Republic Hydrometeorological Service of Serbia
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Republic of Serbia

SEASONAL BULETIN FOR SERBIA

Autumn 2024

Belgrade, December 10th 2024

Division for Climate Monitoring and Climate Forecast
Department of National Center for Climate Change, Climate Model Development and Disaster Risk Assessment
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Analysis of the autumn 2024 for Serbia relative to the 1991-2020 base period

Temperature

Averagely warm autumn in Serbia with the mean air temperature in a range from 10,6 ºC in Požega to 14,0 ºC in Belgrade, and on the mountains from 6,0 ºC at Kopaonik to 9,5 ºC at Zlatibor (*Figure 1*).

Departure of the mean air temperature from the normal[1], during autumn, ranged from -0,2 ºC in Leskovac to +1,0 ºC at Crni Vrh. Seasonal departure in Belgrade was around +0,7 ºC (*Figure 2).*

Based on the percentile method[2], mean autumn air temperature was in the normal category in most of Serbia and warm category in Loznica, Cuprija, Crni Vrh and Kopaonik (*Figure 3).*

Based on the tercile method, mean autumn air temperature was in the normal category in most of the country, and warm in central and parts of eastern and northwestern Serbia (*Figure 4).*

[1] Term ***normal*** refers to ***climatological standard normal***, that is, the average value of a particular climate element, calculated for the period from January 1, 1991 to December 31, 2020

[2] **n**th 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

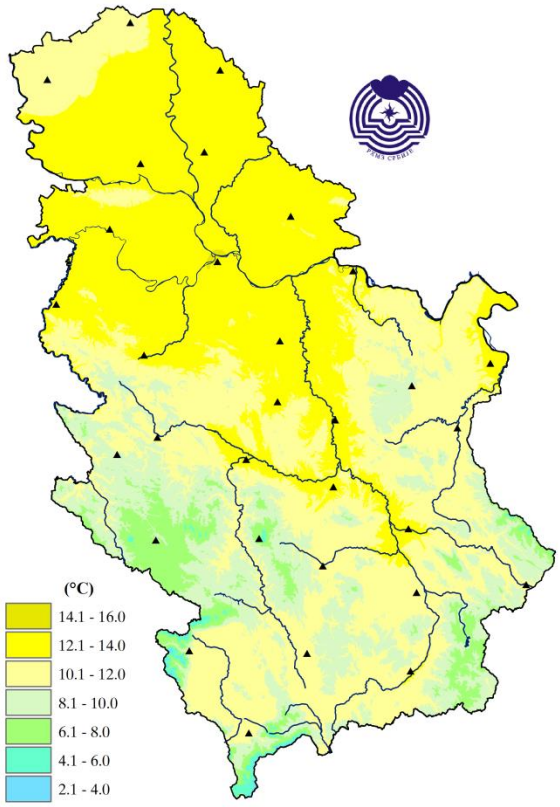

Figure 1. Spatial distribution of mean sasonal air temperature

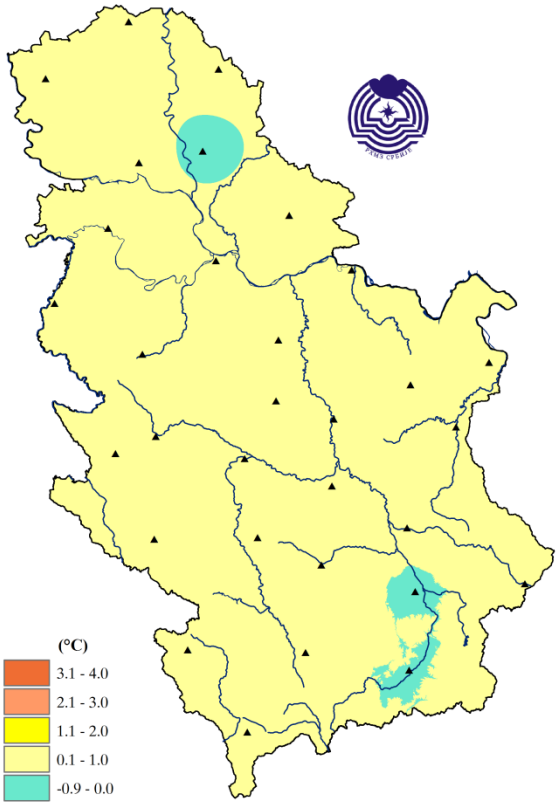

Figure 2. Mean seasonal air temperature anomaly from normal

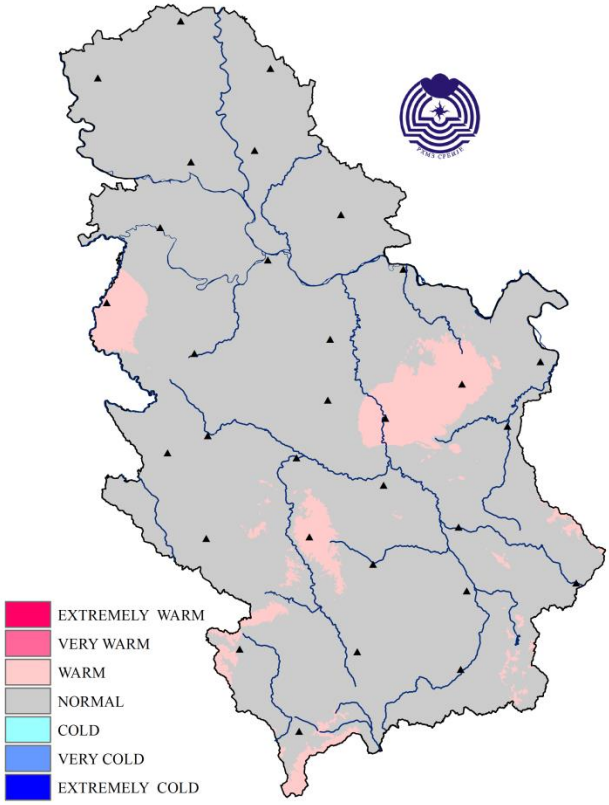

Figure 3. Spatial distribution of mean seasonal air temperature according to the percentile method

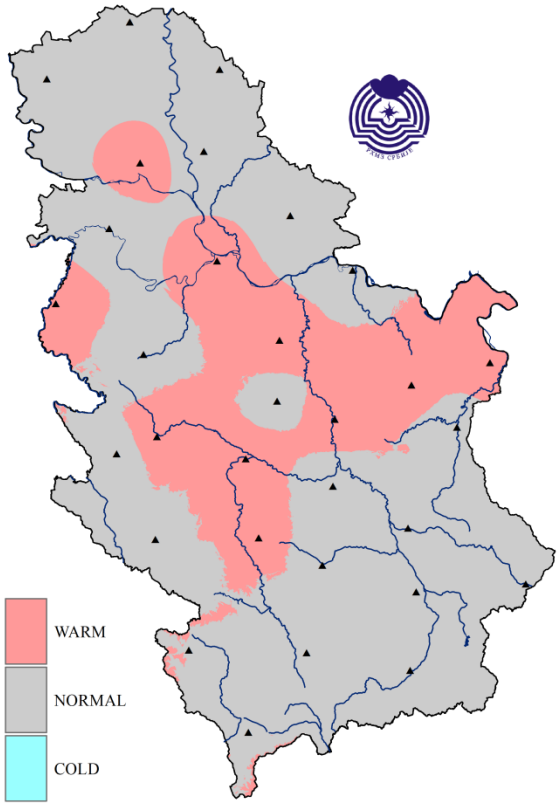

Figure 4. Spatial distribution of mean seasonal air temperature according to the tercile method

In autumn, the highest daily air temperature of 38,3 ºC was measured in Cuprija on September 3 **matching** the previous seasonal record for this station set on September 1, 2015. The maximum autumn air temperature **was exceeded** on Palic and Sombor this autumn. On September 3, Palic observed air temperature of 35,6 ºC, thereby breaking the previous record of 35,3 ºC set on September 18, 2015. Sombor observed air temperature of 36,6 ºC thereby breaking the previous record of 35,5 ºC set on September 18, 2015.

