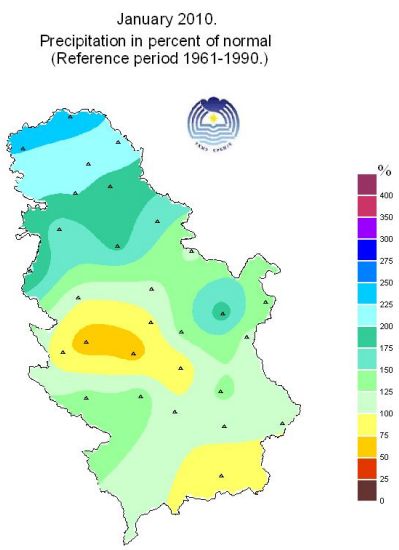
SIGNIFICANT CLIMATE EVENTS ON THE TERRITORY OF SERBIA IN 2010

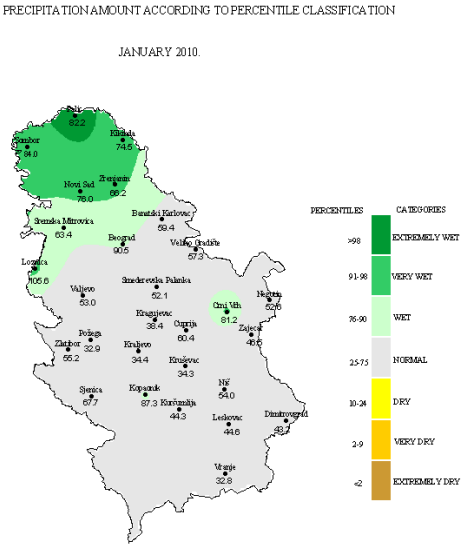
JANUARY

Temperature within normal. In northern parts, precipitation sums extremely above normal.
Maximum number of days with precipitation exceeded on Zlatibor and Sombor.

According to percentile distribution, mean monthly temperatures were within normal range in most parts of the country.

Monthly number of days with precipitation was higher than normal. Maximum days with precipitation, total of 26, was recorded on Zlatibor thereby breaking the previous record for this station. The new record was also set in Sombor where there were 17 days with precipitation. Monthly precipitation totals were in the interval of 63% to 231% of normal values and, according to percentile distribution, most parts remained in the category of normal. It was rainy, very rainy and extremely rainy in northern parts (Figure 1 and Figure 2).





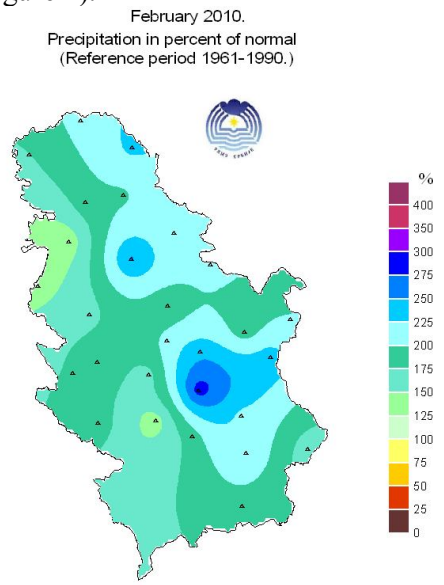
FEBRUARY

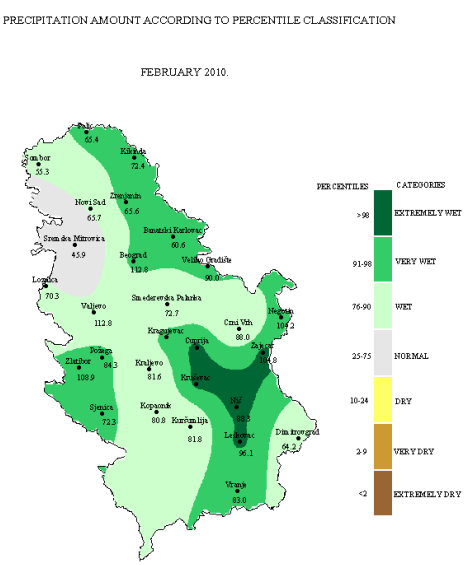
Temperatures within normal. In the southeast, precipitation sums extremely above normal. Record-breaking highest daily precipitation sum set in Belgrade.

Mean monthly temperatures were within normal in most parts.

Monthly number of days with precipitation was higher than normal in whole Serbia. Monthly precipitation sums were in the interval of 132% to 289% of normal values. According to percentile distribution, they were in the category of rainy and

very rainy in most areas, and in the southeast of Serbia it was extremely rainy (Figure 3 and Figure 4).





The highest daily precipitation sum of 39.1 mm was measured in Belgrade on 25 February thereby breaking the previous record for February which amounted to 34.8 mm (3 February 1962).

MARCH

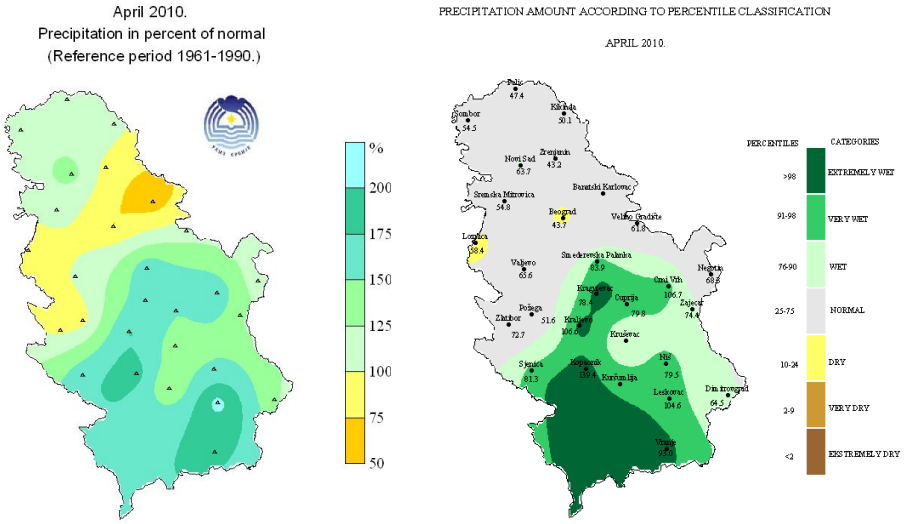
Significant anomalies of temperature and precipitation were not recorded in March.

