FREQUENCY OF HAZARDOUS WEATHER EVENTS WHICH CAN OCCUR OVER THE WHOLE YEAR IN THE AREA OF ORADEA, BIHOR COUNTY

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Abstract

The frequency of hazardous weather events which can occur over the whole year in the area of Oradea is analysed is this paper using meteorological data recorded at the Oradea weather station over a period of 45 years (1970-2014). Due to the temperate continental climate with oceanic influences, the most frequent hazardous weather events which can occur over the whole year are: fog, foggy air, haze and strong wind.

In the area of Oradea, the multiannual average of foggy days is 33.7 days. Depending on the synoptic conditions of formation, the most common is radiation fog, which occurs frequently along the valley of Crişul Repede. This hydrometeor also occurs when over a radiatively cooled air mass flows a warmer air mass, which results in the formation of advection-radiation fog. Another type of fog occurring in Oradea is frontal fog, which arrives along with the atmospheric fronts it accompanies.

The multiannual average of days with foggy air 175.9 days, with variations between 267 days in 1980 and 110 days in 1990 and 2000.

In Oradea, the number of days with strong wind and haze is low, the multiannual averages being around 2 days.

Key words: fog, foggy air, hazardous weather events, haze, strong wind

INTRODUCTION

Fog consists of suspended tiny water droplets or ice crystals in the atmosphere, usually of microscopic size, which reduce visibility to 1 km or lower at the Earth's surface. Fog usually looks like a white veil, but when it is formed in polluted areas and contains dust and smoke, it has a greyish hue or is slightly coloured (I.N.M.H., 1995; Bogdan, Niculescu, 1999; Ciulache, 2002; Cristea, 2004; Dumiter, 2007; Erhan, 1999).

Foggy air means that horizontal visibility is reduced between 1 and 10 km, due to suspended water particles in the atmosphere. Its appears like a greyish veil, usually not very dense. Foggy air is the initial stage of fog and clouds. It lasts for a short time in the atmosphere (I.N.M.H., 1995; Măhăra, 2001; Lucchetti, 2009).

Haze consists of suspended, extremely small particles, invisible to the naked eye, which are numerous enough to give the air an opalescent aspect. Its relative humidity is below 70%, and visibility is between 1 and 10 km (I.N.M.H., 1995; Köteles, Pereş, 2010; Pereş, 2012).

Wind is considered to be strong when the two-minute average speed reading of a wind vane is 16 m/s or above. It is one of those weather events which are unfavourable to human activity in certain fields (I.N.M.H., 1995; Pereș, 2012).

High wind speeds are the result of high horizontal pressure gradients and of very active, vertically high Cumulonimbus clouds. Strong wind starts gradually, lasts for a long time, sometimes a few days, and its direction usually does not change (Gaceu, 2002, 2005; Măhăra, Gaceu, 2005; Moza, 2009; Pereș, 2011, 2012, 2013, 2015).

The aim of this paper is to offer an analysis of the features of hazardous weathers events in the area of Oradea, by attempting an analysis of their evolution, as well as of the factors which rule or generate them.

MATERIAL AND METHOD

In order to presents the features of hazardous weather events in the area of Oradea, the data obtained through visual observations and using instruments at the Oradea weather station from 1970 to 2014 were used.

The analysis of the hazardous weather events was performed using the data recorded in the weather observation tables prepared at the weather station included in the study. The data are kept at the Archives of the National Meteorological Administration Bucharest (A.N.M. Bucharest). The study covered a period of 45 years. The data obtained from the A.N.M. Archives were processed using statistical and mathematical methods. The results obtained using the above methods were then graphed, so that the fluctuation in time of the hazardous weather events could be better followed.

RESULTS AND DISCUSSION

Fog

The multiannual average number of foggy days over the period 1970-2014 is 33.7 days. Over the 45 years included in the study the number of foggy days in Oradea varied from one year to another on a range of 55 days in 1978 and 17 days in 2007 (Fig. 1).

The frequency of years in which there were more foggy days than the multiannual average was 46.7%, while the years with negative deviations made up 53.3% of the total (Fig. 2).

Over the year, the highest number of foggy days are recorded in January, with a multiannual average for this month of 8.6 days, while in the summer months the average of these days are between 0.4 and 0.5 days. The number of foggy days is high in all cold months. In December, the average number for this month is 7.7 days, while in February it is 4.9 days (Fig. 3).