Number of summer days[3] ranged from 17 in Pozega and Kursumlija to 28 in Cuprija, reaching up to 10 in the upland, as in Sjenica and Zlatibor. Belgrade observed 23 summer days. Number of summer days was 1 to 4 days above the autumn average in most of Serbia (*Figure 5).*

Tropical days[4] ranged from 9 on Palic, Zrenjanin, Kikinda, Kursumlija and Vranje to 12 in Loznica and Valjevo. Belgrade observed 11 tropical days. On the mountains, there was only 1 tropical day recorded at Crni Vrh. In most of Serbia, the recorded number of tropical days was 5 to 8 days above the average (*Figure 6).*

Days with the maximum daily air temperature of 35 ºC and above were recorded in most of Serbia, the highest number of days, total of 5, was recorded in Loznica, Krusevac and Cuprija. At 8 MMS, in Vojvodina and nortwestern Serbia, there was a **record-breaking number of days with the maximum daily air temperature of 35 ºC and above** (*Table 1).*

Table 1. Exceeded number of days with Tmax ≥ 35 ºC

MMS	Number of days with Tmax ≥ 35 ºC Autumn 2024	Average number of days Tmax ≥ 35 ºC	Deviation of the number of days with Tmax ≥ 35 ºC	Exceeded maximum with Tmax ≥ 35 ºC	Year of the maximum Tmax ≥ 35 ºC
LOZNICA	**5**	0.2	4.8	3	1987/2015
SOMBOR	**4**	0.1	3.9	2	2008/2015
NOVI SAD	**4**	0.1	3.9	3	2015
ZRENjANIN	**4**	0.1	3.9	3	2015
KIKINDA	**4**	0.1	3.9	3	2015
B.KARLOVAC	**4**	0.2	3.8	3	2015
S.MITROVICA	**4**	0.1	3.9	3	2015
PALIĆ	**2**	0.0	2.0	1	2008/2015

Number of ice days[5] was as follows: Zlatibor recorded 6, Crni Vrh and Kopaonik recorded 5, Sjenica recorded 2.

The lowest daily air temperature of -14,0 ºC was measured in Sjenica on November 24. On the same day, in the lowland, the lowest air temperature of -9,5 ºC was measured in Leskovac while Belgrade observed -1,0 ºC on November 18 and 24.

Number of tropical nights[6] was as follows: Belgrade recorded 6, Veliko Gradiste and Nis recorded 4, Novi Sad, Smederevska Palanka and Cuprija recorded 3, Palic, Zrenjanin, Kikinda and Kraljevo recorded 2, Banatski Karlovac and Kragujevac recorded 1.

[3] Summer day refers to a day with maximum air temperature 25°C and above
[4] Tropical day refers to a day with maximum air temperature 30°C and above
[5] Ice day is defined as the day with maximum air temperature lower than 0°C
[6] Tropical night is defined as the day with the minimum daily air temperature of 20°C and above

Frost days[7] were recorded in the entire country, ranging from 4 in Belgrade to 21 in Zajecar. In the upland, their number ranged from 17 days at Zlatibor to 34 days in Sjenica. The observed number of frost days was 2 to 5 days above the average for most of Serbia (*Figure 7).*

Sjenica observed 3 days with severe frost[8] while Kopaonik recorded 2 days with severe frost.

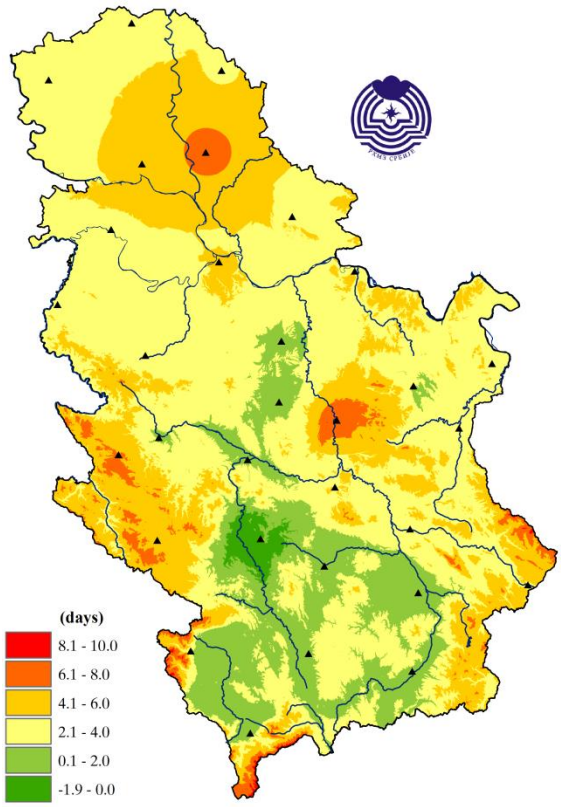

Figure 5. Deviation of the number of summer days from the normal

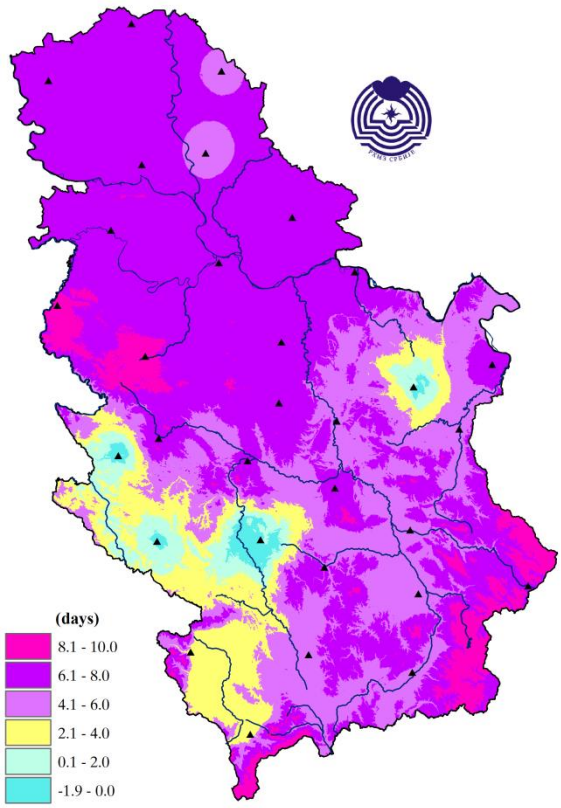

Figure 6. Deviation of the number of tropical days from the normal

[7] Frost day is defined as the day with minimum air temperature lower than 0°C
[8] Day with severe frost is defined as the day with the minimum air temperature below -10°C

