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THE WHITE CRIŞ LANE VULNERABILITY TO THE ICE DEPOSITS

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Résumé: ***La vulnérabilité des dépôts de glace dans le couloir dépressionnaire de Crisul Alb.*** Cet étude présente l`analyse des principaux paramètres caractéristiques pour les dépôts de glace dans le couloir de Crişul Alb. L`analyse est basée sur les données de stations météorologiques Ineu, Gurahont et Tebea pour la période 1970-2006. On a analysé la structure des dépôts de glace, le nombre moyen et maximum de jours et cas avec dépôts de glace, l`intervalle favorable, la durée maximale, le diamètre et le poids maximales. De cette analyse résulte que ces phénomènes sont caractérisés par fréquence, durée et poids faibles, ainsi que la vulnérabilité de la région est très faible dans la moitié de l'est du couloir et faible dans la moitié occidentale du couloir de Crişul Alb.

Mots-clés: dépôts de glace, vulnérabilité, couloir, Crişul Alb

Introduction

Ice deposits are normal phenomena for the cold season which, in certain condition when they are characterized by a long duration and large weight, can turn into climatic risk phenomena.

The genetic cause of the ice deposits is represented by the state of the atmosphere determined by the general air circulation, but it was revealed that depending on the type of deposit the conditions of formation are different. This deposits can be formed by sublimation of water vapour in the air (soft ice pellets), or by the freezing of extra chilled water drops (hard ice pellets and glaze), or by the freezing of the wet snow and sleet.

1. Data and methods

There were analysed data from 6 weather stations, three of them - Ţebea, Gurahonţ and Ineu, located inside the lane and the other three - Chişineu Criş, Şiria and Moneasa-Izoi - outside the lane. The period analyzed was 1970-2006.

The analyzed parameters were: the structure of the ice deposit, average and maximum annual and monthly number of days with ice deposits, trend and probability, average and maximum annual and monthly number of cases with ice deposits, extreme and mean date for occurrence of ice deposits and the favourable interval, maximum duration, maximum diameter and maximum weight of ice deposits.

2. Results and discussions

2.1. The ice deposits structure

The ice deposits may results from a single type, or from a combination of deposits successively formed in different wheatear conditions. The hoar-frost present the highest frequency (68-77%), the glaze frequency is 13-23 %, the frost wet snow 1-9 % and combined deposits 2-9 % (figure 1).

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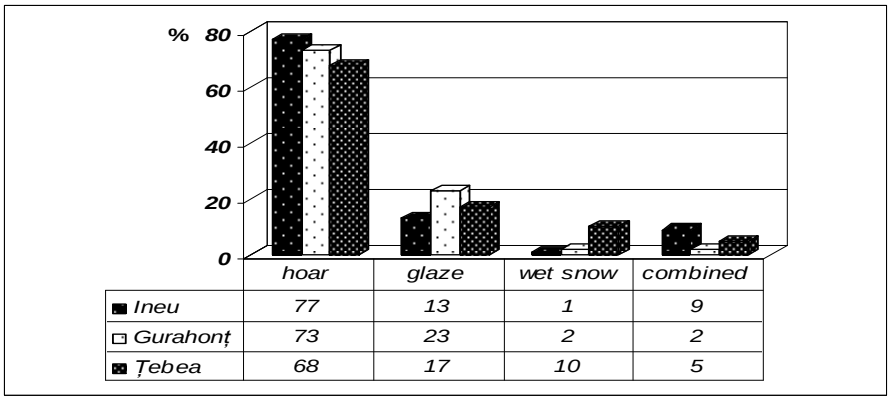

Fig.1. The ice deposits structure

2.2. The average annual and monthly number of days with ice deposits

At the stations located in the western part of the corridor, in the plain area, the ice deposits were reported every year, at the stations located inside the river corridor the years where the ice deposits were reported had a frequency of 68 % at Țebea and only 27 % at Gurahonț.

The annual average number of days with ice deposits is very low at the stations located in the upper and middle lane (Țebea - 1,7 days, Gurahonț - 1,6 days) and grows in the lower course of the river reaching at Ineu 10,7 days. Comparison with the number of days with ice deposits registered at the stations situated outside the lane: Chisineu Criș - 18,6 days, Șiria - 40 days/year, points out the lanes shelter character.

