BLIZZARD – VENTURE HYDROMETEOR IN DOBROGEA

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Abstract. Snow blizzard violence causes snow dispel, crops are then subject to frost formation drifts in sheltered obstacles (on the outskirts of villages along the snow fences bordering the routes or railway embankments, the river valleys in small depressions etc.). Snowdrifts stop road and rail traffic, destroying walls and roofs of homes. Through its mechanical action on the ground objects, blizzard causes breaking of young branches, unveiling homes, breaking electrical telephone, telegraph wires, etc.

Introduction

The risk factors and climatology aspects in Dobrudja (including blizzard), have been researched in papers written by D. Ţâştea etc. (1967), I.F. Mihăilescu (1986, 1999, 2001), Bogdan Octavia (1978, 1996,1999), S. Chiulache and Nicoleta Ionac (1995), Cr. Păltineanu etc. (2000), M. Lungu (2009).

The analysis of blizzard in Dobrudja is based on the data obtained from the observations accomplished in eighteen meteorological stations between 1965 and 2005. Its purpose is the climatic characterization of the regime, of the occurrence probability (in the representative landscape points, with relatively complete recordings) and of its territorial distribution.

Blizzard is the rapid snow dispel by wind, which causes a sharp decrease in visibility and blocks communication paths. When blizzard is accompanied by snowfall, it is called snow blizzard.

Special attention is paid to blizzard, starting from the fact that on the territory of Romania, the largest annual average number of days with blizzard has been recorded in eastern and southern regions (where Dobrogea territory also fits), "the highest annual average values are recorded here, between five and seven days (Besleaga N., 1962), because of the sewage effect caused by the orographic barrier of the Curvature Carpathians and the thermal barrier represented by the Black Sea. Most storms usually occur in January, but they can also occur, completely at random, in November-December or February-March (Ciulache S., 1998). Blizzards

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are, for the mid-latitudes where Dobrogea is situated, spectacular winter atmospheric phenomena.

There are two key elements involved in producing this venture hydrometeor: wind speed and the amount of fallen snow. As a hazardous climatic phenomenon, blizzard can occur in full winter, but also very early in autumn or very late in spring, when its effects are associated with frost and crop damage may be even higher.

Based on the complexity of the phenomenon, several types of blizzard can be distinguished: general blizzard, snow blizzard, ground blizzard, blowing snow.

General blizzard is usually the most complex phenomenon that includes all the elements: snow, strong wind, dispel and snow transport both on ground and in altitude, sometimes being impossible to distinguish whether there is fresh snowfall or just the snow on the ground being dispelled.

Snow blizzard is the phenomenon during which snow is associated with high wind speed.

Ground blizzard is the phenomenon during which the wind is blowing hard, dispelling the snow on the ground, without any fresh snowfall at the same time.

Note that not every storm can be considered a climatic risk phenomenon because the wind speed and the amount of snow falling or the snow shattered during snowfall in the air or on the ground varies greatly both in time and space. Often, freshly fallen snow can be shattered by winds at speeds below 10 m / s without being considered a climate risk. These are moderate storms. Their effect is the accumulation of snow around shelters and unveiled crops, which, in the absence of snow, are subject to winter frosts.

1. Results and discussions

Blizzards fall within the category of climate risk, primarily due to wind speed (speeds over 11 m / s - strong storms, or over 15 m / s - violent storms), but also because of heavy snowfalls that can form a snow layer 25-50 cm thick, snowdrifts up to 1-2 m high or higher, disturbing economic activities.

Therefore, blizzard, as a climatic risk phenomenon, must meet several conditions:

-high speed winds and abundant snowfalls in winter;

-very early blizzards (in autumn), respectively very late blizzards (in spring), off-season.

2. Genetic causes of blizzard

The cause that generates this venture hydrometeor in Dobrogea is the appearance of a baric gradient determined by an anticyclone field located in the north of our country and a deep depression located in southeastern Europe. Baric

landscape orientation makes the airflow over our country become either a rather eastern component, due to the European extension of the Siberian Anticyclone, the presence of the sea acting as a thermal barrier, and the presence of the curvature in the Carpathians. Sometimes, it is more a western component, which can be produced both by the European extension of the Siberian Anticyclone, and by the Scandinavian Anticyclone joined with the Azores, a situation that is less common in the south-eastern part of the country. This direction is also driven by the anticyclone, which is sometimes moving from northern Europe to be located in northern Poland ('unique synoptic coupling').

3. The main parameters characterizing blizzard

3.1. Average data on blizzards and their annual average range. In Dobrogea, the average date of the first blizzards is in December at most stations (Constanta, Mangalia Adamclisi, Tulcea, Sulina Medgidia) and the last decade of November (Hârşova, Corugea).

