

# VERIFICATION OF THE SEECOF-11 SUMMER 2014 CLIMATE OUTLOOK FOR THE TERRITORY OF SERBIA COMPARED TO THE 1981-2010 BASE PERIOD

## Temperature

According to the Consensus statement of SEECOF-11, mean summer seasonal temperature in Serbia was expected to be: warmer than average (temperature in the upper tercile) with 35% probability, average with 35% probability and below average with 30% probability, compared to the 1981-2010 climatological base period.

Based on the meteorological monitoring, summer 2014 was normal across entire Serbia with average temperature according to the tercile method (*Figure 1*).

Verification has shown that the temperature didn't reach the lower tercile which was indicated in the outlook with the minimum probability.

## Precipitation

The SEECOF-11 climate outlook for the summer 2014 indicated above-average precipitation totals in the mountains of the central and southern parts of the country with 40% probability for the upper tercile. In rest of Serbia the probabilities for below, near or above-average conditions were expected to be approximately equal.

Monitoring of precipitation showed wet summer conditions across most of Serbia (*Figure 2*).

The outlook for a wet summer was correct for central and southern parts of the country.

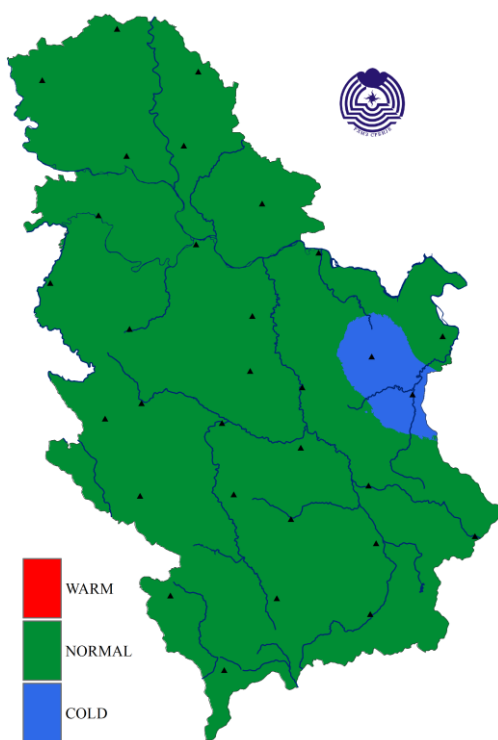


Figure 1. Monitoring of the summer 2014 temperature in Serbia using the tercile method, compared to the 1981-2010 base period

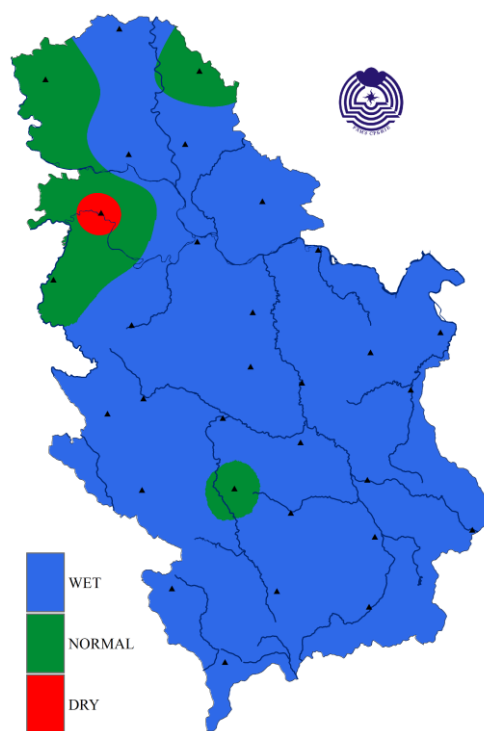


Figure 2. Monitoring of the summer 2014 precipitation in Serbia using the tercile method, compared to the 1981-2010 base period

**Summer 2014 was very warm, rainy to extremely rainy across most of Serbia. Only one heat wave was registered, in first half of the June. Record-breaking summer precipitation sums in Nis (289.8 mm).**

## **Analysis of the 2014 summer season for Serbia compared to 1961-1990 base period**

### **Temperature**

During summer 2014, mean air temperature ranged between 19,3°C in Dimitrovgrad and 22,6°C in Negotin and in the mountain areas from 12,1°C on Kopaonik to 16,5°C on Zlatibor (Figure 1).

The departure of the mean air temperature from the normal<sup>1</sup> for the 1961- 1990 base period during summer 2014 ranged from 0,5°C in Zajecar to 1,4°C in Negotin and in the high-lying areas from 0,5°C on Crni Vrh to 1,5°C on Kopaonik Mountain (Figure 2).

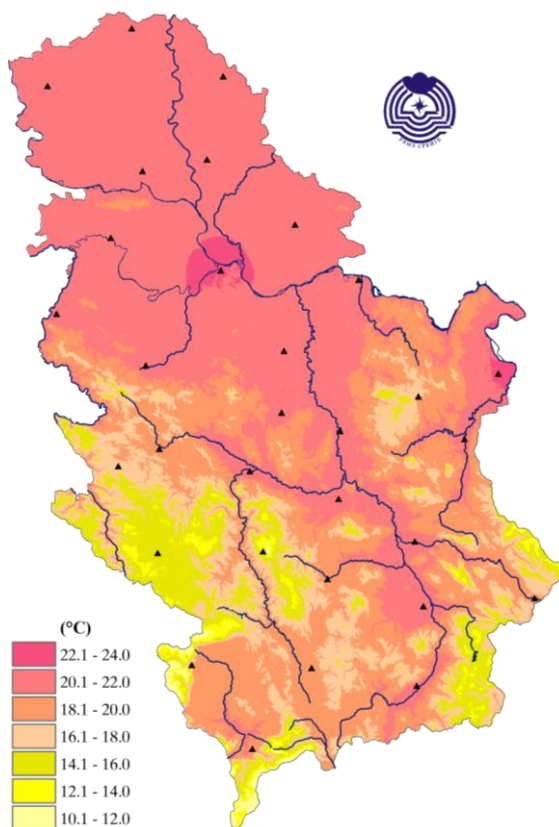


Figure 1. Spatial distribution of mean seasonal air temperature (°C) during summer 2014

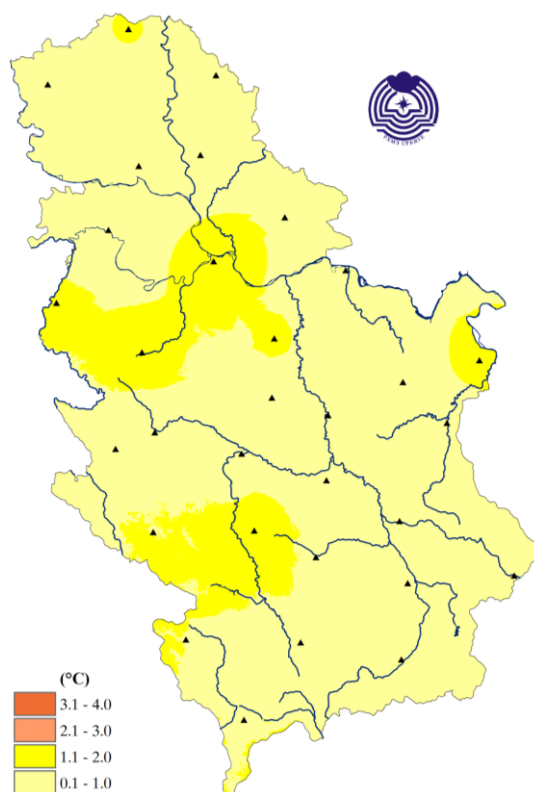


Figure 2. Mean seasonal air temperature anomaly compared to the 1961-1990 base period during summer 2014

<sup>1</sup> Term *normal* refers to *climatological standard normal*, that is, the average value of a particular climate element, calculated for the period from January 1, 1961 to December 31, 1990

According to the percentile method<sup>2</sup>, mean air temperature during summer 2014 was in the category of very warm across most of Serbia and warm in Kraljevo, Krusevac, Curpija, Nis, Zajecar, Dimitrovgrad, Vranje and Zlatibor (Figure 3).

According to the tercile method, mean air temperature was in the warm category in the entire Serbia (Figure 4).

