SPECIFIC CLIMATIC PHENOMENA DURING THE COLD SEASON IN COVURLUI PLAIN AND BRATES MEADOW

Gigliola Elena Dobrin[1],

Résumé. En hiver, sur la plaine du Covurlui et dans la prairie du Brates, les phénomènes climatiques sont limitées par la température d`hiver, avec une baisse dans la plupart de cas de la température de l`air et du sol en dessous de 0° C, leur variation étant plus élevée que pendant l`été. Dans les conditions d`un relief spécifique, on peut remarquer quelques anomalies représentées par des phénomènes météorologiques qui apparaissent très tôt ou très tard. Aussi, dans cette région on remarque une spécificité locale imposée par la présence du Danube comme facteur modulateur thermique, qui empêche la formation des inversions de température et qui favorise l`apparition des phénomènes comme le givre, le verglas, la brume et la neige. En revanche, la présence du Danube rend le numéro des jours au sol couvert le plus bas a Galati.

***Keywords**: Covurlui Plain, Brates Meadow, Danube, cold season, drizzle, hoarfrost, frost, glaze, sleet, snow, fog, blizzard*

Introduction

During the cold season, climatic phenomena depend on the thermal winter regime, with a decrease within the air and soil surface temperature below 0° C, with a greater variety than during the warm season. Given the terrain conditions specific to the area, some anomalies might be spotted, characterized by early or late meteorological phenomena.

Analysis of meteorological phenomenas

Drizzle is a specific phenomenon especially during the cold semester. The number of drizzle days is small in Măicănești (3.2 days), while in the rest of the region it is produced between an average of 11.4 and 13.6 days/year, increasing slowly in the hilly northern region. The highest number of drizzle days was recorded in Galati, as an exception, as a result of the existence of broad aquatic surfaces in the area. In the Covurlui Plain and Brates Meadow, the highest average monthly values were recorded in November (almost ¼ of the average annual number of drizzle days) (Img.1).

Hoarfrost may appear in Covurlui Plain and Brates Meadow starting September until May (except for Galati, where this phenomenon has not been recorded for such a late period). Annually, the hoarfrost intervals range from 37.7 days in Măicăneşti up to 55.0 days in Tecuci (Img.2). The smaller number of hoarfrost days from Galați and Măicăneşti is due to the fact that radiative cooling is less intense as a result of higher inferior nebulosity, as well as

[1] elenadobringl@yahoo.com

evaporation of the aquatic surfaces of the area. The distribution of the phenomenon depends on the altitude and local conditions. Most hoarfrost days have been recorded in 1992 in Galați, in 1989 and in 1992 in Măicăneşti, in 1989 and 2000 in Tecuci, as well as in 1978 in Balinteşti.

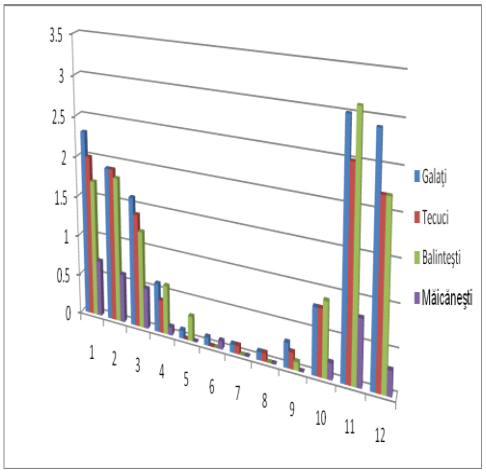

Figure 1: The average number of drizzle days in Covurlui Plain and Brates Meadow, as well as the adjacent areas.

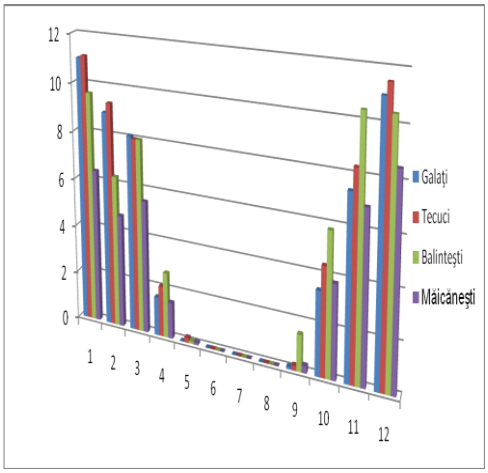

Figure 2: The average number of hoarfrost days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

