FREQUENCY OF HAZARDOUS WEATHER PHENOMENA IN THE COLD SEMESTER OF THE YEAR IN THE AREA OF ORADEA, BIHOR COUNTY

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Abstract

The paper presents the characteristics of hazardous weather phenomena in the cold semester of the year (hoarfrost, glaze, frost, snow gust, blizzard) in the area of Oradea over a period of 45 years. The most frequent hazardous weather phenomena is hoarfrost, with a multiannual average of 50.9 days/year. In 51.1% of the years included in the study the number of hoarstfrosty days was below the multiannual average, and in 48.9% of the years the deviation was positive. The average of frost occurence is 8 days per year. In 42.2% of the years the number of frosty days was higher than the multiannual average, in 53.3% of the years there was a negative deviation and in 4.4% of years there was no deviation. Of the hazardous weather phenomena which occur in the cold period of the year blizzard if the least frequent, the multiannual average is 1.2 days. Data show a low frequency also for glaze and snow gust, the multiannual averages of these events are 3 times per year.

Key words: blizzard, frost, glaze, hoarfrost, snow gust

INTRODUCTION

Adverse weather events are characterized by an extensive time-space variation, they can be dangerous and can have serious consequences in all socio-economic fields (Topor, 1958; Măhăra, 1967; Bryant, 1991; Ciulache, Ionac, 1995; Bogdan, Niculescu, 1999; Moldovan, 2003; Pereș, 2012, 2015).

In our country, and thus in Oradea too, due to the moderate continental climate, exposed to oceanic influences, the most frequent hazardous weather phenomena in the cold semester, which are presented in this study, are the following: hoarfrost, glaze, frost, snow gust, blizzard.

MATERIAL AND METHOD

This study was based on an rich set of weather data logged at the Oradea Weather Station over a long period of time, that is, 1970 - 2014.

RESULTS AND DISCUSSION

Hoarfrost

The multiannual average of hoarfrosty days in Oradea is 50.9 days/year, with variations between 17 days in 2010 and 93 days in 1998 (Fig. 1).

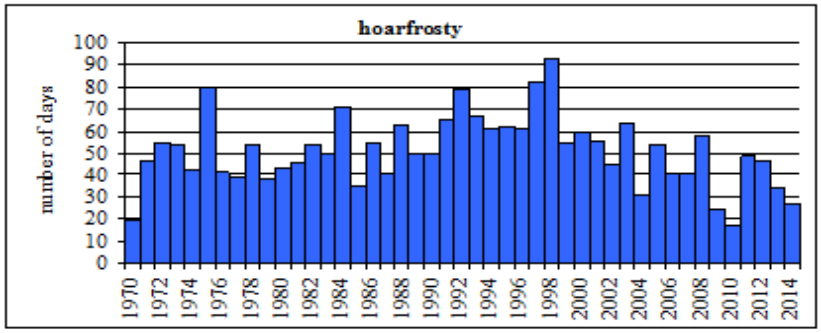

Fig. 1. Annual variations of hoarfrosty days in Oradea, 1970-2014

In some years, the number of hoarfrosty days was above the multiannual average, while in others it was below it. Thus, in 51.1% of the years included in the study there were fewer hoarfrosty days than the multiannual average, while in 48.9% of the years the deviation was positive (Fig. 2).

Looking at the spread in time of the positive and negative deviations against the multiannual average, it can be seen that in the first half of the period, 1970-1990, the deviations were either negative or positive, which was followed by a period, 1991-2001, with only positive deviations. In the last years included in the study, 2002-2014, the annual number of hoarfrosty days decreased and apart from 2003, 2005 and 2008, in all years the deviations were negative (Fig. 2).