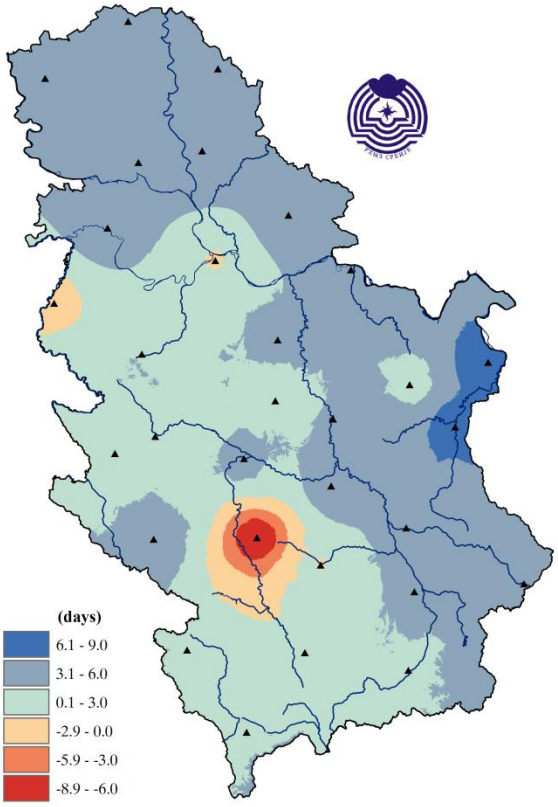

Figure 7. Deviation of the number of frost days from the normal

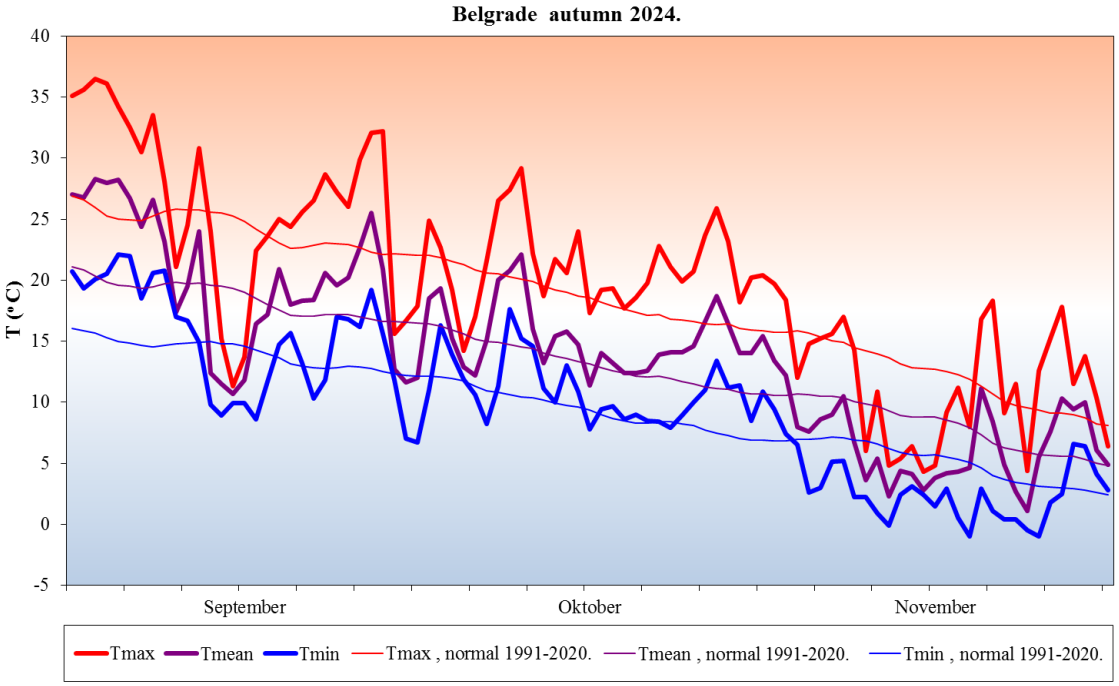

Figure 8. Three – month course of mean, maximum and minimum air temperature in Belgrade

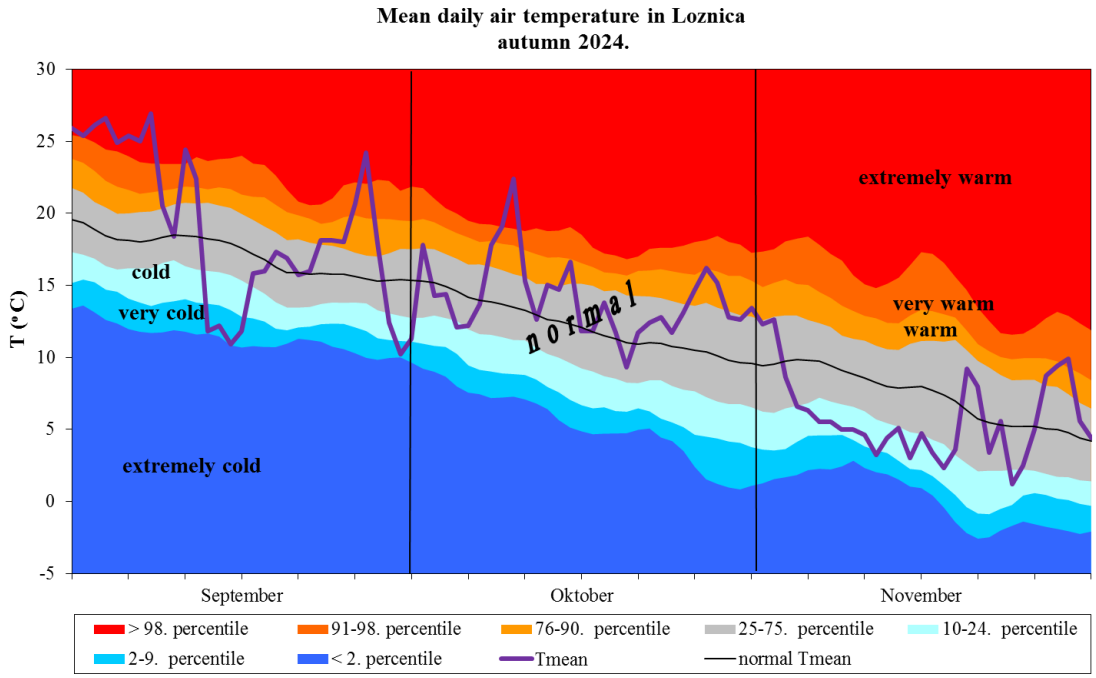

Figure 9. Three – month course of mean daily air temperature in Loznica

Assessment of the mean air temperature and precipitation sums (*Figure 10*) in Serbia based on the tercile distribution compared to the 1991-2020 base period shows that autumn 2024 was marked by air temperature and precipitation sums within the average. Based on the assessment of the minimum and maximum air temperature (*Figure 11*), mean minimum air temperature was at the lower tercile threshold, whilst maximum air temperature was above the upper tercile threshold.

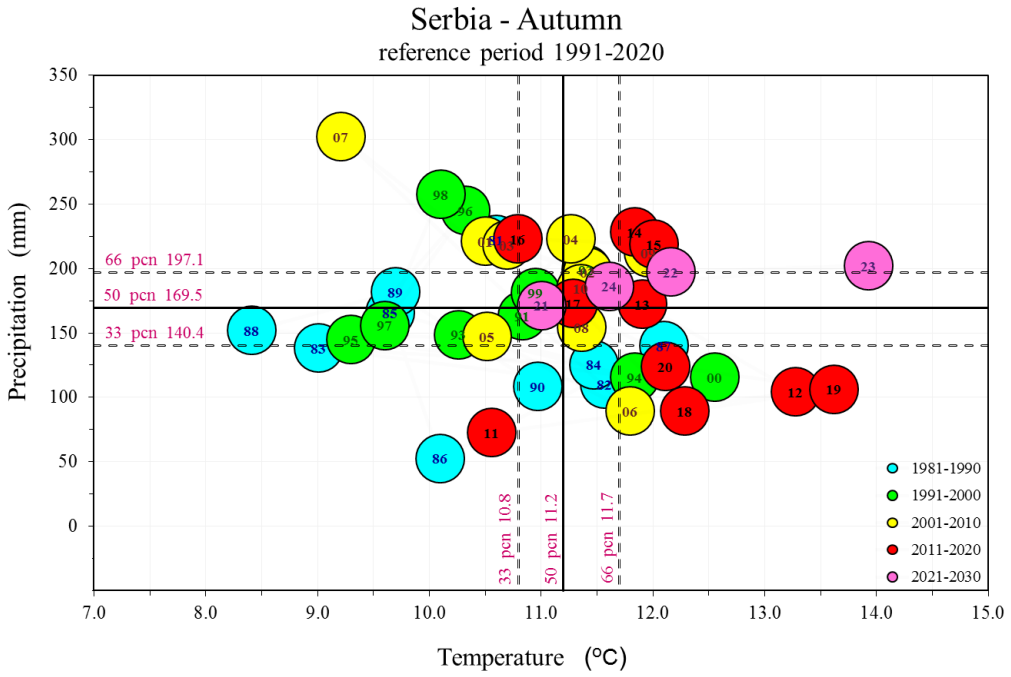

Figure 10. Assessment of mean air temperature and precipitation sums for Autumn in Serbia with the accompanying terciles compared to the 1991-2020 normal

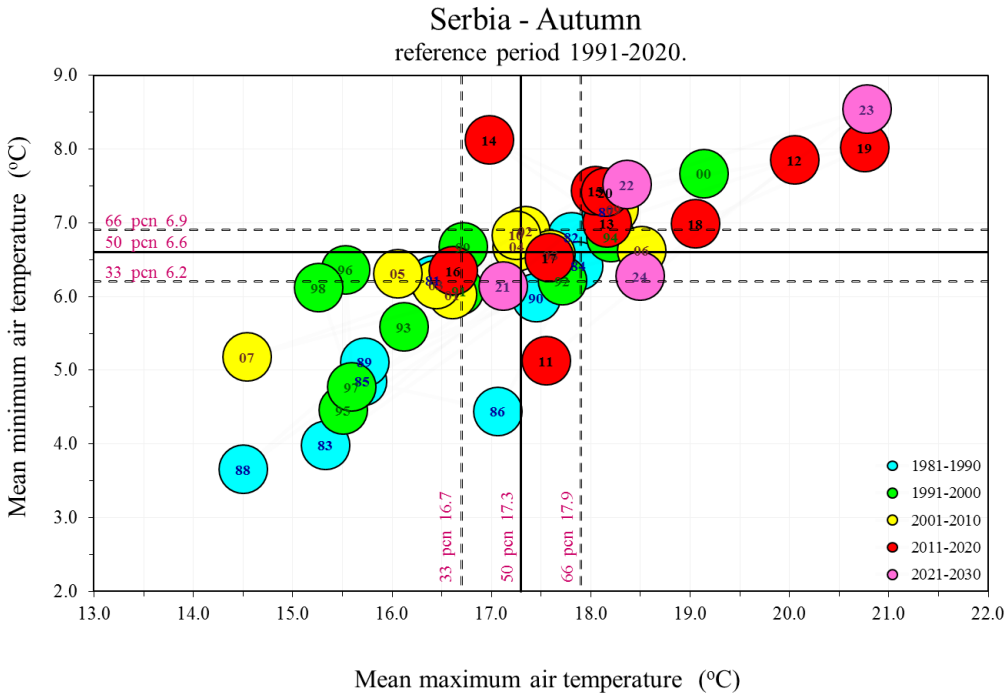

Figure 11. Assessment of minimum and maximum air temperature for Serbia with the accompanying terciles in relation to the 1991-2020 base period

Heat and cold waves

During autumn, there were two heat waves[9]. The onset of the first one was recorded at the end of August lasting until September 8, several places until September 9. The second heat wave was registered only in Negotin from October 28 to November 2 (Table 2). The longest lasting heat wave of 17 days was recorded in Sombor, lasting from August 23 to September 8, and on Palic, from August 24 to September 8, total of 16 days. Elsewhere, duration of heat wave was around 9 days.

