UNIVERSITY OF CRAIOVA **Series: Geography**
UNIVERSITATEA DIN CRAIOVA **Seria: Geografie**

Vol. 13 (new series) – 2010
Vol. 13 (serie nouă) – 2010

CLIMATIC AND AGROCLIMATIC FEATURES OF THE SUMMER 2010 WITHIN OLTENIA

CARACTERISTICI CLIMATICE ŞI AGROCLIMATICE ALE VERII ANULUI 2010 ÎN OLTENIA

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Abstract: During the spring and summer of 2010, climatic evolutions were atypical. Following a severe 2009-2010 winter, the spring was cold and excessively rainy until March, normal from the pluviometric point of view in April and very rainy in May. The weather was cold in June, cool in July and it became normal in thermal terms in the last summer month, August, registering an upward average trend during both seasons. The cold weather started in the first part of the autumn of 2009, being a characteristic of the entire period. The rainfall regime registered higher values than the normal in June (very rainy), it was normal in July and less rainy in August. The combination between the thermal and pluviometric regimes during the analysed period led to the development of a real agroclimatic risk situation, as emphasized in the present paper. This analysis is useful for climatologists and agroclimatologists, emphasizing unusual aspects of the Oltenia climate.

Key-words: cold spring, cool summer, agroclimatic risks, Hellmann criterion, excess pluviometric regime
Cuvinte cheie: primăvară rece, vară răcoroasă, riscuri agroclimatice, criteriul Hellmann, regim pluviometric excedentar.

1. INTRODUCTION

Especially in the last 30 years, weather aspect was obviously related to climate changes in Oltenia. The climatic evolutions registered in the spring and summer of 2010 support this theory. The winter of 2009-2010 installed early and it was characterized by cold periods and blizzards; in pluviometric terms, it was a rainy winter. The cold winter weather continued also in March, as between the 5th and the 12th of the month, snowfalls and other climatic phenomena specific to winter affected the region and blizzards occurred between the 8th and the 11th. In March, there were broadcast five meteorological warning messages – yellow code for dangerous

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meteorological phenomena. We shall further analyse the climatic features of 2010 summer.

2. CLIMATIC FEATURES OF 2010 SUMMER

2.1. Climatic features of June 2010

The values of the mean monthly temperature oscillated between 15.1°C at Apa Neagră and 18.6°C at Dr. Tr. Severin and Calafat, while their deviations compared to the multiannual mean values were comprised between -2.9°C at Băileşti and -1.3°C at Polovragi. According to Hellmann criterion, June was cold (C) within most of the region, cool (Cl) in the Subcarpathian depressions and the Olt Couloir, at Rm. Vâlcea (Table no. 1).

Table no. 1

Thermal features (°C) of June 2010 in Oltenia

Meteorological station	Alt. (m)	Mean temperature June 2010	Normal value June	Δ=Tmed-N	Hellmann criterion	TMin	Tmin Date	TMax	Tmax Date
Dr. Tr. Severin	77	**18.6**	20.7	-2.1	C	**9.9**	3	**36.5**	13
Calafat	66	**18.6**	21.0	-2.4	C	8.9	2	36.3	13
Bechet	65	18.5	21.3	-2.8	C	8.1	2	35.8	12
Băileşti	**56**	18.2	21.1	**-2.9**	C	8.8	2	35.6	13
Caracal	112	18.5	20.8	-2.3	C	9.4	2	34.9	13
Craiova	190	18.2	20.6	-2.4	C	9.4	2	35.2	12
Slatina	165	18.3	20.5	-2.2	C	9.6	3	35.1	13
Bâcleş	309	16.5	19.0	-2.5	C	8.6	3	35.5	13
Tg. Logreşti	262	16.3	18.8	-2.5	C	7.0	3	34.0	13
Drăgăşani	280	17.3	19.4	-2.1	C	9.3	2	33.4	13
Apa Neagră	250	**15.1**	16.6	-1.5	Cl	**5.6**	3	35.4	13
Tg. Jiu	210	17.3	19.4	-2.1	C	6.4	3	33.7	13
Polovragi	546	16.4	17.7	**-1.3**	Cl	5.9	3	**30.6**	13
Rm. Vâlcea	243	17.6	19.0	-1.4	Cl	8.0	3	34.2	13
Parâng	**1585**	10.3	10.5	-0.2	N	1.9	2	25.9	13
Mean-Oltenia		17.0	19.1	-2.0	C	7.8		34.1	

(*Source: processed data*)

The values of the mean daily temperatures varied between 11.1°C at Polovragi, on March 1 and 28.8°C at Bâcleş, on 13.

The minimum monthly values varied between 5.6°C at Apa Neagră and 9.9°C at Dr. Tr. Severin, while their mean was 7.8°C. The coldest interval of June 2010 was between the 2nd and the 3rd, when there were registered the lowest thermal values. *The maximum monthly temperature values* varied between 30.6°C at Polovragi and 36.5°C at Dr. Tr. Severin and they were all registered on June 13.

The graph of mean temperature values *emphasizes a single warming period, between June 10 and 16, when the daily mean temperatures exceeded 25.0°C; the maximum values were above 30.0°C (maximum values ≥30°C were registered between June 8 and 17), while the climatic hot days threshold (≥35°C) was*

surpassed during the interval June 12 and 15. The general monthly mean for the region was 17.0°C and its deviation compared to the normal was -2.0°C, which allows us to classify this month as a cold month (C) within the entire region.