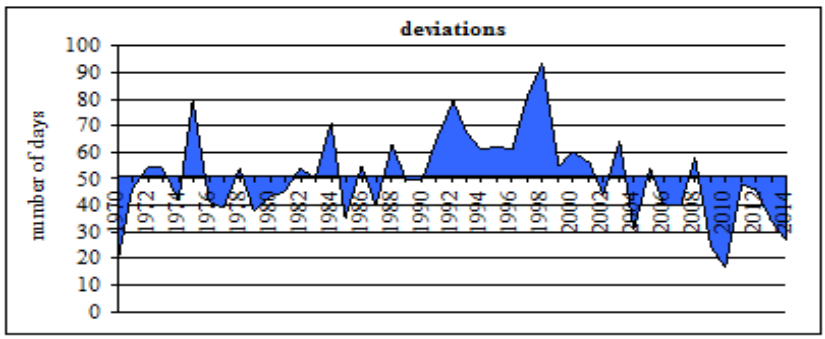

Fig. 2. Deviations of the annual numbers of hoarfrosty days from the multiannual average in Oradea, 1970-2014

Over the year, hoarfrost occurs between September-May, with the highest number of days in December, when the average is 9.7, followed by January, when the average of such days is 9.5 (Fig. 3).

The lowest numbers of hoarfrosty days occur in the transition months, that is, in the months which begin and close the cold period, with averages of 0.1 and 0.2 days in May and in September respectively.

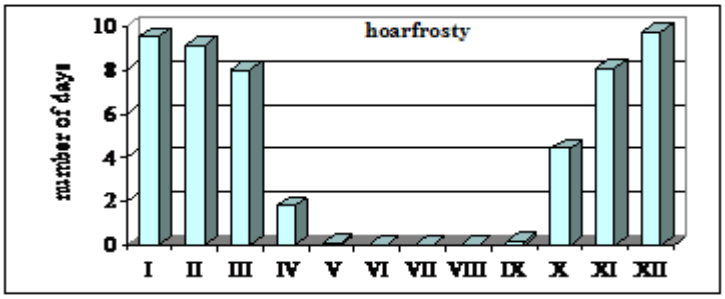

Fig. 3. Multiannual monthly averages of hoarfrosty days in Oradea, 1970-2014

Glaze

In Oradea, the multiannual average of glazy days is low, only 3 days/year. This low figure is due to climatic influences from the west and south-west of the continent, which are rather strong in this part of the country (Iliescu, 1973; Dragotă, 1995; Gaceu, 2002; Cristea, 2004; Köteles, Moza, 2010; Köteles, Pereş, 2010; Costea, 2014).

In the 45 years included in the study, the highest number of glazy days was recorded in 2002, when it occurred 13 times, 7 in December and 6 in January.

There were more years with no glaze at all, 1975, 1979, 1983, 1990, 1991, 1995, 2000, 2001 and 2004 (Fig. 4), which means a 20% frequency of the total years included in the study.

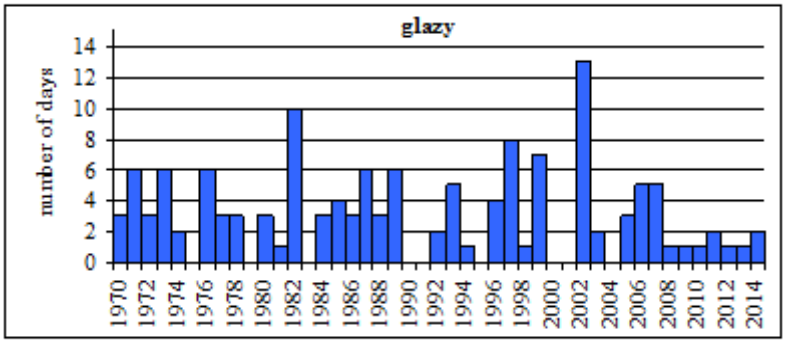

Fig. 4. Annual variations of glazy days in Oradea, 1970-2014

In 31.1% of the years there were more glazy days than the multiannual average, the years with negative deviations represented 48.9% and in 20% of the years, the number of glazy days was equal to the multiannual average (Fig. 5).