APRIL

Temperatures within normal. In central, southern and southeastern parts precipitation extremely above normal. Record-breaking highest daily precipitation sums set in Kraljevo and on Kopaonik.

Mean monthly temperatures were within normal in most parts.

Monthly number of days with precipitation was higher than normal in most parts. Monthly precipitation sums were in the interval of 62% to 210% of normal values. In southern and central parts precipitation was in the categories of considerably and extremely above normal according to percentile distribution (Figure 5 and Figure 6).



The highest daily precipitation sum of 50, 6 mm was measured in Kraljevo on 20 April thereby breaking the previous record for Kraljevo for April (49.2mm on 30 April 1958.). On the same day, on Kopaonik Mountain the new record was set (44.5 mm) breaking the previous one of 37.8mm recorded on 21 April 1972.

MAY

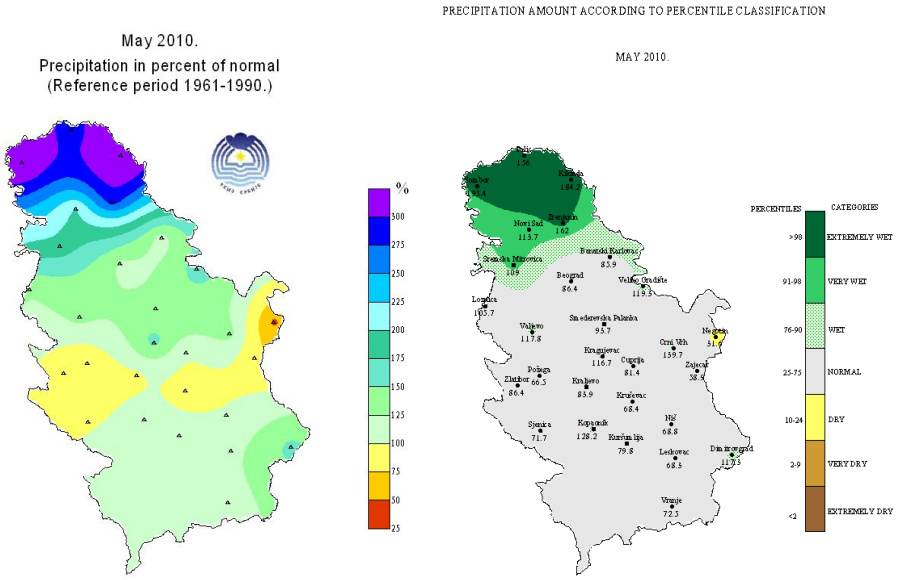
Temperatures within normal range. In Vojvodina, monthly precipitation sum extremely above normal; monthly maximum number of days with precipitation was exceeded; highest daily precipitation sum was surpassed. Dry in eastern parts.

Mean monthly temperature was within normal range in most parts.

In the second and third decade precipitation was more frequent than in the first decade. Total monthly number of days with precipitation was in northern and parts of central and eastern Serbia twice higher compared to normal value. On the stations Sombor, Kikinda and Banatski Karlovac, 18 to 21 days with precipitation were recorded thereby breaking the previous record in this part of Serbia.

Monthly precipitation sum was in the interval from 46% to 350% from normal values. In most parts of Serbia, precipitation remained in the category of normal. It was dry in a part of eastern Serbia and very rainy and extremely rainy on the territory of Vojvodina where measured maximum monthly precipitation total was 195.4 mm in Sombor (Figure 7 and Figure 8).

Highest daily precipitation sum of 69.4 was measured on 31 May in Kikinda thereby setting the new record for this station (65.4mm 31 May 1939).



JUNE

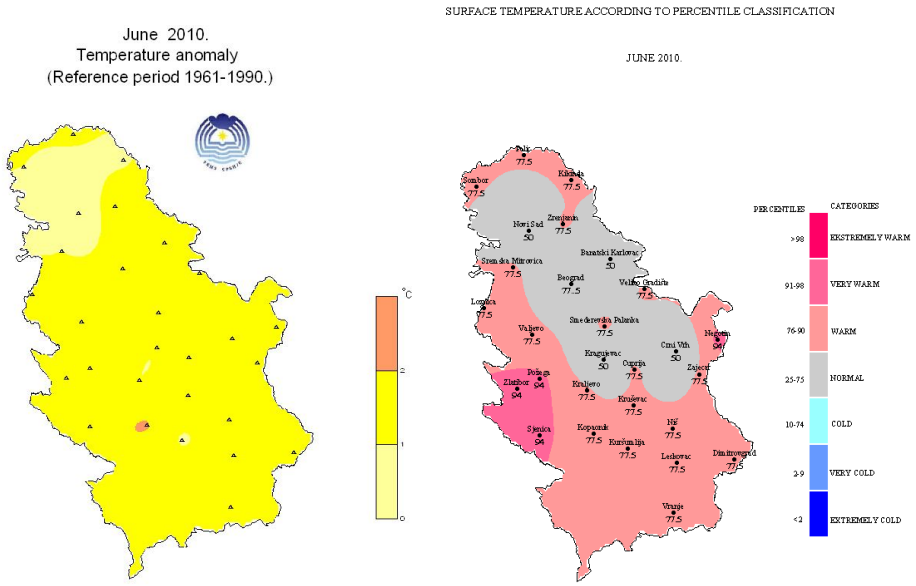
June marked very warm weather, heat wave was recorded. Absolute temperature maximum exceeded on the mountains. Highest monthly and daily precipitation sums exceeded in Vojvodina and in western parts.

