

# WEATHER COSTS. CASE STUDY: BLIZZARDS IN ROMANIA DURING THE 2000 – 2012 PERIOD

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**ABSTRACT. Weather costs. Case Study: Blizzards in Romania during the 2000 – 2012 periods.** In mid-latitude regions, blizzards may have serious consequences not only on humans, but also on the environment and the economy. In Romania, blizzards may be produced throughout the country, but due to some local conditions and particularities of the underlying active surface, their intensity, duration and frequency are different; the most exposed and vulnerable areas are: The Romanian Plain (and especially the Baragan Steppe – Plain Area), Moldavia and Dobrogea. This study makes a survey of several blizzard episodes, which occurred during the wintertime of the 2000 – 2012 periods. They have been approached from the point of view of the consequences that this kind of weather phenomenon actually has on the society under meteorological, economic and social aspects; the fact that its aftermath may sometimes be of sizeable proportions, occasionally leading even to loss of human lives, being well-known already.

**Keywords:** blizzards, economic impact, weather costs.

## INTRODUCTION

The blizzard is a complex weather phenomenon characterised by massive snowfall, major increases of wind speed, reduced horizontal and vertical visibility (Ciulache S., Ionac N., 1995). Taking into account the multitude of the associated meteorological phenomena (air temperature decrease, wind speed increase, snow blizzards, etc.) and the amplitude of its consequences, through their spatial extent and severity of resulting damages, the blizzard represents an important meteorological phenomenon. They may produce material and sometimes human losses which can't be neglected, most often seriously affecting the financial resources of the local communities and not only. Climatically, Romania is located in the mid-latitude zone of transition in the Northern Hemisphere, but it is characterized through very obvious shades of excessiveness, which are rather specific of a mid-latitude continental climate, especially in the E and SE (Clima României, 2008). It makes some meteorological phenomena, like blizzards, to manifest themselves with different intensities, depending on the local physical – geographical factors, also determining different consequences from one area to another. The aim of this paper is to analyze some of the most important aspects of the negative impact, on the population and the economy of some Romania's geographical areas, through the costs they actually generated, which some blizzard episodes produced on the country's territory, in the cold seasons between 2000 and 2012.

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## 2. DATA AND METHODS

Despite of the absence of a centralized database regarding the specific emergency interventions of the General Authority for Emergency Situations (GAES), especially in case of some dangerous atmospheric phenomena like blizzards, and of the heterogeneity of the information that are currently issued by some specialized organizations of the National System of Emergency Situations Management (NSES), as well as the ones transmitted by the mass-media, all the statistic information, emergency reports and press communicates given by various state institutions like: The National Meteorology Administration, The Ministries of Economy and Energy, Agriculture, Environment, Transportation, Health, etc., or by the many county, city, town committees, have constituted an important documentation base not only about the meteorological characteristics of the blizzards produced on the Romanian territory over the last twelve years (2000-2012), but also of the negative consequences, which they had on the population and on the economy of some communities. Especially the rural areas, from the geographical regions with a higher frequency of blizzards: the Bărăgan Plain, Dobrogea and Moldavian Tableland areas.

## 3. DISCUSSIONS

### 3.1. Meteorological and climatic characteristics of blizzards in Romania

In Romania, the blizzard is the result of the interactions between the particularities of the air circulation over the European continent and the characteristics of the active underlying surface. The blizzard most often occurs in some specific synoptical situations, especially in the eastern and southern Romanian regions, characterized by a joint coupling of the East – European, Azorical or Scandinavian anticyclones and also by the Mediterranean cyclones, which, if getting into contact, produce large air-temperature and air-pressure lapse rates, which can horizontally exceed 40-50 hPa/km and 2-3°C/100 km or even more (Bălescu I., Beșleagă N., 1962). But the most powerful blizzards occur when an anticyclonic belt extends over Eastern and Central Europe, following the movement of an anticyclone over the Mediterranean Sea, affected by an intense cyclogenetic activity. Such an anticyclonic belt frequently occurs between the ridges of an East - European anticyclone joining with a dorsal of the Azorical anticyclone over Central Europe. The anticyclonic belt is sometimes replaced by several individual anticyclones (Azoric and Scandinavian or East - European), which extend, through a ridge, over the Romanian territory and join with the cyclones hovering over the Mediterranean or Black Sea. Besides the up - mentioned synoptical causes, the particularities of the active underlying surface also play an important role in the genesis of the blizzard and this relates mainly to the presence of the Carpathian Mountains, whose part as a major orographic obstacle becomes even more obvious as blizzards, which are produced when two types of air masses with different physical features brutally meet, produce high disturbances of the meteorological elements only in the inferior layers of the troposphere (up to 600 - 800 m altitude).

