





VERIFICATION OF THE SEECOF-30 WINTER 2023/2024 CLIMATE OUTLOOK AND SEASONAL BULLETIN FOR THE TERRITORY OF SERBIA

Belgrade, 8 April 2024

Republic Hydrometeorological Service of Serbia

Division for Climate Monitoring and Climate Forecast Department of National Center for Climate Change, Climate Model Development and Disaster Risk Assessment web: <u>http://www.hidmet.gov.rs</u> mail: <u>k.c@hidmet.gov.rs</u>

Temperature

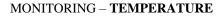
The SEECOF-30 outlook for the winter 2023/2024 in Serbia indicated normal-(30% probability) to above-normal temperature in Serbia with 50% probability.

Climatological monitoring showed that the winter 2023/2024 was warm in the entire Serbia, with above-normal temperature based on the tercile method (*Figure* A). The outlook for a warm winter was correct.

Precipitation

According to the SEECOF-30 outlook for the winter 2023/2024, above normal precipitation were indicated for Serbia with 50% probability.

Based on the climatological monitoring of precipitation, the winter of 2023/2024 was dry in almost the entire Serbia whilst average precipitation sums were recorded in some parts of central and northwestern Serbia (*Figure* B). The outlook above average winter precipitation sums was incorrect for the entire Serbia.



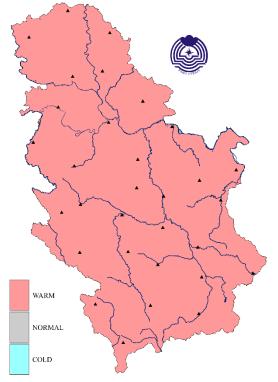


Figure A. Monitoring of the winter temperature using tercile method compared to the 1991-2020 base period



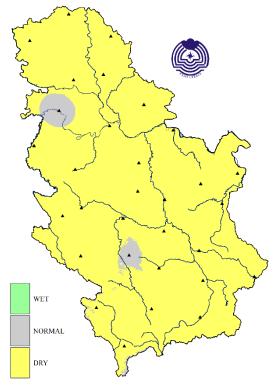


Figure B. Monitoring of the winter precipitation using tercile method compared to the 1991-2020 base period

Winter 2023/2024			Air Temperature (°C)											
Station	Rank*	Rank**	33	50	66	Observed value								
Belgrade (1887-2023)	1	1	1.7	2.6	3.7	7.4								
Palić (1945-2023)	1	1	0.2	1.0	2.1	5.0								
Sombor (1941-2023)	1	1	0.5	1.1	2.1	5.2								
Novi Sad (1948-2023)	1	1	0.8	1.3	2.4	5.9								
Zrenjanin (1943-2022)	1	1	0.6	1.5	2.4	5.7								
Kikinda (1948-2023)	1	1	0.3	1.4	2.1	5.6								
Banatski Karlovac (1985-2023)	1	1	0.5	1.5	2.2	5.5								
Loznica (1952-2023)	1	1	6.5											
Sremska Mitrovica (1925-2023)	1	1	0.6	1.3	2.3	5.0								
Valjevo (1926-2023)	1	1	1.2	1.9	2.8	6.0								
Kragujevac (1925-2023)	1	1	1.2	2.2	2.8	6.2								
Smederevska Palanka (1939-2023)	1	1	1.0	1.9	2.8	5.8								
Veliko Gradište (1926-2022)	1	1	0.4	1.5	2.2	4.9								
Crni Vrh (1966-2023)	1	1	-3.3	-2.8	-2.0	1.6								
Negotin (1927-2023)	1	1	0.7	1.4	1.9	5.7								
Zlatibor (1950-2023)	1	1	-2.0	-1.2	-0.5	2.8								
Sjenica (1946-2023)	1	1	-3.4	-2.5	-1.6	1.6								
Pozega (1952-2023)	1	1	-1.0	0.0	0.7	3.4								
Kraljevo (1926-2023)	1	1	1.1	1.8	2.4	5.9								
Kopaonik (1949-2023)	3	2	-5.0	-4.3	-3.6	-1.1								
Kursumlija (1952-2023)	1	1	0.4	1.3	2.0	5.0								
Krusevac (1927-2023)	1	1	0.8	1.9	2.4	5.6								

Cuprija (1948-2023)	1	1	0.6	1.7	2.2	5.8
Nis (1925-2023)	1	1	1.2	2.1	2.9	5.9
Leskovac (1948-2023)	2	1	0.5	1.5	2.2	4.7
Zajecar (1929-2023)	1	1	0.1	0.7	1.2	4.6
Dimitrovgrad (1945-2023)	2	1	-0.3	0.6	1.5	4.0
Vranje (1926-2023)	2	1	0.5	1.4	2.2	4.7

*Rank –period of stations work (warmest season) **Rank – 1991-2024 period (warmest season)

Winter 2023/2024]	Precipit	ation sums (mm)
Station	Rank [*]	Rank**	33	50	66	Observed Value
Belgrade (1887-2023)	21	5	139.2	155.4	168.8	79.1
Palić (1936-2023)	30	12	95.9	114.7	133.2	95.0
Sombor (1931-2023)	32	11	107.6	116.0	132.8	103.9
Novi Sad (1945-2023)	16	7	116.0	127.7	146.7	79.7
Zrenjanin (1925-2023)	19	7	110.7	122.9	140.6	83.0
Kikinda (1925-2023)	23	7	100.6	112.6	126.7	84.7
Banatski Karlovac (1946-2023)	12	7	108.3	124.3	143.6	69.7
Loznica (1925-2023)	9	2	171.7	205.5	209.6	101.0
Sremska Mitrovica (1925-2023)	32	12	103.7	124.9	137.9	111.2
Valjevo (1926-2023)	9	4	140.8	162.2	181.4	100.2
Kragujevac (1925-2023)	9	6	118.8	127.2	142.4	66.4
Smederevska Palanka (1926-2023)	16	7	124.0	144.5	165.6	95.3
Veliko Gradište (1926-2023)	22	11	110.3	142.8	162.3	100.4