By the end of the first and during the whole second decade, mean daily temperatures were in the category extremely above normal. This period is characterized by a heat wave that encompassed whole Serbia for 12 days. Tropical days were then recorded and their number was higher than normal. Most tropical days, 10 to 12, were recorded in southern parts of Serbia.

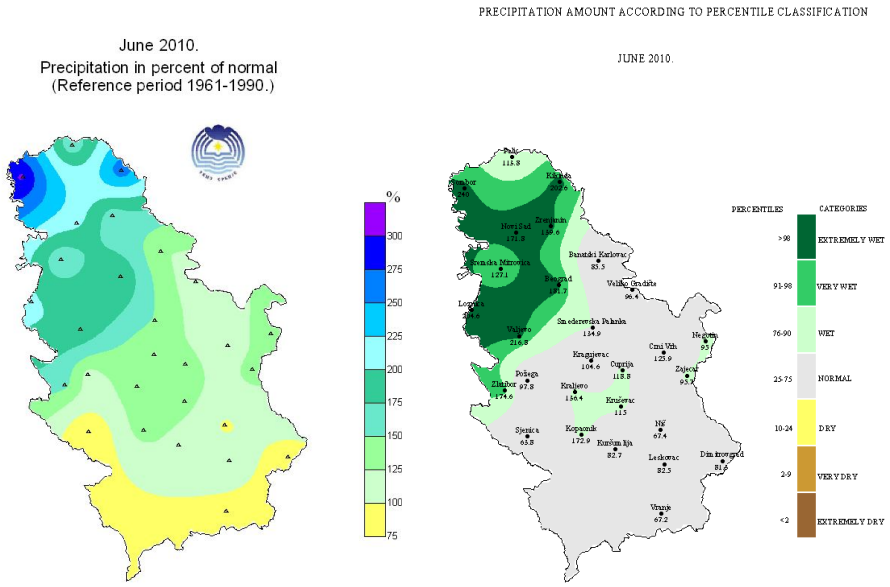
On Kopaonik and in Sjenica (mountain stations), new highest daily air temperature record was set on 12 June. The temperature of 25.4 °C was recorded on Kopaonik (the previous record 24.8 °C, 27 June 2006) and in Sjenica 32.2 °C (previous record was 31.6 °C, 26 June 1982).

This period was also characterized by tropical nights. Their number was two to three times and, at some places, even four times higher than normal, and there was a number of record-breaking highest daily air temperatures. Most tropical nights, the total of 12, was recorded in Nis and Leskovac.

Mean monthly temperatures deviated from normal values by 0.2 °C to 2.7 °C. According to percentile distribution, in central parts of Serbia, they remained in the category of normal and in other parts they were in the categories hot and very hot (Figures 9 and Figure10).



Precipitation in the first and third decade was recorded more often than in the second and monthly number of days with precipitation was three to four times higher then normal. Majority of days with precipitation, 22 in total, were recorded on Crni Vrh. This exceeds the past maximum of 20 days (in 1987). Total monthly precipitation sum was in the interval of 75% to 304% of normal values. Precipitation was in the categories of rainy and very rainy in Vojvodina, western and central parts of Serbia. Precipitation remained in the category of normal in other parts (Figure 11 and 12).



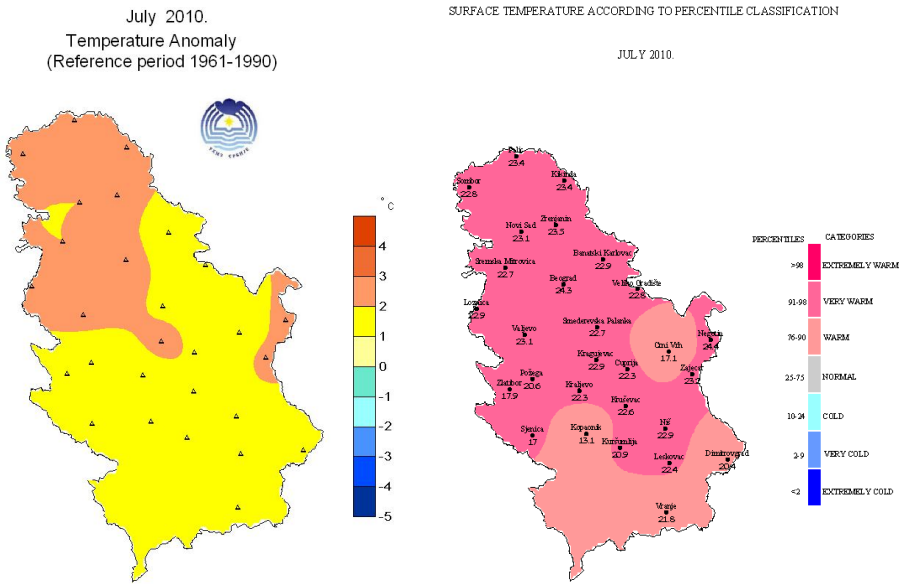
Maximum monthly precipitation sum was measured in Sombor and amounted to 240.0 mm which is three times higher than normal values and thereby breaking the previous record measuring 227.0 mm (in 2001). Monthly precipitation total was also exceeded in the area of Kikinda with the total of 202.6 mm (past maximum was 186.8 in 1954) and Valjevo with 216.8 mm (past maximum was 193.3 mm in 1979).

Maximum daily precipitation sum, measuring 113.2 mm for the territory of Serbia was also registered in Sombor on 22 June thereby breaking the previous record for Sombor (83.3 mm on 30 June 1974). Daily maximum was also exceeded on the stations of Novi Sad where 67.6 mm was recorded on 22 June (previous record of 60.0 was on 6 June 1981) and in Kikinda where 90.1 mm was recorded on 19 June (previous record of 65.4 mm was on 30 June 1939).

JULY

July was very hot; monthly maximum of the number of tropical nights exceeded. Precipitation within normal range

Mean monthly temperatures deviated from normal values by 1.1 °C to 2.6 °C. They were in the categories of hot and very hot in most parts of Serbia (Figure 13 and Figure 14).