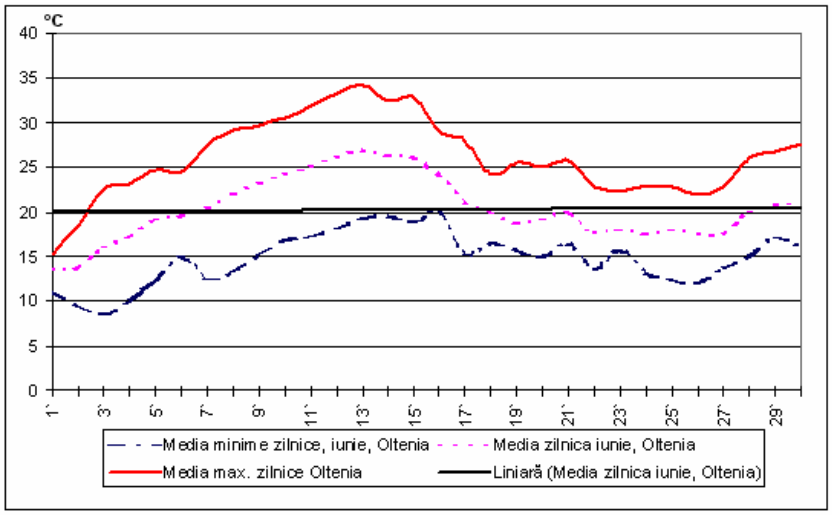

Fig. 1. Variation of the mean temperature values within Oltenia region: means of minimum daily temperatures, daily means, and means of maximum daily temperatures in June 2010 *(Source – processed data)*

Pluviometric features of June 2010

Monthly rainfall amounts oscillated between 64.8 l/sq m at Calafat, in the south-west of Oltenia, and 196.4 l/sq m at Polovragi; the deviations from the normal values were comprised between -13.7 l/sq m at Slatina, in the southeast of the region, and 84.1 l/sq m at Polovragi. The percentage deviations of the monthly rainfall amounts varied between -17 percent at Slatina and 123.2 percent at Dr. Tr. Severin. The classification of the types of pluviometric regime according to Hellmann criterion indicates a great variability – from less dry (LD) at Slatina to exceptionally rainy at Dr. Tr. Severin, Bechet, Apa Neagră, Polovragi, and Parâng (Table no. 2). This variability is mainly induced by rain showers, which generated great rainfall amounts in certain areas, while in the others they are insignificant due to the instability of the air mass and less to the atmospheric instability of frontal type. The data archives show that, on average, there were registered 2 days with significant rainfall amounts in the south of the region, 6-7 days in the hilly area and 10 days with poor rainfalls. The general rainfall mean for the entire region was 117.6 l/sq m and its deviation from the normal value was of 34.9 l/sq m, which, in percentage terms, is 42.3 percent, enabling us to classify the month as a very rainy month (VR) within the entire region.

Agroclimatic features of June

On the background of an optimum moisture regime of the soil, both during the period of water accumulation in the soil (November-March) and during the critical months (April-May), associated to a cold (C) thermal regime, there were

signalled 1 to 3-week delays in the phenological evolution of the crop plants within most of the region. At the same time, increased rainfall amounts (76-200 l/sq m) registered in June at the meteorological stations with agrometeorological program led to a favourable water supply of the soil within almost the entire agricultural territory of the country, both for autumn and spring crops. Thus, on June 29, 2010, the moisture storage accessible to autumn wheat (0-100 cm) and maize (0-50 cm) in Oltenia was optimum (AO), close to optimum (ApO) and satisfactory (AS) *(*Fig. 2 and 3*/Buletinul Agrometeorologic,* June 24-30, 2010*)*.

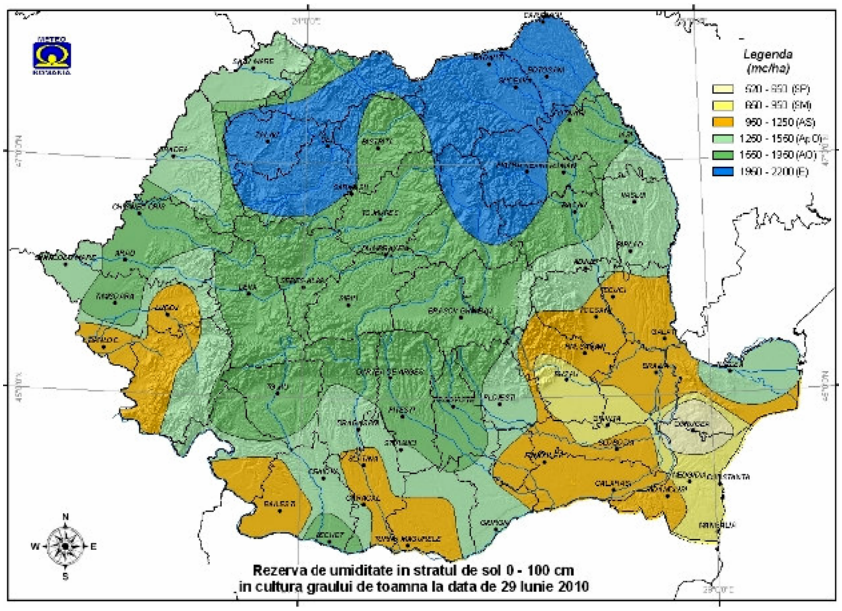

Fig. 2. Moisture storage in the soil 0-100 cm layer for autumn wheat, on June 29, 2010 (*according to ANM Bucureşti***)**

2.2. Climatic features of July 2010

The values of the mean monthly temperatures oscillated between 18.4°C at Tg. Logreşti and 22.2°C at Calafat; the deviations from the multiannual monthly means varied between -2.3°C at Tg. Logreşti and -0.5°C at Polovragi.

According to Hellmann criterion, July was cool (Cl) within most of the region, except for the areas where thermal inversions are frequent (phenomena registered also during the warm season, especially during night, which brings to lower minimum thermal values and, consequently, to lower daily means than in the neighbouring areas): Bechet, Tg. Logreşti, and Apa Neagră. *The monthly mean for the entire region* was 19.8°C, while its deviation from the normal was -1.4°C, confirming its classification as a cool month within the entire region. *The monthly minimum values* varied between 7.6°C, registered at Apa Neagră on the 8th and 14.5°C at Calafat, on the 30th.

The coldest mornings at different meteorological stations were registered on

July 5, 8, 9, 28, 29, and 30, when there were also registered the monthly minimum temperatures (Table no. 3); most of the minimum values were registered on July 8. Between July 12 and July 24, there were registered minimum thermal values of ≥20°C (tropical nights) at different meteorological stations.