Frost mostly appears during the invasions of humid and very cold air, usually arctic maritime air. Mellow frost is usually created during an anticyclone regime, with extremely low temperatures (Apostol, 2004). Hard grainy frost is created due to the icing of fine water drops from the layer of air near the ground, at the advection of cold air masses (between -2.0° C and -7.0° C) and strong wind (Apostol, 2004). Both types of frost are produced only during November-March, sometimes even missing in March (figure 3).In December, more than one third of the average annual number of frost days are produced. The most numerous frost days have been recorded in Covurlui Plain and Brates Meadow (for the analyzed periods), in 1997 in Galați, 1999 in Tecuci, 1962 in Măicăneşti and Balinteşti (over 20 days).

Glaze consists in the formation of a thick, transparent layer of ice, derived from the icing of overcooled water which is precipitated on the ground during the cold season of the year, in a rare case secondary glaze derived from rain of positive temperatures (Pop, 1988). The average annual number of glaze days increases in Covurlui Plain and Brates Meadow from South to North , being able to form in the interval of November-March (and very rarely in October) (figure 4). In this case, Galati makes a strong discordant note with this rule due to the presence of the Danube in the South unit, which favours the formation of liquid precipitation, that when deposited on the icy ground gives birth to this climatic phenomenon. On the other side, Balinteşti, the northernmost meteorological station from the analysed ones, has a lower number of liquid precipitation days and therefore glazed frost is less likely in this area. The lowest number of glaze days have been recorded in Covurlui Plain and Brates Meadow in 1985 in Galați, 2003 in Tecuci, 1963 in Balinteşti and 1987 in Măicăneşti (over 10 days).

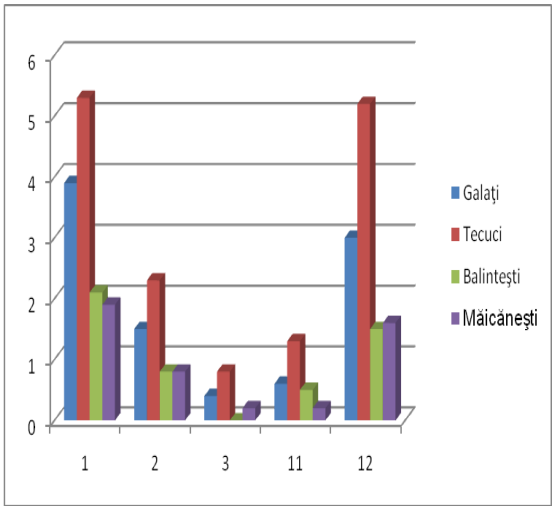

Figure. 3: The average number of frost days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

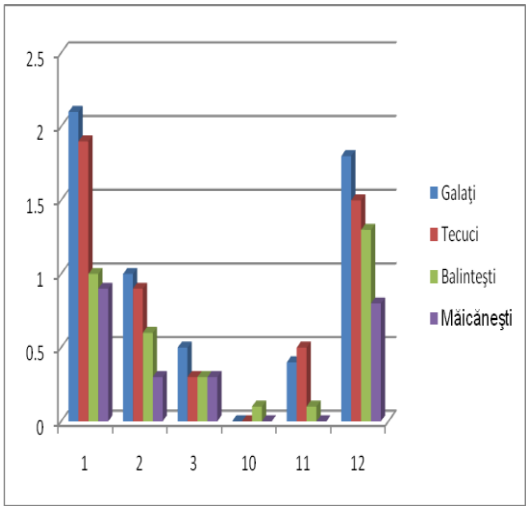

Figure 4. The average number of glaze days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

Sleet and sleet showers do not have as frequent high values. They are types of precipitation less trenchant or significant and scientific concerns towards them are quite rare. Early or late sleet can cause damage to crops. In Romania, the average annual number of sleet days increases from South-East to North-West. Bogdan Octavia (1978) appreciates for the highland and lowland regions that the average annual number of sleet days is 4-5.

The average annual number of sleet days in Covurlui Plain and Brates Meadow was determined on the basis of data strings from the meteorological stations in Galaţi, Măicăneşti, Tecuci and Balinteşti, with a minimum of 22 years. The average annual number of sleet days is higher than in the Covurlui Plateau and similar to the surrounding plain units (figure 5). The Covurlui Plain and Brates Meadow area presents ideal conditions for producing sleet (at the latitudes and higher altitudes in the North, sleet is replaced with snow, while in the South, at lower altitudes, with rain).

