# CLIMATE VARIABILITY IN THE SPRING OF 2018 IN THE SOUTH-WEST OF ROMANIA IN THE CONTEXT OF CLIMATE CHANGE

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**Abstract.- Climate variability in the spring of 2018 in the south-west of Romania in the context of climate change.** The paper analyses climatic variability in south-western Romania in the spring of 2018. After the warm winter, from the late winter phenomena with snow layer, recorded in March in the intervals 1-8.III and 19-27.III, it followed the warmest month of April, by temperature averages, throughout the history of climate observations, and the warm weather has continued throughout May. In March there was an absolute climatic record of the minimum temperature at Tg. Logrești of -24.8°C (1.III.2018). In April the weather was warm on most of the Northern Hemisphere except the North American continent. The temperature averages registered in April 2018 have become absolute climatic records not only in Oltenia but even in the whole country and an extended area on the European continent. In Oltenia, April was excessively droughty, but heavy rainfall in March provided the groundwater reserve throughout the month, although some cereal crops have been affected. April was warm in all Oltenia with a general average deviation of 2.5°C, and the rainfalls returned, but the drought continued in the Romanați Plain. Climatic variability was particularly high, the climate evolving from an extreme to the other, but nevertheless the statistical analysis of the climatic data shows that the climate warming continued. The paper is part of an extensive series of studies on climate variability in Oltenia and climatic risk phenomena (Bogdan, Marinica, Andreea Floriana Marinică 2010, 2017; Marinică, Andreea Floriana Marinică 2016) being useful to all interested in climate problems in the south-west Romania.

**Keywords: warm winter, late winter phenomena, early coming of spring, late spring hoar, atmospherical drought**

## 1. INTRODUCTION

Year 2017 was the year of climatic extremes, and the evolution of time from one extreme to another continued in 2018. After the warm winter of 2017-2018, in which a single late-winter episode occurred in 25.II-3.III.2018 in which the weather cooling peaked at 1.III when the temperature minima recorded the value of -24.8°C at Apa Neagră and Tg. Logreşti meteorological stations., and at

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the latter, the value became the ***absolute thermal minimum***, followed by a warmer spring than normal. In the spring of 2018, thermal anomalies were the most important and recorded on extensive areas from the Northern Hemisphere. Thus, March was excessively rainy not only in Oltenia, where monthly precipitation was over 100 mm at five meteorological stations, but even in the whole country and Europe. At the end of March, orange and red hydrological code alerts were issued for the rivers in 11 counties and on the Danube, a situation created by falling precipitations and rapid snow melting after the second late winter episode in which the snow layer (registered in 19-27. III) covered large areas of the continent, and in Oltenia reached maximum thicknesses between 20 cm at Caracal and 36 cm at Polovragi on 23 and 24.III. For the period March 21st, 15:00 - March 31st, 6:00, a yellow flood code was issued for the entire Romanian Danube sector, downstream of S.H.E.N. Porțile de Fier, Mehedinți, Dolj, Olt, Teleorman, Giurgiu, Călărași, Ialomița, Brăila, Galați, Constanța and Tulcea. For the period March 24th, 6:00 - March 31st, 18:00, orange flood code was issued on the Danube, the Hârşova - Brăila sector and the Danube Delta - the counties of Constanţa, Brăila and Tulcea. It was followed by the excessive drought in *April* in Oltenia and excessively warm for the entire continent of Europe, and very warm in Eurasia, classified as the warmest April month of the last 60 years for Romania and Europe after the temperature averages deviation from the normal values, which were between 1-8°C (Figure 1).


**Fig. 1.** Deviations of the monthly mean temperatures from the normal of April in Europe (after Bmeteo.com)

*Average temperature deviation in April* for the entire Romania was 4.3°C, which shows that April 2018 was the warmest of the last 60 years. As we shall see below, our opinion is that April 2018 was the warmest of all the history of climate observations. Other April high temperatures in Romania were in descending order of deviations from normal: April 2000 with $\Delta t = 2.7°C$, 1989 with $\Delta t = 2.6°C$,

1968 with Δt = 2.5°C, 1961 with Δ T = 2.3°C. We are therefore seeing a general trend for the entire country in April.

After the WMO report, in April 2018, record temperatures were registered for this month across the world. The highest temperatures were recorded in Pakistan and India, where it was abnormally warm even if these temperatures were recorded in a summer month. ***In Nawabshah, Pakistan, in 30.IV.2018 was recorded a temperature of 50.2°C, which is an absolute global climatic record of April***, also supported by Christopher C. Burt, author of the book "*Extreme Weather: A Guide and Record Book*" and a Weather Underground collaborator, (https://timesofindia.indiatimes.com/world/pakistan/pakistans-nawabshah-town-sees-highest-ever-april-temperature/articleshow/64010618.cms; https: / /www.nytimes.com/2018/05/04/world/asia/pakistan-heat-record.html). April's old record for this locality was 48.2°C, and the new record is very close to June's thermal record (50.5 ° C). (Https://en.wikipedia.org/wiki/Climate_of_Nawabshah). On the North American continent was the coldest April month of the last 20 years with a negative deviation of -2.2°C from the average (http://www.philly.com/philly/news/weather/coldest-april-20-years-philadelphia-global-warming-weather-20180508.html). This results in a warm global month at global level with a general average deviation of more than 2.0°C.

May 2018, according to monthly averages and deviations, was warmer than normal with a global average deviation of 2.9°C for the Northern Hemisphere, according to the NOAA National Environmental Information Center. (https://www.ecowatch.com/monthly-temperatures-climate-change-2576246064.html?xrs=RebelMouse_fb). All these climatic processes have been achieved in the absence of the El Ninõ climate process.

## 2. DATA AND METHODS

In order to accomplish this work, we used data from the ANM archive and the international databases, the synoptic maps available on the Internet from the international forecasting centres, the ANM site, satellite information, and the information published in the print media and the results of our processing.

## 3. RESULTS AND DISCUTIONS

### 3.1. Climatical conditions from March 2018

***The thermal regime.*** Monthly average temperatures in March ranged between 2.7°C in the Sub-Carpathian area at Polovragi and 4.9°C at Dr. Tr. Severin in the extreme west, and their deviations from the average in the last century were

all negative except for a single station and were between -1.8°C at Băileşti and 0.4°C at Voineasa, leading to the classification of the thermal types, according to Hellmann Criterion, from normal (N) in the area of the Subcarpathian hills to the mountain, to cool (CO) in the Oltenia Plain, Mehedinți Hills and Apa Neagră Subcarpathian Depression (Table 1).

