

## ICE DEPOSITS UNDER THE SHAPE OF GLAZED FROST - RISK PHENOMENA IN THE AREA OF DEVA CITY

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**Abstract:** The study referring to ice deposits under the shape of glazed frost around the area of Deva City has been carried out for the period 1961 - 2010. Within the analyzed period, the maximum number of glazed frost days amounted to 9 in 1965. The average number of glazed frost is of 2 days. In the area of Deva city, the glazed frost phenomenon has a moderate occurrence.

**Key words:** glazed frost phenomenon, Deva city area

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### INTRODUCTION

Glazed frost is deposited under the shape of a compact layer of transparent or non-transparent ice, when on the terrestrial surface fall precipitations made of overcooled drops, which will have previously crossed low-temperature air layers, below 0°C (Măhăra, 2001). In the surroundings of Deva, most frost and glazed frost phenomena are determined by air masses which spread from the Panonian Plain, north and north-western Europe. As a supporting argument we show the synoptic conditions which favour the occurrence of hoarfrost in the area of Deva city in figure 1. The presented geosynoptic conditions trigger most colds, due to the cold air mass invasions from Greenland to South-Eastern Europe. The low pressure from the region of Romania attracts the high pressure cold air from the Scandinavian Peninsula.

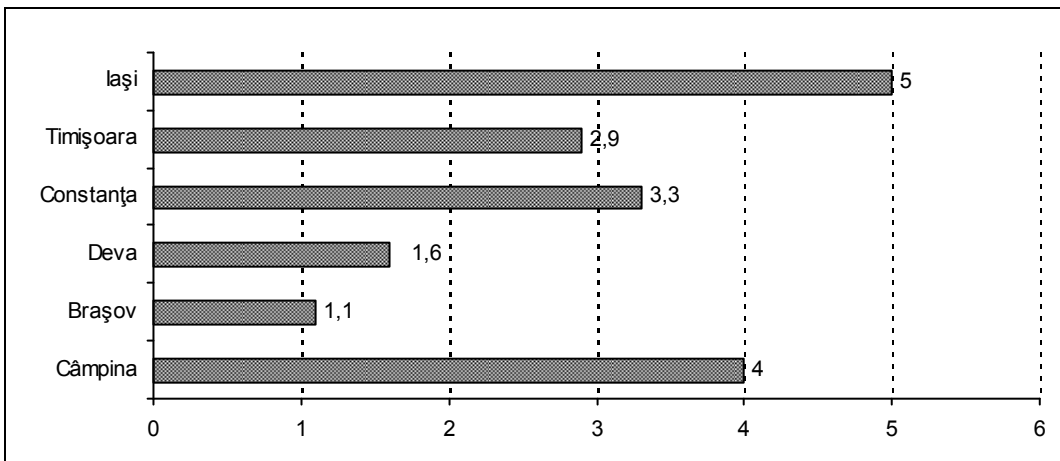
### METHODOLOGY

For the glazed frost analysis in the area of Deva city we have used the data coming from the weather station of Deva during 1961 - 2010. The data referring to the number of hoarfrost days for the cities of Iași, Timișoara, Constanța, Brașov and Câmpina were taken from the study on *The Climate of Romania*, 2008. Within the current study we have analyzed the indicators referring to the multiannual average number of glazed frost days, the deviations of the annual number of glazed frost days from the multiannual average, the monthly average number of glazed frost days (Frey et al., 2011). The comparative analysis of the number of glazed frost days for certain cities of Romania, set a different locations aims to highlight the importance of the geographical position and the relief by the occurrence of glazed frost phenomenon on Romania's territory (Dousset et al., 2011; Thorsson et al., 2011).