The maximum annual number of sleet days was estimated for plain areas from Romania as being generally 2-3 times higher than the average annual number (Bogdan, 1978). The maximum annual values from this area are of 8 days in Măicăneşti, 15 days in Galaţi, and 11 days in Balinteşti and Tecuci.

Sleet is produced in Galati and Tecuci, in the interval X-IV, while in Măicăneşti and Balinteşti, in the interval XI-IV (tab.103), at the majority of meteorological stations from Covurlui Plain and Brates Meadow. The maximum number of sleet days occurs in March, except Galati which has the highest number of sleet days in December.

Showers are a specific feature especially in the case of rain, the number of rain shower days being similar to the number of rainy days. Snow showers are a rare phenomenon, and those of sleet, even more rare. In the Covurlui Plain and Brates Meadow as well as in the adjacent areas, the average annual number of sleet shower days presents subunit levels (figure 6), as for the whole area of East Romanian Plain.

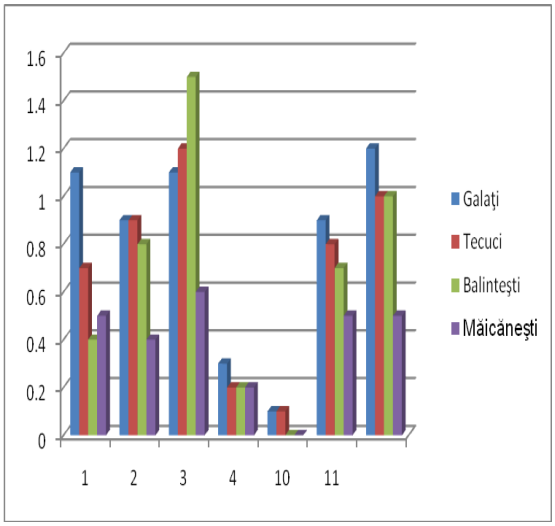

Figure 5. The average number of sleet days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

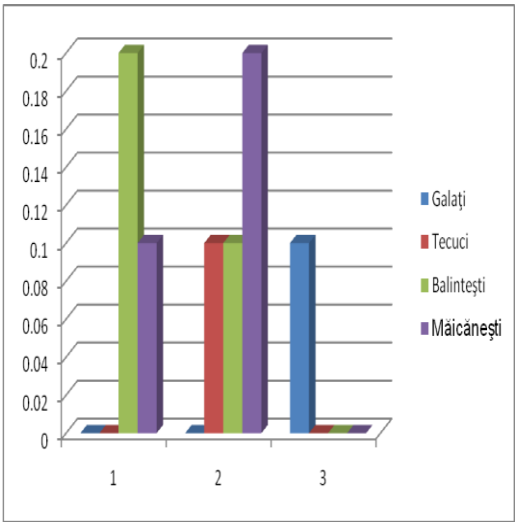

Figure 6. The average number of sleet shower days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

Snow and snow showers are of great importance due to the water intake they bring, the snow layer formation along with its effects, as well as to the damage that early and late snows bring to crops. The first extension paper regarding snow, with no differentiation made between the snow and snow showers, at the level of our entire country, based on a series of 20 years of observation (Donciu, 1930), presents parameters of snow in this geographical unit, at values less reduced than those determined by us on the basis of long strings of data. In this paper, the number of snowy days has been settled, for average annual values, for Covurlui Plain and Brates Meadow, at values ranging from 15 days in the South side, to 20 days at higher altitudes from the North.

For period 1896-1955 (with interruptions), the average annual values of the number of snowy days are 16.8 in Galati (Clima R.S.R., vol.II, 1966). At the level of the whole country, for highland regions, the average annual number of snowy days was settled to 15-20 (Geografia Romaniei , vol. I, 1983), while in Atlas Climatologic (1966), for Covurlui Plain and Brates Meadow, to 15-20 days (except for the South-Eastern part of this unit, where values are mapped between 10-15 days).

In this paper, we mention that the average annual number of snowy days increases in Covurlui Plain and Brates Meadow, from South to North and with altitude from 17.7 days in Măicăneşti to 30.0 days in Balinteşti (figure 7 and 8).