As for the average range of the last blizzard events across the Dobrogea territory, they were reported in the first decade of March, table 1.

Tab. 1 - Monthly and annual average number of days with blizzard in Dobrogea (1965-2005)

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	**Annual**
Constanța	0,4	0,5	0,4									0,1	**1,4**
Mangalia	0,3	0,1	0,1									0,1	**0,6**
Hârşova	0,8	0,5	0,4								0,1	0,2	**2,0**
Medgidia	0,2	0,2	0,1									0,1	**0,6**
Adamclisi	0,2	0,6	0,4									0,1	**1,3**
Tulcea	0,2	0,2	0,2									0,1	**0,7**
Sulina	0,5	0,4	0,4									0,1	**1,4**
Corugea	1,5	0,9	0,6								0,7	1,1	**4,8**

Annual average interval favoring blizzards. This is the interval comprised between the two averages, between the first and the last blizzard, and ranges by territory as follows:

- for coastal regions or wind sheltered area it ranges between the average date of the first blizzard (in December) and the average date of the last blizzard (early March), that is between 3 and 3.5 month / year;

- for north-western regions, but also for western regions, this interval increases with altitude, increasingly creating more and more favorable conditions

for snow and wind speed increase; in general, it ranges properly between November and March, which means 3.5 to 4 months per year.

3.2. Extreme data on blizzard production. Blizzard may occur much earlier, or later, off-season, when it may acquire climate risk characteristics through the consequences it triggers on society and the environment.

The earliest blizzard that occurred during the last considered period was in November (20 November, 1975, November 1993, blizzard occurred in four intervals: 6-7 November, 12-14 November, 20-22 November, 29 November – 1 December, as well as on 4 November , 1995).

The latest storm reported in the same period occurred in April (on 18 April, 1974 a blizzard during which wind speed was of 20 m/s, accompanied by heavy snowfalls). Because of the relatively late date, when the soil was already starting to accumulate heat, the snow melted, unable to form the layer. At this time, garden flowers were in bloom, as well as cherry trees, thus, if it had not been for the wind blowing at high speed, one could think it was a rain of cherry petals.

3.3. Blizzard hazard intervals. Intervals between average and extreme data of blizzard production, from the beginning of the cold semester, respectively the end of it, are climate risk intervals for blizzards that occur off-season and can cause considerable damage to the economy of Dobrogea, especially to agriculture. Blizzards occurring off-season, accompanied by negative temperatures and snow accumulation can cause compromised crops.

The average time interval between the first blizzard from the beginning of the cold semester and that of the last blizzard from its end, is the interval of climate risk for blizzards produced in the cold season, which can also have quite serious consequences (especially on transport), given their violence and the snow layer formed, as well as the nature of its deposit.

3.4. Average and maximum annual number of days with blizzard. Although the possible range of days with blizzard phenomena is quite big (3-4 months), sometimes equal to the total duration of the cold period of the year (if we take into account the ranges of climate risk off-season), however, the annual average number of days with blizzard is low.

The fewest days with snow blizzards occur in wind sheltered regions, coastal areas (less than 1.5 days / year), and most of them in the west and higher regions in the northwest (more than 2, even 4 days / year).

These were unevenly distributed in the months with blizzards, the maximum being 1.5 days in January (the month with most days with blizzard) at Corugea, Figure 4.5. As for the maximum number of days with blizzard, it was of eight in the coastal area and eleven in the west and north-west, under the most violent blizzard conditions in January 1966.

Therefore, Dobrogea, together with Baragan, can be considered the main "arena" for blizzard events because of their position between the Curvature of the Carpathians on one hand, and the Black Sea on the other hand, channeling the masses of arctic cold air from north and north-eastern Europe through this "Carpathian Gateway" towards the Romanian Plain and Dobrogea, while interacting with the warm tropical air masses from the Mediterranean Sea (Bogdan, 1978, 1980).

3.5. Direction and wind speed during blizzards. This complements the aspect of climatic hazard in blizzards. Direction highlights the path of cold air advection, and speed, the value of the thermo-baric contrast between the two air masses, cold and warm, causing turbulence and mechanical action of wind. During blizzards, north winds have been found to prevail, followed by the north-eastern and north-western winds, figure 1.

Fig. 1 - Wind direction during blizzards (% of all cases) and average speed (m/s) in Dobrogea (1965-2005)

Dominant directions are also accrued the highest wind speeds, during blizzards. They can reach, on average, 6-10 m/s on the southern coast and in sheltered areas, and 11-15 m/s in the remaining territory.