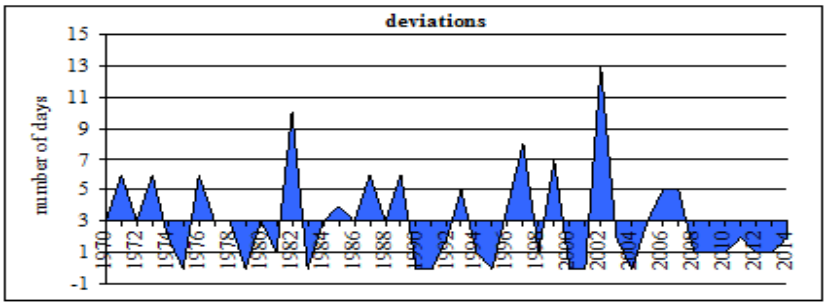

Fig. 5. Deviations of the annual numbers of glazy days from the multiannual average in Oradea, 1970-2014

In the area of the study glaze occurs from November to March. The month with the highest multiannual average of glazy days is January, 1.5 days/month.

In December, glaze occurs with an average of 0.9 days/month, the lowest number of such days is recorded at the end of the period when the event occurs, that is, in March, 0.1 days on average, as well as at the beginning of the period when the event can occur, that is November, 0.2 days (Fig. 6).

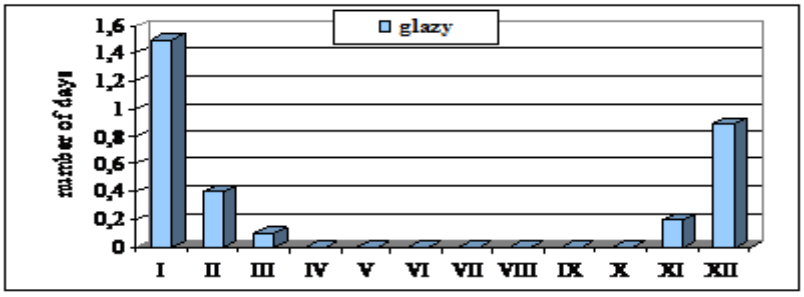

Fig. 6. Multiannual monthly averages of glazy days in Oradea, 1970-2014

The highest probability of this event is in January, when the highest frequency of glazy days is recorded, that is, 50.7% of the total such days in the period of the study. The lowest frequency, and the lowest probability, of occurrence is March, only 2.2% (Table 1).

Table 1

Multiannual monthly totals and overall total of glazy days, as well as percentages of these totals in Oradea, 1970-2014

Month	I	II	III	XI	XII	Overall total
Total	69	16	3	9	39	136
Frequency (%)	50.7	11.8	2.2	6.6	28.7	100

Source: A.N.M. Archives

The month with the highest number of glazy days was January 1982, when it occurred 10 times, followed by December 2002, with 7 days.

Frost

The multiannual average of frosty days in Oradea is 8 days/year, but there were wide variations from one year to the other. Thus, in 1977, 1986 and in 2003, the highest figure was recorded, 19 days in each year, while in 2002, 2004, 2007 and in 2012 this event did not occur at all (Fig. 7).

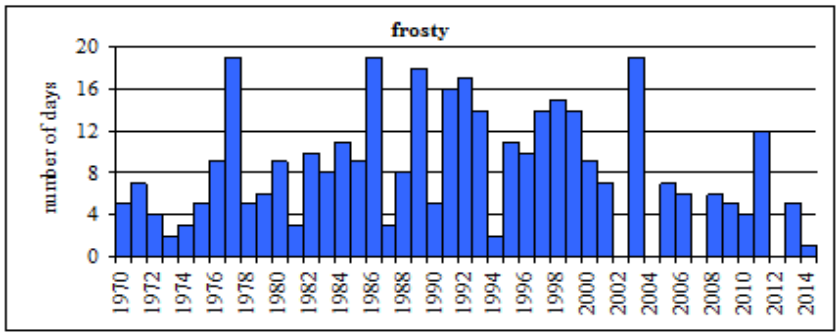

Fig. 7. Annual variations of frosty days in Oradea, 1970-2014

The frequency of positive deviations from the multiannual average is 42.2%, while that of negative ones is 53.3%, and in 4.4% of the years the annual figure was equal to the multiannual average (Fig. 8).