**Table 1**. Air temperature regime in Oltenia and the minimum and maximum soil surface temperatures in **March 2018**, for the ≤ 600 m altitude area (NIII= mean temperature values for March, for the period 1901-1990, MIII= mean temperatures for March 2018, Δ=M-N = temperature deviation, CH = Hellmann Criterion).

| Meteorological station | Hm | NIII | MIII | Δ=M-N | CH | Tmax air | | Tmin air | | Tmax soil | | Tmin soil | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (°C) | Date | (°C) | Date | (°C) | Date | (°C) | Date |
| Dr.Tr. Severin | 77 | 5.9 | **4.9** | -1.0 | **CO** | **21.3** | 31 | **-14.4** | 1 | **38.6** | 31 | -17.2 | 1 |
| Calafat | 66 | 5.6 | 4.1 | -1.5 | **CO** | **19.9** | 31 | ***-9.4*** | 1 | 21.1 | 30 | 15.2 | 1 |
| Bechet | 65 | 5.4 | 4.1 | -1.3 | **CO** | **26.1** | 31 | **-18.4** | 1 | 25.2 | 31 | -15.0 | 1 |
| Băileşti | 56 | 5.4 | 3.6 | ***-1.8*** | **CO** | **22.5** | 31 | **-13.9** | 1 | ***18.5*** | 30 | -18.6 | 1 |
| Caracal | 112 | 4.9 | 3.7 | -1.2 | **CO** | **24.5** | 31 | **-16.4** | 1 | 21.2 | 31 | -17.5 | 1 |
| Craiova | 190 | 5.1 | 3.8 | -1.3 | **CO** | **21.3** | 31 | **-14.4** | 1 | 30.5 | 31 | -17.6 | 1 |
| Slatina | 165 | 5.0 | 3.6 | -1.4 | **CO** | **22.3** | 31 | **-21.9** | 1 | 19.6 | 31 | -21.5 | 1 |
| Bâcleş | 309 | 4.5 | 3.0 | -1.5 | **CO** | ***18.6*** | 31 | **-15.0** | 1 | - | - | - | - |
| Tg. Logreşti | 262 | 3.6 | 3.3 | -0.3 | **N** | **21.7** | 31 | ***-24.8*** | 1 | 26.2 | 31 | -28.0 | 1 |
| Drăgăşani | 280 | 4.7 | 3.8 | -0.9 | **N** | **20.8** | 31 | **-16.9** | 1 | ***18.5*** | 31 | **-11.0** | 1 |
| Apa Neagră | 250 | 4.2 | 2.8 | -1.4 | **CO** | **20.1** | 31 | ***-24.8*** | 1 | 22.6 | 31 | ***-29.2*** | 1 |
| Tg. Jiu | 210 | 4.8 | 4.1 | -0.7 | **N** | **21.9** | 31 | **-19.0** | 1 | 29.8 | 31 | -19.6 | 1 |
| Polovragi | 546 | 3.0 | ***2.7*** | -0.3 | **N** | **19.4** | 31 | **-17.8** | 1 | 25.2 | 30 | -26.0 | 2 |
| Rm. Vâlcea | 243 | 5.0 | 4.2 | -0.8 | **N** | **21.9** | 31 | **-17.8** | 1 | 26.0 | 11 | -25.1 | 1 |
| Voineasa | 587 | 2.4 | 2.8 | **0.4** | **N** | **19.7** | 31 | **-17.4** | 1 | - | - | - | - |
| Parâng | 1585 | - | - | - | **-** | **9.6** | 31 | **-19.5** | 1 | - | - | - | - |
| Avg. Oltenia | **-** | 4.6 | 3.6 | -1.0 | **CO** | **20.7** | | **-17.6** | - | 24.8 | - | -20.1 | - |
| Ob. Lotrului | 1404 | -2.4 | -1.2 | 1.2 | **WS** | **11.9** | 31 | **-22.9** | 1 | - | - | - | - |

(Source: data processed after ANM Archive)

***The monthly average air temperature*** calculated for the whole region was 3.8°C, and its deviation from normal was -1.0°C, which classifies March as cool (CO) on average for the entire region.

*Monthly air temperature maxima* were recorded on 31.III and were between 18.6°C at Bâcleş and 26.1°C at Bechet, and their average for the entire region was 20.7°C. Daily temperatures were negative in the first two days of the month when winter days were recorded after the late winter episode of late February (20.II-2.III.2018). Then the temperature rose rapidly in the period 3-17.III, and the temperature maxima reached and slightly exceeded 20°C, causing the plants to start vegetation and the flower buds on some trees. Between 19-27.III, the air temperature dropped again, recording a late winter episode, with snowfall and a consistent snow layer, which led to the destruction of the floral buds.

*Monthly air temperature minima* were recorded at 1.III when intense cooling at the end of February reached peak and were -24.8°C at Apa Neagră and Tg. Logreşti, and -9.4°C at Calafat, and their average for the whole region was -

17.6°C. For Tg. Logresti, -24.8°C is the absolute thermal minimum of March, thus becoming the new thermal record for the minimum of March.

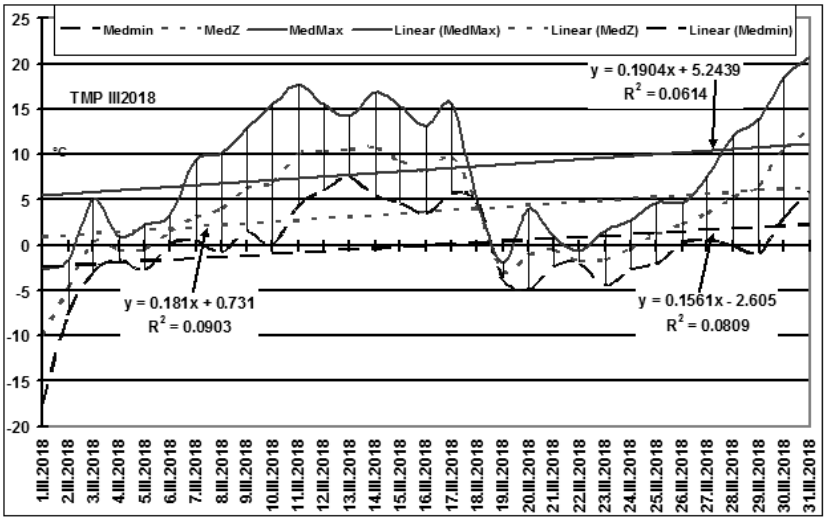


**Fig 1.** Variation of parameters that characterize air temperature in March 2018 in Oltenia (mean, daily minimum and maximum calculated temperatures for the whole region) (Source: data processed after ANM Archive).

*The charts of the air temperature characteristics* in March in Oltenia (daily average minima, daily average and daily average maxima calculated for the whole region) had strongly increasing linear trends, and among them the fastest growing average is for the daily maxima (Figure 1). The increasing trends were faster after the spring equinox and even accelerated in the last pentacle of the month. Cooling and air warming processes led to high temperature oscillations so that the maximum amplitude was recorded at Tg. Logreşti of 46.5°C, and the maximum amplitude for the entire region was 50.9 ° C.

*The maximum values of the soil surface temperature* were recorded on 30-31.III and were between 18.5°C at Băileşti and Drăgăşani, and 38.6°C at Dr. Tr. Severin and their average for the entire region was 24.8°C. The minimum values of the soil surface temperature were recorded on 1.III and were between -29.2°C at Apa Neagră and -11.0°C at Drăgăşani, and their average for the whole region was -17.6°C. The maximum surface amplitude of the soil surface temperatures was recorded at Dr. Tr. Severin (55.8°C), the maximum amplitude for the region being 67.8°C.

