

SNOWSTORM – SEVERE METEOROLOGICAL PHENOMENON. CASE STUDIES: TWO SNOWSTORM EPISODES FROM THE 2011-2012 WINTER

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Abstract

In meteorology, a snowstorm is considered to be a severe meteorological phenomenon of average risk. During any snowstorm episode, associated phenomena, such as massive snowfalls, wind speeds of up to 150 km/h, dissipation and accumulation of snow, drops in air temperature, can occur simultaneously. In Romania, snowstorms are associated with a cold and dry wind, locally called *crivăț*, especially in the Eastern Southeastern parts of the country, as well as the Southeastern half of the Romanian Plain. The two snowstorm episodes studied took place in late January (the 24th-26th) and early February (6th-8th), current year. Knowing the synoptic situation in which these two episodes occurred, and the weather evolution in both cases, in this paper I will point out aspects such as how the phenomena occurred, area of development, effects and damages done, similarities and differences between the two periods. At the end of the paper, I will propose measures that should be considered by the authorities, in order to decrease or even avoid damages and life loss.

Keywords: snowstorm, *crivat*, blockage, similarities, differences

1. INTRODUCTION

The snowstorm is a snow transportation above the surface of the Earth caused by sufficiently strong and turbulent wind, accompanied or not by snowfall (Tastea and colab., 2006). The synoptical forming conditions are the presence of a warm and humid air mass which comes into contact with a very cold and dry air mass and the presence of an anticyclonic field.

Due to the high speed of the wind during a snowstorm episode occurs the piling of the snow, the accentuated temperature drop, which associated with the high speed of the wind amplifies the cold sensation (equivalent temperature), a snow layer can be deposited (freezing rain).

The aerosynoptic conditions of producing this phenomenon are the following: there has to be a very cold air advection at the earth surface level due to a barometric maximum situated in the northern and eastern side of Romania (the East European Anticiclone dorsal, the Siberian Anticiclone, or of an locally extended anticyclonic belt) and an advection of warm and humid marine air facilitated by a Mediterranean (regional) cyclone centered in the Black Sea area, in altitude the existence of a dorsal or a very cold air core with a movement from NNE.

The characteristic period of producing this phenomenon is from November until March, rarely in October or April.

The frequency with which it can be produced is of 6 to 8 days/year in Baragan, 4 days/year in Moldova, 2-3 days/year in S and SW and about one day/year in Banat, Crisana and Transilvania. The medium timeframe in successive days is of 1-4 days in Baragan and non-successive days between >3 and <9 days in Baragan. The effects of a snowstorm episode are: transportation blocking (road, railroad, air and naval), traffic accidents resulting in casualties, damages caused by ice buildups, the fire frequency increases, constructions can be destroyed, the uprooting of the trees, the dissipation of the snow from the fields which has a negative effect on agriculture (the loss of an important quantity of water and disappearance of the protective snow layer), floods may be caused in case of the melting, if a warm air mass occurs.

The snowstorm phenomenon in Romania can be produced in any region of the country, the most affected areas being the ones outside of the Carpathians (Moldova, Dobrogea, the center and east of the Romanian Plain). In this paper I will present the similarities and differences between two snowstorm episodes produced between 24-26 January and 6-8 February 2012. To better highlight this aspect, I used hourly data, synoptic terrestrial and altitude maps and aerological surveys provided by the National Meteorological Administration