Nearly all these days are registered in the cold semester, but snowy days can also be recorded in the warm semester, when the average number of these is subunit.

The maximum annual number of snowy days has ranged between 44 days in Măicăneşti and 63 days in Galaţi, all the maximum annual values being recorded in the year 1969 (table.1)

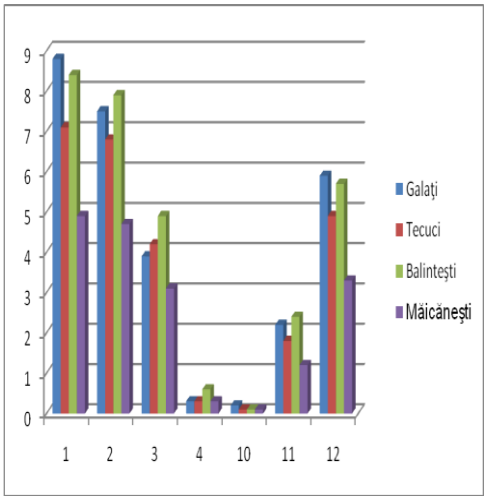

Figure 7 The average number of snowy days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

Table 1 The maximum annual number of snowy days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

Meteorological station	Snow		Snow showers	
	Anual	Monthly	Anual	Monthly
Galaţi	63	18	8	7
1961 - 2008	1969	Jan-74	1998, 2000	Mar-98
Tecuci	48	17	8	8
1961 - 2008	1969	Feb-86	1998	Mar-98
Balinteşti	57	18	7	4
1961 - 1983	1969	Feb-69	1976	Feb-75
Măicăneşti	44	15	3	3
1961 - 1999	1969	Dec-69	1961	Dec-61

The average number of snowy days registers values higher than a day in months of November and March (this month hovering around 4 days), on the entire territory of Covurlui Plain and Brates Meadow as well as the adjacent areas. The highest average monthly values were registered in January (in Galaţi, in January) (figure 7).

The maximum monthly number of snowy days has reached 18 in January, 1974 in Galaţi and in February 1969 in Balinteşti, 17 days in Tecuci (February 1969) and 15 days in Măicăneşti, in December (table 1). The probability that a day with precipitations will be a snowy one increases from October until January, only to decrease until April (for example, in Galati, from 1% in October and April to 85% in January) (Donciu, 1030). The first snow usually appears when the average daily temperature of the air drops to 2-3° C, and the last one, when the average daily temperature crosses the threshold of 5° C (*Clima R.P.Române*, vol. I, 1962).

Snow showers have recorded low values of the average annual number of days, in the entire studied area and especially in Măicăneşti (in the South), compared with Balinteşti (in the North) (figure 9).

The maximum annual number of days with snow showers falls under values much lower than the maximum annual number of days with snow, and shows values which increase to the North along with the altitude rise (from 3 days in Măicăneşti, to 7-8 days in North ,in Balinteşti and Tecuci). Near Danube Valley (in Galati), the maximum annual value is particularly high (8 days in Galati, as in North) (table 1).

The highest average monthly values of the number of snow shower days were recorded in March and sometimes in February or December. The maximum monthly values of the number of snow shower days show the same tendencies as the maximum annual number.

