



VERIFICATION OF THE SEECOF-20 WINTER 2018/2019 CLIMATE OUTLOOK AND SEASONAL BULLETIN FOR THE TERRITORY OF SERBIA

Belgrade, 29 March 2019

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Temperature

According to the SEECOF-20 outlook for the winter 2018/2019 approximately equal probabilities for below, near or above normal temperature for Serbia were indicated, relative to the 1981–2010 climatological base period (*Figure A*), so climatology (average seasonal temperature) was suggested.

Based on the climatological monitoring, the winter of 2018/2019 was warm in almost entire northern part, as well as parts of western, central and eastern parts of Serbia. Average seasonal temperature conditions were observed in rest of Serbia, with near or above-normal temperature based on the tercile method (*Figure B*). The outlook for a normal winter was correct for most of Serbia.

OUTLOOK – WINTER 2018/2019

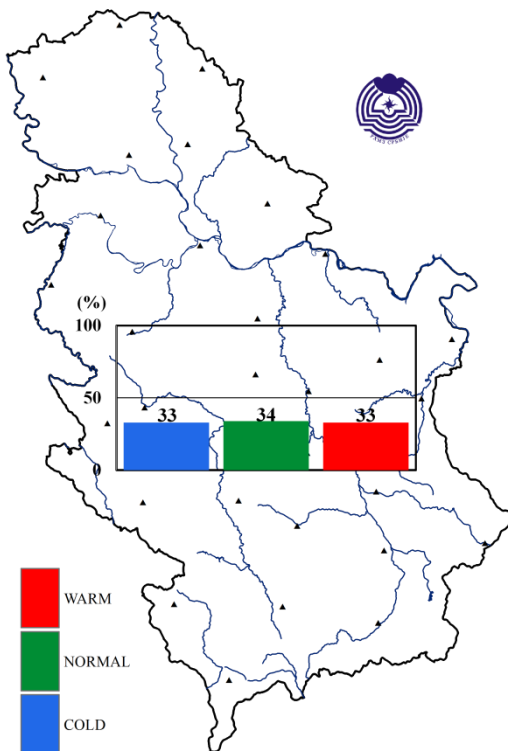


Figure A. SEECOF-20 - winter temperature outlook

MONITORING – WINTER 2018/2019

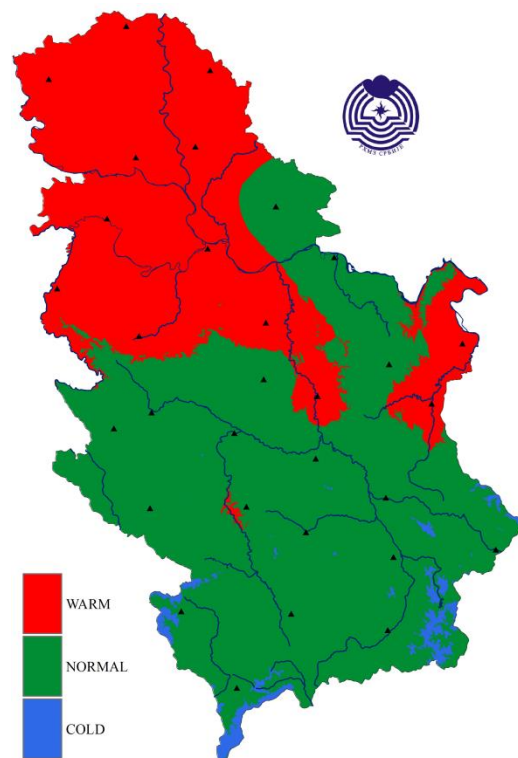


Figure B. Monitoring of the winter temperature using tercile method compared to the 1981-2010 base period

Precipitation

The SEECOF-20 climate outlook for the winter 2018/2019 indicated near normal to wetter than normal conditions for Serbia (Figure C). Consequently, average to above-average seasonal precipitation sums were suggested.

Monitoring of precipitation showed that winter outlook was very good. Winter was wet in most of Serbia, while normal conditions were observed in some northern, western, central and eastern parts of the country, with the exception of north-western part where dry winter conditions were recorded (Figure D).

OUTLOOK – WINTER 2018/2019

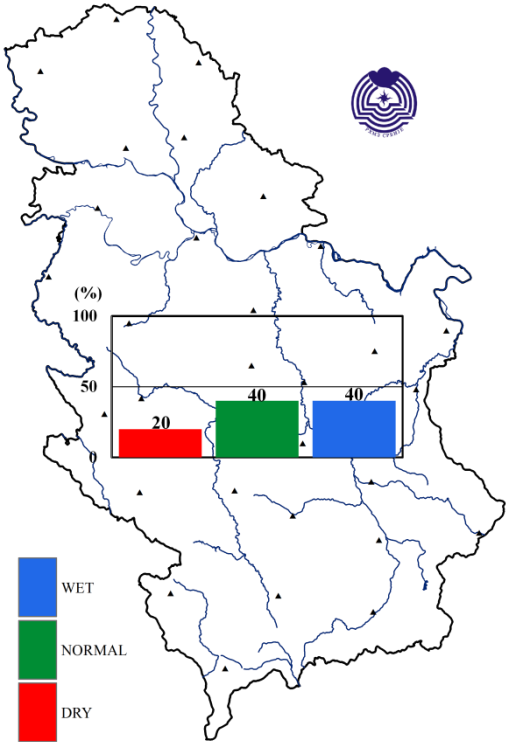


Figure C. SEECOF-20 - winter precipitation outlook

MONITORING – WINTER 2018/2019

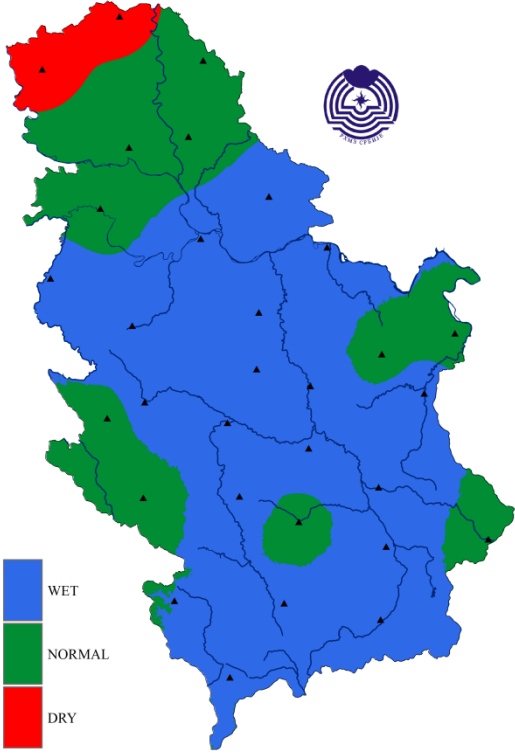


Figure D. Monitoring of the winter precipitation using tercile method compared to the 1981-2010 base period

