Republic Hydrometeorological Service of Serbia
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Republic of Serbia

SEASONAL BULLETIN FOR SERBIA

SPRING 2024

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Division for Climate Monitoring and Climate Forecasts
Department of National Center for Climate Change, Climate Model Development and Disaster Risk Assessment
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- ***The warmest spring for Sombor, Novi Sad, Zrenjanin, Kikinda, Banatski Karlovac, Loznica, Sremska Mitrovica, Valjevo, Belgrade, Negotin, Požegi, Kuršumlija, Cupriji, on Palic and Zlatibor***
- ***Record low number of frost days in Smederevska Palanka, Sjenica, Požega, Kuršumlija and Crni Vrh***
- ***Record low number of ice days at Kopaonik***
- ***Record low number of days with snow cover at Zlatibor, Kopaonik and Sjenica***
- ***Record low snow depth for Crni Vrh and Kopaonik***

Analysis of the spring season 2024 for Serbia compared to the 1991-2020 base period

The warmest and averagely rainy **spring** (*Figure 1*) with **mean seasonal air temperature extremely above the average**[1] in almost entire Serbia, with spring precipitation sums within the average in most of Serbia.

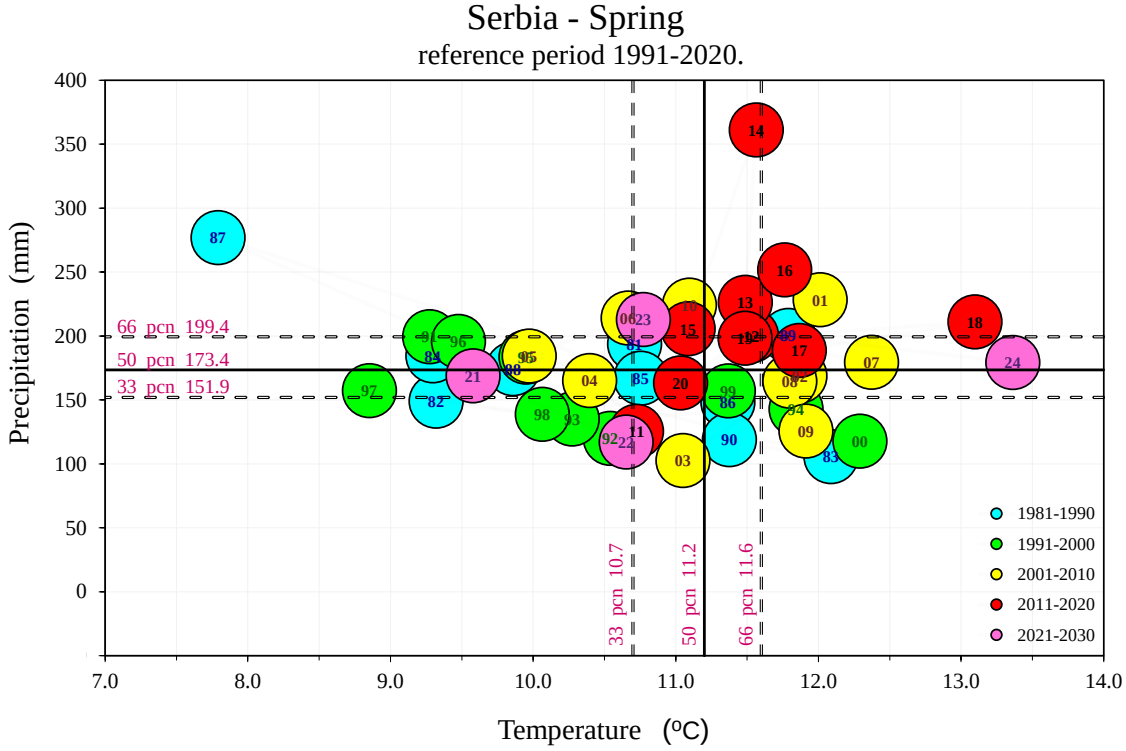

Figure 1. Assessment of mean air temperature and precipitation for spring in Serbia based on the accompanying terciles relative to the 1991-2020 base period

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

Temperature

Spring 2024 ranks as **the warmest for Serbia** (Figure 2) since 1951 with the mean air temperature of 13.4 °C, which is +2.3 °C above the normal. Also in **Belgrade, spring was the warmest since 1888** (Figure 3) with observed mean spring air temperature of 15.8 °C and departure of +2.5 °C from the normal. Record-breaking values of the mean, mean maximum and mean minimum spring air temperature were registered since the record-keeping in most of Serbia began (Table 1).

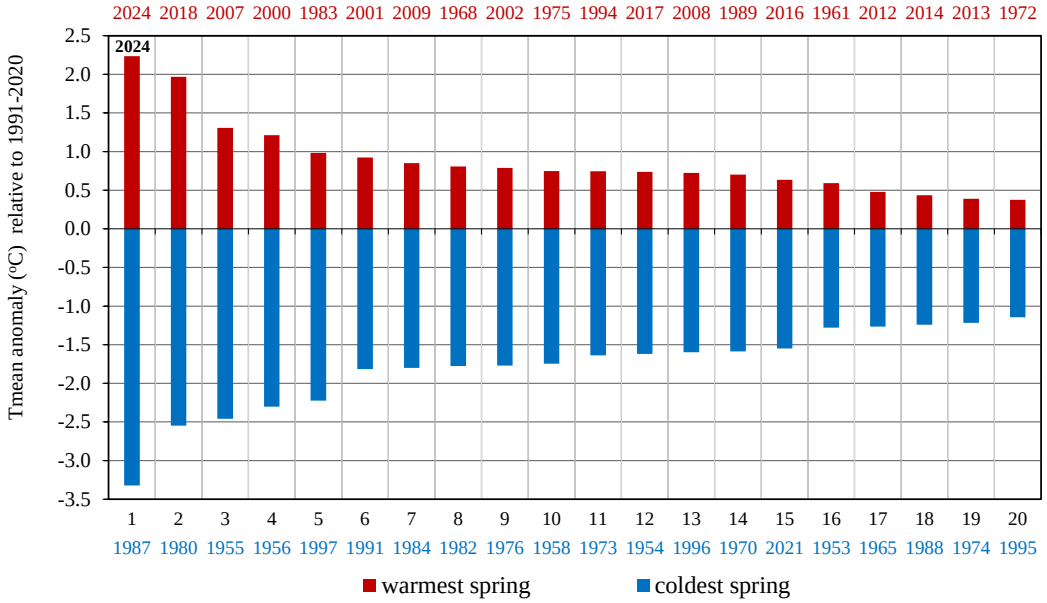

Figure 2. Rank of twenty warmest and coldest spring seasons in Serbia for the 1951-2024 period

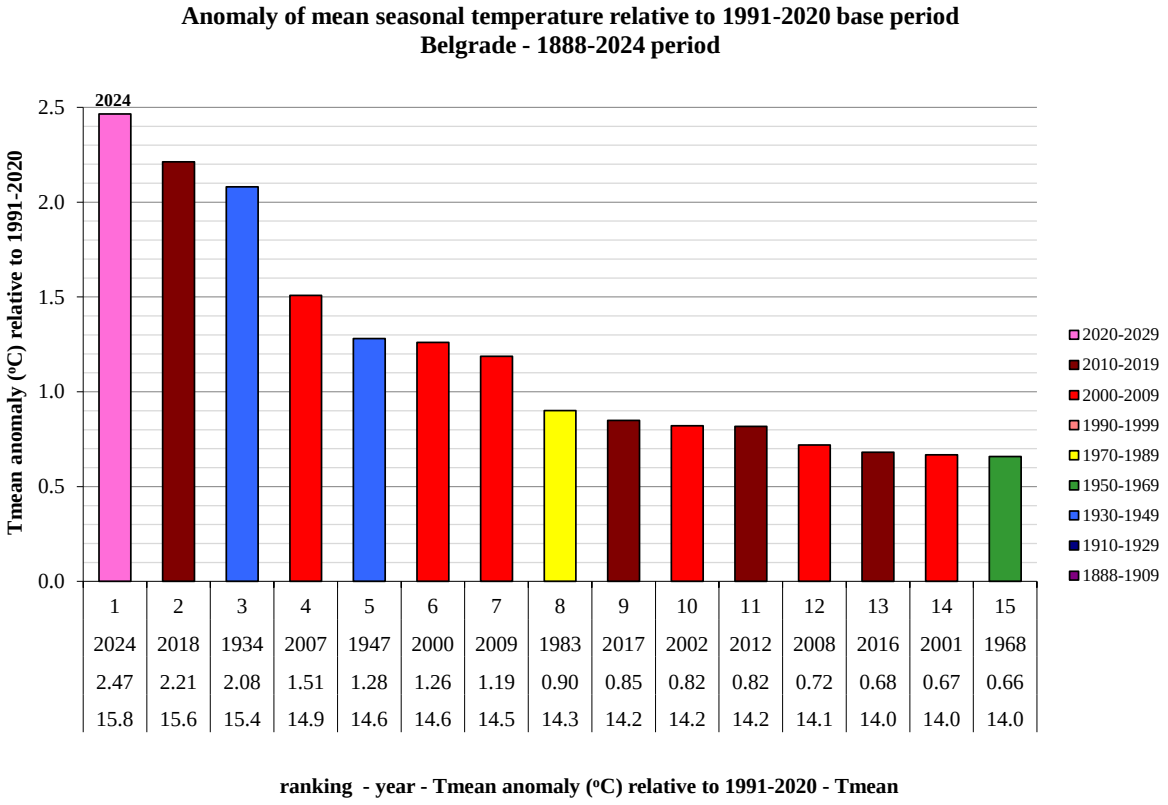

Figure 3. Rank of the warmest springs in Belgrade for the 1888-2024 period

Table 1. Record-breaking values of the mean (Tsr), mean maximum (Tsrmaks) and mean minimum (Tsrmin) spring air temperature

