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AIRSYNOPTICAL CONDITIONS WHICH HAD AN INFLUENCE ON AIR TEMPERATURE REGIME DURING WARM SEASON, IN NORTHERN MOLDAVIA, IN THE PAST 20 YEARS (1994-2013)

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Abstract. In the present work has been studied weather types that have characterized the North of Moldavia over the last 20 years and the role of synoptic conditions which stood behind them. In this study, we will show the role of aersynoptical conditions which give the look of the weather characterized during this period, a frequency of types of circulations to highlight a general trend, the induced effects on air temperature and in the weather and climate risks, that resulted (scattered thunderstorms phenomena associated with a high termic contrast, dryness, freezing phenomena, early, in the final of August and September and later, in April-May).

Introduction

The status of the weather during the warm season (April-September) for the most part of Romania (implicitly, in the studied region), through its position in the South-Eastern part of the center of the european continent, is characterized by the influence of some baric centers, such as Azore Anticyclone, Scandinavian Anticyclone or low pressure systems, such as Iceland Depression or Arabic, the last one manifests itself, especially during the month of June (Topor, 1965), (fig. 1). The present study shows that over the past 20 years (1994-2013) northern Moldavia was characterized by circulations from sector North-East on the anticyclonic component, followed by those in the southwestern sector, this time, on the cyclone component. A significant proportion was from the northern sector on the anticyclone component and from the Northwest on a cyclone component.

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As the adverse effects on human society, most damaging types of movements are those from the North-East on the anticyclone feature, which is responsible for the drought, along with those from the East, on the same feature (Bogdan, 1999). Also have negative effects the south-western circulations on cyclone background, this is responsible for moist and warm air advections, resulting a weather with a heightened thermal discomfort throughout the summer, especially. Another type of circulation with adverse effects is represented by the North on anticyclone component, that imports cold air, which lead to compromising crops. Such atmospheric circulations are corroborated and with current warming trend of global climate and, implicitly, at the regional level. Furthermore, an role in increasing the frequency of days with extreme temperatures has the North Atlantic Oscillation (NAO), by increasing the negative phases (Bojariu, 2002).

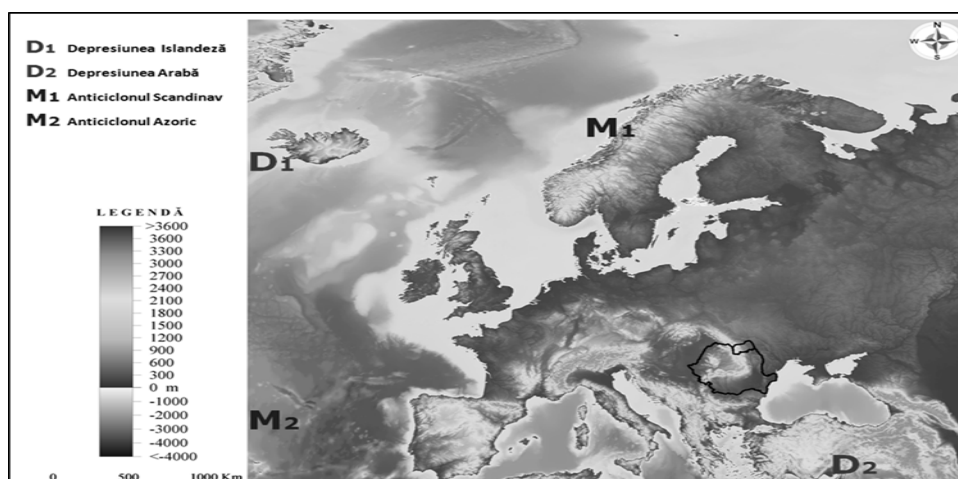


Figure 1. Distribution of baric centers in Europe in the warm semester (April-September)

A risk is represented also by the Arabic Depression, in particular, towards the end of the spring and early summer, with dry weather at the time when most of the crops are growing, the end of April-middle of June.

Methodology

In order to achieve this, we used climatic data regarding temperatures for October-March 1994-2013, taken from <http://www.ogimet.com/> and from <http://rp5.ru/>. These data have been processed using specific software, especially Microsoft Excel 2007. In parallel with these data, synoptic side were chasing the synoptic surface maps of 500 hPa geopotential and at the level of 1000 hPa geopotential from <http://www1.wetter3.de/Archiv/>. From the last, we extracted the

types of circulations, for 00 UTC. They represents 3660 maps for all days of the warm semesters of the 1994-2013 period. Following the observations made on the synoptic maps, we have established 17 types of circulations, 8 on the anticyclone feature (NA, NEA, SHE, the, to, SVA, NVA); 8 on the cyclonic feature (NC, NEC, EC, ESA, SC, SVC, VC, CNV), plus the atmospheric conditions noted, calm. These selections are an adaptation for the studied area of the classification of Hess-Brezovsky (Peter, 2009).