***The rainfall regime of March 2018***. The monthly precipitation values recorded were between 40.5 mm at Voineasa and 121.2 mm at Apa Neagră, and their percentage deviations from the average values ranged between 20.2% at Parâng and 207.6% at Băileşti causing classifications of the rainfall types from normal (N) in a restricted area of the Voineasa Depression, and exceptionally rainy (ER) in most of Oltenia (Table 2). At five meteorological stations (31.3%) the monthly quantities were ≥100 mm and their average for the whole region was 89.2 mm and the percentage deviation was 112.7% confirming that "on average" March was excessively rainy (ER) for the entire Oltenia region. Precipitation was in the form of rain, slush and snow. The snow layer existed in two intervals of 9 days. The first interval was between 1-9.III (due to snowfall in the last part of February) with maximum thickness recorded on 1.III, between 19 cm at Rm. Vâlcea and 44 cm at Craiova and 70 cm in the mountain area at Obârşia Lotrului, with an average of 29.3 cm for the area with an altitude of ≤ 600 m. The second interval with a layer of snow (19-27.III) was due to the late winter episode and its maximum thickness was between 20 cm at Caracal on 23.III and 36 cm at Polovragi on 24.III, with the average for the entire region of 24.5 cm.

*The synoptic causes* of this second late winter episode were due to the interaction of a Mediterranean Cyclone with the East-European Anticyclone, in which a particularly cold cPk air mass persisted which, interacting with the warm and humid air from above the Mediterranean Sea, created heavy snowfall in the 21 and 22.III, that formed a consistent layer of snow. The snow was accompanied by ***deposition of Saharan dust***, so that ***in Craiova the snow layer had a yellowish colour, and in the Tulcea County, orange***. It helped to smoother the snow layer more quickly by converting the solar radiation into more heat to its surface, so that although negative temperatures were recorded in the air, the snow melted rapidly.

### 3.2. Climatical conditions from April 2018

***The thermal regime.*** Monthly average air temperatures were between 12.2°C at Voineasa and 17.2°C at Dr. Tr. Severin and their deviations from the average calculated for the last century were between 4.3°C at Bechet and Caracal and 5.7°C at Drăgăşani, leading to the its classification as warm (W) for most of the region to the very warm (VW) at Dr. Tr. Severin, Bâcleş, Drăgăşani, Tg. Jiu and Rm. Vâlcea. *The monthly average air temperature for the whole region* was 15.8°C, and its deviation from normal was 4.9°C, which confirms that ”in average”, the month was warm for the entire Oltenia region. **For the whole country**, according to ANM website: "The average temperature of April 2018 had values between 1.3°C at Omu and 17.2°C at the Dr. T. Severin meteorological station. The highest values, above 16.0°C, were recorded in southern Muntenia and in the areas of Oltenia, Banat and Crişana". ”The average air temperature deviation in April 2018 compared to the median of the standard reference range (1981-2010)

in Romania was positive across the country. The highest positive deviation, 6.0°C, was recorded at the Sinaia weather station (1500 m)." It has been established that these deviations have been the highest in the last 60 years and as a result April was the warmest of the last 60 years.

In our opinion, ***April 2018 was the warmest in all the history of climate observations*** (after monthly averages and deviations from normal). We will continue to argue this statement. Statistical analysis of temperature data shows that the monthly averages recorded in April 2018 were the highest in the history of the cliff and as a result are absolute climatic records for this parameter at all weather stations.

**Table 2.** Rainfall quantities registered in the spring of 2018 (Σ) ($l/m^2$), compared with normal values (N for the period 1901-1990), deviation (Δ %) and pluviometric type according to Hellmann Criterion (CH).

| Meterological station | Hm | March 2018 | | | | April 2018 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **ΣIII** | N | Δ% | **CH** | **ΣIV** | N | Δ% | **CH** |
| Dr. Tr. Severin | 77 | 104.6 | 49.3 | 112.2 | **ER** | ***43.2*** | 56.5 | ***-23.5*** | **D** |
| Calafat | 66 | 114.8 | 38.1 | 201.3 | **ER** | 14.4 | 47.3 | -69.6 | **ED** |
| Bechet | 65 | 85.2 | 36.3 | 134.7 | **ER** | 21.8 | 48.6 | -55.1 | **ED** |
| Băileşti | 56 | 117.8 | 38.3 | ***207.6*** | **ER** | 7.6 | 49.4 | ***-84.6*** | **ED** |
| Caracal | 112 | 73.6 | 35.7 | 106.2 | **ER** | ***7.0*** | 45.1 | -84.5 | **ED** |
| Craiova | 190 | 94.7 | 31.5 | 200.6 | **ER** | 7.8 | 43.1 | -81.9 | **ED** |
| Slatina | 165 | 87.1 | 37.5 | 132.3 | **ER** | 19.0 | 47.4 | -59.9 | **ED** |
| Bâcleş | 309 | 52.3 | 43.1 | 21.3 | **R** | 12.7 | 54.5 | -76.7 | **ED** |
| Tg. Logreşti | 262 | 91.3 | 37.9 | 140.9 | **ER** | 14.4 | 49.9 | -71.1 | **ED** |
| Drăgăşani | 280 | 89.8 | 37.4 | 140.1 | **ER** | 16.2 | 40.1 | -59.6 | **ED** |
| Apa Neagră | 250 | **121.2** | 63.6 | 90.6 | **ER** | 29.3 | 76.4 | -61.6 | **ED** |
| Tg. Jiu | 210 | 88.9 | 43.8 | 103.0 | **ER** | 24.6 | 64.0 | -61.6 | **ED** |
| Polovragi | 546 | 105.0 | 50.9 | 106.3 | **ER** | 14.6 | 70.4 | -79.3 | **ED** |
| Rm. Vâlcea | 243 | 97.1 | 36.8 | 163.9 | **ER** | 16.8 | 58.5 | -71.3 | **ED** |
| Voineasa | 587 | ***40.5*** | 37.9 | 6.9 | **N** | 13.9 | 67.2 | -79.3 | **ED** |
| Parâng | 1585 | 63.7 | 53.0 | ***20.2*** | **R** | 25.2 | 86.3 | -70.8 | **ED** |
| Average Oltenia | | 89.2 | 41.9 | 112.7 | **ER** | 18 | 56.5 | -68.1 | **ED** |
| Ob. Lotrului | 1404 | 82.8 | - | - | **-** | 32.9 | - | - | **-** |
| Meterological station | Hm | May 2018 | | | | Spring 2018 | | | |
| | | **ΣV** | N | Δ% | **CH** | **ΣP** | N | Δ% | **CH** |
| Dr. Tr. Severin | 77 | 121.6 | 80.7 | 50.7 | **ER** | 269.4 | 186.5 | 44.5 | **VR** |
| Calafat | 66 | 61.6 | 60.8 | 1.3 | **N** | 190.8 | 146.2 | 30.5 | **VR** |
| Bechet | 65 | 66.2 | 58.6 | 13.0 | **LR** | 173.2 | 143.5 | 20.7 | **R** |
| Băileşti | 56 | 66.0 | 70.1 | -5.8 | **N** | 191.4 | 157.8 | 21.3 | **R** |
| Caracal | 112 | ***35.2*** | 61.4 | ***-42.7*** | **VD** | ***115.8*** | 142.2 | ***-18.6*** | **D** |
| Craiova | 190 | 58.8 | 60.6 | -3.0 | **N** | 161.3 | 135.2 | 19.3 | **R** |
| Slatina | 165 | 52.2 | 64.8 | -19.4 | **LD** | 158.3 | 149.7 | 5.7 | **N** |
| Bâcleş | 309 | 99.4 | 74.9 | 32.7 | **VR** | 164.4 | 172.5 | -4.7 | **N** |
| Tg. Logreşti | 262 | 82.8 | 73.4 | 12.8 | **LR** | 188.5 | 161.2 | 16.9 | **LR** |
| Drăgăşani | 280 | 84.4 | 69.7 | 21.1 | **R** | 190.4 | 147.2 | 29.3 | **VR** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Apa Neagră | 250 | 127.8 | 108.8 | 17.5 | **LR** | 278.3 | 248.8 | 11.9 | **LR** |
| Tg. Jiu | 210 | 147.6 | 85.3 | 73.0 | **ER** | 261.1 | 193.1 | 35.2 | **VR** |
| Polovragi | 546 | **243.2** | 103.9 | **134.1** | **ER** | **362.8** | 225.2 | **61.1** | **ER** |
| Rm. Vâlcea | 243 | 89.0 | 97.3 | -8.5 | **N** | 202.9 | 192.6 | 5.3 | **N** |
| Voineasa | 587 | 124.8 | 95.5 | 30.7 | **VR** | 179.2 | 200.6 | -10.7 | **LD** |
| Parâng | 1585 | 135.2 | 114.8 | 17.8 | **LR** | 224.1 | 254.1 | -11.8 | **LD** |
| Average Oltenia | | 99.7 | 80.0 | 24.6 | R | 206.9 | 178.5 | 15.9 | **LR** |
| Ob. Lotrului | 1404 | 181.7 | - | - | **-** | 297.4 | - | - | **-** |