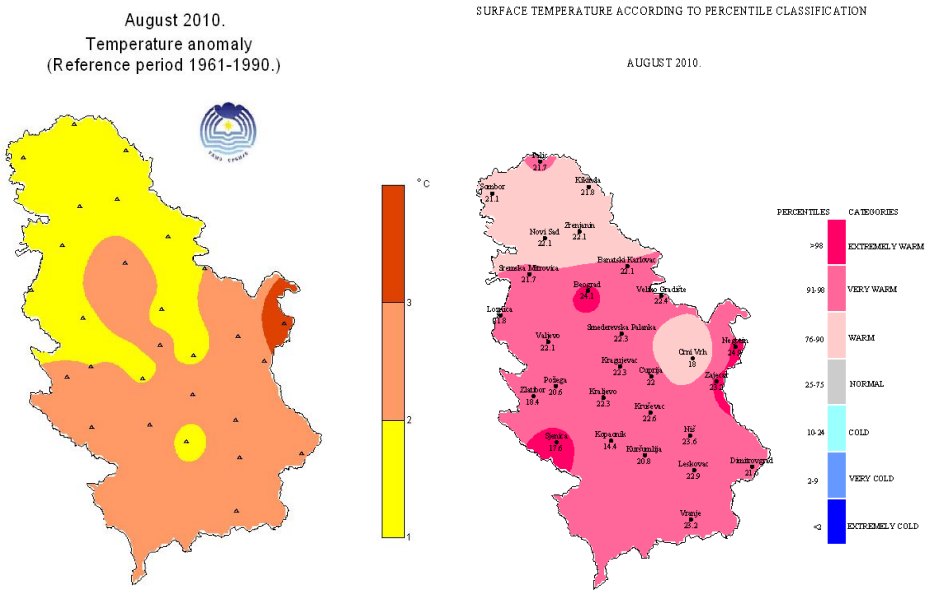
A number of tropical days and tropical nights were considerably above normal in most parts. Majority of tropical days, the total of 19, was recorded in Negotin and majority of tropical nights, the total of 11, was recorded in Belgrade. On the majority of stations, previous records in number of tropical nights in July was exceeded.

Monthly precipitation sum was in the category of normal in most parts of Serbia.

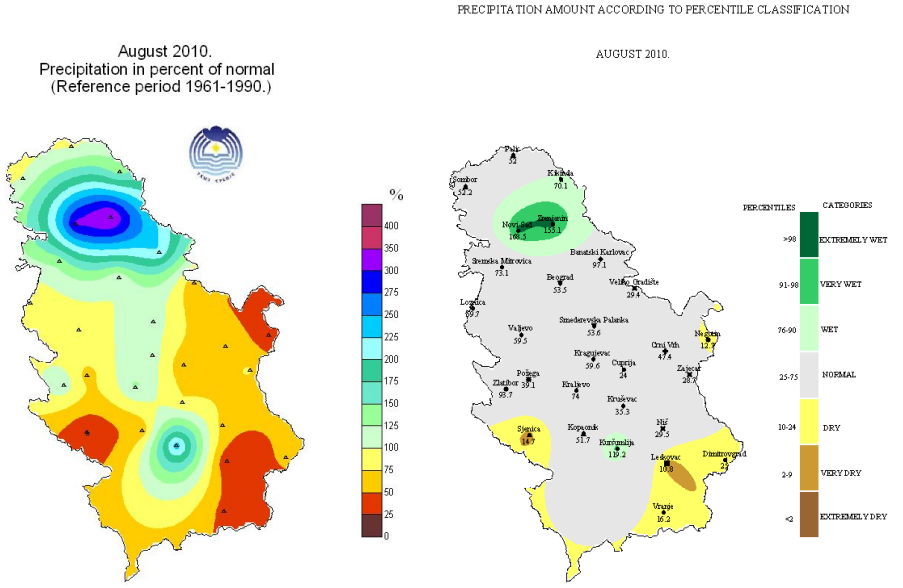
AUGUST

In southern parts extremely hot and dry. In northern parts, precipitation extremely above normal; daily and monthly precipitation totals exceeded.

Mean monthly temperatures deviated from normal values by 1.0 °C to 3.7 °C during August. In southern parts, they were in the categories of considerably and extremely above normal and in northern parts, in the category above normal (Figure 15 and Figure 16).



Total monthly precipitation sum was in the interval from 22% to 332% of normal values. In most parts they were in the categories above, considerably above and extremely above normal and, in some parts of southern Serbia, they were below normal (Figure 17 and Figure 18).



The highest monthly precipitation total was recorded in Novi Sad and it amounted to 168.5 mm thereby breaking the previous record for this station, measuring 147.7 mm (recorded in 1972). In Zrenjanin, on 1 August, measured daily precipitation sum was 64.7 mm breaking the previous record which amounted to 57.8 mm (recorded on 21 August 1939).

In Kursumlija, on 7 August, measured daily precipitation sum was 40.4 mm breaking the previous record which amounted to 37.4 mm (recorded on 17 August 1979).