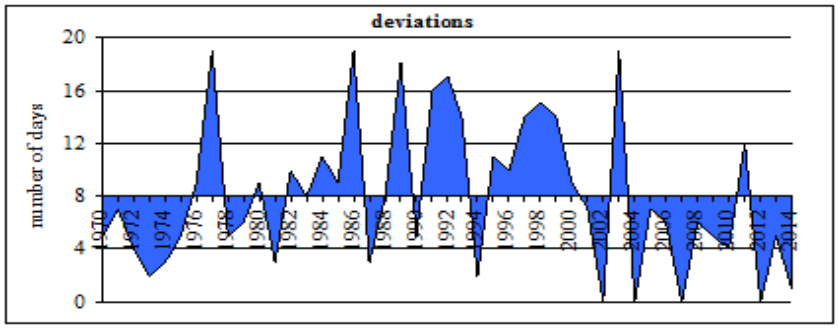

Fig. 8. Deviations of the annual numbers of frosty days from the multiannual average in Oradea, 1970-2014

It can be seen that in the last part of the period included in the study the annual number of frosty days is lower, apart from 2003 and 2011, which means that this event had a low frequency from 2002 to 2014, with four years when it did not occur at all (2002, 2004, 2007, 2012).

In Oradea, frost occurs from November to March. The multiannual monthly average of frosty days is the highest for January, 3.2 days, followed

by December with 2.9 days. In the month at the of autumn and at the beginning of spring, the number of frosty days is low, 0.4 days and 0.2 days respectively (Fig. 9).

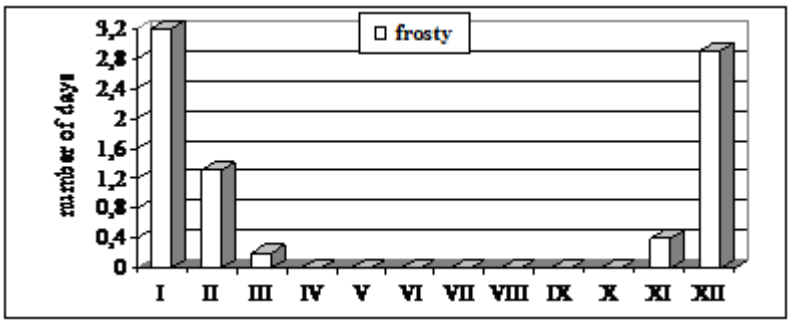

Fig. 9. Multiannual monthly averages of frosty days in Oradea, 1970-2014

The monthly frequency of frosty days shows that January is the month when this event is mostly likely to occur, this is the month when the highest number of frosty days was recorded (143 days), which means a frequency of 39.5% of the total such days. The event is least likely to occur in March, when during the period of the study there were only 8 days when frost occurred, which means 2.2% (Table 2).

The month with the highest number of frosty days was December 1986, when the conditions were adequate for its formation on 16 days. The January month with the highest number of frosty days was that of 1989, when there were 12 such days.

Table 2

Multiannual monthly totals and overall total of frosty days, as well as percentages of totals in Oradea, 1970-2014

Month	I	II	III	XI	XII	Overall total
Total	143	59	8	20	132	362
Frequency (%)	39.5	16.3	2.2	5.5	36.5	100

Source: A.N.M. Archives

Snow gust

The multiannual average of days when snow gust occurred in Oradea is 3 days.

In the period of the study, the years when snow gust occurred most often were 1985, 2003 and 2005, with 11 days in each year. There were 12 years when this hydrometeor did not occur at all, in 1972, 1974, 1978, 1990, 1994, 1997, 1998, 2007, 2008, 2011, 2013 and 2014, which represents 26.7% of the total number of years included in the study (Fig. 10).

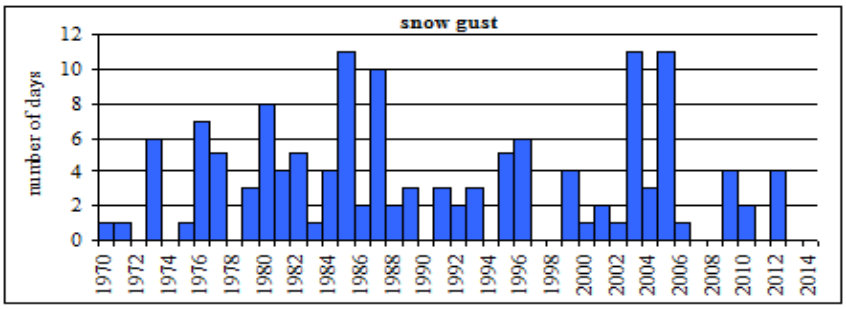

Fig. 10. Annual variations of days with snow gust in Oradea, 1970-2014

The distribution in time of days when snow gust occurred shows that the years with negative deviation from the multiannual average prevailed, their frequency was 53.3%, while the positive deviations represented 35.6%, and in 11.1% of the years there were no deviations (Fig. 11).