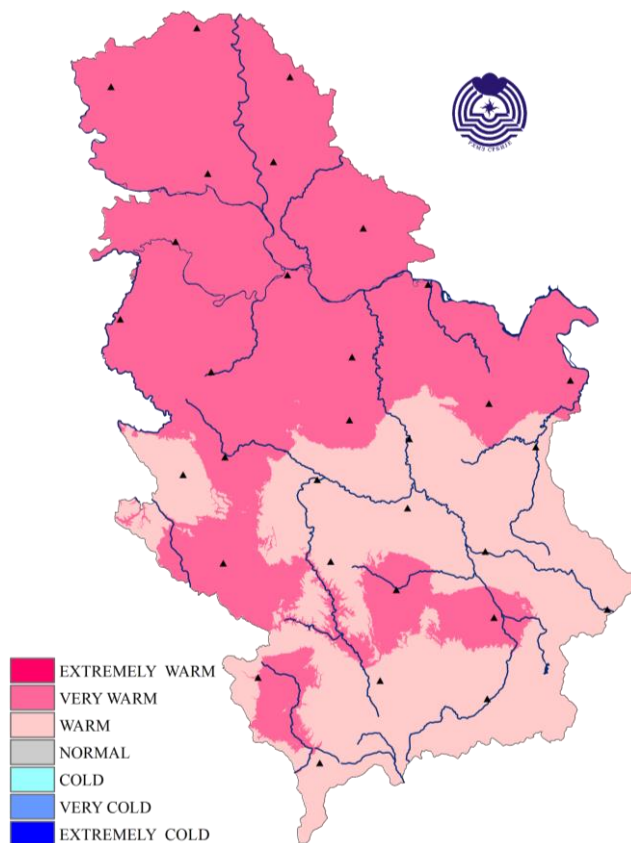


Figure 3. Air temperature in Serbia during summer 2014 using percentile method compared to the 1961-1990 base period

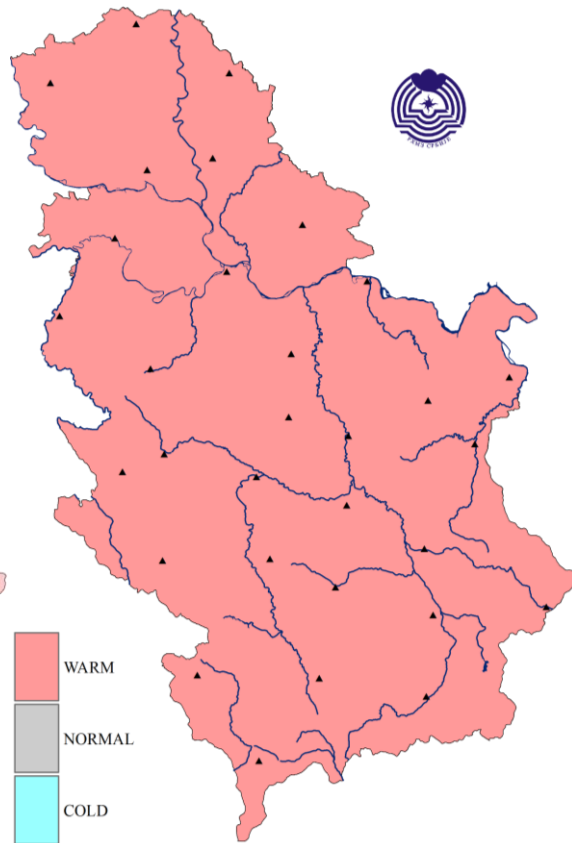


Figure 4. Air temperature in Serbia during summer using tercile method compared to the 1961-1990 base period

The highest daily air temperature during summer 2014, measuring 36°C was observed on 13 and 14 August in Cuprija.

The greatest positive deviation of the number of summer days from the average was recorded in northwestern, northeastern and southern Serbia (Figure 5).

The number of summer days with the maximum daily air temperature above 25°C varied from 64 in Loznica, Valjevo, Pozega, Kraljevo and Palic to 77 days in Negotin and in the mountain areas between 5 on Crni Vrh and 27 days on Sjenica. Kopaonik didn't observe any summer days. The greatest positive deviation of the number of tropical days from the average was registered in Leskovac, total of 11 days (Figure 6).

<sup>2</sup> nth percentile of a variable refers to the value of the observed variable below which there is n percent of data previously arranged in an ascending order

The number of tropical days with maximum air temperature above 30°C was recorded in the entire Serbia except for Kopaonik, Crni Vrh and Sjenica. The number of tropical days varied from 15 in Dimitrovgrad and Pozega to 37 days in Leskovac. The greatest positive deviation of the number of tropical days from the average was observed in Leskovac, total of 11 days (Figure 6).

During summer 2014, tropical night were observed across most of Serbia with the exception of southern, southeastern, western and central mountain areas. The highest number of tropical nights with the minimum air temperature above 20°C was registered in Belgrade, total of 15 days.

During summer 2014, most of Serbia experienced tropical nights with the exception of southern, southeastern, western and central mountain areas. The highest number of tropical nights with the minimum air temperature above 20°C was recorded in Belgrade, total of 15 days.

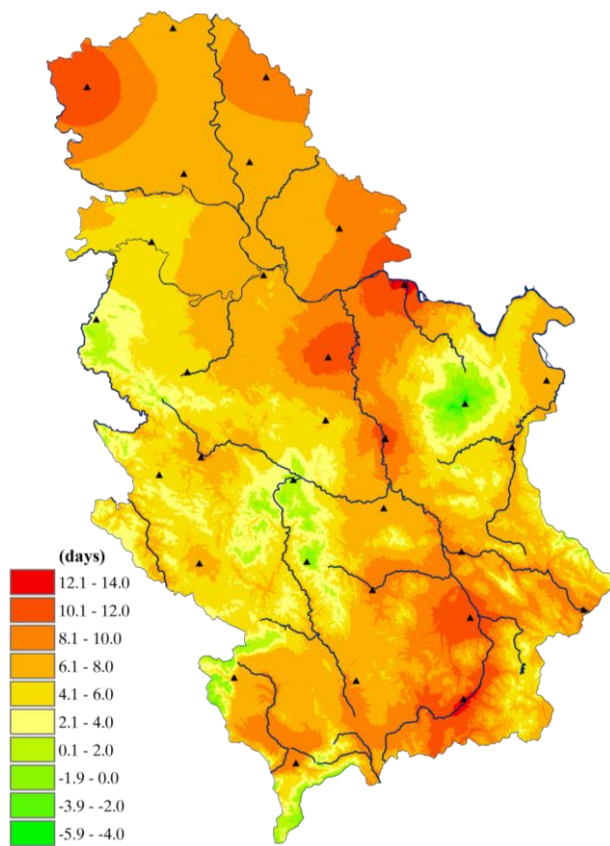


Figure 5. Deviation of the number of summer days during summer compared to the normal for the 1961-1990 base period

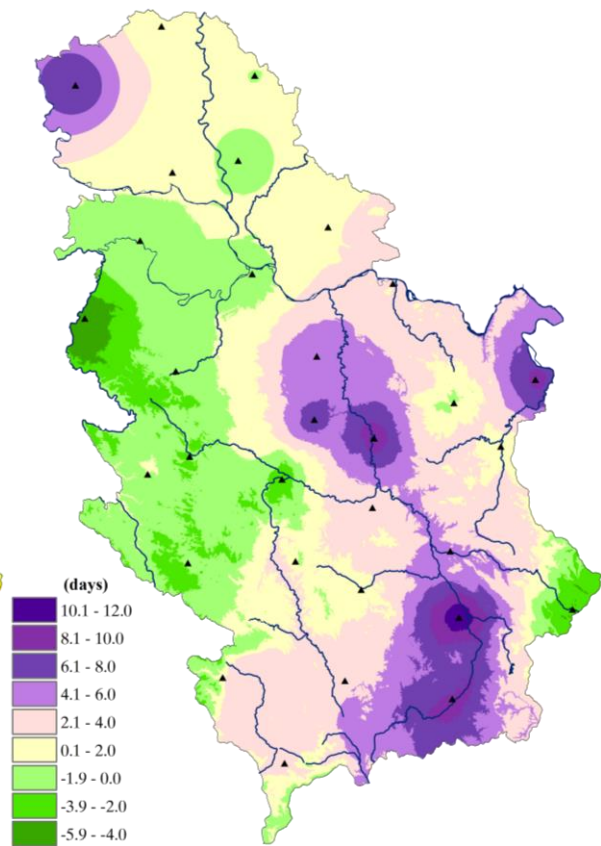


Figure 6. Deviation of the number of tropical days during summer compared to the normal for the 1961-1990 base period

The lowest air temperature during summer 2014, measuring 1.1°C was observed on Kopaonik on 2<sup>nd</sup> of June.

During most of the summer season, mean and maximum air temperature varied greatly in Belgrade, while the minimum air temperature was mostly above the multiannual average (Figure 7).



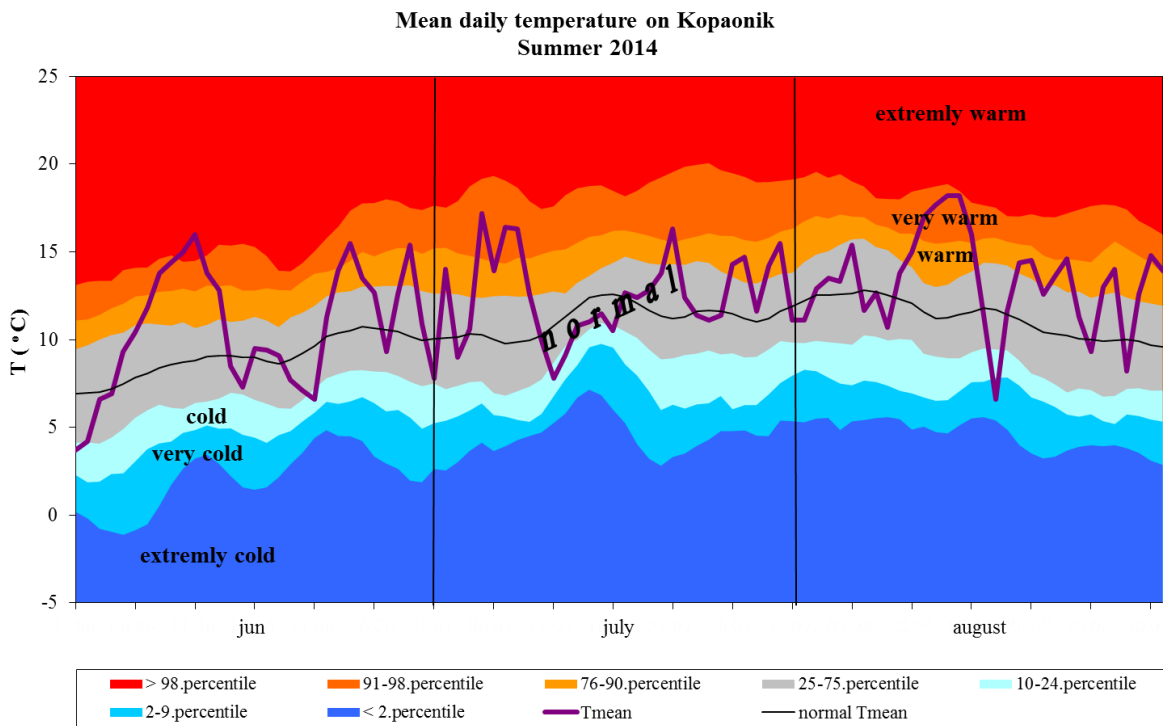


Figure 9. Three-month course of the daily air temperature on Kopaonik during summer 2014