Winter 2018/2019		Air Temperature (°C)				
Station	Rank*	Rank**	33	50	66	Observed value
Belgrade (1888-2019)	15	28	1.5	2.4	3.0	3.2
Palić (1945-2019)	14	20	-0.1	0.5	1.5	2.0
Sombor (1942-2019)	15	22	0.0	0.9	1.8	2.0
Novi Sad (1948-2019)	16	24	0.4	1.1	1.8	1.9
Zrenjanin (1946-2019)	15	23	0.3	1.0	1.8	1.9
Kikinda (1948-2019)	14	21	0.1	0.9	1.7	1.8
Banatski Karlovac (1986-2019)	16	16	0.7	1.4	2.0	1.8
Loznica (1952-2019)	14	19	0.7	1.8	2.5	2.9
Sremska Mitrovica (1925-2019)	16	31	0.4	0.9	1.6	1.7
Valjevo (1926-2019)	15	26	0.7	1.3	2.2	2.4
Kragujevac (1925-2019)	16	31	0.9	1.5	2.3	2.2
Smederevska Palanka (1939-2019)	16	28	0.7	1.5	2.1	2.1
Veliko Gradište (1926-2019)	16	31	0.4	1.0	1.6	1.6
Crni Vrh (1967-2019)	17	21	-3.6	-3.2	-2.1	-2.4
Negotin (1927-2019)	9	12	0.7	1.1	1.8	2.4
Zlatibor (1950-2019)	21	34	-2.2	-1.8	-0.8	-1.6
Sjenica (1946-2019)	23	35	-3.4	-2.5	-2.0	-2.7
Pozega (1952-2019)	18	29	-1.3	-0.7	0.3	0.0
Kraljevo (1926-2019)	19	33	0.5	1.1	2.1	1.8
Kopaonik (1950-2019)	26	34	-5.0	-4.6	-3.8	-4.9
Kursumlija (1952-2019)	17	28	0.3	1.0	1.5	1.4
Krusevac (1927-2019)	17	30	0.7	1.1	1.9	1.9

Cuprija (1948-2019)	14	25	0.4	1.2	1.7	1.8
Nis (1925-2019)	19	38	1.1	1.6	2.3	2.0
Leskovac (1948-2019)	19	34	0.3	0.9	1.7	1.4
Zajecar (1929-2019)	14	27	0.0	0.4	1.1	1.2
Dimitrovgrad (1945-2019)	18	33	-0.5	0.0	1.1	0.7
Vranje (1926-2019)	21	43	0.3	1.0	1.7	1.1

*Rank –period of stations work (warmest season)

**Rank – 1981-2019 period (warmest season)

Winter 2018/2019			Precipitation sums (mm)			
Station	Rank *	Rank **	33	50	66	Observed Value
Belgrade (1888-2019)	9	27	129.8	152.3	158.3	181
Palić (1945-2019)	31	65	90.1	104.4	121.5	72.4
Sombor (1942-2019)	29	65	104.2	114.8	123.0	96.1
Novi Sad (1948-2019)	19	37	109.9	119.1	133.5	122
Zrenjanin (1946-2019)	17	48	106.5	115.7	127.0	122.8
Kikinda (1948-2019)	24	61	98.0	105.5	121.2	100.9
Banatski Karlovac (1946-2019)	8	20	108.3	122.7	132.5	153.1
Loznica (1926-2019)	12	26	166.4	171.6	201.4	207.4
Sremska Mitrovica (1925-2019)	20	56	103.0	115.9	130.1	119.5
Valjevo (1926-2019)	9	19	149.5	157.6	173.3	191.5
Kragujevac (1925-2019)	7	12	113.0	120.0	134.0	179.3
Smederevska Palanka (1939-2019)	6	7	121.8	132.7	157.6	194.3
Veliko Gradište (1926-2019)	9	23	120.8	147.9	161.3	168.3

Crni Vrh (1967-2019)	16	20	127.6	143.8	170.7	160.6
Negotin (1927-2019)	16	25	105.9	137.3	186.9	172.6
Zlatibor (1950-2019)	18	23	204.3	225.1	237.8	232.7
Sjenica (1946-2019)	20	34	140.9	151.4	177.6	157.7
Pozega (1952-2019)	8	23	124.3	147.5	157.6	178.7
Kraljevo (1926-2019)	8	15	126.9	137.3	156.8	203.9
Kopaonik (1950-2019)	2	2	158.1	204.0	232.1	298.7
Kursumlija (1952-2019)	18	37	123.5	150.9	174.5	164.4
Krusevac (1927-2019)	9	14	115.1	133.2	155.6	185
Cuprija (1948-2019)	7	11	127.5	148.1	163.1	209.6
Nis (1925-2019)	7	13	117.7	137.1	150.6	179.4
Leskovac (1948-2019)	8	14	127.3	150.4	161.8	186.7
Zajecar (1929-2019)	16	29	103.7	136.3	146.6	152.8
Dimitrovgrad (1945-2019)	19	38	111.6	120.4	143.9	132.5
Vranje (1926-2019)	11	27	111.7	126.9	137.1	156.5

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

**Rank – 1981-2019 period (highest seasonal precipitation)

Country	Seasonal temperature DJF		Seasonal precipitation DJF		High Impact Events
	Observed	SEECOF-20 climate outlook for temperature	Observed	SEECOF-20 climate outlook for precipitation	
Serbia (1)	Average in most part of Serbia	No predictive signal (33, 34, 33) in entire Serbia	Above normal and normal in most of Serbia	Above-normal (20, 40, 40) in entire Serbia	<ul style="list-style-type: none"> * Winter of 2018/2019 was the 2nd wettest at Mnt. Kopaonik * December: record-breaking snow depth in Zrenjanin (Dec 16) * January: record-breaking number of days with precipitation (Valjevo, Kragujevac and Pozega) and cloudy days (Cuprija and Dimitrovgrad) * February: record-breaking daily precipitation sum in Valjevo (Feb 12)

Winter 2018/2019 was wet and averagely cold. Kopaonik observed 2nd wettest winter relative to the seasonal precipitation sums. Above-average precipitation totals observed in central and southern Serbia, below-average precipitation totals recorded in northernmost areas.

Analysis of the winter 2018/2019 for Serbia relative to the 1981-2010 base period

Temperature

Mean winter air temperature ranged from 0.0°C in Pozega to 3.2°C in Belgrade, and on the mountains from -4.9°C at Kopaonik to -1.6°C at Zlatibor (*Figure 1*).

Departure of the mean air temperature from the normal¹ in winter for the 1981-2010 base period ranged from 0.1°C in Vranje to 1.4°C on Palic, and on the mountains from -0.6°C at Kopaonik to 0.5°C at Crni Vrh (*Figure 2*).

