THE WARM WINTER OF 2022-2023 IN SOUTHWEST ROMANIA

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Abstract. Global warming continued in 2022. The excessively hot summer with long and intense tropical heat waves was followed by a warm (C) and scarcely rainy (PP) autumn, and the 2022-2023 winter was very warm (FC) with an overall seasonal average of 3.25°C and deviation from normal of 4.2°C, being *the second warmest winter in the entire history of climate records for Oltenia*. Throughout the winter, *six winter heat waves were recorded in the intervals: 8-11.XII (4 days), 16-17.XII (2 days), 23.XII-8.I (17 days), 17-20.I (4 days), 31.I-4.II (5 days), 14-26.II (13 days) totaling 45 days, i.e. half of the winter days and a single cold wave in the interval 5-11.II with a duration of 6 days.* On January 18, 2022, *3 absolute thermal records were recorded in Oltenia for January*: *21.7°C in Bechet, 20.8°C in Caracal and 19.8°C in Slatina*. Most very warm winters (FC) have been recorded since 2000 (6 winters out of 7, i.e. 85.7%). So, in general, we are currently in a period of climate warming, a process related to the cycles of climate warming and cooling studied by the Serbian physicist Milankovitch, whose causes are of a cosmic nature.

Keywords: warm winter, monthly temperature averages, the Hellmann Criterion, warm winter phenomena, winter heat waves, vegetative processes.

Rezumat. Iarna caldă 2022-2023 în sud-vestul României. În anul 2022 încălzirea climatică a continuat. După vara excesiv de călduroasă cu valuri de căldură tropicală lungi și intense a urmat toamna caldă (C) și puțin ploioasă (PP), iar iarna 2022-2023 a fost foarte caldă (FC) cu media generală anotimpuală de 3,25°C și abaterea față de normală de 4,2°C, fiind *a doua cea mai caldă iarnă din toată istoria înregistrărilor climatice pentru Oltenia*. În tot cursul iernii s-au înregistrat șase *valuri de căldură de iarnă în intervalele: 8-11.XII (4 zile), 16-17.XII (2 zile), 23.XII-8.I (17 zile), 17-20.I (4 zile), 31.I-4.II (5 zile), 14-26.II (13 zile) însumând 45 de zile, adică jumătate din zilele iernii și un singur val de frig în intervalul 5-11.II cu durata de 6 zile.* În data de 18.I.2022 în Oltenia s-au înregistrat *3 recorduri termice absolute pentru luna ianuarie*: *21,7°C la Bechet, 20,8°C la Caracal și 19,8°C la Slatina*. Cele mai multe ierni foarte calde (FC) s-au înregistrat începând cu anul 2000 (6 ierni din 7 adică 85,7%). Așadar la modul general, actual ne aflăm într-o perioadă de încălzire climatică, proces care ține de ciclurile de încălziri și răciri climatice studiate de fizicianul sârb Milankovitch, ale căror cauze sunt de natură cosmică.

Cuvinte cheie: iarna foarte caldă, medii lunare de temperatură, criteriul Hellmann, fenomene de iarnă caldă, valuri de căldură de iarnă, procese vegetative.

INTRODUCTION

Worldwide, the last eight years have been the hottest ever recorded globally (EU's Copernicus Climate Change Service (C3S)). According to C3S, the global temperature has now risen by 1.2°C compared to pre-industrial times.

At the continental level, the year 2022 in Europe was the second warmest year in history. Thus in 2022, the temperature record was broken in 12 European countries. There have been extreme weather events that have reduced harvests, dried up rivers and caused thousands of deaths. The EU's Copernicus Climate Change Service (C3S) said 2022 was the world's fifth warmest year on record in the last 170 years, noting that Copernicus records only date back to 1950, but other existing data confirm that the year last year was the fifth warmest since 1850. Temperatures in Europe have risen more than twice the global average over the past three decades.

At the level of Romania, the year 2022 was the third warmest year in the history of meteorological measurements in Romania. The five warmest years from 1900-2022 are: 2019, 2020, 2022, 2015 and 2007. The average annual temperature was 11.77°C, and the thermal deviation was 1.55°C from the period 1981-2010. The maximum temperature recorded in 2022 was +41.7°C in Calafat, on July 23. There were many dry months; December was extremely warm compared to normal, and June broke dozens of records. The warmest 5 years from the period 1900-2022 are: 2019, 2020, 2022, 2015 and 2007, and the period 2012-2022 represents the warmest period of 11 consecutive years, a fact that obviously confirms the trend of increasing air temperature and in our country. The period 1991-2020, considered the current climatic reference period according to O.M.M. recommendations, registers an increase of 0.5°C in the level of the multiannual average annual air temperature in Romania, compared to the previous period 1981-2010 (ANM).

In Oltenia, the warmest year in the entire history of meteorological observations was 2019 with the average for the entire region (excluding the mountain area) of 12.41°C and the deviation from normal (calculated for the last century) of 2.55°C. The year 2022 is the second warmest year with an average of 12.26°C and a deviation of 1.96°C, the third is 2015 with an average of 12.22°C and a deviation of 1.92°C, the 4th is 2020 with an average of 12.18°C and deviation of 1.88°C, and 5th is 2012 with an average of 11.82°C and a deviation of 1.52°C. Climate warming continued into the winter of 2022-2023.

The work is part of a series of extensive studies on climate variability in southwest Romania and the effects of climate warming, being useful to all those interested in climate evolution in this part of Romania (BOGDAN et al., 2007, 2008; MARINICĂ & CHIMIŞLIU, 2008; BOGDAN & MARINICĂ, 2009; BOGDAN et al., 2010; MARINICĂ et al., 2010, 2011, 2012, 2013; BOGDAN et al., 2014. We will further analysanalyse the multiple aspects of climate

variability from Oltenia characteristic of the winter 2021-2022, at the regional level in Oltenia and the consequences on agricultural crops, biotopes, the economy and the environment in general.

MATERIAL AND METHOD

To carry out the work, we used the results of daily processing, with special software from the weather forecasting process, the data archive of ANM[1], the maps currently made in the operational activity, those on the Internet provided by the international analysis and forecasting centers and those from ANM Bucharest. We used the international databases and the facilities offered by Office to prepare the tables and graphs. We used the Hellmann criterion and the comparison with normal air temperature averages calculated for the last century (1901-1990). The comparison with the normal values of the last 30 years is not conclusive because the normal values for the last 30 years are moving averages with a linear upward trend like the averages being compared.

The paper analyses the climatic variability of the warm winter 2022-2023 in the south-west of Romania, based on the thermal and pluviometric regime of the months of December 2022, January and February 2023 and the overall thermal and pluviometric regime of the winter 2022-2023. The effects on the environment and biotopes were also analysed.

RESULTS

1.a. The thermal regime of December 2022.

The monthly air temperature averages were between 1.3°C at Voineasa and 3.8°C at Dr. Tr. Severin, and their deviations from the normal averages calculated for the last century were between 2.2°C at Calafat and Apa Neagră and, and 3.2°C at Voineasa (Table 1). According to the Hellmann Criterion[2], December 2022 was warm (C) at all weather stations. The overall average monthly air temperature for the entire Oltenia region was 2.75°C, and its deviation from normal was 2.57°C, which confirms according to the Hellmann criterion that December 2022 was warm on average for the entire region Oltenia. According to the general average for the entire Oltenia region, December 2022 was the 6th warmest December in the entire history of climate observations, after the very warm December 2015 (FC – the only very cold December) with the overall average of 5.19° C, 2020 with an average of 3.25°C, 2019 with an average of 3.13°C, 1982 with an average of 3.08°C and 1979 with an average of 3.06°C. In 26 days, the average daily temperature for the entire Oltenia region was positive.

The highest monthly air temperatures were recorded on 27.XII and ranged between 12.1°C at Voineasa on 11.XII.2022 and 16.9°C at Apa Neagră on 27.XII.2022, and their average for the entire Oltenia region was 14.8°C.

The minimum monthly temperatures in the air were recorded the most in the last decade of the month on various dates and were between -7.4°C at Apa Neagră on 13.XII.2022 and 3.6°C at Drobeta Turnu Severin on 21.XII.2022, and their average for the entire region was -5.8°C. In most of December, daily minimum temperatures were positive.

The heat units[3] in December were between 65.8 in the Voineasa intramontane depression and 123.0 at Drobeta Turnu Severin in the west of the region, and this average for the entire region was 96.2, which confirms that December it was warm. **The cold units**[4] were registered in 5 days in the intervals 13-14.XII and 20-22.XII and were between 4.6 at Drobeta Turnu Severin and 21.8 at Voineasa, and their average for the entire region it was 10.5. No frost was registered.

[1] ANM= National Meteorological Administration

[2] ***Hellmann Criterion for monthly air temperature averages***: $\Delta t \leq -10.0°C$ => excessively cold (ER); $-9.9 \leq \Delta t \leq -5.0°C$ => very cold (FR); $-4.9 \leq \Delta t \leq -2.0°C$ => cold (R); $-1.9 \leq \Delta t \leq -1.0°C$ => cool (RC); $-0.9 \leq \Delta t \leq +0.9°C$ => normal (N); $1.0 \leq \Delta t \leq 1.9°C$ => warm (CL); $2.0 \leq \Delta t \leq 4.9°C$ => hot (C); $5.0 \leq \Delta t \leq 9.9°C$ => very hot (FC); $\Delta t \geq 10.0°C$ => excessively hot (EC).

[3] **Heat units**= ΣTaver daily □0°C; ***Cold units*** = ΣTaver daily < 0°C.