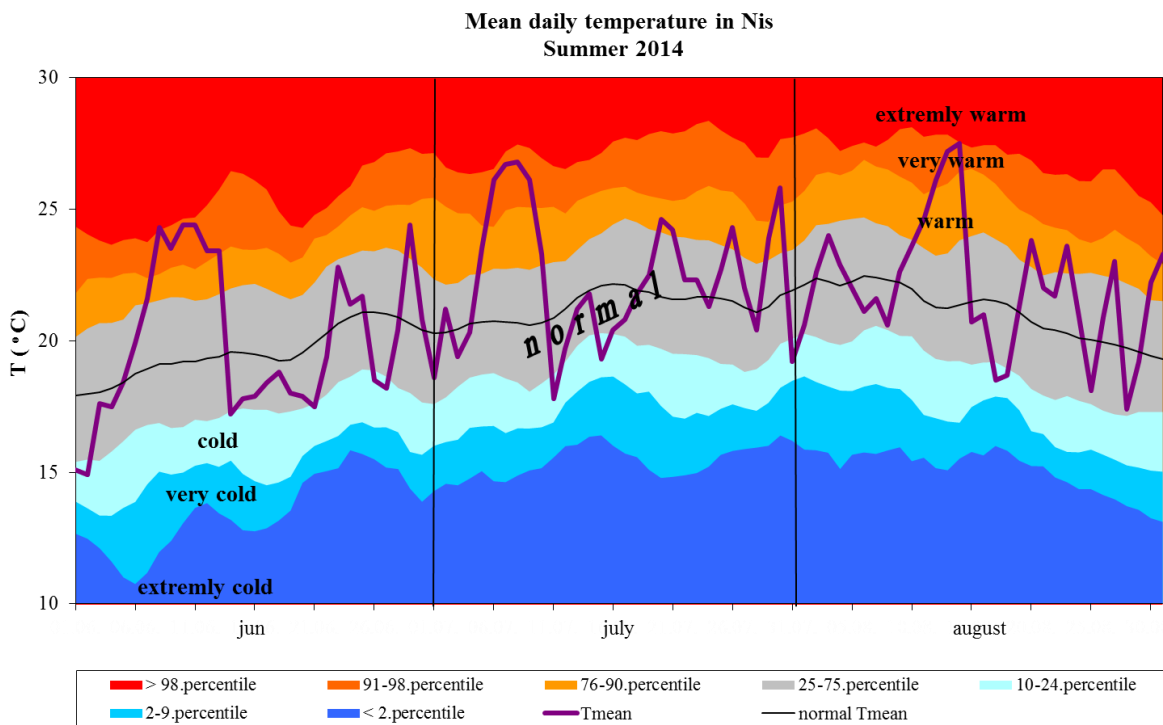


Figure 10. Three-month course of daily air temperature in Nis during summer 2014

## Precipitation

During summer 2014, precipitation sums were above the average compared to the normal for the 1961 – 1990 base period almost across entire Serbia with the exception of Sremska Mitrovica and Kopaonik. Precipitation sums ranged from 82% in Sremska Mitrovica to 189% in Zajecar compared to the normal (*Figure 11*).

According to the percentile method, precipitation sums during summer were in the following categories: rainy and very rainy in most of Serbia, extremely rainy in Belgrade, Valjevo, Kraljevo, Zajecar and Nis and normal in Sombor, Kikinda, Sremska Mitrovica, Loznica, Leskovac and Vranje (*Figure 12*).

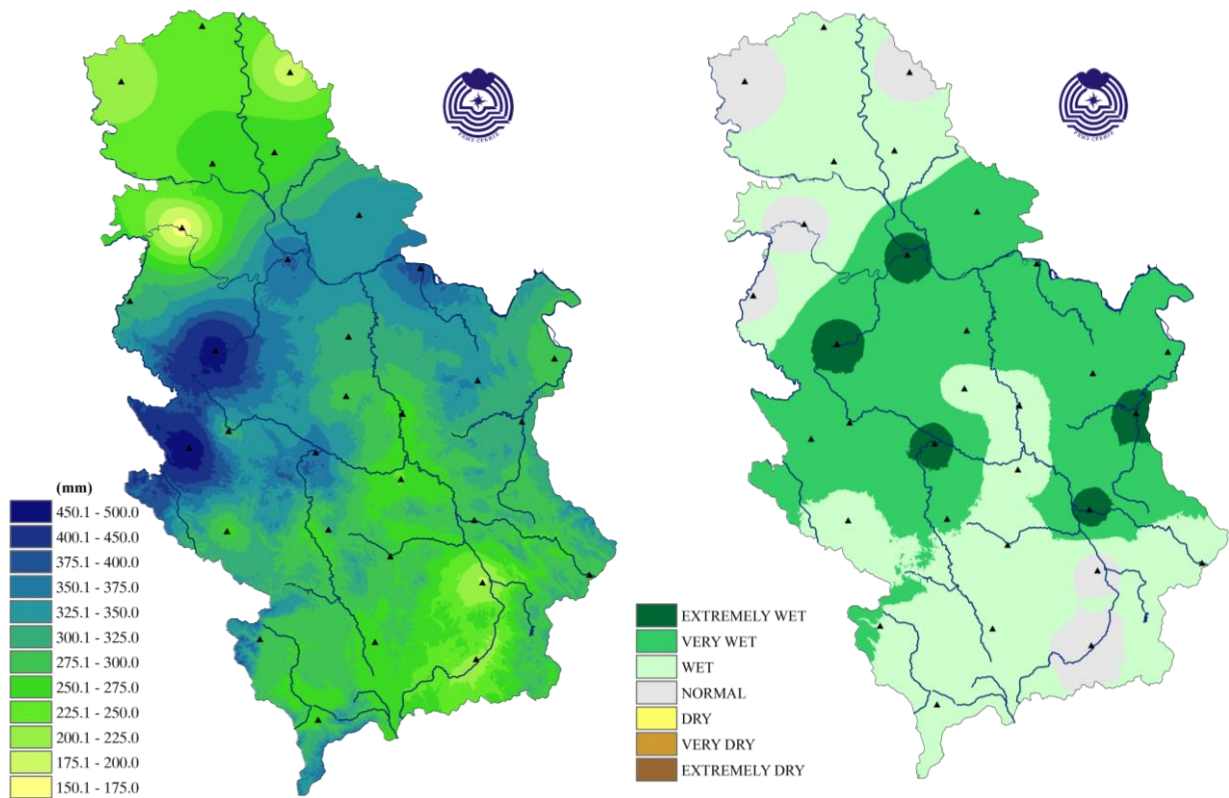


Figure 11. Spatial distribution of the precipitation sums expressed in the percentages of normal during summer 2014

Figure 12. Precipitation sums using percentile method during summer 2014 compared to the 1961-1990 base period

According to the tercile method, precipitation sums were above the average across most of Serbia, within multiannual average in Kikinda and Loznica, and below the average in Sremska Mitrovica (Figure 13).

The maximum daily amount of precipitation of 85.8mm was registered on Crni Vrh on 1<sup>st</sup> of August. The amount of 289.8 mm observed in Nis was the record breaking precipitation total registered during summer 2014.