Two cold waves[10] were recorded during November. The first one was registered from 4 to 11 November and the second one affected only Leskovac from 22 to 26 November.

Table 2. Heat and cold waves in Serbia

HEAT AND COLD WAVES IN SERBIA - AUTMN 2024

(relative to the 1991-2020 base period)

	SEPTEMBER																													
station/day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
PALIC	EW	EW	EW	EW	EW	VW	VW	EW																						
SOMBOR	EW	EW	EW	EW	EW	VW	VW	EW																						
KIKINDA	EW	EW	EW	EW	VW	VW	VW	EW																						
ZRENJANIN	EW	EW	EW	EW	EW	VW	VW	EW																						
NOVI SAD	EW	EW	EW	EW	EW	EW	VW	EW																						
SR.MITROVICA	EW	EW	EW	EW	EW	VW	VW	EW																						
BELGRADE	EW	EW	EW	EW	EW	VW	VW	EW																						
LOZNICA	EW	EW	EW	EW	EW	EW	EW	EW																						
VALJEVO	VW	EW	EW	EW	EW	VW	VW	EW																						
V.GRADISTE	EW	EW	EW	EW	VW																									
SM.PALANKA	EW	EW	EW	EW	EW	VW	VW	VW																						
KRAGUJEVAC		VW	EW	EW	EW	VW	VW	VW																						
KRALJEVO	VW	EW	EW	EW	EW	EW	VW	EW																						
POZEGA	VW	EW	EW	EW	EW	EW	VW	EW																						
ZLATIBOR		VW	VW	EW	VW	VW	VW	EW																						
CUPRIJA	EW	VW	EW	EW	EW	VW	VW	VW																						
KRUSEVAC	VW	VW	EW	EW	EW	VW	VW	VW	VW																					
NEGOTIN	EW	EW	EW	EW																										
ZAJECAR																														
CRNI VRH	VW	EW	EW	EW	VW																									
KOPAONIK			VW	EW	EW	EW	VW	VW																						
SJENICA		VW	VW	EW	VW	VW	EW	EW																						
NIS		VW	EW	EW	EW	VW	VW	VW	VW																					
VRANJE		VW	VW	VW	EW	VW	VW	VW																						
DIMITROVGRAD																														
LESKOVAC		VW	VW	EW	EW	VW	VW	VW	VW																					
KURSUMLIJA		VW	EW	EW	EW	VW	VW	VW	VW																					
B.KARLOVAC	EW	EW	EW	EW	VW	VW	VW	VW																						

	OCTOBER																														
station/day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
PALIC																															
SOMBOR																															
KIKINDA																															
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POZEGA																															
ZLATIBOR																															
CUPRIJA																															
KRUSEVAC																															
NEGOTIN																												EW	VW	VW	VW
ZAJECAR																															
CRNI VRH																															
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VRANJE																															
DIMITROVGRAD																															
LESKOVAC																															
KURSUMLIJA																															
B.KARLOVAC																															

	NOVEMBER																													
station/day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
PALIC																														
SOMBOR																														
KIKINDA				VC	VC	VC	VC	EC	EC																					
ZRENJANIN				VC	EC	VC	VC	EC	VC	VC	EC																			
NOVI SAD																														
SR.MITROVICA																														
BELGRADE																														
LOZNICA																														
VALJEVO																														
V.GRADISTE																														
SM.PALANKA				VC	VC	VC	EC	EC	VC																					
KRAGUJEVAC					VC	EC	EC	EC	EC																					
KRALJEVO						VC	EC	EC	EC	VC																				
POZEGA						VC	VC	VC	VC	VC																				
ZLATIBOR																														
CUPRIJA				VC	VC	VC	EC	EC	EC																					
KRUSEVAC						VC	VC	EC	EC	EC																				
NEGOTIN	VW	VW																												
ZAJECAR				VC	VC	EC	EC	EC	EC																					
CRNI VRH																														
KOPAONIK																														
SJENICA						VC	VC	VC	VC	EC																				
NIS						VC	VC	VC	EC	VC																				
VRANJE																														
DIMITROVGRAD																														
LESKOVAC						VC	VC	VC	EC	EC												VC	VC	EC	VC	VC				
KURSUMLIJA																														
B.KARLOVAC					VC	VC	VC	EC	VC	EC	VC																			

[9] Heat wave is, according to the percentile method, a period during which maximum daily air temperature is in the very warm and extremely warm categories for 5 consecutive days or longer
[10] Cold wave is, according to the percentile method, a period during which minimum daily air temperature is in the very cold and extremely cold categories for 5 consecutive days or longer

Precipitation

Autumn precipitation sums were around the average compared to the normal for the 1991-2020 base period. Precipitation sums were in a range from 80,4 mm in Negotin to 319,5 mm at Kopaonik (*Figure 12*). Departure of the seasonal precipitation sums from the normal ranged from 48% in Negotin to 152% in Leskovac (*Figure 13*).

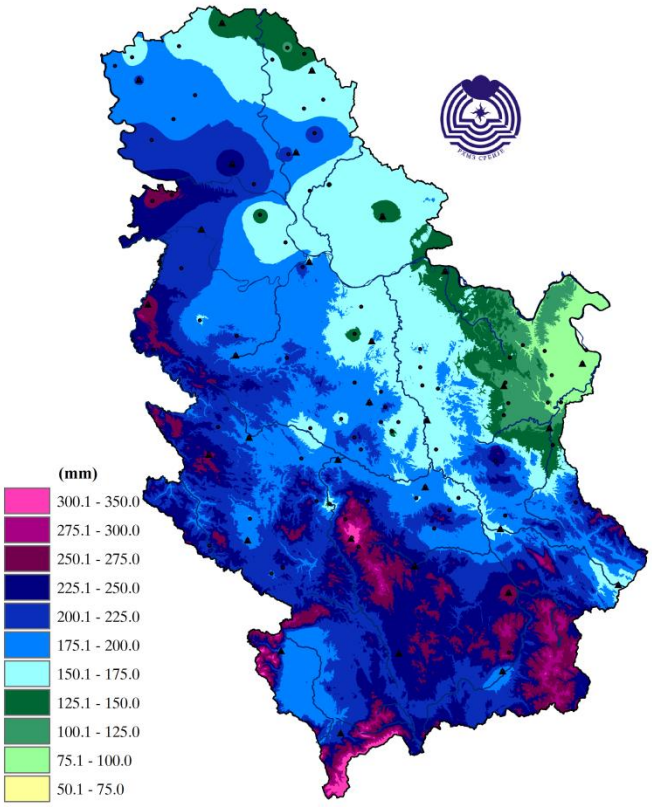

Figure 12. Spatial distribution of the seasonal precipitation sums (mm) according to data from 28 major meteorological, 19 climatological and 54 rain gauge stations