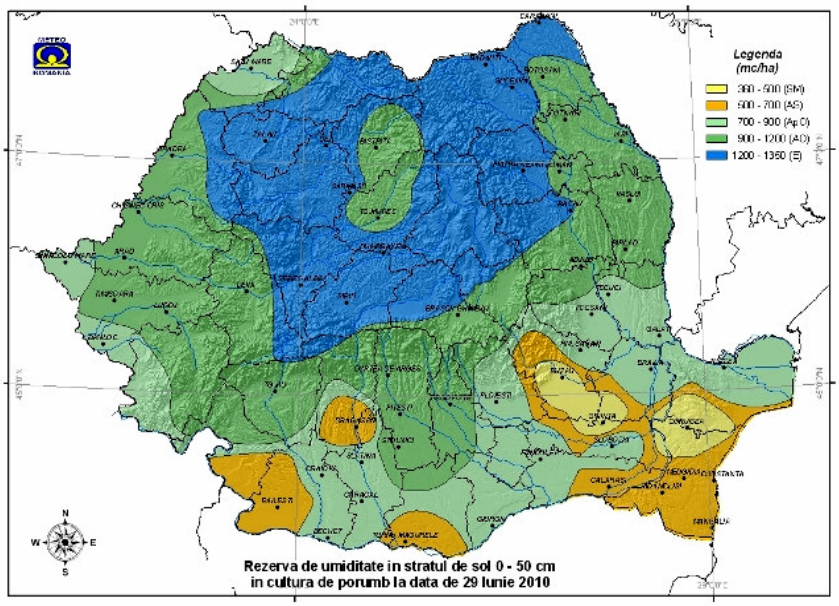

Fig. 3. Moisture storage in the soil 0-50 cm layer for maize, on June 29, 2010
(according to ANM Bucureşti)

The maximum monthly temperatures varied between 30.3°C at Polovragi and 36.1°C at Calafat and they were registered on July 16, 18, 22, and 23 (most of them on the 22nd and the 23rd).

In the interval July 11 – July 24, the maximum thermal values frequently exceeded 32°C, and thus, it developed a hot weather, while in the intervals July 17-19 and, then, July 22-24 and isolately or locally on the 14th, there were temperatures ≥35°C, which means dog days.

The graph rendering the mean temperature values for the entire region (daily means, daily minimum means, daily maximum means) indicates the hot period in the interval July 11-24 and a general easily increasing linear tendency, stressing a slow temperature increase, as it was the case during the previous months (Fig. 4).

Agroclimatic features of July

The specific agrometeorological features of July in Oltenia were: there were registered 13 days of hot weather (Tmax≥32°C), while the maximum temperatures close to the dog days threshold correlated with increased air humidity led to the increase of the bioclimatic index THI to critical values, ≥ 80.

Table no. 2

Pluviometric features[5] of 2010 summer in Oltenia

Meteorological station	Alt. m	June 2010					July 2010					August 2010					2010 summer				
		S	N	Ä=S-N	Ä%	H. Cr.	S	N	Ä=S-N	Ä%	H. Cr.	S	N	Ä=S-N	Ä%	H. Cr.	S	N	Ä=S-N	Ä%	H. Cr.
Dr. Tr. Severin	77	161.8	72.5	89.3	**123.2**	**ER**	44.6	49.3	-4.7	-9.5	**N**	**12.8**	38.2	**-25.4**	-66.5	**ED**	219.2	160.0	59.2	37.0	**VR**
Calafat	66	**64.8**	65.6	-0.8	-1.2	**N**	38.6	45.6	-7.0	-15.4	LD	14.8	35.6	-20.8	-58.4	**ED**	**118.2**	**146.8**	-28.6	**-19.5**	LD
Bechet	65	121.2	**62.3**	58.9	94.5	**ER**	44.6	46.6	-2.0	-4.3	**N**	16.4	37.9	-21.5	-56.7	**ED**	182.2	**146.8**	35.4	24.1	**R**
Băileşti	56	69.0	66.5	2.5	3.8	**N**	53.0	45.0	8.0	17.8	LR	82.2	39.0	43.2	**110.8**	**ER**	204.2	150.5	53.7	35.7	**VR**
Caracal	112	109.2	73.7	35.5	48.2	**VR**	**9.8**	53.8	**-44.0**	**-81.8**	*ED*	37.6	39.9	-2.3	-5.8	**N**	156.6	167.4	-10.8	-6.5	**N**
Craiova	190	83.0	71.2	11.8	16.6	LR	47.0	51.4	-4.4	-8.6	**N**	29.2	42.1	-12.9	-30.6	**VD**	159.2	164.7	-5.5	-3.3	**N**
Slatina	165	66.9	80.6	**-13.7**	**-17.0**	LD	45.2	57.5	-12.3	-21.4	**D**	53.0	46.8	6.2	13.2	LR	165.1	184.9	-19.8	-10.7	LD
Bâcleş	309	88.6	72.0	16.6	23.1	**R**	71.6	47.1	24.5	52.0	**ER**	10.8	**33.4**	-22.6	**-67.7**	**ED**	171.0	152.5	18.5	12.1	LR
Tg. Logreşti	262	89.6	72.3	17.3	23.9	**R**	84.6	49.5	35.1	**70.9**	**ER**	51.2	43.6	7.6	17.4	LR	225.4	165.4	60.0	36.3	**VR**
Drăgăşani	280	86.2	87.6	-1.4	-1.6	**N**	29.2	51.6	-22.4	-43.4	**ES**	41.4	46.4	-5.0	-10.8	LD	156.8	185.6	**-28.8**	-15.5	LD
Apa Neagră	250	175.8	99.2	76.6	77.2	**ER**	57.7	72.7	-15.0	-20.6	**D**	75.3	60.1	15.2	25.3	**R**	308.8	232.0	76.8	33.1	**VR**
Tg. Jiu	210	121.0	93.0	28.0	30.1	**VR**	75.5	61.9	13.6	22.0	**R**	59.4	64.3	-4.9	-7.6	**N**	255.9	219.2	36.7	16.7	LR
Polovragi	546	**196.4**	**112.3**	**84.1**	74.9	**ER**	**124.8**	88.9	**35.9**	40.4	**VR**	92.2	**76.5**	15.7	20.5	**R**	**413.4**	**277.7**	**135.7**	**48.9**	**VR**
Rm. Vâlcea	243	108.6	86.9	21.7	25.0	**R**	47.0	98.0	-51.0	-52.0	**ED**	**120.1**	69.4	**50.7**	73.1	**ER**	275.7	254.3	21.4	8.4	**N**
Parâng	1585	221.6	124.1	97.5	78.6	**ER**	163	132.1	30.9	23.4	**R**	156.4	90.6	65.8	72.6	**ER**	541.0	346.8	194.2	56.0	**ER**
Media Oltenia		117.6	82.7	34.9	42.3	**VR**	62.4	63.4	-1.0	-1.6	**N**	56.9	50.9	5.9	11.7	LR	236.8	197.0	39.9	20.2	**R**

