AEROSYNOPTIC CONDITIONS THAT INFLUENCED THERMAL REGIME DURING THE COLD SEMESTER IN NORTHERN OF MOLDAVIA IN THE LAST 20 YEARS

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Abstract:The present work highlights the evolution of temperatures that have characterized the North of Moldova over the last 20 years, of course, and the role of synoptic conditions which stood behind them, which have succeeded in the past 20 years (1994-2013) during cold semester (October-March). This study shows the role of aerosynoptic conditions that influenced the thermal regime during this period, namely: a frequency of types of movement in which will highlight a general trend, the induced effects on the temperature and thus the resulting climate risks (sudden melted snow,chinook, that in the case of the Western circulations), that after long periods of cold weather ,it has favored the production of ice bridges on the rivers, which is a constituent of the production flooding in time of accelerated warming associated circulations mentioned.

Key-words*: Northern of Moldavia, synoptic context, cold semester, atmospheric circulation, foehn*

Introduction

Weather conditions during the cold semester in the most part of Romania (implicitly and the studied region's), through its location in the South-East part of the european continent, is characterized by the influence of Azores Anticyclon, Euro-Siberian and Icelandic depressions, mediteraneans (fig. 1). Thus, during the cold semester from the last 20 years (1994-2013) Northern of Moldavia was characterized by movements in the North-Western sector, that because we talk and about the arched shape of the Carpathian chain which, through the "Coandă effect" (Apostol, 2004) deviates the directions of movement of the Western and atlantic air masses remembered. This deviation of Western circulations does, that after a frosty episode, North of Moldova is the first region of the country who felt the process of heating. For this reason, and the layer of snow is subjected to rapidily melting.

Also, even the Western movements, crossing the mountain range characterized by the Eastern Carpathians, is subjected to the processes of foehn (rather, ,,pseudo-foehn", notion defined by Bordei Ion (2008), and this is characterized by an accelerated warming, most being high regions of the western area studied (geographical area of Obcinele Bucovinei).

A significant proportion in the types of movement they occupy and those from the north-eastern sector, corresponding to maximum euro-siberian baric, then being loosened conditions for pronounced cooling,appearance of thermal inversions, followed by the northern sector associated with the Scandinavian anticyclon, which is responsible for most of the time, early and late mist, these having detrimental effects on crops.