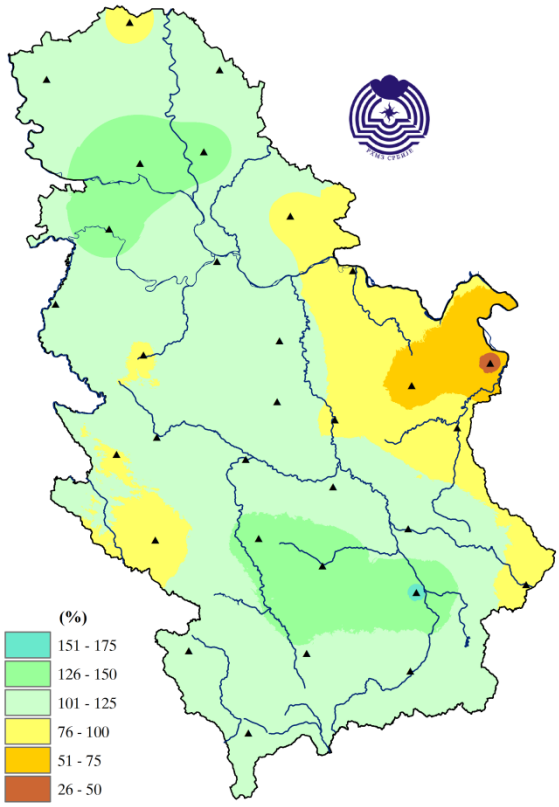

Figure 13. Spatial distribution of the seasonal precipitation sums in the percentages of normal

Based on the percentile method, autumn precipitation sums were in the normal category in most of the country, rainy in Novi Sad, Zrenjanin, Kursumlija, Leskovac and Kopaonik, and very dry in Negotin and Crni Vrh (*Figure 14).*

Precipitation sums based on the tercile method were within the average in most of Serbia, above the average in the northwest, south and parts of central Serbia, and below the average in the east (*Figure 15).*

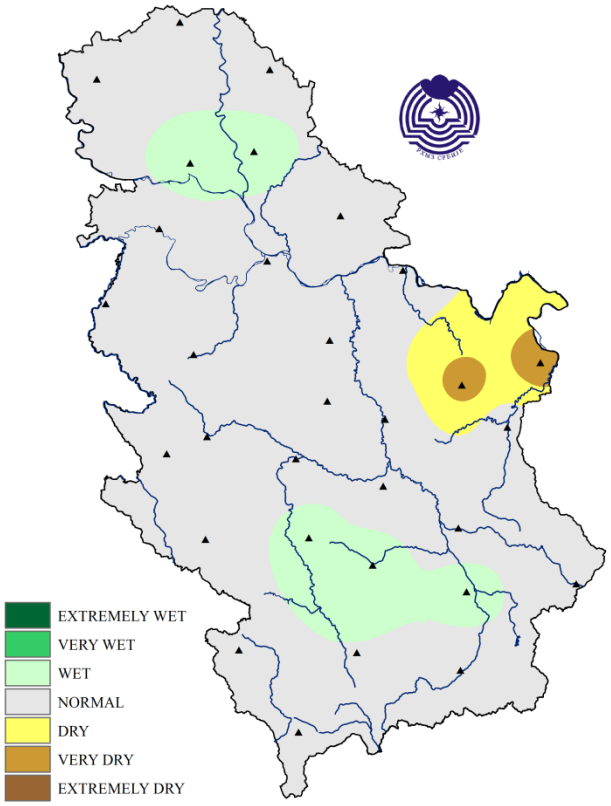

Figure 14. Seasonal precipitation sums according to the percentile method

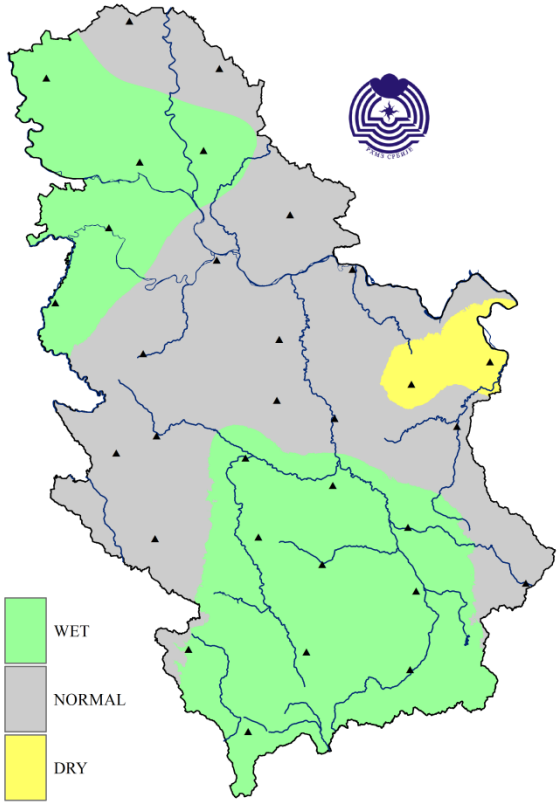

Figure 15. Seasonal precipitation sums according to the tercile method

In autumn, the maximum daily precipitation sum of 59,6 mm was recorded in Kursumlija on September 11 **thereby breaking the previous record of** 57,7 mm set on November 8, 2016. Belgrade recorded the highest daily autumn precipitation sum of 20,5 mm on November 23.

Number of days with precipitation of 0,1 mm and above during autumn ranged from 21 in Zajecar to 33 in Vranje, and on the mountains from 30 in Sjenica to 33 at Kopaonik. The recorded number of days was 2 to 8 days below the autumn average (*Figure 16).*

Two days with precipitation of 50 mm and above was recorded at Kopaonik, and one day in Kraljevo, Kursumlija and Krusevac.

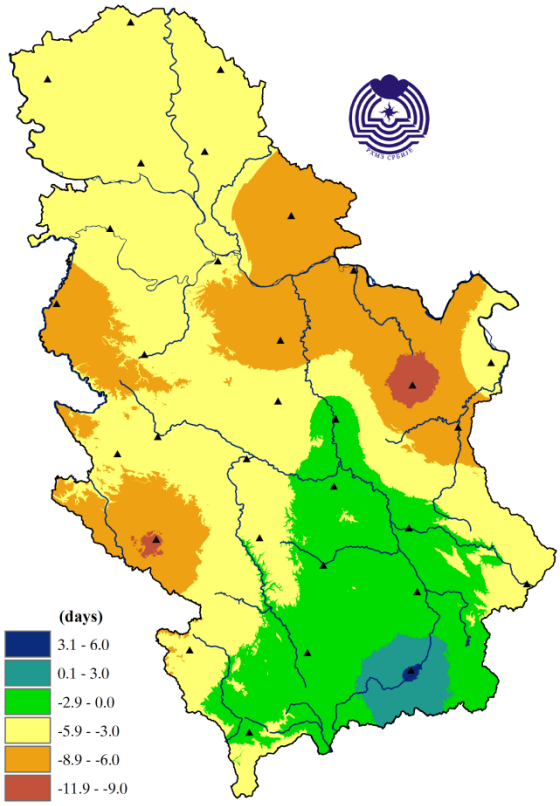

Figure 16. Spatial distribution of deviation of number of days with precipitation

Autumn 2024 was **the 7th wettest** for Leskovac (*Figure 17*) and **the 9th driest** for Negotin (*Figure 18).*