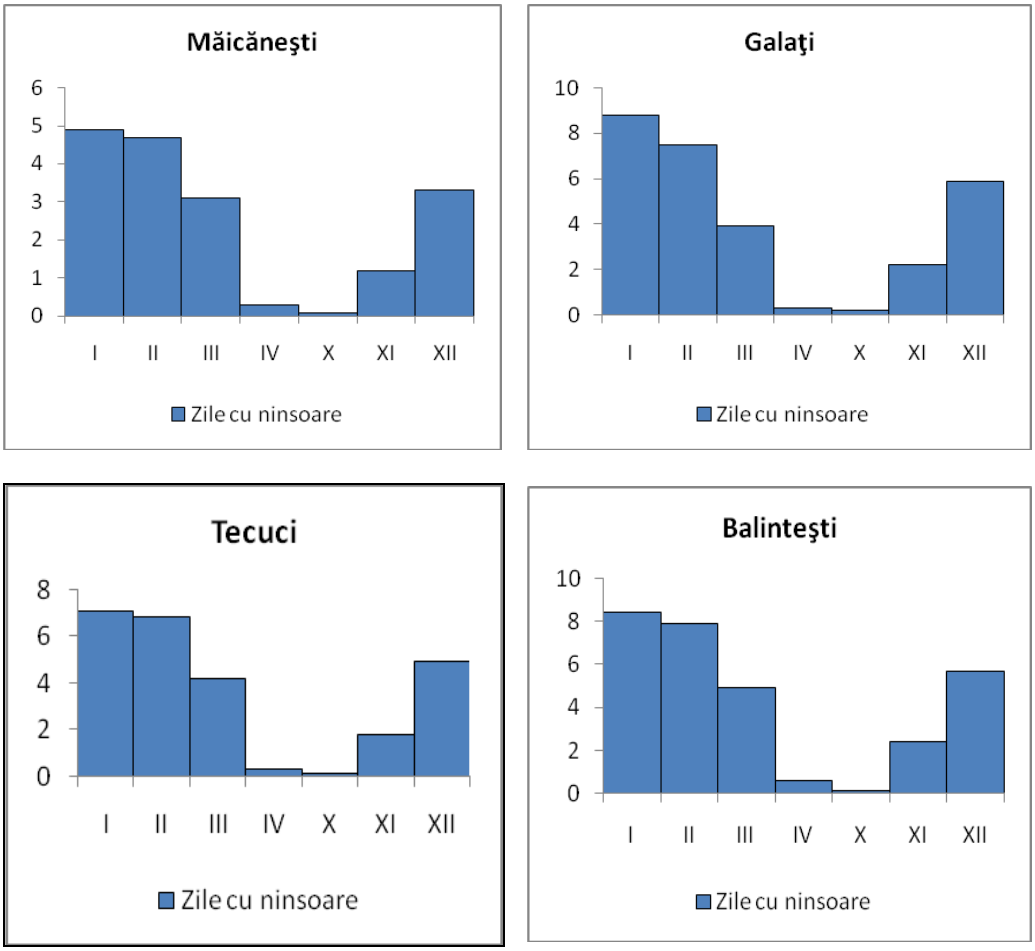

Figure 8: The annual variation of the number of snowy days

Blizzard is a phenomenon which involves transport of snow above the terrestrial surface. In order to appear, high speed of wind and presence of the snow layer are necessary. The phenomenon may or may not be accompanied by snow. After 1960, the snow transport phenomenon was highlighted in the meteorological charts through transport of snow on the ground and transport of snow at height, as blizzard being considered the second case, even though there is no longer a good accordance with the data from before 1961. The synoptic situations favourable to the recording of blizzards are produced, when above Central and Western Europe drives a high pressure belt or a series of anticyclones (Azoric, Scandinavian and Siberian), along with the depressions which develop over the Mediterranean Sea or the Black Sea (Bălescu, Beşleagă, 1962). A special role in the development of blizzard belongs to the main morphological features of the terrain, especially to the opening of the plain (figure 10).

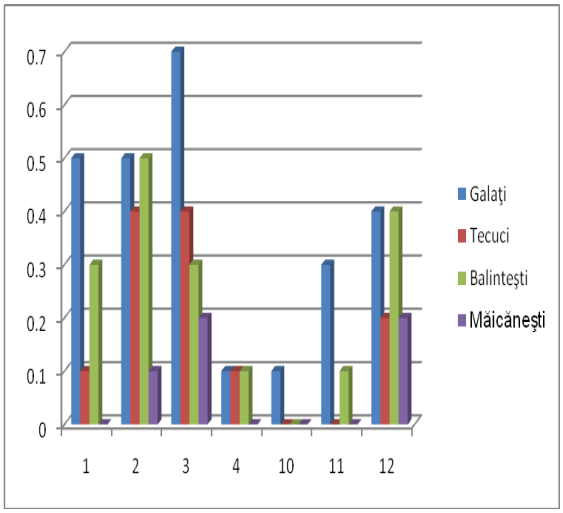

Figure. 9. The average number of snow showers Days in Covurlui Plain and Brates Meadow, as well as the adjacent areas

