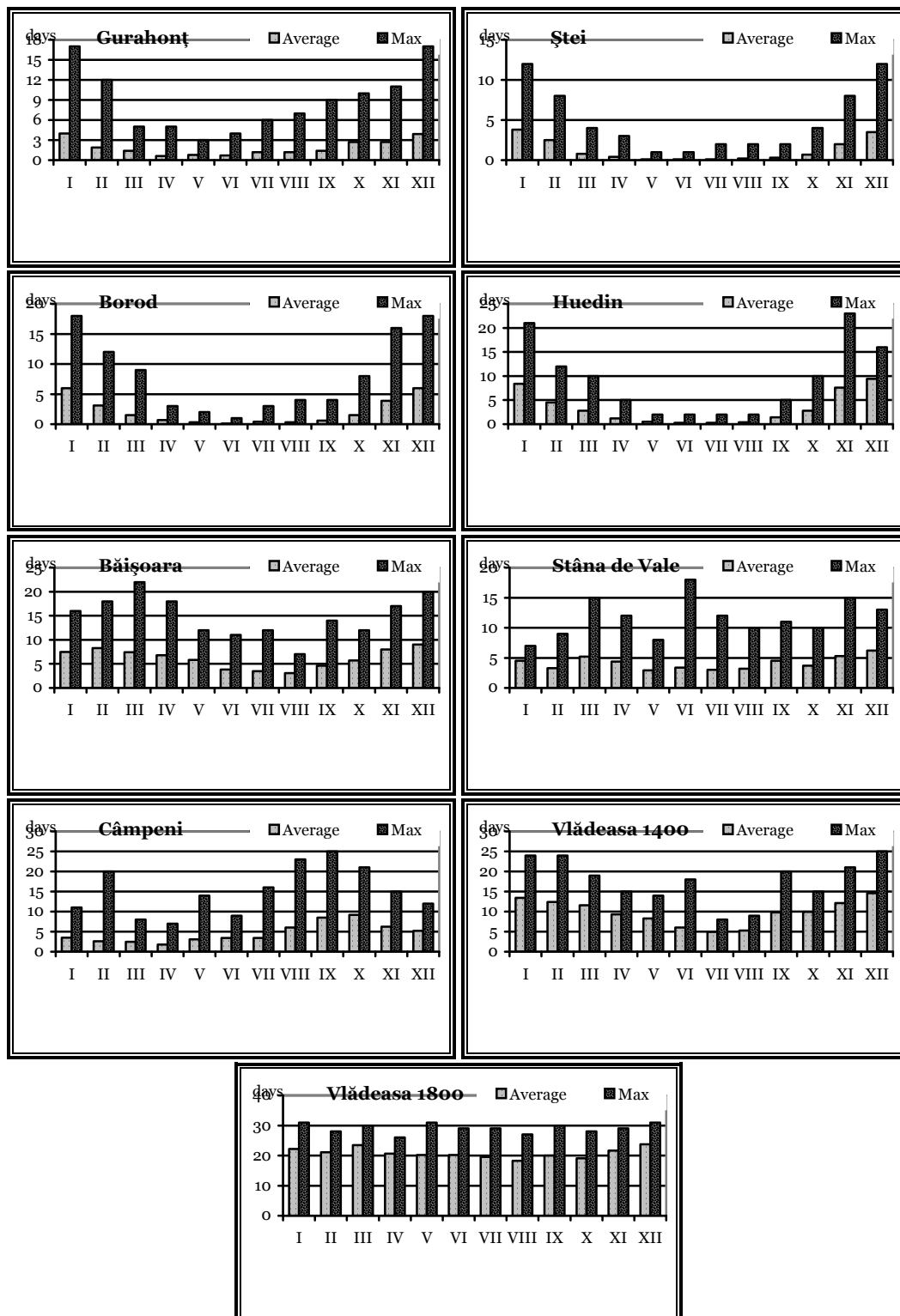


Figure 1. The monthly maximum and medium number of days with fog in the Apuseni Mountains

The maximum number of foggy days at medium and low altitudes is 3-4 times bigger than the average but, on highest peaks, due to the moderating role of the mountain is only 1,5 times bigger than the average. (chart 2, fig. 1).

The yearly occurrence of foggy days grows proportionally with the altitude from 14,4 days at Ștei, to 73,2 days at Băișoara and to 249,9 days on the highest peaks such as Vlădeasa 1800. This law of vertical areas is sometimes contradicted by local geographical conditions. Thus, at Gurahonț (177 m), due to the positioning of the station in a closed intramountainous depression, a value of 34,6 foggy days is registered, while at Ștei (265 m), in open golf-depression conditions, ventilated, only 14,4 foggy days are recorded during a year (chart 1).