(Source: processed data)

[5] S = monthly sum of the rainfall amounts (l/sq m); N = multiannual mean of the monthly rainfall amounts (l/sq m) calculated for the interval 1901-1990 and considered normal; Ä = S-N is the deviation of the monthly amounts (l/sq m) compared to the normal; Ä% = percentage deviation of the monthly amounts compared to the normal; H. Cr. = classification according to Hellmann criterion: ER = exceptionally rainy; VR = very rainy; R = rainy; LR = less rainy; N = normal; LD = less dry; D = dry; VD = very dry; ED = exceptionally dry

Table no. 3

Thermal features (°C) of July 2010 in Oltenia

Meteorological station	Alt. m	Mean temp. July 2010	Normal value July	Δ=Tmed-N	Hellmann criterion	TMin	Tmin Date	TMax	Tmax Date
Dr. Tr. Severin	77	22.1	23.0	-0.9	**N**	13.8	29	35.2	18;22
Calafat	66	**22.2**	**23.2**	-1.0	**Cl**	**14.5**	30	**36.1**	18;23
Bechet	65	20.9	23.0	-2.1	**C**	14.0	5;9;30	35.0	22
Băileşti	**56**	20.9	22.8	-1.9	**Cl**	12.8	9	35.0	18
Caracal	112	21.5	22.9	-1.4	**Cl**	14.3	28	34.2	23
Craiova	190	20.5	22.3	-1.8	**Cl**	12.0	8	34.4	18
Slatina	165	20.7	22.0	-1.3	**Cl**	12.6	9	33.7	16;23
Bâcleş	309	19.5	21.3	-1.8	**Cl**	9.8	8	33.1	22;23
Tg. Logreşti	262	**18.4**	20.7	**-2.3**	**C**	9.0	8	32.7	23
Drăgăşani	280	20.6	21.7	-1.1	**Cl**	13.0	8	34.1	22
Apa Neagră	250	18.5	20.5	-2.0	**C**	**7.6**	8	33.2	22
Tg. Jiu	210	19.8	21.3	-1.5	**Cl**	11.3	29	34.0	22
Polovragi	546	19.2	**19.7**	**-0.5**	**N**	8.7	8	**30.3**	18
Rm. Vâlcea	243	20.5	21.2	-0.7	**N**	13.6	29	34.0	22
Parâng	**1585**	12.1	12.5	-0.4	**N**	4.9	8	24.0	23
Mean-Oltenia		19.8	21.2	-1.4	**Cl**	11.5		33.3	

Pluviometric features of July 2010

Monthly rainfall amounts varied between 9.8 l/sq m at Caracal, in the southeast of the region, and 124.8 l/sq m at Polovragi, located in the Oltenia Subcarpathians. The deviations compared to the normal value were between -44.0 l/sq m at Caracal and 35.9 l/sq m at Polovragi, which, according to Hellmann criterion, renders a great diversity of pluviometric regime types – from excessively dry in the east of the region (Caracal, Drăgăşani, and Rm. Vâlcea) to excessively rainy on small surfaces at Tg. Logreşti and Bâcleş. This last feature was induced by isolate or local rainfalls generated by the instability of the air mass and less by atmospheric fronts. The general mean for the entire region was 62.4 l/sq m (Table no. 2), while its deviation was of only -1.0 l/sq m, which in percentage terms means -1.6 percent, underlining a normal pluviometric regime for the entire region (N). However, this aspect is less significant if we take into account the drought affecting the east of the region. Nebulosity regime was high due to the instability of the air mass and there were registered, on an average, 2 days with significant rainfalls ≥ 10 l/sq m. In the hilly area, there were about 7-8 such days and 15 days with generally poor rainfalls and frequent thunderstorms.

The greatest values were reached at Calafat (54.5 units) in 22 days, 7 of them being successive between the 10th and the 16th of July and 14 in the interval between the 11th and the 24th of July. At the same time, besides the days characterized by hot weather ($\sum T_{max} \geq 32°C$), there were also registered tropical nights ($\sum T_{min} \geq 17°C$), which affected the vegetative processes of certain crops.

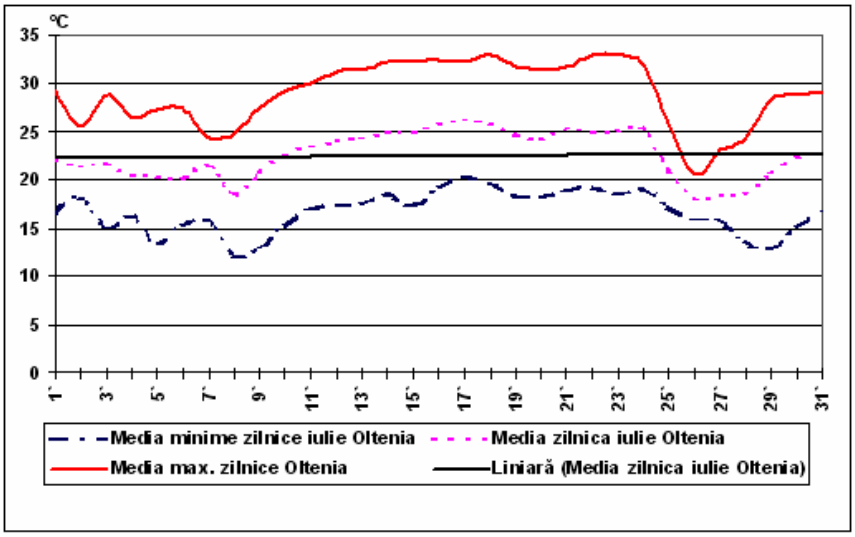

Fig. 4. Variation of the mean temperature values for the entire Oltenia region in July 2010: means of daily minimum temperatures, daily means and means of daily maximum temperatures *(Source: processed data)*

By the end of July, moisture storage at maize crops (0-100 cm) oscillated between 600 and 900 cubic m/ha in the centre of Oltenia (moderate drought – MD), between 900 and 1,200 cubic m/ha in most of the region (satisfactory supplying – SS), while in the north and extreme southeast, it was between 1,500-1,900 m^3/ha (supplying close to the optimum value – CO) (Fig. 5).