At most stations the deposits are present starting in November until March. The average monthly number of days with ice deposits has the highest values in December and January (table 1).

The average monthly and annual days with ice deposits

Table 1

Station	Ice deposit	Month							Annual
		X	XI	XII	I	II	III	IV	
Chișineu Criș	Hoar-frost	0,1	1,0	4,8	6,0	3,1	0,6	-	15,4
	glaze	-	0,2	0,8	2,3	0,2	-	-	3,5
Ineu	Hoar-frost	-	0,4	3,6	4,4	1,3	0,1	-	9,8
	glaze	-	0,1	0,1	0,9	0,1	0,1	-	1,3
Gurahonț	Hoar-frost	-	0,03	0,4	0,6	0,1	-	-	1,1
	glaze	-	-	0,1	0,2	-	-	-	0,3
Țebea	Hoar-frost	-	-	0,4	0,7	0,2	0,03	-	1,3
	glaze	-	-	0,2	0,1	0,03	-	-	0,3
Șiria	Hoar-frost	-	0,4	6,4	11,9	6,0	1,9	0,4	27,0
	glaze	-	0,5	3,3	2,8	1,3	0,1	-	8,0
Moneasa-Izoi	Hoar-frost	-	1,1	3,2	2,0	1,3	0,1	-	7,7
	glaze	-	0,4	0,4	0,2	0,4	0,1	-	1,5

The annual and monthly maximum number of days with ice deposits is lower at the stations located inside the lane than those located outside. For the analyzed period, the absolute maximum for the annual number of days with ice deposits was reported at Șiria - 81 days in 1996 (compared, inside the lane the absolute maximum was 23 days in 1992 at Ineu). For the monthly values, the absolute maximum was also registered at Șiria: 26 days

in the December of 2001 and January of 2003 (compared, inside the lane - 14 days in the December of 1992, at Ineu).

2.3. Maximum annual and monthly number of days with ice deposits

The maximum annual number of the days with ice deposits has lower values in eastward half of the lane (Ineu 23 days). In the mountain zone, at Monesa-Izoi, the maximum number of days with ice deposits is 29 days. The highest maximum annual number of days with ice deposits is at Şiria – 81 days in the year 1996.

The maximum monthly number of days with deposits has the highest values in the months January and December and the lowest in the months November and March. At all the three stations situated in the interior of Crişul Alb lane the maximum number of days with hoarfrost deposits is higher than the maximum number of the days with glaze deposits (figure 2).