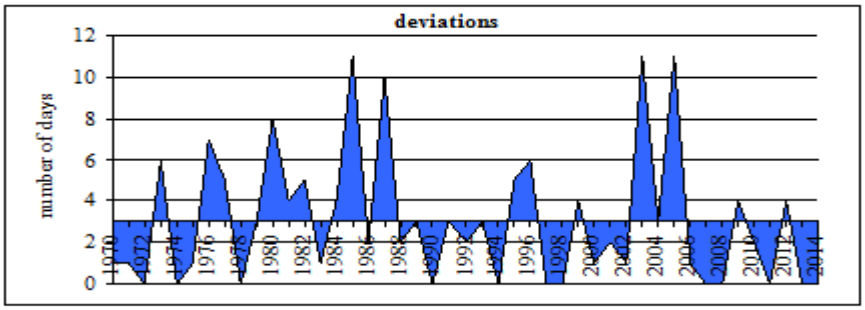

Fig. 11. Deviations of the annual numbers of days when snow gust occurred from the multiannual average in Oradea, 1970-2014

Over the year, snow gust occurs from November to March. The event is most likely to happen in January, which is due to the fact that that is the month with the most significant snow accumulation. Thus, the highest number of days when snow gust occurs was recorded in January, with a multiannual average of 1.1 days and a maximum of 7 days in 2003. In February, the highest number of days with snow gust was recorded in 1985, 5 days, and the multiannual average of this month is 0.9 days.

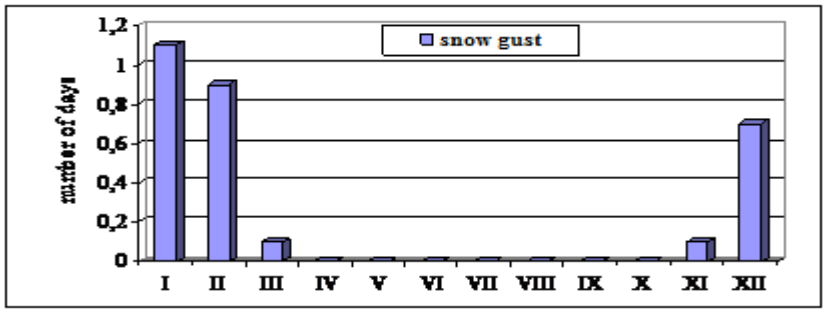

Fig. 12. Multiannual monthly averages of days with snow gust in Oradea, 1970-2014

The lowest values are recorded in the month which is at the end of the snow cover formation period, that is, in March, as well as in the month at the beginning of the period when snow accumulates on the ground, which is November, when there are 0.1 days with snow gust on the average (Fig. 12).

Blizzard

Blizzard is an infrequent weather event in Oradea. Its multiannual average is 1.2 days, and the period when it is likely to occur is from November to February.

The small number of blizzardy days in Oradea is the result of the characteristics of atmospheric dynamics in this part of the country, which show weak climatic influences from the east and north-east of the European continent, where such phenomena develop (Cristea, Cristea, 1999; Moza, 2009; Pereş, 2011).

In the period included in the study, the highest number of blizzardy days was recorded in 1987, when this phenomenon occurred on 7 days, all of them in January. It is worth mentioning that in 53.3% of the 45 years included in the study blizzard did not occur at all in Oradea (Fig. 13).