[4] ***The severity degree of winter*** in agrometeorology (winter type) is classified according to the sum of agrometeorological frost units (Σ of the differences between the daily minimum temperature values <-15°C and the critical agroclimatic threshold of -15.0°C, in the XII-II interval). Therefore, an agrometeorological frost unit is the difference of 1°C that is obtained between the critical threshold of -15.0°C and a thermal minimum in the air ≤ -15°C (for example for Tmin = -16.0°C the difference is -15.0°C - (-16.0°C) = 1, i.e. one frost unit, (SANDU, MATEESCU, VĂTĂMANU, 2010). ***Cold units for the entire cold season*** are calculated as the Σ of the average daily temperatures ≤ 0°C, during November- March; A cold day is the day when the average temperature is ≤ 0°C; ***Active temperatures*** are those ≥0°C, and the temperature of the biological minimum is 0°C. It is called a ***winter day***, the day when the maximum air temperature is < 0°C. ***Heat units*** (Σ of average daily temperatures ≥ 0°C). For public weather diagnoses and forecasts ***frost means a temperature ≤ -10.0°C. Frost*** defined by weather forecast terms (which are adapted for living organisms) differs from ***agrometeorological frost*** (temperatures ≤ -15°C), the plants being better adapted to the climatic conditions (due to their cellular structure and specific biotic processes). ***Starting from 21.II.2022, ANM redefined the agrometeorological frost for temperatures ≤ -10°C, an aspect due to a long series of warm winters in which the agrometeorological frost after the old thermal limit of -15°C had disappeared. Similarly, frost units are calculated after the new limit.***

Table 1. The air temperature regime in Oltenia and the minimum and maximum temperature values at the soil surface **in December 2022** (N XII = December normal values calculated for the interval 1901-1990, M XII = monthly averages of December 2022; Δ = M-N = deviation temperature, CH = Hellmann criterion)..

Meteorological Station	Hm	NXII	MXII	Δ=M-N	CH	Tmax air (°C)	Tmax air Data	Tmin air (°C)	Tmin air Data	Tmax soil (°C)	Tmax soil Data	Tmin soil (°C)	Tmin soil Data
Dr. Tr.Severin	77	1,4	3,8	2,4	C	15,4	27	-3,6	21	17,6	31	-4,5	13
Calafat	66	1,0	3,2	2,2	C	15,2	27	-3,8	21	18,9	10	-1,4	13
Bechet	65	0,4	3,0	2,6	C	15,5	31	-4,4	20	15,3	31	-1,8	20
Băileşti	56	0,4	2,9	2,5	C	14,5	27	-4,2	22	20,8	31	-3,6	21
Caracal	112	-0,1	2,9	3,0	C	14,9	27	-4,7	22	23,7	11	-4,8	22
Craiova	190	0,1	2,7	2,6	C	14,8	27	-4,6	22	15,7	27	-4,8	14
Slatina	165	0,3	2,6	2,3	C	15,2	27	-4,9	21	13,3	10	-2,9	21
Bâcleş	309	-0,4	2,6	3,0	C	15,0	31	-5,9	22	-	-	-	-
Tg. Logreşti	262	0,1	2,4	2,3	C	15,6	31	-5,9	29	17,5	10	-6,1	29
Drăgăşani	280	0,6	2,9	2,3	C	15,9	27	-6,5	22	14,7	31	-4,3	22
Apa Neagră	250	0,1	2,3	2,2	C	16,9	27	-7,4	13	21,3	27	-6,0	13
Tg. Jiu	210	0,1	2,5	2,4	C	15,9	27	-6,1	13	17,2	27	-7,2	13;14
Polovragi	546	0,1	2,6	2,5	C	14,6	27	-6,5	20	16,0	31	-8,4	14
Rm. Vâlcea	243	0,5	3,5	3,0	C	15,8	27	-4	21	16,6	11	-6,3	30
Voineasa	587	-1,9	1,3	3,2	C	12,1	11	-6,9	14	-	-	-	-
Parâng	1585	-	-	-	-	9,8	21	-12,7	13	-	-	-	-
Oltenia average	-	0,18	2,75	2,57	C	14,8	-	-5,8	-	17,6	-	-4,8	-
Ob. Lotrului	1404	-4,9	-0,9	4,0	C	9,8	15	-14,7	20	-	-	-	-

(Source: data processed from the ANM archive)

As for maximum temperature at the surface of the soil, most were recorded in the last decade of the month and ranged from 13.3°C in Slatina on 10.XII.2022 to 23.7°C in Caracal on of 11.XII.2022, and their average for the entire Oltenia region was 17.6°C. ***The minimum monthly temperatures at the soil surface*** were recorded on various dates and ranged from -8.4°C to Polovragi on 14.XII.2022 to -1.4°C in Calafat on 13.XII.2022, and their average for the entire region was -4.8°C. For most of the day the ground remained thawed and crop plants and spontaneous vegetation continued their vegetative stage throughout the month of December 2021, the biotopes and biocenoses[5] remained active. ***Vernalization***[6] occurred in the cold intervals of December 2022, January and February 2023. The graphs of the variation of the parameters characterizing the air temperature (the daily averages of the minimum temperatures, the average temperatures and the daily averages of the thermal maximums) had increasing trends, and among them the fastest increasing was the maximum temperature (Fig. 1).

We note that the warming of the weather that occurs regularly near Christmas (25.XII) occurred in the interval 26-31.XII. This warming has deep causes related to the precession movement of the Earth, which after the 21.XII, determines the beginning of the gradual orientation towards the Sun of the Northern Hemisphere of the Earth and therefore begins the reorientation of the hot and cold advection flows.

In December 2022, three heat waves were recorded in the intervals: 8-11.XII, 16-17.XII and 23.XII.2022-8.I.2023 totaling 15 days from December and 8 days from January. No cold waves were recorded.

1.b. Rainfall regime of December 2022

The monthly amounts of precipitation were between 29.1 l/m^2 at Caracal and 128.4 l/m^2 at Apa Neagra, and their percentage deviations from normal were between -28.2% at Craiova and 62.7 % in Polovragi (Table 2). According to the Hellmann Criterion, the month of December 2022 was dry (S) in Caracal, Craiova and Slatina, slightly dry (PS) in Băileşti, normal rainfall (N) in Calafat and Bâcleş, slightly rainy (PP) in Bechet and Drăgăşani, rainy (P) at Râmnicu Vâlcea and Parâng, very rainy (FP) at Drobeta Turnu Severin and Tg. Jiu and excessively rainy (EP) at Târgu Logreşti, Apa Neagră and Polovragi. The average monthly amount of precipitation for the entire region was 58.6 l/m^2, and its percentage deviation from normal was 14.8%. According to the Hellmann criterion, January was slightly rainy (PP) on average for the entire region. The precipitation was liquid throughout Oltenia, and it snowed in the mountains. The snow layer was insignificant and was recorded in one morning (15.XII) with a maximum thickness of 4 cm at Apa Neagră, Polovragi and Drobeta Turnu Severin.

[5] The term ***biocenosis*** (from the Greek *koinosis* - to divide) represents a supra-individual level of organization of living matter and describes the totality of living organisms, plant (*phytocenosis*) and animals (*zoocenosis*), which interact with each other and coexist in a certain environment or sector of biosphere (*biotope*), forming a unitary whole with it and which is in a dynamic balance dependent on that environment. It is characterized by a certain structure and functioning given by the pattern of circulation of matter, energy and information. The term biocenosis was proposed by Karl Möbius in 1877 (http://ro.wikipedia.org/wiki/Biocenoz%C4%83).

[6] ***Vernalization*** represents the acquisition or acceleration of the flowering capacity under the influence of exposure to low temperatures.