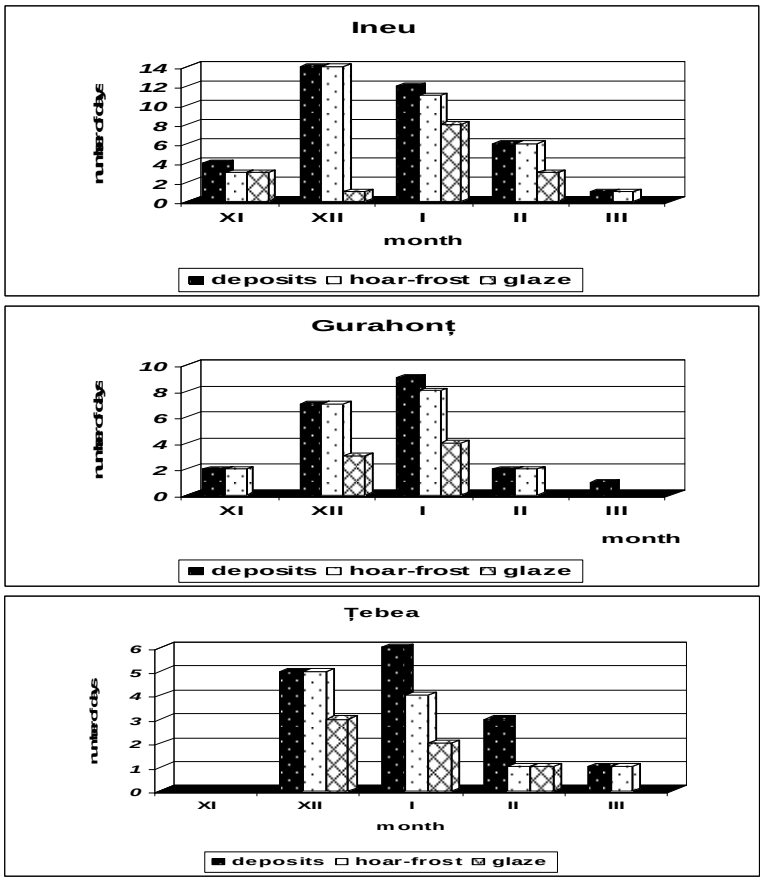

Fig. 2. The maximum monthly number of days with ice deposits

2.4. The tendency of evolution and the probability of a certain number of days with ice deposits occurring

Data analysis has emphasizes a negative tendency for the stations Ineu, Gurahonț, Țebea and Moneasa-Izoi and a positive tendency for Chisineu Criş and Şiria, the stations at which, a rise of the number of days whit ice deposits has been observed after the year 2000 (figure 3).

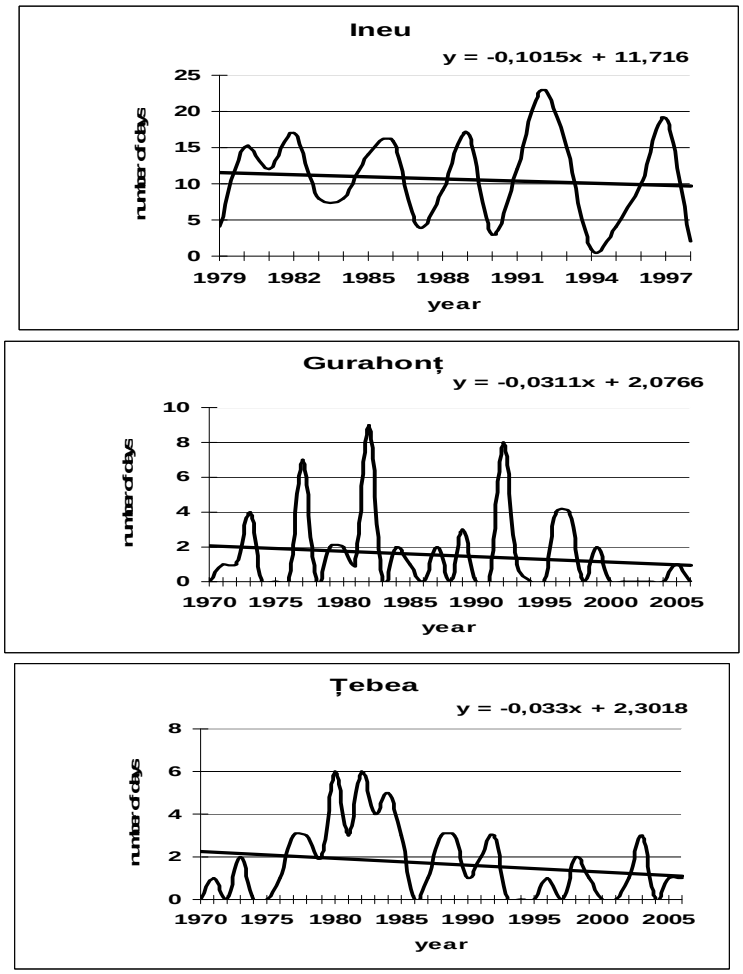

Fig. 3. The tendency of evolution for the annual number of days with ice deposits

Statistical probability was calculated with the formula $p = [m (n+1)] \times 100$, where p represents probability, m number of favourable cases and n total number of cases.

The lowest probability of occurrence of these phenomena are characteristic of stations Țebea, Gurahonț and Moneasa-Izoi, and the highest in the western area located outside the lane, at Chisineu Criș and Șiria (table 2).

The probability of occurrence of a certain number of days with ice deposits

Table 2

Probability %	Station/number of days					
	Chisineu Criș	Ineu	Gurahonț	Țebea	Șiria	Moneasa-Izoi
5	36	22	8	6	80	15
20	25	17	3	2	60	11
80	8	4	0	0	24	0
95	5	2	0	0	10	0

2.5. Average and maximum annual and monthly number of cases with ice deposits

The number of cases with ice deposits is different from the number of days. There are years in which the number of cases is greater than the number of days because during a single day may occur several cases, depending on weather condition variation. But there are also situations in which the number of cases is smaller because one case can last over several days if the weather conditions maintain constant.