2.3. Climatic features of August 2010

Mean monthly temperatures were between 17.4°C at Apa Neagră and 21.7°C at Dr. Tr. Severin and their deviations compared to the multiannual means were between -2.7°C at Apa Neagră and +0.8°C at Polovragi. According to Hellmann criterion, August was cold (C) at Băileşti, Apa Neagră, and Tg. Logreşti and normal within most of the region (Table no. 4).

The general mean for the entire Oltenia was 20.0°C, with a deviation of 0.0°C, which allows us to classify it as a normal month from the thermal point of view.

The monthly minimum values oscillated between 8.6°C at Bechet and Apa Neagră and 14.9°C at Drăgăşani, while the mean of monthly minimum values was 11.2°C. Most of the minimum values were registered on the 21st and the 30th of August, when there occurred two significant cooling periods.

The monthly maximum temperatures were 33.3°C at Polovragi and 39.1°C at Bechet, while the mean of monthly maximum values reached 35.4°C. Most of the maximum values were registered on the 14th and 28th of August, namely in the hottest days of the month.

The graph rendering the mean temperature values for the entire region (daily means, daily minimum means, and daily maximum means, Fig. 6) indicates two main warming periods: August 10-17, when on the 14th it was registered the

maximum temperature, 28.2°C at Bechet, and August 24-28, when it was registered the maximum thermal value for the entire country, 39.1°C at Bechet and 39.0°C at Calafat.

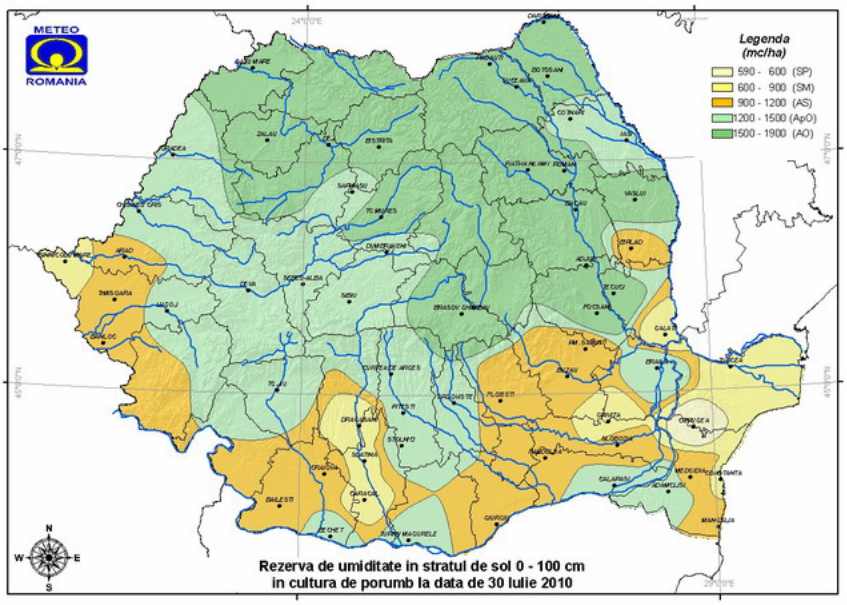

Fig. 5. Moisture storage in the soil 0-100 cm layer for maize, on July 30, *(according to ANM Bucureşti)*

Table no. 4

Thermal features (°C) of August 2010 in Oltenia

Meteorological station	Alt. m	Mean temp. August 2010	Normal value August	Δ=Tmed-N	Hellmann criterion	TMin	Tmin Date	TMax	Tmax Date
Dr. Tr. Severin	77	**21.7**	22.2	-0.5	**N**	14.1	30	36.6	15
Calafat	66	21.6	**22.7**	-1.1	**CI**	11.3	30	**39.0**	28
Bechet	65	21.1	22.4	-1.3	**CI**	**8.6**	30	**39.1**	28
Băileşti	**56**	20.1	22.5	-2.4	**C**	9.2	30	37.0	28
Caracal	112	21.3	22.4	-1.1	**CI**	11.4	30	37.0	28
Craiova	190	21.5	22.2	-0.7	**N**	12.3	30	36.2	28
Slatina	165	21.6	22.2	-0.6	**N**	12.8	24	36.1	14
Bâcleş	309	19.2	20.9	-1.7	**CI**	12.6	30	33.8	15
Tg. Logreşti	262	18.2	20.2	-2.0	**C**	10.4	21	34.4	14;15
Drăgăşani	280	21.5	21.5	0.0	**N**	**14.9**	30	36.4	15
Apa Neagră	250	**17.4**	20.1	**-2.7**	**C**	**8.6**	21	34.6	14
Tg. Jiu	210	20.0	20.9	-0.9	**N**	11.7	21	35.5	14;15
Polovragi	546	20.2	**19.4**	0.8	**N**	10.8	21	**33.3**	14
Rm. Vâlcea	243	20.5	20.5	0.0	**N**	13.8	21	35.8	15
Parâng	**1585**	13.4	12.0	1.4	**CI**	5.0	30	26.1	14
Media-Oltenia		20.0	20.8	-0.9	**N**	11.2		35.4	

It is worth mentioning that this value (39.1°C) represents the maximum thermal value for the entire summer 2010 in the whole country. We may also notice two insignificant warming periods – August 2-3 and August 6, when temperature reached maximum values of 35°C at Bechet and Băileşti, which means dog days on small areas in the extreme south of the region.

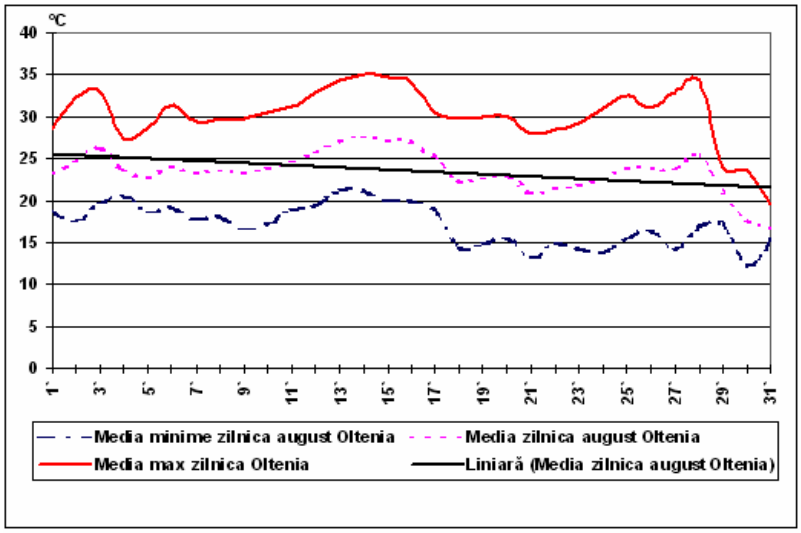

Fig. 6. Variation of mean temperature values for the entire Oltenia region: means of daily minimum temperatures, daily means, and means of the daily maximum temperatures in August 2010 *(Source: processed data)*

The most important cooling period was registered by the end of the month, August 30-31. On the 30th, the thermal minimum values decreased below 15°C, one below 9°C, which means the thermal regime characteristic to September developed two days earlier.