STATION	period of observations	Ta (°C) SPRING 2024	previous Ta maximum	year of Ta maximum	Tamax (°C) SPRING 2024	previous Tamax maximum	year of Tamax maximum	Tamin (°C) SPRING 2024	previous Tamin maximum	year of Tamin maximum
PALIC	1946-2023	14.5	13.7	2018	20.6	19.4	2007	8.6	8.4	2018
SOMBOR	1942-2023	14.6	13.7	2018	21.5	20.3	2007	8.2	7.9	2018
NOVI SAD	1949-2023	15.3	14.2	2018	21.7	19.9	2018	8.8	8.6	2018
ZRENJANIN	1944-2023	14.9	14.7	1946	21.2	20.1	1947	8.9	8.6	2018
KIKINDA	1949-2023.	15.0	14.0	2018	21.2	19.7	2018	8.6	8.1	2018
B. KARLOVAC	1986-2023	14.8	14.3	2018	21.1	20.5	2018	9.3	8.7	2018
LOZNICA	1953-2023	15.0	14.2	2018	21.8	20.6	1983	8.9	8.5	2018
S. MITROVICA	1926-2023	14.8	14.7	1934	21.5	-	-	8.7	8.4	2018
VALJEVO	1927-2023	14.6	14.2	2018	21.2	-	-	8.4	8.2	2018
BEOGRAD	1888-2023	15.8	15.6	2018	21.3	-	-	10.9	10.8	2018
KRAGUJEVAC	1926-2023	14.4	-	-	21.0	20.9	1934	8.0	-	-
S. PALANKA	1940-2023	14.3	-	-	21.3	20.7	2018	8.1	7.9	2018
V. GRADISTE	1927-2023	13.9	-	-	20.8	-	-	8.0	-	-
CRNI VRH	1967-2023	8.5	-	-	13.0	-	-	5.2	5.1	2018
NEGOTIN	1928-2023	14.4	14.4	2007	20.4	-	-	8.9	-	-
ZLATIBOR	1951-2023	10.1	10.0	2018	15.3	-	-	5.9	5.6	2018
SJENICA	1947-2023	9.1	-	-	15.8	-	-	2.9	-	-
POZEGA	1953-2023	12.6	12.4	2018	20.4	20.0	2018	6.1	6.0	2018
KRALJEVO	1927-2023	14.4	-	-	20.8	20.6	1983	8.1	8.0	2018
KOPAONIK	1950-2023	5.2	-	-	9.3	-	-	1.7	-	-
KURSUMLIJA	1953-2023	12.8	12.7	2018	19.9	-	-	6.5	6.2	2018
KRUSEVAC	1931-2023	14.1	-	-	20.9	-	-	7.8	-	-
CUPRIJA	1949-2023	14.6	14.1	2018	21.3	20.8	2000	8.2	8.0	2018
NIS	1926-2023	14.5	-	-	21.0	-	-	8.8	-	-
LESKOVAC	1949-2023	13.5	-	-	21.3	21.3	2018	6.8	-	-
ZAJECAR	1930-2023	13.0	-	-	20.0	-	-	6.6	-	-
DIMITROVGRAD	1946-2023	12.0	-	-	19.5	-	-	6.0	6.0	1947
VRANJE	1927-2023	13.6	-	-	20.2	-	-	7.0	-	-

Mean spring air temperature (Figure 4) ranged from 12.0 ºC in Dimitrovgrad to 15.8 ºC in Belgrade, and on the mountains from 5.2 ºC at Kopaonik to 10.1 ºC at Zlatibor.

Departure of the mean air temperature from the normal during spring (Figure 5) ranged from +1.4 ºC in Zajecar to +3.0 ºC in Novi Sad, and on the mountains from +1.9 ºC at Crni Vrh to +2.5 ºC at Kopaonik.

Based on the percentile[2] method, mean air temperature (Figure 6) during spring was in the extremely warm category in almost the entire Serbia and very warm category only in Zajecar.

Based on the tercile method, mean air temperature (Figure 7) in spring was in the warm category in entire Serbia.

In the appendix are graphs showing 15 warmest springs since record keeping began for the stations:, Novi Sad, Sremska Mitrovica, Valjevo, Cuprija, Negotin and Zlatibor.

[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

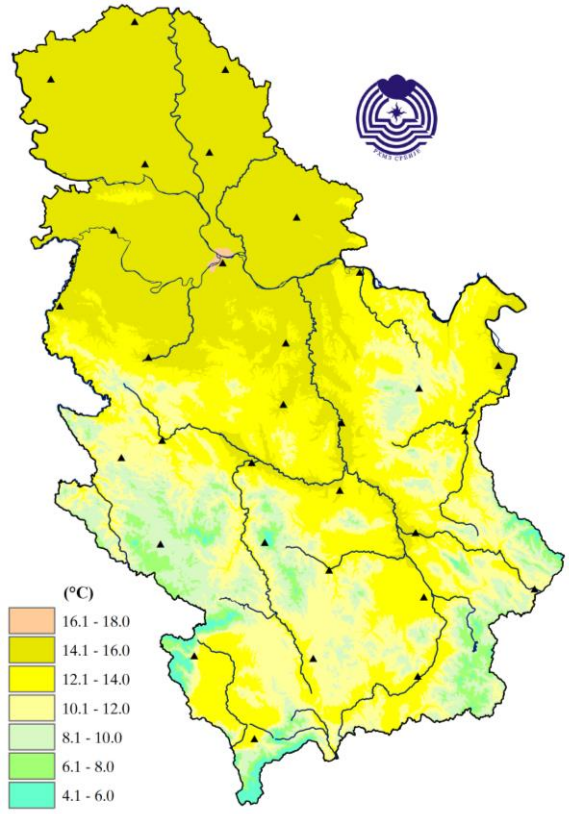

Figure 4. Spatial distribution of mean spring air temperature

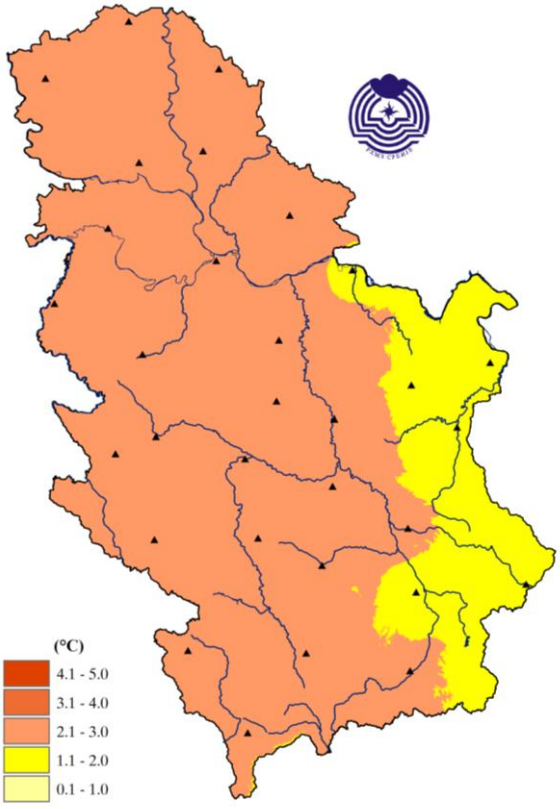

Figure 5. Spatial distribution of mean spring air temperature anomaly from the normal

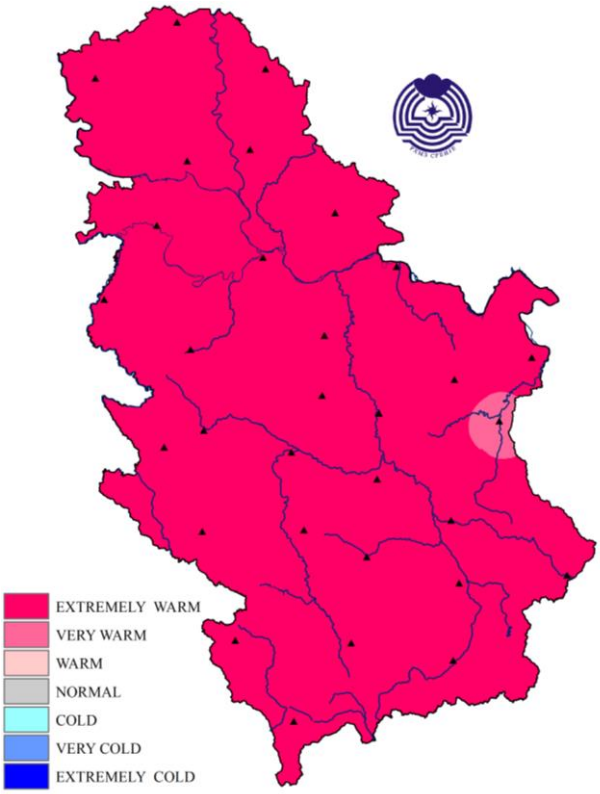

Figure 6. Spatial distribution of mean winter air temperature according to the percentile method

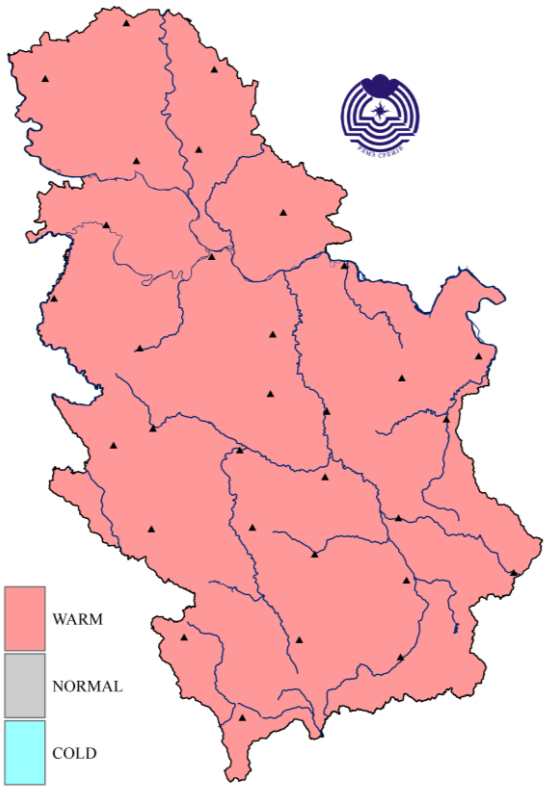

Figure 7. Spatial distribution of mean winter air temperature according to the tercile method

In spring, the highest daily air temperature of 33.7 ºC was measured in Cuprija on April 15, while Belgrade observed 31.0 ºC.

Number of summer days[3] ranged from 16 in Dimitrovgrad to 32 in Sombor, Novi Sad and Zrenjanin, and on the mountains, 1 day was registered in Crni Vrh, Zlatibor and Sjenica. In almost the entire Serbia, deviation of the number of summer days from the normal was positive (Figure 8) from up to 4 days in Dimitrovgrad to 17 days above the average in Novi Sad and Zrenjanin, apart from the mountains, up to 1 day below the average at Zlatibor.

Number of tropical days[4] was within the average in most of Serbia, up to 4 days was registered in Cuprija, whereas on the mountains, along with Kursumlija, Vranje and Palic there weren't any tropical days.

In spring, entire Serbia didn't observe any tropical nights[5].