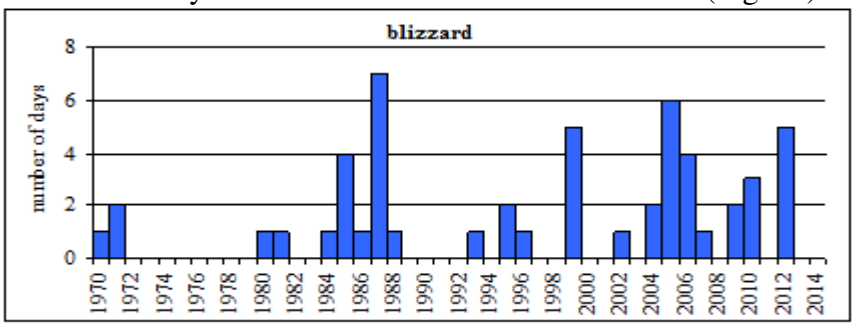

Fig. 13. Annual variations of blizzardy days in Oradea, 1970-2014

Over the years, the annual number of blizzardy days was either above or below the multiannual average, the deviations were negative in 75.6% of the years and positive in 24.4% of them (Fig. 14).

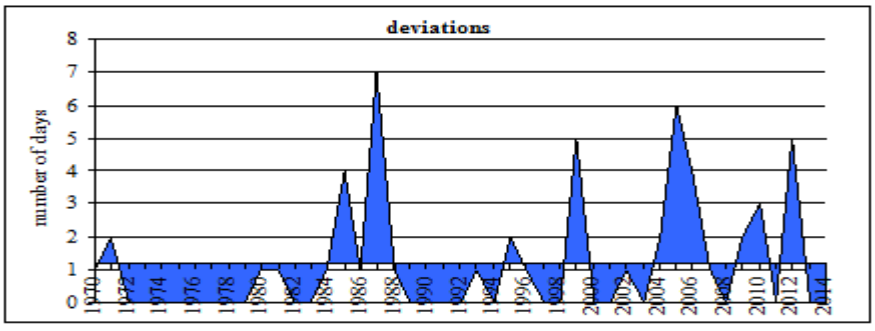

Fig. 14. Deviations of the annual numbers of blizzardy days from the multiannual average in Oradea, 1970-2014

Over the year, the highest multiannual monthly average of blizzardy days was recorded in February, that is, 0.5 days, followed by January with an average of 0.4 days (Fig. 15). The highest number of blizzardy days was recorded in January 1987, when the phenomenon occurred on 7 days, followed by February 1999, with 4 days.

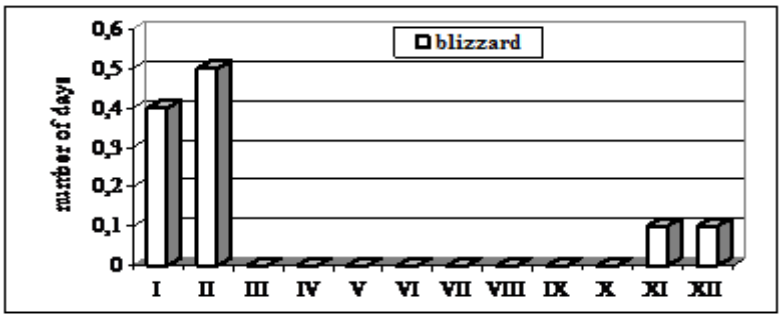

Fig. 15. Multiannual monthly averages of blizzardy days in Oradea, 1970-2014

CONCLUSIONS

In the period included in the study, the multiannual average of hoarfrosty days was 50.9 days/year. This phenomenon can occur from September to May, with the highest figures in the winter months (9-10 days), when thermal inversions are frequent.

The multiannual average number of glazy days is low, only 3 days/ year. In the area of the study, glaze start to occur in November and there are conditions for its formation until March, with the highest number of such days in January (1.5 days).

The multiannual average of frosty days is 8 days/year. The phenomenon occurs from November to March, with the highest frequency in January and December (3 days). The high frequency of frosty days in the winter months is strongly connected with the advection of cold and humid Arctic maritime air masses.

Blizzard occurs rarely, as the climatic influences from the east and north-east of the continent, which generate this phenomenon, are weak in this part of the country. The multiannual average of blizzardy days is 1.2 days, which are likely to occur from November to February.

Regarding the days when snow gust occurs, the average is 3 days/ year. The phenomenon occurs from November to March, with the highest frequency in January (1.1 days), which is also the month with the most significant snow accumulation.

Acknowledgments

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