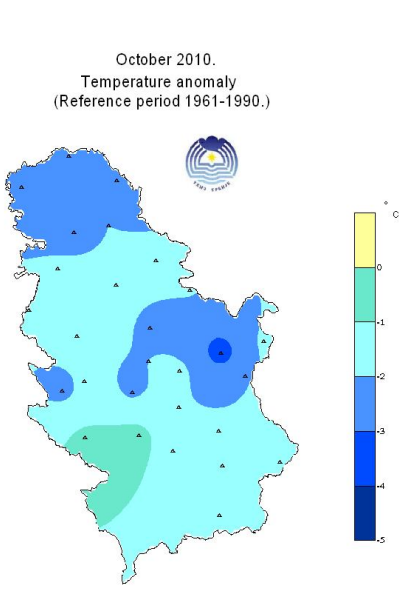
SEPTEMBER

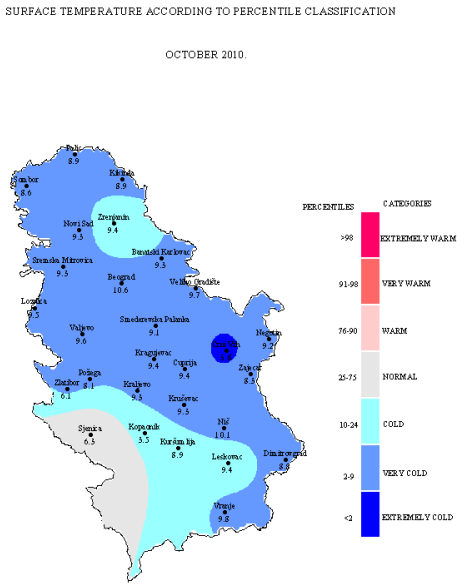
Significant temperature and precipitation deviation from normal was not recorded in September.

OCTOBER

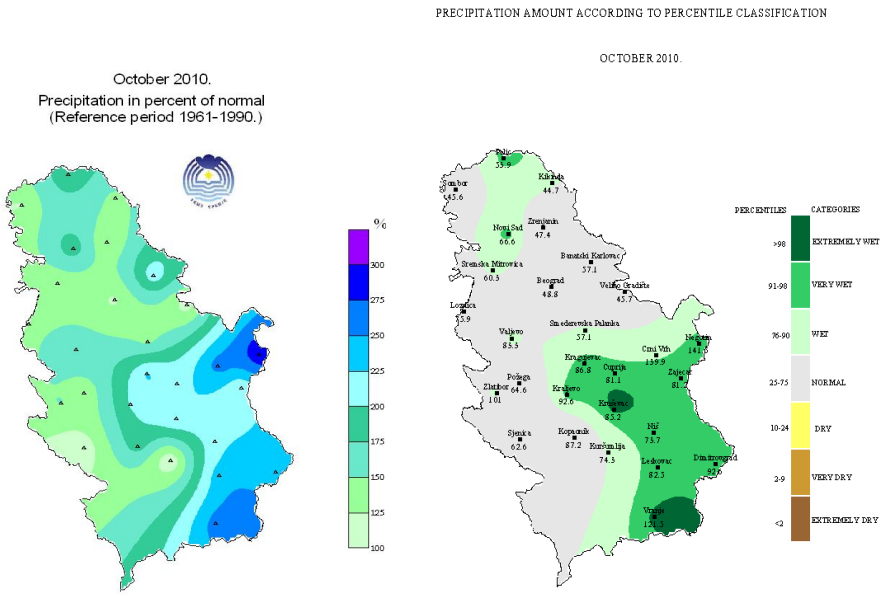
October was extremely cold, precipitation in southeastern parts extremely above normal

Deviation of mean monthly temperatures from normal values amounted to -3.5 °C to -0.6 °C. According to the percentile distribution, temperatures were in the categories below, considerably below and extremely below normal (Figure 19 and Figure 20).





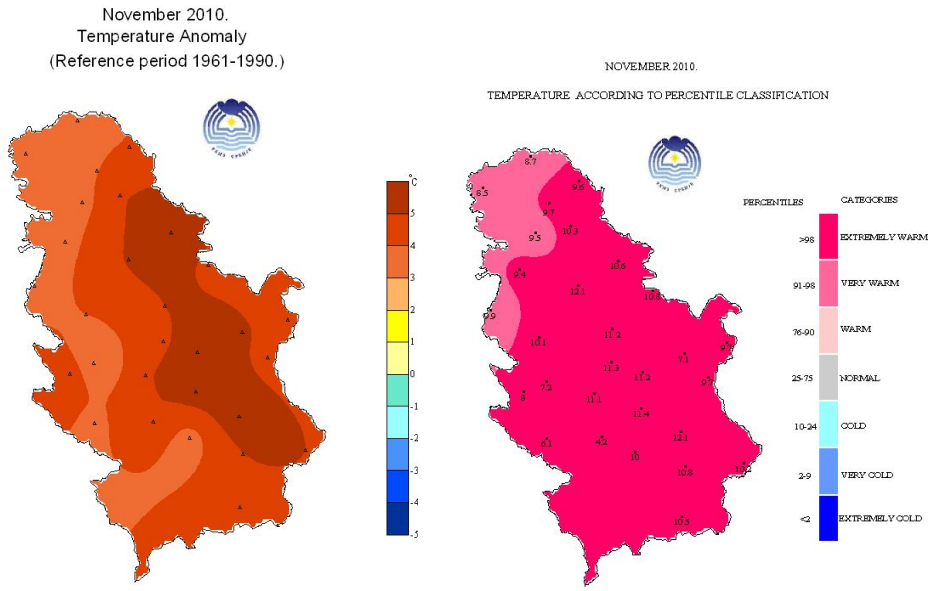
Monthly precipitation sums were in the interval of 100% to 296% of normal values. It was rainy, very rainy and extremely rainy in southeastern parts. Precipitation was in the category of normal in other parts (Figure 21 and Figure 22).



NOVEMBER

November was extremely hot. Heat wave observed lasting up to 22 days. Precipitation below normal in central areas.

