

# CONSIDERATION ON THE CLIMATIC VARIABILITY IN OLTENIA IN THE AUTUMN OF 2013

*MARINICĂ ANDREEA FLORIANA*<sup>1</sup>, *MARINICĂ I.*<sup>2</sup>

**ABSTRACT.** Consideration on the climatic variability in Oltenia in the autumn of 2013. In the autumn of 2013, in Oltenia, weather evolution has been marked by an exceptional variability with fast transitions from a warm weather to an extremely cold and even excessively cold in some intervals and from an excessively rainy weather to a droughty weather. These fast transitions from one extreme to another of weather aspect are due to the increase of climatic variability, an aspect which is directly connected to climatic global warming. After the warmish summer of 2013, in the end of August, beginning with August 24, a cooling process has begun which has slowly continued during the whole month of September and has strengthened in the last two days. The cooling climax was registered in the interval October 4-5, when negative thermal minimum values were registered, frost in the air and ground and early hoarfrosts which affected crops, especially the vegetable crops. In November the high daily air temperature means led to gradual enforcements, and in the end of the month the autumn crops were in advanced development stages, and in rape the floral stems and studs appeared. The intense weather cooling and snowfalls were registered in the interval November 26-28 2013 which constituted a serious climatic hazard, surprising the unadapted crops to the intense weather cooling. The snow layer reached 22 cm in Caracal in Romanați Plain. The analysis of the climatic conditions in the south-west of Romania in the autumn of 2013 is a continuation of some extended studies on climate variability. The paper is useful to specialists, doctoral candidates and master graduates and to all people interested in the climate's evolution (Bogdan, Marinică, 2007, Marinică et al. 2012, 2013, Sandu et al. 2012).

**Keywords:** precipitation excess, weather intense cooling, early hoarfrosts.

## 1. INTRODUCTION

In the summer of 2013 weather was warmish and marked by *three heat waves* in the intervals: June 17-23, July 24-30 and August 2-14, which amounted a total of 27 days. In the end of each summer month intense weather cooling occurred, which decreased the monthly means: June 24-30, July 30-31 and August 26-31 which has slowly continued during September, superposing with a normal climate cooling, strengthening it, and reaching the climax in the interval October 4-5 2013.

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<sup>1</sup>KlimaCampus, Hamburg, Germany  
e-mail: andreea@gmail.com

<sup>2</sup>National Meteorological Administration, Regional Meteorological Center Oltenia, Craiova, Romania  
e-mail: ionmarinica@yahoo.com

*The droughty intervals* were interrupted by short intervals in which mainly light rainfalls were registered, and on restricted areas significant and even abundant quantities of precipitation were registered. The atypical weather during the winter, spring and summer of 2013 continued in the autumn too. We will further analyze these significant climate variations, the effects and the causes of their occurrence.

## **2. CLIMATIC CHARACTERISTICS OF SEPTEMBER 2013**

### **2.1 The thermal regime of September 2013**

*The monthly temperature means* were comprised between 11.7°C in Voineasa and 18.0°C in Calafat, and their deviations from the monthly multiannual means (calculated for the interval 1901-1990) were comprised between -1.9°C in Tg. Logrești and -0.2°C in Bechet, determining according to Hellmann criterion classifications of pluviometric time type from little droughty in Voineasa and to excessively rainy in most of the meteorological cool in Getic Piedmont in Slatina, in the south limit of Gorj Hills in Tg. Logrești, in Subcarpathians and in the mountains (Parâng) and normal in most part of Oltenia.

*The monthly maximum thermal values* were comprised between 24.1°C registered in Voineasa on September 1 and 31.8°C in Calafat on September 12. Most of the monthly maximum thermal values were registered on 1 September, and in Oltenia Plain on September 12.

*The monthly minimum air temperature values* were comprised between 2.3°C in Tg. Logrești and Parâng registered in the beginning of the second decade of the month, on September 21 and 8.9°C in Dr. Tr. Severin and Bechet registered on the same date.