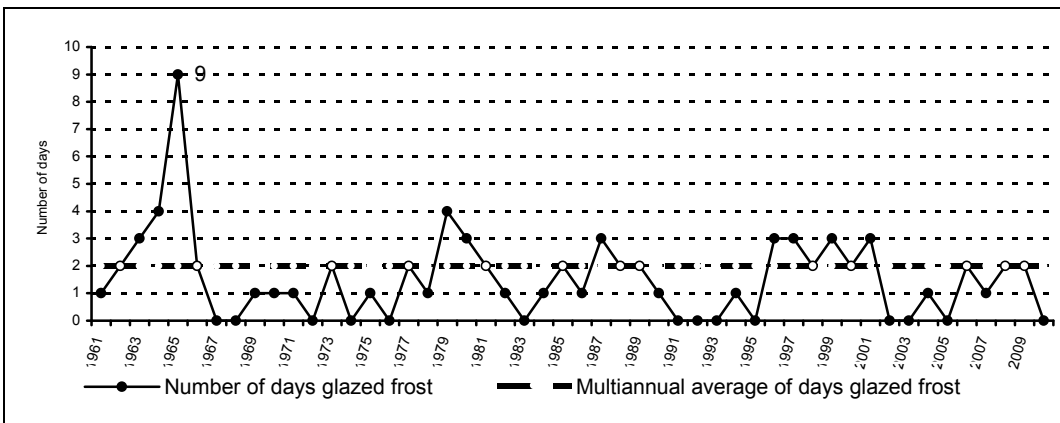
## RESULTS

### The multiannual variation of glazed frost days

The analysis of the average number of glazed frost days is highly important because, according to the duration of the phenomenon we can quantify the intensity of the produced damages. Analysing by comparison the number of glazed frost days for Câmpina, Braşov, Deva, Constanţa, Timişoara and Iaşi (figure 1), we can note that they differ according the shape of the relief and the features of the air mass dynamics. The greatest number of glazed frost days can be registered in the cities in which arid temperate continental influences can be encountered which favour the persitancy of anticyclical regime whereas in the cooridor regions and depressions the number of glazed days is lower.



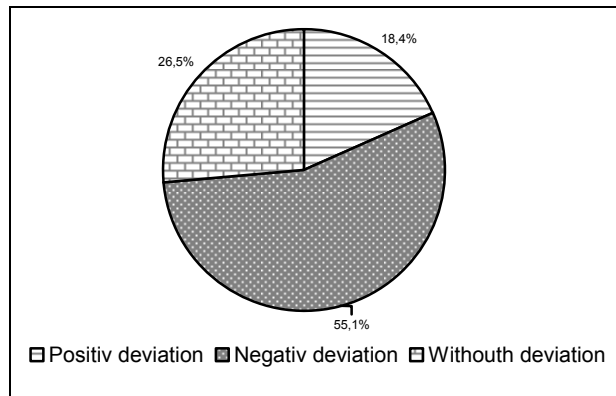
**Figure 1.** The multiannual average number of glazed frost days at Iași, Timișoara, Constanța, Deva, Brașov, Câmpina  
(Data source: Clima României, 2008)



**Figure 2.** The evolution of the annual number of glazed frost days at Deva, 1961 - 2010  
(Data source: Administratia Națională de Meteorologie)

Within the area of Deva city the multiannual average number of glazed frost days during 1961 - 2010 was of 2 days. The differences between the numbers which are shown versus the recorded data from the chart are determined by the analyzed period. The study referring to the number of glazed frost days, presented within the Geography of Romania relates to the period 1961 - 2007, whereas in the

present study the analyzed period relates to the years 1961 - 1965, 9 days with glazed frost. In 1965 in the area of Deva city most hoarfrost days could be registered as well as the highest number of days with frost for the analyzed period, namely 173 days. In January 1965, the average temperature was of  $-1.8^{\circ}\text{C}$  and all along the month 43.3 mm rainfall could be registered which, on the backdrop of negative temperatures, had triggered the glazed frost occurrence. Such situations were determined by the replacement of some differently-featured air masses which favour glazed frost occurrence. In 1964, 1979 and 2001 could be registered 4 glazed frost days (figure 2).