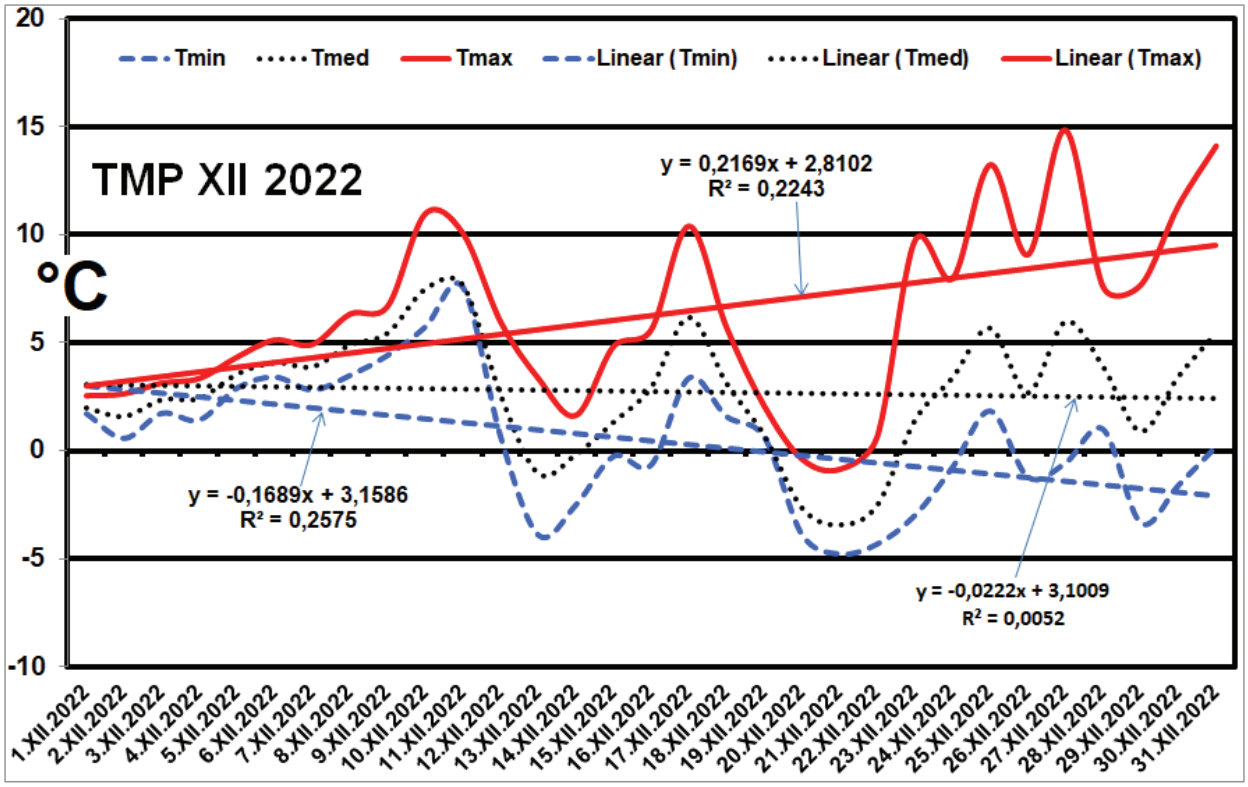

Figure 1. The variation of the parameters characterizing the air temperature (average of daily maximums, daily average and average of daily maximums, calculated for the entire region) in December 2022. (Source: data processed from the ANM archive).

Table 2. Amounts of precipitation recorded in the winter of 2022-2023 (Σ), compared to normal values[7] (N); Δ% = percentage deviation from normal, CH = Hellmann's Criterion

No	Meteorological Station	Hm	December 2022				January 2023				February 2023			
			ΣXII	N	Δ%	CH	Σ I	N	Δ%	CH	ΣII	N	Δ%	CH
1	Dr. Tr. Severin	77	89,6	61,2	46,4	FP	88,8	51,4	72,8	EP	28,4	47,9	-40,7	FS
2	Calafat	66	41,6	45,5	-8,6	N	91,9	40,4	127,5	EP	18,1	38,0	-52,4	ES
3	Bechet	65	31,8	*36,3*	-12,4	PP	55,8	33,5	*66,6*	EP	17,6	34,8	-49,4	FS
4	Băileşti	56	37,8	46,8	-19,2	PS	72,3	38,5	87,8	EP	25,8	36,1	-28,5	S
5	Caracal	112	*29,1*	39,5	-26,3	S	95,4	34,7	174,9	EP	11,4	34,5	-67,0	ES
6	Craiova	190	30,0	41,8	-28,2	S	95,5	37,5	154,7	EP	23,2	30,4	-23,7	S
7	Slatina	165	32,9	42,8	-23,1	S	101,5	36	181,9	EP	17,9	38,4	-53,4	ES
8	Bâcleş	309	55,9	54,7	2,2	N	65,8	50,5	30,3	FP	10,3	44,1	*-76,6*	ES
9	Tg. Logreşti	262	69,8	44,8	55,8	EP	123,1	35,9	242,9	EP	30,1	41,0	-26,6	S
10	Drăgăşani	280	51,7	44,6	15,9	PP	116,1	34,1	240,5	EP	33,9	35,4	*-4,2*	N
11	Apa Neagră	250	*128,4*	**82,3**	56,0	EP	**185,1**	70,9	161,1	EP	32,0	66,4	-51,8	ES
12	Tg. Jiu	210	89,9	64,0	40,5	FP	131,8	53,9	144,5	EP	27,4	52,0	-47,3	FS
13	Polovragi	546	91,3	56,1	*62,7*	EP	170,9	48,9	*249,5*	EP	*35,6*	48,4	-26,4	S
14	Rm. Vâlcea	243	55,8	46,2	20,8	P	122,3	35,5	244,5	EP	13,2	38,4	-65,6	ES
15	Voineasa	587	34,5	55,1	*-37,4*	FS	119,8	42,7	180,6	EP	*12,3*	44,0	-72,0	ES
16	Parâng	1585	67,3	54,6	23,3	P	163,5	57,7	183,4	EP	79,5	47,7	66,7	EP
	Oltenia average	-	58,6	51,1	14,8	PP	112,5	43,9	156,3	EP	26,0	42,3	-38,5	FS
17	Ob. Lotrului	1404	102,5				**199,8**				110,7			

(Source: data processed from the ANM archive)

2.a. The thermal regime of January 2022.

The monthly air temperature averages ranged from 1.4°C in Voineasa to 5.4°C in Drobeta Turnu Severin, and their deviations from normal ranged from 6.1°C in Voineasa to 7.2 °C in Caracal. According to the Hellmann criterion, January was very warm (FC) throughout Oltenia (Table 3). The average air temperature calculated for the entire Oltenia region was 4.08°C, and its deviation from normal was 6.6°C. According to the Hellmann criterion, January 2023 was very warm (FC) on average for the entire Oltenia region. ***The month of January 2023 is the second warmest month in the entire history of climate observations*** after the absolute climate record held by January 2007 which has the average for the entire Oltenia region of 4.73°C. The maximum monthly air temperatures were recorded on different dates and

[7] The ***Voineasa and Bâcleș weather stations*** cannot be taken into account, because they have incomplete rainfall data in the cold season (as the precipitation sensor is covered).

ranged from 11.9°C in Voineasa on 5.I.2023 to 22.3°C in Slatina on 19.I.2023. ***The longest heat wave of the winter 2022-2023 was recorded between 23.XII.2022-8.I.2023 and lasted 17 days*** (comparable to the duration of heat waves in summer). The most intense heat wave of this winter was recorded between January 17-20 (4 days), and on January 18, 2022, ***3 absolute thermal records for January were recorded in Oltenia: 21.7°C in Bechet, 20.8°C in Caracal and 19.8°C in Slatina.*** At the level of the entire country, in Romania on the dates of 17 and 18.I.2023 more than 100 daily and monthly temperature records were recorded, and for the Northern Hemisphere we cite the value of -62.7°C recorded in Yakutsk in Siberia (the coldest city in the world), which is the lowest temperature in the last 20 years for this locality (according to CNN). On the last day of January, ***the 5th heat wave of the winter began, which was registered during 31.I-4.II.2023 (5 days).*** No cold waves were recorded in January 2023. The average monthly maximum temperature for the entire Oltenia region was 18.4°C. ***The minimum monthly air temperatures for the month of January were recorded on different date***s (Table 3) and ranged between -5.6°C in Apa Neagră on 8.I.2023 and -1.0°C in Calafat on 21.I.2023. The average of the minimum linear air temperature calculated for the entire Oltenia region was -3.5°C. In the month of January 2023, the waves of fall totaled 13 days (41.9% of the days of the month). ***The heat units*** ranged from 50.4 in Voineasa to 143.6 in Drăgășani, and their average for the entire region was 127.6, being the highest of all winter months. ***Cold units*** were insignificant and ranged from 0 in Drobeta Turnu Severin, Calafat, Băilești, Caracal and Târgu Jiu to 6.1 in Polovragi, with the average for the whole region of 1.5, being the lowest of all winter months. No frost was recorded in January 2023.

At the surface of the soil, the maximum temperature values were recorded on the dates of 1, 2, 3, 6 and 18.I and ranged from 15.9°C in Slatina on 2.I.2023 to 26.8° C in Băilești on 18.I.2023, and their average for the entire Oltenia region was 20.0°C. ***The minimum monthly temperatures*** on the soil surface were recorded the most in the dates of 8 and 9.II and ranged from -6.0°C in Apa Neagră to -0.9°C in Calafat, and their average for the entire region was -3.5°C. The ground remained thawed for most of the day. As a result of the warm weather, the plants continued their state of slow vegetation, and the trees, vines and others continued their state of vegetative rest. In January, snowdrops, hyacinths, myosotis, hazel and others bloomed, and the bees went out to collect pollen and propolis on many days. ***The graphs of the variation of the parameters characterizing the air temperature in January*** (daily averages, daily minimums and daily maximums) had linear decreasing trends (Fig. 2) and the fastest decreasing was the maximum temperature (Fig. 2).

Table 3. The air temperature regime in Oltenia and the minimum and maximum temperature values at the soil surface in ***January 2023*** (N I = January normal values calculated for the interval 1901-1990, M I = monthly averages of January 2023; Δ=M-N = temperature deviation, CH = Hellmann Criterion).