The highest number of days with the precipitation of 1.0 mm and above, simultaneously the greatest deviation of the average values for the summer was recorded in Pozega. The total number of days was 40, which is 14 days above the average (Figure 14)

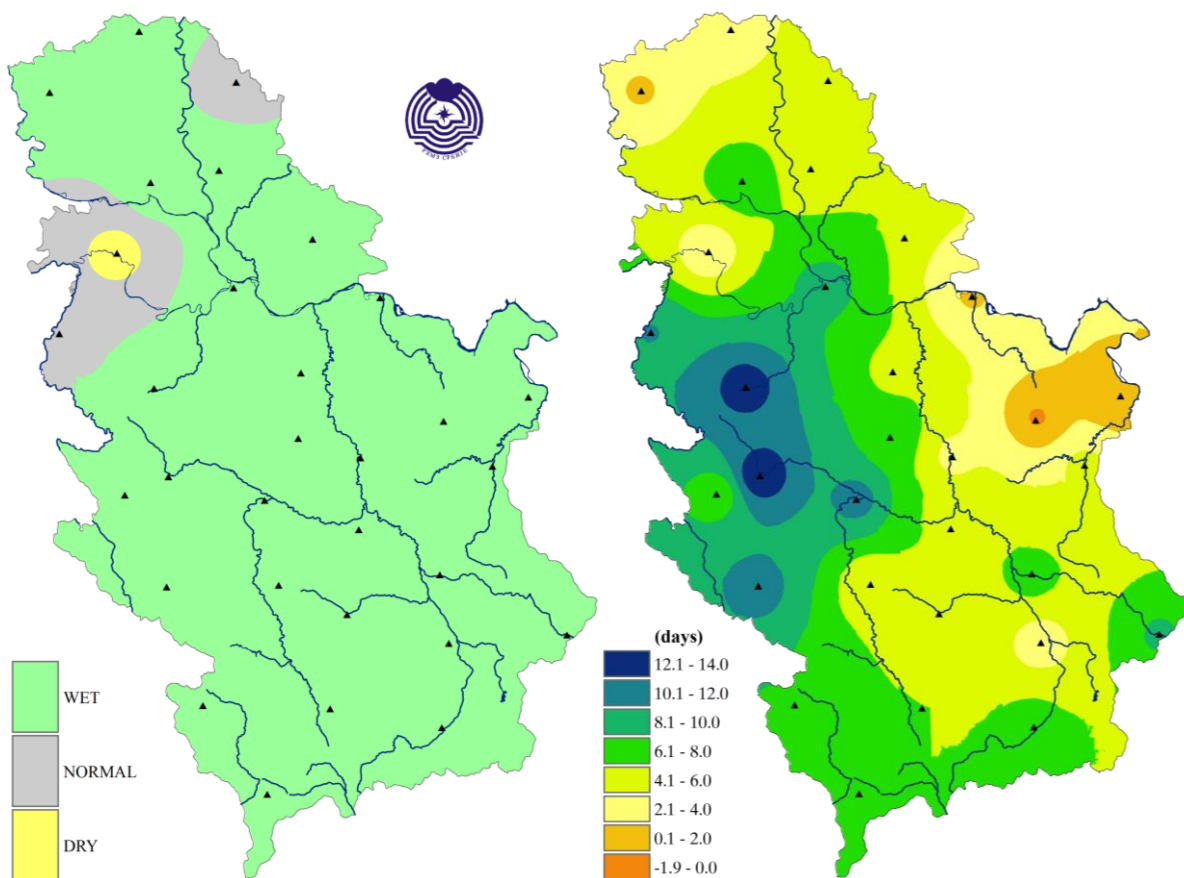


Figure 13. Precipitation sums using tercile method during summer 2014 compared to the 1961-1990 base period

Figure 14. Deviation of the number of days with precipitation of 1.0 mm and above during summer 2014

Figures 15 and 16 show cumulative sums of precipitation for Belgrade and Novi Sad during summer 2014 per month and compared to the average cumulative sums of precipitation.



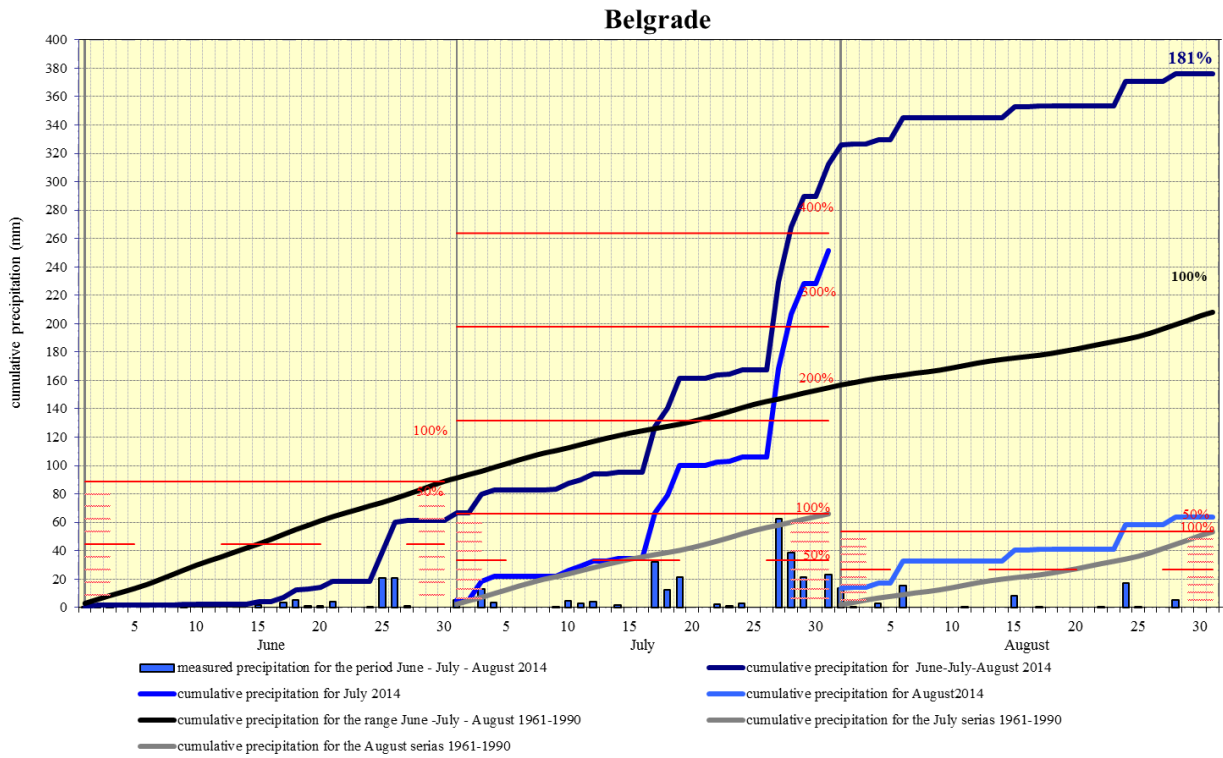


Figure 15. Cumulative sums of precipitation for Belgrade

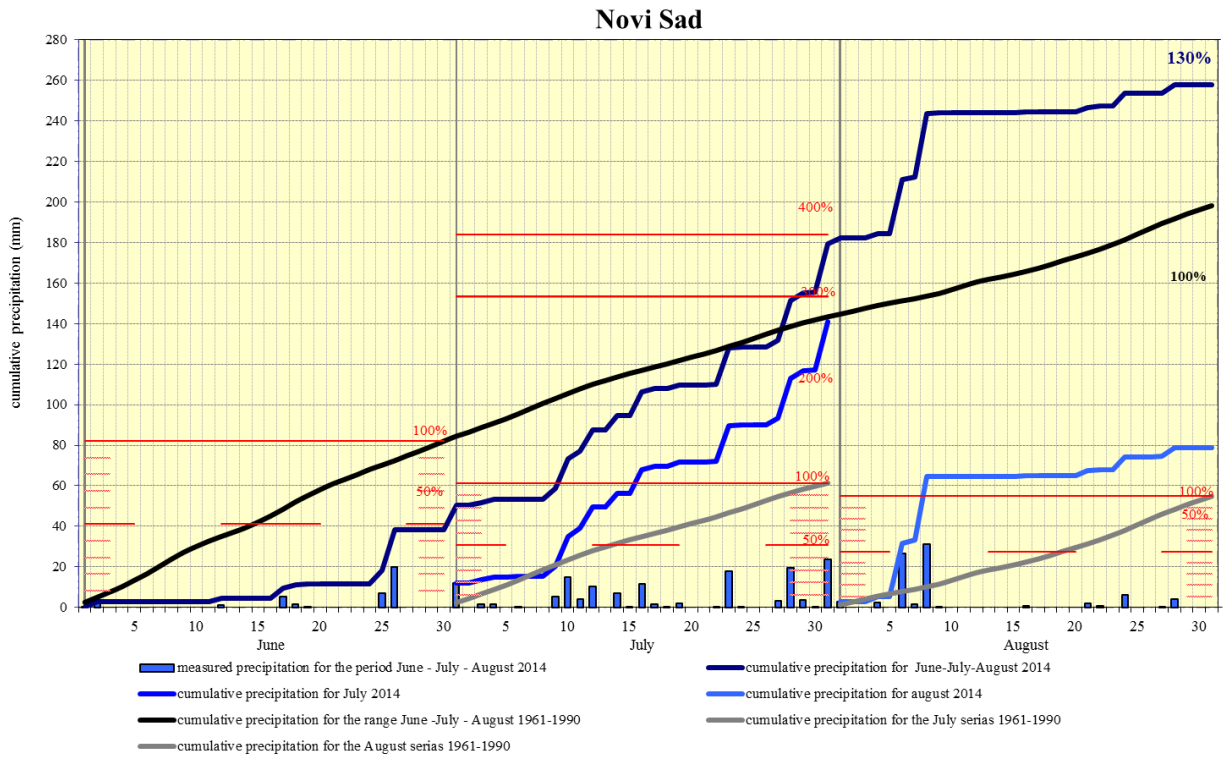


Figure 16. Cumulative sums of precipitation for Novi Sad

## Sunshine duration (insolation)

During summer 2014, sunshine duration was above the average across much of Serbia apart from western, eastern, southeastern and certain central areas. Insolation ranged from 669.6 hours in Pozega to 898 hours in Vranje (*Figure 17*).

Sunshine duration ranged from 85% in Zajecar to 118% in Kursumlija, compared to the normal for the 1961 – 1990 base period (*Figure 18*).