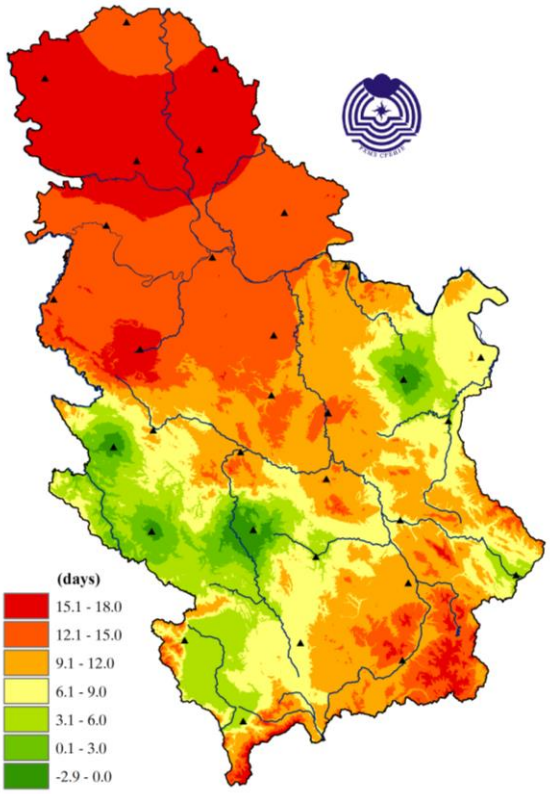

Figure 8. Deviation of the number of ice days from the normal

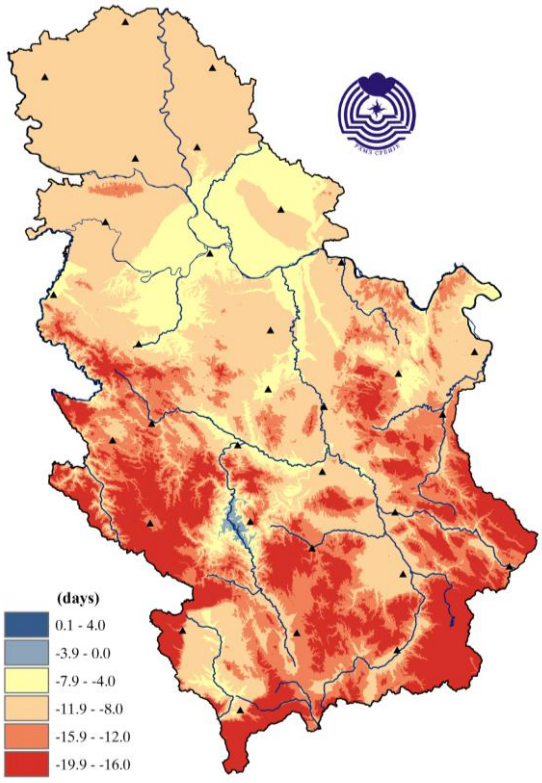

Figure 9. Deviation of the number of frost days from the normal

The lowest spring air temperature of –8.1 ºC was measured at Kopaonik on March 20. As for the lowland, –4.0 ºC was measured in Veliko Gradiste and Dimitrovgrad on March 21. On March 20, Belgrade observed minimum daily air temperature of +1.8 ºC.

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

In spring, number of frost days ranged from 1 day in Loznica, Nis and Palic to 8 frost days[6] in Dimitrovgrad, whereas Belgrade didn't observe any. On the mountains, number of frost days ranged from 9 days at Zlatibor to 32 frost days at Kopaonik. The recorded number of frost days was below the average (*Figure 9*) in entire Serbia, from 6 days below the average in Belgrade and Kragujevac up to 16 days below the average at Kopaonik. **The record low number of frost days in spring was recorded in Smederevska Palanka (3), Sjenica (18), Pozega (7), Kursumlija (5) and Crni Vrh (14).**

In spring, entire Serbia didn't see any days with severe frost[7].

Ice days[8] were recorded only in some mountainous regions, 1 day at Crni Vrh and 2 days at Kopaonik, which is record low number of ice days at Kopaonik, up to 12 days below the spring average.

Belgrade observed spring mean, maximum and minimum air temperature above the multiannual average almost entire March until mid-April, end of April, middle of the first and during third decade of May, and below the average during the second half of April, beginning and middle of May (*Figure 10*).

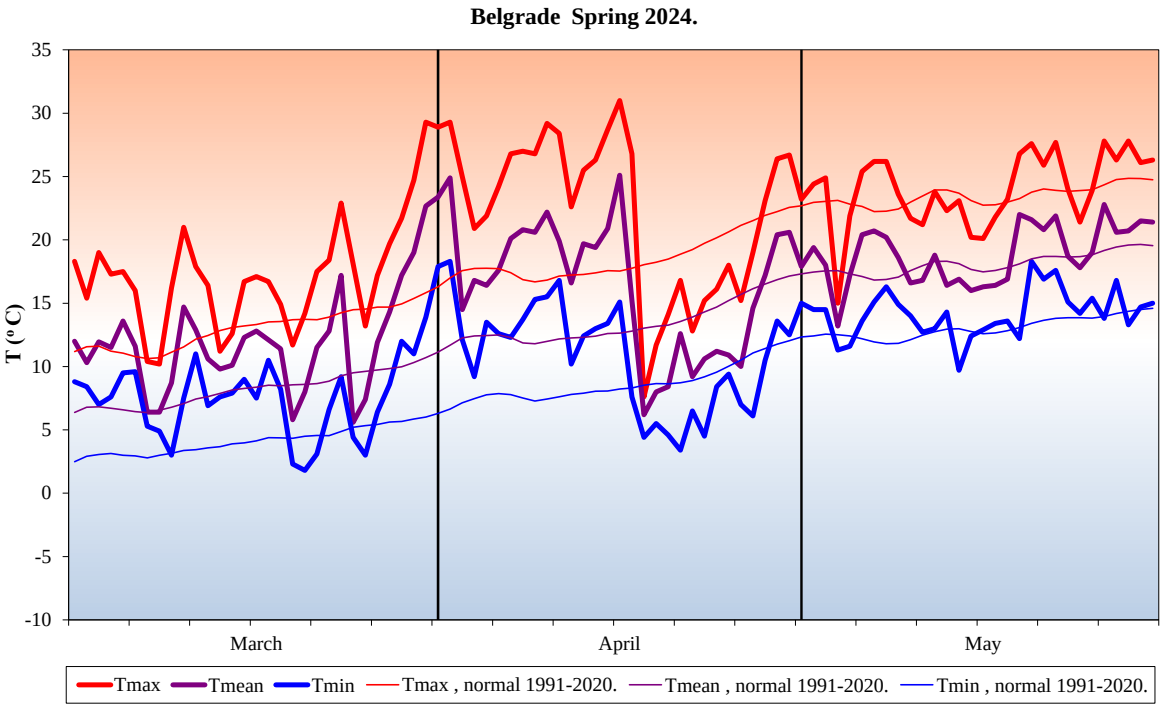

Figure 10. Three–month course of the mean, maximum and minimum daily air temperature in Belgrade

[6] Frost day is defined as the day with minimum daily air temperature below 0 °C
[7] Day with severe frost is defined as the day with the minimum daily air temperature below –10 °C
[8] Ice day is defined as the day with maximum daily air temperature below 0 °C

Heat waves during spring 2024

There were two heat waves[9] recorded during spring (*Table 1*). The first lasted from 27 March to 2 April affecting entire Serbia apart from the mountainous regions of the western Serbia. The second heat wave was recorded in the period from 5 to 16 April, first affecting the entire territory of Serbia, and later almost the entire territory of Serbia.

Table 1.

HEAT WAVES IN SRBIJA - SPRING 2024

(reference period 1991-2020)

	MARCH																															APRIL																														MAY																													
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	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	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																													EW	EW	EW	EW	VW			VW	EW	EW	EW	EW	VW	EW	EW	EW	EW	EW																																													
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LESKOVAC																												VW	EW	EW	EW	EW	VW			VW	VW	VW	EW	EW	EW	VW	VW	VW	EW	EW	VW																																													
KURSUMLIJA																													EW	EW	EW	EW	VW			VW	EW	VW	EW	EW	EW																																																		
B. KARLOVAC																												VW	EW	EW	EW	EW				VW	VW	EW	EW	EW	EW		EW	EW	EW	EW	EW																																													

EW	EXTREMELY WARM
VW	VERY WARM

[9] Heat wave, according to the percentile method, is a period of minimum five days with maximum daily air temperature is in the very warm and extremely warm categories

Precipitation

Spring precipitation totals (*Figure 11)* ranged from 87.9 mm on Palic to 267.3 mm at Zlatibor. Precipitation sums compared to the normal (*Figure 12*) ranged from 54% in Valjevo (*Figure 15*) to 153% in Vranje (*Figure 16*).

Based on the percentile method (*Figure 13)*, spring precipitation sums were in the following categories: normal category in most of Serbia, rainy category in Sombor, Sremska Mitrovica, Negotin, Pozega, Leskovac and Dimitrovgrad, very rainy in Vranje, and dry in Novi Sad, Banatski Karlovac and Palic, and very dry in Valjevo.

Spring precipitation sums based on the tercile method (*Figure 14)* were in the rainy category in Sombor, Sremska Mitrovica, Negotin, Pozega, Leskovac, Dimitrovgrad and Vranhje, dry category in Novi Sad, Banatski Karlovac, Valjevo, Veliko Gradiste, Cuprija as well as Crni Vrh and Palic, elsewhere within the average.

Number of days with precipitation during spring ranged from 24 days in Sombor to 47 days at Kopaonik. The recorded number of days with precipitation was below the average in the northern, western and central parts of Serbia, up to 10 days below the average in Sombor, and up to 6 days above the average in Kursumlija, Negotin, Zajecar and Dimitrovgrad (*Figure 17*).

The maximum daily precipitation sum of 55.2 mm was measured in Kikinda of May 23.