2. THE SYNOPTICAL FORMATION CONDITIONS OF THE SNOWSTORM PHENOMENON

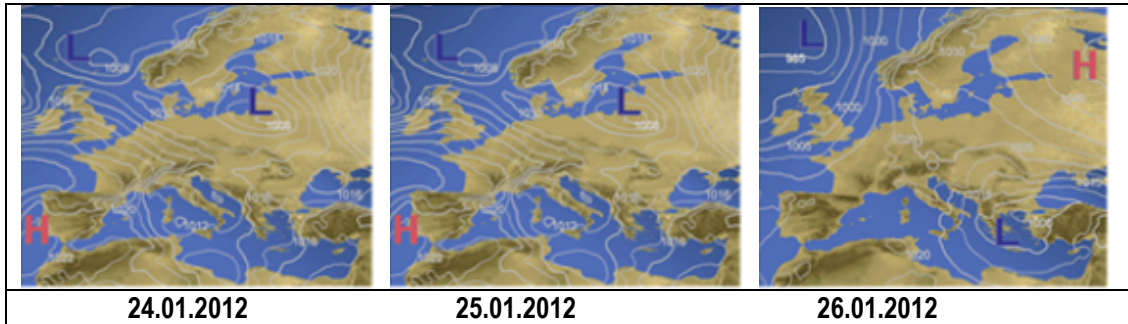


Image 1 The atmospheric pressure at sea level during the 24-26 January 2012 episode

A coupling between the Icelandic cyclone elongated to S acted on ground, up until above the British Islands with the movement direction NW-SE, with the Mediterranean which acted in South Europe with a movement direction W-E up until above the Black Sea. The anticyclonal East European belt was acting in the NNE side, moving towards the central and western part of the continent.



Image 2 The atmospheric pressure at sea level during the 6-8 February 2012 episode

A cold air mass was present on the ground due to the East European anticyclone which had a great expansion over the continent with the movement direction NE-SW. The Mediterranean cyclones on the southern part of the continent had the movement direction S-E reaching gradually above the Black Sea.

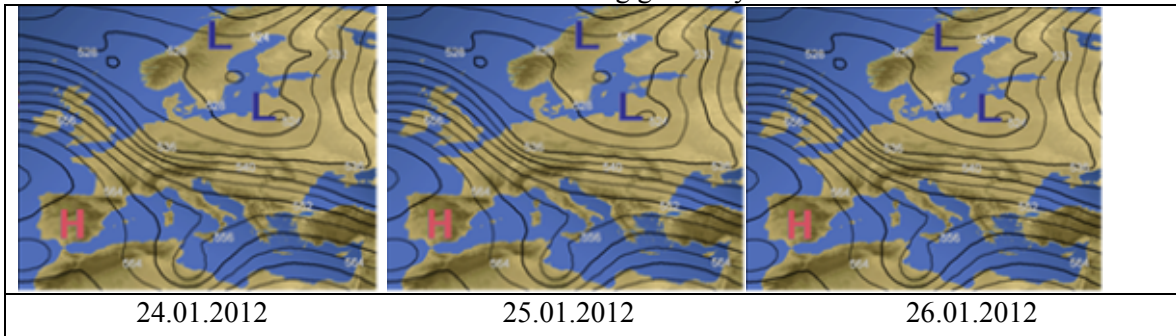


Image 3 The atmospheric pressure at the 500 mb geopotential level during the 24-26 January 2012 episode

On altitude, the depressionary field lies in the NW part with the movement tendency towards SE. There is a high pressure field on the S part with the movement direction W-E

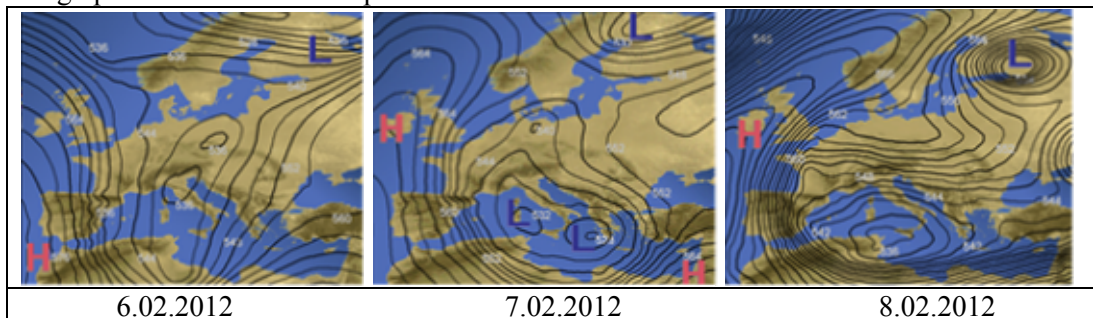


Image 4 The atmospheric pressure at the 500 mb geopotential level during the 6-8 February 2012 episode

On altitude the depressionary field was positioned on the NE side with the movement direction towards SW, developing several cores. There is a maximum pressure level on the W side which was moving from S to N.