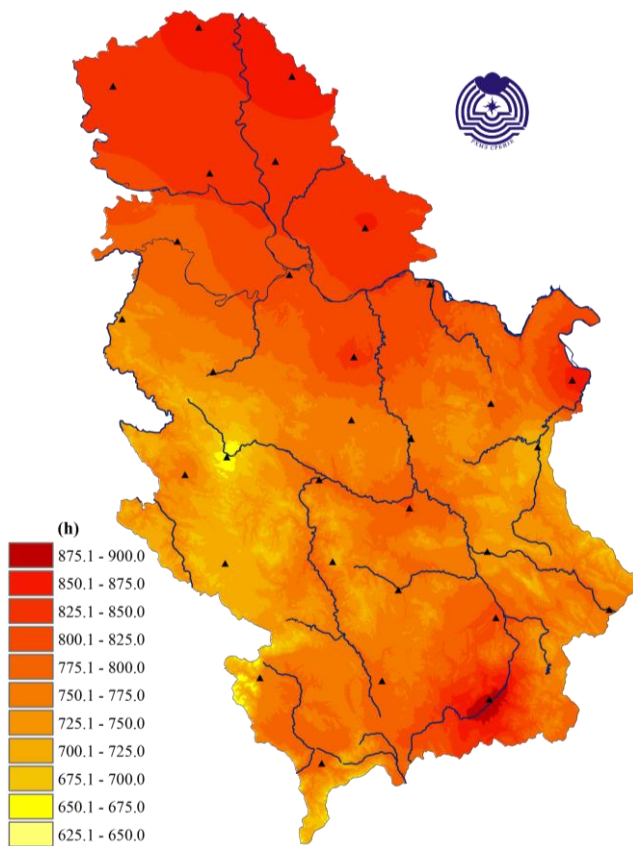


Figure 17. Insolation during summer 2014, expressed in hours

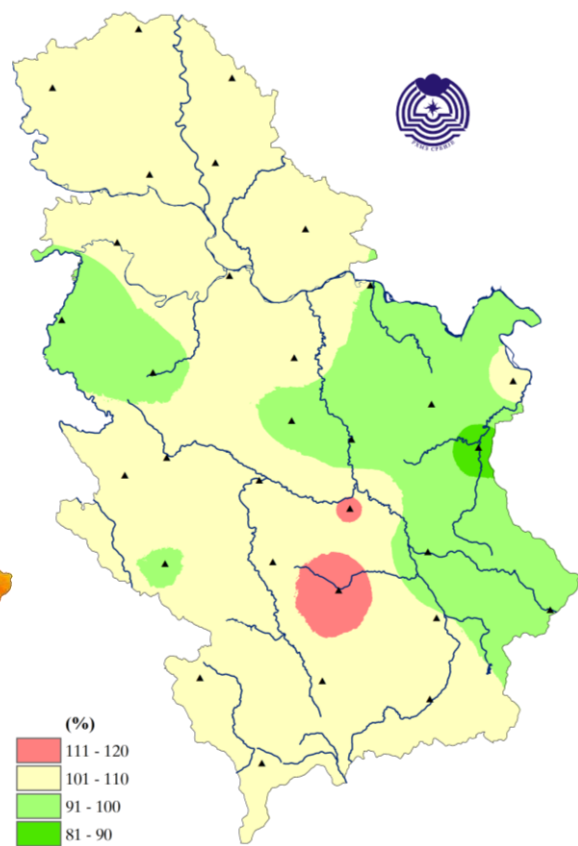


Figure 18. Insolation during summer 2014, expressed in the percentages of normal



# Analysis of the 2014 summer season for Serbia compared to the 1971-2000 base period

## Temperature

During summer 2014, the departure of the mean air temperature from the normal for the 1971 – 2000 base period ranged from  $-0,1^{\circ}\text{C}$  in Zajecar to  $1^{\circ}\text{C}$  in Negotin and on the mountains from  $0,1^{\circ}\text{C}$  on Crni Vrh to  $0,7^{\circ}\text{C}$  on Kopaonik (*Figure 19*).

According to the percentile method, mean air temperature during summer 2014 was in the following categories: normal in most of Serbia, warm in Novi Sad, Zrenjanin, Loznica, Sremska Mitrovica, Valjevo, Belgrade, Pozega and Kursumlija (*Figure 20*).

According to the tercile method, mean air temperature during summer 2014 was above the average across most of Serbia and within the normal values in Kraljevo, Krusevac, Nis, Zajecar Vranje and on Crni Vrh.



Figure 19. Mean seasonal air temperature anomaly compared to the 1971-2000 base period during summer 2014

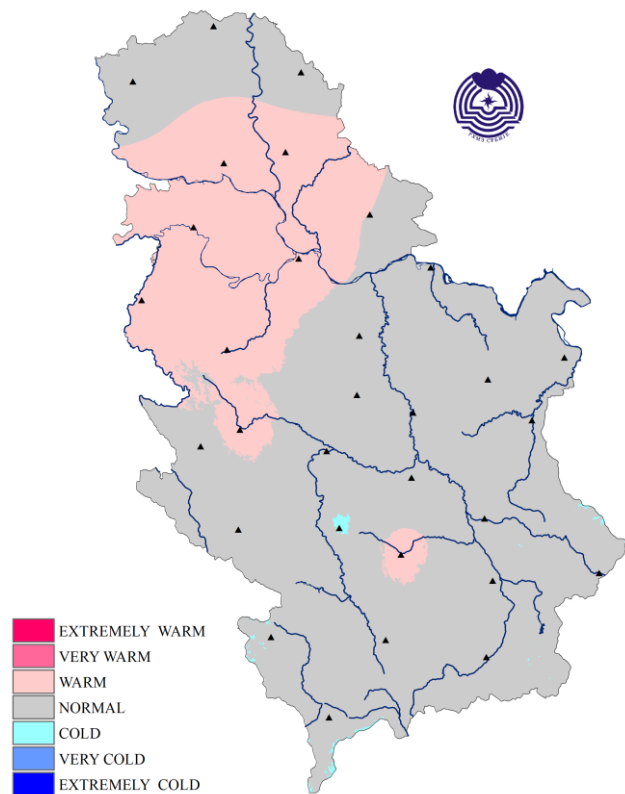


Figure 20. Air temperature in Serbia during summer 2014 using percentile method compared to the 1971-2000 base period

## Precipitation

During summer 2014, precipitation sums were above the average compared to the normal for the 1971 – 2000 base period across entire Serbia with the exception of Sremska Mitrovica. Precipitation sums ranged between 82% in Sremskoj Mitrovici and 196% in Zajecar compared to the normal (*Figure 21*).

According to the percentile method, precipitation sums were in the following categories: rainy and very rainy across most of Serbia, extremely rainy at certain stations and in the normal category in northwestern, northeastern and southernmost areas (*Figure 22*).

According to the tercile method, precipitation sums were above the average across most of Serbia, within multiannual average in Sombor, Kikinda and Loznica, and below the average in Sremska Mitrovica.

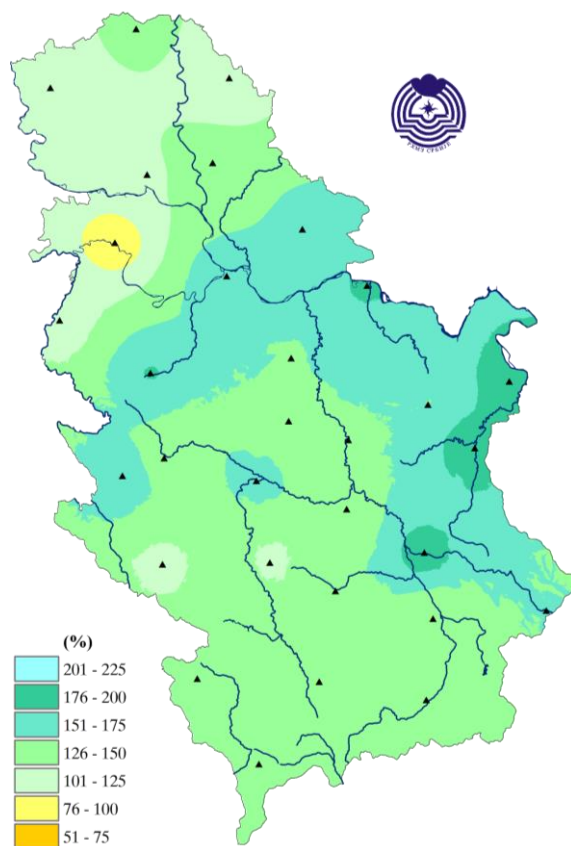


Figure 21. Spatial distribution of precipitation sums expressed in the percentages of normal during summer compared to the 1971-2000 base period

