

CONSIDERATIONS OF THE FOG REGIME IN THE AIRPORTS AREA FROM MOLDAVIA TERRITORY (ROMANIA)

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ABSTRACT. Consideration of the fog regime in the airports area from Moldavia territory (Romania). In the airports area where the possibility of frequent mists and lasting fog exist, there is a risk that the aviation activity shut down for hours and sometimes for days. The paper is based primarily on the factual material represented by continually measured data during the 1961-2012 period by the weather stations which are located in Iași, Bacău and Suceava airports area. Of all the airports located on the Moldova territory, the Iasi airport have lowest risk of occurrence of fog (33 days/year), and the opposite, with the highest number of days with fog, is Bacău airport (57 days/year). Annual average duration of fog case is between 5.4 hours at Iași and 8.3 hours at Suceava. In all that three airports, calculations based on long sequences of observations (1961 - 2012) have indicated that the annual number of days with fog presents a downward trend, more pronounced in Bacău and Suceava airports.

Keywords: fog, regim, evolution, trends, Moldavia airports

1. INTRODUCTION

Fog reduces visibility to the ground and near ground. It is important for air navigation, but not by its density and extension, but also its irregular frequency and the appearance of the „spots” which are spread over the large areas. For this reason, the aviation activity can be interrupted for hours, days and sometimes for weeks from airports area where the possibility of fog exist. (Topor et al, 1966).

Decreasing of horizontal visibility, most often associated with the phenomenon of fog, is responsible for the waste of time, money and even lives in all transport activities. Concerning aviation, reduction of visibility involves the occurrence of flight safety problems, disruptions in air traffic, delays and significant financial losses to airlines (Stolaki et al, 2009).

The measurements by the instrumentality of radiosounding, weather balloons and remote sensing is carried permanently for various meteorological parameters, in altitude and land surface, to determine the atmospheric turbulence, or to study the microphysics of aerosols and fog.

The research of radiative processes, surface turbulent fluxes, mesoscale circulations, pollution etc, is needed because this numerous processes is influencing the fog. We mention the studies conducted by Sirbu (1983), Maier (2007). Studying the synoptic conditions favorable for fog formation in fixed point were made recently in the USA (Tardif and Rasmussen, 2008).

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Many authors have approached the fog phenomenon using the 1-D, 2-D and 3-D numerical models (Zdunkowski și Nielsen, 1969; Brown și Roach, 1976; Oliver et al, 1978; Brown, 1980; Forkel, 1987).

Fundamental studies on the fog were developed by Bogdan, Mihai (1972); Țâștea, Sârbu (1984); Croitoru et al (2011) and sinoptic conditions of fog which favor it were conducted by Băncila, 2005; Bordei, Tăulescu, 2006. The numerous studies have analyzed the regime of fog in certain geographical areas of Romania (Erhan, 1979; Apostol, 2004; Gaceu, 2005 a, b; Mihailă, 2006; Bogdan, Marinică 2007; Clima României, 2008; Mureșan, Croitoru, 2009; Tănase, 2011).

Regarding the phenomenon of fog at Romania airports we mention the papers elaborated by Șorodoc, 1961; Chertic, Lorentz 1964; Grama, 1965; Șorodoc, Cristodor, 1965 and those relating to forecast of fog in the airports area: Chertic, Lorentz, 1964. It is noted that the majority of studies on airports are old, with short rows of data, with short strings of data, sometimes from the three periods of observations.

Fog is the most important weather elements with negative impact on aviation activities in the airports area from Moldavia territory, therefore, deserves special attention.

2. THE ANNUAL, SEASONAL AND MONTHLY REGIME OF FOG

Average number of days with fog is the parameter that shows the qualitative aspect of the phenomenon. Knowing the number of days with fog has great practical significance, because it gives an indication of the existence of this phenomenon.

The average number of annual, anotimpual and monthly days with fog is expressed through an ratio of the annual, anotimpual or monthly number days with fog and number of years from that period.

The analyzed material showed that in the airports area from Moldavia territory (Fig. 1), during the period 1961 – 2012, were recorded on the average between 33.3 days with fog at Iași station to 58.6 days with fog at Bacău (Fig. 2).



