

CLIMATOLOGICAL LANDMARKS OF THE BLIZZARD PHENOMENON IN THE BĂRĂGAN PLAIN AREA

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ABSTRACT: The Bărăgan plain, situated in the E part of the Romanian Plain, is characterized by a temperate lowland climate, with an accentuated degree of continentality. Advection of air masses from all directions generates high intensity of weather phenomena specific to the two extreme seasons. Of course, a particular role have the active underlying surface and local geography. The blizzard, the most complex meteorological phenomenon of the cold season, has one of its production poles in this area, and is amplified by its association with the local wind “crivăț”, but favored by local physical-geographical factors (waste and land use having a particular role). Studying the blizzard phenomenon is particularly important, especially due to the impact that it produces over the environment and the socio-economical activities in a well populated area such as the Bărăgan Plain.

Keywords: blizzard, climatological analysis, spatio-temporality, duration, intensity;

1. INTRODUCTION

The well defined geographical subregion of the Romanian Plain, The Bărăgan Plain (Fig. 1) is situated in SE Romania. The southern and eastern limits are established by the Danube floodplain, the northern one by the Siret and Buzău floodplains. The western limit corresponds to the interference between the silvosteppe and the forest, i.e. the Argeș floodplain from the confluence with Dâmbovița river to the river mouth, then Dâmbovița, Pasărea, Obârșia Mostiștei and Sărata (Romanian Geography, V, 2005).

Due to its position, with a large opening to east-north-east, the climate is lowland temperate, with an accentuated degree of continentality. Climatic continentality is characterized by high thermal contrasts, from winter (-2...-4°C in January, but possible minimal values of < -30°C), to summer (22-23°C, in June and possible maximum values of > 40°C), low rainfall (450-550 mm/y, with variations from 200-300mm/y in dry years, to over 700-800 mm/y in rainy years), early winter weather phenomena (hoarfrost, frost), intense summer phenomena (hail, storms, and sometimes even tornados), droughts and dryness possible throughout

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the year, predominant northern wind (“Crivăț”), as well as the most intense forms of blizzard (Bogdan, 1980).

The uniformity of the relief of the Bărăgan Plain induces reduced topoclimatic differentiations.

In terms of settlements, the specificity is given by the gathered plain villages, the predominant land use is agricultural, with crops predominantly cereals, leguminous, and, to a lesser extent, fruit trees and vines or grazing.

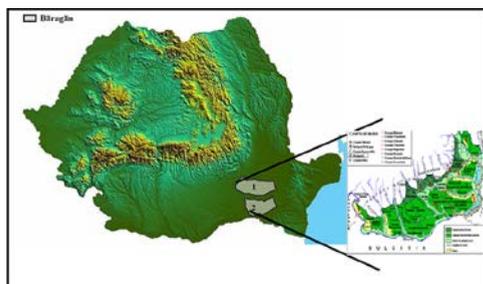


Fig. 1. The map of Romania and of the Bărăgan plain

Source: <http://ro.wikipedia.org>

For these reasons, a brief climatic analysis of the blizzard phenomenon could have a practical importance, by processing meteorological data for a period of over 50 years (1961-2012) from the meteorological stations: Brăila, Buzău, Călărași, Făurei, Grivița, Urziceni, with the mention that Buzău is situated at the border between Bărăgan and Buzău-Siret Plains respectively.

2. DATA AND METHODS

For the present study, the meteorological data were provided by NMA (National Meteorological Administration). For a correct and fair climatological analysis of the phenomenon, meteorological data were used from 6 meteo-synoptic stations situated in the area presented in the introduction (Brăila, Buzău, Călărași, Făurei, Grivița and Urziceni). The study covers the period between 1 October, 1961 and 30 April, 2012, with the mention that for Brăila, the data is from 1975 (when the station was established) to 2012 and that for Făurei, the period is 1961-2001 (the station was discontinued in 2001). Data about the following were used: occurrence/non-occurrence of the blizzard phenomenon, direction and average and maximum speed of the wind. Only data during the occurrence of the blizzard episodes were selected. Data were subjected to homogenization through a statistical method and were then processed.

The statistical methods used are primary data collection and processing, thus data were collected from the archives of the National Meteorological Administration, chronologically grouped for each station and for each weather element: time of occurrence of each episode of the blizzard, the number of days with blizzard, the number of successive and non-successive days. There was also determined the intensity of the blizzards on different thresholds, according to the classification made by Bogdan, Niculescu (1999), calculating the average and maximum wind speed for those thresholds, and the spatial distribution of the predominant wind direction.

The following statistical indicators were used: frequency of days with blizzard, frequency of successive and non-successive days and frequency of the phenomenon's intensity.

To calculate the frequency, the number of blizzard cases was multiplied by 100, and the result was divided by the number of years/number of total cases. Distribution series were used to calculate the arithmetic means.