Crni Vrh (1966-2023)	5	4	127.6	160.5	183.1	84.8
Negotin (1941-2023)	4	3	108.4	163.1	206.9	49.2
Zlatibor (1950-2023)	18	7	204.3	229.6	237.8	156.6
Sjenica (1925-2023)	25	8	143.5	170.7	192.5	117.3
Pozega (1925-2023)	13	6	122.6	155.7	171.1	93.0
Kraljevo (1926-2023)	5	3	127.3	142.5	163.6	80.9
Kopaonik (1949-2023)	30	12	156.1	207.8	254.5	189.7
Kursumlija (1925-2023)	15	9	123.5	150.9	175.8	90.7
Krusevac (1925-2023)	8	4	121.8	137.7	163.4	75.1
Cuprija (1947-2023)	11	6	136.7	159.6	176.9	84.5
Nis (1925-2023)	15	8	117.7	142.4	163.1	88.6
Leskovac (1925-2023)	15	5	134.0	153.8	174.9	90.6
Zajecar (1925-2023)	3	2	102.6	140.1	158.2	51.5
Dimitrovgrad (1926-2023)	22	7	118.4	130.3	171.3	91.0
Vranje (1926-2023)	32	10	121.1	133.4	154.3	115.7

*Rank –period of stations work (lowest seasonal precipitation) **Rank – 1991-2024 period (lowest seasonal precipitation)

	Seas	onal temperature DJF	Sea	asonal precipitation DJF	
Country	Observed	SEECOF-30 climate outlook for temperature	Observed	SEECOF-30 climate outlook for precipitation	High Impact Events
Serbia (1)	Above normal in entire Serbia	Above-normal (20, 30, 50) in entire Serbia	Below normal in almost entire Serbia	Above-normal (20, 30, 50) in entire Serbia	 THE WARMEST winter since 1951 and dry in most of Serbia Record breaking mean, mean maximum and mean minimum winter air temperature in most of Serbia The absolute winter maximum air temperature record was exceeded in Valjevo on December 2nd, reaching 25.6 °C One summer day was recorded in Valjevo, Kragujevac and Kraljevo Two heat waves were registered in most of Serbia Record low number of ice days at Crni Vrh, Zlatibor and Sjenica Record low number of frost days at Crni Vrh and Kopaonik Record low number of days with snow cover in Kursumlija 3rd driest winter for Zajecar, 4th driest for Negotin, 5th driest for Kraljevo and Crni Vrh Record breaking winter sunshine duration in Kikinda, Krusevac and Kraljevo

Analysis of winter season 2023/2024 for Serbia relative to the 1991-2020 base period

The warmest and dry winter (*Figure 1*) with the record-breaking mean seasonal air temperature significantly above the normal¹ and precipitation sums below the average.

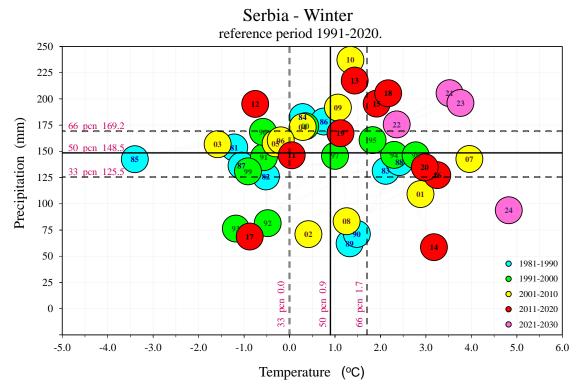


Figure 1. Assessment of mean air temperature and precipitation for winter in Serbia based on the accompanying terciles relative to the 1991-2020 base period

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

Winter 2023/2024 ranks as **the warmest for Serbia** (*Figure 2*) since 1951, with the mean winter air temperature of 4.8 °C, which is +3.9 °C higher than the normal. The winter 2024 with the air temperature of 7.4 °C and anomaly of +4.5 °C ranks as the warmest winter for Belgrade since 1888. Record breaking mean, mean maximum and mean minimum winter air temperatures were registered in most of Serbia (Table 1).

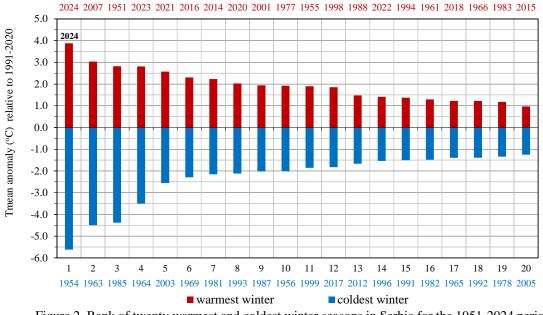
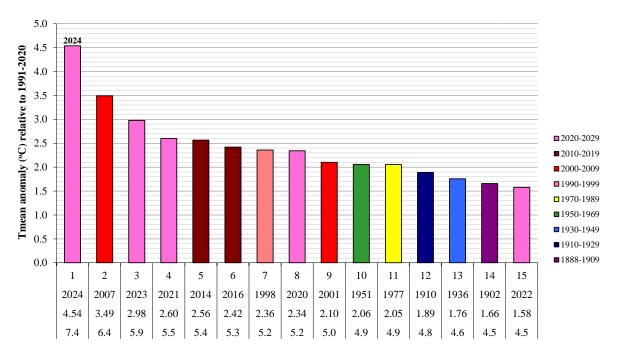


Figure 2. Rank of twenty warmest and coldest winter seasons in Serbia for the 1951-2024 period



Anomaly of mean seasonal temperature relative to 1991-2020 base period Belgrade - 1888-2024 period

