



## **VERIFICATION OF THE SEECOF-22 WINTER 2019/2020 CLIMATE OUTLOOK AND SEASONAL BULLETIN FOR THE TERRITORY OF SERBIA**

Belgrade, April 1<sup>st</sup> 2020

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## Temperature

The SEECOF-22 outlook for the winter 2019/2020 in Serbia indicated warmer than normal temperature in Serbia with 60% probability relative to the 1981–2010 climatological base period (*Figure A*).

Climatological monitoring showed that the winter 2019/2020 was warm in entire Serbia, with above-normal temperature based on the tercile method (*Figure B*). The outlook for a warm winter was correct in entire Serbia.

OUTLOOK – WINTER 2019/2020

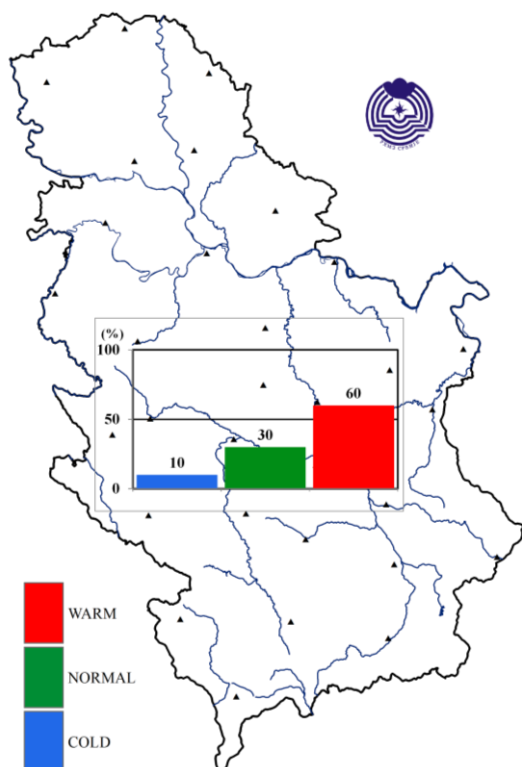


Figure A. SEECOF-22 - winter temperature outlook

MONITORING – WINTER 2019/2020

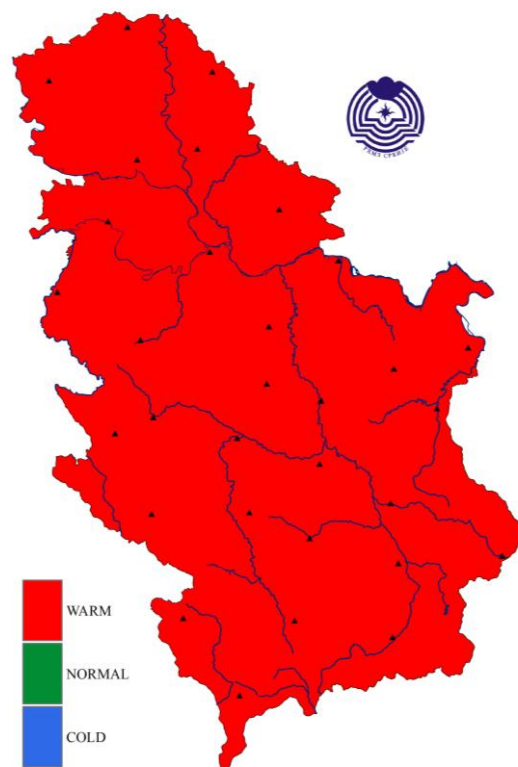


Figure B. Monitoring of the winter temperature using tercile method compared to the 1981-2010 base period

## Precipitation

According to the SEECOF-22 outlook for the winter 2019/2020 approximately equal probabilities for below, near or above normal precipitation for Serbia were indicated, relative to the 1981–2010 climatological base period (*Figure C*), so climatology (average seasonal precipitation) was suggested.

Based on the climatological monitoring of precipitation, the winter of 2019/2020 was normal in most of Serbia. Below normal seasonal precipitation were observed in the eastern Serbia as well as in the parts of western and northern Serbia. Above average precipitation were in some parts of the southern and western Serbia (*Figure D*). The outlook for a normal winter was correct for most of Serbia.