Obtained results

Average air temperature. In the studied period, average air temperature recorded during the warm semester was bny 16,1°C at the meteorological station of Suceava and 17,3°C at the one from Botosani, when we talk about an increase in

Table 1. Average temperatures characteristic to Suceava and Botoșani 1994-2013

An	Suceava			Botoșani		
	Maxima	Minima	Medie	Maxima	Minima	Medie
1994	22,14	11,29	16,84	24,58	11,74	18,03
1995	20,66	10,20	15,05	23,42	10,99	16,70
1996	19,82	9,61	14,96	22,18	10,80	16,40
1997	18,96	9,39	13,98	21,24	10,57	15,54
1998	20,11	10,96	15,30	22,68	11,68	16,82
1999	20,92	11,67	16,89	23,60	12,13	17,78
2000	21,19	10,91	16,76	23,68	11,14	17,54
2001	21,08	10,73	16,08	23,44	11,44	17,01
2002	20,92	10,99	16,23	23,22	11,66	17,28
2003	21,42	11,92	17,28	24,22	11,33	17,54
2004	20,26	10,61	15,34	23,00	10,60	16,49
2005	19,91	11,26	15,49	22,93	11,24	16,66
2006	20,21	11,23	15,61	23,05	11,18	16,73
2007	21,96	12,06	16,96	25,01	11,94	18,19
2008	19,85	11,77	16,42	22,89	11,30	16,84
2009	21,75	11,20	16,56	24,90	10,69	17,68
2010	20,98	12,26	16,45	24,05	12,54	17,93
2011	21,33	11,63	16,40	24,54	11,43	17,80
2012	23,34	12,86	17,88	26,66	12,71	19,34
2013	20,96	12,11	16,39	23,92	11,91	17,65

average temperature, apparently at a year-on-year. This is blamed on climate changes (IPCC, 2007). During the 20-years study, the lowest average temperatures were specific to the year 1997, when at Suceava, media throughout the all semester was 13,98° C and at Botosani, 15,54° C. This period was characterized by a deviation with -2,16°C°, compared to average feature of 20-years interval, and at Botosani, with -1,76°C (fig. 2). Cooler feature of this year for the studied area was

due to the persistence of circulation from the northern sector, to which it was added, and the high degree of instability which characterized the summer of that year. The same tendency is observed in the distribution of the maximum average air temperature, at Suceava, it were only 18,96°C and 21,24°C at Botoșani and in the trend of minimum average, with 13,98°C at Suceava and Botoșani 15,54°C (table 1).

The warmest interval was represented, incontestable, of the warm semester of year 2012, when at Suceava, the average air temperature was around 17,88°C and at Botoșani 19,34°C. This values were positive deviations in relation to the average of the period studied, with 1,74°C at Suceava and with 2,04°C at Botoșani. (tab. 1, fig. 2). Warm semester of 2012 was the most warmly throughout the

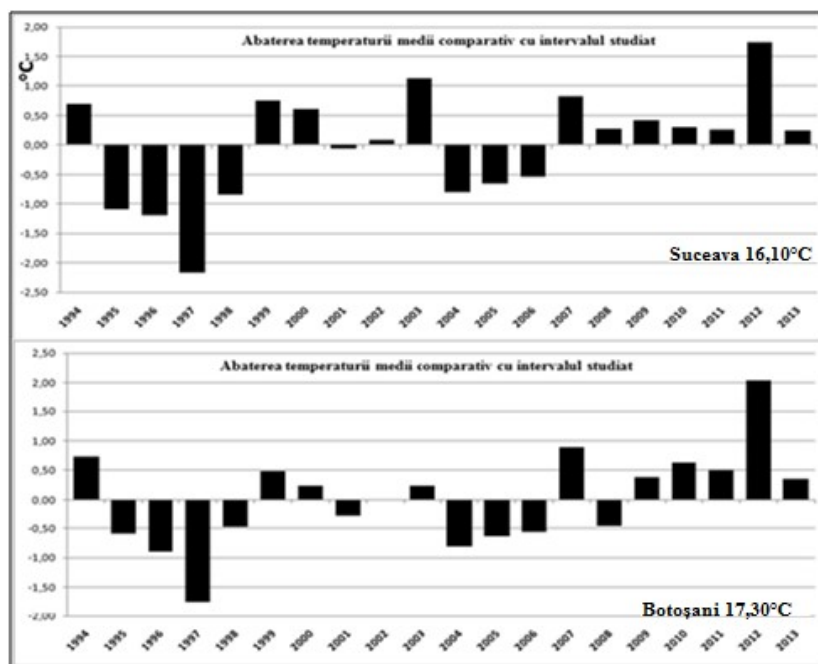


Figure 2. The average temperature deviation compared to the average interval studied-Suceava and Botoșani - warm semester, 1994-2013