Meteorological Station						**Tmax air**		**Tmin air**		**Tmax soil**		**Tmin soil**	
	Hm	**NI**	**MI**	**Δ=M-N**	**CH**	**(°C)**	**Date**	**(°C)**	**Date**	**(°C)**	**Date**	**(°C)**	**Date**
Dr. Tr..Severin	77	-1,1	5,4	6,5	FC	18,3	3	-1,9	8	24,7	3	-2,3	9
Calafat	66	-1,8	4,5	6,3	FC	20,1	18	-1,0	21	19,3	18	-0,9	9
Bechet	65	-2,2	4,2	6,4	FC	22,3	19	-4,6	8	19,0	18	-2,0	9
Bailești	56	-2,3	4,2	6,5	FC	19,9	18	-2,9	8	26,8	18	-3,2	8
Caracal	112	-2,9	4,3	7,2	FC	20,8	18	-1,9	21	19,3	3	-2,4	8
Craiova	190	-2,6	4,2	6,8	FC	19,8	18	-1,7	30	20,9	18	-2,4	30
Slatina	165	-2,4	4,3	6,7	FC	19,8	18	-2,2	8	*15,9*	*2*	-2,7	8
Bacleș	309	-3,0	4,1	7,1	FC	16,8	18	-2,5	31	-	-	-	-
Tg. Logrești	262	-2,7	3,8	6,5	FC	18,0	12	-5,3	8	18,4	1	-5,2	8
Dragasani	280	-2,2	4,6	6,8	FC	18,0	2	-2,0	31	17,7	2	-3,2	8
Apa Neagră	250	-2,6	3,7	6,3	FC	19,6	13	*-5,6*	*8*	20,3	6	*-6,0*	*29*
Tg. Jiu	210	-2,6	4,2	6,8	FC	19,4	1	-3,9	8	19,9	1	-5,3	8; 9
Polovragi	546	-3,2	3,6	6,8	FC	18,2	3	-4,1	31	19,5	2	-4,8	9
Rm. Vâlcea	243	-2,2	4,7	6,9	FC	18,4	2	-2,7	31	17,7	6	-4,5	9
Voineasa	587	-4,7	*1,4*	*6,1*	FC	*11,9*	*5*	-4,8	9	-	-	-	-
Parâng	1585	-	-	-	-	13,1	2	-11,6	30	-	-	-	-
Oltenia average average	-	-2,6	4,08	6,6	FC	18,4	-	-3,7	-	20,0		-3,5	
Ob. Lotrului	1404	-6,2	-1,4	4,8	C	10,4	3	-13,3	30	-	-	-	-

(Source: data processed from the ANM archive)

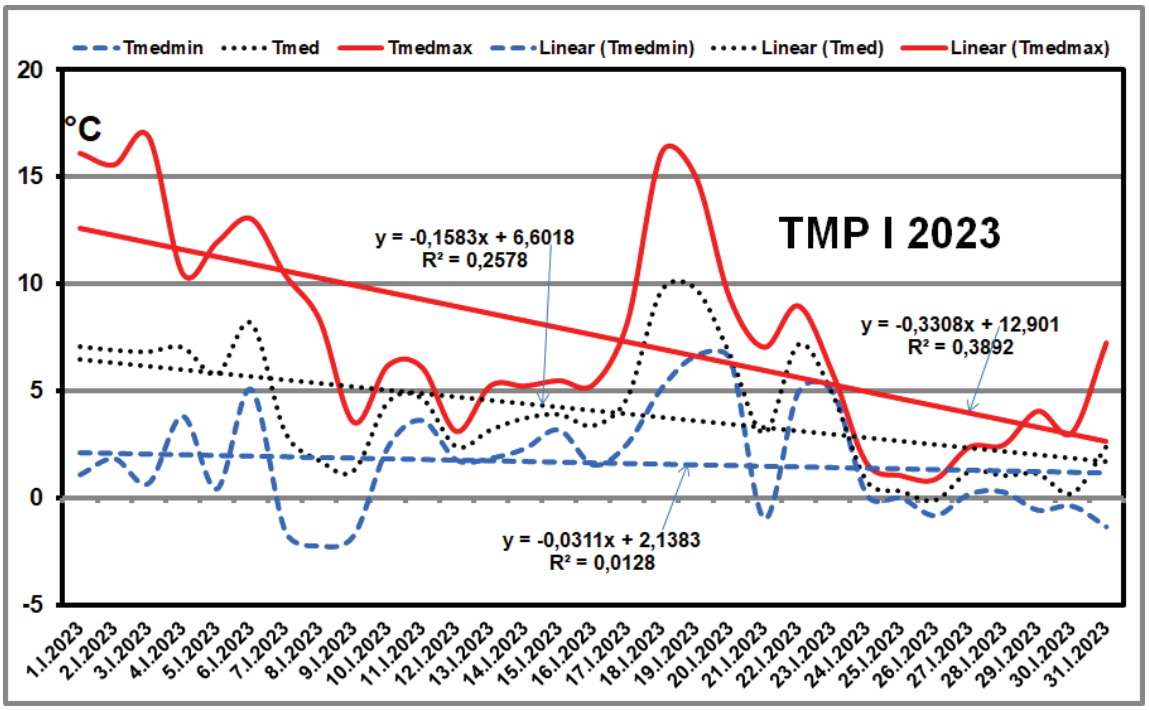

Figure 2. The variation of the parameters that characterize the air temperature (average of daily maximums, daily average and average of daily maximums, calculated for the entire region) in January 2023. (Source: data processed from the ANM archive).

2.b. The rainfall regime of January 2023

The monthly amounts of precipitation ranged from 55.8 l/m^2 in Bechet in the Oltenia Plain to 185.1 l/m^2 in Apa Neagră, with ***the maximum rainfall in the mountain area at Ob. Lotrului of 199.8 l/m^2***. The percentage deviations of the monthly amounts of precipitation compared to normal were between 66.6% in Bechet and 249.5% in Polovragi. According to the Hellmann Criterion[8], the month of January was excessively rainy (EP) throughout the Oltenia region (Table 2). The average monthly amount of precipitation in January 2023, for the entire Oltenia region, was 112.5 l/m^2, and its deviation from normal was 156.3%, which, according to the Hellmann Criterion, confirms that the month of January was on average excessively rainfall (EP) for the entire region. In January there were three rainy intervals due to some Mediterranean cyclones: 9-12.I (4 days), 16-23.I (8 days) and 26-28.I (3 days) totaling 15 days (48.4 % of the total number of days of the month). Of these, the most important interval was 8-12.I with the average amount of precipitation for the entire region of 25.4 l/m2 on 10.I.2023 (the rainiest day of the winter 2022-2023). Most of the precipitations were in the form of rain. On some nights, the drop in air temperature caused the rain to turn to sleet and snow and the formation of an insignificant layer of snow. Thus, 10 days were recorded with an insignificant layer of snow that melted quickly, and the maximum thickness of 9 cm was recorded in Apa Neagră on 27.I.2023.

3.a. The thermal regime of February 2023.

The monthly air temperature averages ranged from -0.3°C in the Voineasa inter-mountain depression (the only negative average except for the mountain area) to 4.6°C in the extreme west at Drobeta Turnu Severin (Table 4). Their deviations from normal values ranged from 1.6°C in Târgu Logrești to 4.2°C in Caracal. According to the Hellmann criterion, the month of February 2023 was warm (C) throughout Oltenia, except for a small area at Târgu Logresti where it was warm (CL – meaning lukewarm, meaning less than warm). The general average of the air temperature calculated for the entire Oltenia region was 2.90°C, and its deviation from the normal of 3.36°C, which according to the Hellmann criterion shows ***that February was on average warm for the entire Oltenia region.*** The maximum air temperatures were recorded in the last decade of the month, those reached on 21.II and ranged from 16.2°C in Voineasa (on 21.II) to 23.2°C in Bechet on 26.II, and their average for the entire region was 19.0°C. The value of 23.2°C from Bechet is the 4th lowest value in the entire data series of this station. The minimum monthly temperatures in the air were recorded during the only cold wave this winter in the interval between 6-11.II, and the most were on 10.II and ranged from -19.3° C in Târgu Logrești (on 6.II.2023) to -8.1°C in Drăgășani, with an average of -12.0°C for the entire Oltenia region.

A certain cold wave was recorded for the whole winter in the interval 5-11.II (6 days) with the maximum intensity of cooling in the morning of 6.II when the minimum thermal temperature of winter of -19.3°C was recorded at Târgu Logrești (to the west of the Muierii Hill at the foot of the hill), and in the mountain area -23.6°C

[8] Hellmann criterion for monthly precipitation amounts: Δp% < -50% → excessively dry (ES); -50.0≤ Δp% ≤-30.1→very dry (FS); -30.0≤ Δp% ≤-20.1→dry (S); -20.0≤ Δp% ≤-10.1→slightly dry (PS); -10.0≤ Δp% ≤-10→normal pluviometric (N); 10.1≤ Δp% ≤20.0→slightly rainy (PP); 20.1≤ Δp% ≤30.0→rainy (P); 30.1≤ Δp% ≤50.0→very rainy (FP); Δp% >50.0→excessively rainy (EP)

at Obârşia Lotrului on 9.II. The recording of this cold wave in the first decade of the last warm winter month proves to us that climate warming is not stable and therefore it is not a change, it is a variability. In February, except for the period in which the cold wave occurred, ***the weather was warm and a heat wave was recorded between 14-26.II (13 days)*** with peaks of warming on the dates of 21.II and 26.II and the maximum warming intensity of 23.2°C at Bechet in the extreme south on 26.II.

At the surface of the soil, the maximum temperatures were recorded in the last decade of the month and ranged from 21.3°C in Calafat on 19.II to 36.3°C in Râmnicu Vâlcea on 22.II, after a maximum of 31.4°C had been recorded on 19.II and a maximum of 30.0°C on 21.II. Râmnicu Vâlcea is the only meteorological station where exceptional thermal maxima ≥30.0°C were recorded at the ground surface this winter. ***The average maximum temperature at the ground surface*** for the whole Oltenia was 25.7°C. ***The minimum monthly temperatures*** at the soil surface were recorded during the air cold wave, in the interval 7-11.II and ranged from -23.5°C in Târgu Logreşti on 7.II.2023 (the second morning after the maximum intensity of air cooling) to -8.2°C in Apa Neagră on 11.II.2023. ***The average monthly minimum temperature*** for the entire Oltenia region was -12.7°C.