3. RESULTS

The climatological analysis of the blizzard phenomenon has been structured by a couple of stages: at first, the duration and frequency of the blizzard episodes was calculated (average number of blizzard days/year, successive and non-successive days), then the occurrence date of the earliest and latest blizzard respectively and the intensity of the blizzards (average wind speed frequency, and maximum wind speed frequency) and finally the predominant direction of the wind.

3.1. Duration and frequency of blizzards.

3.1.1 Frequency of blizzards

The average frequency of blizzard days, according to Fig.2, is between 3 and 8 days.

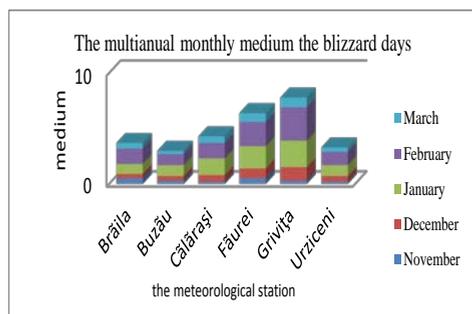


Fig. 2. The multiannual monthly medium of the blizzard days

The month with the most numerous blizzard days is February (1-3 days), the one with the fewest blizzard days is November (0.2-0.5 days). The months December and March have had an approximately equal distribution (0.4-1.2 days); in January there were recorded between 0.9 and 2.4 days. In term of spatiality, the highest annual number of days with blizzard was recorded at Grivița (8) and Făurei (6.4), and the lowest at Urziceni (3.3) and Buzău (3).

3.1.2 Blizzard duration

3.1.2.1 Successive days

In order to determine the duration in terms of successive days, blizzards with the following durations have been calculated: 1 day to 8 successive days, calculating their percent from the total number of days with blizzard.

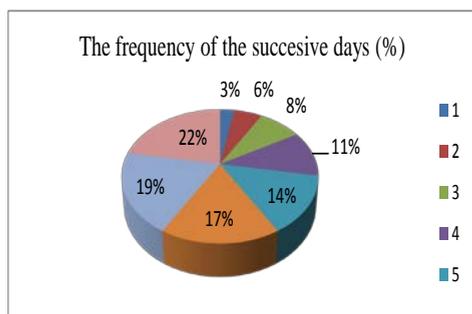


Fig. 3. The frequency of the successive days

In Bărăgan, the successive day-duration is between 1 and 8 days. The most frequent ones are: 1 day (43.2%), 2 days (40.3%), 3 days (12.4%), decreasing from 4 days (2.8%), to 5 and 6 days (0.7%), 7 and 8 days (0.1%) (fig.3). The spatial distribution highlights Buzău(56.1%) for 1- day blizzard, Făurei, Grivița and Urziceni (41.7, 38,7 and 47.5%) for 2- day blizzards.

From the spatial distribution point of view, successive days frequency outlines the following:Urziceni has an interval between 1-4 successive days, Călărași – of 1-5 days, Brăila – of 1-6 days, Făurei - of 1-7 days and Grivița - of 1-8 days.

3.1.2.2 Non-successive days

In order to calculate the non-successive days frequency, a few thresholds of blizzard days have been settled. The number of years without blizzard has been calculated, then the following intervals: 1-4 non-successive days, 4-8 non-successive days, 9-12 non-successive days, and more than 12 non-successive days. After that, the frequency was calculated by multiplying the number of possible cases by 100 and dividing the result by the total years considered for each station, according to the established interval.

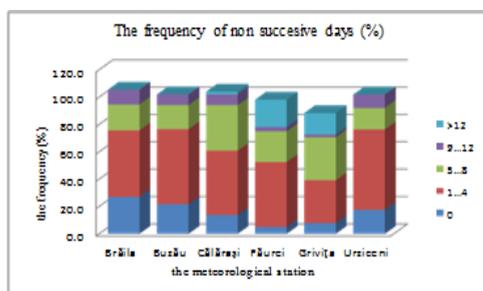


Fig. 4. Frequency of non- successive day

The frequency of non-successive days, shows in fact, the probability of the phenomenon to occur (Bălescu and Beșleagă, 1962). From Fig.4 it can be seen that the highest frequency is in the 1-4 day - interval, at all 6 meteorological stations studied, and the minimum frequency of occurrence – in the interval shorter than 12 days.

Also, we can see that the probability of the phenomenon not to occur is different; at Făurei and Grivița (5.0 and 7.8%) we find the smallest percent, and the highest percent at Brăila and Buzău (27.0 and 21.6)

Concluding, from the non-successive day- point of view, a relative homogeneous spatial distribution can be noticed, highlighting two peaks: Făurei and Grivița, as being two poles of occurrence of the blizzard phenomenon.