sequence of observations, because the area under study, and the rest of the country, by the way, was located at the contact between the Atlantic low pressure areas (which have worked extensively throughout the all warm semester of 2012 over the center, northern and western Europe) and those of high pressure situated over the Mediterranean basin and the geographical area of European Russia. Such a

predominance of this thermobaric context facilitated the warm and tropical air advections to the studied region, this on a component that's predominantly southwest, cyclonic and anticyclonic being recorded in an equal measure. Years like 2012, were associated with an excessive climate, with a long string of warm and dry days, followed by episodes of instability, with rain, which had torrential character, resulting flash floods (Mihăilă, 2012). Categorical, that the maximum average was in close touch with average temperatures, thus, the year 2012 was characterized by values of temperature 23,34°C at Suceava and 26,66°C at Botoșani. At a small distance was and the year 2007, with maximum average values of 21,96°C at Suceava and 25,01°C at Botosani (tab. 1, fig. 2)

Along with the trend of maximum average air temperature have evolved and minimum average, all year of 2012, being the warmest and under this aspect, with 17,88°C at Suceava and 19,34°C at Botoșani.

Moreover, in the last period (after year 2000), we can observe an increase of the frequency with very high temperatures. This is, clearly, global warming (IPCC, 2007; Croitoru et al. 2011b; Hennessy, Pittock, 1995; Colombo et al., 1999; Tahas et al., 2011). What was said at the global or regional level, is supported and at a regional level, at the level of Moldavia, the fact that 21st century was represented by maximum values of very high temperature (Machidon et al, 2012).

Synoptic context if the warm semesters in the interval 1994-2013. April-September intervals of 1994-2013 was characterized by the predominance of the circulations from the north-eastern sector under anticyclonic regime (NEA). It occupied a share of 11,32%, this being blamed on Azoric Anticyclone activity,

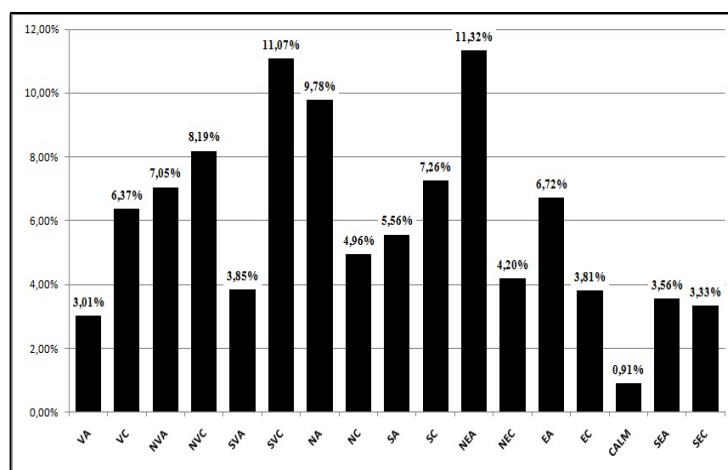


Figure 3. Share of the types of movements for northern Moldavia during the warm semester (April-September) 1994-2013

which most often migrate to the central regions of Europe, the conditions under the geographical space looked to be located in the southeast part of it (fig. 3). Moreover, they occupy a significant proportion and movements from the south-western sector under a cyclone (SVC), those occupying 11.07% of total, this type of movement being associated with tropical movements, from the north-western regions of the Sahara. This type of movement will appear when there is a junction between areas of high pressure which are found across south-eastern and Eastern Europe and the advance to the central regions of the Atlantic depressions.

As it appeared in the graph below (fig. 3), in addition to atmospheric movements, a significant proportion (over 5,5%) occupy most types of circulations in the northern sector (NA = 9,78%), northwest (NVC = 8,19 NVA = 7,05%,%), plus intermediate circulations (VC = 6,37%; SA = 5%).

The Influence of types of movements during the temperatures over the warm semester of Northern Moldavia. For the warm semester, the lowest averages of thermic values are associated with movements from the north, on cyclonic feature (NC), the conditions under which, at Suceava, we talk about an average temperature of 13,27°C, which is a negative deviation of 2,83°C, compared to the average temperature of 16,10°C, at Botoşani. For Botoşani, from the same direction, the average temperature is about 14,78°C. This represents a negative deviation of 2,52°C compared to the average multiannual semester value lying around 17,30°C.