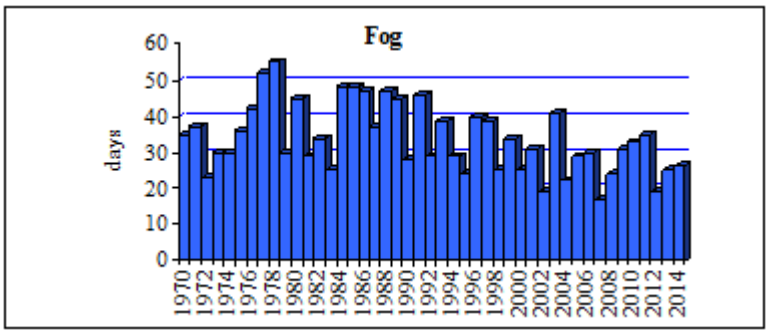

Fig. 1. Yearly variation of foggy days in Oradea, 1970-2014

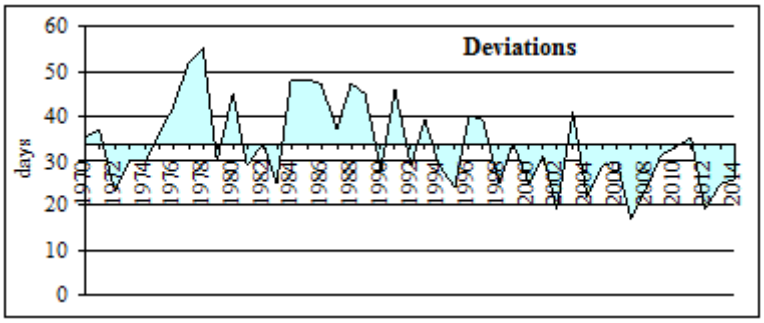

Fig. 2. Deviations of the annual numbers of foggy days from the multiannual average in Oradea, 1970-2014

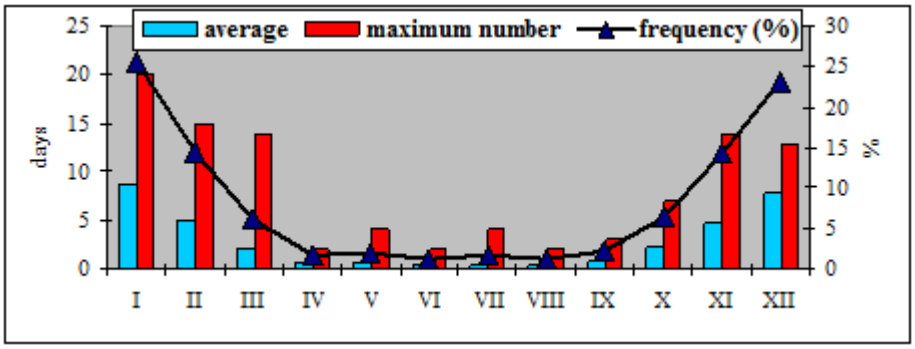

Fig. 3. Monthly variations of the average and maximum numbers of foggy days and frequencies in Oradea, 1970-2014

The foggy days recorded in January give the highest percentage, 25.6%, of all foggy days over the period of the study, while the lowest numbers are those for the summer months, around 1-2%. The high frequency of foggy days in the cold season is the result of lower temperatures, high atmospheric moisture, high atmospheric pressure, which prevent the dispersal of pollutants, and that gives a higher degree of atmospheric pollution in this season.

The lowest values over the year occur in the summer months and are caused by high temperatures, which maintain a low atmospheric humidity and pressure. In the spring months, the number of foggy days is between those for winter and summer, with averages of 2.1 days in March, 0.6 days in April and 0.7 days in May. In autumn, the number of foggy days raises from 0.8 days in September to 2.2 days in October and 4.8 days in November (Fig. 3).

In the period included in the study, the highest number of foggy days in a month was 20, recorded in January 1989, followed by 15 days, in February 1980. If we look at the months of the year over the period of the study, there were 11 month, namely January to November, which happened to have no fog at all in some years. Only December is the month with fog in every year, the minimum number of foggy days in this month was recorded in 2014, 2 days.

Foggy air

The multiannual average number of days with foggy air in Oradea is 175.9, but there were significant variations from one year to another. The highest number of days with foggy air was recorded in 1980, 267 days, and the years with the lowest number of such days were 1990 and 2000, with 110 days each (Fig. 4).