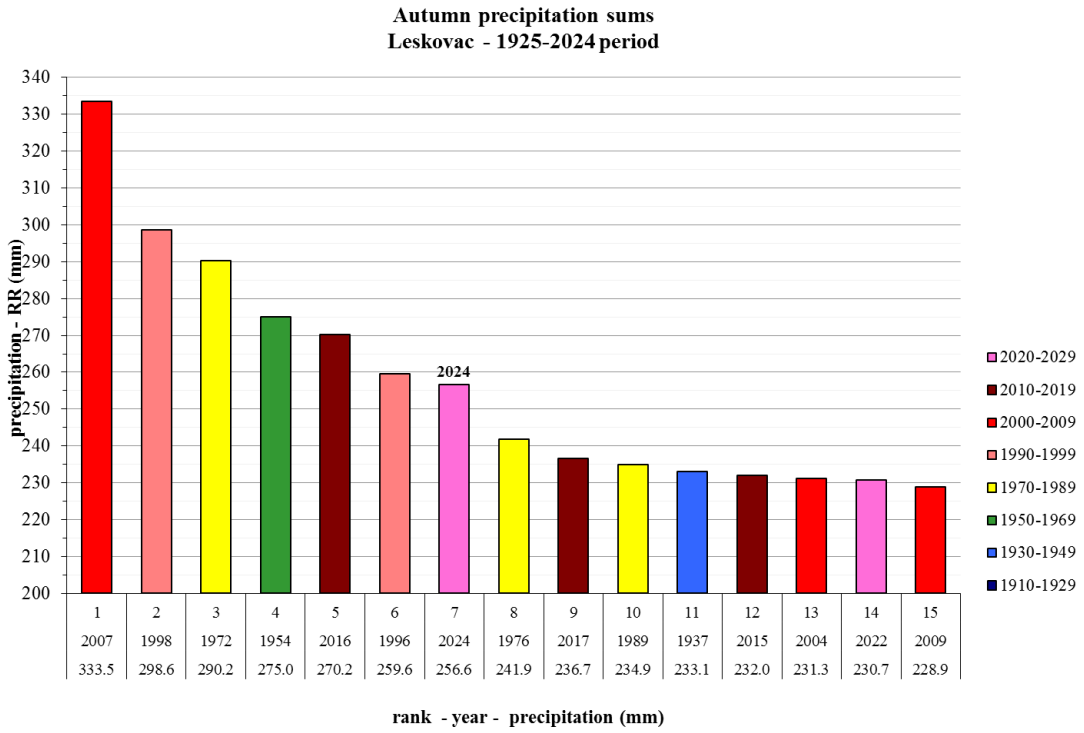

Figure 17. The highest precipitation in Leskovac for the period 1925-2024

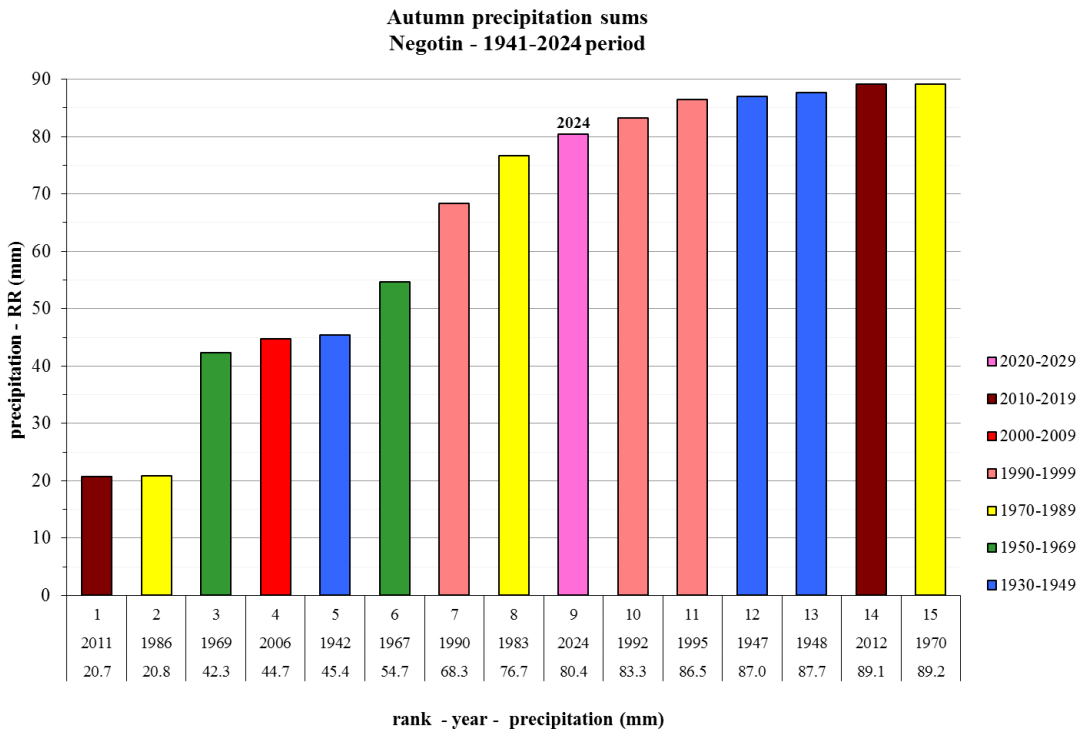

Figure 18. The lowest precipitation in Negotin for the period 1941-2024

Snow cover was recorded on the mountains at the beginning of the second decade of November, while in the lowland, at most places it was observed at the beginning of the third decade of November. The highest number of days with snow cover was recorded at Kopaonik, total of 17 days, whereas in the lowland, Leskovac observed the highest number, total of 7. Snow cover was not observed on Palic, Kikinda and Negotin.

The highest snow cover depth of 21 cm was measured at Kopaonik and Sjenica on November 21. In the lowland, the highest snow cover depth of 7 cm was measured in Dimitrovgrad on the same day. On November 23, Belgrade recorded 5 cm of snow cover.

Figures 19 to 22 show cumulative precipitation sums for Leskovac, Novi Sad, Kursumlija and Negotin during autumn by month compared to the average cumulative precipitation sums.