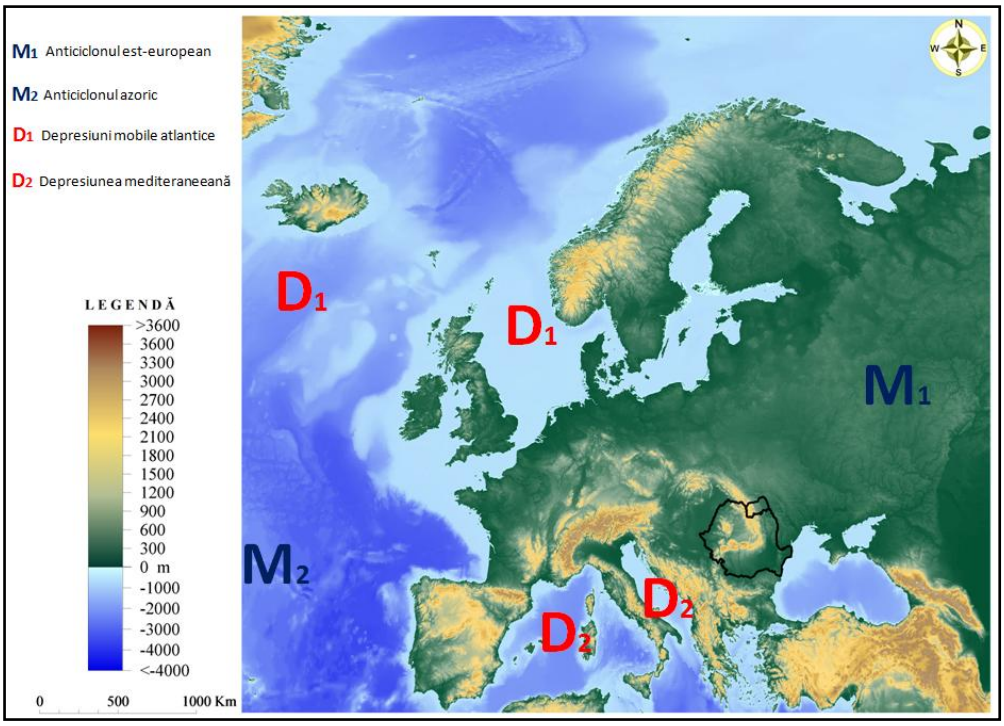

Figure 1.The distribution of main baric center on European continent

The methodology of the study addressed

For this material, we used meteorological data related to temperatures for October-March period of 1994-2013, taken from http://www.ogimet.com/and from http://rp5.ru/. These data were collected and processed using Microsoft Excel 2007 software. In parallel with this data, for the synoptic part we have pursued the synoptic material at 500hPa geopotential area and at the level of 1000 hPa geopotential on http://www1.wetter3.de/Archiv/. From the latter we extracted the types of movement for 00 UTC, this represents a total of 3963 days (for the entire cold semester 1994-2013). Following the observations made on the synoptic material,we have established 17 types of movement, 8 in anticyclonic context (NA, NEA, SHE, SEA, SA, SVA WILL, NVA); 8 in cyclonic context (NC, NEC, EC, ESA, SC, SVC, VC, CNV) plus the atmospheric calm conditions, noted CALM.

Obtained results

Average temperature recorded

In the interval studied (1994-2013), the average temperature associated with the cold semester at the weather station from Suceava was 1,3° C and at Botoșani, it was located around 2,2° C (table 1). During this 20 years studed, 1995-1996 period was characterized by the lowest mean values of temperature, with a mean value of 2,4°C in Suceava and Botoșani to 1,6°C, this representing a negative thermal deviation of 3,7°C from Suceava and at Botoșani 3,8°C. This period was characterized, by the way, and the longest interval with the existence of snow depth, it appeared at the beginning of November and went towards the end of the month of March. Also, the maximum average values were 1,1°C at Suceava, it was 3,7°C below average (4,8°C) and at Botoșani, this average was 2,3°C, which is a thermal

negative deviation with 4,3°C below the multi-annual average (6,6°C). Minimum average values were around -5,9°C at Suceava, which is 3,9°C below the multi-annual average (-2,0°C) and Botoșani, this value was around -5,4°C, being with 3,7°C below the multi-annual average (-1,7°C).

Tab.1 Average temperatures recorded at weather stations, Suceava and Botoșani in the period 1994 to 2013. Data source: http://www.ogimet.com/

Suceava	t max medie (°C)	t min medie (°C)	t med (°C)	Botosani	t max medie (°C)	t min medie (°C)	t med (°C)
1994-1995	6,2	-1,8	1,9	1994-1995	7,7	-0,9	3,3
1995-1996	1,1	-5,9	-2,4	1995-1996	2,3	-5,4	-1,6
1996-1997	4,8	-2,7	1,0	1996-1997	6,4	-1,6	2,2
1997-1998	5,6	-2,5	1,3	1997-1998	6,9	-1,3	2,5
1998-1999	3,9	-2,5	0,7	1998-1999	5,7	-2,1	1,7
1999-2000	5,6	-1,7	1,9	1999-2000	7,2	-0,7	3,0
2000-2001	7,2	0,2	3,6	2000-2001	8,8	0,2	4,3
2001-2002	6,3	-2,2	2,0	2001-2002	7,7	-1,5	2,9
2002-2003	2,1	-3,2	-0,5	2002-2003	4,1	-3,4	0,2
2003-2004	4,3	-1,9	1,1	2003-2004	6,3	-1,2	2,2
2004-2005	5,0	-1,5	1,5	2004-2005	6,8	-1,2	2,6
2005-2006	3,3	-3,0	0,0	2005-2006	5,2	-3,2	0,7
2006-2007	8,4	0,8	4,4	2006-2007	10,1	0,6	5,2
2007-2008	4,9	-1,2	1,7	2007-2008	7,1	-1,0	2,9
2008-2009	5,7	-0,8	2,3	2008-2009	7,6	-0,5	3,3
2009-2010	4,1	-2,1	0,9	2009-2010	5,9	-2,0	1,8
2010-2011	4,9	-1,8	1,4	2010-2011	6,8	-2,0	2,3
2011-2012	4,2	-2,9	0,6	2011-2012	6,3	-3,6	1,2
2012-2013	4,2	-2,0	1,0	2012-2013	5,9	-2,1	1,8
medii 1994-2013	4,8	-2,0	1,3	medii 1994-2013	6,6	-1,7	2,2

At the opposite pole, the 2006-2007 period was characterized by average temperature values that were located around 4,4°C at Suceava and Botoșani to 5,2°C, these thermal positive deviations representing 3,1°C from Suceava and Botoșani to 3,0°C, which is observed and at mean values of maximum, where we talk about an average of 8,4°C , being situated with 3,6°C above the multi-annual average (4,8°C); Botoşani, with an average of 10,1°C what made that thermal deviation from this parameter to be 3,5°C above the multi-annual average of 6,6°C. Average minimum were around 0,8°C, representing a positive thermal deviation of 2,8°C (fig. 2) and at Botosani, it was 0,6°C, being with 2,3°C above the semestrial multi-annual average (-1,7°C).