OUTLOOK – WINTER 2019/2020

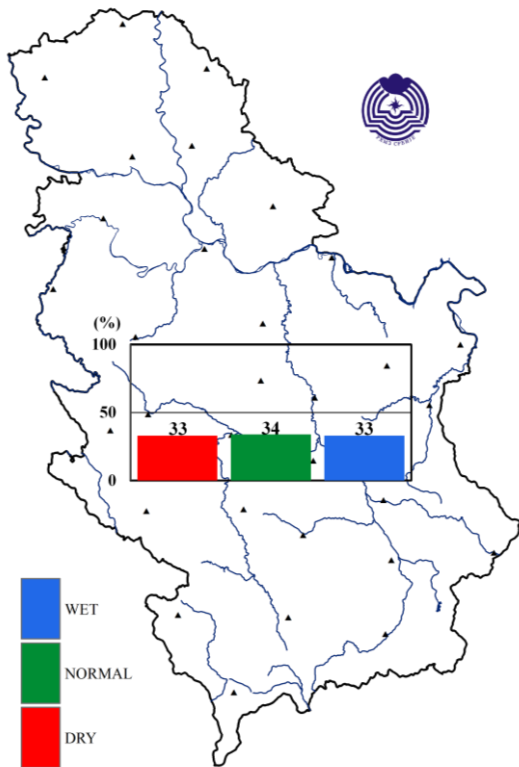


Figure C. SEECOF-22 - winter precipitation outlook

MONITORING – WINTER 2019/2020

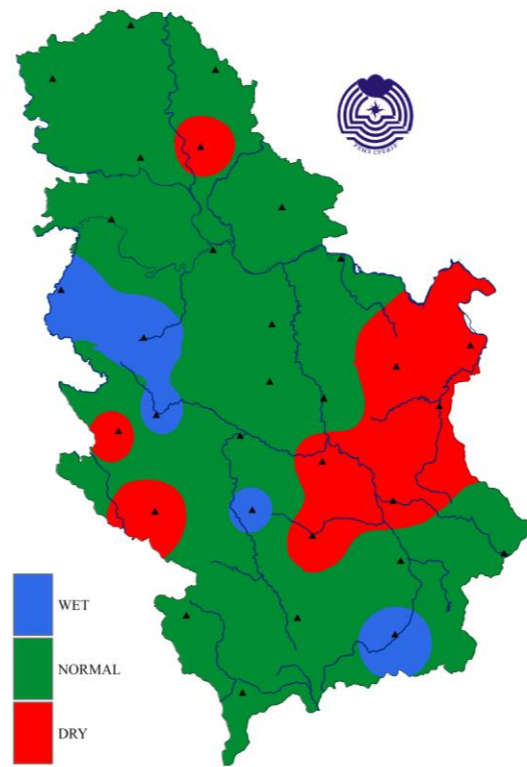


Figure D. Monitoring of the winter precipitation using tercile method compared to the 1981-2010 base period