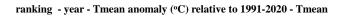


Figure 3. Rank of the warmest winters in Belgrade for the 1888-2024 period

STATION	period of observations	Ta (°C) WINTER 2024	previous Ta maximum	year of Ta maximum	Tamax (°C) WINTER 2024	previous Tamax maximum	year of Tamax maximum	Tamin (°C) WINTER 2024	previous Tamin maximum	year of Tamin maximum					
PALIC	1946-2023	5.0	4.3	2007	9.6	8.2	2007	1.0	-	-					
SOMBOR	1942-2023	5.2	4.9	2007	10.3	9.4	2007	1.1	-	-					
NOVI SAD	1949-2023	5.9	4.9	2007	11.0	9.4	2007	1.7	1.3	2007					
ZRENJANIN	1944-2023	5.7	5.0	2007	10.5	8.9	2007	1.7	1.6	2007					
KIKINDA	1949-2023.	5.6	4.5	2007	10.1	8.5	2023	1.6	1.1	2007					
B. KARLOVAC	1986-2023	5.5	4.6	2023	10.6	8.8	2023	1.7	1.4	2007					
LOZNICA	1953-2023	6.5	5.8	2007	12.1	10.9	2007	2.1	1.9	2007					
S. MITROVICA	1926-2023	5.0	4.6	2007	10.7	9.5	2007	0.7	-	-					
VALJEVO	1927-2023	6.0	5.2	2007	12.4	11.1	2007	1.0	0.9	1951					
BEOGRAD	1888-2023	7.4	6.4	2007	11.8	10.0	2007	3.9	3.4	2007					
KRAGUJEVAC	1926-2023	6.2	5.3	2007	12.2	10.5	2007	1.5	1.4	1951					
S. PALANKA	1940-2023	5.8	5.3	2007	11.4	10.2	2007	1.2	-	-					
V. GRADISTE	1927-2023	4.9	4.2	2007	10.1	8.8	2007	0.6	-	-					
CRNI VRH	1967-2023	1.6	1.0	2007	5.1	4.2	2007	-1.1	-1.6	2007					
NEGOTIN	1928-2023	5.7	5.6	2007	10.8	10.1	2007	1.2	-	-					
ZLATIBOR	1951-2023	2.8	2.3	2014	6.8	-	-	-0.4	-1.0	2014					
SJENICA	1947-2023	1.6	1.5	1951	7.5	6.7	2016	-3.2	-	-					
POZEGA	1953-2023	3.4	2.7	2007	10.2	7.9	2007	-1.4	-	-					
KRALJEVO	1927-2023	5.9	4.6	2007	11.5	9.4	2007	1.1	0.9	1951					
KOPAONIK	1950-2023	-1.1	-	-	2.5	-	-	-4.1	-	-					
KURSUMLIJA	1953-2023	5.0	3.9	2007	11.4	9.8	2007	0.0	-0.2	1955					
KRUSEVAC	1931-2023	5.6	4.9	1951	11.7	9.7	2023	0.6	-	-					
CUPRIJA	1949-2023	5.8	4.5	2023	11.7	9.7	2007	1.2	0.9	1951					
NIS	1926-2023	5.9	5.4	1951	11.5	10.8	1951	1.3	-	-					
LESKOVAC	1949-2023	4.7	-	-	11.1	10.3	1951	-0.2	-	-					
ZAJECAR	1930-2023	4.6	4.6	2007	11.2	10.7	2007	-0.9	-	-					
DIMITROVGRAD	1946-2023	4.0	-	-	10.1	9.2	2023	-0.8	-	-					
VRANJE	1927-2023	4.7	-	-	10.3	9.2	2023	-0.1	-	-					

Table 1. Record breaking mean (Ta), mean maximum (Tamax) and mean minimum (Tamin) winter air temperatures

Mean seasonal winter air temperature ranged from 3.4 °C in Pozega to 7.4 °C in Belgrade, and on the mountains from -1.1 °C at Kopaonik to 2.8 °C at Zlatibor (*Figure 4*).

Departure of the mean winter seasonal air temperature from the normal ranged from +3.3 °C in Vranje and Leskvocac to +4.5 °C in Belgrade, and on the mountains from +2.9 °C at Kopaonik to +4.1 °C at Crni Vrh (*Figure 5*).

Based on the percentile method, mean seasonal winter air temperature was in the extremely warm category in almost entire Serbia, apart from Kopaonik where it was in a very warm category (*Figure 6*).

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

In the <u>appendix</u> are graphs showing 15 warmest years since record keeping began for the stations: Negotin, Novi Sad, Kraljevo, Kragujevac, Nis, Zlatibor and Veliko Gradiste.

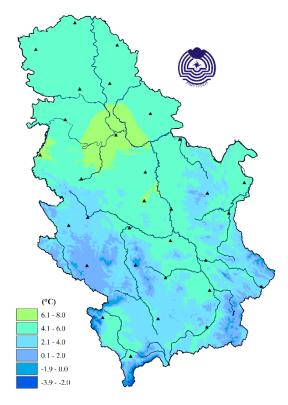


Figure 4. Spatial distribution of mean winter air temperature

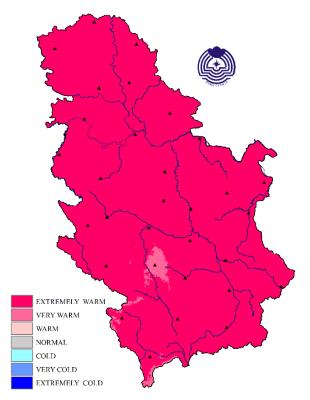


Figure 6. Spatial distribution of mean winter air temperature according to the percentile method

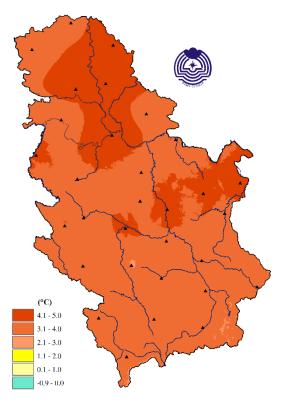


Figure 5. Spatial distribution of mean winter air temperature anomaly from the normal

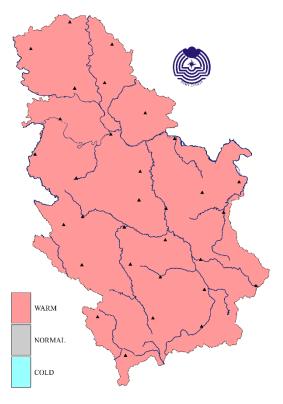


Figure 7. Spatial distribution of mean winter air temperature according to the tercile method

The highest winter air temperature of 25.6 °C was measured in Valjevo on December 2, thereby breaking the previous record of 25.4 °C set on February 25, 2008. Besides Valjevo, one summer day, with the maximum daily air temperature above or equal to 25 °C, was also registered in Kragujevac and Kraljevo.

Number of ice days, with the maximum daily air temperature below 0 °C, ranged from 1 in Sombor and Kraljevo to 5 in Banatski Karlovac, Loznica, Veliko Gradiste and Pozega. On the mountains, their number ranged from 6 in Sjenica to 24 days at Kopaonik. Number of ice days was significantly below the winter average in entire Serbia (*Figure 8*), 8 to 15 days below the winter average, and on the mountains up to 24 days below the average. **Record low number of ice days was registered during winter, in Sjenica (6 days), Crni Vrh (19 days) and Zlatibor (10 days).**

The lowest winter air temperature of -20.0 °C was measured in Sjenica on January 22.

Number of frost day, with the minimum daily air temperature below 0 °C ranged from 18 days in Belgrade to 63 days in Pozega, and on the mountains from 49 at Zlatibor to 72 at Kopaonik. **Record low number of frost days was registered at Kopaonik and Crni Vrh (50 days).** Number of frost days was significantly below the winter average in entire Serbia, from 9 to 26 days below the average (*Figure 9*).