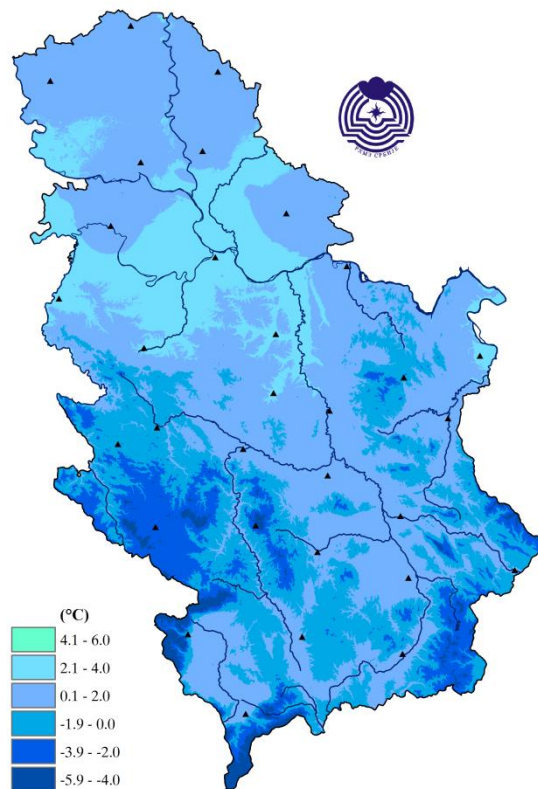


Figure 1. Mean seasonal air temperature

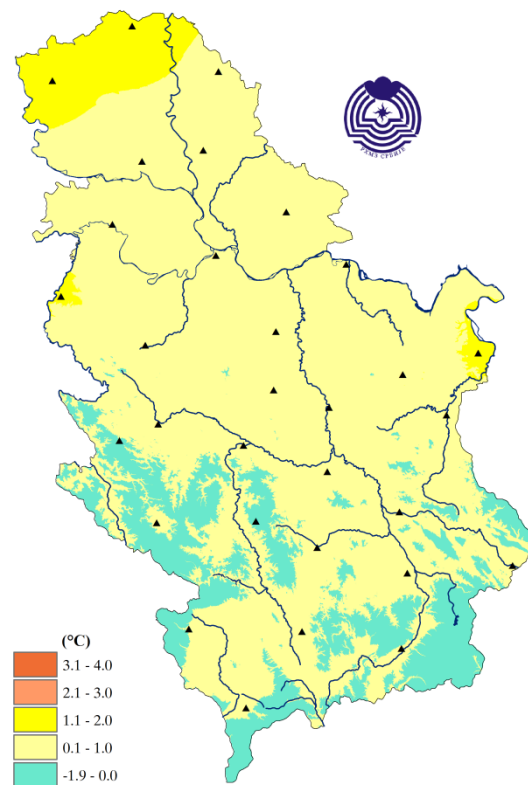


Figure 2. Departure of the mean seasonal air temperature relative to the 1981-2010 base period

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, 1981 to December 31, 2010

Based on the percentile method², mean winter air temperature was in the normal category in the entire country apart from Negotin where it was warm (*Figure 3*).

Based on the tercile method, mean winter air temperature was in the warm category in northern, eastern and parts of western and central Serbia, and normal category in the remainder of the country (*Figure 4*).

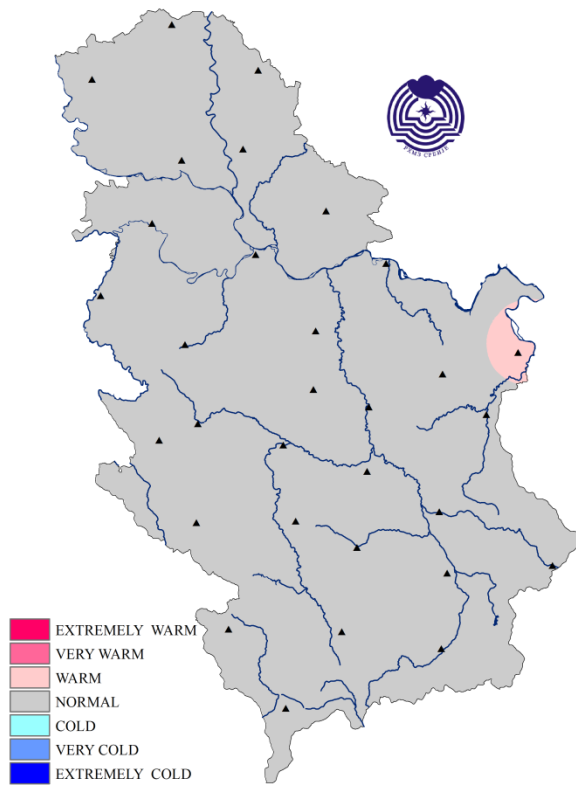


Figure 3. Mean seasonal air temperature based on percentile method

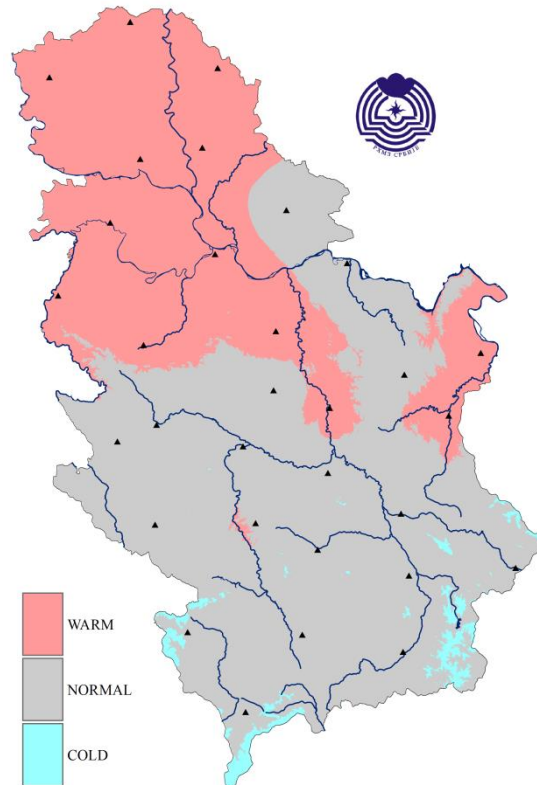


Figure 4. Mean seasonal air temperature based on tercile method

The number of ice days, with the maximum daily air temperature below 0°C, ranged from 2 days in Loznica to 15 days in Vranje, and on the mountains their number ranged from 30 days in Sjenica to 57 days at Kopaonik. The recorded number of ice days was below the winter average, in the lowland up to 13 days below the average was observed in Loznica, and in the mountains, number of ice days was above the winter average, up to 8 days above the average at Kopaonik. The exception to this was Sjenica that experienced 2 days below the winter average (*Figure 5*).

The lowest winter air temperature of -22.1°C was observed in Sjenica on January 8.

²nth 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

Number of frost days, with the minimum daily air temperature below 0°C, ranged from 36 in Belgrade to 74 in Zajecar, and on the mountains from 81 at Crni Vrh to 87 at Kopaonik. Number of frost days was below the winter average in most of Serbia, up to 11 days below the average in Negotin and Belgrade. Certain areas of western, eastern and southern Serbia observed above average number of frost days, in the lowland up to 7 days above the average in Veliko Gradiste, and in the upland, up to 10 days above the average at Zlatibor (Figure 6).

Number of days with severe frost, with the minimum daily air temperature below -10°C, ranged from 6 days at Zlatibor to 27 days at Kopaonik, and in the lowland up to 5 days was recorded in Sombor, Banatski Karlovac, Kragujevac and Pozega. The recorded number of days with severe frost was up to 9 days below the average in the lowland, and at Crni Vrh up to 11 days below the winter average.