Pluviometric features of August 2010

The monthly rainfall amounts varied between 12.8 l/sq m at Dr. Tr. Severin and 120.1 l/sq m at Rm. Vâlcea. In the mountains, at Parâng, they reached 156.4 l/sq m. The deviations compared to the multiannual means oscillated between -25.4 l/sq m at Dr. Tr. Severin and 50.7 l/sq m at Rm. Vâlcea, while in the mountainous area, it was 65.8 l/sq m at Parâng. The percentage deviations were comprised between -67.7 percent at Bâcleş and 110.8 percent at Bechet. According to Hellmann criterion, the month was excessively dry (ED) in the western half of the Oltenia Plain, except for the area near Băileşti, where it was excessively rainy (ER), less rainy (LR) to normal (N) in the east of the plain, rainy (R) to less dry (LD) within the hilly region, normal in Tg. Jiu - Câmpu Mare Depression, and excessively rainy in the mountainous and submountainous area (Table no. 2). This diversity of classes is mainly induced by a great rainfall variability, which, in its turn, is generated by the type of air mass and atmospheric front instability. Consequently, important rainfall amounts affected

reduced areas, while on large surfaces, rainfalls missed or there were insufficient amounts over long periods of time.

Agroclimatic considerations for August

In the interval August 7-29, rainfalls were insignificant (except for two settlements), being registered 17 days without rainfalls. Under these circumstances, in the period with maximum water necessity in the case of maize (July), pedological drought with different intensity degrees (moderate, strong, and extreme) affected almost the entire region.

There was often noticed the temporary fading and rolling of the leaves during noon hours, their yellowing and drying, as well as stage perturbations in their evolution. By the end of August, the moisture storage in the 0-100 cm soil layer varied between 80 and 360 m^3/ha in the central part of the region (extreme drought – ED), between 350 and 650 m^3/ha within most of the region (strong drought – SD), 650 and 950 m^3/ha (moderate drought – MD) on small surfaces in the southwest and north, and between 950 and 1,250 m^3/ha (almost satisfactory) in the northern extremity of the region (Fig. 7).

The heat wave registered between August 24 and 28, 2010

During this summer, dog days phenomenon (temperature maximum values ≥35°C) was registered in just a few days compared to the previous years, when summers were excessively hot. Thus, *in June,* temperature maximum values ≥35°C were registered isolately on the 12th and on the 14th, and locally on the 13th (three days). The thermal maximum value of June was 36.5°C registered at Dr. Tr. Severin on the 13th.

In July, the thermal values ≥35°C registered isolatedly on 14, 17, 18, 22, 23, and 24 (6 days), but there were numerous days with maximum thermal values close to dog days threshold and THI≥80. The maximum temperature of July in Oltenia reached 36.4°C, on the 18th, at Calafat.

In August, temperatures ≥35°C, with isolate or local character, registered in 15 days, namely 3, 6, 10-17, and 24-28. Therefore, we notice the occurrence of two moderate heat waves. The first was in the interval August 10 and 17, which lasted for 8 days and the maximum value for the entire Oltenia reached 38.2°C at Calafat on the 14th. The second heat wave registered between August 24 and 28, 2010, lasted only 5 days, but it was more intense than the first. The maximum temperature reached 39.1°C at Bechet and it also represents the highest temperature of 2010 in the entire country. This second heat wave was followed by a rapid cooling of the weather, temperature oscillating between 10 and 14°C at all the meteorological stations, which means the development of a thermal regime characteristic to September starting with August 29. We shall further analyse the physical mechanism inducing this heat wave.

At the moment when the heat wave started, the distribution of the baric centers above Europe was as it follows (Fig. 8). The northern half of the continent was covered by cyclonic fields; in the south of the Scandinavian Peninsula, there was centered a cyclone of Icelandic origin, the central pressure registering 980 damgp, while the Atlantic Ocean and the Great Russian Plain were affected by another two cyclonic

centers. In the west of the continent, there was located the Azoric Anticyclone, which displayed a central pressure value of more than 1,020 hPa. East of the Black Sea, there acted the East-European Anticyclone with values over 1,015 hPa. Between these two baric formations, there developed a poor anticyclone belt (Romania was affected by it) displaying pressure values a little higher than 1,010 hPa. In the lower troposphere, Romania was affected by a western circulation, and the air mass was cPw+cT.

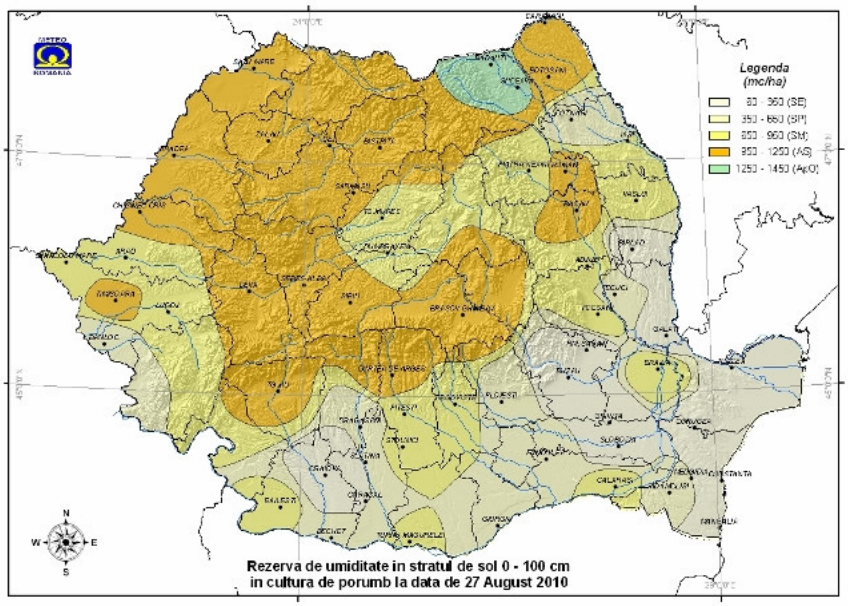

Fig. 7. Moisture storage in the 0-100 cm soil layer for maize, on August 27
(according to ANM Bucureşti)