In spring, there weren't any days with snow cover in the lowland, whereas in the hilly-mountainous regions, number of days with snow cover ranged from 1 in Sjenica to 26 days at Kopaonik, which is 27 days below the spring average. **The previous record of the lowest number of days with snow cover was broken at Zlatibor, Kopaonik and Sjenica.**

The maximum snow cover depth of 19 cm was measured at Kopaonik on March 14, which is **the lowest spring snow depth since the record-keeping at Kopaonik began**. **Record low spring maximum snow depth of only 3 cm was measured at Crni Vrh.**

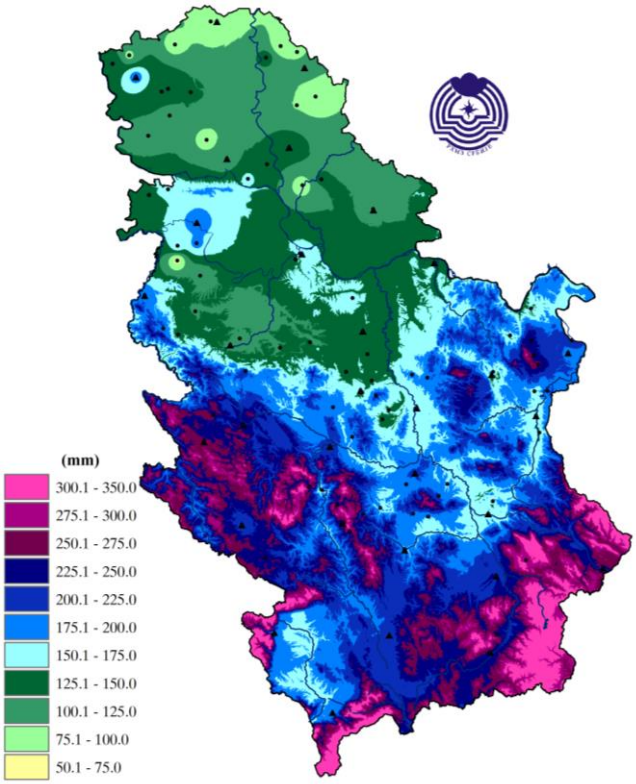


Figure 11. Spatial distribution of spring precipitation sums based on data from 28 Primary meteorological, 15 climatological and 56 rain gauge stations

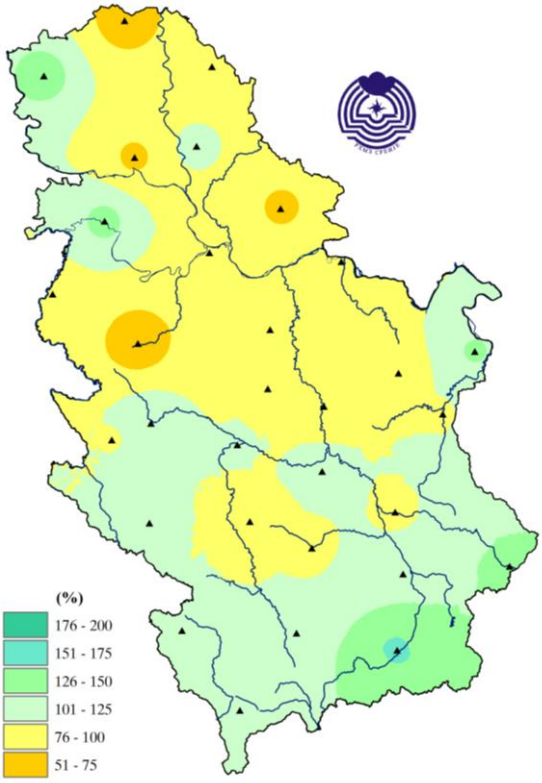


Figure 12. Spatial distribution of spring precipitation sums in percentage of normal