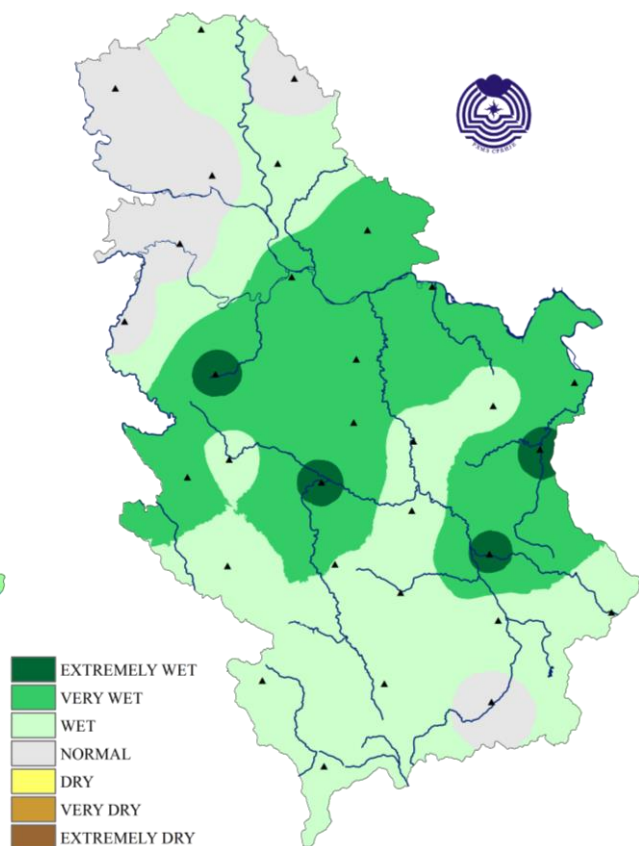


Figure 22. Precipitation sums using percentile method during summer 2014 compared to the 1971-2000 base period

# Analysis of the 2014 summer season for Serbia compared to the 1981-2010 base period

## Temperature

The departure of the mean air temperature from the normal during summer 2014 for the 1981 – 2010 base period ranged from  $-0,9^{\circ}\text{C}$  in Zajecar to  $0,2^{\circ}\text{C}$  in Valjevo and Kursumlija and on the mountains between  $-0,4^{\circ}\text{C}$  on Crni Vrh and  $0,1^{\circ}\text{C}$  on Kopaonik (Figure 23).

According to the percentile method, mean air temperature was in the normal category across entire Serbia with the exception of Zajecar where it was cold (Figure 24).

According to the tercile method, mean air temperature was within the normal across entire Serbia with the exception of Zajecar and Crni Vrh where it was below normal.

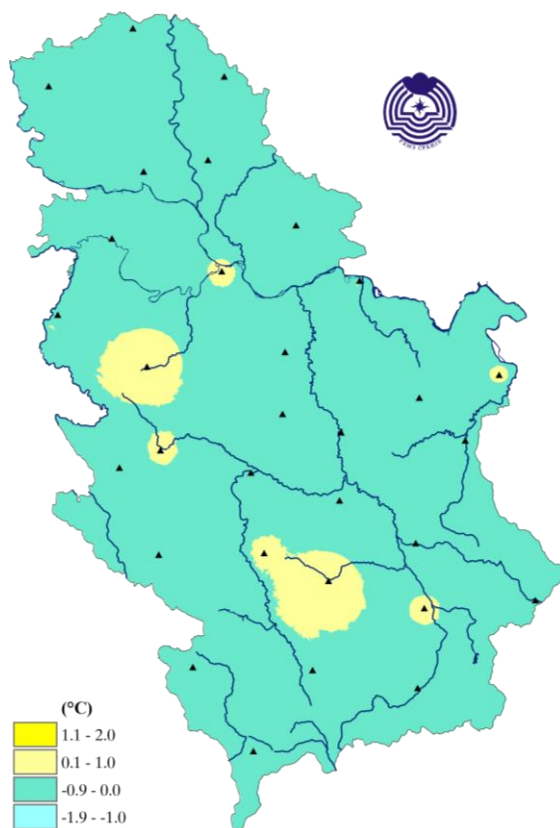


Figure 23. Mean seasonal air temperature anomaly in Serbia during summer 2014 compared to the 1981-2010 base period

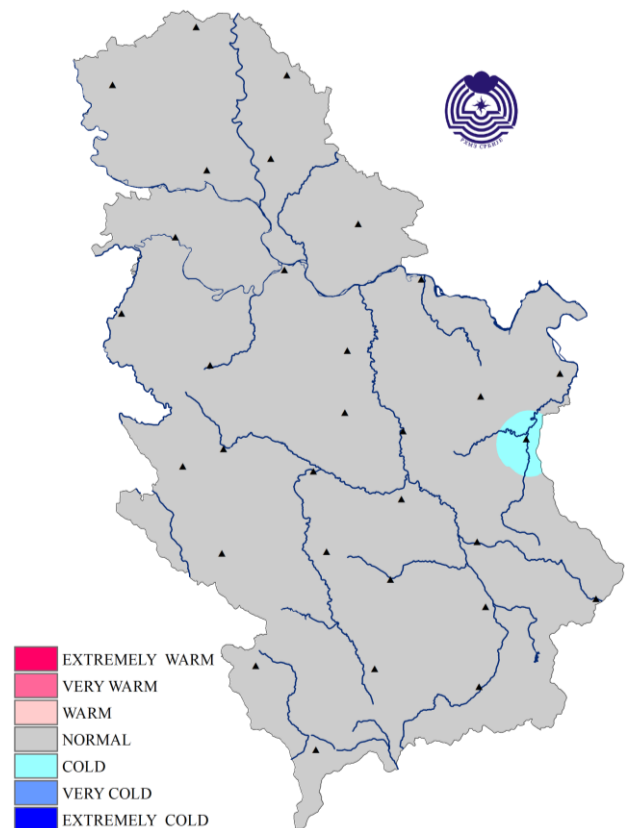


Figure 24. Air temperature in Serbia during summer 2014 using percentile method compared to the 1981-2010 base period

## Precipitation

During summer 2014, precipitation sums were above the average compared to the normal for the 1981- 2010 base period across entire Serbia with the exception of Sremska Mitrovica. Precipitation sums ranged between 84% in Sremska Mitrovica and 196% in Nis compared to the normal (*Figure 25*).

According to the percentile method, precipitation sums during summer 2014 were in the following categories: rainy and very rainy across most of Serbia, extremely rainy at certain stations and in the normal category in northwestern, northeastern, southern and in central mountain areas (*Figure 26*).

According to the tercile method, precipitation sums were in the following categories: above the average across most of Serbia, within multiannual average in Sombor, Kikinda, Loznica and Kopaonik, and below the average in Sremska Mitrovica.

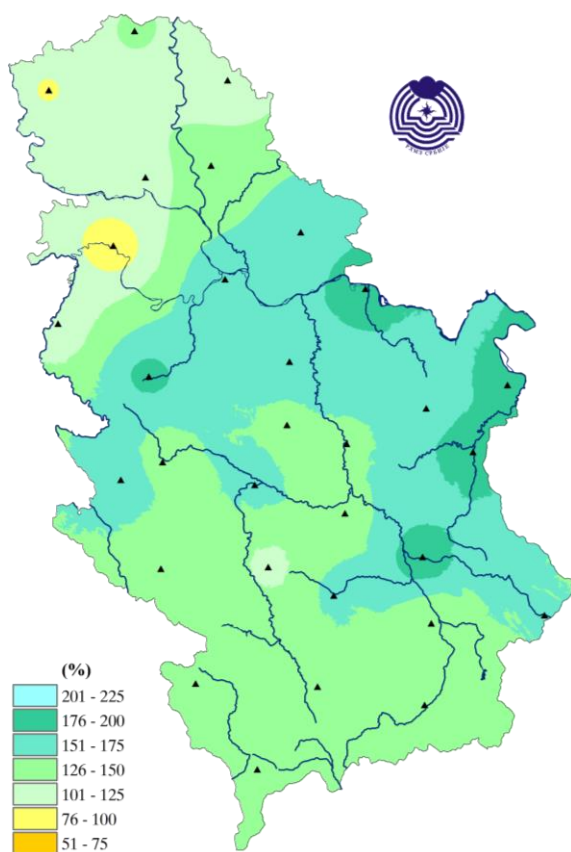


Figure 25. Spatial distribution of precipitation sums expressed in the percentages of normal during summer compared to the 1981-2010 base period

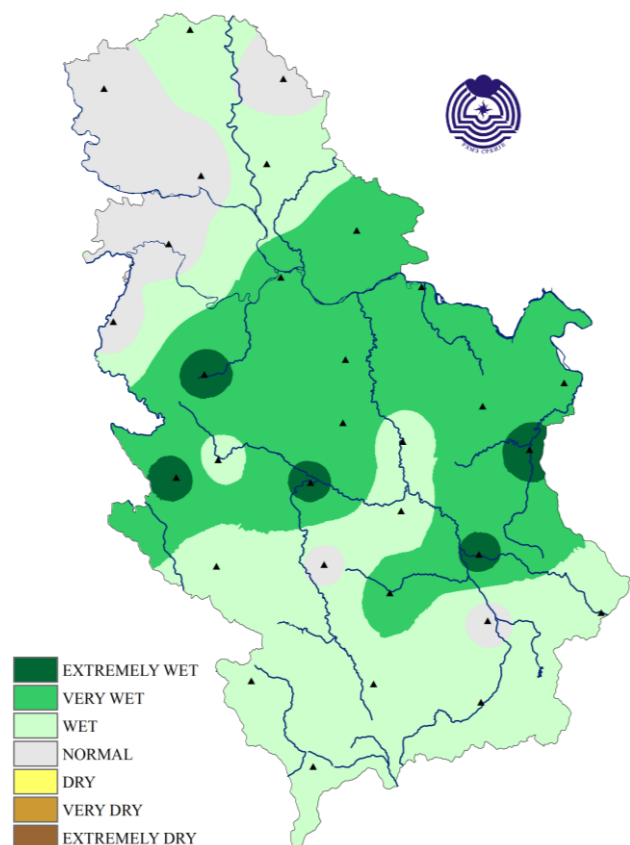


Figure 26. Precipitation sums using percentile method during summer compared to the 1981-2010 base period

## **High impact events during summer 2014**

Serbia experienced only one heat wave during summer 2014 with the exception of Vranje and Dimitrovgrad where none occurred. At most places it lasted from 6 to 13 of June.