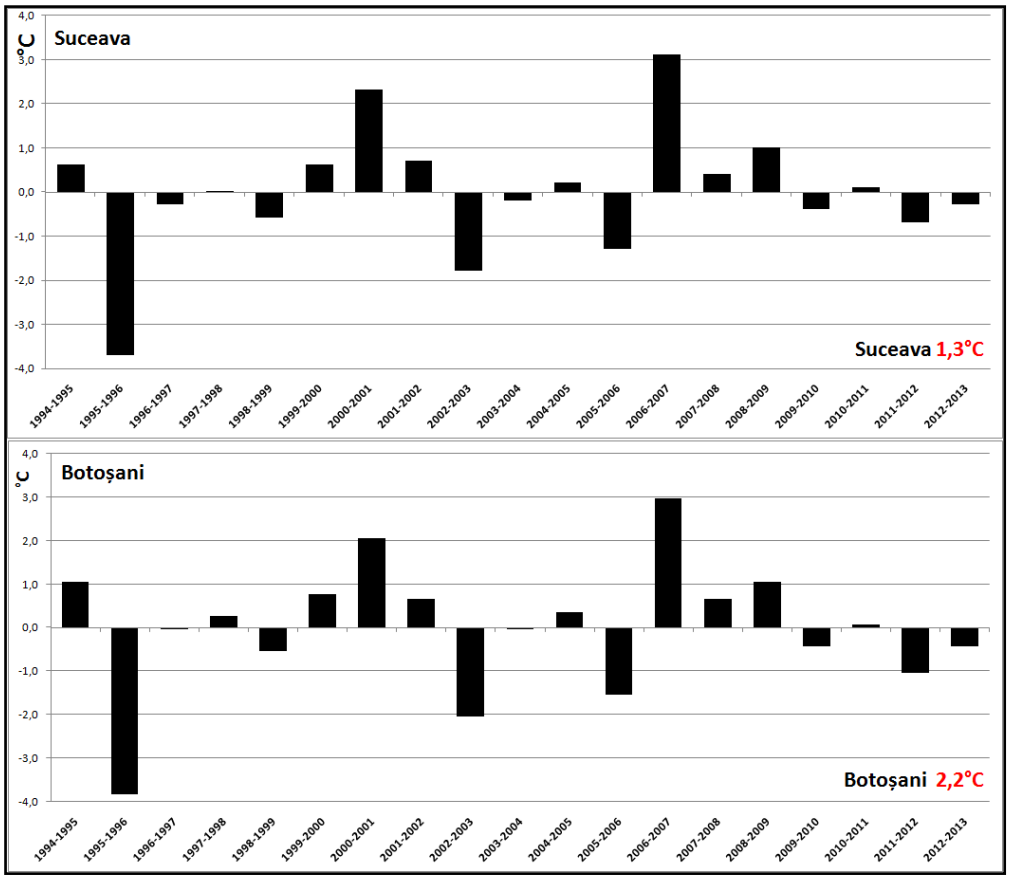

Figure 2 Thermal anomalies from Suceava and Botoșani during the cold semester (October-March 1994-2013)

Synoptic context that characterised the cold semester during the interval 1994-2013

This period was characterized by the predominance of circulations from North-West sector in anticclonic regime (NVA), it has occupied a share of 10,68%, this being blamed on the presence of depressional activity corresponding to Islandic depressions wich activate across the North and North West of the continent and to extend of the maximum azoric over the southern part of it, being facilitated a circulation from the West, but the area studied on account of the Carpathian chain arching, based on the "Coandă effect", this movement comes to a trajectory from the North-West, in the absence of this geomorphologic context we will have spoken about a clear dominance of Western circulations in anticyclonic regime (VA). Moreover, a significant proportion of movements occupy and the northern sector under anticyclonic regime (NA), occupying 9,55% of total, this being associated with polar circulations, from Scandinavian Peninsula region, these amid the maximum activation of Scandinavian baric. As it is rendered in the graph below (fig. 3), in addition to atmospheric movements mentioned, a significant proportion (over 5.5 percent) takes up most types of movement in the western sector (VA = 9.37 percent; VC = 5,50%) plus intermediate movements (SVC = 9,10 µg%; SVA = 8,10).