Fig. 1. Locations of airports in Moldavia region (Romania)

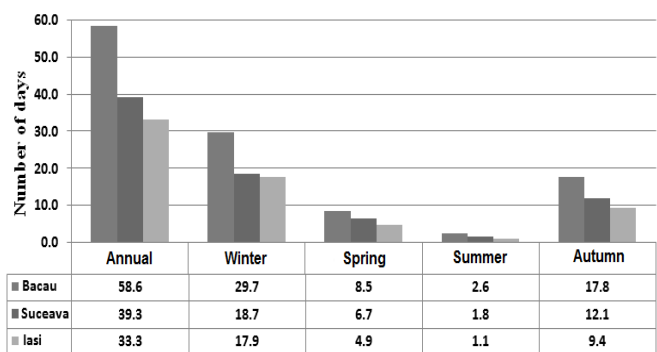


Fig. 2. The annual and anotimpual number of days with fog at weather stations from Iași, Bacău and Suceava (1961-2012)

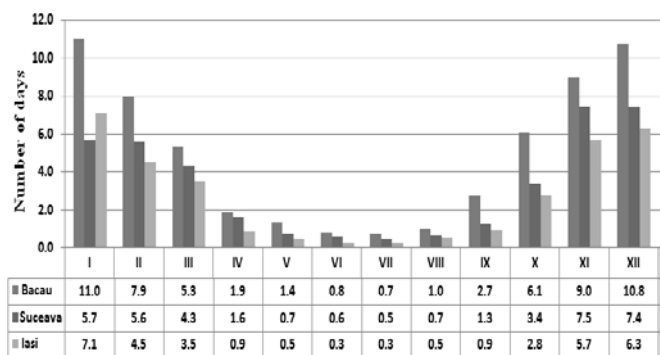


Fig. 3. The monthly number of days with fog at weather stations from Iași, Bacău and Suceava (1961-2012)

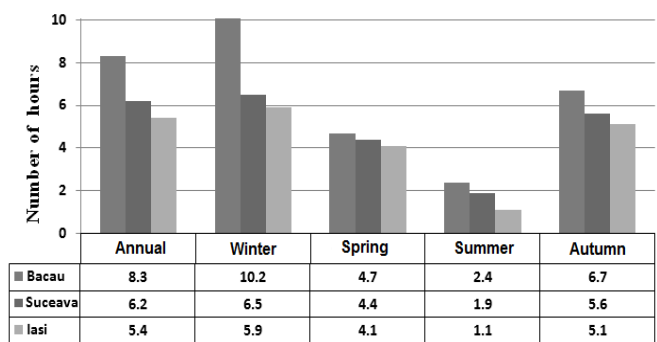


Fig. 4. The average length of the case of fog (hours and tenths) at weather stations from Iași, Bacău and Suceava (2003-2012)

Frequency periods of fog increase starting September in all that three airports area. Maximum frequency with fog is recorded in November and December at Suceava airport area, the difference between that two months being only of 0.1 days (Fig. 3).

The trend remains upward until February for the other two airports (Iași and Bacău) (Fig. 3). With the arrival of autumn and by the end of winter the radiative processes, advection and thermal contrast between the active surface and the air from above reaching the highest values.

From measurements performed between 2003 – 2012, the duration of fog occurrence was between 5.4 hours at Iași station and 8.3 hours at Bacău station. The annual and anotimpual average length of the case of fog in the area of that three airports from Moldavia territory exceeds, in cold season of year, six hours frequently (Fig. 4).

3. THE ANNUAL AND SEASONAL FREQUENCY OF FOG

Diurnal evolution of fog indicates the highest reduction of fog frequency in the late of afternoon and in early evening (Fig. 5), when active surface is on maximum heating and relative humidity of the air is greatly decreases. Because of favorable thermal and moisture conditions, the fog have high frequency in the second part of the night and in the morning.

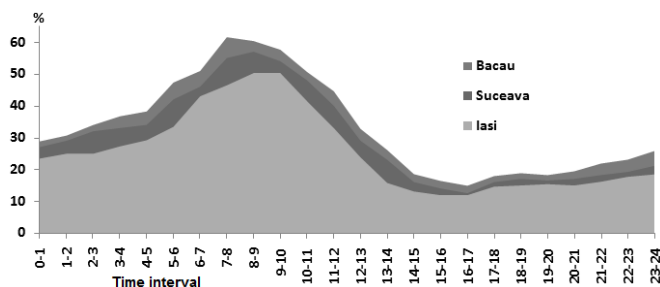


Fig. 5. The diurnal frequency (%) of fog – annual average at weather stations from Iași, Bacău and Suceava (2003-2012)

In *spring*, when the temperatures are increasing, maximum diurnal generally kept during the mornings, between 6⁰⁰ - 9⁰⁰ local time, while minimum diurnal is produced during the afternoon, especially between 14⁰⁰- 17⁰⁰ local time (Fig. 6).