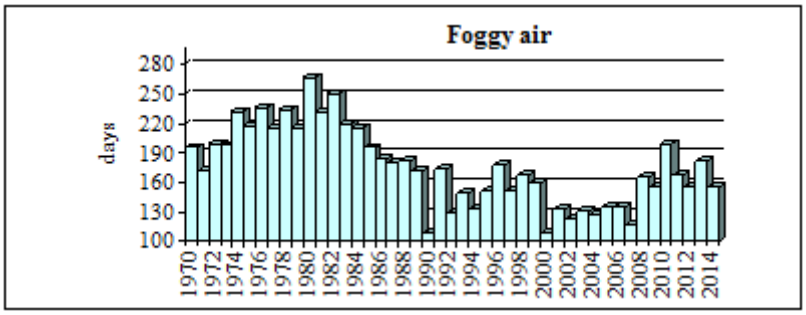

Fig. 4. Yearly variation of days with foggy air in Oradea, 1970-2014

When compared with the multiannual average, the annual figures of days with foggy air show deviations from that one, positive in 46.7% of the years and negative in 53.3% ones (Fig. 5).

Looking at the distribution in time of the positive and negative deviations, it can be seen that in the first half of the period included in the study, from 1970 to 1988, the deviations were positive, apart from 1971, after which, from 1989 to 2014, the deviations were mainly negative, apart from 1996, 2010 and 2013 (Fig. 5).

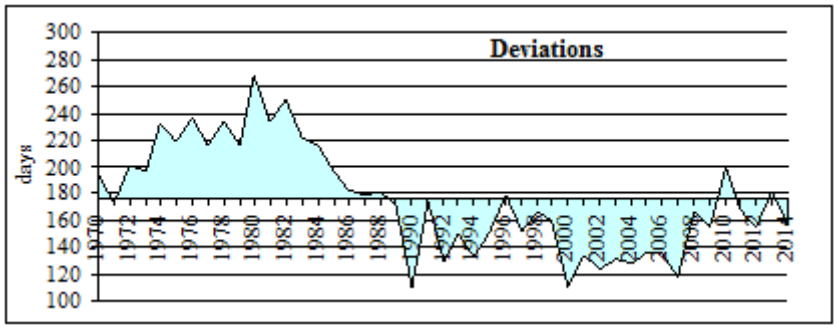

Fig. 5. Deviations of the annual numbers of days with foggy air from the multiannual average in Oradea, 1970-2014

Over the year, the most days with foggy air are recorded in the cold season, the highest values are recorded in January and December, with multiannual averages of 24.8 and 24.3 days respectively. The number of days with foggy air is high in all months of the cold season. The higher frequency of foggy air in the cold season of the year is the result of low temperatures, higher concentrations of pollutants in this time of the year, when the higher air pressure prevents the dispersal of pollutants, and air humidity reaches the highest values.

The fewest days with foggy air occur in the warm season, in the months of May and June, with monthly averages of 7.6 days and 8.1 days respectively. The average for July is 8.6 days and for August 8.8 days (Fig. 6).

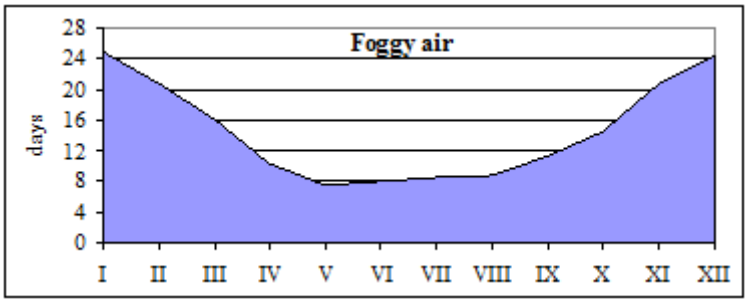

Fig. 6. Monthly evolution of days with foggy air in Oradea, 1970-2014

Haze

Between 1970 and 2014, the multiannual average of days with haze is 2.1 days. Over the 45 years included in the study the number of days with haze varied from one year to another, the highest figure was recorded in 1982, 13 days. There were more years in which this lithometeor was absent. Thus, in the years included in the study, there were 25 years with haze and 20 without this lithometeor (Fig. 7).