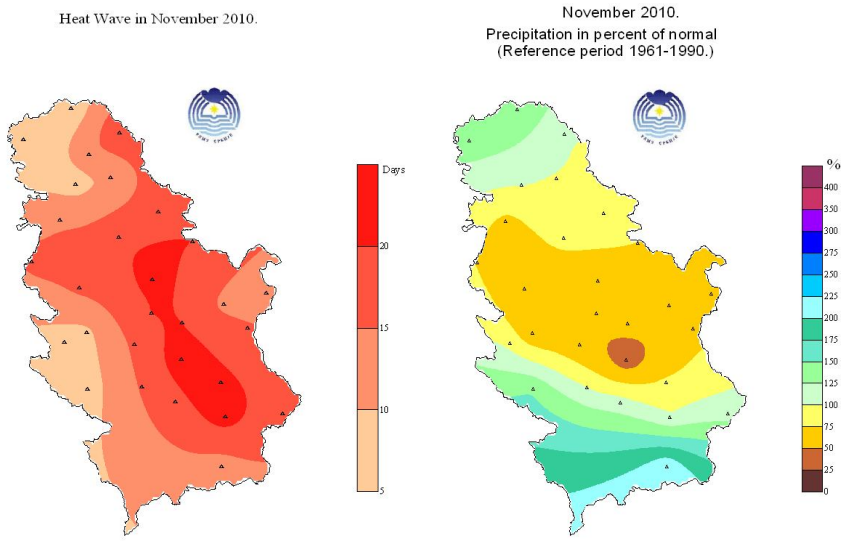
Anomaly of the mean monthly temperatures from normal values amounted from 3 °C to 6°C, and according to percentile distribution they were in the category extreme and considerably above normal (Figures 23 and 24). In the area of eastern, southeastern and central Serbia, this was **the hottest November** in the last 50 years.



During the first two decades of the month, heat wave was recorded lasting more than 15 days in most areas (Figure 25).

However, absolute temperature maximum was not exceeded.

Monthly number of days with precipitation, as well as monthly precipitation sums, remained within normal range in most areas. It was rainy in the north as well as in the part of southern and southwestern Serbia and dry in parts of western and central Serbia (Figure 26).



DECEMBER

Monthly number of days with precipitation higher than normal, previous records broken.

Temperature within normal range. Rainy in the south, precipitation within normal range in other parts.

December 2010 was characterized by a great number of days with precipitation. The total number of days with precipitation was higher than normal. On seven main meteorological stations it was exceeded, and on four stations the previous record was reached. Most days with precipitation, the total of 25, was observed in Loznica (a station in western Serbia).

Monthly precipitation sums remained within normal range in most parts. It was rainy and very rainy in southern, southeastern and southwestern parts of Serbia.

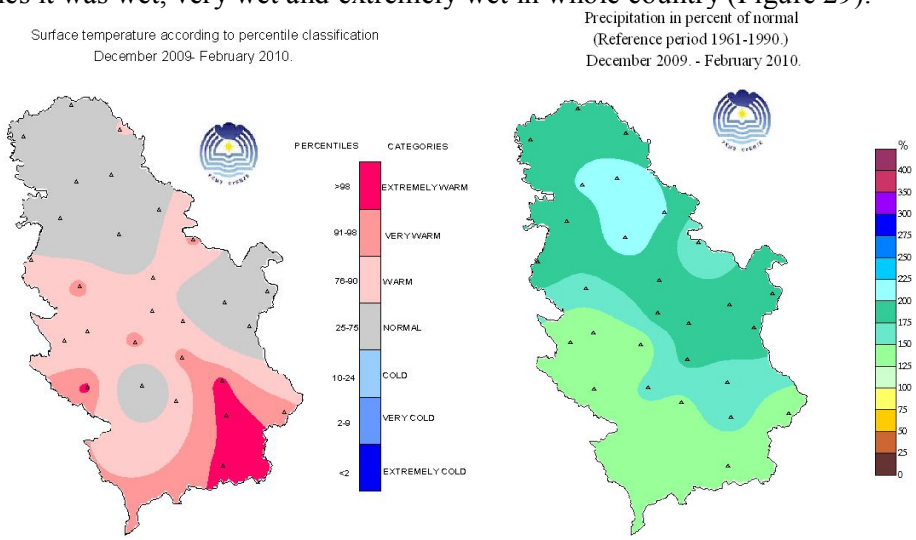
WINTER SEASON 2009/2010 IN SERBIA

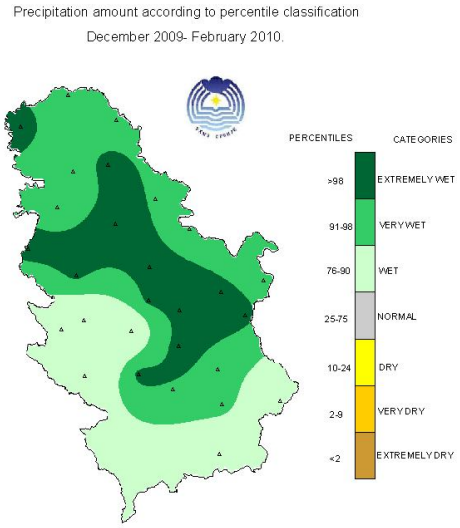
During the winter season 2009/10, the air temperature over Serbia was above normal, by approximately 1ºC on average. The highest positive anomalies (around 2ºC) were in the south and far southwest of the country. Smaller negative anomalies (up to 0.4ºC) were observed only in a narrow belt in the east of Serbia.

According to the method of percentiles, northern and eastern parts of the country were within normal range, central parts in the category of hot and southeastern parts in the category very hot and extremely hot (Figure 27).

This seasonal precipitation was 130 to 214% of normal values. It mostly occurred in the northern half of Serbia with the maximum in the northeastern parts of the country (Figure 28).

On the basis of the assessment of normal criterion by the method of percentiles it was wet, very wet and extremely wet in whole country (Figure 29).