In the period between 2000 – 2012, blizzards occurred in: 2001 (24 - 27 February), 2002 (7 – 9 November), 2003 (24 - 27 December), 2004 (21 – 27 January), 2005 (27 January – 6 February), 2006 (5 – 7 January, 1-3 February, 12 – 15 March), 2007 (16 – 19 November), 2008 (1 – 6 January, 26 – 29 January, 23 – 27 December), 2009 (15 – 20 December, 25 – 29 December), 2010 (16 – 18 January, 6 – 14 February); 2011 (18 – 20 February); 2012 (6 – 8 January, 24 – 26 January, 6 – 8 February, 10 – 12 February, 15 – 20 February, 6 – 10 December, 12 – 15 December, 18 – 22 December). To conclude, in the period of reference (2000 – 2012), there was a total number of 26 blizzard cases; the highest number of cases occurred in 2012 (8 cases), followed by 2006 and 2008, each with 3 cases; 2005, 2009 and 2010, each with 2 cases and 1 case per year in the rest of the period. As regards their monthly distribution, most of the blizzards occurred in January and February (8), December (7), November (2), March (1) (Table 1).

**Table 1. Monthly and Annual Distribution of Blizzards in Romania (2000 - 2012)**

No.	Year	Total no. of cases	January	February	March	November	December
1	2001	1		1			
2	2002	1				1	
3	2003	1					1
4	2004	1	1				
5	2005	2	1	1			
6	2006	3	1	1	1		
7	2007	1				1	
8	2008	3	2				1
9	2009	2					2
10	2010	2	1	1			
11	2011	1		1			
12	2012	8	2	3			3
13	Total	26	8	8	1	2	7

### 3.2 Human, social and economic impacts of blizzards in Romania

The blizzard is one of the most complex and spectacular atmosphere hazard and its environmental and economical impacts can be quite substantial. The high wind speeds, the heavy snowfalls, the reduced vertical and horizontal visibility, the low air temperature, etc. represent important elements of disturbing human communities and activities, sometimes leading to remarkable economical and social damages and even to human casualties, if taking into consideration that the persons which are caught by the blizzard in open spaces or the ones that are stuck in traffic because of the snow piles can even die of hypothermia. In addition, the fires produced during these phenomena have a great magnitude, often causing deaths, through carbon monoxide intoxication, or burns, thus creating substantial damage by the burning of both private and public houses and goods. The blizzards produced in Romania during the period of reference caused significant damage to several sectors of national economy and, in many cases, also caused human casualties.

For example, according to the official statistics, **the blizzards in the winter of 2011 – 2012** (25-27 January; 4-8 February 2012) caused damages of over 1 billion Euros at national level. According to Romania's Ministry of Domestic Affairs (MAI) and the General Inspectorate for Emergency Situations (IGSU) reports, the blizzards together with the very low air-temperatures in January - February 2012 produced great losses: 79 deaths, out of which 42 were homeless people; over 1,300 people injured; 161 county roads blocked; the highways A1, A2 and other 37 national roads were closed; over 480 towns were left without electricity, the windmills in Dobrogea were also seriously damaged, 236 towns were completely isolated by snow, a total of 545 towns from 21 counties were affected by the blizzard, 416 trains were cancelled and 8 railroads were closed, the trains from Constanța recorded over 600 minutes of delay; 8,212 schools were closed; 10 customs were closed (at the borders with Bulgaria, Ukraine and the Republic of Moldavia); 3 airports (București-Băneasa, București-Otopeni, Iași) were temporarily closed and many flights were cancelled or have registered great delays; all the harbours in the Constanța county were closed because the Black Sea froze over a distance of 200 m away from the shore in the area of Constanța, Costinești and Năvodari localities; this is also why the following Danube harbours had to be closed: Bechet, Calafat, Drobeta Turnu Severin, Moldova Veche, Orșova, Ovidiu, and the following waterways too: Măcin, Brațul Borcea, Brațul Bala, the Poarta Albă Midia - Năvodari Canal; 2,950 farmers from 31 counties suffered irreparable damage; 123 roof-tops were blown away in Medgidia etc. A total number of 25 counties have been badly affected, the greatest losses being recorded in the counties from the southern, south-eastern and eastern parts of the country (Iași, Bacău, Vrancea, Buzău, Ialomița, Tulcea, Giurgiu, etc.).