(Source: data processed after ANM Archive)

The same conclusion applies to the whole of Romania and to a large part of the Northern Hemisphere. ***The monthly average for the entire Oltenia of 15.8°C is an absolute climatic record*** for the entire period of observations (1894-2018). The statistical analysis of the heat types, according to Hellmann Criterion, in April for the last 58 years (period 1961-2018), according to the average for the Oltenia region, shows that the minimum monthly averages were 7.1°C recorded in 1997, and maximum of 16.8°C recorded in 2018. The weight of April normal was 41.37%. April 2018 is the only month when some meteorological stations recorded very warm weather (5 stations, Table 3).

**Table 3.** Air temperature regime in Oltenia and minimum and maximum soil surface temperatures in April 2018 for ≤ 600 m altitude area (NIV = average temperature values for April, average temperatures in April for the period 1901-1990, MIV`18 average temperatures in April 2018, Δ = M-N = temperature deviation, CH = Hellmann Criterion)

| Meteorological station | Hm | NIV | MIV`18 | Δ=M-N | CH | Tmin air | | Tmax air | | Tmin soil | | Tmax soil | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (°C) | Date | (°C) | Date | (°C) | Date | (°C) | Date |
| Dr.Tr. Severin | 77 | 11.9 | **17.2** | 5.3 | **VW** | **1.9** | **3** | **30.2** | **23;24** | **0.6** | 3 | **57.7** | 29 |
| Calafat | 66 | 11.8 | 16.7 | 4.9 | **W** | **0.5** | **3** | **32.4** | **24** | **0.0** | 3 | **39.6** | 29 |
| Bechet | 65 | 12.0 | 16.3 | ***4.3*** | **W** | **-0.5** | **3** | **31.6** | **24** | **-0.3** | 3 | **47.4** | 26 |
| Băilești | 56 | 11.9 | 16.3 | 4.4 | **W** | **1.2** | **3** | **30.2** | **24** | **1.2** | 3 | **37.6** | 26 |
| Caracal | 112 | 11.6 | 15.9 | ***4.3*** | **W** | **0.4** | **3** | **30.2** | **26** | **1.8** | 3 | **34.6** | 26 |
| Craiova | 190 | 11.5 | 16.4 | 4.9 | **W** | **1.5** | **3** | **30.0** | **24** | **0.6** | 3 | **52.0** | 26 |
| Slatina | 165 | 11.4 | 15.9 | 4.5 | **W** | **-0.4** | **3** | **29.5** | **24** | **0.6** | 3 | **33.5** | 26 |
| Bâcleș | 309 | 10.2 | 15.7 | 5.5 | **VW** | **2.9** | **2** | **27.7** | **24** | **-** | - | **-** | - |
| Tg. Logrești | 262 | 10.3 | 14.9 | 4.6 | **W** | ***-2.7*** | **3** | **27.9** | **24** | **-2.0** | 3 | **49.6** | 24 |
| Drăgășani | 280 | 10.9 | 16.6 | **5.7** | **VW** | **2.0** | **3** | **29.7** | **24** | **2.8** | 3 | ***30.5*** | 24 |
| Apa Neagră | 250 | 10.1 | 15.0 | 4.9 | **W** | **-1.0** | **3** | **28.8** | **22** | **-0.3** | 3 | **32.4** | 29 |
| Tg. Jiu | 210 | 10.9 | 16.4 | 5.5 | **VW** | **-0.3** | **3** | **29.0** | **23** | **-0.5** | 3 | **54.0** | 26 |
| Polovragi | 546 | 10.4 | 15.0 | 4.6 | **W** | **-0.4** | **3** | ***26.3*** | **22** | ***-4.0*** | 3 | **47.5** | 26 |
| Rm. Vâlcea | 243 | 10.8 | 16.3 | 5.5 | **VW** | **1.1** | **3** | **28.3** | **24** | **1.2** | 3 | **49.6** | 24 |
| Voineasa | 587 | 7.7 | ***12.2*** | 4.5 | **W** | **-2.6** | **3** | **27.4** | **22** | **-** | - | **-** | - |
| Parâng | 1585 | - | - | - | **-** | **-3.9** | **3** | **18.5** | **26** | **-** | - | **-** | - |
| Average Oltenia | **-** | 10.9 | **15.8** | 4.9 | **W** | **-0.0** | - | **28.6** | - | **0.1** | 3 | **42.6** | |
| Ob. Lotrului | 1404 | 2.0 | 6.6 | 4.6 | **W** | **-8.4** | **3** | **20.2** | **26** | **-** | - | **-** | - |

(Source: data processed after ANM Archive)

*The April month was not excessively cold (EC), cold (CL), excessively warm (EW) and very warm (VW)* at any station. For the analysed period there were 10 cool months (CO, ie with negative deviations between -1.9 .... -1.0°C) (1969,

1979, 1980, 1981, 1982, 1984, 1987, 1988, 1991 and 2003), ie 17.24% and no month after 2003, in the symmetrical class of warmer months (WS, ie with positive deviations between 1.0 ... 1.9°C) were registered 7 months (1985, 1994, 1999, 2006, 2008 and 2009), ie 12.06% (Table 4). *In the class of cold months* (CL, with negative deviations between -4.9 ...- 2.0°C) there were recorded 3 months (1965, 1974, 1997) ie 5.17%, and in the symmetrical class of warm months (W with positive deviations between 2.0 and 4.9°C) were recorded 12 months (four times more) (1961, 1966, 1968, 1972, 1983, 1986, 1989, 2000, 2012, 2013, 2016 and 2018), ie 20.68%, which clearly shows the warming trend of April. This trend is also confirmed by the graph of monthly average values in the analysed range (Figure 2). Such evolutions of the average monthly temperature were registered at all the meteorological stations in Oltenia. ***The coldest April*** in the history of climate observations was recorded after 1990, in 1997, and the average for the entire region was 7.1°C with the highest negative deviation from the normal of -3.8°C. Also after 1990 was recorded the warmest April month in the history of climatic observations, with the highest positive deviation of 4.9°C (Table 4).