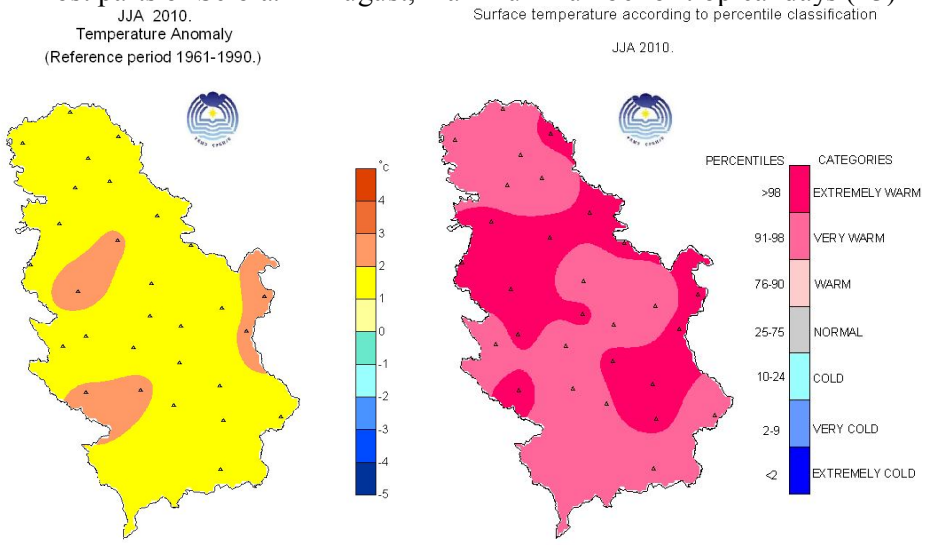


SUMMER SEASON 2010 IN SERBIA

During summer season 2010, the air temperature over Serbia was above normal, by 1 to 2ºC on average. The highest positive anomalies (2 to 3ºC) were in eastern and some parts of western Serbia (Figure 30). According to the method of percentiles, all parts of the country were in the category of very hot and extremely hot (Figure 31).

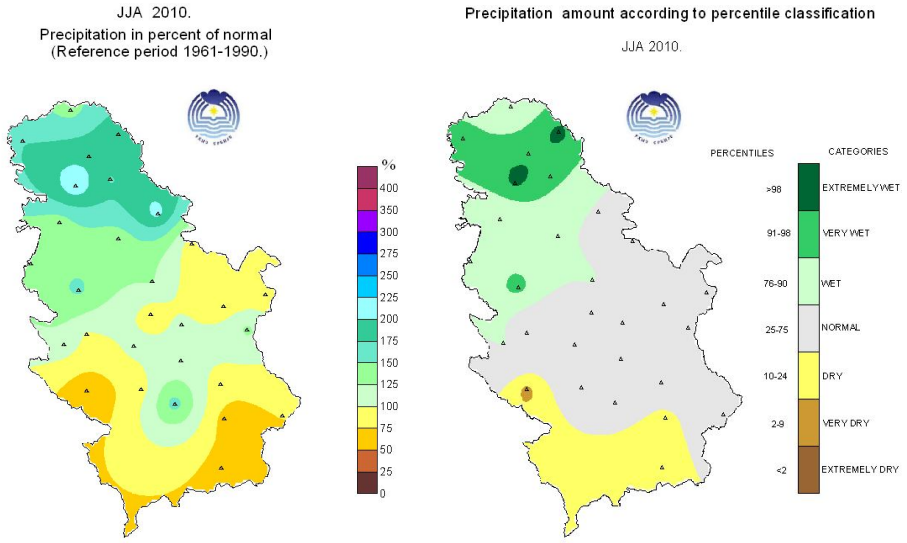
This summer, seasonal precipitation was lower than average in eastern, southeastern and southwestern parts, while in other parts of Serbia measured precipitation was higher than average, with maximum over northern Serbia (Figure 32). The assessment of normal criterion by the method of percentiles shows that most of Serbia was within normal. Very wet and extremely wet was in northern, and dry in the southern parts (Figure 33).

Number of summer days, tropical days and tropical nights was higher than average in most parts of Serbia. In August, maximum number of tropical days (23)



was observed in Negotin and Leskovac, which is more than two times higher than average for this month.

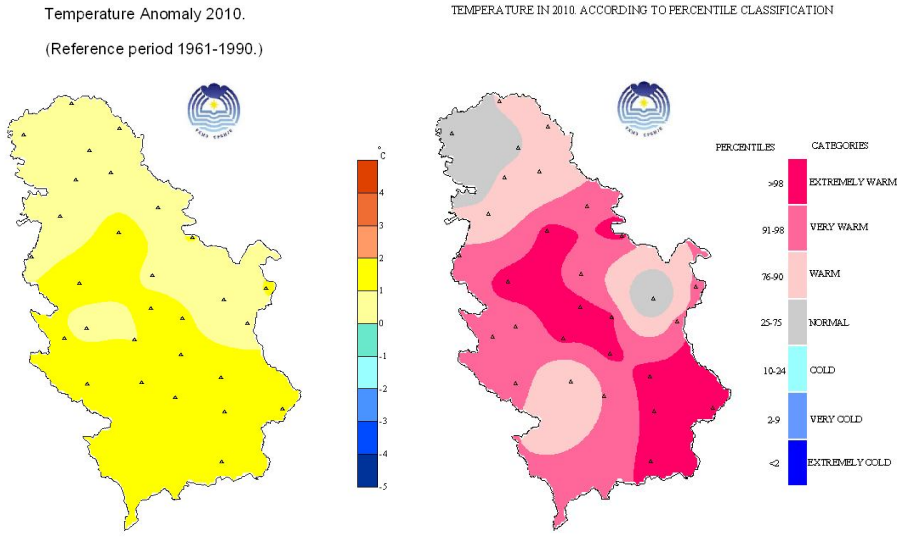
Most parts of Serbia were hit by a heat wave this year, from 7th to 14th of June.



ANNUAL TEMPERATURE AND PRECIPITATION

Temperature

The range of mean annual temperatures were in the interval of 4.1 to 13.1°C and in major part of Serbia their deviations from normal (the 1961-90 base period) were from 1 to 2 °C (Figure 34). According to the percentile distribution, they were in the category ***above*** normal in northern parts and in the category ***extremely above*** normal in other parts (Figure 35).



Precipitation

Annual precipitation amounts were 140-190% of normal in northern parts, where at six main meteorological stations total precipitation amounts were the highest over the past sixty years. At four main meteorological stations in western and southern parts of Serbia secondary maximums* of total precipitation amounts were registered (Table 1). In other parts of the country they were somewhat lower (Figure 36). According to percentile distribution, it was rainy and ***extremely*** rainy in whole Serbia (Figure 37).