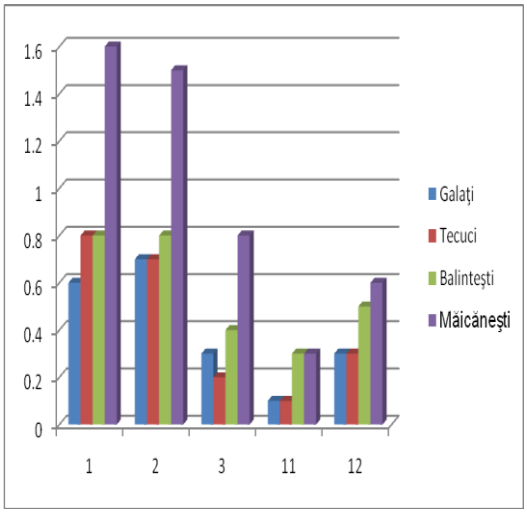

Figure 10. The avearge number of days with snow carried at heights in Covurlui Plain and Brates Meadow, as well as the adjacent areas

The blizzard is produced at the interference of two different air masses and it only affects the inferior layer of the troposphere, up to 600-800 m, more frequent in the East and South-Eastern regions of the Carpathians. The Covurlui Plain region and the Brates Meadow region are situated in an open zone, aerodynamically speaking, especially in the South and East sector. Covurlui Plain and Brates Meadow fall in the area with 1-3 days of blizzard a year (Bălescu, Beşleagă, 1962). For the periods mentioned in the table, the average number of blizzard days ranged between 2.0 days/year in Galaţi, 2.1 days a year in Tecuci, 2.8 days/year in Balinteşti, and 4.8 days/year in Măicăneşti (Img. 10). If in Măicăneşti the really high value (almost double) compared to Balinteşti is explained through the plain position (with a broad opening in the way of wind) of the first meteorological station, while the other is situated in the hilly region from the South of Covurlui Plateau; in Galaţi, where we notice the lowest average number of blizzard days (explained by the shelter climate) created by the urban area.

Blizzard may occur in Covurlui Plain and Brateş Meadow in the interval November-March. The maximum number of blizzard days oscillated between 12 days in Galaţi, 17 days in Tecuci and Balinteşti and 26 days in Măicăneşti, all in the year 1969. The number of blizzard days is no longer highlighted in the meteorological tables, being considered similar to the phenomenon of snow being carried at heights. However, the number of days during which snow is being carried at heights is far lower, which leads to the conclusion that the two phenomena should not be assimilated (Apostol, 2004). The most favourable conditions for triggering blizzards are met within the area in January and February (0.6-1.6 days/month). After year 1970, most blizzards were recorded in 1981 (14 days in Măicăneşti), 6 days in Galaţi (in 2003), 5 days in Tecuci (in 1973 and 1985) and 3 days in Balinteşti.

Snow is the most typical climatic winter phenomenon contributing to the decrease of air temperature. The characteristics of circulation, along with the position of the unit studied at East Carpathians and the terrain morphology, require differences in the appearance, melting, duration, number of days and thickness of the snow layer in Covurlui Plain and Brateş Meadow, as well as in other areas close to these. Here, the layer of snow is slightly stable, with reduced average thickness. The snow layer installs averagely two weeks after the

usual time in which the first snow is being produced, while the last day with a snow layer is usually recorded two weeks after the average date of the last snow (*Geografia României*, vol.I, 1983). The average time of the first day with a snow layer lies between 14.XII, in the north side (in Tecuci) and 17.XII, in the South, in Galați. The last day with a snow layer is lies between 1.III in the Tecuci area and 27.II in the Galați area. (*Clima R.S.România*, vol.II, 1966). The persistence of the snow layer increases rhythmically from South to North. The stability of the snow layer, settled by I. Ujvari (1972),after the Köppen snow layer stability indicator , he situates the Covurlui Plain and Brateş Meadow , along with the near areas in a zone with a relatively stable snow blanket in its North side, as well as in an area with a less stable snow blanket in the Southern zones, while in South-East with an unstable snow blanket. The average number of days with a snow layer in the period elapsed after 1961, is much lower than the one revealed in *Clima R.S.România*, vol.II, (1966), which analyzed the period 1926-1955. Therefore, in the quoted paper, there are mentioned average values of 77 days in Tecuci and 75 days with a snow layer in Galați. In Covurlui Plain and Brateş Meadow, along with the adjacent areas, according to our analysis, the average annual number of days with a snow layer reaches the lowest value in Galați (36.9 days) and the highest in Tecuci (49.4 days).

This difference may be put on behalf of the obvious heating tendencies towards the climate, manifested especially in the last decades. The first layer of snow appears everywhere in November. The last layer of snow may be recorded in April; most days with snow layers are to be found in January and February.