The graphs of the variation of the parameters characterizing air temperature in February (daily averages, daily minimums and daily maximums) had linear increasing trends (Fig. 3), and the fastest increasing was the minimum temperature, meaning that in February the main climate process is the increase of minimums of temperature and initiation of the springing process (Fig. 3). ***The heat units*** ranged from to35 in Voineasa and 149.6 in Calafat, and their average for the entire region was 110. The cold units were recorded mainly during 5-11.II and ranged from 15 in Drobeta Turnu Severin to 52.4 in Târgu Logreşti, and their average for the entire region was 27.0, as the highest of all winter months. The only winter month in which agrometeorological frost was recorded in the low altitude area was February, and the frost units ranged from 0 in Drobeta Turnu Severin, Caracal, Drăgăşani and Râmnicu Vâlcea to 32 in Târgu Logresti and in the mountain area 22 in Parâng and 45.9 in Obârşia Lotrului. The average of frost units for the entire Oltenia region was 5.9, and for the low altitude area 4.8, signifying a mild winter from an agrometeorological point of view.

Table. 4. The air temperature regime in Oltenia and the minimum and maximum temperature values at the soil surface in February 2023 (N II = February normal values calculated for the interval 1901-1990, M II = monthly averages of February 2023; Δ = M-N = temperature deviation, CH = Hellmann criterion).

Meteorological Station	Hm	NII	MII	Δ=M-N	CH	Tmax air		Tmin air		Tmax soil		Tmin soil	
						(°C)	Date	(°C)	Date	(°C)	Date	(°C)	Date
Dr. Tr .Severin	77	0,9	4,6	3,7	C	20,0	21	-8,7	10	28,7	21	-9,8	10
Calafat	66	0,4	4,5	4,1	C	20,7	21	-12,6	11	*21,3*	*19*	-12,8	11
Bechet	65	-0,1	3,9	4,0	C	23,2	26	-13,6	6	27,3	19	-9,0	11
Băileşti	56	-0,1	3,0	3,1	C	19,3	21	-14,5	6	25,8	19	-17,5	10
Caracal	112	-0,7	3,5	**4,2**	C	22,3	26	-8,9	11	25,4	22	-9,5	9
Craiova	190	-0,4	3,0	3,4	C	21,0	26	-12,4	11	22,7	26	-13,2	12
Slatina	165	-0,2	3,1	3,3	C	20,4	26	-10,7	10	23,9	22	-11,9	7
Bâcleş	309	-0,9	2,6	3,5	C	17,9	21	-10,5	9	-	-	-	-
Tg. Logreşti	262	-0,7	0,9	***1,6***	CL	19,3	21	*-19,3*	*6*	23,4	21	*-23,5*	*7*
Drăgăşani	280	-0,2	3,7	3,9	C	20,2	21	-8,1	10	22,8	22	-8,9	10
Apa Neagră	250	-0,6	3,0	3,6	C	18,3	21	-11,7	10	26,7	22	-8,2	11
Tg. Jiu	210	-0,4	3,2	3,6	C	20,8	21	-10,3	10	23,1	21	-11,5	11
Polovragi	546	-1,4	1,9	3,3	C	16,6	21	-12,0	10	26,2	22	-16,8	10
Rm. Vâlcea	243	0,0	3,2	3,2	C	20,1	21	-10,0	10	36,3	22	-12,2	10
Voineasa	587	-2,5	*-0,4*	2,1	C	*16,2*	*21*	-13,6	10	-	-	-	-
Parâng	1585	-	-	-	-	7,5	16	-15,4	6	-	-	-	-
Oltenia average	-	-0,46	2,90	3,36	C	19,0		-12,0	-	25,7	-	-12,7	-
Ob. Lotrului	1404	-5,5	-3,1	2,4	C	9,2	16	-23,6	9	-	-	-	-
Petroşani	-	-1,3				14,0	21	-18,7	7	11,0	21	-19,5	7

(Source: data processed from the ANM archive)

3.b. ***The rainfall regime of February 2023***

The monthly amounts of precipitation ranged from 11.4 l/m^2 in Caracal to 35.6 l/m^2 in Polovragi, and their percentage deviations from normal were between -67.0% at Caracal and -4.2 % in Dragăşani. According to the Hellmann criterion, the month of February was pluviometrically deficient with deficits ranging from excessively dry (ES) in Calafat, Caracal, Bâcleş, Apa Neagră, Rm. Vâlcea and Voineasa to normal pluviometrically (N) in a limited area in Drăgăşani. The exception was the mountain area where it was exceptionally rainy (EP) in Parâng (Table 2). The average monthly amount for the entire region was 26.0 l/m^2, and its percentage deviation from normal was 38.5%. Except for the mountain area, for the area with low altitude the percentage deficit of precipitation is -46.5%. According to the Hellmann criterion, on average, February was very dry (FS) for the entire Oltenia region. ***The snow layer*** was recorded locally, in the interval 5-12.II.2023 during the cold wave and gradually dispersed as the temperature increased, and the maximum thickness was 21 cm in Craiova (Fig. 4)

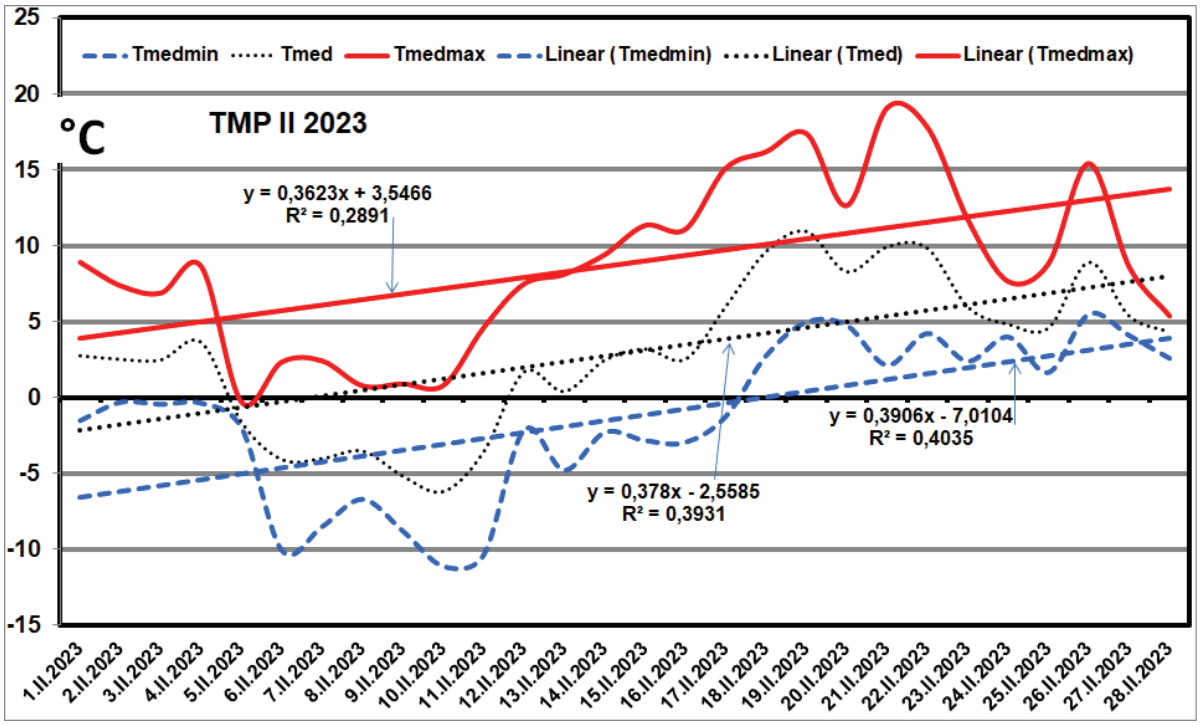

Figure 3. The variation of the parameters characterizing the air temperature (average daily minimums, daily average and average daily maximums, calculated for the entire region) in February 2023 (Source: data processed from the ANM archive).

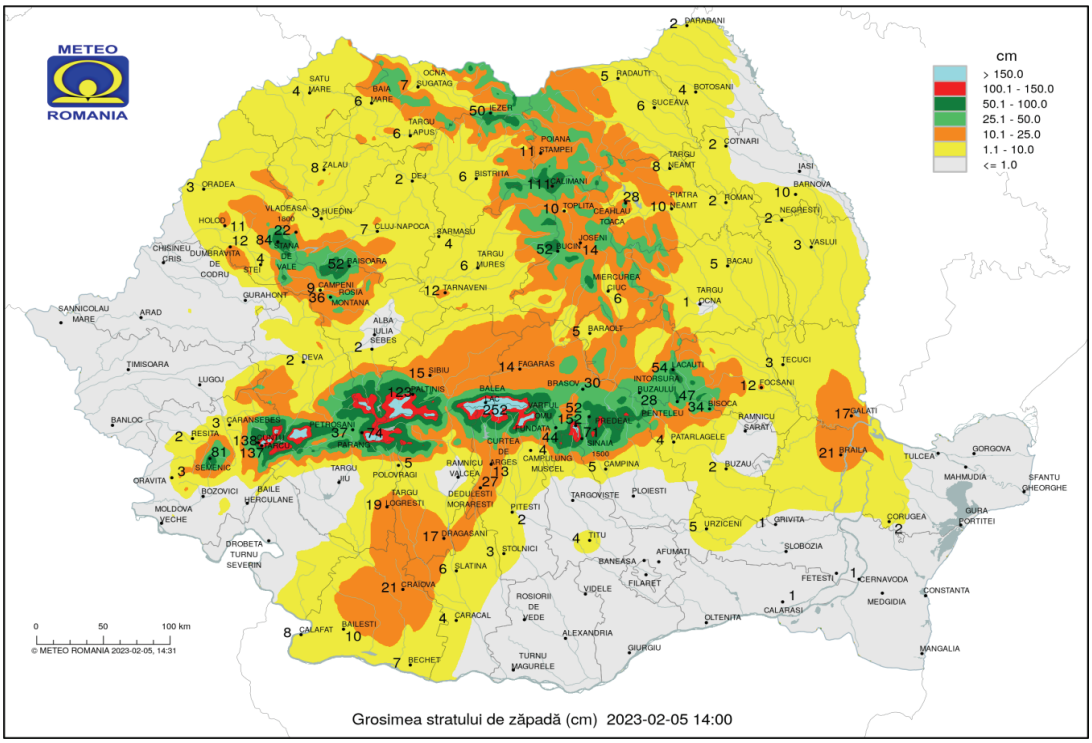

Figure 4. The maximum thickness and extent of the snow cover in the winter of 2022-2023 (5.II.2023 at 14:00) (according to ANM Bucharest).