In *summer*, maximum diurnal of fog phenomenon is record after sunrise, between 7⁰⁰- 8⁰⁰ local time (Fig. 7). The convective inertia that positively enhances month by month from spring to mid-summer, maximum length of days, strong insolation, the shining period of sun, high angle of solar rays at the earth surface contact, finally produce the disruption of the balance of the air layers at large thicknesses, so that the formation of fogs becomes null.

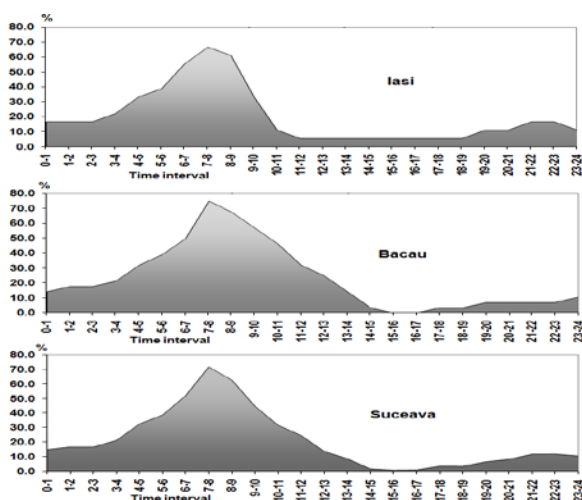


Fig. 6. The diurnal frequency (%) of fog in spring season at weather stations from Iași, Bacău and Suceava (2003-2012)

The autumn is the season when solar radiation intensity and daily temperatures is decreases, relative humidity is increases, as a result the fog phenomenon increase in intensity. In this conditions, diurnal evolution of fog in the autumn is much clear compare with the other seasons (spring and summer). The maximum diurnal values occurred in the morning, between 7⁰⁰- 10⁰⁰ local time, and register a minimum intensity in the afternoon, between 13⁰⁰ - 17⁰⁰ local time (Fig. 8).

In *winter*, the formation of fogs is possible during the whole diurnal interval. However, there is a diurnal maximum in the morning, between 6⁰⁰ - 11⁰⁰ local time, the minimum being recorded in the afternoon, between 14⁰⁰ - 17⁰⁰ local time (Fig. 9).

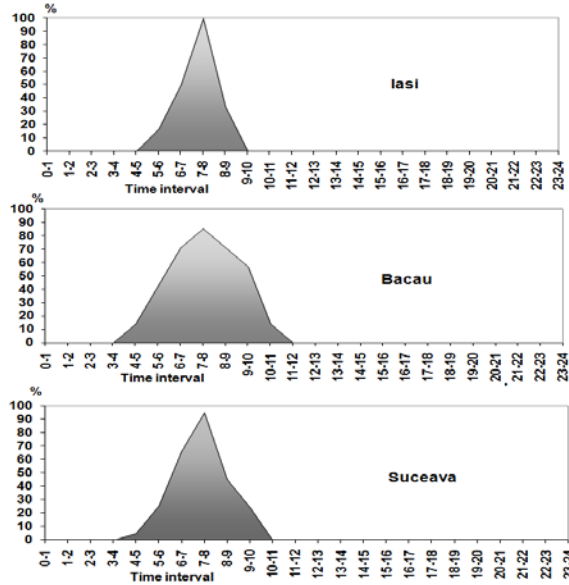


Fig. 7. The diurnal frequency (%) of fog in summer season at weather stations from Iași, Bacău and Suceava (2003-2012)