*The monthly maximum ground surface temperature values* were comprised between 40.2°C in Polovragi registered on September 9 and 57.4°C in Calafat on September 1. *The monthly minimum ground surface temperature values* were comprised between 1.7°C in Plovragi and 7.5°C in Dr. Tr. Severin and Calafat and were generally registered on the same date as the ones of the air temperature. *Five weather cooling intervals* were registered: September 3, September 5-6, September 13-14, September 18-21 and September 28-30, and this last cooling continued in October reaching the climax in the interval October 4-5.

### **2.2. Pluviometric regime of September 2013**

The monthly quantities of precipitation were comprised between 46.4 l/m<sup>2</sup> in Calafat in the south-west of the region and 157.2 l/m<sup>2</sup> in Drăgășani in Olt Couloir. In seven meteorological stations (of 16) the monthly quantities of precipitation exceeded 100 l/m<sup>2</sup>. *The percentage deviations from the multiannual means* were comprised between -12.0% in Voineasa (the only station with a negative deviation) and 212.5% in Drăgășani, determining according to Hellmann criterion classifications of pluviometric time type from little droughty in Voineasa and to excessively rainy in most of the meteorological stations. *The general precipitation mean* for the entire region was 97.0 l/m<sup>2</sup>, and its percentage deviation

from the multiannual mean was 105.2% designating an exceedingly rainy month for the entire region.

Overall, 10 days with precipitation were registered, of which two days with average precipitation for the entire region of 32.5 l/m<sup>2</sup> and 37.4 l/m<sup>2</sup>, namely on 29 and 30 September. The precipitation registered in these two excessively rainy days caused an excess of humidity in ground, and the moderate precipitation during most part of the month and the temperature close to normal allowed the development of agricultural works and the setting up of autumn crops in very good conditions.

In the interval September 29-30 the quantities of precipitation were comprised between 36.5 l/m<sup>2</sup> in Voineasa and 126.8 l/m<sup>2</sup> in Drăgășani being the highest registered in the autumn of 2013 and representing normal percentage values of September comprised between 66.2% in Voineasa and 266.7% in Slatina.

*The maximum quantity of precipitation registered in 24 hours* was of 75,2 l/mp in Drăgășani, on September 30.

*Synoptic causes of exceedingly precipitation* in the last two days of September. The precipitation was caused by a Mediterranean Cyclone with a transbalkan evolution, on Vc trajectory. This was very fast formed in the interval September 29, 2013 at 12 UTC - September 29, 2013 at 18 UTC in the Genova Gulf.

As a consequence of these quantitatively important rains registered in the last two days of the month, in most part of the region water ground reserve was restored, and on October 1, 2013, the water supply in the ground layer of 0-20 cm, land fell within close to optimum limits, in the northern half of the region, satisfactory values in the median part, and in the south-east of Oltenia humidity deficits in the ground were registered, the pedological drought being moderate and strong on a restricted area (Caracal-Bechet-Corabia-Turnu Măgurele).

### **3. CLIMATIC CHARACTERISTICS OF OCTOBER 2013**

#### **3.1 The thermal regime of October 2013.**

*The monthly air temperature means* were comprised between 8.1°C in Voineasa and 12.4°C in Dr. Tr. Severin, and their deviations from the monthly multiannual means were comprised between -0.5°C in Bechet in the south of Oltenia Plain and 1.1°C in Rm. Vâlcea. The classifications of the type of thermal time in October indicates a normal thermal month in most part of the region excepting a restricted area in Olt Couloir in Rm. Vâlcea where it was warmish, and in the mountainous area it was warm. *The air temperature mean* calculated for the entire region was 10.9°C, and its deviation from the multiannual mean was 0.5°C, which confirms the classification of normal thermal month for the entire region. *The highest daily temperature means* were registered on 11 and October 23 when the means for the entire region exceeded 14.0°C (14.9°C on 11 and 14.6°C on October 23). *The minimum air temperature values* were negative in most of the meteorological stations and were comprised between -4.5°C in Voineasa and 0.4°C in Băcșan and were registered in most of them on October 5.