In general both, average number and maximum number of cases are lower than the days, except station Ţebea (figure 4).

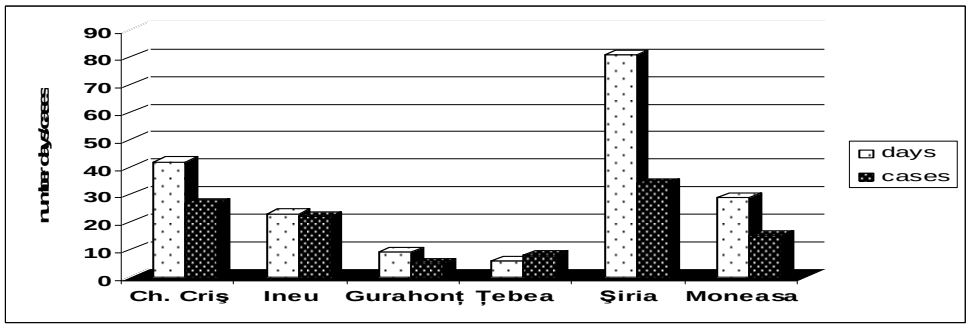

Fig.4. The maximum annual number of days and cases with ice deposits

2.6. Average and extreme data for the occurrence and the favourable interval for the ice deposits

The average date of occurrence for the first ice deposit is placed at the end of December at the stations located in the middle and upper lane approximately three weeks lather than in the plain where the first deposit occurs usually in the first decade of December.

The earlier first deposit was recorded at Chisineu Criş in 28 October 1976.

The last ice deposit occurs at Ineu, Ţebea and Gurahonţ in the first and the second decade of January, and in the second decade of February at Chisineu Criş and Moneasa-Izoi. At Şiria the average data for the last ice deposit is placed in the second decade of March. The latest ice deposit occurs in the April of 2003 at Şiria (table 3).

The average and extreme data for the occurrence and the favourable interval for the ice deposits

Table 3

Station	First deposit			Last deposit			Favourable interval (days)
	The earlier	Average	The latest	The earlier	Average	The latest	
Chişineu Criş	28 X 1976	4 XII	26 II 1981	24 XII 1994	12 II	21 III 1976	70
Ineu	13 XI 1988	8 XII	17 I 1987	7 I 1990	6 II	12 III 1984	30
Gurahonţ	1 XII 1977	28 XII	14 II 1987	4 XII 1980	10 I	14 II 1985	14
Ţebea	6 XII 1990	31 XII	7 II 1987	13 XII 1988	17 I	14 III 1998	18
Şiria	2 XI 2006	26 XI	20 I 1985	17 I 1990	11 III	9 IV 2003	106
Moneasa - Izoi	7 XI 1978	12 XII	22 I 1991	31 XII 1976	7 II	13 III 1988	58

2.7. Maximum duration of the ice deposits

The maximum duration of the ice deposits is an important parameter because the degree of hazard is determined on the basis of ice deposits duration - greater the length, the negative effects are greater. Duration can be appreciated in number of days or in number of hours. For the practice is important the maximum duration for a case with ice deposits. The smallest maximum duration was recorded at Ţebea, in the upper line, where the maximum duration was 35,4 hours in January 1980 (it was a hoar-frost).The maximum duration grows to west, so at Gurahonţ the highest value exceeds 120 hours (129,5 hours in January 1982- more than 5 days with glaze) and at Ineu where the maximum duration exceeds 200 hours (225,9 hours in December 1986, 9,4 days with hoar-frost).This values characterised the stations placed inside the corridor are less than the values at the station located outside the corridor where at Chisineu Criş the maximum duration for a single case surpassed 250 hours (261.8 hours in January 1982 -11 days with hoar-frost) and at Şiria over 280 hours (280,6 hours-11,6 days with hoar-frost in December 2005)-figure 5.