Chart 2. Maximum monthly and yearly days of fog occurrence in the Apuseni Mountains

Source: data provided by the National Agency of Meteorology archive

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Gurahonț (177 m)	17	12	5	5	3	4	6	7	9	10	11	17	71
Ștei (265 m)	12	8	4	3	1	1	2	2	2	4	8	12	26
Borod (333 m)	18	12	9	3	2	1	3	4	4	8	16	18	56
Huedin (560 m)	21	12	10	5	2	2	2	2	5	10	23	16	59
Câmpeni (591 m)	11	20	8	7	14	9	16	23	25	21	15	12	143
Stâna de Vale (1108 m)	17	9	15	12	8	18	12	10	11	10	15	13	108
Băișoara (1360 m)	16	18	22	18	12	11	12	7	14	12	17	20	107
Vlădeasa 1400 (1404 m)	24	24	19	15	14	18	8	9	20	15	21	25	155
Vlădeasa 1800 (1836 m)	31	28	30	26	31	29	29	27	30	28	29	31	299

A similar situation is noticed at Stâna de Vale (1108 m) where we have 49,2 foggy days, diferent from the 56,8 foggy days recorded at Câmpeni (591 m) (chart 1). Local conditions are also an influential factor : the meteorological platform at Stâna de Vale is situated in a small depression (2 km long), surrounded by peaks higher with 300-500 m which force the clouds into an upward movement, so that the air loaded with water drops does not reach the bottom of the depression. Instead, at Câmpeni, the large valley of Arieș allows the air movement along the surrounding slopes , formation of fog being also helped by the large water area represented by the Aries river.

Compared to the yearly average number, the maximum yearly number with foggy days may be 2-3 times higher except for the peaks where the difference is smaller: 299 days compared to 249,9 days registered at Vlădeasa 1800 (charts 1 and 2).

4.2. Frequency of fog occurrence during the day

Data resulted from meteorological observations reveal that, in the Apuseni Mountains, the occurrence of fog during the day varies from a few hours to several consecutive days. The highest interval of fog daily occurrence is, on the average, between 9 și 10,30 hours in winter and 5,30 and 7 hours in summer. Cases of fog persistence for several consecutive days are more frequent during winter, but during the transitional seasons (spring and autumn) this phenomenon may also occur favoured by frequent quasi-stationary fronts which maintain a marked cloudiness within strata.

4.3. Duration of fog

Fog duration depends both on the values of air relative humidity and on the characteristics of relief. Thus, in the Apuseni Mountains fog duration is reduced on the western slopes due to a thermoconvection which forces masses of air move rapidly upwards the slopes . The phenomenon lasts longer on the eastern slopes , where masses of air lacking condensation factors, move downwards and maintain contact with the warmer land surface, so the water vapours still present condense and generate the fog phenomenon. The average annual duration of fog in the Apuseni Mountains varies between 79,1 hours at Ștei and 3243,1 hours at Vlădeasa 1800 (chart 3).

The yearly maximum duration is, in general, 1,5-2 times bigger than the average (chart 4). The monthly average takes highest values in December in the upper half of the researched mountainous area (37,5 hours at Stâna de Vale, 85,4 hours at Băișoara and 367,2 hours at Vlădeasa 1800) and, in January in the mountainous peripheric area (24,0 hours at Ștei, 75,3 hours at Borod). The cause for this is the differentiated thermal condition which allows ascending of humid oceanic air masses up the peaks in December and favours their stagnation in the peripheric depressions as a consequence of cold air movement downwards from the peaks, together with inversions of temperature and fog banks. To be noted that after Vlădeasa 1800 with 367,2 hours, the longest monthly average is at Huedin (103,8 hours) and Băișoara (85,4 hours) in December, due to the rapid movement of the cold air from the higher slopes (chart 3). The lowest value of average monthly fog duration is registered in June, when the instability of air masses and thermoconvection are more marked. During this month, the fog may last, on the average, less than an hour at the periphery of the mountains, exceeds 12 hours at medium altitudes, reaches 220 hours on the highest peaks and drops to 28,9 hours on the eastern slope at Băișoara (chart 3).

Maximum monthly duration is in general 3-4 times over the monthly average except for Vlădeasa station 1800 where the differences are smaller, 1-1,5 times (charts 3 and 4).

Duration of fog phenomenon during the day varies from a few hours up to several consecutive days. During one day fog is most frequent between 8,30 and 10,30, in winter and between 5,30 and 7, in summer.