### *3.2.1. Effects of Blizzards on Energy Demand, Production and Distribution*

The damages quantified by Electrica S.A. for the two months affected by blizzards in 2012 (January-February), totalled about 10 - 20 Million Euros. Most of the damages were caused by the power supply shortage in several cities, by the poles which were broken, by the damages to the transformers and the power supply stations, by a production halt due to the frozen rivers. A total of about 83,000 consumers were affected by the power supply shortage, out of which 45,000 were customers of Electrica SA and 38,000 were customers of other private companies (ENEL, CES, EON). The first reactor of the Nuclear Electric Plant in Cernavodă was also closed (<http://www.antena3.ro/romania/viscolul-si-ninsoarea-au-produs-pagube-record-la-electrica-s-a-155423.html>).

Besides, according to the press communicate from the 7<sup>th</sup> of February 2012, the "ELECTRICA SA" company recorded the following damages to the medium voltage power lines after the blizzard which occurred at the beginning of February 2012 (Table 2): a total of 46 aerial electrical lines were affected and 17 aerial lines (LEA) were partially damaged, 767 transformer points were damaged, affecting 78 towns and leaving a number of 64,500 consumers without electricity. (<http://www.electrica.ro/comunicat-de-u-presa-7-02-2012>).

**Table 2. Synthesis of damages produced at medium-voltage power lines in selected Romanian counties, on 7.02.2012**

County	Total no. of affected LEA	Total no. of partially affected LEA	Damaged Transformation Points	No. of affected localities	Total no. of consumers without electricity
Buzău	25	10	386	32	35,000
Brăila	13	3	207	24	14,000
Dâmbovița	4	1	46	4	3,000
Vrancea	2	2	65	10	3,500
Galați	1	1	23	4	1,500
Prahova	1	0	40	4	7,500
<b>Total</b>	<b>46</b>	<b>17</b>	<b>767</b>	<b>78</b>	<b>64,500</b>

The blizzards produced in the past few years weren't milder either. For example, the blizzard on 5-7 January 2006 determined the electrical power supply shortage of 22 towns in the Bacău county and the one on 12-15 March 2006 produced damages which were evaluated by the Electrica SA to a total amount of 8 Billion ROL, because 70 poles were broken and 50,000 inhabitants from 177 towns were left without electricity.

During the winter of 2005 (27 January-6 February), there were affected 70 towns, 11 LEA, 194 PT and 17 telecommunication networks. The most seriously damaged counties were: Brăila, with 28 towns, 11 LEA, 190 PET and 10 telecommunication networks; Buzău, with 12 towns, 7 telecommunication networks; Vrancea with 8 towns; Galați, with 6 towns; Bacău, with 5 towns; Constanța, with 4 towns; Argeș, with 3 towns; Dâmbovița, with 2 towns; Dolj and Vâlcea with 1 town each.

In 2004, during the blizzard on 21 - 27 January, 463 towns were badly affected, 32 aerial medium voltage power lines were totally damaged and 28 lines were partially damaged, 1,191 transformer points were damaged; the most affected areas being the Bacău, Vaslui, Neamț, Galați, Vrancea, Constanța, Iași, Gorj counties.