The maximum air temperature values were mainly  $\geq 25.0^{\circ}\text{C}$  and were comprised between  $22.9^{\circ}\text{C}$  in Polovragi and  $26.4^{\circ}\text{C}$  in Bechet, and their monthly mean was  $24.5^{\circ}\text{C}$ . These were registered in the beginning of the second decade and in the third decade, thus confirming the ascending trend of the temperature. The monthly minimum ground surface temperature values were comprised between  $-4.7^{\circ}\text{C}$  in Polovragi and  $+1.6^{\circ}\text{C}$  in Dr. Tr. Severin (the only positive minimum value). The monthly minimum temperature mean in the ground surface was  $-2.2^{\circ}\text{C}$ .

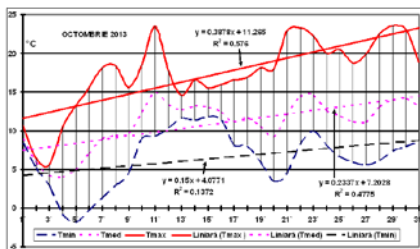
**The monthly minimum ground surface temperature values on 5 October, which constitutes a climatic anomaly** since it would have been normal that the monthly minimum air temperature values be registered in the last decade (or five days) of the month, as a consequence of the gradual weather cooling.

The monthly maximum ground surface temperature values were comprised between  $25.5^{\circ}\text{C}$  in Slatina registered on October 12 and  $35.8^{\circ}\text{C}$  in Dr. Tr. Severin registered on October 23. Most of the maximum ground surface temperatures values were registered on 12 and October 13, and in the central part of the region in Craiova on October 31. The monthly maximum temperature mean in the ground surface was  $31.2^{\circ}\text{C}$ , which means a higher value than the multiannual mean.

**As climatic hazard phenomena, we mention the early and intense hoarfrost** associated with negative minimum temperatures registered in the interval October 4-7. Hoarfrost on restricted areas occurred on October 8. This hoarfrost

totally damaged vegetable crops, causing significant damages for the agriculture.

Overall the thermal normal air regime in most part of the month associated with significant precipitation from agricultural point of view and the registration of high air and ground surface temperature (excepting the interval October 4-7 2013) led to the **prolongation of the optimum time<sup>3</sup> for seeding autumn crops.**



**Fig. 1. Variation of the general mean for the entire region, of the daily minimum, average and maximum temperature values in October 2013.**

Charts of the air temperature variation (daily minimum, average, maximum temperature value) indicate linear ascending trends, which is still **a climatic anomaly** since once with the decreasing of day time, in October, it is normal to decrease the air temperature too (Fig. 1). After the interval October 1-5 of intense weather cooling, a long interval of weather warming came next 6-30 October in which the maximum thermal values often exceeded  $20^{\circ}\text{C}$  and only in the last day a cooling process occurred.

<sup>3</sup> From a calendar point of view, the optimum period for setting up autumn crops is until 25 October, and after this date the setting up of crops is recommended only if the ground temperature mean is comprised between  $10-13^{\circ}\text{C}$

### 3.2. Pluviometric regime of October 2013.

*The monthly quantities of precipitation* registered in October at the meteorological stations in Oltenia were comprised between 28.3 l/m<sup>2</sup> in Caracal in Romanați Plain and 101.0 l/m<sup>2</sup> in Polovragi in the area of Subcarpathian Depressions, and their percentage deviations from the multiannual means were comprised between -15.5% in Calafat and 51.2% in Rm. Vâlcea, determining the criterion classifications of pluviometric time type between little droughty in the west of Strehaia Plateau (Dr. Tr. Severin), in the south-west of Oltenia Plain (Calafat), in Oltenia Plain in Băilești, in Romanați Plain in Caracal, in Strehaia Piedmont in Bâcleș, in Subcarpathian Depression in Apa Neagră and excessively rainy in Olt Couloir in Rm. Vâlcea in the southern limit of Vâlcea Subcarpathians.

*The monthly precipitation mean* was comprised between was 60.9 l/m<sup>2</sup>, and its percentage deviation from the multiannual mean was 12.9% designating a little rainy month overall for the entire region.