Fog may appear during a whole year, although it more frequent in the cold season (November-February). In Covurlui Plain and Brateş Meadow, as well as in the nearby areas, the average annual number of foggy days is very different (49.8 days in Galați, 41.7 days in Măicăneşti, 43.2 days in Tecuci and 34.9 days in Bălăbăneşti). The number of annual average foggy days in this area is relatively low compared to the rest of the country, the values recorded here being among the lowest. These are estimated in *Geografia României*, vol. I (1983), at values lower than 50 a year. In Galați, Tecuci and Măicăneşti, due to valleys belonging to the Danube, Bârlad , respectively Siret , as well as lakes Brateş, Cătuşa, Mălina (in the vicinity of Galați), but also of the present interference of multiple circulations, the average number of foggy days has higher values. The maximum number of foggy days has been recorded in December, significant values being presented during each of the cold season months.

The maximum number of foggy days was in the studied area for 60-76 days per year. From a genetic point of view, in Galați, the most frequent fog is the advection type (38%) and radiation (26%) (Mihăilescu, 1970). Fog of advection nature have been more frequent in the winter and were formed at the West and South-East outskirts of the anticyclones and in the East and South-East side of the cyclones. Radiative fog is produced more frequently during the winter, as a result of radiative cooling from cloudless nights, based on the anticyclonic time states (Apostol, 2004). Evaporation fog is produced frequently in the river meadows, as well as above lakes and ponds from Brateş, Danube and Siret meadows.

Fog is frequently associated in the zone of the steel platform factory, Mittal Steel Galați, with aerosol of industrial origin, creating the smog, especially in the second part of the night and in winter mornings, with atmospheric calm.

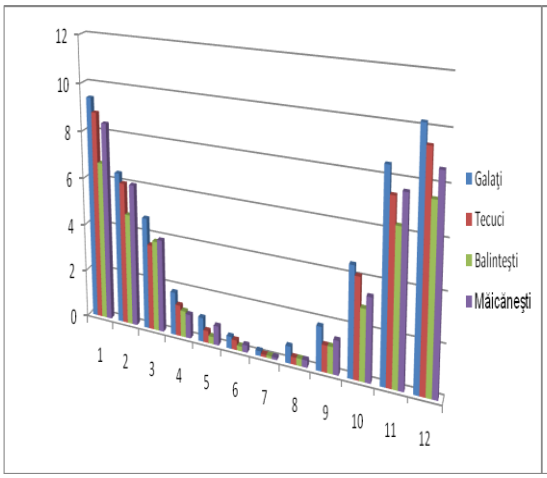

Figure 11. The average number of foggy days in Covurlui Plain and Brates Meadow, as well as adjacent areas

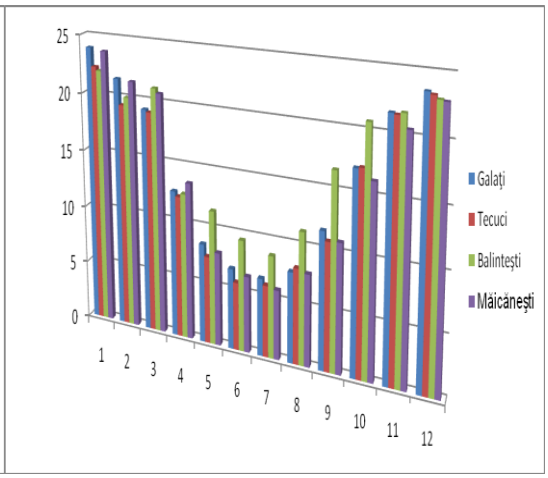

Figure 12. The average number of days with foggy air in Covurlui Plain and Brates Meadow, as well as adjacent areas

The foggy air is mainly produced during up to 50% of annual days in Galaţi, while in Balinteşti, in 54% of days from a year. The frequency of foggy air increases, usually, from a few days during summer months to an almost daily frequency in the winter (Img. 14)

Conclusions

The cold season climatic phenomena are strongly affected by the presence of large aquatic surfaces in the South of the studied unit. Therefore, in Galaţi, on the Danube shore, phenomena as drizzle, hoarfrost, glazed frost, sleet, snow shower days show higher values than other meteorological stations. On the other hand, blizzard is not a specific phenomenon to the urban areas, thus in this city it holds the lowest values, at a great distance from Măicăneşti, situated at the same latitude.

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