4. Seasonal climate characteristics of winter 2022-2023

The seasonal air temperature averages ranged from 0.8°C in Voineasa to 4.6°C in Dr. Tr. Severin, and their deviations from normal ranged from 3.5°C in Tg. Logrești to 4.8°C in Caracal. According to the Hellmann criterion, the winter of 2022-2023 was very warm (FC) throughout the Oltenia region (Table 5). ***The seasonal average of the air temperature*** calculated for the entire Oltenia region was 3.25°C, and its deviation from normal was 4.2°C. According to the Hellmann criterion, on average the winter of 2022-2023 was very warm (FC).

In descending order, the seasonal average of 3.25°C is the second highest in the entire climate data series for Oltenia, so the winter of 2022-2023 was the second warmest winter in the entire history of climate observations after

the Mediterranean winter of 2006-2007 with the seasonal average of 3.44°C and the deviation from normal of 4.39°C. ***The winters of 2006–2007 and 2022–2023 are the only winters with a seasonal average ≥3.0°C in the entire data set, showing that climate warming has continued.***

The seasonal amounts of precipitation ranged from 105.2 l/m^2 in Bechet and 345.5 l/m^2 in Apa Neagră, and their percentage deviations from normal ranged from0.6% in Bechet and 48.5% in Polovragi. According to the Hellmann criterion, the winter of 2022 ranged from normal pluviometric in a limited area in Bechet to excessively rainy (EP) in Tg. Logreşti, Polovragi and in the mountain area (Parâng) (Table 5).

Table 5. The overall thermal and rainfall regime of the winter 2022-2023. (Hm = altitude of the weather station, W`20-`21=average temperature values in winter 2021-2022 (°C), NW = normal values of seasonal averages of temperature in winter (°C), Δ = W-N = deviations of average temperatures compared to normal (°C) CrH = Hellmann Criterion, SW = sum of precipitations in winter 2022-2023 (l/m^2), NW = normal values of precipitation in winter (l/m^2), Δ = S-N= deviations from normal (l/m^2), Δ% = percentage deviations from normal).

No	Meteorological Station	Hm	Thermal regime (°C)				Pluviometric regime (l/m^2)				
			W`22-`23	NW	Δ=W-N	CrH	SW	NW	Δ=S-N	Δ%	CrH
1	Dr. Tr. Severin	77	4,6	0,4	4,2	FC	206,8	160,5	46,3	22,4	P
2	Calafat	66	4,1	-0,1	4,2	FC	151,6	123,9	27,7	18,3	P
3	Bechet	65	3,7	-0,6	4,3	FC	*105,2*	104,6	0,6	*0,6*	N
4	Băileşti	56	3,4	-0,7	4,1	FC	135,9	121,4	14,5	10,7	PP
5	Caracal	112	3,6	-1,2	4,8	FC	135,9	108,7	27,2	20,0	P
6	Craiova	190	3,3	-1,0	4,3	FC	148,7	109,7	39,0	26,2	P
7	Slatina	165	3,3	-0,8	4,1	FC	152,3	117,2	35,1	23,0	P
8	Bâcleş	309	3,1	-1,4	4,5	FC	132,0	149,3	*-17,3*	*-13,1*	PS
9	Tg. Logreşti	262	2,4	-1,1	*3,5*	FC	223,0	121,7	101,3	45,4	EP
10	Drăgăşani	280	3,7	-0,6	4,3	FC	201,7	114,1	87,6	43,4	FP
11	Apa Neagră	250	3,0	-1,0	4,0	FC	345,5	219,6	125,9	36,4	FP
12	Tg. Jiu	210	3,3	-1,0	4,3	FC	249,1	169,9	79,2	31,8	FP
13	Polovragi	546	2,7	-1,5	4,2	FC	297,8	153,4	144,4	48,5	EP
14	Rm. Vâlcea	243	3,8	-0,6	4,4	FC	191,3	120,1	71,2	37,2	FP
15	Voineasa	573	0,8	-3,0	3,8	FC	166,6	141,8	24,8	14,9	PP
16	Parâng	1585	-	-	-	-	310,3	160,0	150,3	48,4	EP
	Oltenia average	-	3,25	-0,95	4,2	FC	197,1	137,2	59,9	30,4	FP
17	Ob. Lotrului	1348	-1,8	-5,5	3,7	FC	197,1	-	-	-	-

(Source: data processed from the ANM archive)

DISCUSSIONS

Throughout the winter, ***six winter heat waves were recorded in the intervals: 8-11.XII (4 days), 16-17.XII (2 days), 23.XII-8.I (17 days), 17-20.I (4 days), 31.I-4.II (5 days), 14-26.II (13 days) totaling 45 days, i.e. half of the winter days and a single cold wave in the interval 5- 11.II with a duration of 6 days.*** The cold wave and the presence of a consistent snow layer in the central area of Oltenia do not allow the 2022-2023 winter to be classified as a Mediterranean winter, although it came very close to this type of winter. On most days the ground remained thawed, and the biotopes and vegetation maintained their slow activity. We will further analyse the synoptic causes of the most intense warming in January produced in the interval 17-20.I.2023 (January being the month that generally defines the type of warm cold winter, etc.) and of the most intense cooling of the weather in this winter recorded in the interval 5-11.II.2023.

The synoptic causes that determined the warming of the weather in the interval 17-20.I.2023. The initiation of the advection of the tropical continental warm air mass (cT) over Europe occurred on 15.I.2023, and the situation evolved slowly at first and then accelerated during 17-19.I, with the peak of warm air advection. In Oltenia, it happened on January 18, and for Muntenia, Dobrogea and Moldova on January 19, 2023. ***At the level of the land surface***, on 18.I. at 18 UTC, the distribution of baric centers over Europe was as follows: The strongly developed Icelandic cyclone, centered west of the Scandinavian Peninsula, had values at the center below 990 hPa, and the trough of this cyclone extended to the north of Africa (isohypse of 552 damgp - Cape Tunis area). In the south of this talweg above Italy, a Mediterranean Cyclone can be identified with atmospheric pressure values at the center ≤1000hPa. (Fig. 5). Over the Atlantic Ocean, the strongly developed Azorean Anticyclone had atmospheric pressure field values at the center ≥1035 hPa. In the east of the European continent, the strongly developed East-European Anticyclone had values of the atmospheric pressure field ≥ 1040 hPa. For Romania, the air circulation was tropical (from the S-W) with warm tropical continental air from North Africa. At the level of 850 hPa (Fig. 6), it can be seen that the warm air in the East penetrated up to the latitude of 65°N and in the West over the Atlantic Ocean up to the latitude of 70°N. The cold air advected on the rear side of the valley baric penetrated as far as southwestern Europe at Gibraltar. We therefore have broad advections of air masses determined by air circulation under the influence of Rossby waves (with long wavelength) and baric centers. Above Romania were present the 5°C and 6°C isotherms that cut the country diagonally from SW to NE, and above SE Romania we have a core of warm air with a temperature of 8°C, which explains the stronger heating of the Muntenia air.

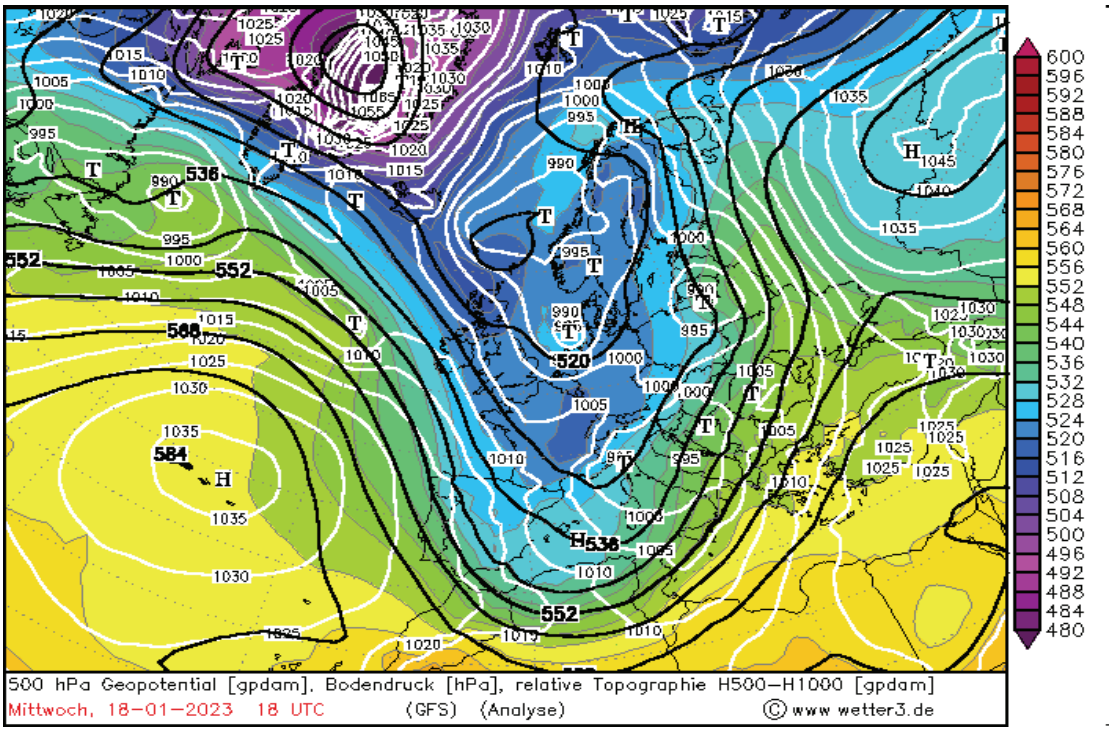

Figure 5. The synoptic situation at the level of the land surface (atmospheric pressure field) superimposed with the synoptic situation at altitude (the geopotential field at the level of 500 hPa - about 5000 m altitude) and the relative baric topography field
(TR 500/1000) from the 18.I.2023 at 18 UTC. (www.wetterr3.de).