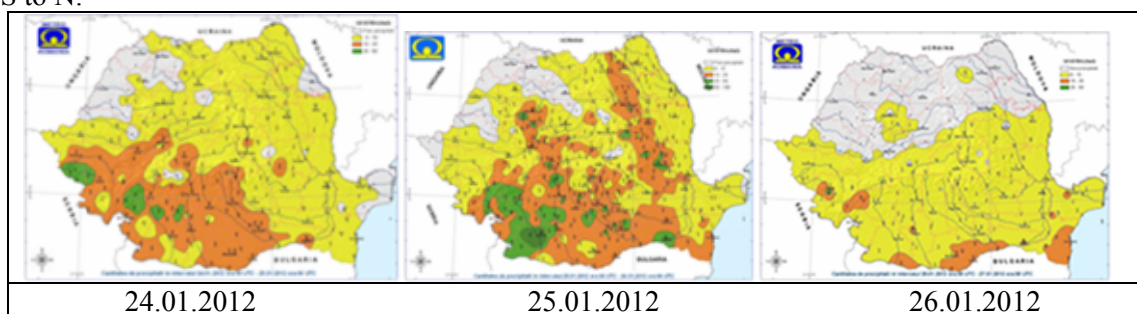


Image 5 Atmospheric precipitations from the 24-26 January 2012 timeframe

These conditions were generated in Romania during severe weather. At the beginning of the timeframe the warm and humid air mass determined rainfalls on the southern side of the country and snowfall on the northern side. They gradually turned into snowfall. The wind intensified, reaching a speed up to 80-90 km/h, blizzarding and piling the snow. The glaze snow phenomenon appeared isolated. The air temperature continued to decrease. A consistent layer of snow was layed down, which was partially piled

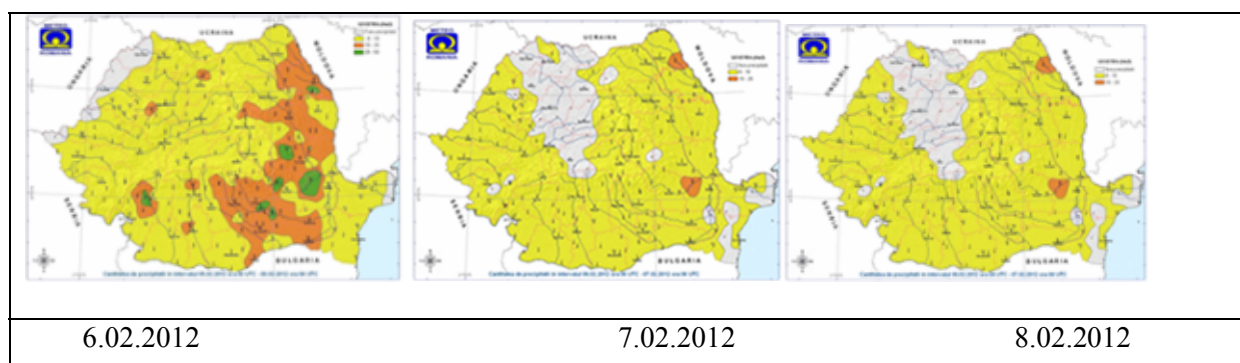


Image 6 Atmospheric precipitations map from the 6-8 February 2012 timeframe

The aero-synoptical conditions generated severe weather in Romania. The cold air mass existence, coupled with the breakthrough of a warm and humid air mass determined glaze snow at the beginning of the timeframe on large enough areas, whose deposition (up to 30-40 mm) persisted several days. The precipitations gradually turned into snowfall, the wind intensified reaching speeds of up to 80-90 km/h, blizzarding and piling the snow. The temperatures continued to decrease and the weather became frosty towards the end of the timeframe.