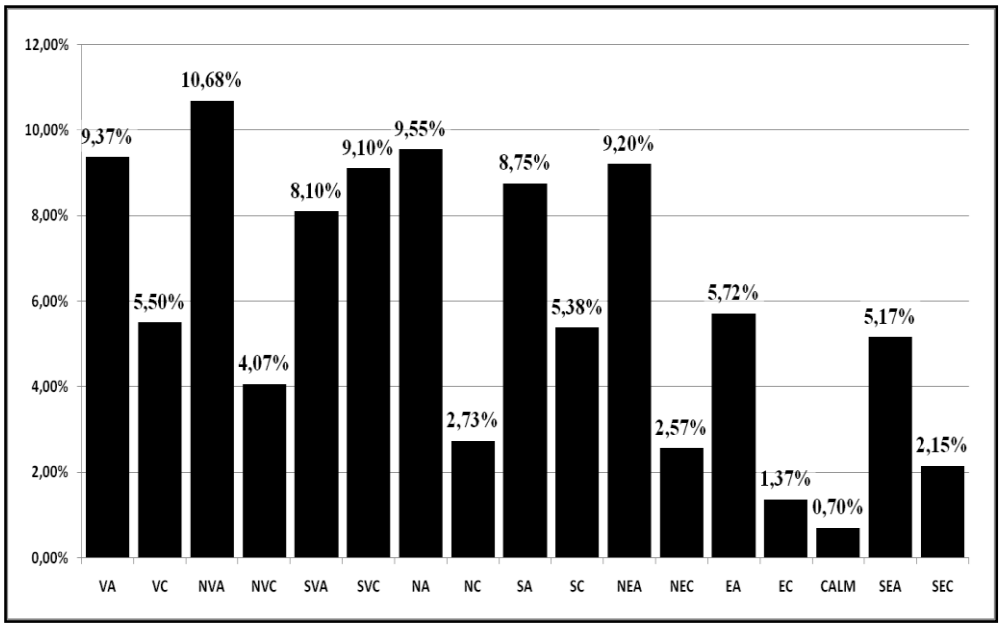

Figure 3 Proportion of types of movements for northern Moldavia during the cold semester (October-March) 1994-2013

An important value is represented and by movements from the north-eastern regions and Eastern Europe, which are attributed to the existence of maximum euro-siberian, baric evidence consists of the movement of the North-Eastern anticyclone (NEA) representing 9,20%, followed by the eastern sector anticyclone (it), this being of 5,72%. Also, movements from the South, and the anticyclone (SA) represents a value not negligible, this being of 8,75%, that amid the situation of Romania in warm sector (Western) of baric maximum what occupies the eastern half of Europe and, in parallel, enabling Atlantic depressions or Mediterranean ones. Low values (below 3%) are represented by the cyclonic movements from the East (EC = 1.37 percent) and intermediate circulations (SEC = 2,15%, NEC = 2,75%).

The influence of the types of movements during cold temperatures related to cold semester in the Northern of Moldavia

Temperature's trend is directly influenced by the type of atmospheric circulation, which is the result of atmospheric transport of air from a specific region to another, influenced and the temperature in the area where it was advected the air. This is subjected to transformation and during transit, as for example, a polar-oceanic air crossing the Alps of Scandinavia will suffer processes of foehn to which it adds the continentalisation process, which is why oceanic polar air reaches across Northern of Romania.

In the studied interval, the lowest average temperatures are associated with circulations from the North-East or the anticyclonic regime (NEA), the conditions under which,at Suceava, we talk about an average temperature of -2,82°C, which is a negative deviation 4,12°C, either as a cyclonic regime (NEC = -2,89°C, representing a negative deviation with up 4,19°C above average, which is 1,30ºC). For the same direction, at

Botoșani, the average temperature is -2,00°C, this represents a negative deviation of 4,20° C per compared to the average multiannual value (2,2°C).