Record-breaking summer precipitation sums in Nis (289.8 mm). During August, extremely rainy conditions were observed in Zajecar, 301% from the average monthly precipitation sums. Record-breaking maximum daily precipitation totals for August (85,8 mm) were observed at the main meteorological station Crni Vrh. July was second wettest month ever recorded in Belgrade, Valjevo and Banatski Karlovac (391%). On 16 July, Cuprija received 58.4 mm of precipitation thereby breaking the previous record for July. The maximum number of days with precipitation was exceeded in Novi Sad and equaled with the values of historical maximum number of days with precipitation at several other stations. The highest daily precipitation amount of 50,7 mm during June was registered in Kraljevo on 18 June thereby breaking the previous daily precipitation record for June.

### **Hydrology**

#### **June 2014**

Following the major floods in May 2014, during first half of June, water levels on the rivers in Serbia were mostly declining, followed by minor decline and stagnation. The exception to this is River Sava at hydrological station Sabac, where water level was above the first flood alert at the beginning of the month. Minor and moderate water level rises were registered at the beginning of the second decade of June on Velika Morava River and its tributaries and at the end of the month on the Kolubara River catchment and Banat watercourses not reaching the warning levels.

During June, water levels fluctuated within the following domains: medium high to low on the Danube River, from high to medium low on the River Sava and from medium high to medium low on small and medium sized watercourses in Serbia.

#### **July 2014**

During July, water levels on the majority of rivers marked minor decline and stagnation, fluctuating between medium and medium low values.

On the rivers Sava and Kolubara, at the end of the second decade of July, marginal and moderate water level rises were registered, not reaching the warning levels.

Moderate water level rises were recorded at the end of the month on the Danube River and on Banat watercourses fluctuating far below warning levels.

#### **August 2014**

During the first decade of August, major water level rise was registered on all watercourses apart from Tisza River. Water levels on the rivers of Danube and Sava were below the warning levels, within those levels on Juzna Morava, and above the warning levels on Kolubara River. During the second decade of August, water levels started to decline while during the third decade they held steady and fluctuated within medium high to low values for this time of the year.



Summer 2014			Air Temperature (°C)			
Station	Rank <sup>*</sup>	Rank <sup>**</sup>	33	50	66	Observed value
<b>Beograd</b> (1888-2014)	25	17	21.6	22.0	22.9	22.3
<b>Palić</b> (1945-2014)	26	19	20.9	21.3	21.9	21.3
<b>Sombor</b> (1942-2014)	28	19	20.6	21.0	21.3	20.9
<b>Novi Sad</b> (1948-2014)	22	16	20.8	21.0	21.6	21.1
<b>Zrenjanin</b> (1946-2014)	24	16	21.0	21.2	21.7	21.4
<b>Kikinda</b> (1948-2014)	27	21	20.8	21.3	21.7	21.2
<b>Banatski Karlovac</b> (1946-2014)	-	-	20.9	21.3	21.8	20.9
<b>Loznica</b> (1925-2014)	18	16	20.7	21.0	21.7	21.1
<b>Sremska Mitrovica</b> (1925-2014)	40	17	20.5	20.8	21.2	20.8
<b>Valjevo</b> (1926-2014)	28	15	20.5	20.9	21.6	21.2
<b>Kragujevac</b> (1925-2014)	44	22	20.6	21.2	21.6	20.9
<b>Smederevska Palanka</b> (1939-2014)	28	18	20.8	21.3	21.8	21.3
<b>Veliko Gradište</b> (1926-2014)	38	18	20.4	21.1	21.4	21.2
<b>Crni Vrh</b> (1967-2014)	27	24	15.9	16.3	16.6	15.8
<b>Negotin</b> (1927-2014)	34	20	22.0	22.7	23.1	22.6
<b>Zlatibor</b> (1950-2014)	30	21	16.3	16.8	17.3	16.5
<b>Sjenica</b> (1946-2014)	30	21	15.3	15.9	16.2	15.7
<b>Pozega</b> (1952-2014)	25	19	18.9	19.4	19.5	19.4
<b>Kraljevo</b> (1926-2014)	23	19	20.6	21.0	21.5	20.7
<b>Kopaonik</b> (1950-2014)	23	19	11.5	12.1	12.5	12.1
<b>Kursumlija</b> (1952-2014)	20	16	19.0	19.4	19.9	19.7

<b>Krusevac</b> (1927-2014)	36	20	20.7	21.1	21.5	20.9
<b>Cuprija</b> (1948-2014)	30	20	20.3	21.0	21.3	20.8
<b>Nis</b> (1925-2014)	42	21	21.2	21.9	22.2	21.4
<b>Leskovac</b> (1948-2014)	28	18	20.4	20.9	21.1	20.9
<b>Zajecar</b> (1929-2014)	48	28	20.9	21.8	22.0	20.6
<b>Dimitrovgrad</b> (1945-2014)	34	20	18.8	19.4	19.7	19.3
<b>Vranje</b> (1926-2014)	42	21	20.3	21.1	21.3	20.8

\*Rank –period of stations work (wormest season)

\*\*Rank – 1981-2014 period (wormest season)

Summer 2014			Precipitation sums (mm)			
Station	Rank*	Rank**	33	50	66	Observed Value
<b>Beograd</b> (1888-2014)	3	2	169.3	222.8	264.1	376.0
<b>Palić</b> (1945-2014)	16	8	161.4	197.6	219.0	243.3
<b>Sombor</b> (1942-2014)	29	14	180.2	187.8	215.1	201.7
<b>Novi Sad</b> (1948-2014)	18	11	174.5	187.8	236.8	258.0
<b>Zrenjanin</b> (1946-2014)	13	6	155.3	175.6	222.8	260.3
<b>Kikinda</b> (1948-2014)	35	14	152.4	174.9	205.7	191.5
<b>Banatski Karlovac</b> (1946-2014)	3	2	146.6	198.6	246.0	345.4
<b>Loznica</b> (1925-2014)	30	12	237.8	256.5	309.0	300.2
<b>Sremska Mitrovica</b> (1925-2014)	56	22	173.9	189.4	226.1	167.8
<b>Valjevo</b> (1926-2014)	3	1	214.0	233.9	286.7	462.5
<b>Kragujevac</b> (1925-2014)	13	3	154.8	195.4	230.6	280.7

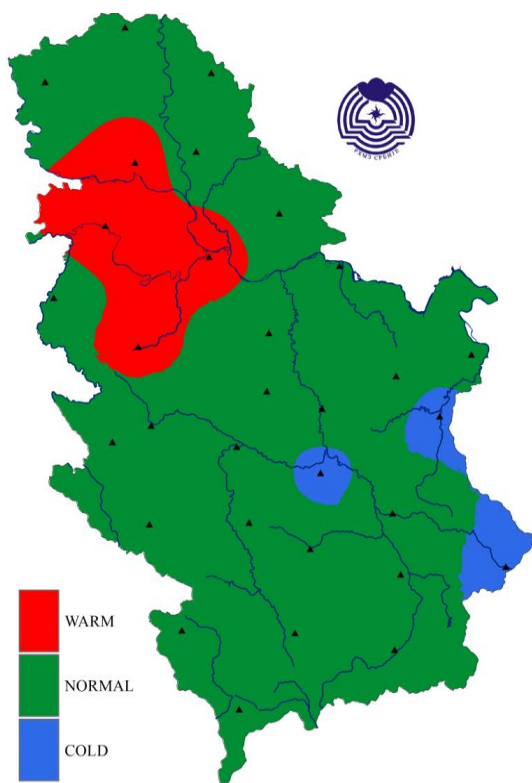
<b>Smederevska Palanka</b> (1939-2014)	6	2	168.2	201.5	231.6	311.6
<b>Veliko Gradište</b> (1926-2014)	5	3	129.4	173.9	238.6	382.4
<b>Crni Vrh</b> (1967-2014)	8	4	169.4	196.9	249.3	357.1
<b>Negotin</b> (1927-2014)	7	4	105.8	138.2	188.9	278.2
<b>Zlatibor</b> (1950-2014)	2	2	230.7	288.4	313.0	491.0
<b>Sjenica</b> (1946-2014)	16	5	191.2	213.6	229.3	270.5
<b>Pozega</b> (1952-2014)	13	5	178.0	218.5	238.1	311.1
<b>Kraljevo</b> (1926-2014)	6	2	209.6	244.4	272.7	369.9
<b>Kopaonik</b> (1950-2014)	20	12	224.1	279.6	323.8	313.6
<b>Kursumlija</b> (1952-2014)	8	4	129.2	175.7	208.0	271.1
<b>Krusevac</b> (1927-2014)	20	6	137.0	172.5	209.9	248.3
<b>Cuprija</b> (1948-2014)	13	6	143.8	185.8	204.9	265.2
<b>Nis</b> (1925-2014)	1	1	125.9	150.2	178.7	289.8
<b>Leskovac</b> (1948-2014)	22	9	126.2	150.3	179.6	198.6
<b>Zajecar</b> (1929-2014)	5	2	115.7	156.2	172.8	309.7
<b>Dimitrovgrad</b> (1945-2014)	14	5	150.2	175.7	203.5	281.1
<b>Vranje</b> (1926-2014)	20	9	112.0	144.3	179.9	209.1