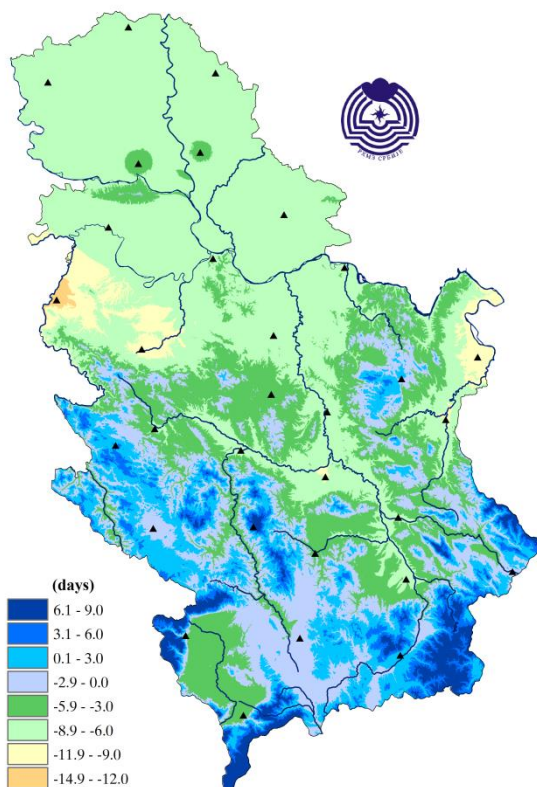


Figure 5. Deviation of the number of ice days relative to the 1981-2010 base period

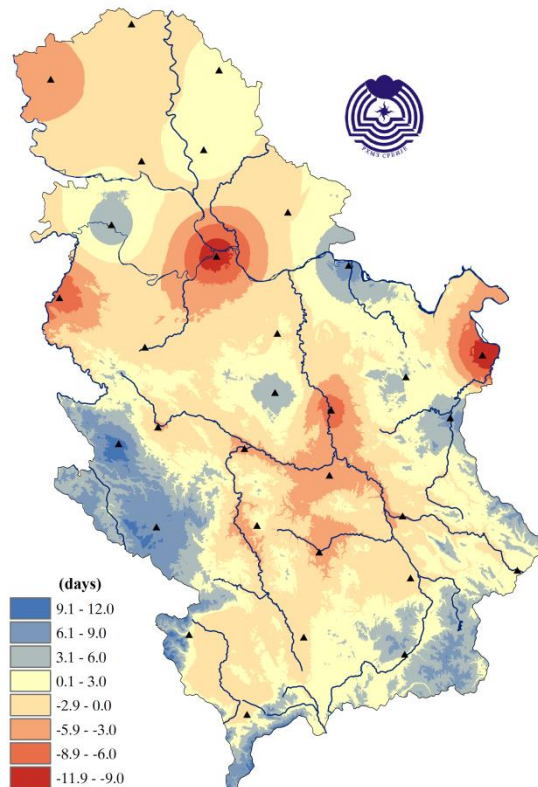


Figure 6. Deviation of the number of frost days relative to the 1981-2010 base period

Belgrade observed warmer periods, with the mean, maximum and minimum air temperature above the multiannual average, in the first and third decade of December, middle and at the end of January, as well as during most of February. Colder periods with the air temperature below the multiannual average were recorded in mid-December, during first and at the beginning of the third decade of January, as well as middle of the third decade of February (Figure 7).

Cold waves / heat waves

In winter 2018/2019, cold waves³ were not recorded apart from the cold wave with the onset at the end of November 2018 in eastern Serbia that continued throughout December, lasting from November 29 to December 3 in Negotin. Heat wave, lasting in the period from February 16 to 20 was registered in Negotin, Kikinda and Palic.

Precipitation

Winter precipitation totals in central and southern parts of Serbia were above the average and in northernmost areas below the average relative to the normal for the 1981-2010 base period, ranging from 72.4 mm on Palic to 209.6 mm in Cuprija, and at Kopaonik 298.7 mm (Figure 9). Precipitation sums expressed in the percentage of normal ranged from 67% on Palic to 149% at Kopaonik (Figure 10).

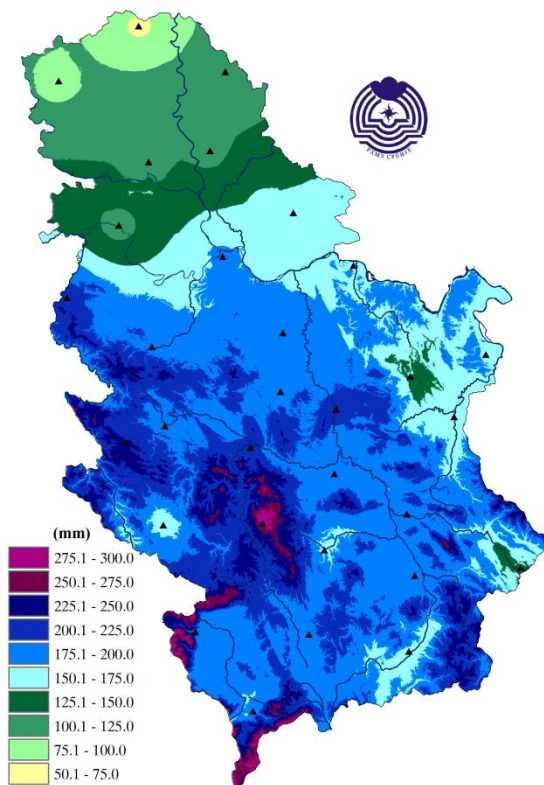


Figure 9. Spatial distribution of winter precipitation sums expressed in mm

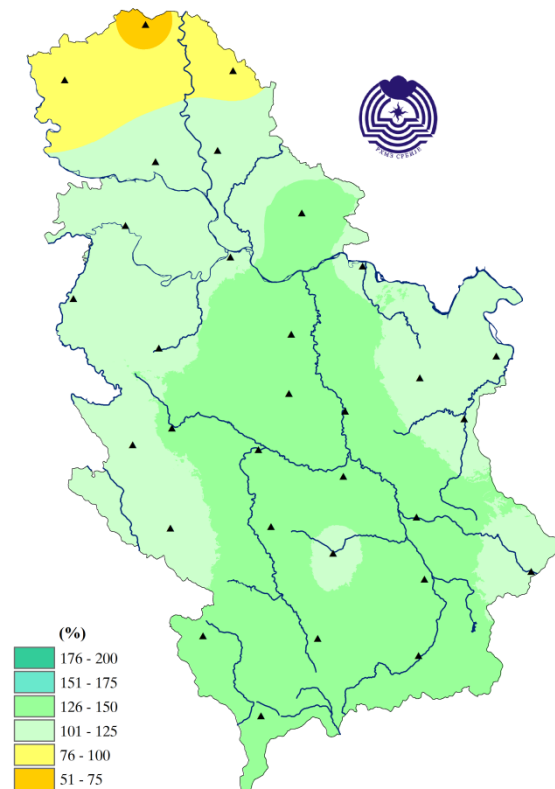


Figure 10. Spatial distribution of the winter precipitation sums expressed in % from 1981-2010 base period

³ Cold wave is defined as period of 5 or more consecutive days with the minimum daily air temperature in the categories of very cold and extremely cold

Based on the percentile method, precipitation sums in winter were in the following category: rainy and very rainy category in the central, southern and some parts of western Serbia, dry category on Palic and within the average in the remainder of the country (Figure 11).

Precipitation sums based on the tercile method were in the rainy category in most of central Serbia, elsewhere it was within the average, apart from northwest where it was in the dry category (Figure 12).

Number of days with precipitation of 1mm and above recorded during winter, ranged from 18 days in Negotin to 41 days at Zlatibor. The recorded number of days with precipitation was up to 6 days below the average in Negotin, in western and central parts of Serbia it was above the average, up to 10 days above the average at Zlatibor (Figure 13).