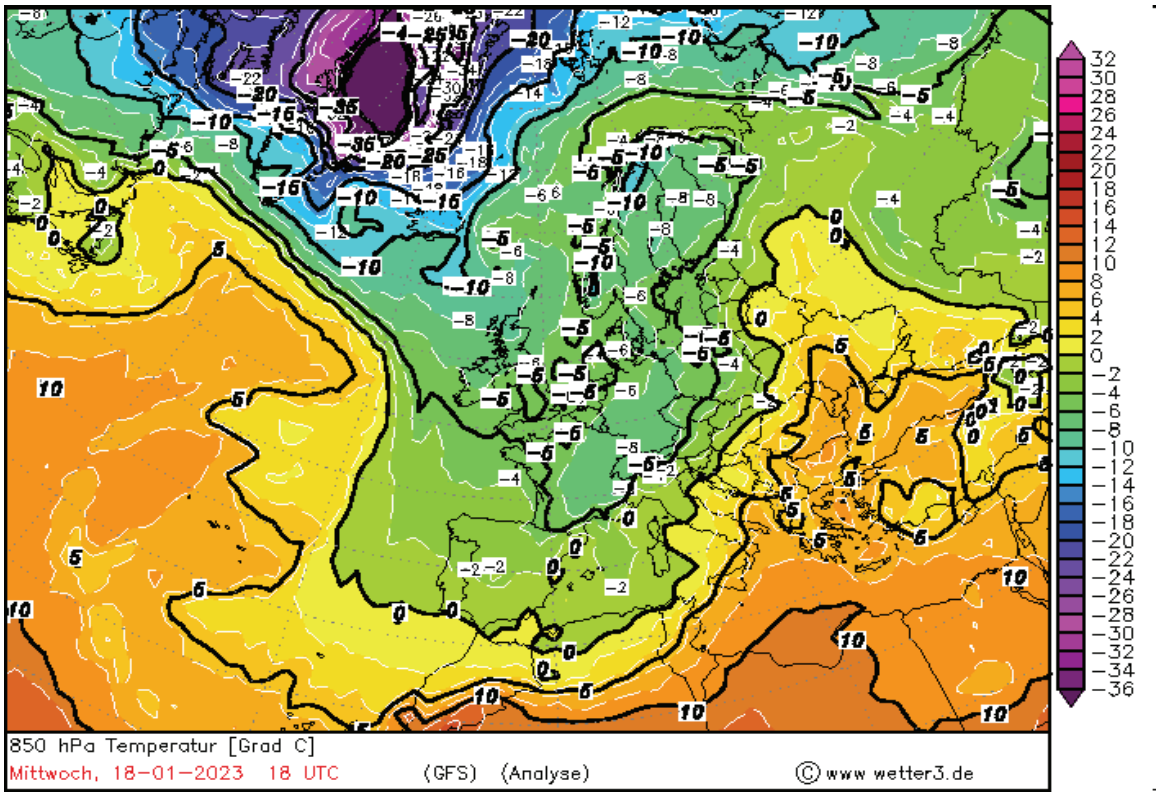

Figure 6. The temperature field at the geopotential surface level at the level of 850 hPa – about 1500 m altitude
from 18.I.2023 at 00 UTC. (www.wetterr3.de).

At the level of 850 hPa (about 1500m altitude) at this time (06 UTC) on 6.II (Figs. 7; 8), we can observe the massive penetration of particularly cold air (isotherm of -10°C) from the northeast over The Russian Plain and Ukraine, to the south of the Balkan Peninsula and Italy, and the cold air boundary was in northern Africa (0°C isotherm). Southwest of the Danube, on the territory of Bulgaria and Serbia, at this level there was an even colder core of air (exceptionally cold) inside the -15°C isotherm (aspect due to the Balkan Mountains - the Alps of Southern Europe -East").

The Azorean anticyclone was united with the East-European one over the north of Africa and further to the East with the Russian-Siberian one forming the huge anticyclone field specific to Eurasia winters.

At the level of 500 hPa (Fig. 7), a high geopotential field with central values ≥ 584 damgp was present over the Atlantic Ocean, west of the coasts of Europe, a low geopotential field was present over the Atlantic Ocean with central values ≤ 512 hPa, and over Eastern Europe a high geopotential field with values at the center ≥576 damgp.

In these conditions, in addition to the advection of warm air, the effect of insolation was added, and at some meteorological stations (over 100 in Romania and 3 stations in Oltenia - mentioned above) record maximum temperatures were recorded - the highest in the entire history of their meteorological observations.

The synoptic causes that determined the cooling of the weather from 6-11.II.2023. For February, the 2023 cooling is the most intense cooling on record since the 1-12.II.2012 cooling, demonstrating that ***climate warming[9] is not a process of change but climate variability,*** with cold snaps and cold winters likely to return anytime. (If climate warming were a change, cold winters and cold waves would never return. For example, living organisms and many other systems evolve through change because the evolutionary phases they go through do not come back.)

Climate evolves through variability because such states have occurred before and will occur again). If the evolution of the climate had taken place through changes, life on Earth would have disappeared long ago. So, there is no climate emergency, the current climate warming is part of the climate cycles (warmings and coolings) studied by Milankovitch throughout his life.

This cooling weather had four peaks on 6.II, 7.II, 9.II and 10.II, on 6.II.2023 with thermal minima of -19.3°C in Târgu Logrești (the lowest in the lowlands for the entire cooling interval), -15.4°C in Parâng, -14.5°C in Băilești, -13.5°C in Obârșia Lotrului, -11.4° C in Craiova; on 17.II with thermal minimums of -16.5°C in Târgu Logrești, -11.2°C in Băilești, -9.9°C in Craiova, -9.2°C in Slatina; on 9.II with thermal minimums of -13.4°C in Târgu Logrești, -9.9°C in Băilești, -9.4°C in Craiova, -9.1°C in Polovragi; and on 10.II with thermal minimums of -16.5°C in Târgu Logrești, -14.1°C in Băilești, -13.6°C in Voineasa, -12.0°C in Polovragi and -11.9°C in Craiova.

We note that the lowest temperature values were recorded west of Muierii Hill[10], which is the longest hill in Romania (over 120 km long) and starts from the mountain (the Muierii Cave area and the Zănoaga summit) forms the balance of waters between the hydrographic basin of Jiului and that of Olteţu, reaches Craiova (airport area) then stretches towards Pielești commune and Leu commune (Zănoaga village) and gradually flattens out, disappearing into the Oltenia Plain. It plays an important role in directing the air masses on the low landforms, especially in winter, and east of it in the Olt corridor the temperatures are higher and warm advections are more frequent.

The Târgu Logrești weather stationis located to the west of Muerii Hill at the foot of the hill, like Polovragi, and Craiova right on the hill. The advection of cold air over Romania started on 24.I.2023 but was weak, keeping the weather close to the thermal normal, then on the night of 5/6.II, it intensified rapidly, with nights with clear skies, when the cumulative cold advection with the effect of decreasing air temperature determined particularly low minimums. At 06 UTC on 6.II.2023, the distribution of baric centers over Europe, at the land surface level, was as follows:

[9] Climate warming and cooling have always been on Earth, being a natural way of climate evolution, for example, 6000 years ago, the Sumerians wrote on their clay tablets: ***it was hot both day and night, it was hot all over the Earth*** (Zecharia Sitchin, The twelfth Planet).

[10] ***The Muerii Hill***, which is now a good part of the border between Gorj and Vâlcea counties, is the oldest transhumance road in Oltenia and has been used since ancient times as the Transalpina king's road, being the shortest way between the Danube Basins and the mountain. 24 communes guard Muierii Hill, on one side and the other, and a large city – Craiova. This is where all the ancient invaders entered the heart of Oltenia. Modern times have forgotten this ancient road, which now remains unmodernized and almost naturally forested. Often the cold air that descends to the south from the mountain area drains past Muierii Hill to the south, settling to the west of it. Thus, at the mesoscale, a local cold front is born, and in front of it to the east of the Muierii Hill, the advection of "slightly warmer" air from the south occurs naturally, the hill constituting a favorable orographic factor and due to its specific curvature of a front cold. Cold advection extends in this direction to the Băilești Plain. The high frequency of the production of these processes means that in the Romanian Plain, at the surface of the soil, the highest thermal minimums in Oltenia are frequently recorded. In the Danube Meadow on the sector of Oltenia, the descent of cold air from the Balkans and the Pre-Balkan Plateau is also produced, which often merges with that arriving from the north, causing particularly low thermal minimums in this area.