In the lowland, there were up to 4 days with severe frost, with the minimum daily air temperature below -10 °C, from 2 to 9 days below the average, and up to 10 on the mountains (Kopaonik, *Figure 10*) which is significantly below the winter average (from 12 to 19 days below the average).

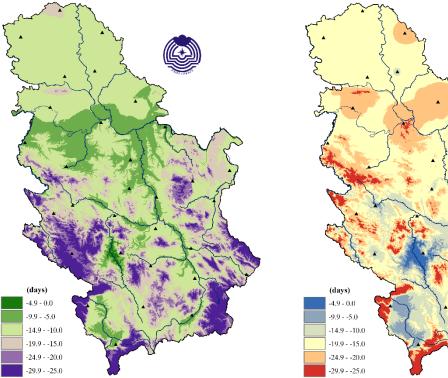


Figure 8. Deviation of the number of ice days from the normal

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

In Belgrade, warmer periods, with air temperature above the multiannual average, were registered at the beginning of December, beginning of the second decade and during the second half of December, in the first half, in the middle and end of January, as well as throughout entire February. Colder periods, with the air temperature below the multiannual average, were registered in the middle of the first decade of December, as well as beginning of second and third decades of February (*Figure 11*).

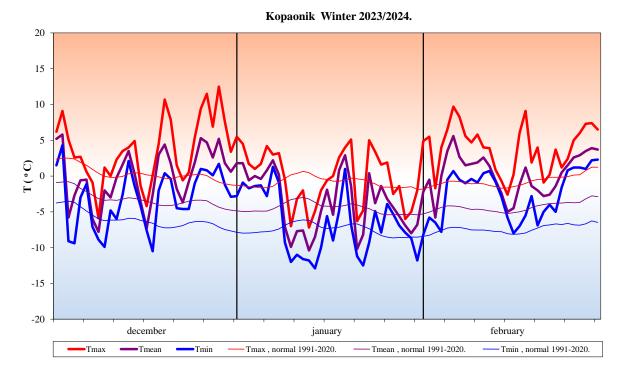
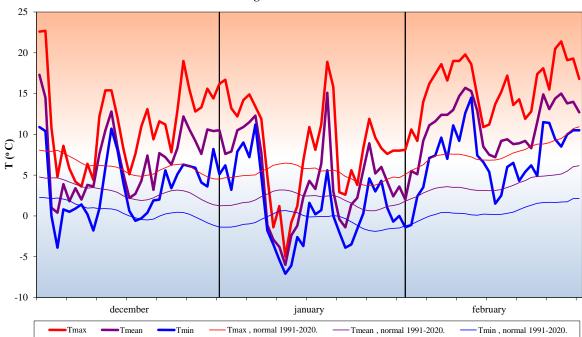


Figure 10. Three-month course of the mean, maximum and minimum daily air temperature at Kopaonik



Belgrade Winter 2023/2024.

Figure 11. Three-month course of the mean, maximum and minimum daily air temperature in Belgrade

Cold wave/ heat wave

During winter 2023/2024, two heat waves² affected most of the country (*Table 2*). The first heat wave lasted from 24 December 2023 to 6 January, the second heat wave lasted from 3 to 12 February, in Valjevo from 22 to 28 February, in Pozega from 23 to 27 February, in Sombor from 15 to 20 February, and in Palic from 16 to 20 February. Cold wave³ was recorded only in Sremska Mitrovica, lasting from 9 to 14 January.

														1	IEA	T / (COL	D V	WAV	VES	IN S	SRB	IA -	WIN	ITE	R 20	23/2	024															
																			(ref	feren	ce per	riod 19	991-20	20)																			
						DE	CEM	BER															J A	NUAI	RY										FE	BRUA	RY						
	2 3 4	5 6	7 8	9 10	11 12	13 14	15 16	17 18	19 20 2	21 22 2	_	25 26			_	2 3			7 8	9	10 11	12 13	14 1	16 1	7 18 1	19 20	21 22	23 24	25 26	27 28	29 30	31 1	_	4 5 6 7 8 9 10 11	12 13					22 2	3 24 2:	5 26	27 28 29
PALIC												EWEWE				vwvv	VEW/V	WEW					\square											vewewewewewewewew				vwvw					$\downarrow \downarrow$
SOMBOR												EWEW/		_							_		\square											vvwvwewvwewewewew		vwv	wvw	vwvw	vw				\downarrow
KIKINDA												EW <mark>EW</mark> V	/wvw	EWEW	EWVN	/vw <mark>ev</mark>	VEW/V	WEW															VN	vvwvw <mark>ew</mark> vw <mark>ewewew</mark> ew									
БЕЧЕЈ																																											
ZRENJANIN											vw	EW EW						wvw																vvwvw <mark>ew</mark> vwewewewew									
NOVI SAD												wvw	ww	vwew	EWVN	www	VEW																	vwvw <mark>ew</mark> vwewewewew									\square
SR. MITROVICA												EWEW/					V <mark>EW</mark> V	w		۷C	/cvc	vcvc	vc										vv	vvwewewvwewewewew									
BEOGRAD													vw	ewew	EWEN	<mark>ww</mark>																		ewewewew	vw								
LOZNICA															EWEN	vwvv	vvw																	ew <mark>vwvwvwew</mark> vwew									
VALJEVO													vw	ewvw	EWEN	vwvv	vvwv	w																						vwv	www	wew	wvw
V. GRADISTE													EW	vwvw	vwvv	ww																		EWEWEWEW	vw								
SM. PALANKA												EW EW	/W <mark>EW</mark>	ew <mark>vw</mark>	vwev	<mark>ww</mark>																		vw <mark>ewewvwewewew</mark> ew									
KRAGUJEVAC													vv	vwvw	vw <mark>ev</mark>	<mark>vw</mark>																		ew <mark>ewvwvwewvwew</mark>									
KRALJEVO																																		vw <mark>ewew</mark> vwvw <mark>ew</mark> vwew									
POZEGA																																	vv	v <mark>wewewewewew</mark> wwew							NVWV	wvw	w
ZLATIBOR																																		vw <mark>vw<mark>ew</mark>vw<mark>ew</mark>vw</mark>									
CUPRIJA											vw	EW EW	/w <mark>ew</mark>																				vv	v <mark>vwewew</mark> vwewewewew									
KRUSEVAC											vw	wvw	ww	vw	vw <mark>ev</mark>	<mark>ww</mark> w	v																	ewew <mark>vwewewvw</mark> ew									
NEGOTIN											EWE	WEWE	wvw	ewew	EWVW	ewev	v vwe	w															vv	v <mark>vwewewewewewew</mark> vw	vw								
ZAJECAR																																		ewewvwvwvwvwew									
CRNI VRH													EW	EW <mark>VW</mark>	vw <mark>ev</mark>																			vw <mark>ew</mark> vwvw <mark>ew</mark> vwvw									
KOPAONIK											V	/w <mark>ew</mark> w	/W <mark>EW</mark>	EW																													
SJENICA												WEWE				www.	vvw																	vw <mark>ewew</mark> vwvwvw									++
NIS																							\uparrow											vw <mark>ew</mark> vw <mark>ew</mark> vwvwew								$\uparrow \uparrow$	++
VRANJE											EWE	wvw	ww	vw																				vw <mark>ewew</mark> vwewew									
DIMITROVGRAD																																		ewewvwewewewew									
LESKOVAC								\square									$^{++}$						$^{++}$											ewewewewewwwew		++	+					$^{++}$	++
KURSUMLIJA												WEWN	/WEW	www	vwvv																			vwewewvwewvwvwew									++
B. KARLOVAC													EW			www	www	w	tt				++											vwvwewvwewewewew	vw							+	++