In addition,for Botoșani, amid a movement in the north-eastern sector under anticyclonic regime (NEC), the average temperature was around -1,82 ° C, which is represented by a negative thermal deviation of 4,02°C. This distribution is normal and as long as from the eastern regions and the North-Eastern of Europe are represented the coldest areas of the continent, there are added and advections of cold air from Siberian stretches.

At the opposite pole, for meteorological station of Suceava, the highest average temperature, of 4,31°C is associated with Western circulations on anticyclonic fund (VA), which represents a positive thermal deviation 3,01°C, followed by the Southwest anticyclonic movement (SVA), with an average temperature of 4,20 °C; the southwestern anticyclone, with an average of 4,06°C.

For Botoșani,the highest averages thermal values are related to circulations from southwestern-cyclonic sector (SVC), with a value of 5,06°C, representing a positive thermal deviation from the average (2,2°C): 2,86°C, followed by the Western anticyclonic movement (WILL), with an average temperature of 5,00°C.

For Suceava, an explanation for the highest average thermal values amid circulation from the West-anticyclone (VA) is attributed to the fact that the point of observation is near the high regions associated to Northern Group of Eastern Carpathians, which translates, in addition to the characteristics of these air masses coming from the West, over the Atlantic Ocean, through the processes of foehn. The second place is held by South-Western movements under anticyclone (SVA).

Thermal values close to ordinary seasonal multiannual (± 1,50) both from Suceava and Botoșani (tab. 2), are characteristic of circulations from the north-western anticyclonic sector (NVA); Northwest anticyclone (CNV); Eastern anticyclone (EA) and from the South-Eastern-anticyclone (SEA).

Table 2 Average temperature on type of movement,multiannual average related to cold semester and thermal anomaly related to each type of circulation
Data Source: http://www.ogimet.com/

Suceava			
1994-2013	TEMP MEDIE TIP CIRCULAȚIE	TEMP MED INTERVAL 1994-2013	DIFERENȚA
NA	-1,66	1,30	-2,96
NEA	-2,87	1,30	-4,17
EA	0,06	1,30	-1,24
SEA	1,14	1,30	-0,16
SA	3,15	1,30	1,85
SVA	4,20	1,30	2,9
VA	4,31	1,30	3,01
NVA	1,69	1,30	0,39
NC	-2,32	1,30	-3,62
NEC	-2,89	1,30	-4,19
EC	-0,46	1,30	-1,76
SEC	0,66	1,30	-0,64
SC	2,73	1,30	1,43
SVC	4,06	1,30	2,76
VC	2,69	1,30	1,39
NVC	0,60	1,30	-0,7
CALM	3,15	1,30	1,85
Botosani			
1994-2013	TEMP MEDIE TIP CIRCULAȚIE	TEMP MED INTERVAL 1994-2013	DIFERENȚA
NA	-0,73	2,20	-2,93
NEA	-2,00	2,20	-4,2
EA	1,09	2,20	-1,11
SEA	2,00	2,20	-0,2
SA	4,00	2,20	1,8
SVA	4,48	2,20	2,28
VA	5,00	2,20	2,8
NVA	2,73	2,20	0,53
NC	-0,98	2,20	-3,18
NEC	-1,82	2,20	-4,02
EC	0,40	2,20	-1,8
SEC	1,98	2,20	-0,22
SC	3,80	2,20	1,6
SVC	5,06	2,20	2,86
VC	4,16	2,20	1,96
NVC	2,08	2,20	-0,12
CALM	3,63	2,20	1,43

Conclusions

The present material showing the evolution of meteorological parameters depending on the type of circulation that characterizes the geographical area of Romania, this classification being an adaptation of the one in the catalogue of "KATALOG DER GROSSWETTERLAGEN EUROPAS". According to this classification,for the area studied, the most obvious movements are the North-Western anticyclonic ones (NVA), with a share of 10,68%, followed by the Western anticyclonic (VA), with a share of 9,37%.

The development of thermal average (from the analysis on the October-March period 1994-2013) it is observed that in the case of predominantly Western-anticyclonic circulation average temperatures are above average 3,01°C (1,30ºC) at Suceava and 2,86°C above average (2,20°C) at Botoșani, in this last point, from the southwestern sector in cyclonic regime (SVC). Thermal values close to averages of the two cities analysed during the cold semester in the period 1994-2013 are recorded during the movements of the NVC, NVA, SEA, SEC. The lowest values of circulation of NEA, when the registered values at Suceava are with -4,12°C compared to the average of this interval analysed and with -4,20°C at Botoșani.

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