3. SIMILARITIES AND DIFFERENCES BETWEEN THE TWO SNOWSTORM EPISODES WHICH OCCURRED IN ROMANIA IN WINTER 2012

Similarities

- ✓ The classical conditions for the producing of the phenomenon were fulfilled in both situations, a warm and humid air mass being present and an anticyclone field in NNE of Europe.
- ✓ The generated phenomenons were snowfall, minor wind intensifications which lead to the blizzarding and piling of the deposited layer.
- ✓ An accentuated air temperature decrease was registered.
- ✓ The freezing rain phenomenon was produced during both episodes.
- ✓ The wind shearing caused the alternation of the cold air layer and the warm air layer.
- ✓ The effects were the blockage of the road, railroad and air traffic, electrical energy alimentation interruptions, the activity cease in some schools from the most affected areas, fires.
- ✓ Consequences: Human casualties and material damage.

Differences

- ✓ The existing weather conditions in the country at the time when the two episodes occurred were totally different, on the first episode case the weather was especially warm for that date, the

thermal contrast between the Northern and the Southern half of the country was very accentuated, being highlighted by extreme temperatures but also by the nature of the precipitations under a solid form on the Northern part and liquid on the Southern, during the second episode the weather had a very cold aspect, even frosty during the night, there was a consistent layer of snow in the entire country, the thermal minimums and maximums were highly decreased, the glazed frost phenomenon occurred on several areas with a thick ice deposit which continued for several days.

- ✓ The existent synoptical conditions in Europe on case of the two episodes, even if apparently the same, still the movement direction of the atmospheric fronts and of the air masses was different. In case of the first episode, the warm and humid air masses on the ground had the movement direction E-SE, the East European anticyclone was positioned on the NNE part of the country, slowly moving West, during the maximum from North Africa was pushed to SW by the mediteranean cyclones which gradually arrived in the Black Sea. The warm and humid air mass from the Mediteranean Sea was present from the beginning of the timeframe during the second episode, the Icelandic cyclones having an influence on the continental weather only on the 6th of February. The East European cyclone was the one which mostly influenced the weather condition and caused seemingly low temperatures and in our country it generated the stronger blizzard phenomenon on the E and SE side of the country in Baragan, Muntenia and Dobrogea and with less intensity on the rest of the territories, the blizzard phenomenon being present in almost all country regions.
- ✓ In altitude, the movement direction of the depressionary field during the first episode was clearly from NW-SE and maximum was situated in the S with direction towards W-E, while in the second episode, the baric minimums had the NE-SW orientation, the depression maximum being positioned in the W side of the continent with the movement direction from S to N.
- ✓ The aerological diagrams best highlight the differences between the two blizzard episodes.