\*Rank –period of stations work (highest seasonal precipitation)

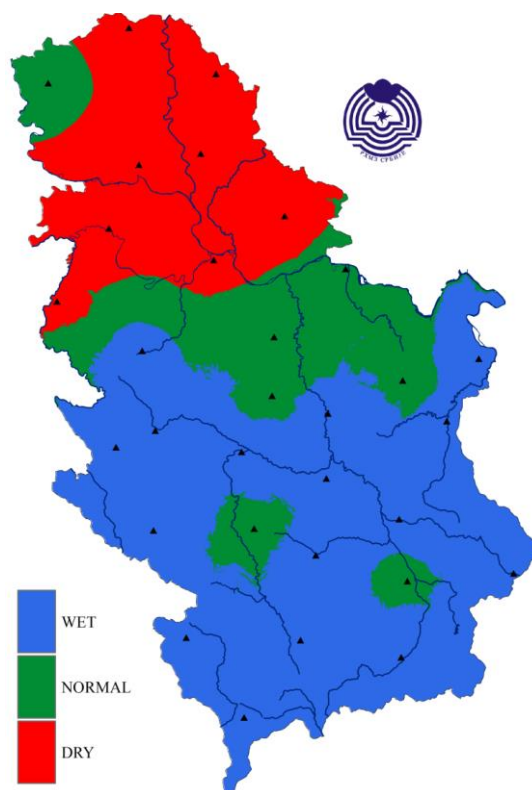
\*\*Rank – 1981-2014 period (highest seasonal precipitation)

Country	Seasonal temperature (JJA)		Seasonal precipitation JJA		High Impact Events *
	Observed	SEECOF-11 climate outlook for temperature	Observed	SEECOF-11 climate outlook for precipitation	
Serbia (1)	Normal	<p><b>Above normal</b> (10, 30, 60)</p> <p>in the northern part of the country</p> <p><b>Above normal</b> (20,30,50)</p> <p>in the rest of Serbia</p>	Above normal to Normal	<p><b>Below normal</b> (40, 30, 30)</p> <p>in the northern part of the country</p> <p><b>No predictive signal</b> (33, 34, 33)</p> <p>in the rest of Serbia</p>	<p>Serbia experienced only one heat wave during summer 2014 with the exception of Vranje and Dimitrovgrad where none occurred.</p> <p>At most places it lasted from 6 to 13 of June. Record-breaking summer precipitation sums in Nis (289.8 mm). During August, extremely rainy conditions were observed in Zajecar, 301% from the average monthly precipitation sums. Record-breaking maximum daily precipitation totals for August (85,8 mm) were observed at the main meteorological station Crni Vrh. July was second wettest month ever recorded in Belgrade, Valjevo and Banatski Karlovac (391%). On 16 July, Cuprija received 58.4 mm of precipitation thereby breaking the previous record for July. The maximum number of days with precipitation was exceeded in Novi Sad and equaled with the values of historical maximum number of days with precipitation at several other stations. The highest daily precipitation amount of 50,7 mm during June was registered in Kraljevo on 18 June thereby breaking the previous daily precipitation record for June.</p>

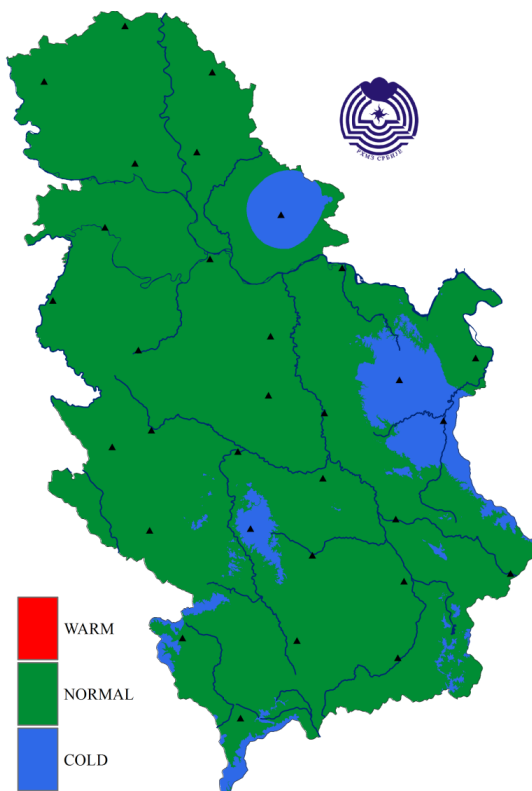
\* Events that had an impact on the society (events that caused great material damage to the society during previous season – on the basis of the assessment of the hydrometeorological service):



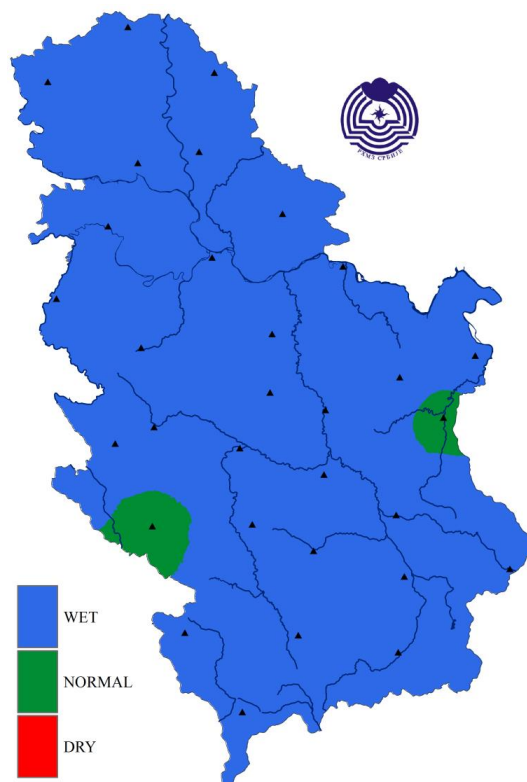
Monitoring of the June 2014 temperature in Serbia using the tercile method, compared to the 1981-2010 base period



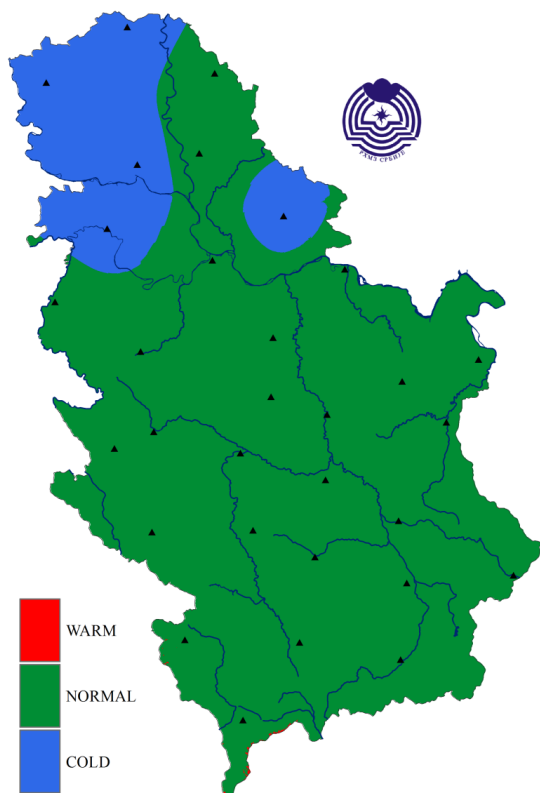
Monitoring of the June 2014 precipitation in Serbia using the tercile method, compared to the 1981-2010 base period



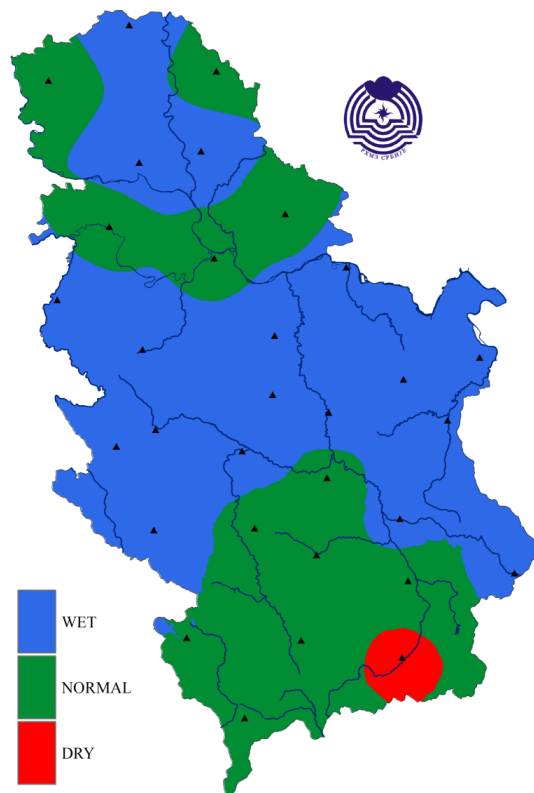
Monitoring of the July 2014 temperature in Serbia using the tercile method, compared to the 1981-2010 base period



Monitoring of the July 2014 precipitation in Serbia using the tercile method, compared to the 1981-2010 base period



Monitoring of the August 2014 temperature in Serbia using the tercile method, compared to the 1981-2010 base period



Monitoring of the August 2014 precipitation in Serbia using the tercile method, compared to the 1981-2010 base period