At the opposite pole, for the meteorological station, the highest average temperature, of 19,47°C is associated with southwestern circulations on anticyclone feature (SVA), which represents a positive thermal deviation of 3,37°C, followed by the anticyclonic southern movement (SA), with an average temperature of 18,56 °C. Thermal values for Botoşani, highest averages are all related movements from the south-western sector-anticyclone (SVA), with a value of 20,84°C, representing a positive thermal deviation from the average (17,30°C) 3,54°C, followed by the anticyclonic southern circulation (HS), with an average temperature of 19,23°C (table 2).

The explanation for the highest temperatures being recorded both in Suceava and Botoşani in the context of circulation from south-west under anticyclone feature (SVA) is vacuuming hot air from the North-Western Sahara (Morocco-Western Algeria) and moving more over the land, which confers on them a certain temperate feature. At the opposite pole, the lowest temperatures in the context of northern circulations, on cyclone fond, is explained by cold, polar-oceanic air

advections and turbidity, this can hinder the solar radiation to bring a calorie intake of the environment.

Throughout the warm semester, the most obvious risks are established by type movements SVC (South-Western movement on a cyclone feature), these high shares in June 2005,(16.00%), followed by July (11,77%) and April (10,83%). They are the cause of warm air advections, but unstable, which fosters the development of convective cloudy (Croitoru et al. 2011b).

Table 2. The average temperature on the type of movement, multi-annual average of warm semester, thermal anomaly of each type of movement

Source: <http://www.ogimet.com/>; <http://www1.wetter3.de/Archiv/>

Suceava			
1994-2013	TEMP MEDIE TIP CIRCULATIE	TEMP MED INTERVAL 1994-2013	DIFERENTA
NA	14,27	16,10	-1,83
NEA	15,90	16,10	-0,20
EA	16,51	16,10	0,41
SEA	16,53	16,10	0,43
SA	18,56	16,10	2,46
SVA	19,47	16,10	3,37
VA	16,93	16,10	0,83
NVA	15,62	16,10	-0,48
NC	13,27	16,10	-2,83
NEC	15,52	16,10	-0,58
EC	15,50	16,10	-0,60
SEC	16,75	16,10	0,65
SC	16,66	16,10	0,56
SVC	18,03	16,10	1,93
VC	15,08	16,10	-1,02
NVC	15,04	16,10	-1,06
CALM	14,30	16,10	-1,80
Botosani			
1994-2013	TEMP MEDIE TIP CIRCULATIE	TEMP MED INTERVAL 1994-2013	DIFERENTA
NA	18,26	17,30	0,96
NEA	17,07	17,30	-0,23
EA	17,67	17,30	0,37
SEA	17,51	17,30	0,21
SA	19,23	17,30	1,93
SVA	20,84	17,30	3,54
VA	18,26	17,30	0,96
NVA	16,98	17,30	-0,32
NC	14,78	17,30	-2,52
NEC	16,79	17,30	-0,51
EC	17,18	17,30	-0,12
SEC	17,59	17,30	0,29
SC	17,03	17,30	-0,27
SVC	18,81	17,30	1,51
VC	16,46	17,30	-0,84
NVC	16,22	17,30	-1,08
CALM	15,48	17,30	-1,82

A risk factor is constituted by the circulations from sector north-eastern on anticyclonic feature (EA, NEA), these being advections from expanses of the land, as well as the Russian Plain or Precaspic, the air being dry and warm, which

translates into installing drought, if such advections are long lasting. Noting that in the area studied, such movements had a significant share, namely: north-eastern anticyclone (NEA) with 15.81% in august, followed by September, with a share of 13.83% and July with 12.42%. Also, EA (the eastern anticyclone) holds non negligible proportion, which is prevalent especially in April, with 9.67%, followed by august, with 8.71%. In addition, a risk factor is represented by movements from northern sector, and especially those on anticyclone feature (NA), the risk constituted by these materializes through cold and polar air advections, which is materialized through late or early frosts, they affect agricultural crops. As share, such movement hold values of over 13% in September, followed by the month of may, 10.97%, the last being the most damaging.

Conclusions

The present material shows 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 made in the catalogue of "Katalog der grosswetterlagen Europas". According to this classification, for the studied area, the most obvious circulations are the north-west anticyclonic ones (NEA), with a share of 11.32%, followed by the southwestern cyclonic ones (SVC), with a share of 11.07%.

The evolution of thermal averages (from the analysis on the interval April-September 1994-2013) it is noted that in the case of circulation predominantly south anticyclonic (SA), average temperatures are with 2.46°C above average (16.10°C) at Suceava, 3.54°C and with above average (17.30°C) at Botoşani, in this last point, from the south-western sector under anticyclone regime (SVA). Thermal values close to averages of the two cities and analysed during the warm semester in the analyzed interval of 1994-2013 is recorded on background of movements VA, EC, SEC. The lowest values are in the case of circulations type NC, when the values are recorded with -2.83 ° C at Suceava, compared to the average of this range under consideration and with -2.52 ° C at Botoşani.

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