3.6. Blizzard duration. The persistence of blizzard enhances its climatic risk character, if the speeds remain high, above the average. Two aspects raise a great practical interest:

- the time interval (successive days) when two or more storms can occur (i.e., total duration on days with blizzard)
- the duration of a blizzard.

The persistence of some synoptic conditions generating blizzard can determine the production of this phenomenon in one or more successive days, continuously or discontinuously (i.e., a snowstorm may occur in several consecutive days or in several consecutive days we may have more storms); therefore, we may speak about two aspects of the blizzard duration.

A good example is the blizzard of 21-22 December, 1998, that lasted 48 hours in Dobrogea, blocking all the traffic arteries in snow, so that cars remained stuck for over 62 hours in the open, and the blizzard of 2-4 January, 2008, which lasted for 54 hours, disrupting shipments from Central and South Dobrogea.

3.7. The amount of snow deposited during a blizzard. Blizzards are often accompanied by heavy snow, resulting in large amounts of water. There were times when snow fallen during blizzards in January, considered one of the driest months of the year, conferred the status of the month with maximum rainfall within 24 hours. This is the case of Constanta station, which, during the blizzard of the 2nd of January, 2008, recorded a maximum of 100.9 mm.

The highest values (over 8 l/m2) occur in more favorable conditions for snow deposit (less violent snowstorm), transport, moisture, conditions met in the northern side, due to the Mediterranean cyclones with a normal development in Northern Dobrogea, a consequence of Mediterranean disturbances (of the Mediterranean cyclones with a retrograde character). The average amount of water decreases gradually, along with its proximity to the sea, to 4-5 l/m2.

In relation to the intensity and duration of blizzards, snow deposits have variable thickness. Average thickness of snow deposits during blizzards measured on the meteorological platforms in Dobrogea between 1965-2005 ranged from 8-10 cm to 50-100 cm, without considering the height of those drifts formed from snow accumulation in sheltered places.

The absolute maximum thickness of a snow-layer formed during a blizzard is even bigger compared to the average.

After 2005, the thickest snow-layer was formed during the blizzard of 2-4 January, 2008; it reached, in some places, 110-120 cm in the eastern side of the South Dobrogea Plateau, and in sheltered areas and northern plains, it reached, in some places, 150 cm, thus amplifying (through its thickness and amount of fallen water) its nature of climatic risk.

Conclusions

In Dobrogea, blizzard is a phenomenon that is almost always present in the winter season.

The favorable interval for the occurrence of this phenomenon is between the average data of its production from the beginning and end of the yearly cold semester.

Based on observations of the period 1965-2005 of the meteorological stations in the territory of Dobrogea, the time interval favorable to its production could, however, be indicated, differentiated on relief steps, in relation to altitude and distance to the sea.

The character of climatic risk phenomenon, which we attribute to blizzards, is very well emphasized by the consequences produced. Due to high wind speed and the amount of fallen snow during blizzards, there are numerous consequences - sometimes very serious – on the environment and economy.

Among the recent blizzards, we can mention those of:

- November 1993 or 4-5 November 1995, when the blizzard produced in early cold season (not as violent as those mentioned above) has suspended the traffic for 3-5 consecutive days, due to lack of prompter and firmer intervention for snow removal; virtually, traffic was interrupted not because of such serious consequences, but because of not preventing it in time; the same thing happened during the blizzard of 21-22 November, 1998

- 2-4 January, 2008 - traffic on several county roads was restricted, trains were delayed for hundreds of minutes, and maritime traffic was suspended. Constanta city was practically under snowdrifts, and the life of those forced to leave the house was a nightmare. A poplar 10 feet high was pulled from its roots and thrown over two cars. Buses were delayed for dozens of minutes or remained stuck in junctions. Others skidded and overturned, to the passengers' horror. Thirty-one communes in Constanta County were left without electricity. On two national roads, people circulated in winter conditions, and other two, Constanta-Ostrov and Constanta-Mangalia were blocked.

Bibliography:

Bogdan Octavia, Niculescu Elena (1999), „*Riscurile climatice din România*", Academis Romana, Institutul de Geografie, Tipar Compania Sega International, Bucureşti, 280p.

Bogdan Octavia (1978), „*Fenemone climatice de iarnă şi de vară*", Editura Ştiinţifică şi Enciclopedică, Bucureşti.

Bogdan Octavia (1992), „*Asupra noţiunilor de "hazarde", "riscuri" şi "catastrofe" meteorologice şi climatice*", S.C. Geografic, t. XXXIX, Bucureşti, p. 99-105.

Ciulache S., Ionac Nicoleta (1995), „*Fenomene atmosferice de risc şi catastrofe climatice*", Ed. Ştiinţifică, Bucureşti.