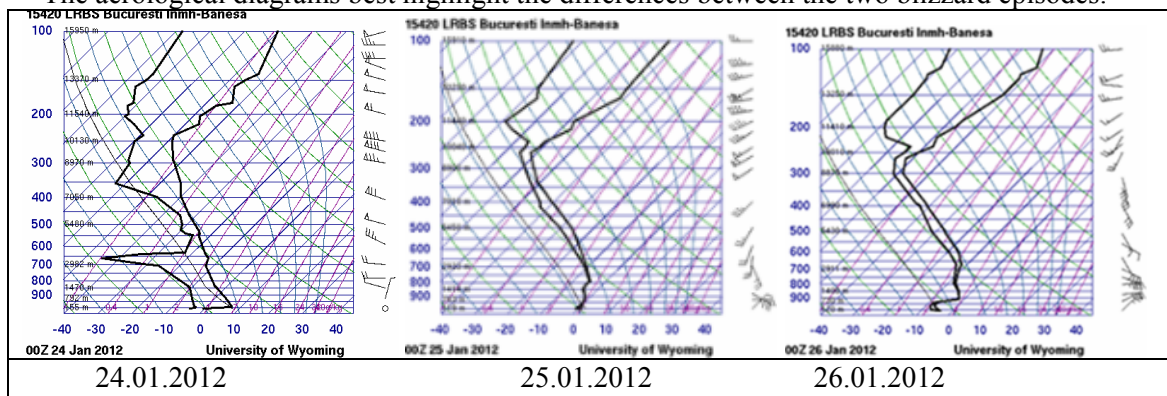


Image 7 The aerological diagrams from the 24-26 January 2012 episode

- ✓ A warm air mass was present on the ground which was gradually mixed with the existing cold air in the superior part of the lower troposphere, the cold air mass replaced it pushing the warm air in the atmosphere.
- ✓ On ground the wind had the predominant NE, E direction and W in altitude.

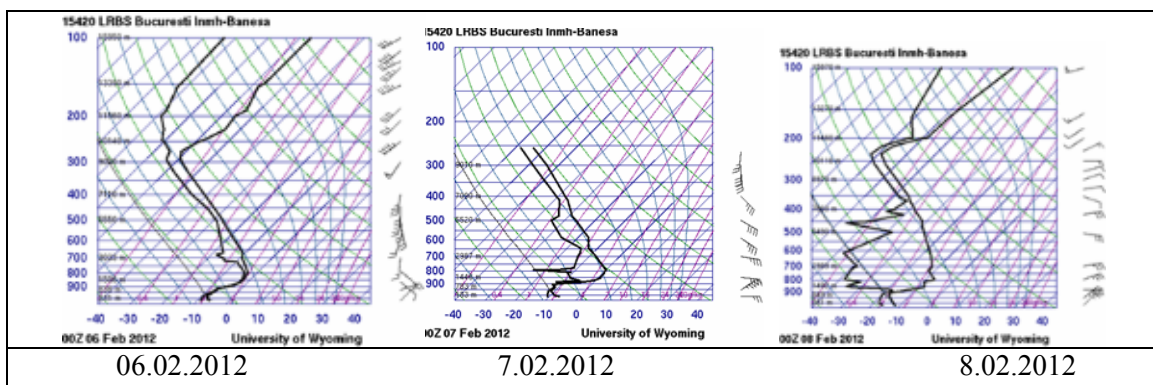


Image 8 The aerological diagrams from the 6-8 February 2012 episode.

- ✓ The cold air mass was present on the ground, which stationed during the entire phenomenon production time while the warm air mass was in altitude.

- ✓ The wind on ground had the predominant direction NE, SE and in the altitude it was predominant SW.

Conclusions

The effects of the blizzard from 24-26 January 2012

- ✓ Railroad transport blockage in 17 counties
- ✓ Power outages in several small towns from the S and SE counties
- ✓ Food supply interruptions for the population from rural areas (especially in the counties Buzau, Braila and Tulcea)
- ✓ Fires in the small town Sindreni, Buzau county
- ✓ 2 Human casualties: a man found dead in a car on the road which links Bucharest to Giurgiu, a 70 year old man found frozen in a small town from Buzau county

The effects of the Blizzard from 6-8 February 2012

- ✓ Road and railroad blockage in 17 counties
- ✓ Power supply interruptions in several small towns from the counties in S and SE Romania
- ✓ Food supply interruptions for the population from rural areas (especially in the counties Buzau, Braila and Tulcea)
- ✓ No human casualties

Measures which need to be implemented to prevent the material damage and human casualties caused by a blizzard episode

- ✓ Building and setup of snow fences in all areas which are vulnerable to such phenomenons
- ✓ Planting of forest plantations
- ✓ Instructing the civil society for such situations
- ✓ Better collaboration of the authorities with the civil society and different humanitarian organizations for helping the victims
- ✓ Road users compliance to traffic regulations

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