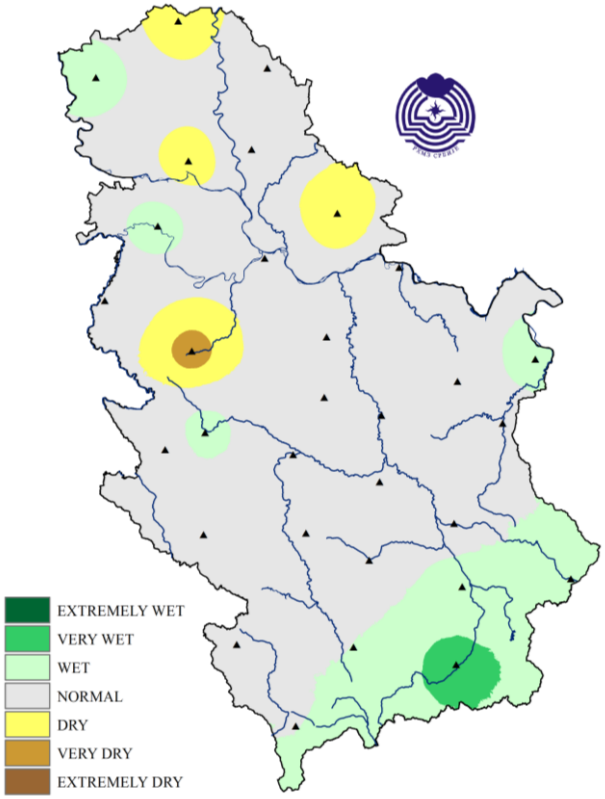


Figure 13. Spring precipitation sums according to the percentile method

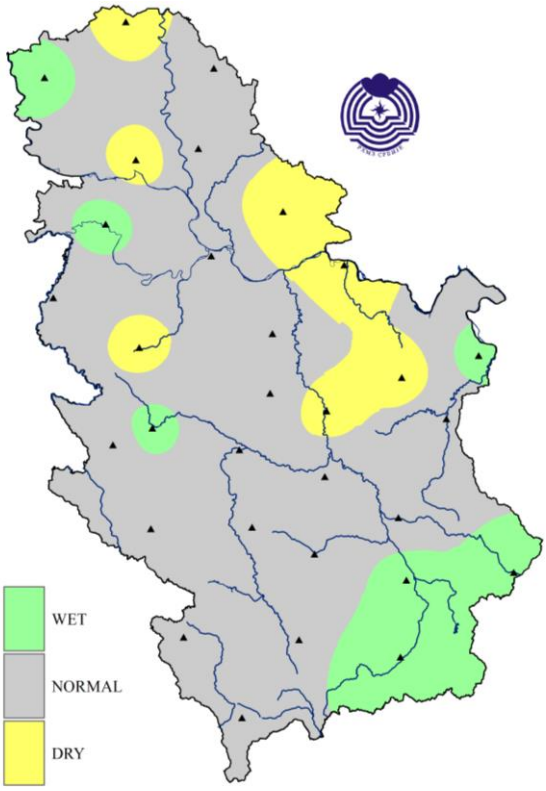


Figure 14. Spring precipitation sums according to the tercile method

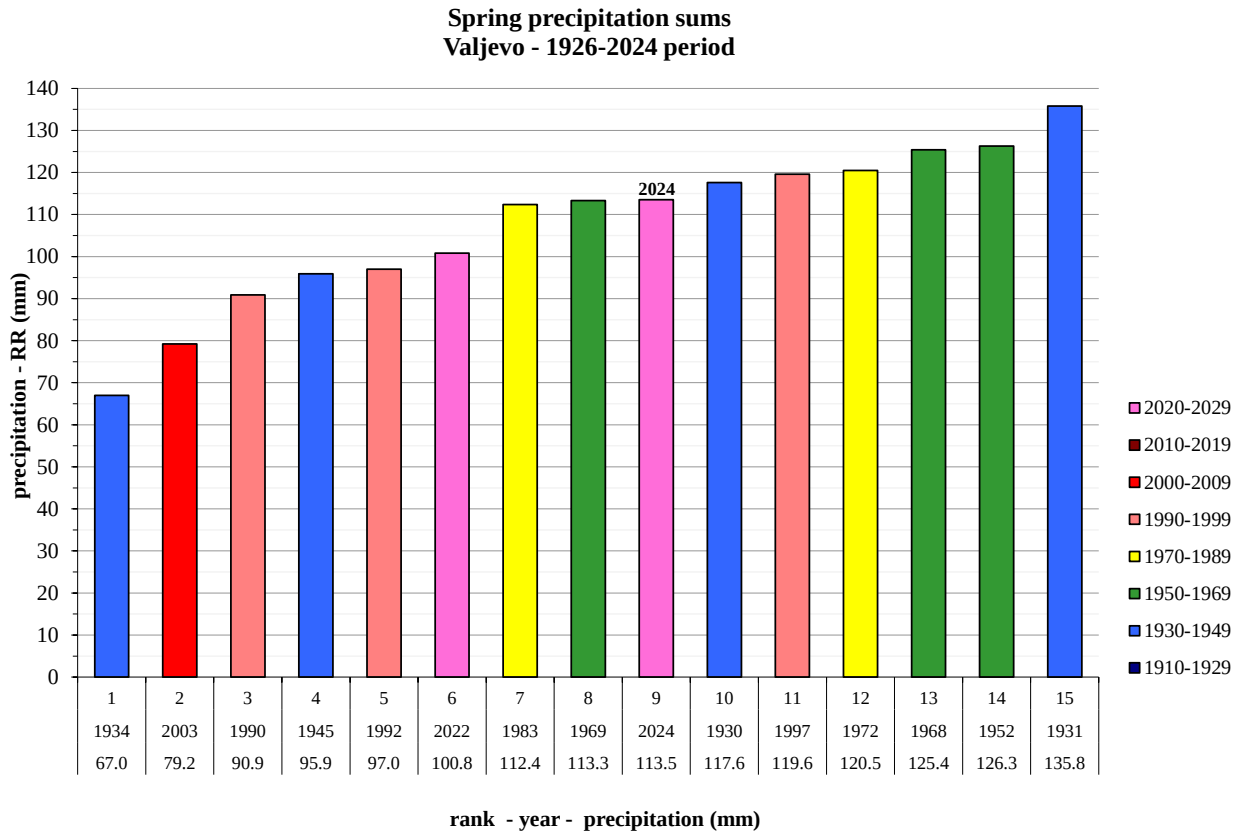


Figure 15. Rank of the driest springs in Valjevo

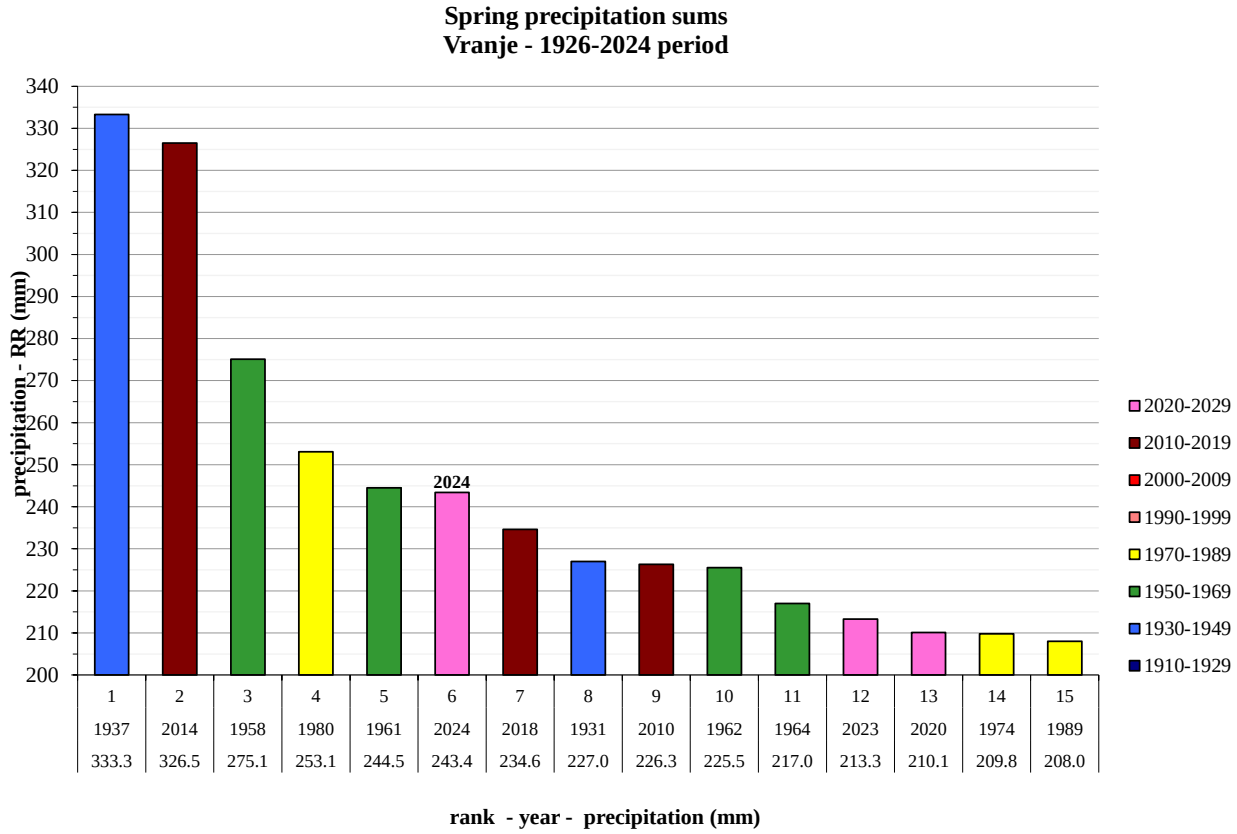


Figure 16. Rank of the wettest springs in Vranje

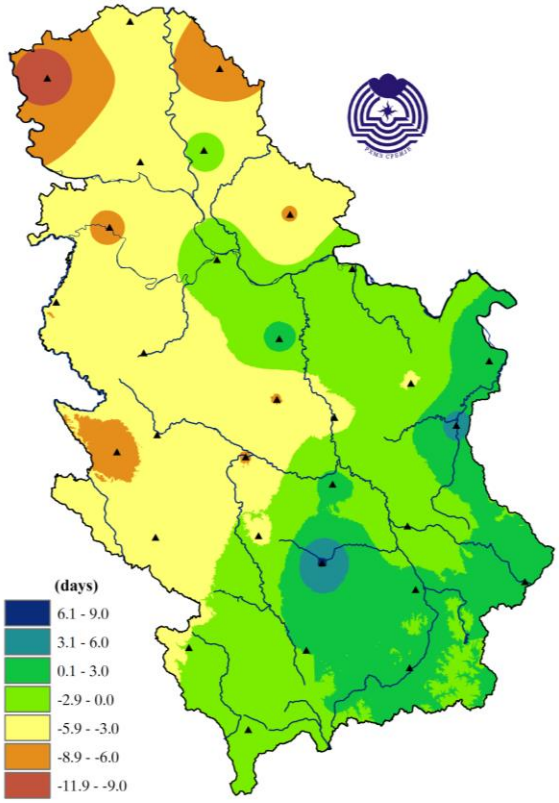


Figure 17. Deviation of number of days with precipitation of 0.1 mm and more from the normal

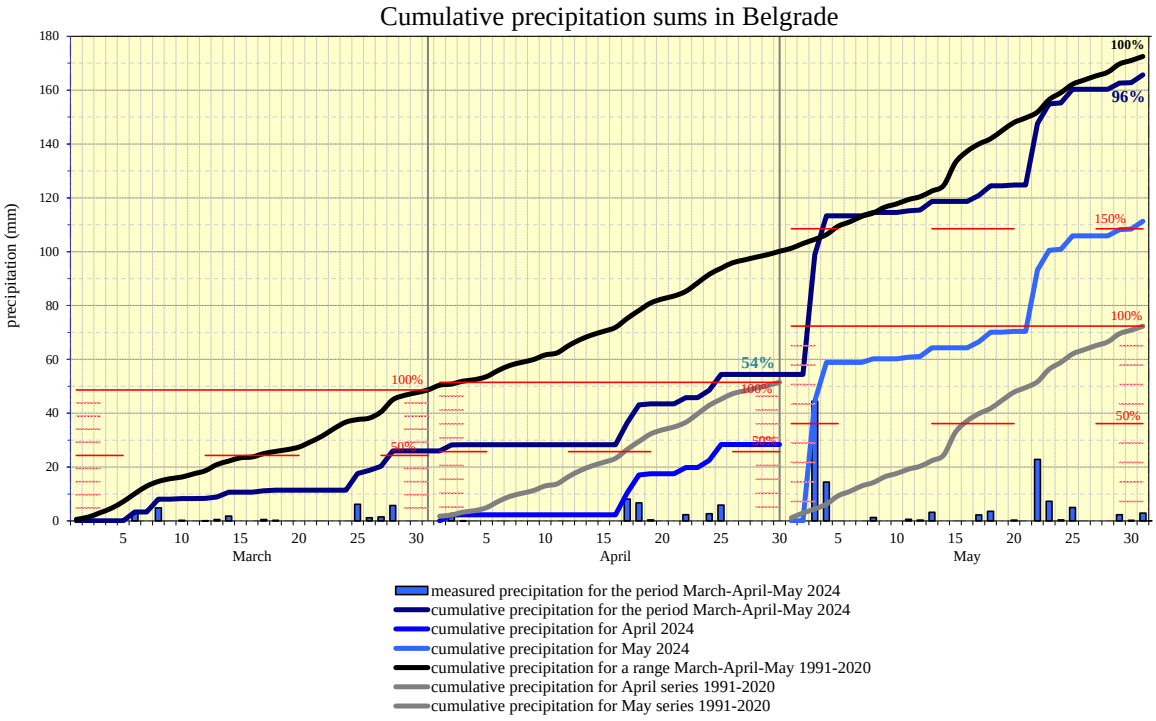


Figure 18. Daily and cumulative precipitation sums in Belgrade

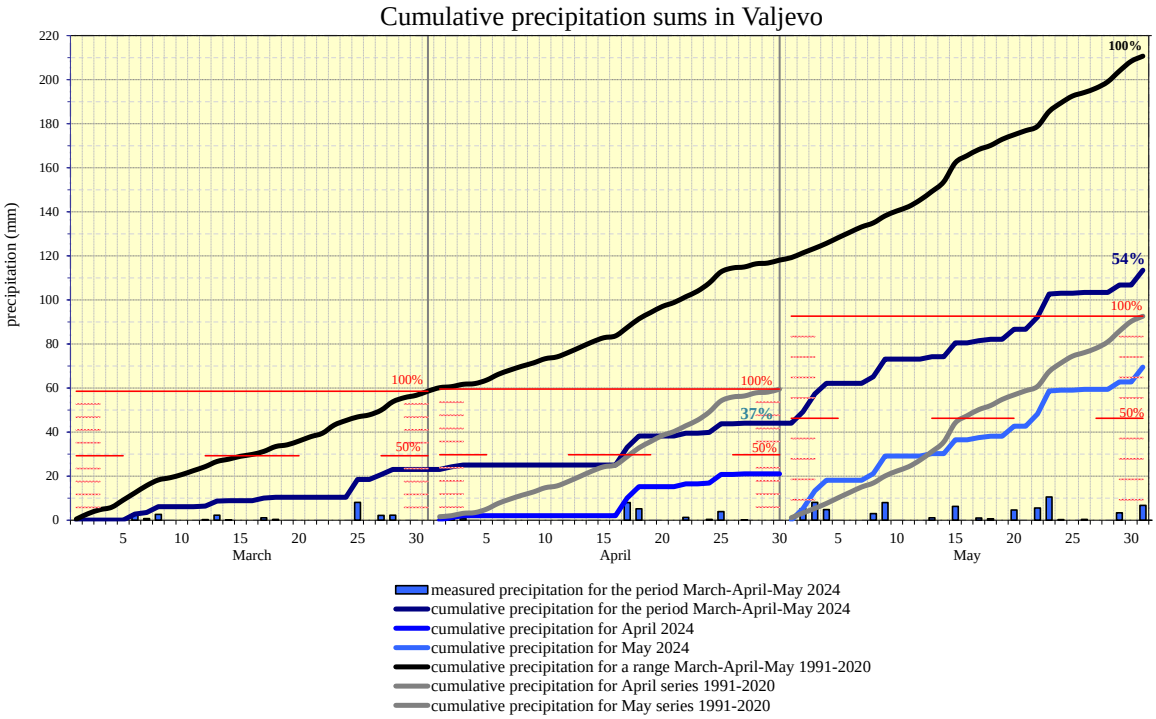


Figure 19. Daily and cumulative precipitation sums in Valjevo

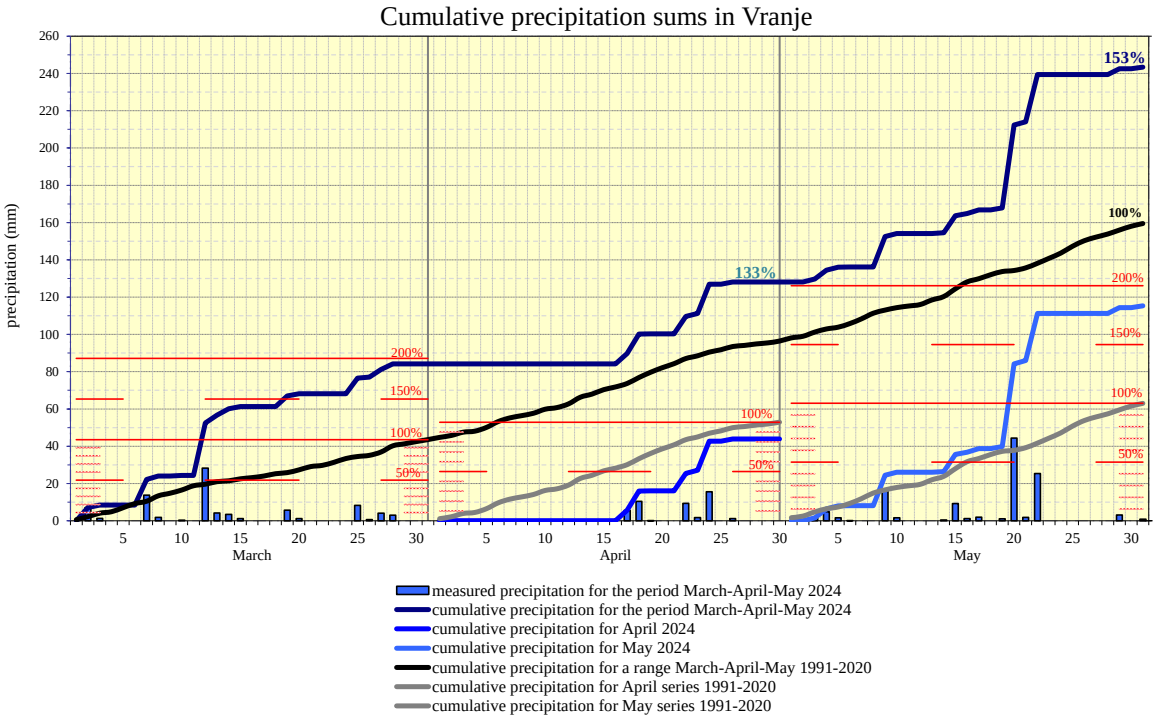


Figure 20. Daily and cumulative precipitation sums in Vranje

Sunshine duration (insolation)