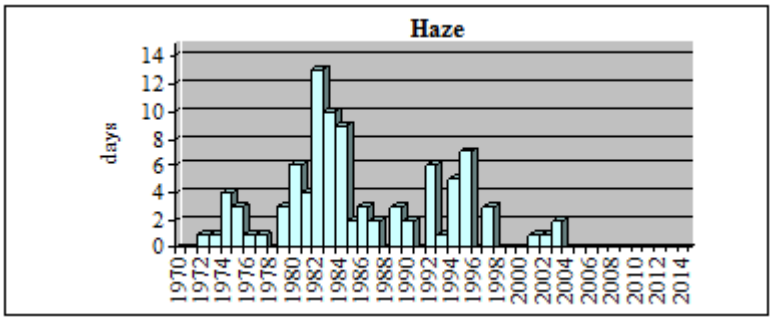

Fig. 7. Yearly variation of the numbers of days with haze in Oradea, 1970-2014

Over the year, the highest frequency of days with haze is recorded in the transition seasons, with the highest figures in October, when the average for this month is 0.5 days (Fig. 8).

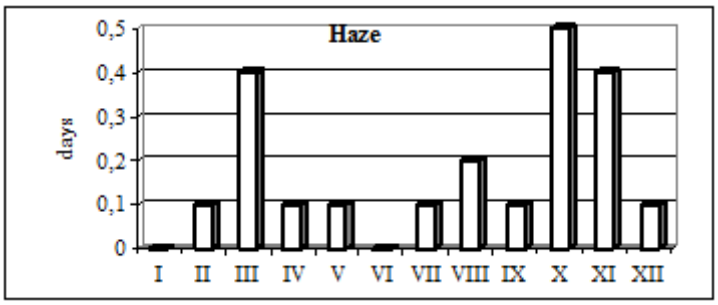

Fig. 8. Monthly evolution of days with haze in Oradea, 1970-2014

Strong wind

In Oradea, the number of days with strong wind is low, the multiannual average being 2.4 days. The highest number of days with strong wind was recorded in 2004, 13 days. In the years included in the study there were only three years with more than 10 days with strong wind, 1975, 11 days, 2004, 13 days, and 2005, 12 days (Fig. 9).

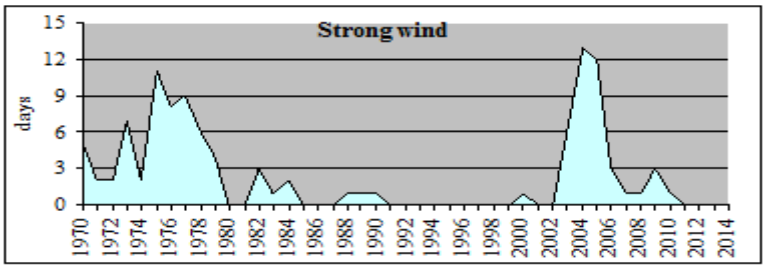

Fig. 9. Yearly variation of the number of days with strong wind in Oradea, 1970-2014

Over the year, the highest monthly averages of days with strong wind are recorded in the winter months, with the highest number of days in February, 0.4 days. Averages of 0.3 days are recorded in more months, January, March and October (Fig. 10).

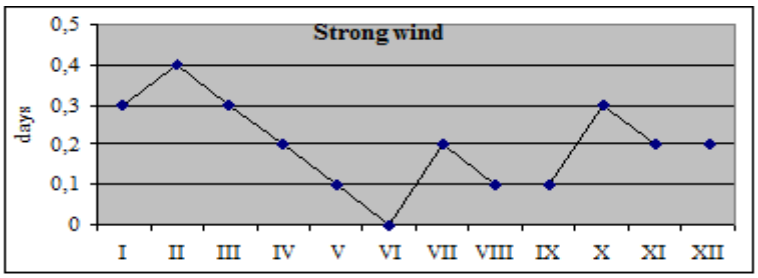

Fig. 10. Monthly evolution of days with strong wind in Oradea, 1970-2014

The lowest monthly averages of days with strong wind are recorded in the warm season of the year. Thus, in June, over the 45 years included in the study, there was only one year, 1982, in which the two-minute average speed reading of a wind vane was 16 m/s or above. In the other months of the warm season of the year, the average number of days with strong wind for each month varied between 0.1 and 0.2 days (Fig. 10).

CONCLUSIONS

The multiannual average number of foggy days is 33.7 days, and of days with foggy air is 175.9 days. Over the year, these two hydrometeors occur mainly in the cold season of the year, as a result of low temperatures, of high atmospheric moisture and of higher atmospheric pollution. Conditions for their formation occur in the warm season of the year, too, but the frequency is lower, as a result of high temperatures, which maintain low atmospheric humidity and pressure.

The multiannual average of haze is 2.1 days. This lithometeor occurs most frequently in the transitional seasons.

Strong wind occurs rarely in the area of Oradea, its multiannual average is 2.4 days. Over the year, it occurs more frequently in winter and more rarely in summer.

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