**Table 4.** Average monthly temperature values calculated for the entire region in April for Oltenia in the last 58 years (1961-2018) (N=10.9°C for the period 1901-1990, Tm= average temperature, deviation Δ=Tm-N, CH = Hellmann Criterion)

| Year | Tm | Δ | CH | Year | Tm | Δ | CH | Year | Tm | Δ | CH | Year | Tm | Δ | CH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1961** | 2.3 | 2.3 | **W** | **1976** | 0.3 | 0.3 | **N** | **1991** | 9.8 | -1.1 | **CO** | **2006** | 12.0 | 1.1 | **WS** |
| **1962** | 0.5 | 0.5 | **N** | **1977** | -0.5 | -0.5 | **N** | **1992** | 11.4 | 0.5 | **N** | **2007** | 12.5 | 1.6 | **WS** |
| **1963** | -0.5 | -0.4 | **N** | **1978** | -0.9 | -0.9 | **N** | **1993** | 10.4 | -0.5 | **N** | **2008** | 12.0 | 1.1 | **WS** |
| **1964** | 0.6 | 0.6 | **N** | **1979** | -1.0 | -1.0 | **CO** | **1994** | 11.9 | 1 | **WS** | **2009** | 12.3 | 1.4 | **WS** |
| **1965** | -3.1 | -3.1 | **CL** | **1980** | -1.2 | -1.2 | **CO** | **1995** | 10.8 | -0.1 | **N** | **2010** | 11.8 | 0.9 | **N** |
| **1966** | 2.0 | 2.0 | **W** | **1981** | -1.2 | -1.2 | **CO** | **1996** | 10.4 | -0.5 | **N** | **2011** | 11.3 | 0.4 | **N** |
| **1967** | -0.3 | -0.3 | **N** | **1982** | -2.0 | -2.0 | **CO** | **1997** | 7.1 | -3.8 | **CL** | **2012** | 13.3 | 2.4 | **W** |
| **1968** | 2.7 | 2.7 | **W** | **1983** | 2.1 | 2.1 | **W** | **1999** | 12.6 | 1.7 | **WS** | **2013** | 13.0 | 2.1 | **W** |
| **1969** | -1.3 | -1.3 | **CO** | **1984** | -1.5 | -1.5 | **CO** | **1999** | 11.7 | 0.8 | **N** | **2014** | 11.5 | 0.6 | **N** |
| **1970** | 0.9 | 0.9 | **N** | **1985** | 1.3 | 1.3 | **WS** | **2000** | 13.8 | 2.9 | **W** | **2015** | 11.1 | 0.2 | **N** |
| **1971** | -0.4 | -0.4 | **N** | **1986** | 2.4 | 2.4 | **W** | **2001** | 10.8 | -0.1 | **N** | **2016** | 14.0 | 3.1 | **W** |
| **1972** | 2.4 | 2.4 | **W** | **1987** | -1.2 | -1.2 | **CO** | **2002** | 10.3 | -0.6 | **N** | **2017** | 10.7 | -0.2 | **N** |
| **1973** | -0.5 | -0.5 | **N** | **1988** | -1.3 | -1.3 | **CO** | **2003** | 9.7 | -1.2 | **CO** | **2018** | 15.8 | 4.9 | **W** |
| **1974** | -2.3 | -2.3 | **CL** | **1989** | 2.5 | 2.5 | **W** | **2004** | 11.5 | 0.6 | **N** | | | | |
| **1975** | 0.7 | 0.7 | **N** | **1990** | 10.9 | 0 | **N** | **2005** | 10.8 | -0.1 | **N** | | | | |

(Source: data processed after ANM Archive)

This shows that climatic warming causes the climatic extremes to be outdated in both directions, and in the relatively short period of systematic climatic observations (1894-2018), the true variations of climate parameters have not been recorded. In April 2018, starting on 3.IV, the daily maximums have passed 20.0°C, after 10.IV they have exceed 25.0°C; starting with 24.IV, they have reached and exceeded 30.0°C. *The graphs of the air temperature characteristics* (the average of the daily minima for the whole region, the daily average and the daily average

maxima) had rapidly increasing trends, and among them the fastest rising temperature was the maximum temperature (Figure 3). Summer and tropical days were recorded. Warming up in the spring of 2018 was a continuous process from 1.III to 5.V when the thermal maxima of May were recorded. *Monthly minimum temperature* were recorded with one exception on 3.IV and ranged between -2.7°C at Tg. Logreşti and 2.9°C at Bâcleş, and their average for the whole region was 0.0°C. The date of 3.IV.2018 was the only day with hoarfrost of local character in the morning, but which had destructive effects on the fruit trees to which some species were blooming.

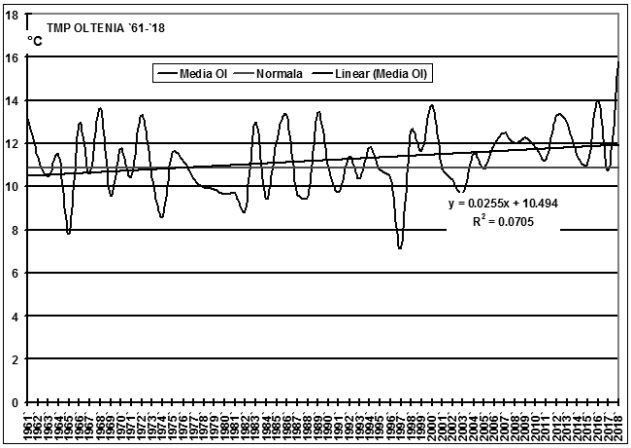


**Fig. 2.** Monthly mean temperature variation for the entire Oltenia region in April between 1961-2018. (Source: data processed after ANM Archive)

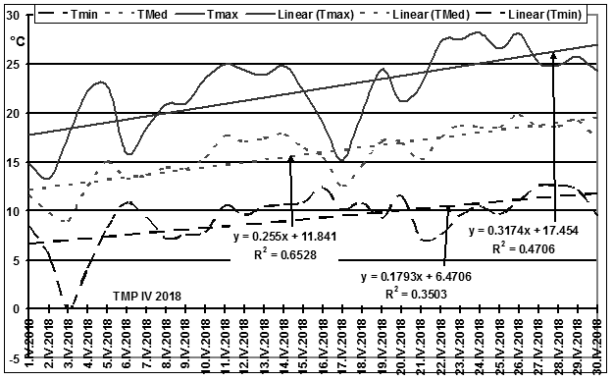


**Fig. 3.** The variation of the parameters that characterize the air temperature in April 2018 in Oltenia (average of the daily minimum, mean and maximum values calculated for the entire region) (Source: data processed after ANM Archive).