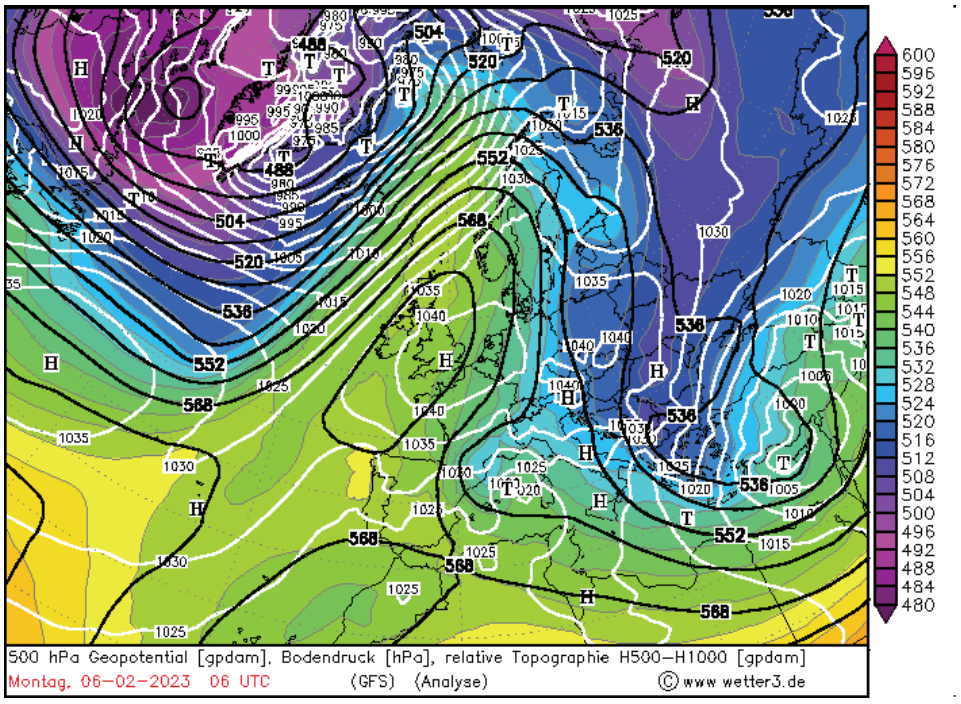

Figure 7. The synoptic situation at the level of the land surface (atmospheric pressure field) superimposed with the synoptic situation at altitude (the geopotential field at the level of 500 hPa - about 5000 m altitude) and the relative baric topography field (TR 500/1000) from the 6 .II.2023 at 06 UTC. (www.wetterr3.de).

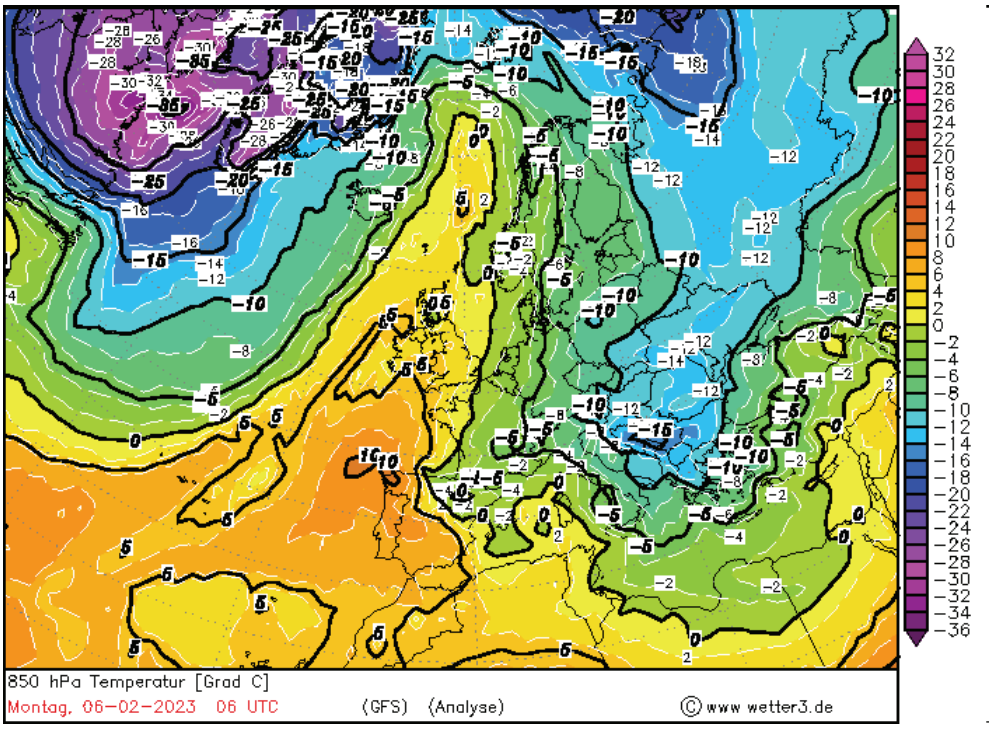

Figure 8. The temperature field at the level of the geopotential surface at the level of 850 hPa – about 1500 m altitude) from 6.II.2023 at 00 UTC. (www.wetterr3.de).

The Azorean Anticyclone had an extended ridge over Great Britain in which the Central European Anticyclone was individualized with atmospheric pressure values at center ≥1040 hPa (Fig. 7), and its ridge was extended to the north of the Scandinavian Peninsula. Above Turkey and in the eastern Mediterranean Sea, a Mediterranean Cyclone was positioned with atmospheric pressure values at the center ≤1000hPa, and in the north-west of Europe on the Atlantic Ocean, the vast field of the Icelandic Cyclone was dominant with several centers and atmospheric pressure values at the center ≤ 975 hPa. ***At the level of 500 hPa*** (Fig. 7) it can be observed that over most of Europe we have a

blocking circulation (the characteristic isohypse of 552 damgp has the form of the letter "Ω"). For Romania, the air circulation was north-east (ultra-polar) and north (polar) with cold polar + arctic continental air masses (cPk+A).

Although the winter-specific anticyclonic belt over Eurasia that brings cold air from Siberia to Europe had been forming for almost a month, the cold wave for SE Europe has only now occurred, and the particularly cold air has been advected from the Scandinavian Peninsula, which connects the area polar. Therefore, the advection of particularly cold air from the polar zone and the cooling of the air during the clear night of 5/6.II with a duration of 13 hours and 56 minutes determined the intensification of the cooling and the achievement of particularly low minimums on the morning of 6.II.2023.

CONCLUSIONS

Winter 2022 -2023 was ***a very warm winter (FC) with the overall seasonal average of 3.25°C and the deviation from normal of 4.20°C, being the second warmest winter in the entire history of climate records for Oltenia.*** In the entire history of climate data, there have been only two winters with a seasonal average ≥3.0°C, the winter of 2006-2007 with an average of 3.44°C and a deviation from normal of 4.39°C and the winter of 2022- 2023 with a mean of 3.25°C and a deviation from normal of 4.20°C. ***Climate warming has continued and is not climate change because it is not a stable process***[11], cold waves and extreme cold weather can occur at any time. The evolution of the climate is done by variability and not by changes. Changes are those developments that do not allow returning to system states recorded in previous phases. For example, living organisms evolve through changes and not through variability (after youth, the copulation cannot return!). For the period 1961-2023 (62 years) the overall mean of winters is -0.19°C and the deviation from normal is 0.76°C, which according to the Hellmann criterion, the winters of the whole period, on average, were warm CL (ie only slightly warmer than normal) and falls into the near-normal class. So in the medium term we cannot talk about climate change. On January 18, 2022, ***3 absolute thermal records were recorded in Oltenia*** for the month of January: 21.7°C in Bechet, 20.8°C in Caracal and 19.8°C in Slatina. For the whole winter, the heat units ranged from151.2 in Voineasa to 433.1 in Drobeta Turnu Severin with an average of 333.4 characterizing a very warm winter (FC), for the entire Oltenia region. We note that no exceptionally warm winter (EC) has been recorded so far. Most cold units were recorded in the interval 5-11.II and ranged from 19.6 in Drobeta Turnu Severin to 77.7 in Voineasa, and their average for the entire region was 38.3. Agrometeorological frost units were recorded in the interval 5-11.II and ranged from 0 in Drobeta Turnu Severin, Caracal, Drăgășani and Râmnicu Vâlcea to 32 in Târgu Logresti and in the mountain area 22 in Parâng and 45.9int Obârșia Lotrului. The average of agrometeorological frost units for the entire Oltenia region was 5.9, and for the low altitude area 4.8, signifying a mild winter from an agrometeorological point of view. In the intervals 1961-1981 for 20 years and 1983-1999 for 16 years no very warm winter (FC) was recorded. Most very warm winters (FC) have been recorded since 2000 (6 winters out of 7, i.e. 85.7%). So, in general, we are currently in a period of climate warming, a process related to the cycles of climate warming and cooling studied by the Serbian physicist Milankovitch, the causes of which are of a cosmic nature. Human activity as well as increasing the amount of CO2 cannot have significant influences on these processes because the weight of CO2 in the entire mass of the atmosphere is 0.03% (i.e. three parts out of 10000, and physico-chemical reasoning shows that the proportion is one molecule of CO2 to 10000 other molecules in the atmosphere.). Global warming and warm climate is biostimulant, and the large number of Earth's population and demographic explosion is due to this process.

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[11] If the climate had evolved through changes, there would have been no life on Earth long ago.

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