3.2. Date of occurrence of the earliest and latest blizzard

The earliest blizzard occurred in the first half of November, and the latest blizzard in the second half of March. In the analyzed time interval, no blizzard occurred in October or April.

Table 1. Absolute occurrence date of the earliest and latest blizzard

station/date	earliest blizzard	latest blizzard
Brăila	11/9/1981	03/18/1992
Buzău	11/3/1980	03/14/19□3 and 1995
Călărași	11/9/1981	03/20/1969
Făurei	11/9/1981	03/19/1969
Grivița	11/11/1993	03/20/1969
Urziceni	11/11/1993	03/20/1963

However, year by year, the temporal distribution is different, since the earliest blizzard could be the last blizzard occurred in the season (in any of the 5 months considered). From the spatial point of view, there can be observed homogeneity of the occurrence date of the earliest and latest blizzard.

The earliest blizzards occurred on November 3, 1980 (Buzău) and the latest on March 20, 1963 and 1969 (Urziceni, Grivița and Călărași) (Table 1)

3.3 Blizzard intensity

The intensity of the blizzard phenomenon is given by the average and maximum wind speed registered during the occurrence of a blizzard episode (Bogdan Niculescu, 1999), thus establishing certain defining thresholds for characterizing the intensity of the phenomenon: moderate blizzards (6-10 m/s), strong (11-17 m/s), and violent ones (>17 m/s).

3.3.1 Wind speed

The wind speed is characterized through its average (calculated by summing and averaging the 4 climatological observations) and the maximum wind speed (determined from the 24 hours of observations and from the warning messages, being considered as maximum speed the highest gusting speed).

3.3.1.1 Average wind speed

According to Bogdan and Niculescu (1999), the average wind speed characterizes the intensity of the blizzard, some speed thresholds being set: < 6, 6... 10, 11...17, >17 m/s).

First, the total number of cases for each threshold has been calculated, then the percent of the total cases, so as to establish the intensity frequency of the phenomenon that characterized each station taken into account.

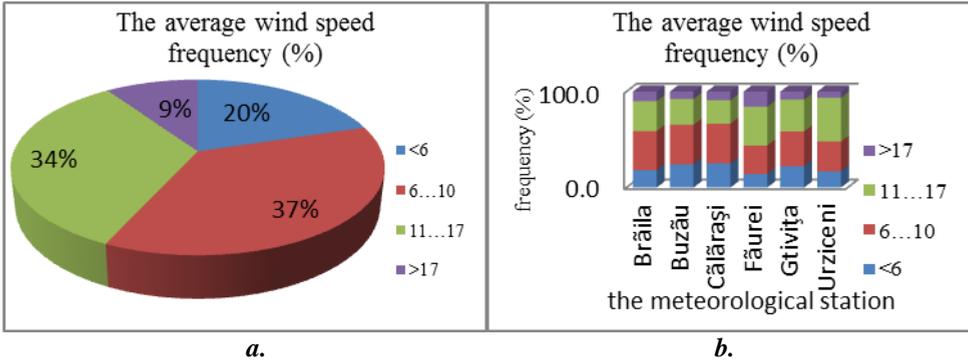


Fig. 5. The average wind speed frequency: a. average of the frequency from all stations; b. spatial distribution

Average wind speed during a blizzard ranges between 0 and 35 m/s, with a 6-10 m/s characteristic interval (37%), moderate blizzards prevailing (Fig. 5 a and b) and with the 11...17 m/s interval (34%) which characterizes the strong blizzards, close enough with respect to frequency. In conclusion, it can be said that the analysed period was characterized by moderate and strong blizzards and with few cases of violent blizzards.

3.3.1.2 Maximum wind speed

The maximum wind speed is in fact the highest intensity that the phenomena can have at a certain point; with the mention that the gusting speed is practically an instantaneous speed.

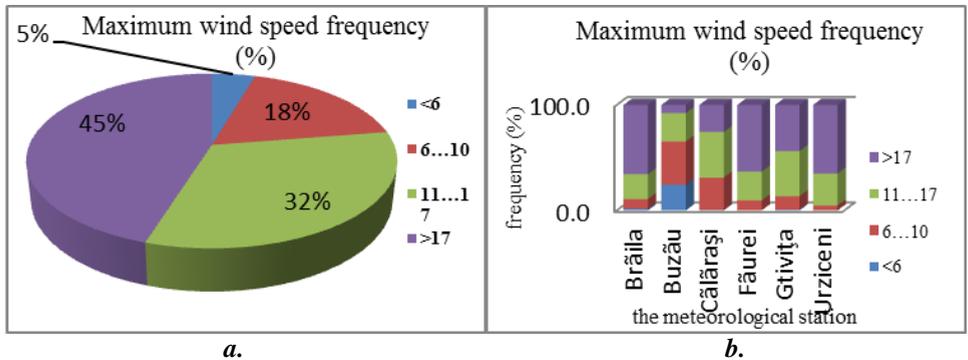


Fig. 6. Maximum wind speed frequency: a. averaged at all stations b. spatial distribution

During one and the same blizzard episode, the wind may increase or decrease in intensity several times. Speaking of maximum speed, the speed interval >17 m/s can be distinguished, the maximum speed sometimes exceeding 35 m/s, reaching even 40 m/s (Făurei and Urziceni, January 1981). However we cannot say

that violent blizzards were predominant, but we can conclude that, at certain moments, the phenomenon had the intensity of a violent blizzard (Fig. 6 a and b).