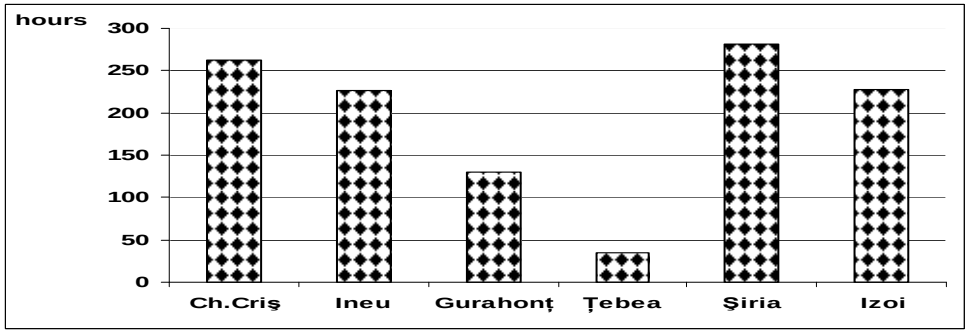

Fig. 5. The maximum duration of the ice deposits

2.8. Maximum diameter of the ice deposits

The maximum diameter of ice deposits is determined by the genetic conditions which cause the formations and the evolution of ice deposit. For the stations located inside the White Criş corridor, during the period 1970-2006, the maximum diameter has values between 10-25mm at Ţebea, 10-30mm at Ineu and Gurahonţ. In literature (Bogdan, Niculescu, 1999) are mentioned for Gurahonţ values for the maximum diameter between 65-76mm, for the deposits formed in January and February 1964, values which were not found after 1970.Outside the corridor the maximum diameter values were between 25-40 mm at Moneasa-Izoi, 20-50 mm at Chişineu Criş and and 30-85 mm at Şiria (figure 6).

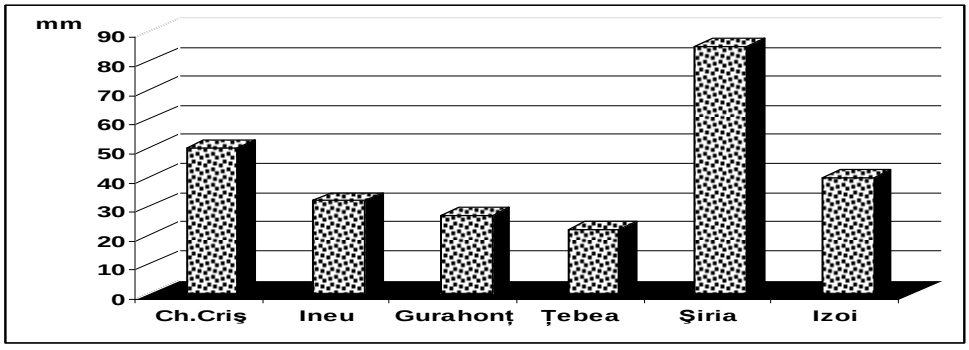

Fig. 6. The maximum diameter of the ice deposits

2.9. Maximum weight of the ice deposits

This is the most important parameter which characterizes ice deposits, because a deposit with heavy weight and long duration may cause great damage.

In literature are cited cases of ice deposits whose weight exceeded 5000g/1 m cable, or even more in high mountain areas. Compared with these values, in the studied area the ice deposits present, in terms of weight, a very low risk (table 4).

The maximum weight of the ice deposits (g/1m cable)

Table 4

Month Station	I	II	III	IV	X	XI	XII	Maximum value
Chişineu Criş	8-56	8-168	8-56	0	0	8-40	8-56	168 -Feb.2005
Ineu	8-40	8-40	0	-	-	24	8-32	40 –Feb.1985
Gurahonţ	8-16	16	8	-	-	8	8-40	40 –Dec.1987
Ţebea	8-56	8-16	0	-	-	-	8-16	56 –Jan . 2003
Şiria	8-112	8-160	8-48	8	-	8-48	8-176	176 –Dec. 1993
Moneasa-Izoi	8-144	16-24	8	-	-	24	8-24	144 –Jan . 1977

The highest values appear in January, February and December and the lowest in March and April.

The maximum weight of ice deposits is much lower at the stations located inside the lane than at the stations located outside the corridor (figure 7).