*On the soil surface the temperature minima* were recorded on 3.IV and were between -4.0°C at Polovragi and 2.8°C at Drăgășani, and their average for the entire region was 0.1°C. Locally appeared low frost. *The soil surface temperature maxima* were recorded in the last pentad on 24, 26 and 29.IV and were between 30.5°C at Drăgășani and 57.7°C at Dr. Tr. Severin and their average for the entire region was 42.6°C.

***The pluviometric regime of April***

Monthly precipitations ranged from 7.0 mm in the Romanați Plain at Caracal and 43.2 mm in the extreme West of Oltenia at Dr. Tr. Severin, and their percentage deviations from multiannual averages were -84.6% at Băileşti in the Oltenia Plain and -23.5% at Dr. Tr. Severin, leading to classifications of the pluviometric types according to Hellmann Criterion as droughty (D) in a restricted area of Dr. Tr. Severin to excessively droughty (ED) in Oltenia (Table 2).

### 3.3. Climatical conditions from May 2018

***Thermal regime of May.*** *Monthly air temperature averages* were between 14.4°C at Voineasa and 20.3°C at Dr. Tr. Severin and their deviations from normal were between 2.0°C at Bechet and 3.2°C at Dr. Tr. Severin determining classification thermal types as warm (W) in Oltenia (Table 5). The average of May for the whole region was 18.5°C and its deviation from the normal was 2.5°C, confirming that May was warm throughout Oltenia. The analysis of the monthly temperature averages over the last 58 years (1961-2018) for the meteorological station in Craiova located in the central part of Oltenia shows that the extremes of the monthly average were recorded after 1990, ie the minimum average of 13.8°C was registered in 1991, the maximum monthly average of 20.4°C (the only average ≥ 20.0°C) in 2003 (Table 6). The months' analysis according to the thermal type shows that excessively cold (EC), very cold (VC), excessively warm (EW) and very warm months (VW) did not occur in May in any year. The number of cold months (CL) (with deviations from normal between -4.9 .... 2.0°C) was 7 (produced in the years: 1964, 1970, 1974, 1978, 1980, 1987, 1991), with a frequency of 12.06%, and six of these occurred before 1990. The last cold month was recorded in 1991, which shows a ***more pronounced warming trend in May after 1991***. *The symmetrical class of the warm months (W)* (with deviations from normal between 2.0 ... 4.9°C) had a number of 8 (produced in the years: 1968, 1969, 1985, 1996, 2002, 2003, 2013 and 2018), ie with a frequency of 13.79 %, of which 5 after 1990, which confirms the above conclusion. *The cold months (CO)* (with deviations from normal between -1.9 .... 1.0°C) were in a number of 10 (produced in the years: 1961, 1965, 1976, 1981, 1989, 1992, 1995, 2004, 2014 and 2016), ie with a frequency of 17.24%, of which 5 were before 1990 and 5 after

(perfect symmetry). *The symmetrical class of the warmish (WS)* (with deviations from normal between 1.0 ... 1.9°C) had a number of 6 (produced in the years: 1983, 1986, 1997, 2000, 2007, 2015) of these occurred after 1990, which also confirms for this class the conclusion above. The normal thermal class (N) (with deviations from normal between -0.9 ... + 0.9°C) had a number of 27 months, ie at a frequency of 46.55%.

For the entire analysed range (1961-2018), the space-time expansion of warm time in April was 33.9%, the normal of 43.6% and the cold of 22.5%, which shows a net predominance of warm time thus confirming the warming trend. The monthly average of 19.4°C recorded at Craiova in May 2018 is the same as in 1989 and the second in descending order after the maximum of 20.4°C in 2003. *The graph of the monthly average air temperature variation* at the meteorological station at Craiova for the period 1961-2018 (58 years) shows an increasing trend (Figure 4), which confirms climate warming in May.

**Table 5.** Air temperature regime in Oltenia and minimum and maximum soil surface temperatures in May for the ≤ 600 m altitude area (NV= average temperature values for May, for the period 1901-1990, MV`18= average temperatures in May 2018, Δ=M-N = temperature deviation, CH = Hellmann Criterion)

| Meterological Station | Hm | NV | MV`18 | Δ=M-N | CH | Tmin air | | Tmax air | | Tmin soil | | Tmax soil | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (°C) | Date | (°C) | Date | (°C) | Date | (°C) | Date |
| Dr.Tr. Severin | 77 | 17.1 | **20.3** | **3.2** | **W** | **9.9** | 18 | **32.5** | 5 | **9.0** | 18 | **59.9** | **9** |
| Calafat | 66 | 17.3 | 19.8 | 2.5 | **W** | **10.2** | 9 | **32.5** | 5 | **11.8** | 2 | **43.4** | **5** |
| Bechet | 65 | 17.5 | 19.5 | ***2.0*** | **W** | **7.2** | 2 | **32.6** | 5 | **9.3** | 2 | **48.7** | **4** |
| Băileşti | 56 | 17.4 | 19.6 | 2.2 | **W** | **8.2** | 9 | **30.8** | 5 | **9.7** | 9 | **41.1** | **5** |
| Caracal | 112 | 17.1 | 19.4 | 2.3 | **W** | **10.7** | 14 | **31.0** | 31 | **12.8** | 2 | **41.1** | **4** |
| Craiova | 190 | 17.0 | 19.4 | 2.4 | **W** | **10.0** | 20 | **30.7** | 5 | **10.4** | 14 | **57.0** | **31** |
| Slatina | 165 | 16.9 | 19.0 | 2.1 | **W** | **9.3** | 18 | **30.2** | 5 | **11.4** | 13 | **36.9** | **31** |
| Bâcleş | 309 | 15.5 | 18.2 | 2.7 | **W** | **10.5** | 20 | ***28.6*** | 5 | **-** | - | **-** | **-** |
| Tg. Logreşti | 262 | 15.3 | 17.5 | 2.2 | **W** | **6.1** | 18 | **29.6** | 5 | **6.5** | 18 | **54.2** | **31** |
| Drăgăşani | 280 | 15.8 | 18.9 | 3.1 | **W** | **9.3** | 20 | **29.9** | 5 | **12.6** | 14 | ***32.9*** | **5** |
| Apa Neagră | 250 | 15.1 | 17.4 | 2.3 | **W** | **6.9** | 20 | **29.6** | 5 | **8.2** | 8 | **34.6** | **5** |
| Tg. Jiu | 210 | 15.9 | 18.5 | 2.6 | **W** | **7.4** | 18 | **31.5** | 5 | **7.0** | 20 | **58.2** | **5** |
| Polovragi | 546 | 14.3 | 16.6 | 2.3 | **W** | **6.2** | 17 | **28.8** | 5 | ***4.1*** | 17 | **53.2** | **5** |
| Rm. Vâlcea | 243 | 15.4 | 18.6 | 3.2 | **W** | **8.8** | 17 | **31.5** | 5 | **9.6** | 18 | **51.0** | **31** |
| Voineasa | 587 | 12.1 | ***14.4*** | 2.3 | **W** | ***4.6*** | 18 | **28.7** | 5 | **-** | - | **-** | **-** |
| Parâng | 1585 | - | - | - | **-** | **4.0** | 17 | **19.4** | 31 | **-** | - | **-** | **-** |
| Average Oltenia | **-** | 16.0 | 18.5 | 2.5 | **W** | **8.1** | - | **29.9** | - | **9.4** | - | **47.1** | **-** |
| Ob. Lotrului | 1404 | 7.2 | 9.6 | 2.4 | **W** | **-0.5** | 17 | **21.7** | 1;2 | **-** | - | **-** | **-** |