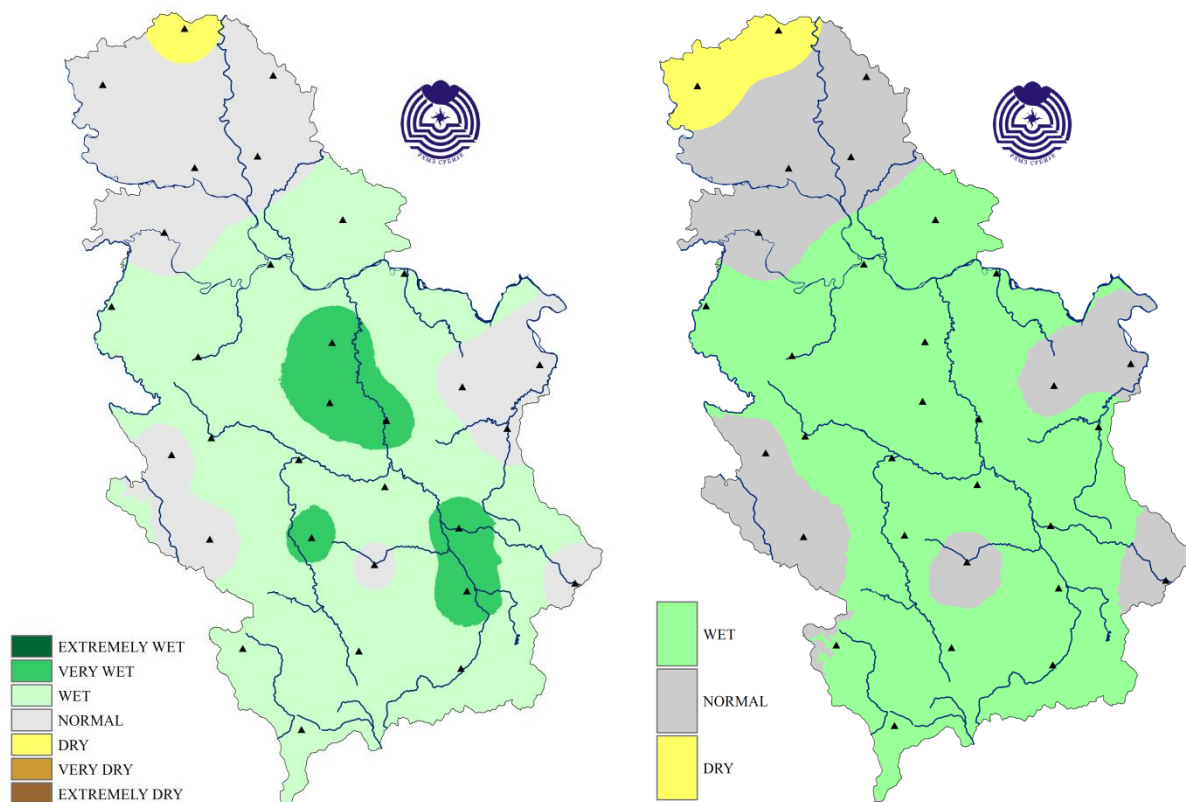


Figure 11. Precipitation sums based on percentile method

Figure 12. Precipitation sums based on tercile method

Number of days with snow cover in the lowland of Serbia ranged from 25 on Palic to 47 days in Pozega, and in the hilly-mountainous regions from 86 in Sjenica and Zlatibor to 90 days at Kopaonik. Recorded number of days with snow cover was above the average in most of the country, in the lowland up to 7 days above the average in Smederevska Palanka and up to 15 days above the average in Sjenica. In northwestern, southeastern and some parts of western and central areas of Serbia, number of recorded days with snow cover was below the winter average, up to 6 days below the average in Loznica (Figure 14). The maximum snow cover depth of 117 cm was observed at Kopaonik on February 14 and 15.

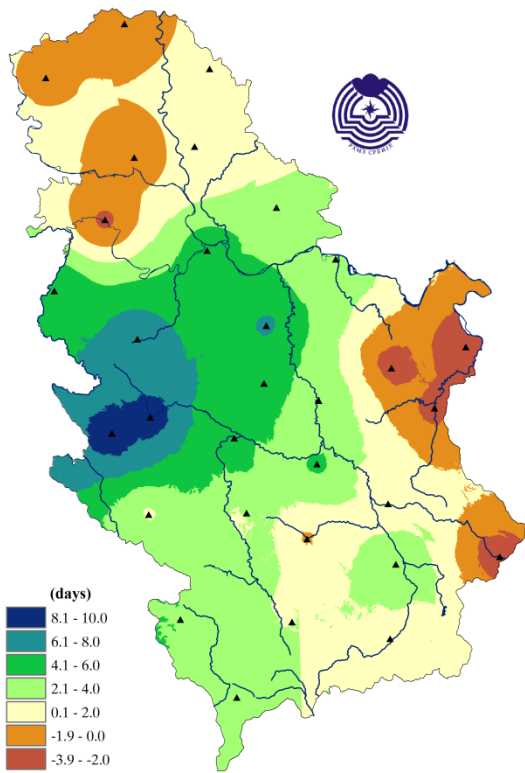


Figure 13. Deviation of the number of days with precipitation of 1.0 mm and above

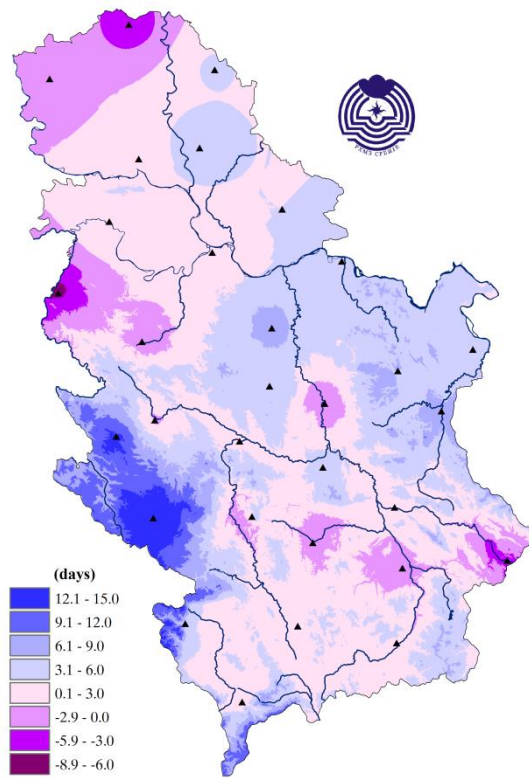


Figure 14. Deviation of the number of days with snow cover

Figures 15 and 16 show cumulative precipitation sums for Palić and Kopaonik in winter and per months relative to the average cumulative precipitation sums.