**Figure 3.** Deviation frequency of glazed frost days at Deva  
(Data source: Administratia Națională de Meteorologie)

In 1967, 1968, 1972, 1974, 1976, 1983, 1991, 1992, 1993, 1995, 2002, 2003, 2005 and 2010 in the area of Deva city, glazed frost did not occur. Versus the multiannual average of glazed frost days in the area of Deva city there were positive and negative deviations as well as deviation-free years (figure 3). For the period 1961 - 2010, 55.1% of the years are characterized by negative deviations, 18.4% by positive deviations 26.5% no deviations.

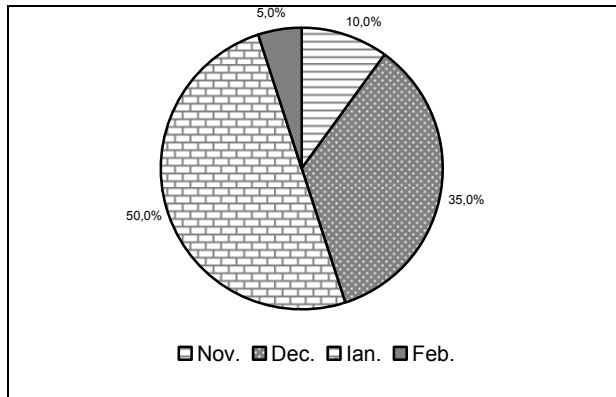
### The monthly average number of gleized frost days at Deva

The analysis of the average monthly number of glazed frost days at Deva highlights the fact that this phenomenon occurs during November and February. The highest monthly number of glazed frost days at Deva can be registered during January, and the lowest number of glazed frost days can be registered in February. In January for the 1961 - 2010 periods the highest number of glazed frost days was of 3 days, registered in 1965, 1979, 1987, 1996. But for the analyzed period the highest number of glazed frost days wasn't registered in a winter month but in the November of 1965, namely 5 glazed frost days. In the November of 1965, the average temperature of the minimums was of  $-0.4^{\circ}\text{C}$  and the entire rainfall quantity of 46.2 mm. Under these circumstances it was possible to record a high number of glazed frost days.

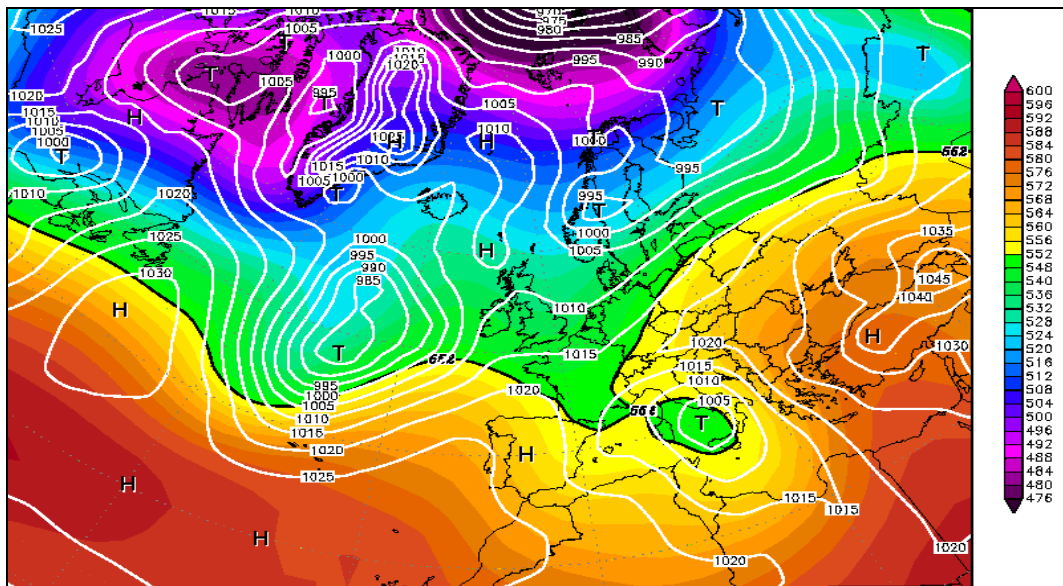
By analyzing the frequency of glazed frost days the highest frequency can be recorded during winter months, 50% in January, 53% in December and 5% in February. Under these conditions the highest probability for the occurrence of glazed frost cases is in January (figure 4).