Chart 3. Monthly and yearly average values of fog duration (hours and tenths) in the Apuseni Mountains

Source: data provided by the National Agency of Meteorology archive

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Ștei	24,0	14,4	3,4	1,2	0,3	0,1	0,2	0,3	0,4	2,2	9,7	23,0	79,1
Borod	75,3	35,1	13,0	3,4	1,7	0,8	2,2	3,9	3,7	11,1	39,7	54,5	244,5
Huedin	90,5	36,5	25,1	6,9	2,2	0,9	1,1	3,0	7,5	20,9	90,6	103,8	388,9
Câmpeni	32,3	11,3	10,0	4,3	4,8	5,2	4,6	8,0	18,4	35,1	34,0	41,4	209,4
Stâna de Vale	29,6	17,4	27,1	20,2	15,9	12,6	13,9	13,2	23,1	20,7	31,2	37,5	262,4
Băișoara	67,6	63,1	52,5	64,0	47,2	28,9	17,5	22,2	38,1	44,6	70,8	85,4	612,0
Vlădeasa 1800	340,8	285,6	314,0	284,4	235,8	220,2	214,6	178,0	256,2	251,2	295,1	367,2	3243,1

Chart 4. Monthly and yearly maximum values of fog duration (hours and tenths) in the Apuseni Mountains

Source: data provided by the National Agency of Meteorology archive

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Ștei	96,8	57,0	15,3	11,4	3,2	1,8	2,2	2,5	4,0	18,7	52,1	82,3	138,8
Borod	197,3	133,9	73,7	16,6	13,0	6,8	14,3	31,6	32,5	47,1	185,7	117,4	467,4
Huedin	231,6	92,3	69,7	34,7	7,5	6,8	9,1	14,8	47,5	68,8	321,6	293,7	581,7
Câmpeni	122,7	46,3	29,8	16,4	22,2	18,0	19,2	22,7	72,0	73,2	88,9	117,4	353,9
Stâna de Vale	139,0	65,5	139,5	56,2	35,1	69,6	53,6	44,2	82,3	69,9	87,6	82,9	622,7
Băișoara	187,9	133,2	161,3	143,6	104,9	87,4	57,8	55,5	98,3	103,3	176,1	216,2	880,8
Vlădeasa 1800	533,8	490,1	526,0	433,3	422,3	367,4	411,9	312,9	520,1	411,8	465,6	525,6	3811,4

4.4. The influence of fog upon tourist and tourist activities in the Apuseni Mountains

If the fog is thin and does not last long (5-10 minutes) it has an agreeable effect, as it gives tourists and people in general a pleasant revigorating sensation, but, if it is dense and persistent has a negative impact of touristic activities and people in general, especially upon transportation because it:

- hides landscape;

- reduces visibility and confuses tourists who may go astray, who may not find the touristic objectives and may even risk their life (especially during winter when they may mistake the mist for a snow layer, when relief disappears and advancing is difficult);

- it reduces air temperature, and, when accompanied by icy wind it generates a penetrating coldness;
- it makes breathing difficult, damages tissues and amplifies the cold sensation;
- advection fog may transport germs responsible for diseases at high distances (Topor, 1957).
- it significantly increases the frequency of traffic accidents

5. Conclusions

Fog represents a risk-involving climatic phenomenon , with a reduced destructive potential however. In the Apuseni Mountains fog is most frequent on peaks where average records reach to 250 days a year, in contrast to medium altitudes where it occurrence drops to 70-100 days a year and lower altitudes where it occurs between 15 and 40 days/year. The maximum number of foggy days during one year is 2-3 times bigger, except for the peaks where the difference is smaller due to the moderating role of the mountain . During one year, the highest frequency of foggy days is registered in the winter months when an average of about 9 days at lower altitudes and 23-24 days at higher altitudes are recorded. On the highest peaks fog is present during all the months of the year, recording , however a minimum in August and October (18-19 days). During one day, in the winter season, the fog is more frequent during the morning hours 8,30 and 10,30, while in the summer season, from 5,30 to 7.

The most undesirable effects of fog are recorded on the peaks of the Apuseni Mountains, where it is dense and persistent , hides the landscape, reduces visibility and confuses tourists who may lose their way, reduces soil temperature, and, when accompanied by icy wind generates penetrating coldness, makes breathing difficult and carries epidemic germs on long distance. It also amplifies the risk of traffic accidents on the roads in the mountainous areas. Positive effects of fog on tourist activities are also to be mentioned, such as a revigorating and rehydration sensation but only if it is not too dense.

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Submitted: April 18, 2009

Accepted: May 14, 2009

Published online: May 30, 2009