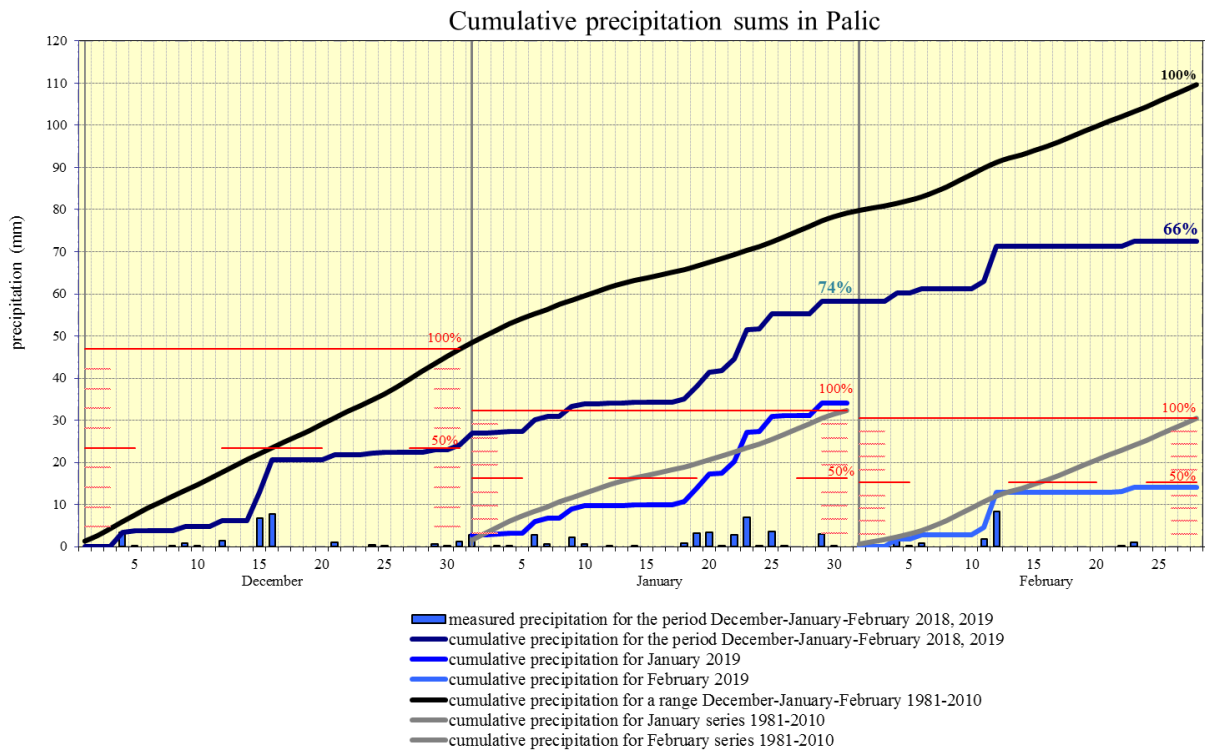


Figure 15. Cumulative precipitation sums for Palić

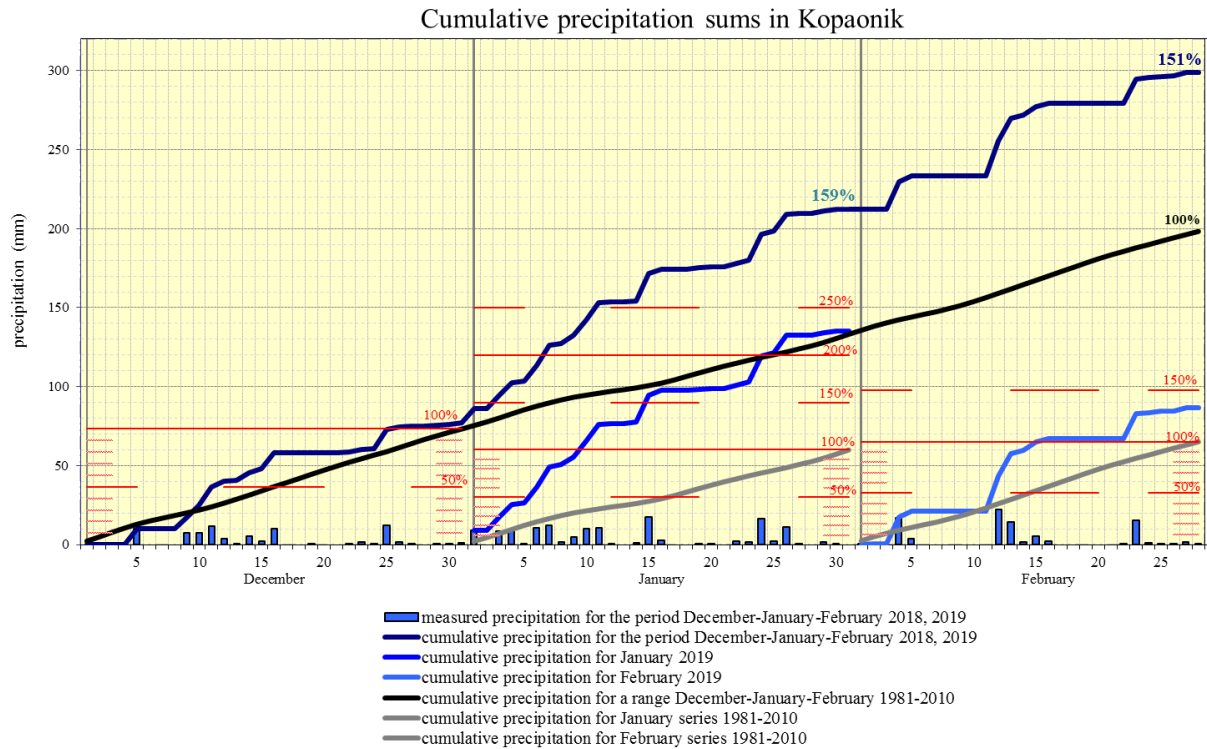


Figure 16. Cumulative precipitation sums for Kopaonik

Winter of 2018/2019 was marked by **wet and averagely warm conditions**, that is, total seasonal precipitation sums were in the upper tercile, and mean seasonal air temperature was within the average (Figure 17).

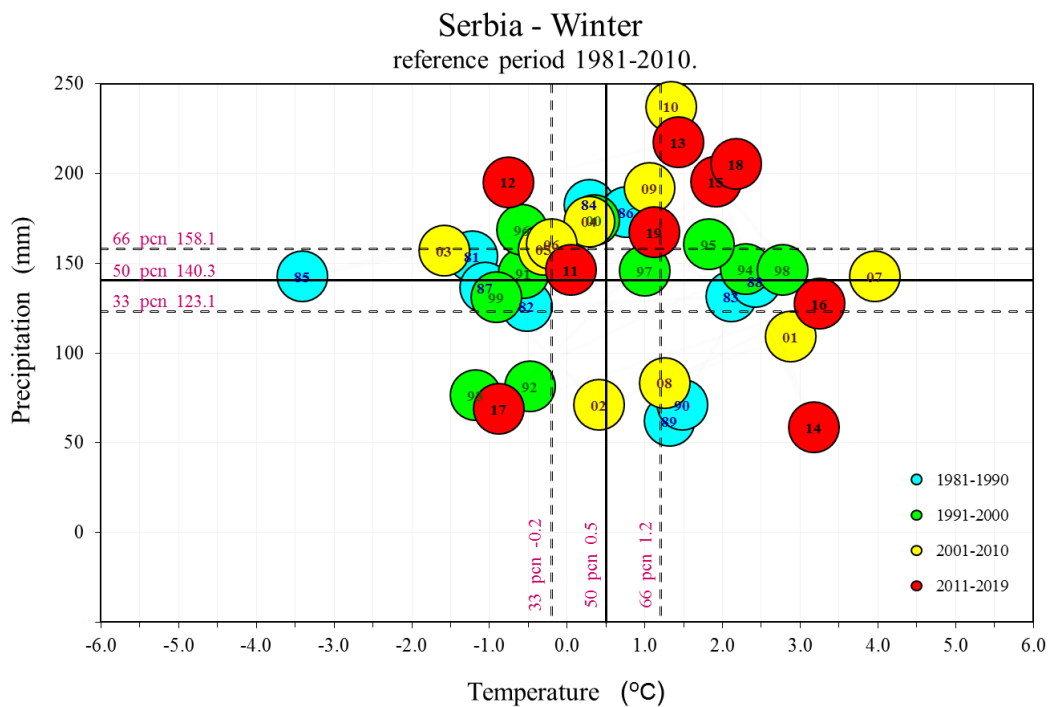


Figure 17. Assessment of the air temperature and winter precipitation sums based on the accompanying terciles relative to 1981-2010 base period

Cloud cover, bright and cloudy days

Mean winter cloud cover was within the average in entire Serbia (*Figure 18*), ranging from 6/10 in Negotin to 8/10 in Pozega.