*The number of days with precipitation* was comprised between 7 days in Voineasa and Slatina and 11 days in Dr. Tr. Severin, Băilești and Polovragi. *Number of days with precipitation  $\geq 15$  l/m<sup>2</sup>* was comprised between 0 in Dr. Tr. Severin, Caracal, Craiova, Bechet and Băilești, 1 in Voineasa and Apa Neagră, and 2 in most part of Getic Piedmont and in Southcarpathians. *Daily precipitation  $\geq 20$  l/m<sup>2</sup>* was registered in Apa Neagră in one single day (on October 16), 2 days in the area of hills, in Subcarpathians and in the mountains (1 and October 16). *The maximum quantity of precipitation* registered in 24 hours was 73.0 l/mp in Berislăvești (Vâlcea County on October 16). *Water reserve on October 30, 2013*, in the ground layer of 0-20 cm, in autumn wheat crop, had satisfactory values and close to optimum limits, in most of the crop areas.

## 4. CLIMATIC CHARACTERISTICS OF NOVEMBER 2013

### 4.1. The thermal regime of November 2013.

*The monthly temperature means* were comprised between 5.9°C in Voineasa and 9.0°C in Dr. Tr. Severin, and their deviations from the multiannual means were comprised between 2.0°C in Calafat and 3.7°C in Voineasa determining the classification of thermal time type of warm in all meteorological stations in Oltenia. *The highest daily temperature means* were registered on 1, 4 and November 5 when the means for the entire region reached and exceeded 12.0°C (12.0°C on 1, 13.2°C on 4 and 14.3°C on October 5). *The lowest daily temperature means* were registered on November 30 when the monthly minimum thermal values were registered and the general mean for the entire region was extremely low (-1.8°C).

*The maximum air temperature values* were mainly  $\geq 20.0^\circ\text{C}$  and were comprised between 19.8°C in Polovragi and 26.6°C in Calafat, and their monthly mean was 21.5°C. These were registered in the beginning of the first decade and

some in its penultimate day, confirming the continuation of an ascending trend, of air temperature registered in October.

Overall the thermal regime of warm air associated with significant precipitation from agricultural point of view and the registration of high air and ground surface temperature (excepting the interval November 26-30 2013) led to the *prolongation of the optimum time for seeding autumn crops and significant gradual enforcement which produced the spectacular development of the seeded ones in the optimum period*. Thus, in the end of November the rape had in general 7-14 leaves and a reduced number of plants had developed floral stems and formed floral buttons. The wheat crop was developed, the plants having a height close to the one in the end of March. Three weather cooling intervals were registered: November 7-10, November 16-19, November 26-30, and the thermal regime specific to the first part of December appeared beginning with November 26.

#### **4.2. Pluviometric regime of November 2013.**

*The monthly quantities of precipitation* were comprised between 31.9 l/m<sup>2</sup> in Calafat and 93.1 l/m<sup>2</sup> in Apa Neagră, and the percentage deviations from the multiannual means were comprised between -41.1% in Calafat and 29.8% in Drăgășani, determining classifications of thermal time types between very droughty in Calafat and Băilești and very rainy in Strehaiia Piedmont in Băcleș.

*The monthly precipitation mean* calculated for the entire region was 61.4 l/m<sup>2</sup>, and its percentage deviation from the multiannual mean was 7.4% determining an overall classification of normal pluviometric month for the entire region. As a consequence of the registered precipitation, on 27 November 2013, in the autumn wheat crop, the humidity reserve in the ground depth of 0-50 cm had satisfactory values in most part of the southern part of the region, close to optimum limits and optimum in the northern half. *The number of days with precipitation* was comprised between 8 days in Calafat, Caracal and Slatina and 15 days in Bechet.

*The number of days with precipitation  $\geq 15$  l/m<sup>2</sup>* was comprised between 0 in Calafat, Bechet and Băilești, 1 in most part of the region and 4 in Apa Neagră in Subcarpathians. *The maximum quantity of precipitation* registered in 24 hours was 47.0 l/m<sup>2</sup> in Călimănești (Vâlcea County on 24 November). On November 27 snowed in the entire region, and *the snow layer* measured up to 22 cm in Craiova and Caracal, and in the mountainous area 30 cm in Parâng, registering climatic phenomena of early winter.