In spring, sunshine duration (*Figure 21*) ranged from 423.6 hours in Zajecar to 766.9 hours in Kikinda.

In relation to the normal for the 1991-2020 base period, insolation ranged from 81% in Zajecar to 120% in Kikinda (*Figure 22*).

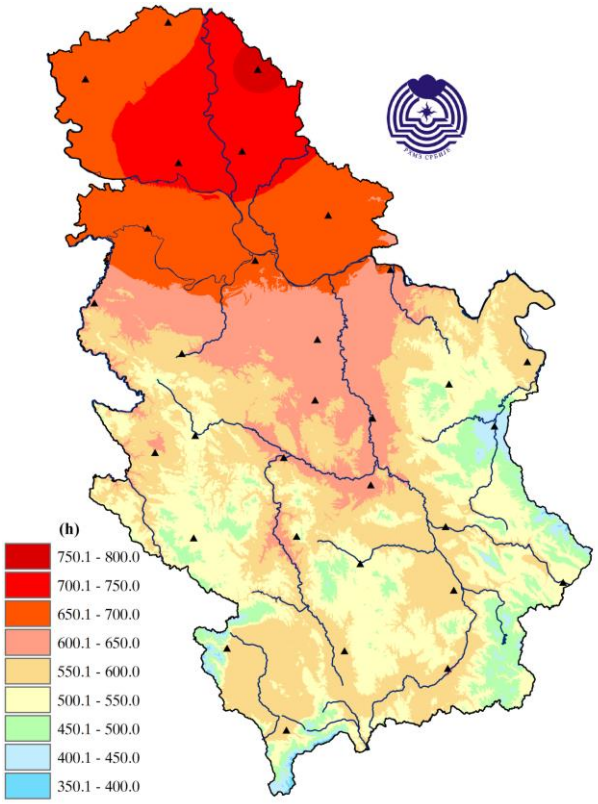


Figure 21. Insolation in hours

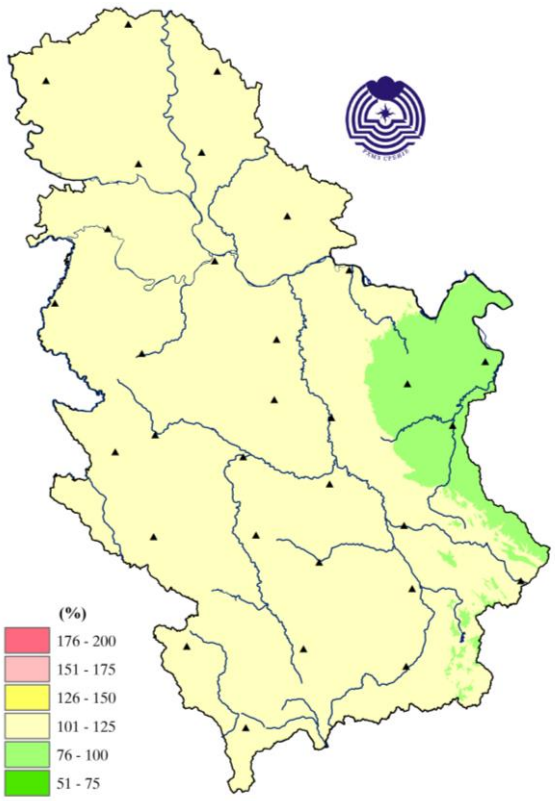


Figure 22. Insolation in percentage of normal

Analysis of the spring season 2024 for Serbia compared to the 1961-1990 base period

Temperature

Departure of the mean air temperature from the normal, during spring, for the 1961- 1990 base period ranged from +2.2 ºC in Zajecar and Dimitrovgrad to +3.9 ºC in Novi Sad, and on the mountains from +2.2 ºC at Crni Vrh to +3.7 ºC at Kopaonik (*Figure 23*).

Based on the percentile method, mean spring air temperature was in the extremely warm category in most of Serbia and very warm category only at Crni Vrh (*Figure 24).*

Based on the tercile method, mean spring air temperature was in the warm category in entire Serbia.

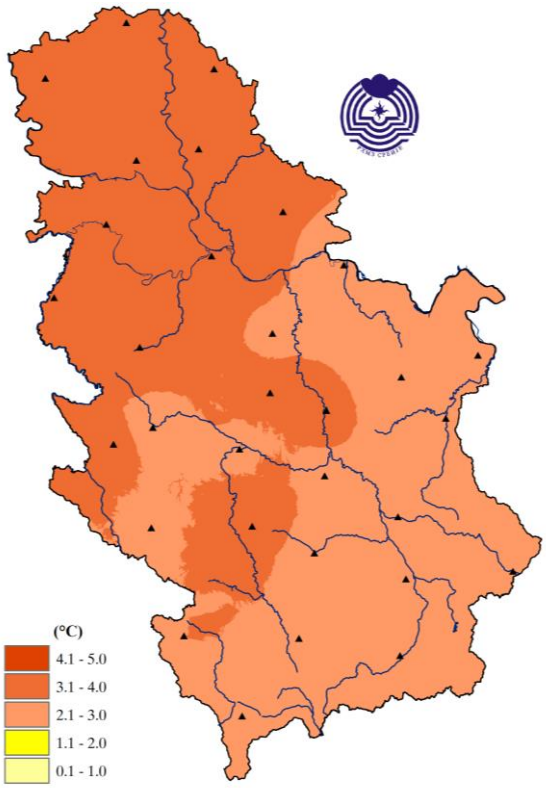


Figure 23. Spatial distribution of mean spring air temperature anomaly from the 1961-1990 normal

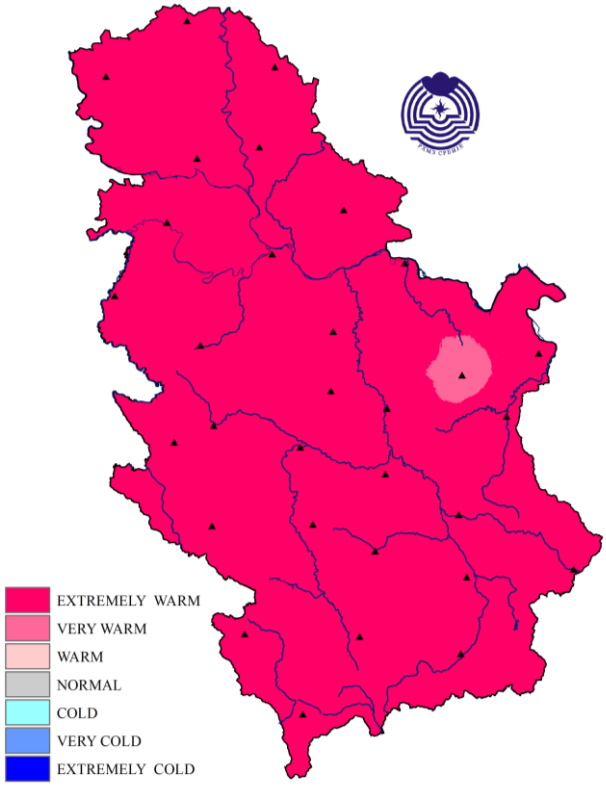


Figure 24. Spatial distribution of mean spring air temperature according to the percentile method

Precipitation

In relation to the normal for the 1961-1990 base period, spring precipitation totals ranged from 55% in Valjevo to 150% in Vranje (*Figure 25*).

Based on the percentile method, spring precipitation sums were in the following categories: normal in most of Serbia, rainy in Sombor, Sremska Mitrovica, Sjenica, Pozega and Leskovac, very rainy in Dimitrovgrad and Vranje, and dry in Kikinda and Banatski Karlovac, and very dry in Valjevo and Palic (*Figure 26).*

Precipitation sums based on the tercile method were in the following categories: rainy in Sombor, Sremska Mitrovica, Negotin, Sjenica, Pozega, Krusevac, Leskovac, Dimitrovgrad, Vranje and Kopaonik, dry in Novi Sad, Kikinda, Banatski Karlovac, Valjevo as well as Crni Vrh and Palic, elsewhere within the average.