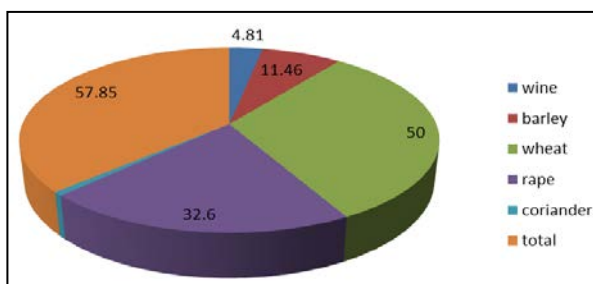
In 2003, only the Electrica SA in the Suceava county registered damages of over 32 Billion ROL because of some extreme hydro-meteorological hazards (blizzard, frost, heavy rainfall and floods).

### **3.2.2. Effects of Blizzards on Agriculture**

The blizzards on January-February 2012 also produced important agricultural damages: the autumn cereal crops (wheat, barley, etc.) were affected up to 62% percent of the total harvest because of plant suffocation by frost; the fruit trees and the vineyards were damaged up to a proportion of 10-30 %; the greenhouses were destroyed in a proportion of 30-100% because of their glass and foil rooftops were broken or torn away, their resistance poles were bent or broken, the plants got all frozen, etc. According to the reports of the Ministry of Agriculture and Rural Development, about 2,950 producers from 31 counties were affected at national scale (the damages to the protected enclosed spaces and greenhouses were evaluated as follows: 1,356,699 m<sup>2</sup> greenhouse windows; 2,556,512 m<sup>2</sup> plastic foil for greenhouses). Only in Matca (Galați county), 35% of the cultivated spaces with early vegetables were affected and 10-

15% of them were 100% destroyed (<http://www.romania-libera.ro/actualitate/locale/viscolul-si-gerul-au-distrus-afacerile-agricultorilor-254610.html>).

In the winter of 2010 (January-February), the damages recorded in agriculture mounted to a proportion of 62,1% of the yearly harvest at national level. For example, only in the Galați county, the damages on the agricultural crops were significant: for wine, from 15,928 ha of crops, 3,436 ha were totally compromised; for barley, from 10,120 ha of crops, 8,183 ha were damaged; for wheat, from 65,614 ha of crops, 35,720 ha were damaged; for rape, from 30,479 ha of crops, 23,290 ha were damaged; for coriander, from 1,207 ha of crops, 728 ha were damaged; from a total of 123,348 ha of crops, over 71,357 ha were damaged by the blizzard (= 57.85%) (Fig.1).



**Fig.1. Blizzard-Affected Land Crops in Galați County, on the winter of 2010**

### 3.2.3. Effects of Blizzards on Transports

The effects of blizzards on transports are always extremely severe, not only through the direct damages caused by the blocking or the traffic restrictions, but especially through the psychological effects on humans caught in traffic, which cannot be materially quantified. For example, because of the blizzards produced in January-February 2012, the passenger **railway services** were carried with difficulty especially in the southeastern part of the country, where the trains had delays of over 600 minutes. There were cases when trains were stuck in railway stations or on open plain-fields for 3 days. Thus, on the 6<sup>th</sup> of February 2012, the InterRegio train which left from Galați to Bucharest, was able to complete the respective route in 60 hours, the travellers having lived nightmare moments in a horror train which had to stop in a plain field for hours on end. Here are some of the most emotional statements of some of the persons who were kept captive by the blizzard in that train: *"When the blizzard started at Faurei it was terrible, we thought it was an earthquake of 6 degrees, it was moving with us, I haven't seen anything like this my entire life"*, said a passenger. And a mother who had sent her children to the mountains, confesses: *"They left on Monday, and now it's Wednesday and they're still on that train. I'm crying when I speak with them on the phone, they're dirty, they haven't been sleeping and they can't stand this anymore."* The passengers stayed for 14 hours in the Faurei railway station and 17 hours in the C.A.Rosetti town in Buzău County. The same nightmare was lived by the passengers of another train which left from Constanta and was heading to Brasov. (<http://stirileprotv.ro/stiri/eveniment/drumuri-blocate-intarzieri-de-zeci-de-minute-la-trenuri-e-iarna-pe-bune.html>).