(Source: data processed after ANM Archive)

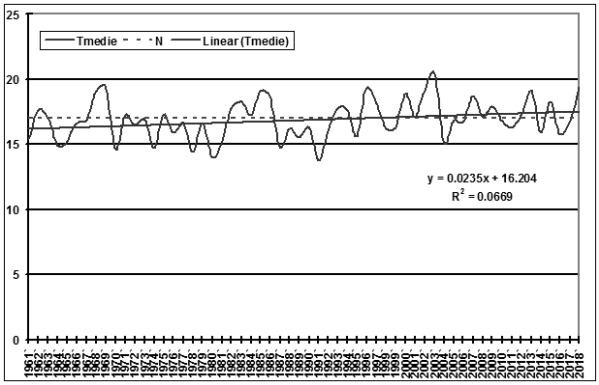


**Fig. 4.** The average monthly air temperature variation in May in Craiova for the period 1961-2018 (Source: data processed after ANM Archive)

Increasing trends and similar conclusions present the analysis of temperature data at each meteorological station, reinforcing the aforementioned. All this shows that May 2018 was particularly warm in terms of monthly average temperatures, although no exceptional temperature maxima were recorded and the process of warming continued. *Monthly air temperature maxima* were recorded atypically in the first pentad of the month on 5.V.2018 (only 2 values on 31.V) and ranged between 28.6°C at Bâcleş and 32.6°C at Bechet, and their average for the entire region was 29.9°C (Table 6).

**Table 6.** Average monthly temperature values in May at Craiova in the last 58 years (1961-2018) (N=17.0°C for the period 1901-1990, Tm= average temperature, Δ=Tm-N deviation, CH = Hellmann Criterion)

| Year | Tm | Δ | CH | Year | Tm | Δ | CH | Year | Tm | Δ | CH | Year | Tm | Δ | CH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1961** | 15.4 | -1.6 | **CO** | **1976** | 15.9 | -1.1 | **CO** | **1991** | ***13.8*** | -3.2 | **CL** | **2006** | 16.7 | -0.3 | **N** |
| **1962** | 17.6 | 0.6 | **N** | **1977** | 16.6 | -0.4 | **N** | **1992** | 16.0 | -1 | **CO** | **2007** | 18.7 | 1.7 | **WS** |
| **1963** | 17.0 | 0.0 | **N** | **1978** | 14.4 | -2.6 | **CL** | **1993** | 17.8 | 0.8 | **N** | **2008** | 17.1 | 0.1 | **N** |
| **1964** | 14.9 | -2.1 | **CL** | **1979** | 16.6 | -0.4 | **N** | **1994** | 17.6 | 0.6 | **N** | **2009** | 17.9 | 0.9 | **N** |
| **1965** | 15.2 | -1.8 | **CO** | **1980** | 14.0 | -3.0 | **CL** | **1995** | 15.6 | -1.4 | **CO** | **2010** | 16.8 | -0.2 | **N** |
| **1966** | 16.6 | -0.4 | **N** | **1981** | 15.2 | -1.8 | **CO** | **1996** | 19.3 | 2.3 | **W** | **2011** | 16.3 | -0.7 | **N** |
| **1967** | 16.9 | -0.1 | **N** | **1982** | 17.8 | 0.8 | **N** | **1997** | 18.1 | 1.1 | **WS** | **2012** | 17.2 | 0.2 | **N** |
| **1968** | 19.1 | 2.1 | **W** | **1983** | 18.3 | 1.3 | **WS** | **1999** | 16.2 | -0.8 | **N** | **2013** | 19.1 | 2.1 | **W** |
| **1969** | 19.4 | 2.4 | **W** | **1984** | 17.2 | 0.2 | **N** | **1999** | 16.3 | -0.7 | **N** | **2014** | 15.9 | -1.1 | **CO** |
| **1970** | 14.6 | -2.4 | **CL** | **1985** | 19.1 | 2.1 | **W** | **2000** | 18.9 | 1.9 | **WS** | **2015** | 18.3 | 1.3 | **WS** |
| **1971** | 17.2 | 0.2 | **N** | **1986** | 18.7 | 1.7 | **WS** | **2001** | 17.1 | 0.1 | **N** | **2016** | 15.8 | -1.2 | **CO** |
| **1972** | 16.5 | -0.5 | **N** | **1987** | 14.8 | -2.2 | **CL** | **2002** | 19.1 | 2.1 | **W** | **2017** | 16.8 | -0.2 | **N** |
| **1973** | 16.9 | -0.1 | **N** | **1988** | 16.2 | -0.8 | **N** | **2003** | **20.4** | 3.4 | **W** | **2018** | 19.4 | 2.4 | **W** |
| **1974** | 14.7 | -2.3 | **CL** | **1989** | 15.5 | -1.5 | **CO** | **2004** | 15.1 | -1.9 | **CO** | | | | |
| **1975** | 17.3 | 0.3 | **N** | **1990** | 16.3 | -0.7 | **N** | **2005** | 16.8 | -0.2 | **N** | | | | |

(Source: data processed after ANM Archive)

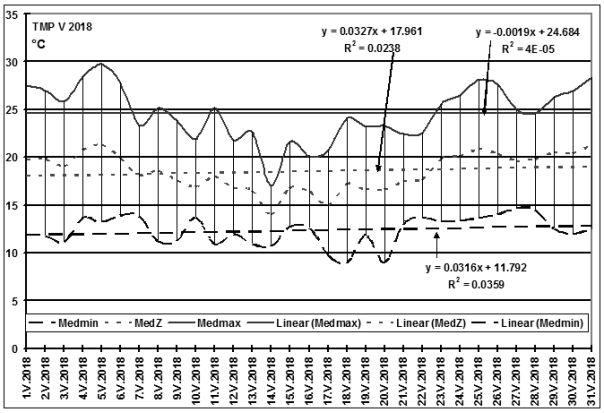


**Fig. 5.** The variation of the parameters that characterize the air temperature in May 2018 in Oltenia (the average of the daily minimums, the daily average and the average of the daily peaks calculated for the whole region) (Source: data processed after ANM Archive).

***Monthly air temperature minima*** were recorded on 2, 9, 14, 17, 18 and 20.V and were between 4.6°C at Voineasa and 10.7°C at Caracal, and their average for the entire region was 8.1°C. *The charts of air temperature parameters* (daily average minima for the entire region, daily average, and daily average maxima) had slightly increasing trends for daily average and minima, and daily average maxima were very slightly decreasing due to the maximum values recorded in 5.V (Figure 5).

*At soil surface, the temperature minima* were recorded on 2, 9, 13, 14, 17, 18 and 20.V, and were between 4.1°C at Polovragi and 12.8°C at Caracal, and their average for the entire region was 9.4°C. The temperature maxima of the soil surface were recorded on 4, 5, 9 and 31.V, and were between 32.9°C at Drăgăşani and 59.9°C at Dr. Tr. Severin and their average for the entire region was 47.1°C.