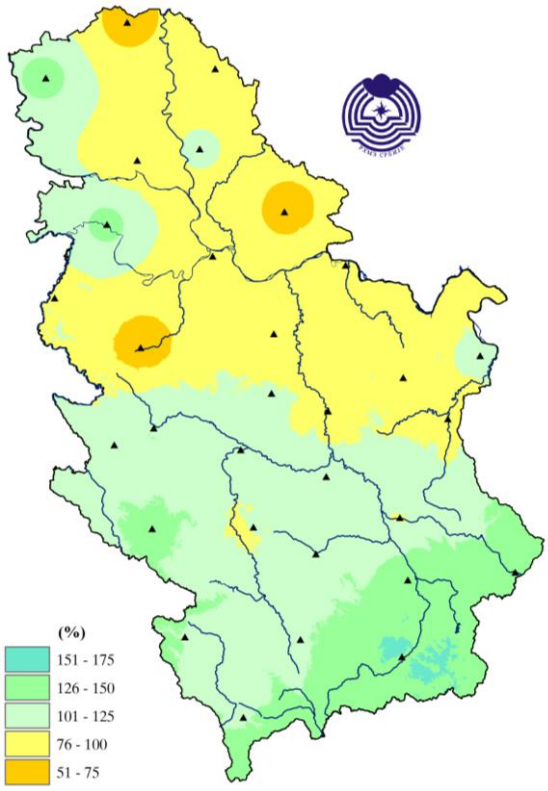


Figure 25. Spatial distribution of spring precipitation sums in percentage of the 1961-1990 normal

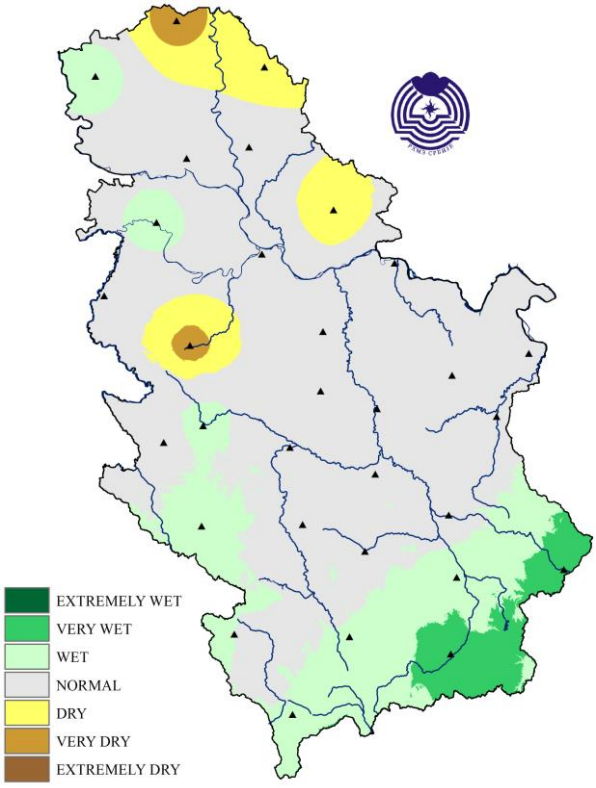
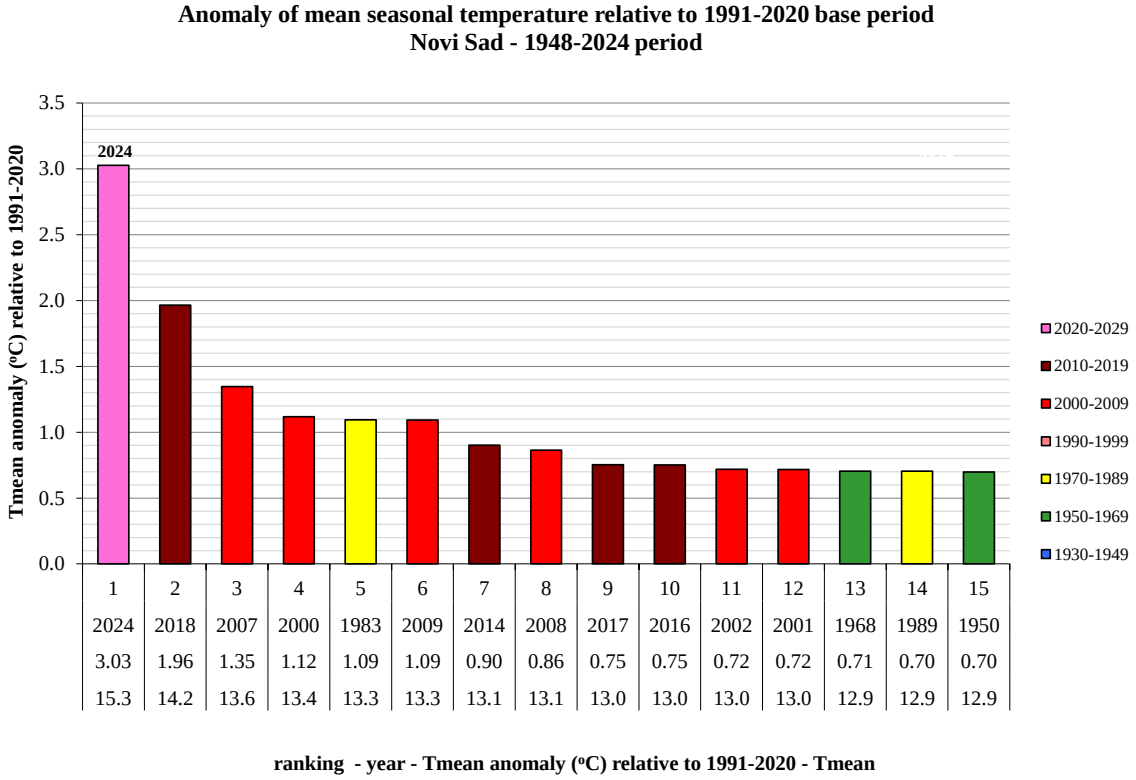


Figure 26. Spring precipitation sums according to the percentile method

Note: Climatological analysis of the meteorological elements based on the preliminary data obtained from the 28 Primary meteorological stations

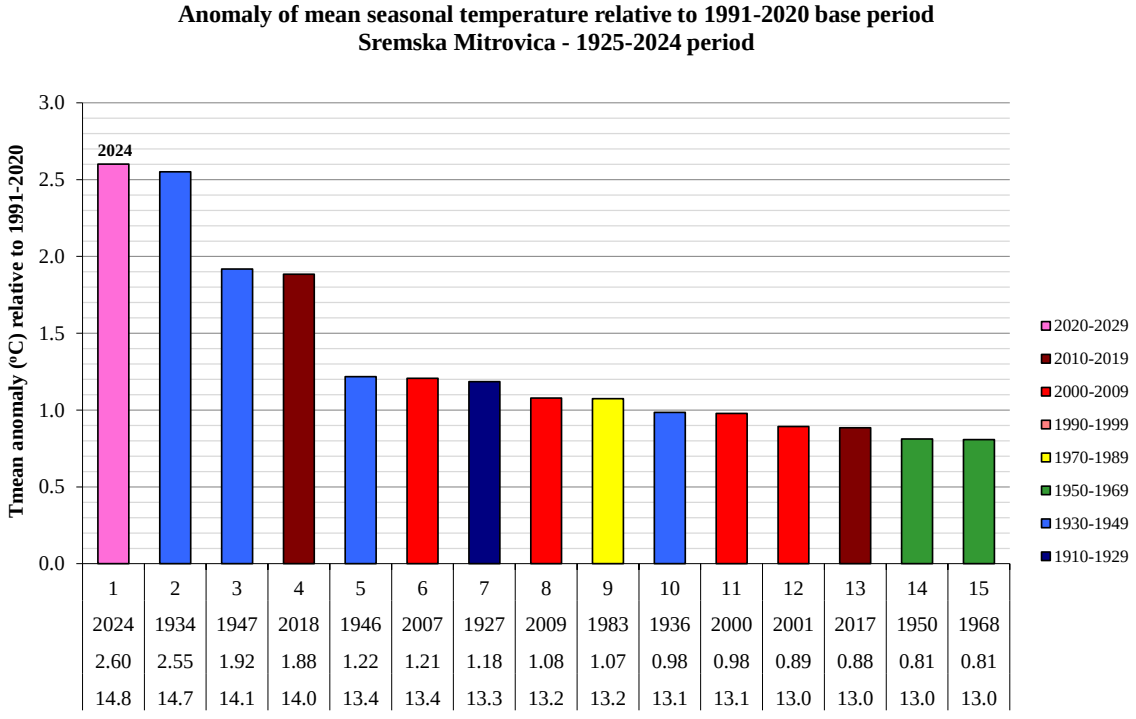
APPENDIX

Mean air temperature



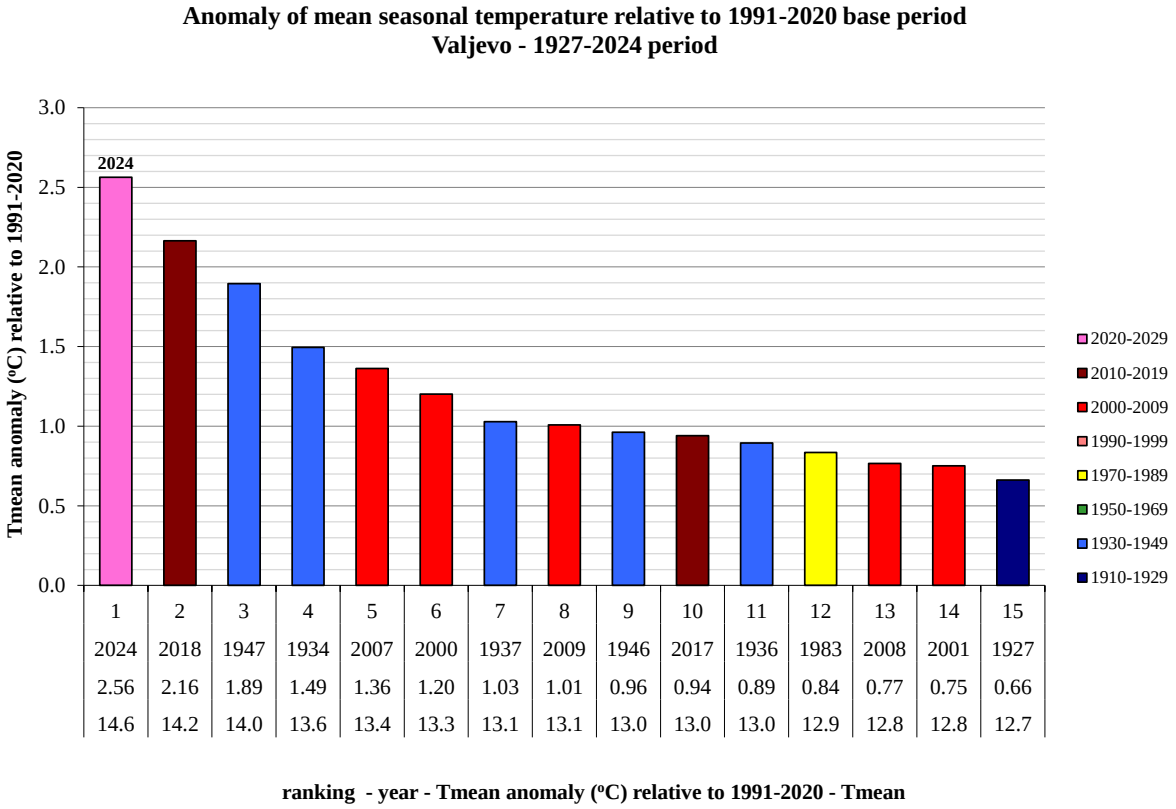
ranking	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
year	2024	2018	2007	2000	1983	2009	2014	2008	2017	2016	2002	2001	1968	1989	1950
Tmean anomaly (ºC) relative to 1991-2020	3.03	1.96	1.35	1.12	1.09	1.09	0.90	0.86	0.75	0.75	0.72	0.72	0.71	0.70	0.70
Tmean	15.3	14.2	13.6	13.4	13.3	13.3	13.1	13.1	13.0	13.0	13.0	13.0	12.9	12.9	12.9