EW	EXTREMELY WARM
VW	VERY WARM
VC	VERY COLD
EC	EXTREMELY COLD

² 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

³ Cold wave, according to the percentile method, is a period of minimum five days with minimum daily air temperature is in the very cold and extremely cold categories

Precipitation

Winter 2023/2024 ranks as the 11th driest winter for Serbia (*Figure 12*) since 1951, the 3rd driest for Zajecar since 1926 (*Figure 13*), the 4th driest for Negotin (*Figure 14*) as well as the 5th driest for Kraljevo (*Appendix 11*) and Crni Vrh (*Appendix 12*).

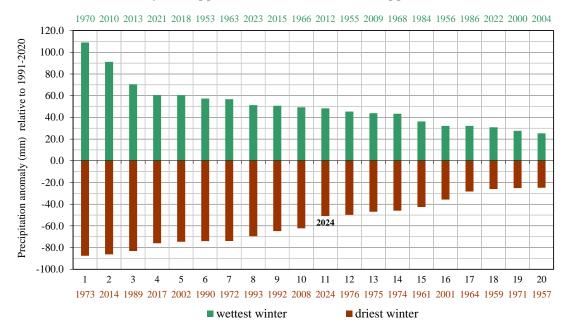
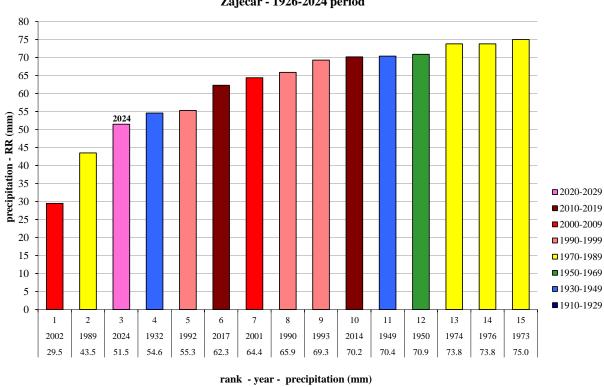


Figure 12. Rank of the wettest and driest winter seasons for Serbia for the 1951-2024 period



Winter precipitation sums Zajecar - 1926-2024 period

Figure 13. Rank of the driest winters for Zajecar

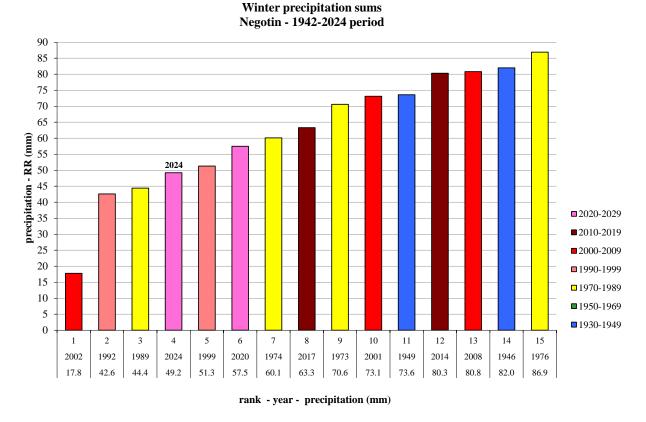


Figure 14. Rank of the driest winters for Negotin

Figures 15, 16 and 17 show cumulative precipitation sums for Negotin, Zajecar and Belgrade during winter, per months and relative to the average cumulative precipitation sums.