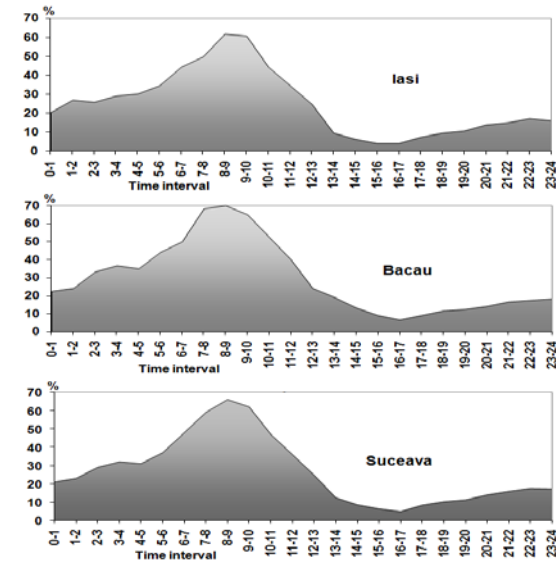


Fig. 8. The diurnal frequency (%) of fog in autumn season at weather stations from Iași, Bacău and Suceava (2003-2012)

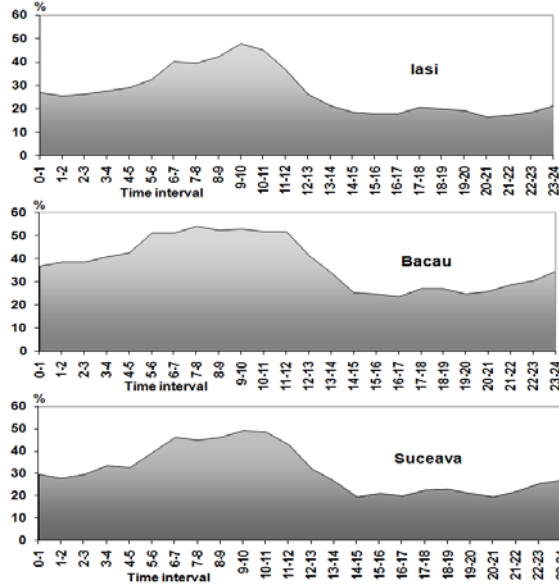


Fig. 9. The diurnal frequency (%) of fog in winter season at weather stations from Iași, Bacău and Suceava (2003-2012)

Long-term trends - 1961-2012 regarding the evolution of the number of days with fog to the three Moldavia airports, they shows that, a descending trend, more clear in the area of Bacău airport (Fig. 10).

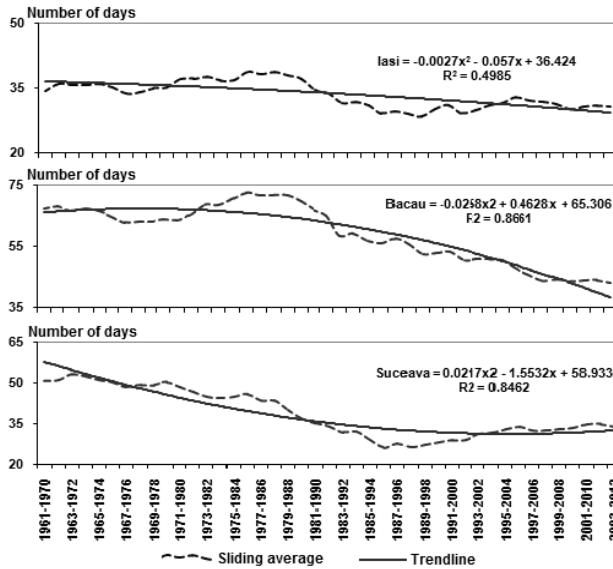


Fig. 10. The sliding averages over a 10-year time series, shifted successively with one year of the number days with fog overall weather stations from Iași, Bacău and Suceava (1961-2012)

4. CONCLUSIONS

The fog, one of the most risky weather phenomena for air navigation, occurs throughout the year in the studied area, being more frequent in the cold season (November to March). Between airports situated on the territory of Moldova, at the Iasi airport is the lowest risk of occurrence of fog (33 days/year), and the highest risk is at the Bacău airport (59 days/year), where the active surface, Siret corridor, has a determinant role in the genesis of fog.

Because the fog has a high frequency especially in the morning it is recommended that this three airports must take into account this fact when the schedule of flights is established, especially that the average duration of episodes with fog, when they were present was big enough (between 5.4 hours to Iași airport and 8.3 hours to Suceava airport).

Calculations based on long sequences of observations (1961 – 2012) have shown for all this three airports, the annual number of days with fog presents a decreasing trend, less highlighted at Iași airport and more pronounced at Bacău and Suceava airports.

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