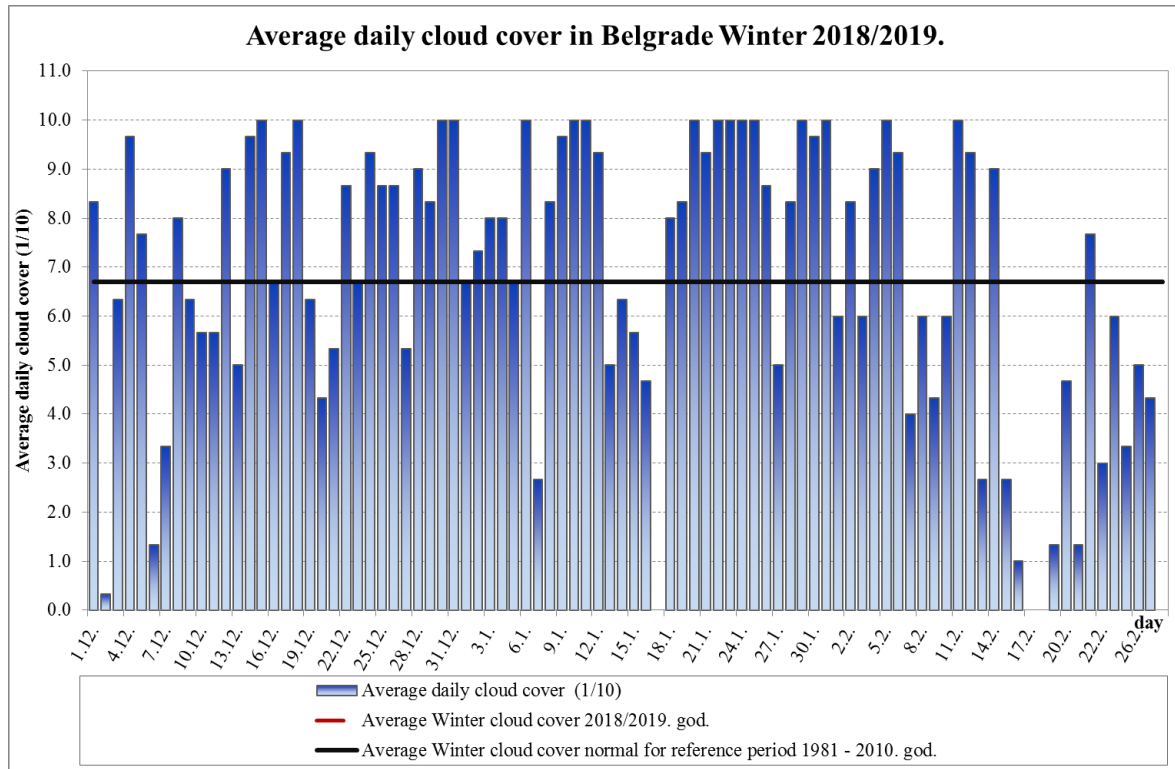


Figure 18. Average daily cloud cover in Belgrade

Number of bright days in winter ranged from 4 days in Pozega to 13 days in Negotin and Sombor. Departure of the observed number of bright days from the winter average ranged from 9 days below the average at Kopaonik to 5 days above the average in Sombor. Number of cloudy days ranged from 36 days on Palic to 55 days in Pozega and Cuprija. In winter, number of cloudy days was below the average on Palic to 12 days above the average in Kursumlija.

Sunshine duration (insolation)

Sunshine duration in winter ranged from 165.4 in Kragujevac to 268.6 hours on Palic (*Figure 21*).

Winter insolation relative to the normal for the 1981-2010 base period ranged from 71% at Kopaonik to 119% in Sombor (*Figure 22*).

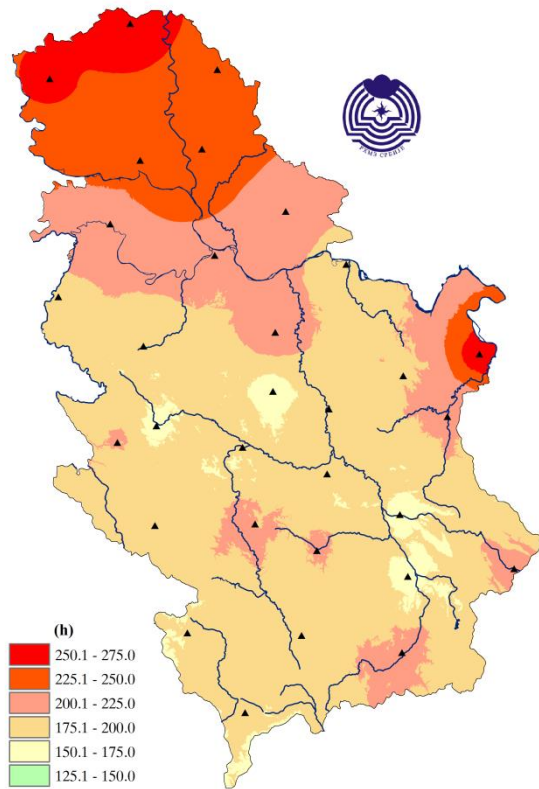


Figure 19. Insolation during winter in hours

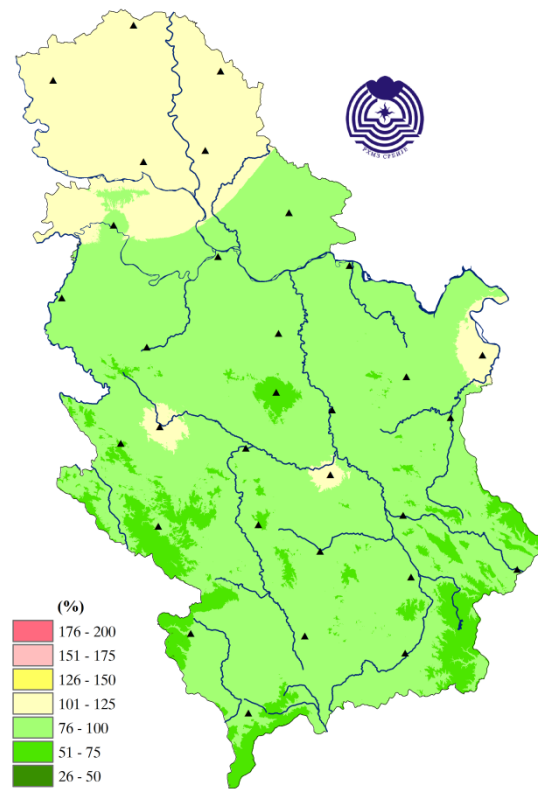


Figure 20. Insolation during winter as percentage of 1981-2010 base period

Analysis of the winter 2018/2019 for Serbia relative to the 1961-1990 base period

Temperature

Departure of the mean air temperature from the normal, in winter for the 1961–1990 base period ranged from 0.2°C in Vranje to 1.9°C in Negotinn and Palic, and on the mountains from -0.1°C at Kopaonik to 0.8°C at Crni Vrh (Figure 21).