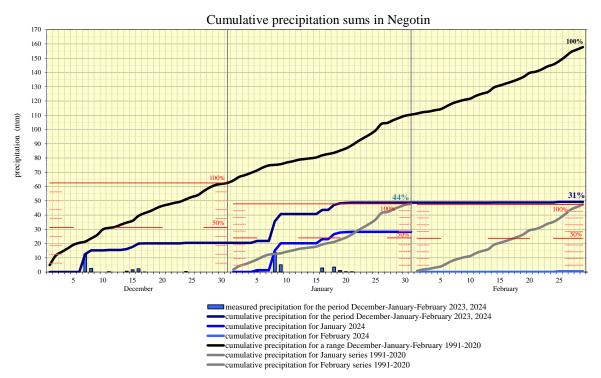


Figure 15. Daily and cumulative precipitation sums for Negotin

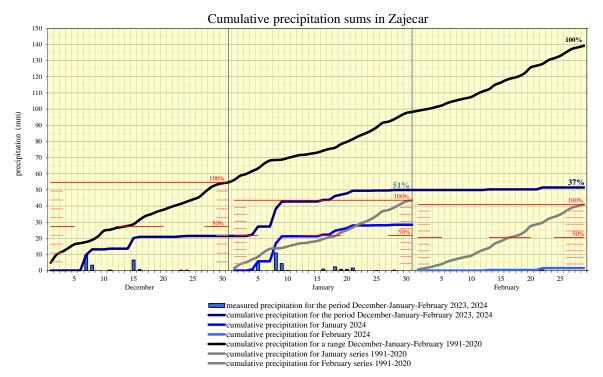


Figure 16. Daily and cumulative precipitation sums for Zajecar

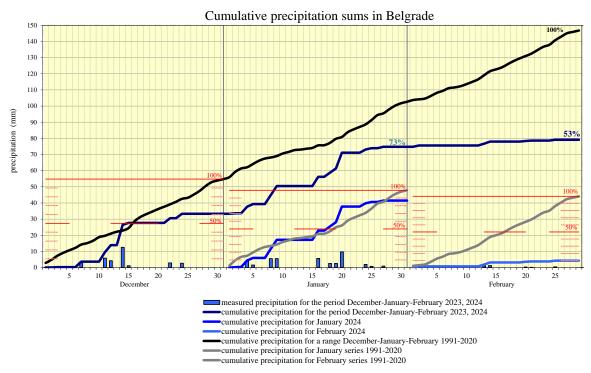


Figure 17. Daily and cumulative precipitation sums for Belgrade

Total winter precipitation sums were below the average in entire Serbia. Precipitation sums ranged from 49.2 mm in Negotin to 115.7 mm in Vranje, and in the upland from 84.8 mm at Crni Vrh to 189.7 mm at Kopaonik (*Figure 18*). Precipitation sums in the percentages of normal (*Figure 19*) ranged from 31% in Negotin (*Figure 15*) to 95% in Sremska Mitrovica, and in the upland from 54% at Crni Vrh to 90% at Kopaonik.

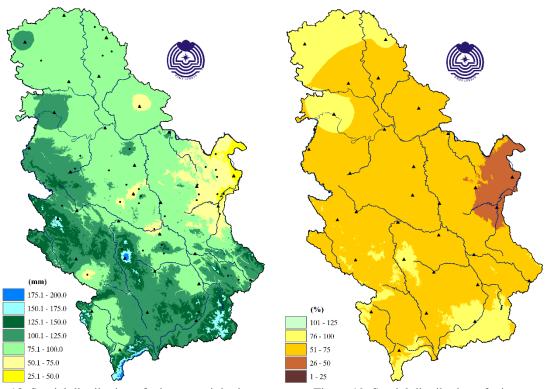


Figure 18. Spatial distribution of winter precipitation sums based on data from 28 Primary meteorological, 13 climatological and 23 rain gauge stations

Figure 19. Spatial distribution of winter precipitation sums in percentage of normal

Based on the percentile method, winter precipitation sums were in the dry category in most of Serbia, and very dry in parts of western, central and eastern Serbia (*Figure 20*).

Based on the tercile method, precipitation sums were in the dry category in most of Serbia, and in normal category in Sremska Mitrovica and Kopaonik (*Figure 21*).

The highest daily precipitation sum of 40.3 mm was measured at Kopaonik on December 15.

Number of days with precipitation of 0.1 mm and above ranged from 18 in Negotin to 38 in Sombor, and on the mountains from 32 at Zlatibor to 41 at Kopaonik. The recorded number of days with precipitation was 2 to 15 days below winter average (*Figure 22*), whereas Sombor recorded 3 days above the winter average.

Number of days with snow cover ranged from 2 in Kikinda and Palic to 15 days in Valjevo. In the hilly-mountainous regions, their number ranged from 30 in Sjenica to 87 at Kopaonik. **Number of days with snow cover was significantly below the normal in entire Serbia**, apart from Kopaonik. From 16 days below the average in Sremska Mitrovica and Belgrade to 41 days below the average at Crni Vrh (*Figure 23*). **Record low number of days with snow cover, total of 6, in Kursumlija** (the previous record of 7 days was set in winter 1951). On December 23, at Kopaonik maximum winter snow depth of 39 cm was recorded.

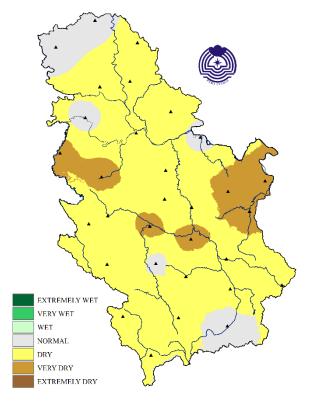


Figure 20. Winter precipitation sums according to the percentile method

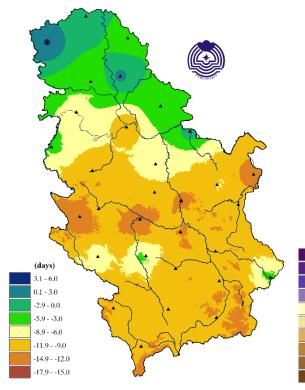


Figure 22. Deviation of number of days with precipitation of 0.1 mm and more from the normal

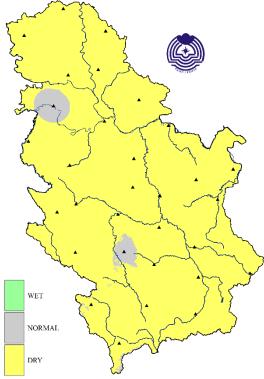


Figure 21. Winter precipitation sums according to the tercile method

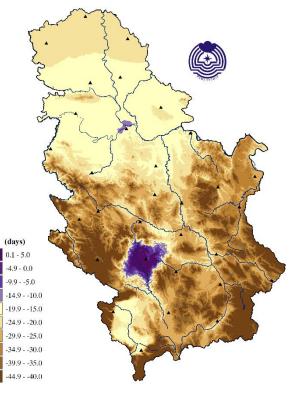


Figure 23. Deviation of number of days with snow cover from the normal

Sunshine duration (insolation)

In winter, sunshine duration ranged from 222.8 hours in Leskovac to 359.7 hours in Kikinda (*Figure 24*). **Record-breaking winter insolation was observed in Kikinda** (previous record of 335.8 hours was set in 1990), **Krusevac** observed 309.6 hours (previous record of 293.0 hours was set in 2014) and **Kraljevo** observed 308.3 hours (previous record of 294.2 hours was set in 1990).

Compared to the normal for the 1991-2020 base period, sunshine duration ranged from 103% at Crni Vrh to 156% in Krusevac (*Figure 25*).

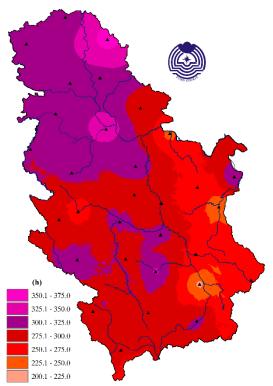


Figure 24. Insolation in hours

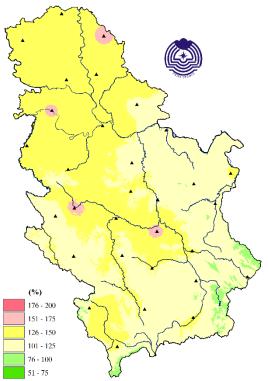


Figure 25. Insolation in percentage of normal

Analysis of the winter season 2023/2024 for Serbia relative to the 1961-1990 base period

Temperature

In winter, departure of the mean air temperature from the normal, for the 1961-1990 base period ranged from +3.7 °C in Dimitrovgrad and Kopaonik to +5.5 °C in Belgrade (*Figure 26*).