Things weren't better either in the past years affected by blizzards. For example, during the blizzard on February 2012, 416 trains were cancelled, in 2010, 40 trains (11 February) and in 2006, 83 trains (23-25 January) were cancelled as well.

**The road services** are also seriously damaged by blizzards, roads being covered by snow piles brought by the wind from the surrounding plains, a fact that determines severe traffic restrictions or even blockings, accidents or even deaths. During the analysed period (2000-2012), a total number of 76 national roads and 418 county roads were affected, the traffic was stopped on several sectors of the A1 and A2 highways, and on other roads the traffic was very difficult. Most of the roads were closed during the blizzards in the winter of 2012 (37 national roads, 161 county roads and portions of the A1 and A2 highways were totally closed) and also in the winter of 2005 (11 national roads, 96 county roads, portions of the highway A2 were closed and the traffic was very difficult on 38 roads) and 2003 (6 national roads, 86 county roads, portions of the A2 highway closed) (Table 3).

**Table 3. Total number of national, regional roads and highways affected by blizzards in Romania, in 2000-2012**

Year	National Roads	Regional Roads	Highways	Roads with traffic restrictions
2012	37	161	A2, A1	
2011	4	20	A2	12
2009	7	35	A2	
2008	11	20	A2	
2005	11	96	A2	38
2003	6	86	A2	
<b>Total</b>	<b>76</b>	<b>418</b>		

Quite relevant for the amplitude of the damages that were produced by blizzards is the fact that on January- February 2012, 20 road sectors were closed, the traffic was completely closed or severely restricted on 32 national roads, on the A2 highway and on other 130 county roads (Fig.2 and Fig.3).



**Fig. 2. Traffic-closed roads in Romania, due to blizzard on 7.02.2012**



**Fig. 3. Traffic-closed roads in Romania, due to blizzard on 8.02.2012**

The situation wasn't better in case of **naval transports**. For example, on the 7th of February 2012, the harbours of Constanța, Midia, Mangalia were closed and so were the waterways: Poarta Albă - Midia Năvodari Canal, between km 0 -17 because of the ice cover; the Danube - Black Sea Canal, km 0 -15, because of the gales, and the

Sulina and Bara Canals. The following routes were also closed: Crișan – Caraorman; Crișan – Mila 23 sat; Tulcea – Periprava; Tulcea – Sfântul Gheorghe; Tulcea – Sulina and the ferryboat passage was interrupted between: Călărași – Chiciu; Zimnicea – Sviston (km 554) and Bechet – Oriahovo. Besides, during the blizzard on the 30<sup>th</sup> of January 2005, 3 harbours were closed: Constanța Sud, Midia, Mangalia, the Bara, Sulina, the Danube- Black Sea Canal waterways and, on the 24<sup>th</sup> of January 2004, 3 harbours were closed: Constanța Sud, Midia, Mangalia and the the Danube- Black Sea Canal (between the km 1-6), Bara and Sulina waterways.

The **air traffic** has also recorded significant damages because of the blizzards. During the blizzards on the winter 2011- 2012 (January- February 2012), 3 airports were closed (București-Băneasa, București-Otopeni, Iași) and 28 flights were cancelled.

According to the officialities, only in 2012 the passengers and commercial air companies, the merchants and exporters, recorded altogether damages of over 1 Billion Euros, because of the high delays at the delivery of various products. For example, the pizza producers registered damages of 60,000 Euros/day at deliveries, the meat producers and processers, damages of 100,000 Euros/day and the transporters, damages of over 100,000 Euros/day (<http://www.romanalibera.ro/bani-afaceri/companii/cati-bani-au-pierdut-transportatorii-din-cauza-viscolului-252819.html>).

#### 4. CONCLUSIONS

The damages produced by the blizzards between 2000 and 2012 are approached in this paper from the perspective of the consequences that the respective weather phenomenon had on human society from meteorological, social and economic points of view. The fact that they can sometimes be substantial is well known already, ultimately even leading to human casualties. For example, during the blizzards of January - February 2012, 79 deaths were registered, from which 42 among the homeless people.

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