***The pluviometric regime of May 2018***

Monthly precipitation quatities ranged from 35.2 mm at Caracal in the Romanați Plain and 243.2 mm at Polovragi, and their percentage deviations from normal were between -42.7% at Caracal and 134.1% at Polovragi determining the classification of the thermal types from very droughty (VD) at Caracal to exceptionally rainy at Dr. Tr. Severin, Tg. Jiu and Polovragi (Table 2). The average of rainfall quantities for the entire region was 99.7 mm, and its percentage deviation from normal was 24.6%, ie, "in average" for the entire region in May was rainy (R).

### 3.4. Seasonal climatical characteristics for the spring of 2018

*The seasonal average air temperatures* were between 9.8°C at Voineasa and 14.1°C at Dr. R. Severin and their deviations from normal were between 1.6°C

at Băileşti in Oltenia Plain and 2.6°C in the Olt Corridor at Drăgăşani and Rm. Vâlcea, and in the mountain area at Ob. Lotrului 2.7°C, leading to the classification as warm spring (W) in most of Oltenia and very warm (VW) in the Olt Corridor and in the mountain area. *The average annual temperature* for the Oltenia region was 12.6°C, and its deviation from the normal of 2.1°C confirming the average warm spring feature for the whole region.

*The annual precipitation quantities* ranged from 115.8 mm at Caracal and 362.8 mm at Polovragi, and their percentage deviations ranged between -26.4% at Caracal and 61.1% at Polovragi, resulting in classifications of pluviometric types from the droughty (D) in the Romanați Plain to excessively rainy (ER) in the Polovragi Subcarpathian Depression (Table 7).

**Table 7.** Overall thermal and pluviometric regime for the spring of 2018 (Hm= altitude of meteorological station, P2018= average temperature values for the spring of 2018 (°C), NtP= normal values for the spring average temperatures (°C), Δ = P-N = deviation from the normal (°C), SP2018= sum of precipitaions for the spring of 2018 (l/m$^2$), NP = normal spring precipitation values (l/m$^2$), Δ = S-N= abaterile față de normală (l/m$^2$), Δ% = percentage deviation from the normal, CrH= Hellmann Criterion).

| Meteorological Station | Hm | Thermal regime (°C) | | | | Thermal regime (°C) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **NtP** | **P**2018 | Δ=P-N | CrH | SP2018 | NP | **Δ=S-N** | Δ% | **CrH** |
| Dr. Tr. Severin | 77 | 11.6 | **14.1** | 2.5 | **W** | 269.4 | 186.5 | 82.9 | 44.5 | **VR** |
| Calafat | 66 | 11.6 | 13.5 | 1.9 | **W** | 190.8 | 146.2 | 44.6 | 30.5 | **VR** |
| Bechet | 65 | 11.6 | 13.3 | 1.7 | **W** | 173.2 | 143.5 | 29.7 | 20.7 | **R** |
| Băileşti | 56 | 11.6 | 13.2 | ***1.6*** | **W** | 191.4 | 157.8 | 33.6 | 21.3 | **R** |
| Caracal | 112 | 11.2 | 13.0 | 1.8 | **W** | ***115.8*** | 142.2 | ***-26.4*** | ***-18.6*** | **S** |
| Craiova | 190 | 11.2 | 13.2 | 2.0 | **W** | 161.3 | 135.2 | 26.1 | 19.3 | **R** |
| Slatina | 165 | 11.1 | 12.8 | 1.7 | **W** | 158.3 | 149.7 | 8.6 | 5.7 | **N** |
| Bâcleș | 309 | 10.1 | 12.3 | 2.2 | **W** | 164.4 | 172.5 | -8.1 | -4.7 | **N** |
| Tg. Logrești | 262 | 9.7 | 11.9 | 2.2 | **W** | 188.5 | 161.2 | 27.3 | 16.9 | **LR** |
| Drăgășani | 280 | 10.5 | 13.1 | **2.6** | **W** | 190.4 | 147.2 | 43.2 | 29.3 | **VR** |
| Apa Neagră | 250 | 9.8 | 11.7 | 1.9 | **W** | 278.3 | 248.8 | 29.5 | 11.9 | **LR** |
| Tg. Jiu | 210 | 10.5 | 13.0 | 2.5 | **W** | 261.1 | 193.1 | 68.0 | 35.2 | **VR** |
| Polovragi | 546 | 9.2 | 11.4 | 2.2 | **W** | **362.8** | 225.2 | **137.6** | **61.1** | **ER** |
| Rm. Vâlcea | 243 | 10.4 | 13.0 | **2.6** | **VW** | 202.9 | 192.6 | 10.3 | 5.3 | **N** |
| Voineasa | 587 | 7.4 | ***9.8*** | 2.4 | **W** | 179.2 | 200.6 | -21.4 | -10.7 | **LD** |
| Parâng | 1585 | | | | | 224.1 | 254.1 | -30.0 | -11.8 | **LD** |
| Average Oltenia | - | 10.5 | 12.6 | 2.1 | **W** | 206.9 | 178.5 | 28.4 | 15.9 | **LR** |
| Ob. Lotrului | 1404 | 2.3 | 5.0 | 2.7 | **VW** | 297.4 | | | | |

(Source: data processed after ANM Archive)

## CONCLUSIONS

The spring of 2018 was warm and on average rainy. Extreme thermal variations have been recorded, from cold winter days with snow cover and thermal minima, to which a thermal record that was recorded in March, with warm summer

and tropical days in all months. Although no exceptionally high thermal maxima were recorded, after the exceptionally high monthly averages, ***April was the warmest in the history of climatic observations,*** with deviations from normal between 4.3°C at Bechet and Caracal and 5.7°C at Drăgăşani, which is ***an absolute climatic record***. The mean deviation for the entire region was 4.9°C, that is, only 0.1°C under the very warm month feature on average for the whole region. The thermal regime for April 2018, due to large deviations from normal of the air temperature, is ***an absolute climatic record for the whole country*** and not only.

The month was warm with deviations from normal between 2.0°C at Bechet and 3.2°C at Dr. Tr. Severin and the average deviation for the entire region was 2.5°C, being the second month of the last 60 years after May 2003. The statistical processing shows that after 1990 the climatic warming of the spring increased, prevailing warm months. Although at the end of February (22.II-1.III) and in the last decade of March (19-26.III) there were two short episodes of winter, the coming of spring was a bit early on average for the whole region (the coming of spring indexes ranged between 211.9 at Voineasa and 388.2 at Dr. Tr. Severin), but it was early in the Olt Corridor, in the Subcarpathian and Intramontan Depressions. The spring was warm on average for the entire region and only March was cool. The pluviometric regime was very variable from excessively droughty in April to excessively rainy in March and rainy in May, which kept the ground water reserve at an average near optimum but with a significant decline at the end of April and early May, affecting cereal crops and delaying the springing of other spring crops. Climatic warming and exceptional variability have resonated with these processes throughout the European continent. All these alternate climatic processes, which are particularly severe climatic risks to agricultural crops and to the environment in general, occurred in the absence of the El Ninõ climate process and during a calm of solar activity, which reinforces and supports the idea that global warming owes much to the impact of human activity on the atmosphere and the environment.

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