### **5. OVERALL CLIMATIC CHARACTERISTICS OF THE AUTUMN SEASON**

#### **5.1. The thermal regime of the autumn of 2013.**

*The seasonal air temperature means* were comprised between 8.6°C in Voineasa and 13.0°C in Dr. Tr. Severin, and their deviations from the multiannual

means multiannual were comprised between 0.2°C in Tg. Logrești and 1.4°C in Voineasa, which determines a classification of thermal time of warmish month in most part of the region, excepting the areas Calafat, Slatina, Tg. Logrești and Polovragi where it was normal, and in the high area in Rm. Vâlcea, Voineasa and Parâng it was warm. *The general seasonal mean for the entire autumn* was 11.3°C, and its deviation from the general multiannual mean was of 0.8°C which confirms the general classification of warmish autumn.

## 5.2. The pluviometric regime of the autumn of 2013.

*The seasonal quantities of precipitation* were comprised between 11.7 l/m<sup>2</sup> in Calafat and 307.9 l/m<sup>2</sup> in Drăgășani, and their percentage deviations from the multiannual means were comprised between -21.2% in Calafat (the only negative deviation) and 74.8% in Tg. Logrești, which according to Hellmann criterion determine classifications of pluviometric time type from droughty in the south-west of Oltenia Plain (Calafat) and excessively rainy in the central part of the region, the hilly area and in Olt Couloir (Craiova, Slatina, Bâcleș, Tg. Logrești, Drăgășani and Rm. Vâlcea).

*The general mean* for the entire region was 219.3 l/m<sup>2</sup>, and its percentage deviation was of 38.4%, which determines an overall classification as very rainy autumn.

## 6. CONCLUSIONS

Although, usually, in Oltenia as well as in Romania, the secondary maximum of precipitation is registered, the autumn of 2013 was very rainy on the whole, and in September was excessively rainy.

*In 2013 the climatic variability was extremely high, from winter to autumn. The precipitation registered in September shows that it was the rainiest month of 2013, with a mean for the entire region of 97.0 l/m<sup>2</sup>*, although, usually, September is the second droughty month of the year after February.

The situation is atypical if we take into consideration that February 2013 was exceedingly rainy with a general mean of 75.5 l/m<sup>2</sup> for the entire region, we observe that the variability of the quantities of precipitation was very high in the entire year. In this autumn a number of days with precipitation comprised between 24 in Slatina and 34 in Bechet and Polovragi was registered, and in the mountainous area in Parâng 41 de days, with the mean for the entire region of 29.6 days.

*The maximum quantity of precipitation registered in 24 hours* was of 75,2 l/mp in Drăgășani, on September 30, and the rainiest interval of autumn (even of the whole 2013) was September 29-30, associated with a sudden weather cooling which reached the climax on October 5.

On November 27 snowed in the whole region, and the snow layer measured up to 22 cm in Caracal, and in the mountainous area 30 cm in Parâng, registering climatic phenomena of early winter. 9 weather cooling intervals were

registered: September 3, September 5-6, September 13-14, September 18-21 and September 28-30, October 1-5, November 7-10, November 16-19, November 26-30, of which two were extremely intense, one being in the end of September which continued in October and the second in the end of November, which led to the formation of the snow layer and to the early winter coming. From a thermal point of view, the autumn of 2013 was overall warmish.

***There were climatic hazard phenomena:***

- ***early and intense hoarfrost*** associated with negative minimum temperature registered in the interval October 4-7 which totally destroyed vegetable crops, causing significant damages for agriculture.

- ***weather intense cooling in the interval October 26-30***, which led to the formation of the snow layer on November 27 and ***the early winter arrival***.

The atypical evolutions during the entire year of 2013 we have studied (Marinică and al. 2013), prove an increase of the climatic variability not only in Oltenia, but also in the entire Romania.

The thermal regime of the warm air on the whole associated with significant precipitation from an agricultural point of view and the registration of high air and ground surface temperature (excepting the interval November 26-30 2013) led to the ***prolongation of the optimum time for seeding autumn crops and significant gradual enforcement which produced the spectacular development of the seeded ones in the optimum period***.

These aspect is due to the negative phase of the North-Atlantic oscillation as well as the high temperature of water in the Mediterranean Sea, which allowed the formation of strong Mediterranean Cyclones whose cloudy systems caused quantitatively significant rains in Oltenia.

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