On the 8th of January 2009 the area of Romania was covered by an anticyclone air mass which had triggered low temperatures. The air mass will have retreated to the north being replaced by a wet air mass from the south of the continent. Under these geosynoptic circumstances the ice deposits of January 14th 2009 at Deva occurred. The damage caused by these ice deposits were mentioned in the local news. The *Hunedorenu* newspaper from January, 15th, 2009 wrote: „*A nightmare in the county. Tens of inhabitants of Hunedoara got into the hospital with hands and legs broken and as many cars in the car service*”.<sup>1</sup>

<sup>1</sup> www.ANM.ro



**Figure 4.** The monthly frequency of glazed frost days  
Case study: ice deposits at Deva since January the 14th, 2009  
(Data source: Administratia Națională de Meteorologie)



**Figure 5.** The baric and geopotential field map at 500 hPa, on January 14th, 2009  
(Data source: www.wetterzentrale.de)

After the terrible frost of the last days, the few rain drops which fell have changed the entire county into a genuine skating rink, to the despair of the tens of drivers who have damaged their cars and the inhabitants of Hunedoara whose strolls on the streets got them plastered. The Emergency departments were filled out within a few hours with persons who fell on the ice and got into the hospital with broken bones yesterday. At Deva, until yesterday at noon, the doctors on call registered 20 such cases. The luckiest were the inhabitants of Hațeg, the representatives of the hospital in the locality stating that they were not faced with any case of fracture caused by the glazed frost outside. The drivers who passed yesterday morning on the county road which links Deva to Hunedoara were forced to abandon their cars on the side of the road as the latter had become impracticable due to glazed frost. Other more courageous ones had ventured only to reach into a ditch or to crash into other cars which were driving on the same route, among which also a bus. The drivers could only resume their way around noon when a machine spread anonskid material. Although not as serious, the situation was not too different on the other roads in the county, all the special vehicles of the County Road and Bridges Department of Hunedoara being

sent on the field. According to the representatives of the County Police Inspectorate of Hunedoara the number of recorded crashings overpassed tens, with expected higher proportions.

According to the Head of the National Road Department of Deva, Gheorghe Brânzan, on the roads found under his rule there weren't any problems but they intervened rapidly to repair the situation. „*Ever since morning, the machines were sent in the territory to prevent glazed frost to deposit. But we are faced with the low temperature on the ground. There are 0 °C degrees outside, but the ground registers -10 °C. The salt is not very efficient either and water turns into ice very quickly*” Brânzan had stated.<sup>2</sup>

The local administrations of the county have also taken out their special vehicles on the roads of the belonging localities. Even though at noon the ice had melted a bit, the weather forecasts warn that the glazed frost phenomena, snow, drizzle, rain and fog could occur until the 21<sup>st</sup> of January. The case study of Deva highlights the fact that ice deposits can trigger material damage in diverse activity fields and afflictions of the human body. By analyzing the map of the barrid field and the geopotential at 500 hPa, on January 14th, 2009 (figure 5) we can note the penetration of some arctic air masses in the north of the continent. At the level of Romania a low-pressure air mass and high humidity was present which favoured the occurrence of glazed frost layer.

## CONCLUSIONS

The ice deposits represent a climatic risk phenomenon for the cold period of the year when optimal conditions for their occurrence are created. The damage which they produce can have an impact on industry, transportation, agriculture.

The risk phenomena are caused by certain indicators such as:

- the weight of the deposits, air deposits which affect the air conductors, tree branches;
- the duration of deposits, mainly in the case of the glazed frost layer, as it affects transportation and triggers damage at the level of different economic branches;
- the combination of the deposit phenomenon with other climatic phenomena, such as fog, which triggers the increment of the risk phenomena mainly in the case of transportations. Under these circumstances the number of car crashes increases.

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<sup>2</sup> www.hunedoara.ro