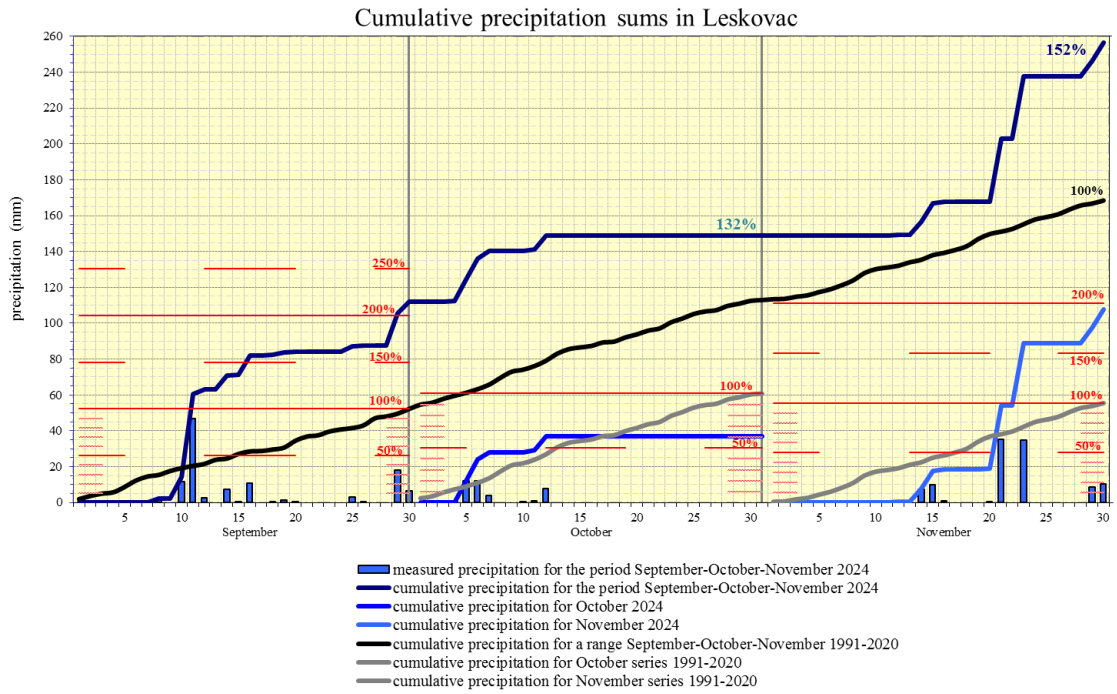

Figure 19. Cumulative precipitation in Leskovac

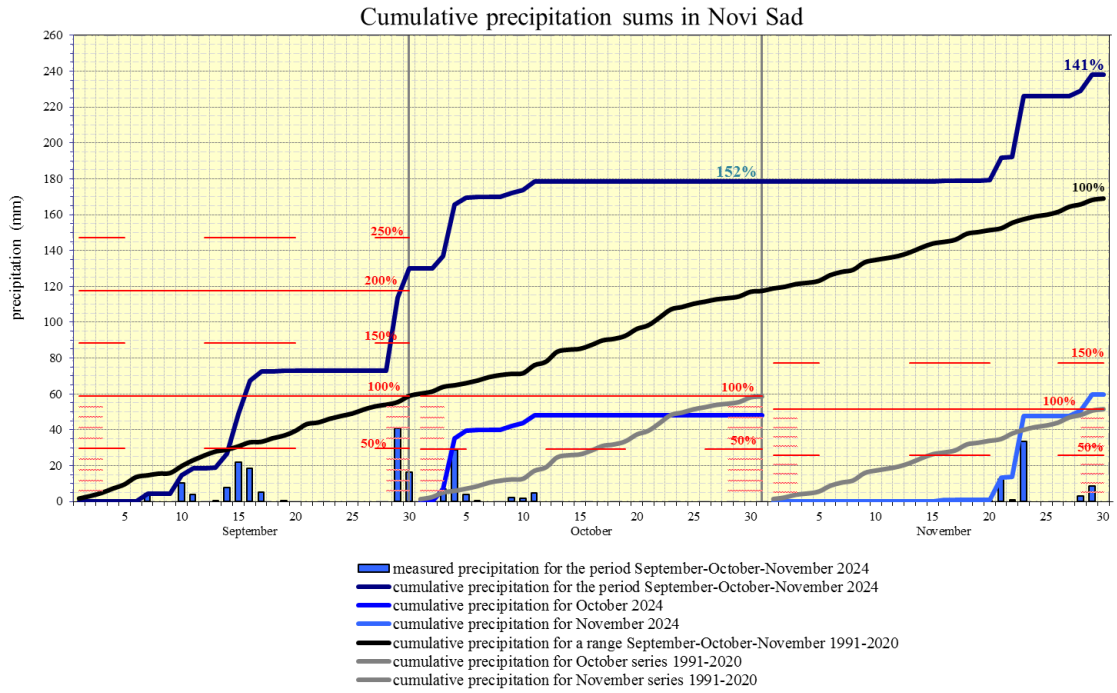

Figure 20. Cumulative precipitation in Novi Sad

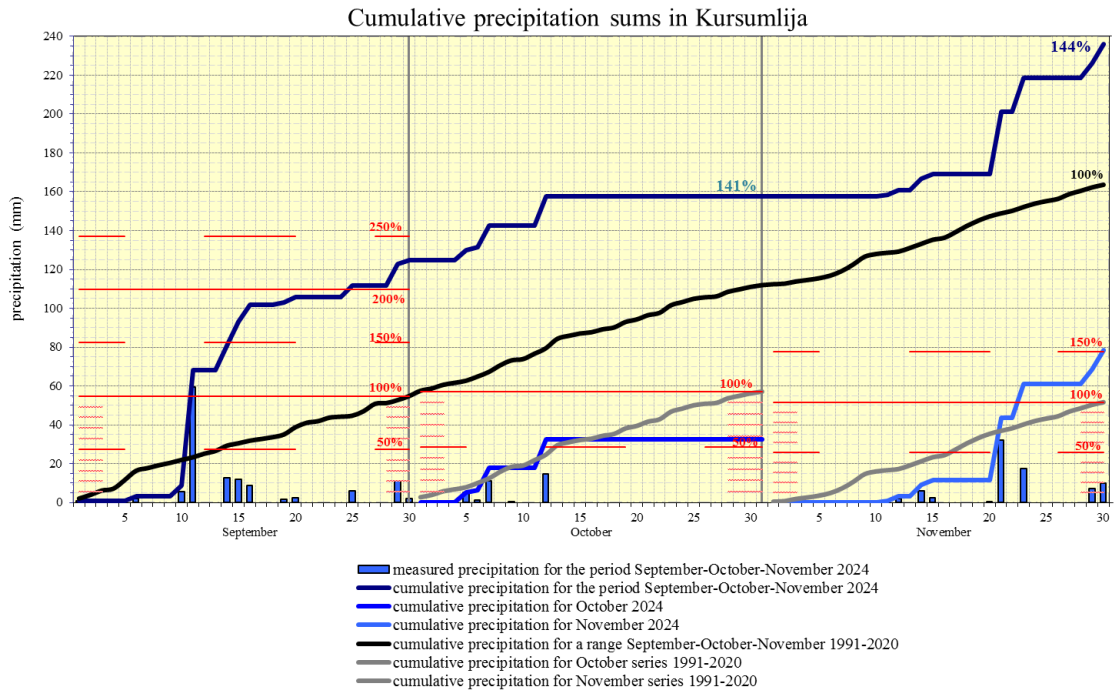

Figure 21. Cumulative precipitation in Kursumlija

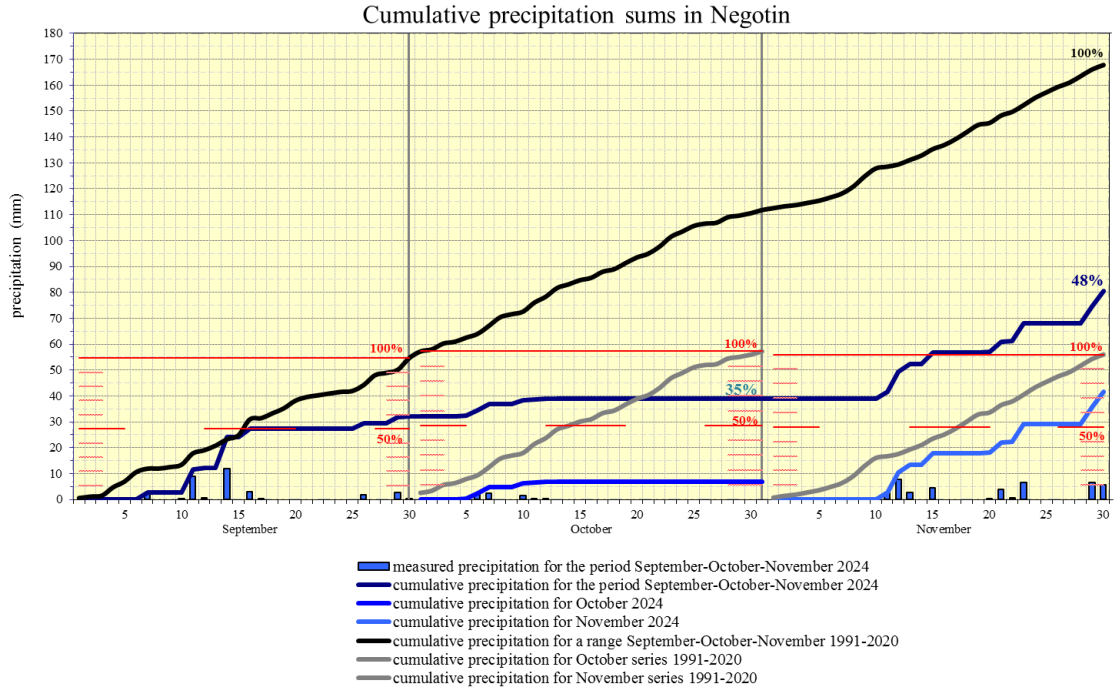

Figure 22. Cumulative precipitation in Negotin

Sunshine duration (insolation)

In autumn, sunshine duration was around the average. Sunshine duration ranged from 356,3 hours to 580,4 hours in Negotin (*Figure 23*).

Compared to the normal for the 1991-2020, sunshine duration ranged from 94% in Leskovac to 135% in Negotin (*Figure 24*).

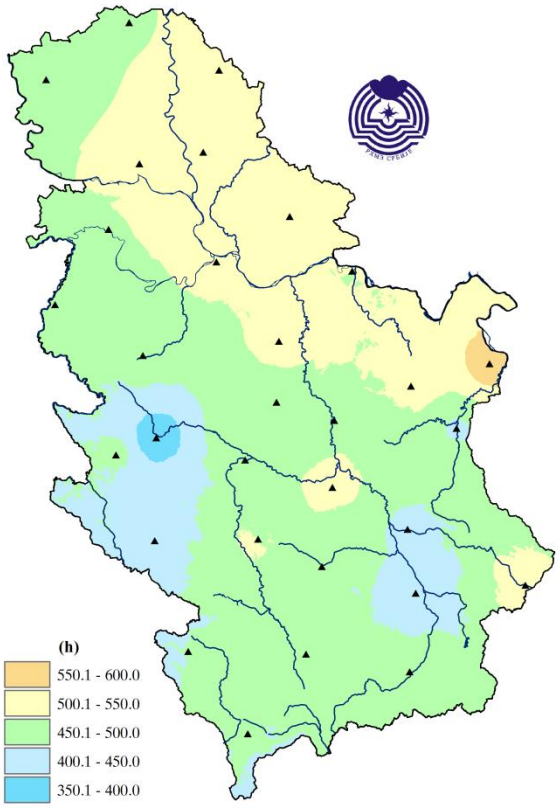

Figure 23. Insolation, expressed in hours

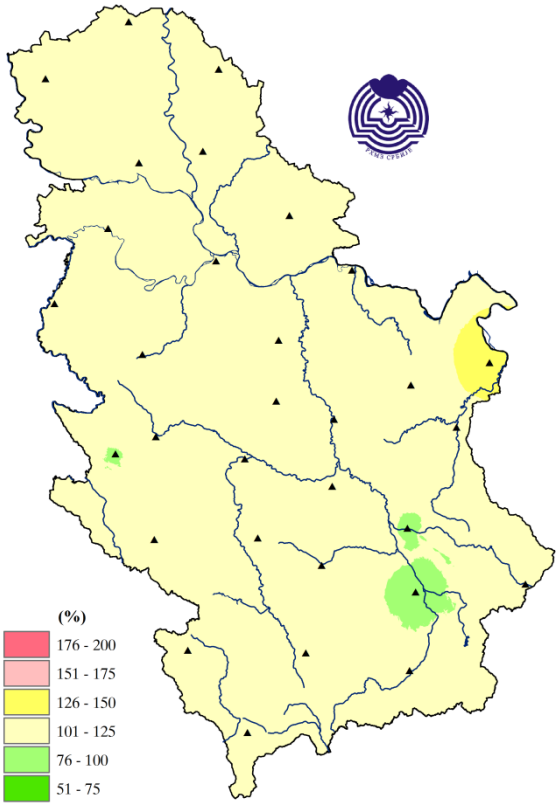

Figure 24. Insolation expressed in the percentages of normal

Analysis of the autumn 2023 for Serbia relative to the 1961-1990 base period

Temperature

Departure of the mean air temperature from the normal, during autumn for the 1961-1990 base period ranged from +0,4ºC in Leskovac to +1,7ºC in Loznica and Belgrade, and on the mountains from +1,0ºC in Sjenica to +2,1ºC at Kopaonik (*Figure 25*).