3.3.2 Predominant wind direction

During a blizzard episode, the predominant wind direction may have fluctuations, but fits in the multiannual climatological directions of the area. The Bărăgan Plain, overlapping the eastern part of Wallachia, is characterized by a predominant direction from the N-E quadrant, but in the north of the plain, a wind divergence towards western Wallachia and southern Dobrudja stands out, highlighting the fact that the air masses, after escaping from the bottleneck between the Carpathian Curvature and the high hills in the north of Dobrudja, spread in the Carpathian-Balkan hollow (Bălescu and Beşleagă, 1962).

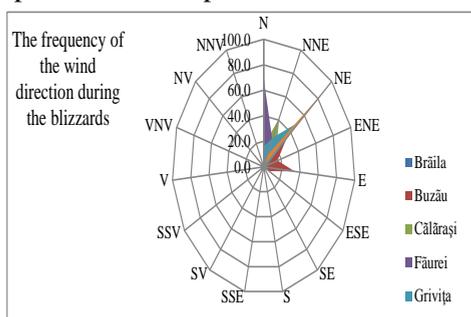


Fig. 7. Frequency of the wind direction during blizzards

In this paper, there have been analysed wind data from meteorological stations taken into consideration, calculating predominant directions frequency (as a percent of the total number of years), during the blizzard episodes. The predominant wind direction fits in the north-eastern quadrant; each station individuates as follows: Brăila, Urziceni and Grivița have predominant as direction the NE, Călărași - NNE, Făurei - N and Buzău NE and E (Fig. 7)

4. CONCLUSIONS

During 1961-2012, the blizzard phenomenon had a temporal distribution from November to March, with no such episodes in October or April.

Thus, it has been remarked that the frequency of the days with blizzard was between 3 and 8 days / year, the most of them been recorded at Grivița, and the fewest at Buzău. Also, the monthly distribution of the phenomenon highlights February as the month with the most numerous days with blizzard (1-3 days) and November as the one with the least number of such cases (0.2-0.5 days).

The duration of the blizzard in the characterized interval, considering successive and non-successive days, shows us that successive days have an interval of 1-8 days, the most frequent ones being the 1- day ones and the less frequent - the 5-8 days ones. Speaking of non-successive days, blizzards had a duration between 1 and 32 days, the most frequent being 1-4 days and the less frequent the one shorter than 12 days.

The absolute date of occurrence of the first and last blizzard had a relative homogeneous distribution. Thus, the earliest blizzards occurred in November, in the first 10-day interval, the 3rd of November 1980 being the earliest date of occurrence. The date of the latest storms was in March, at the end of the 2 10-day interval (20 March, 1963 and 1969). The spatial distribution highlights the fact that Buzău had the earliest blizzard, whereas Urziceni, Grivița and Călărași - the latest one.

As regards the intensity of the phenomena, moderate blizzards (37 %) or strong ones (34 %) were the most frequent, but there also occurred violent blizzards - in a lower percent (8 %). The average wind speed which characterizes the intensity of the phenomenon was situated between 0 and 35 m/s – Urziceni and Făurei. The maximum wind speed highlights an intensification of the phenomenon in its occurrence interval, reaching values of more than 35 m/s (40 m/s, January 1981, Făurei and Urziceni), speeds characteristic to the strong and violent intensities.

The predominant wind direction was situated in the north-eastern quadrant, specific to the characterized area, the spatial repartition pointing out Brăila, Urziceni and Grivița with the predominant NE direction, Călărași - the NNE direction, Făurei – the N direction and Buzău – the NE and E directions.

As a final opinion, it can be said that the blizzard episodes occurred between 1961 and 2012 fit in the multiannual climatological standard specifications from all points of view. The temporal distribution displayed periods of time without blizzards, periods with 1 or 2 - day blizzards and yearly periods with 32 day- blizzards.

Blizzard intensity had, in certain conditions, violent characteristics, but generally, they were moderate or strong.

In conclusion, the blizzard is a phenomenon specific to the cold season. One of the poles of its occurrence in Romania is the Bărăgan Plain; however and the vulnerability of the area is not caused by the phenomenon but by the incapacity and poor organization of the people.

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