Based on the percentile method, mean air temperature was in the normal category in most of Serbia and warm category in Loznica, Valjevo, Negotin, Cuprija, Krusevac, Belgrade and Palic (Figure 22).

Based on the tercile method, mean air temperature was above the average in most of Serbia, apart from western and southeastern parts of the country.

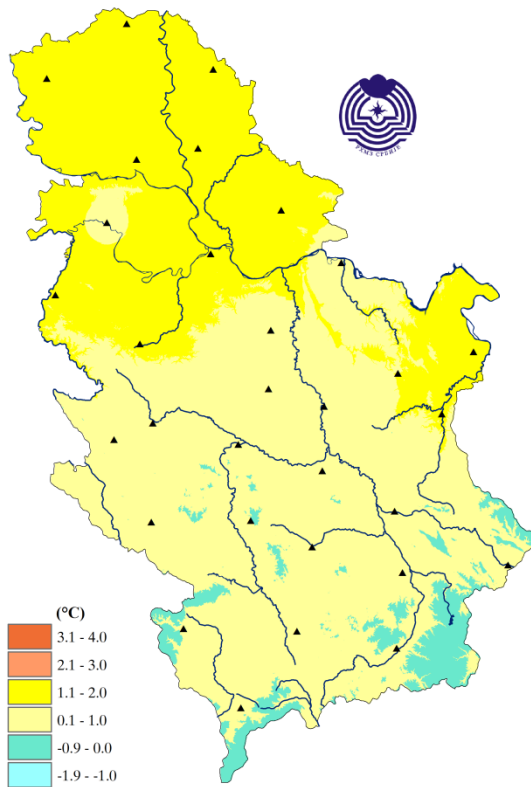


Figure 23. Departure of the mean seasonal air temperature relative to the 1961-1990 base period

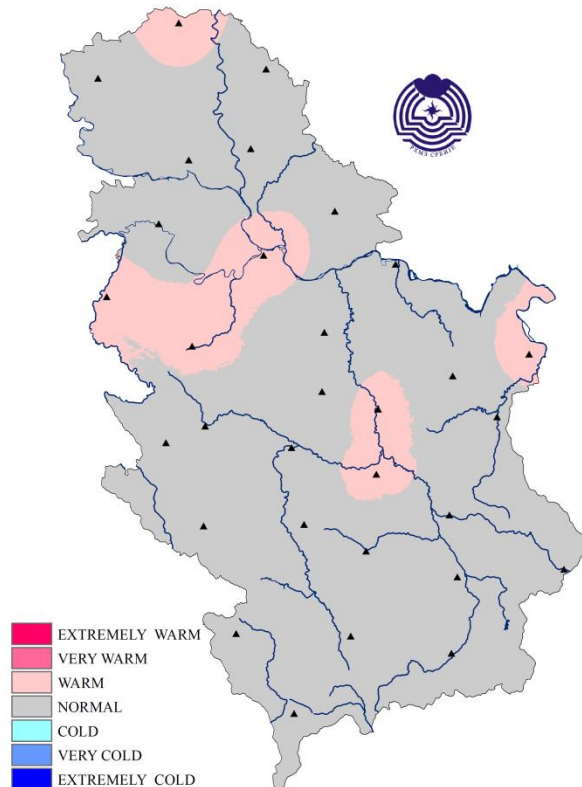


Figure 24. Mean seasonal air temperature based on percentile method relative to the 1961-1990 base period

Precipitation

Winter precipitation sums in most of central Serbia were above the average, and in northernmost parts of the country below the average relative to the 1961-1990 base period. Precipitation sums expressed in the percentages of normal ranged from -64% at Palic to 161% at Kopaonik (Figure 23).

Based on the percentile method, winter precipitation sums in the northernmost parts of the country were in the dry category, in most of central Serbia in the categories of rainy and very rainy, at Kopaonik extremely rainy, and normal category in the remainder of the country (Figure 24).

Precipitation sums based on the tercile method in most of Serbia were in the rainy category apart from northern areas where it was within the average, and on Palic in dry category.

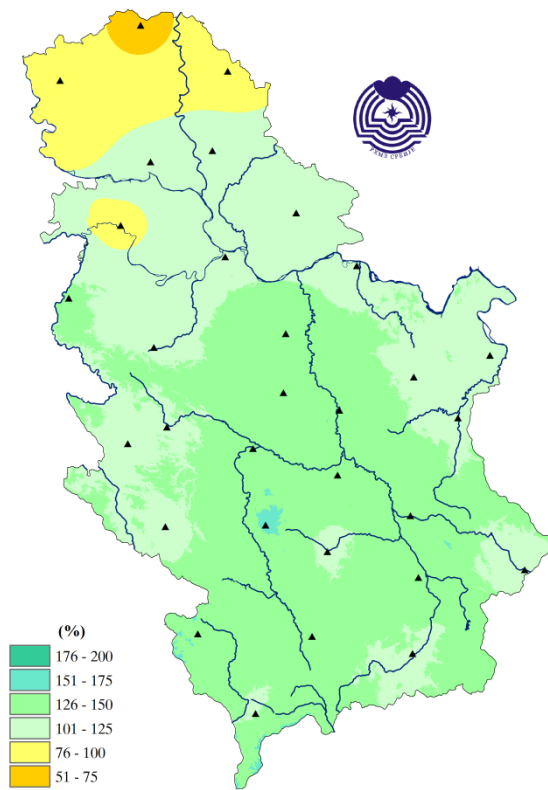


Figure 25. Seasonal precipitation sums expressed as the percentages of normal relative to the 1961-1990 base period

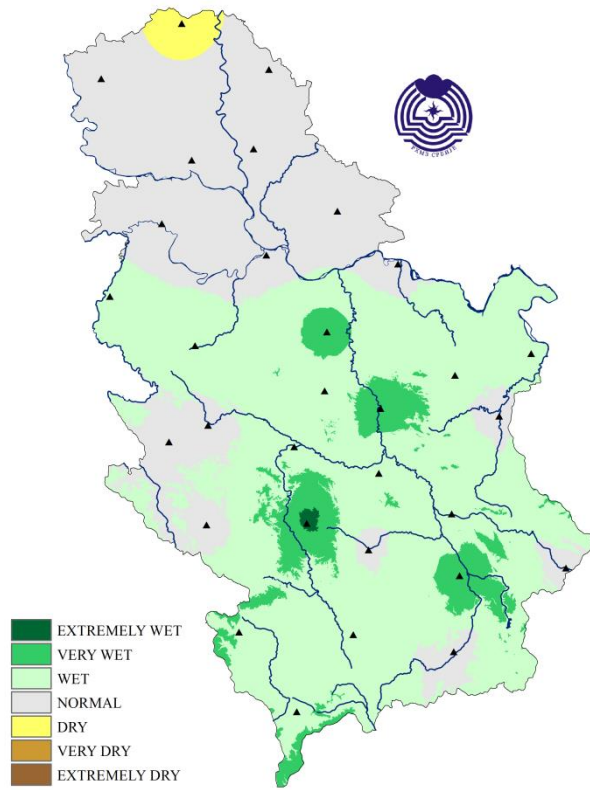


Figure 26. Seasonal precipitation sums based on percentile method relative to the 1961-1990 base period