Based on the percentile method, mean winter air temperature in entire Serbia was in the extremely warm category (*Figure 27*).

Based on the tercile method, mean winter air temperature was above the average, in the warm category across the entire country.

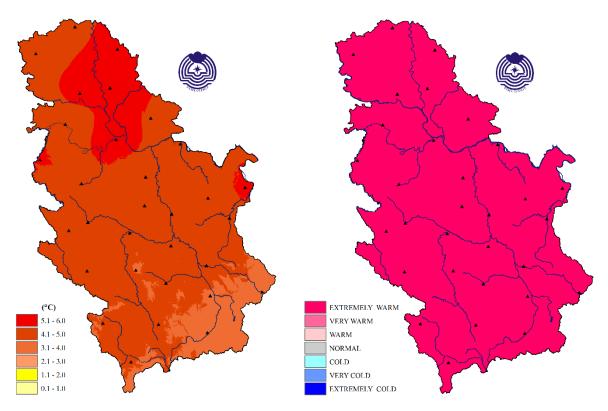


Figure 26. Spatial distribution of mean winter air temperature anomaly from the 1961-1990 normal

Figure 27. Spatial distribution of mean winter air temperature according to the percentile method

Precipitation

Winter precipitation sums were below the average in most of Serbia relative to the normal for the 1961-1990 base period, apart from Kopaonik. Precipitation sums ranged from 34% in Negotin to 102% at Kopaonik (*Figure 28*).

Based on the percentile method, winter precipitation sums were in the dry and very dry category in most of Serbia, extremely dry in easternmost regions, and normal category in parts of northern, southwestern, southern and southeastern Serbia (*Figure 29*).

Based on the tercile method, precipitation sum were in the dry category in most of Serbia, normal category in Sombor, Sremska Mitrovica as well as Palic and Kopaonik.

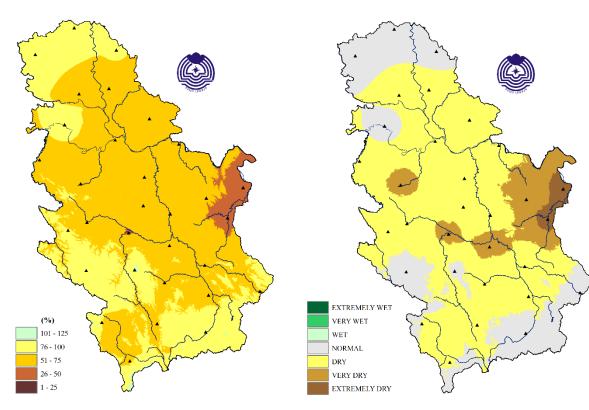
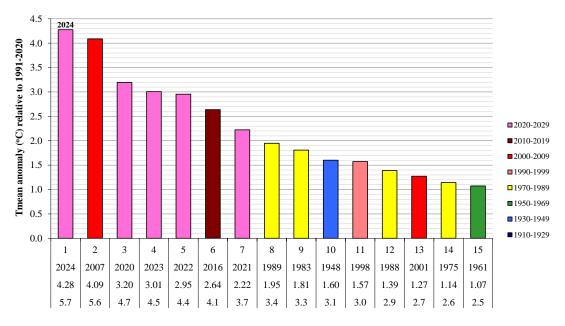


Figure 28. Spatial distribution of winter precipitation sums in percentage of the 1961-1990 normal

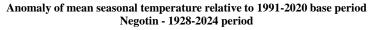
Figure 29. Winter precipitation sums according to the percentile method

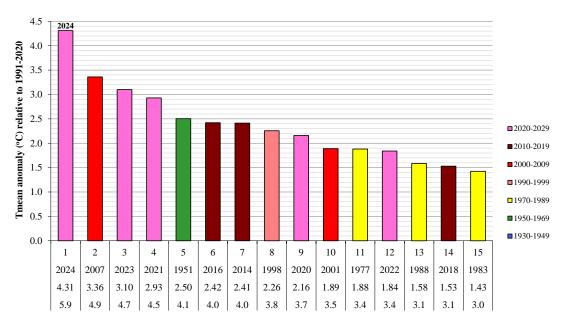
Note: Climatological analysis of the meteorological elements based on the preliminary data obtained from the 28 Primary meteorological stations

APPENDIX



Mean air temperature

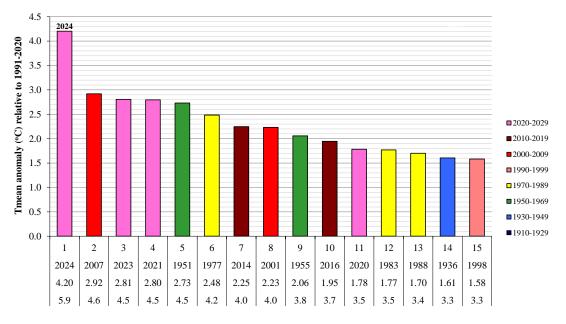




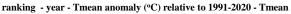
Anomaly of mean seasonal temperature relative to 1991-2020 base period Novi Sad - 1949-2024 period

ranking - year - Tmean anomaly (°C) relative to 1991-2020 - Tmean Appendix 2. Rank of the warmest winters in Novi Sad for the 1928-2024 period

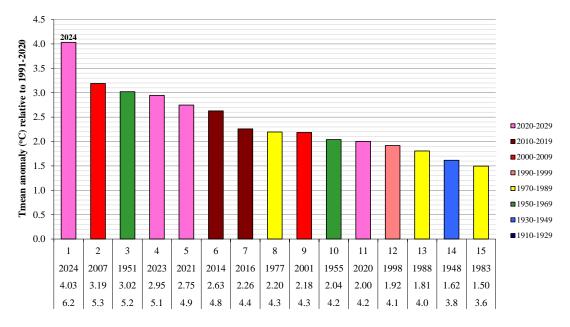
ranking - year - Tmean anomaly (°C) relative to 1991-2020 - Tmean Appendix 1. Rank of the warmest winters in Negotin for the 1928-2024 period



Anomaly of mean seasonal temperature relative to 1991-2020 base period Kraljevo - 1927-2024 period