At the level of 500 hPa, we may notice a vast low geopotential field that covered the northern half of the continent. Its center of 544 damgp was placed above the north of the Great Britain and the south of the Scandinavian Peninsula. In the southern half of the continent, there was a high geopotential field. At this level, for Romania, air circulation was western in concordance with the circulation registered in the low troposphere. At the level of 300 hPa, there occurred a strong western jet stream, which extended from the west of North America over the Atlantic Ocean to Austria and western Germany (Fig. 12). This type of situation persisted till August 28, 2010, and the circulation became easily south-western.

At the level of 850 hPa, we may notice the penetration of warm air within the entire low troposphere from northern Africa above Italy, the Adriatic Sea and Romania to Ukraine (the 15°C isotherm, Fig. 9).

The persistence of this situation determined the air warming on the continent and air circulation from southwestern sector in the last part of this interval intensified the advection of warm air from northern Africa.

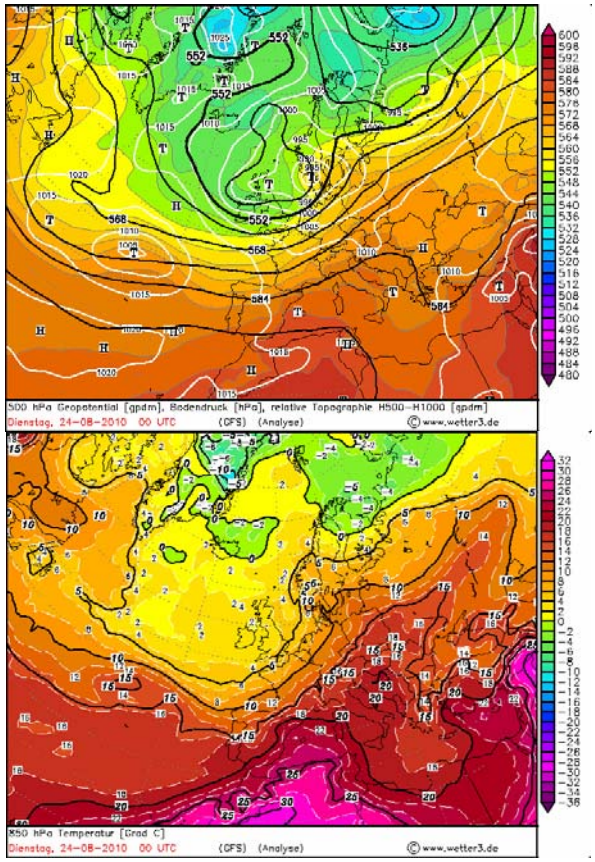

Fig. 8. ***Pressure map at surface level, geopotential field at the level of 500 hPa and relative topography 500/1,000 on August 24, 2010, at 00 UTC, when the heat wave started*** **(***according to Archiv, wetter3.de***).**

Fig. 9. ***Temperature field map at the level of 850 hPa on August 24, 2010, at 00 UTC, when the heat wave started*** **(***according to Archiv, wetter3.de***).**

At the moment the heat wave reached maximum intensity, on August 28, 2010, we may notice the interruption of the anticyclone belt above Romania and Ukraine and the positioning of the aforementioned cyclone in the east of the Russian Plain, as well as a cooling process of the weather in Central Europe (Fig. 10). The position of the jet stream (Fig. 13) also marked the position of the polar front (a cold front in fact), which brought to the intense cooling registered on the 29th and the following days. As usually in such situations, in front of the cold front, southwestern warm air advection intensified – cT (continental tropical) from northern Africa (Fig. 11). The climax of the warm advection coincided with the noon hours of maximum insolation and essentially contributed to the achievement of the maximum thermal value of 39.1°C at Bechet, in the south of the region.

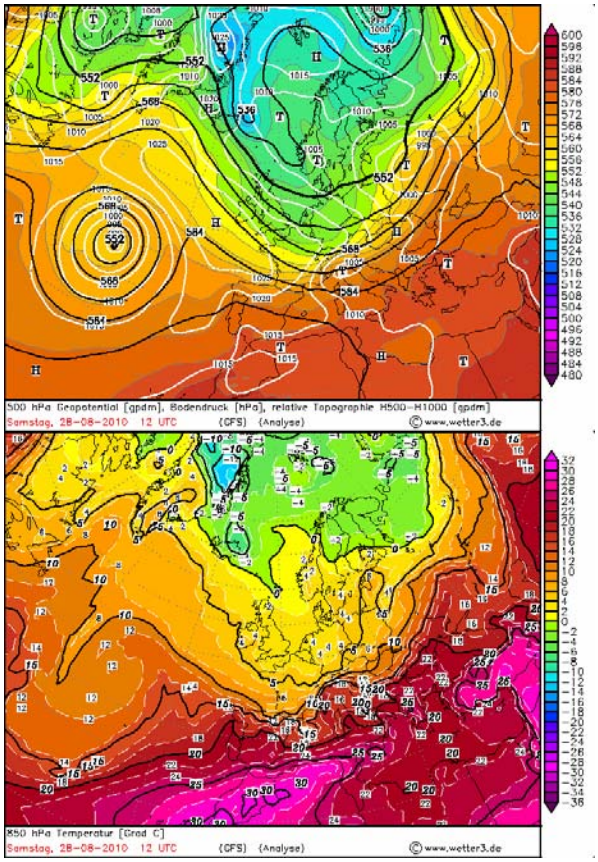

Fig. 10. ***Pressure map at surface level, geopotential field at the level of 500 hPa and relative topography 500/1,000 on August 28, 2010, at 12 UTC, when the heat wave reached maximum intensity*** **(***according to Archiv, wetter3.de***).**

Fig. 11. ***Temperature field map at the level of 850 hPa on August 28, 2010, at 00 UTC, when the heat reached maximum intensity*** **(***according to Archiv, wetter3.de***).**