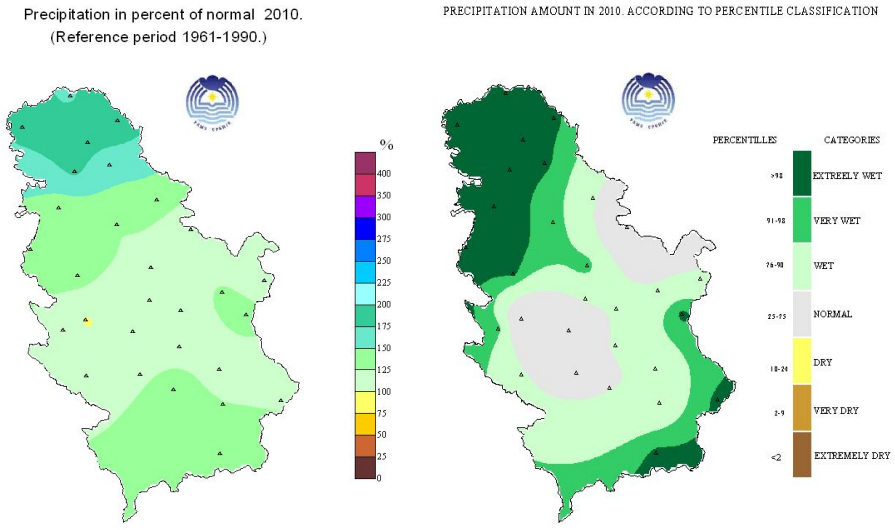


Table 1: Maximum annual amount of total precipitation untill and for the year 2010

Station	Long.	Lat.	H(m)	Year	Amount (mm)	Amount(mm) 2010.
Palic	19.77	46.10	102	2001	789.0	930.0
Sombor	19.08	45.78	88	1937	952.9	1034.2
Novi Sad	19.85	45.33	84	2001	998.6	1042.3
Zrenjanin	20.35	45.40	80	1999	884.6	905.1
Kikinda	20.47	45.85	81	1999	831.3	1031.0
Loznica	19.23	44.55	121	1955	1144.3	1096.3*
Valjevo	19.92	44.28	176	1937	1180.3	1065.9*
Kursumlija	21.27	43.13	382	1979	907.4	884.5*
Vranje	21.90	42.48	432	1934	893.5	846.9*

HYDROLOGICAL SITUATION

In the period of 20 December to 31 January 2010, big water wave developed on the Sava River due to frequent precipitation leading to local flooding lasting from 10 to 14 January.

At the beginning of January and in the middle of February, melting of snow cover in combination with precipitation caused significant water level rise on the rivers in Vojvodina and in the basin of the river Veliki Timok as well. During the second half of February, on hydrological stations Knjazevac and Zajecar flood defense limit was overcome on the river Beli Timok resulting with flood. During the third decade of April, there was also flood on Veliki Timok because of intensive precipitation.

During the second half of April there was sudden, significant water level rise on the rivers Juzna Morava and Velika Morava and moderate increase in the basin of Zapadna Morava due to intensive precipitation. Emergency flood defense limit was overcome on the whole basin of the Juzna Morava.

During the second half of May and the first decade of June, water levels were in moderate to significant increase on all water courses of Banat and regular and extraordinary flood defense limits were overcome.

By the end of the third decade of June, prominent high water wave formed on the rivers Sava, Danube and Tisza due to heavy rains and already high water levels. This rise of water level lasted until the first decade of July and caused minor material damage.

In the period from 23 June to 5 July, a great flood wave was recorded on the basin of the rivers Kolubara and Jadar. New, historical maximum water levels were recorded on the river Kolubara. On the tributaries of the Kolubara, the Tamnava, the Ljig and the Jadar, major flooding was recorded and it caused significant material damage.

By the end of November and beginning of December, heavy rains lasting many days in the area of Montenegro, Herzegovina, Bosnia and Croatia caused simultaneous and significant rise of water levels on the whole basin of the rivers Drina and Sava. Extreme precipitation was recorded in Montenegro and eastern Herzegovina where 100 to 200 mm of rain fell in three days by the end of November.

On the tributaries of the Drina (the Piva, the Tara, the Cehotina, the Lim and the Jadar), as well as on the Drina, flood wave lasted from the end of November to the

first decade of December. Flood wave was of great magnitude partly due to the fact that the accumulations on the Drina basin could not receive immense quantity of water, thus the emptying was carried out during the wave peak and not before it.

Conditional (warning) levels were overcome on all the rivers of this basin and the water level recorded on 3 December 2010 on the hydrological station Radalj on the Drina (between Zvornik and Loznica) is a new historical maximum (Hmax = 659cm).

At the same time there was a reaction on the Sava river due to the precipitation in the upper and lower section, so that flood wave was also formed on this river during the first decade of December. The limits of extraordinary defense were overcome at Jamena, Sremska Mitrovica and Sabac during the first decade of December.

By the middle of the first decade of December, the water level on the Tisa rose (the limits of regular defense were overcome at Novi Knezevac and Titel) so that the combination of the influence of this event and the wave from the Drina and the Sava caused the shifting of the wave peak at Belgrade on the Sava and also at Zemun, Pancevo and Smederevo on the Danube. At these stations, the limits of regular flood defense were overcome by the end of the second decade of December.

The rise of the water levels on Drina Rivercaused great floods on the territories of Montenegro, Republic Srpska, Bosnia and Herzegovina and Podrinje (great material damage) and minor flooding in the Sava region on our territory (minor material damage).

AGROMETEOROLOGICAL EXTREME EVENTS DURING 2010

Heavy floods in spring months disturbed the sewing of spring crops, caused river floods and the rise of ground waters. In March, rains and sporadic snow favored the development of plant diseases, disturbed fruit pollination and disabled proper protection measures. All these caused decreased fruit yield. Greatest damages were suffered by winter wheat because heavy rains in June and beginning of July disturbed sewing and caused falling down of wheat and loss of grains.