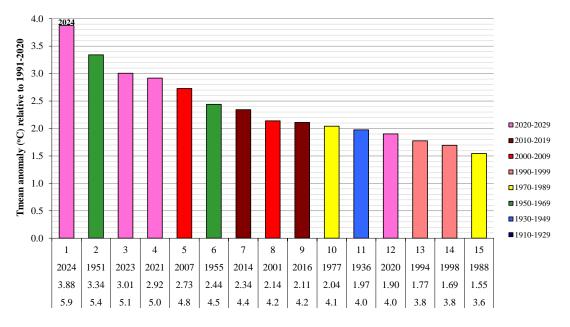
Appendix 3. Rank of the warmest winters in Kraljevo for the 1927-2024 period



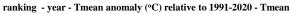
Anomaly of mean seasonal temperature relative to 1991-2020 base period Kragujevac - 1926-2024 period

ranking - year - Tmean anomaly (°C) relative to 1991-2020 - Tmean

Appendix 4. Rank of the warmest winters in Kragujevac for the 1926-2024 period



Anomaly of mean seasonal temperature relative to 1991-2020 base period Nis - 1926-2024 period



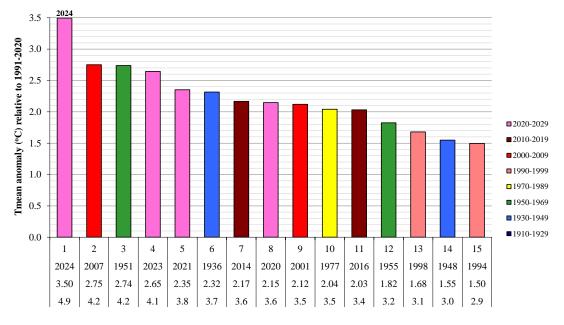
Appendix 5. Rank of the warmest winters in Nis for the 1926-2024 period



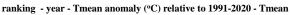
Anomaly of mean seasonal temperature relative to 1991-2020 base period Zlatibor - 1951-2024 period

ranking - year - Tmean anomaly (°C) relative to 1991-2020 - Tmean

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

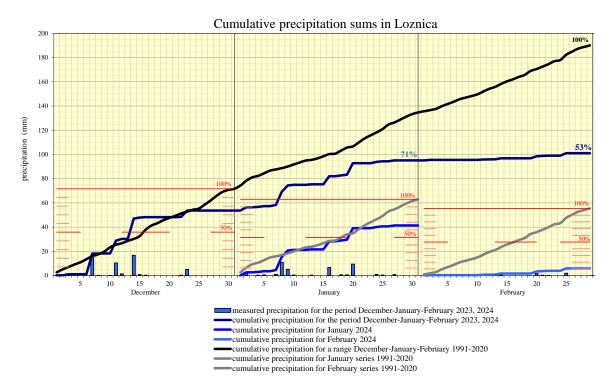


Anomaly of mean seasonal temperature relative to 1991-2020 base period Veliko Gradiste - 1927-2024 period

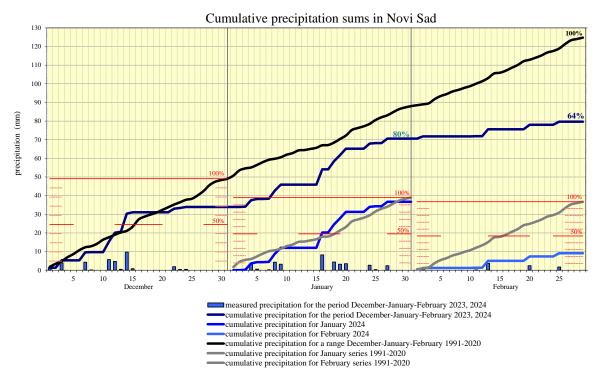


Appendix 7. Rank of the warmest winters in Veliko Gradiste for the 1927-2024 period

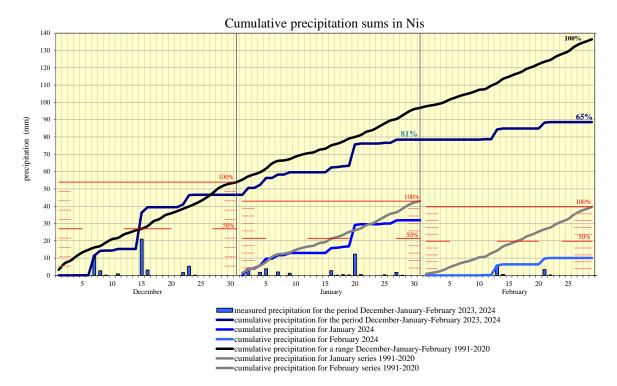
Precipitation



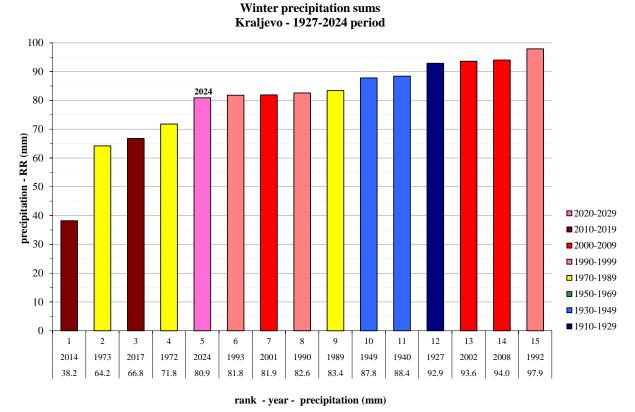
Appendix 8. Daily and cumulative precipitation sums for Loznica



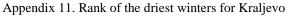
Appendix 9. Daily and cumulative precipitation sums for Novi Sad

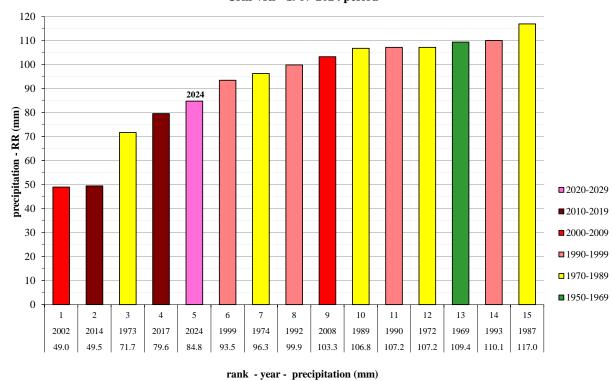


Appendix 10. Daily and cumulative precipitation sums for Nis









Winter precipitation sums Crni Vrh - 1967-2024 period

Appendix 12. Rank of the driest winters for Crni Vrh