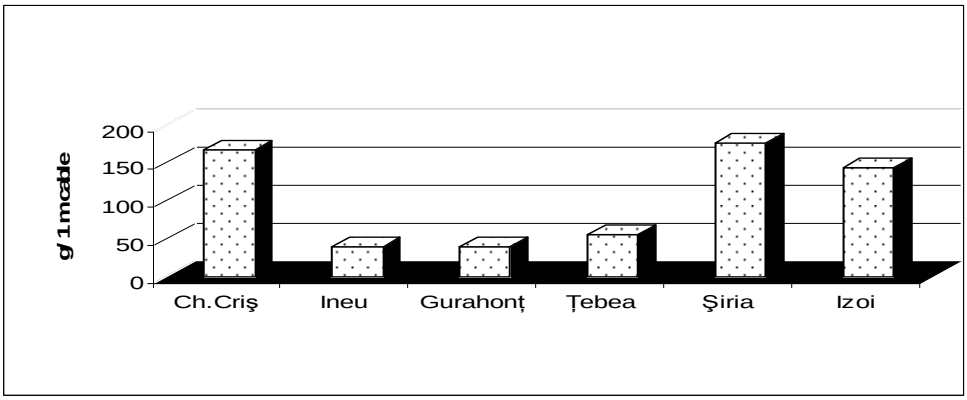

Fig. 7. The maximum weight of the ice deposits

2.10. Vulnerability to the ice deposits

To determine the degree of vulnerability at ice deposits we used the methodology presented by Octavia Bogdan (2007) who established five vulnerability steps for our country, from very low to very high. Parameters used for determining the degree of vulnerability were the favourable interval, the average and maximum annual number of days and cases with ice deposits, maximum diameter (mm), maximum weight (g/1m cable).

Except the favourable interval which lead to a medium vulnerability, the remaining parameters emphasis a very low vulnerability for the eastern half of the corridor and a low vulnerability for the western half. The area located outside the corridor has a greater vulnerability, the most exposed station is Şiria which receives for the most parameters the qualification medium vulnerability, and the only parameter which lies in the low vulnerability rating is the weight of the ice deposits.

Conclusions

Inside the lane of White Criş the ice deposits have a lower frequency and intensity than in the outside area. Even normally the duration and intensity of the ice deposits are lower in the plain area than in the hilly and mountainous area, in the White Criş lane the situation is different, the variability of the phenomena being determined less by the altitude, and more by the local characteristics of the relief - orientation, exposure, position in front of the dominant air masses.

The highest frequency and intensity of those phenomena appears at Şiria, station which is located in the south-west part of the corridor, with a wide exposure in front of warm and moist air invasions during the cold season which is convenient for the formation of fog and ice deposits. The eastern half of the lane has a shelter aspect determined by the ground configuration; the volcanic hillocks from the central part of the corridor obstruct the advance of the warm and moist air masses from the west and south-west. The foehn wind effect which cause the reduction of the cooling intensity and the decreasing of the frosting and sublimation of water vapours processes, as in the mountainous area where is located Moneasa-Izoi station, is added to these causes.

REFERENCES

Bălescu O. (1962), *Condiţiile sinoptice care favorizează depunerile de gheaţă în RPR*, MHGA, VII, 4, Bucureşti, p.250-251

Bălescu O. (1962), *Depunerile de gheaţă pe conductorii aerieni*, MHGA, 2, Bucureşti, p. 108-116

Bogdan Octavia, Niculescu Elena (1999), *Riscurile climatice din România*, Academia Română, Institutul de Geografie, Bucureşti

Marinică I, Purecel Maria (1997), *Analiza la nivel local privind apariţia ceţii şi a chiciurei în perioada 10-20 ianuarie 1997*, mss. Comunicare la Sesiunea Ştiinţifică Anuală a I.N.M.H., Bucureşti 1997

Neagu Elena, Popa Anestina (1976), *Depunerile de gheaţă pe conductorii aerieni în intervalul 1 iulie 1972- 30 iunie 1973 pe teritoriul României*, Studii şi Cercet., I/2, Meteorologie, IMH, Bucureşti, p. 585-597

Ţepeş Elena (1968), *Primele rezultate ale măsurătorilor instrumentale asupra depunerilor de gheaţă pe conductoarele aeriene*, Hidrotehnica 16, 1, Bucureşti, p.26-30