Based on the percentile method, mean air temperature was in the warm category in most of Serbia, very warm in Loznica, Belgrade, Crni Vrh and Kopaonik, and normal in Zrenjanin, Veliko Gradiste, Sjenica, Leskovac, Zajecar, Dimitrovgrad and Vranje (*Figure 26).*

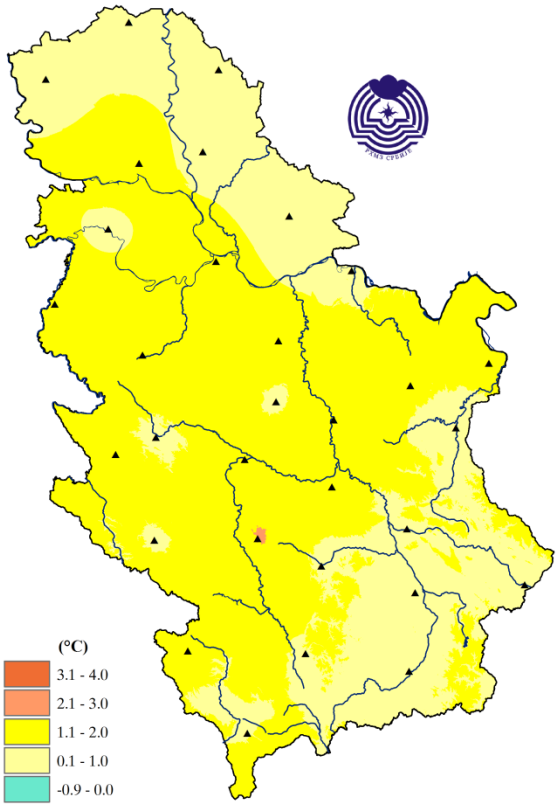

Figure 25. Mean seasonal air temperature anomaly from normal

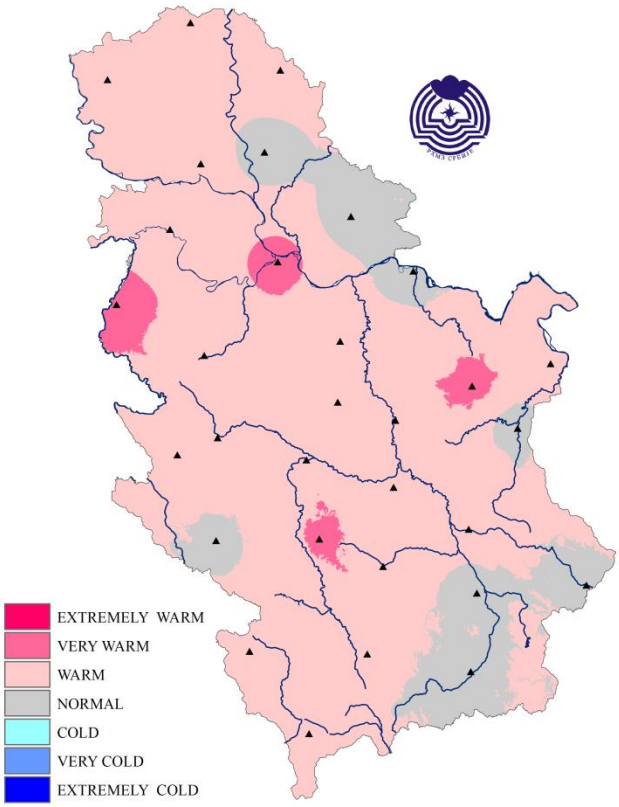

Figure 26. Spatial distribution of mean seasonal air temperature according to the percentile method

Precipitation

Autumn precipitation sums were above the average in most of Serbia; around the average in parts of eastern and western Serbia, and below the average in the easternmost areas of the country compared to the normal for the 1961-1990 base period. Precipitation sums compared to the normal ranged from 52% in Negotin to 203% in Novi Sad (*Figure 27*).

Based on the percentile method, autumn precipitation sums were in the following categories: normal and rainy in most of Serbia, very rainy in Sombor, Zrenjanin, Loznica, Sremska Mitrovica and Leskovac, extremely rainy in Novi Sad and Kopaonik, and dry in Negotin (*Figure 28).*

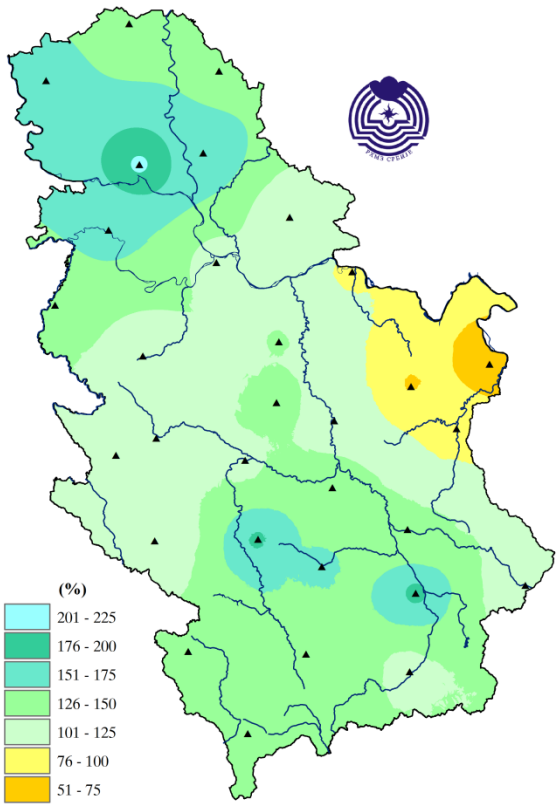

Figure 27. Spatial distribution of seasonal precipitation sums in percentage of normal

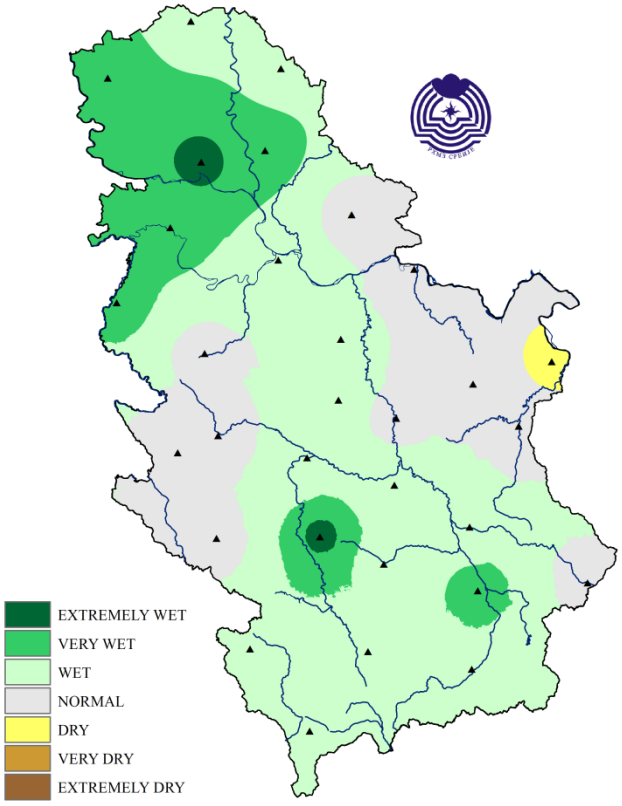

Figure 28. Seasonal precipitation sums according to the percentile method

Napomena: Klimatološka analiza meteoroloških elemenata urađena je na osnovu preliminarnih podataka sa 28 Glavnih meteoroloških stanica