Appendix 1. Rank of the warmest springs in Novi Sad for the 1948-2024 period

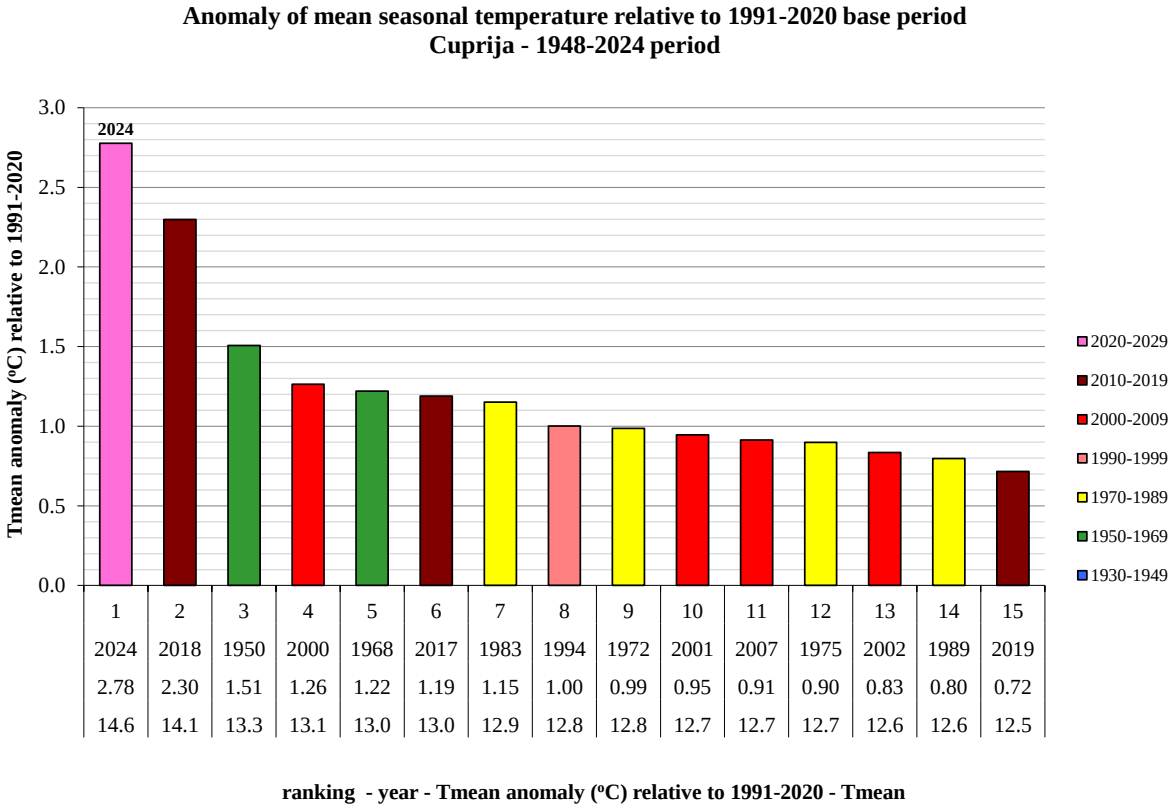


ranking	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
year	2024	1934	1947	2018	1946	2007	1927	2009	1983	1936	2000	2001	2017	1950	1968
Tmean anomaly (ºC) relative to 1991-2020	2.60	2.55	1.92	1.88	1.22	1.21	1.18	1.08	1.07	0.98	0.98	0.89	0.88	0.81	0.81
Tmean	14.8	14.7	14.1	14.0	13.4	13.4	13.3	13.2	13.2	13.1	13.1	13.0	13.0	13.0	13.0

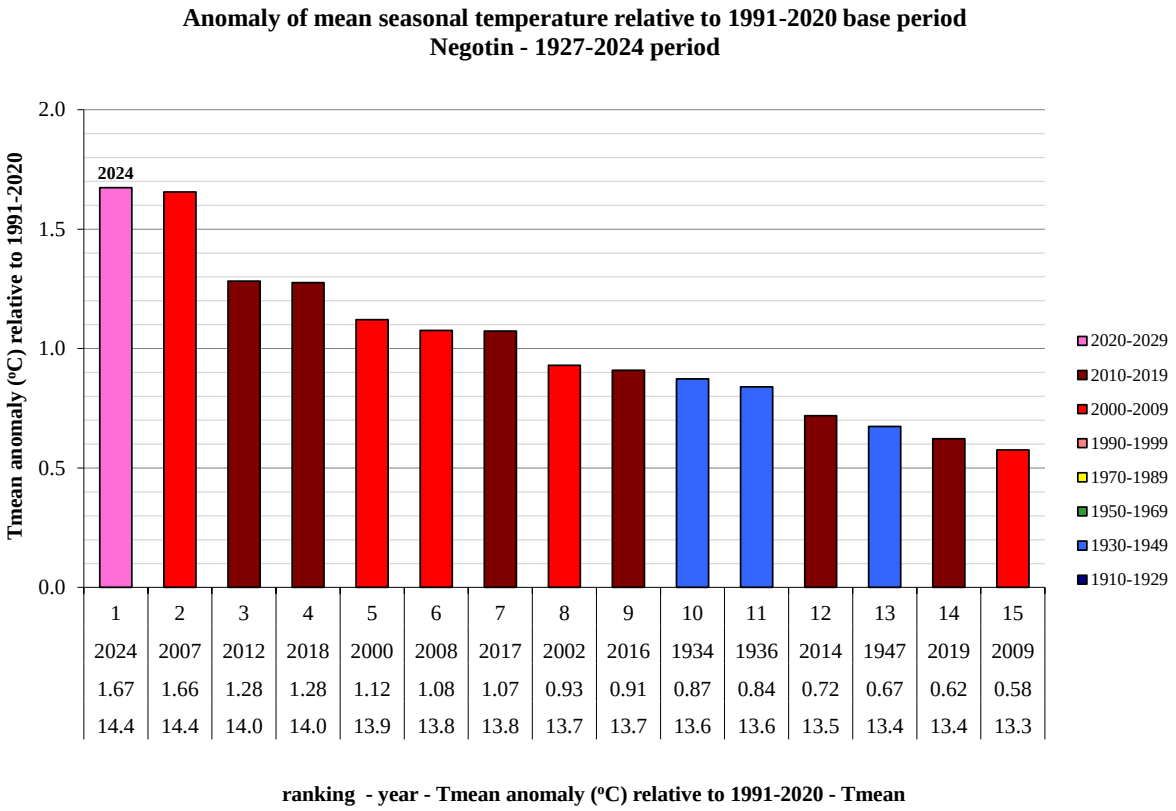
Appendix 2. Rank of the warmest springs in Sremska Mitrovica for the 1925-2024 period



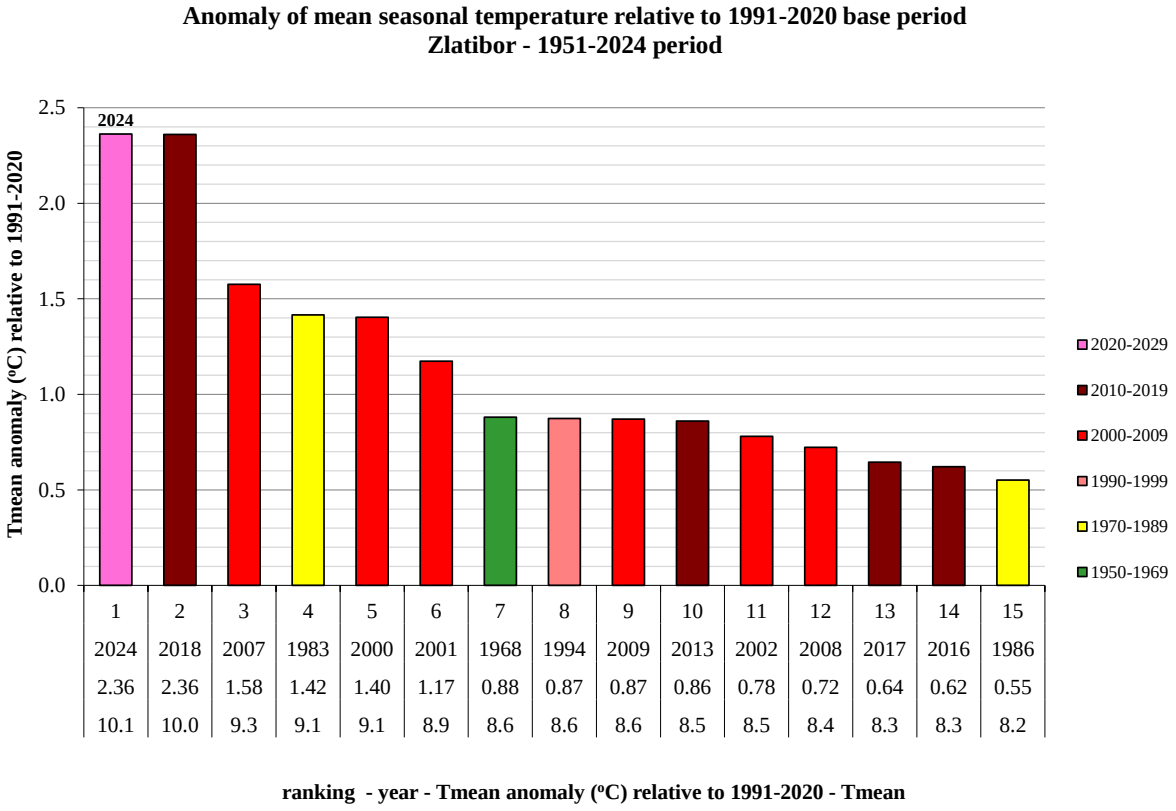
Appendix 3. Rank of the warmest springs in Valjevo for the 1927-2024 period



Appendix 4. Rank of the warmest springs in Cuprija for the 1948-2024 period



Appendix 5. Rank of the warmest springs in Negotin for the 1927-2024 period



Appendix 6. Rank of the warmest springs at Zlatibor for the 1951-2024 period