3. PLUVIOMETRIC FEATURES OF THE SUMMER 2010

Total rainfall amounts registered during the summer varied between 118.2 l/sq m at Calafat and 413.4 l/sq m at Polovragi, while in the mountains, it reached 541.3 l/sq m at Parâng. The deviations of these amounts compared to the multiannual values oscillated between -28.8 l/sq m at Drăgăşani and +135.7 l/sq m at Polovragi, while the percentage deviations were comprised between -19.5 percent at Calafat and 48.9 percent at Polovragi. According to Hellmann criterion, the classification was from less dry (LD) at Calafat, Slatina, and Drăgăşani to very rainy (VR) at Dr. Tr. Severin, Băileşti, Tg. Logreşti, Apa Neagră, and Polovragi and normal at Craiova, Slatina, and Rm. Vâlcea. In the mountainous area, it was

excessively rainy (ER). The great diversity of pluviometric types reflects the great variability of the rainfall amounts during this summer, which was atypical from many points of view. The general mean for the entire region was 236.8 l/sq m and its deviation compared to the multiannual mean was 39.9 l/sq m, namely 20.2 percent, which classifies this summer as rainy (R) (Table no. 2).

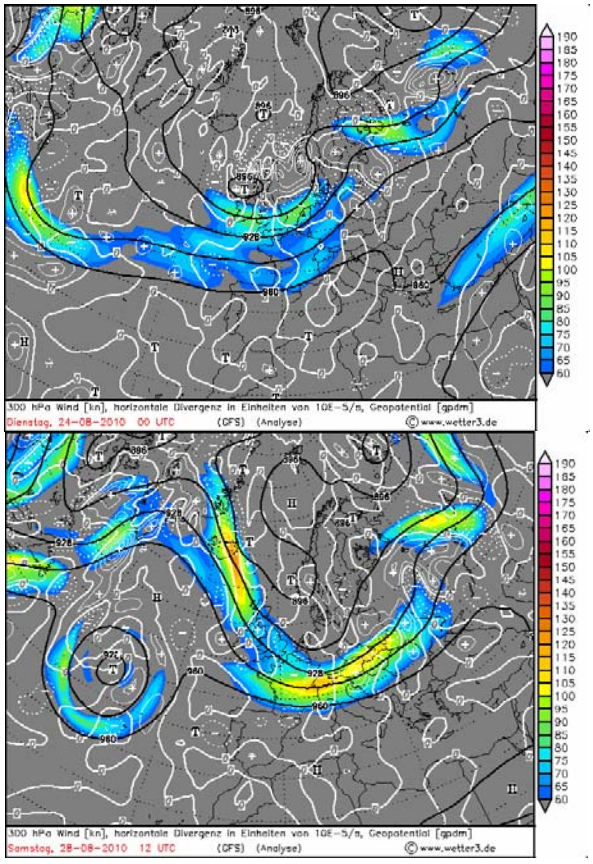

Fig. 12. The jet stream above Europe on August 24, 2010, at *00 UTC, when the heat wave started* (*according to Archiv, wetter3.de***).**

Fig. 13. The jet stream above Europe on August 28, 2010 at *12 UTC, when the heat wave reached maximum intensity* (*according to Archiv, wetter3.de***).**

The variation curve of the mean monthly rainfall amounts for the entire region in spring and summer displays a normal distribution ('Gauss' bell') emphasizing the rainy period registered in May and June, while the curve of mean temperatures for the entire region is upward displaying almost the same slope from March till August (Fig. 14).

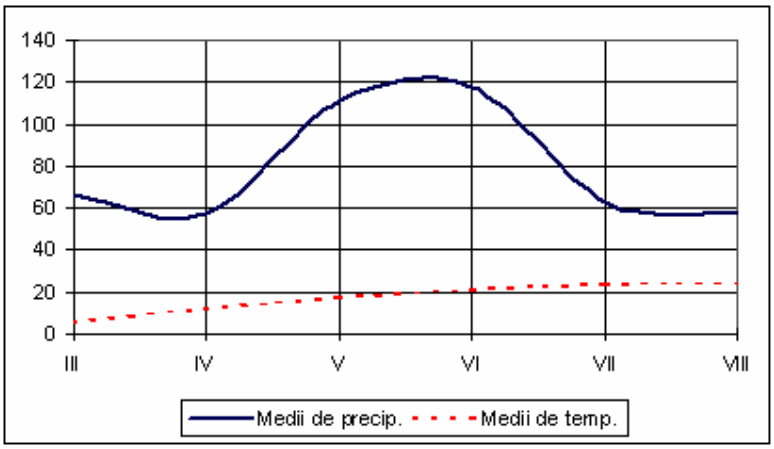

Fig. 14 Variation of mean rainfall amounts (l/sq m) and temperature (°C) for the entire region of Oltenia, in the spring and summer of 2010
(Source: processed data)

4. CONCLUSIONS

From the pluviometric viewpoint, the spring of 2010 was very rainy. It predominated moisture excess in the soil, which facilitated the presence of certain diseases and pest attack upon agricultural crops, favoured by the cool thermal regime. In April and May, the lower thermal values led to the decrease of the vegetation development rhythm, as well as to the delay of certain spring agricultural works (sowing, phytosanitary treatments). The complex interpretation of the data referring to the agroclimatic resources (thermal and hydric) of an agricultural zone allows us to characterize the favourability degree for a wide variety of species cultivated in our country according to the climatic and soil conditions, as well as to the necessities of these varieties. Each vegetation factor has the greatest influence on the agricultural species when it acts singularly or combined at certain intensity, according to the necessities of the plant.

The variable weather continued in summer; rainfall amounts reduced in July and August. June was generally very rainy (VR), July was normal in pluviometric terms and August less rainy (LR); there was registered a great variability of types according to the meteorological station and month.

The rainfall climax was reached in May and June, as it was normal, then the amounts decreased rapidly in July and August (Fig. 14), while temperature gradually increased. By the end of August, temperature decreased and, consequently, the thermal regime characteristic to September started on August 29.

The summer was marked by the presence of two moderate heat waves in August, which underlines the fact that such phenomena are possible even during cool summers. Although in Oltenia, the weather was generally cold (C) in spring and cool (Cl) in summer, at a global level, the thermal mean value for the entire

northern hemisphere was the greatest ever registered, thus, confirming the global warming process.

Presently, the registration of cold and cool periods, even at regional level, is considered beneficial for the general evolution of climate on the background of global warming.

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