Winter 2019/2020		Air Temperature (°C)				
Station	Rank*	Rank**	33	50	66	Observed value
<b>Belgrade</b> (1887-2020)	5	5	1.5	2.4	3.0	5.2
<b>Palić</b> (1945-2020)	5	4	-0.1	0.5	1.5	3.2
<b>Sombor</b> (1941-2020)	5	4	0.0	0.9	1.8	3.5
<b>Novi Sad</b> (1948-2020)	6	5	0.4	1.1	1.8	3.7
<b>Zrenjanin</b> (1943-2020)	6	5	0.3	1.0	1.8	3.7
<b>Kikinda</b> (1948-2020)	6	5	0.1	0.9	1.7	3.3
<b>Banatski Karlovac</b> (1985-2020)	6	6	0.7	1.4	2.0	3.7
<b>Loznica</b> (1952-2020)	3	3	0.7	1.8	2.5	4.5
<b>Sremska Mitrovica</b> (1925-2020)	8	5	0.4	0.9	1.6	3.4
<b>Valjevo</b> (1926-2020)	8	5	0.7	1.3	2.2	3.9
<b>Kragujevac</b> (1925-2020)	8	5	0.9	1.5	2.3	4.1
<b>Smederevska Palanka</b> (1939-2020)	9	6	0.7	1.5	2.1	3.9
<b>Veliko Gradište</b> (1926-2020)	5	3	0.4	1.0	1.6	3.6
<b>Crni Vrh</b> (1966-2020)	3	3	-3.6	-3.2	-2.1	0.3
<b>Negotin</b> (1927-2020)	2	2	0.7	1.1	1.8	4.6
<b>Zlatibor</b> (1950-2020)	7	5	-2.2	-1.8	-0.8	0.8
<b>Sjenica</b> (1946-2020)	14	10	-3.4	-2.5	-2.0	-1.3
<b>Pozega</b> (1952-2020)	9	8	-1.3	-0.7	0.3	1.1
<b>Kraljevo</b> (1926-2020)	9	6	0.5	1.1	2.1	3.5
<b>Kopaonik</b> (1949-2020)	5	4	-5.0	-4.6	-3.8	-2.3
<b>Kursumlija</b> (1952-2020)	7	5	0.3	1.0	1.5	3.2
<b>Krusevac</b> (1927-2020)	8	4	0.7	1.1	1.9	3.6

<b>Cuprija</b> (1948-2020)	3	2	0.4	1.2	1.7	3.8
<b>Nis</b> (1925-2020)	9	5	1.1	1.6	2.3	3.9
<b>Leskovac</b> (1948-2020)	7	5	0.3	0.9	1.7	3.3
<b>Zajecar</b> (1929-2020)	2	2	0.0	0.4	1.1	3.4
<b>Dimitrovgrad</b> (1945-2020)	6	4	-0.5	0.0	1.1	2.6
<b>Vranje</b> (1926-2020)	8	5	0.3	1.0	1.7	2.9

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

\*\*Rank – 1981-2020 period (warmest season)

<b>Winter 2019/2020</b>			<b>Precipitation sums (mm)</b>			
Station	Rank *	Rank **	33	50	66	Observed Value
<b>Belgrade</b> (1887-2020)	65	15	129.8	152.3	158.3	133.3
<b>Palić</b> (1936-2020)	38	19	90.1	104.4	121.5	101.3
<b>Sombor</b> (1931-2020)	35	16	104.2	114.8	123.0	109.4
<b>Novi Sad</b> (1945-2020)	42	25	109.9	119.1	133.5	129.5
<b>Zrenjanin</b> (1925-2020)	28	11	106.5	115.7	127.0	98.1
<b>Kikinda</b> (1925-2020)	31	13	98.0	105.5	121.2	99.0
<b>Banatski Karlovac</b> (1946-2020)	29	16	108.3	122.7	132.5	119.0
<b>Loznica</b> (1925-2020)	66	25	166.4	171.6	201.4	205.3
<b>Sremska Mitrovica</b> (1925-2020)	46	23	103.0	115.9	130.1	123.9
<b>Valjevo</b> (1926-2020)	73	33	149.5	157.6	173.3	206.6
<b>Kragujevac</b> (1925-2020)	49	22	113.0	120.0	134.0	128.5
<b>Smederevska Palanka</b> (1926-2020)	43	19	121.8	132.7	157.6	132.4
<b>Veliko Gradište</b> (1926-2020)	44	18	120.8	147.9	161.3	142.5

<b>Crni Vrh</b> (1966-2020)	16	12	127.6	143.8	170.7	119.8
<b>Negotin</b> (1941-2020)	5	5	105.9	137.3	186.9	57.5
<b>Zlatibor</b> (1950-2020)	33	14	204.3	225.1	237.8	203.2
<b>Sjenica</b> (1925-2020)	21	9	140.9	151.4	177.6	110.3
<b>Pozega</b> (1925-2020)	69	33	124.3	147.5	157.6	179.4
<b>Kraljevo</b> (1926-2020)	52	22	126.9	137.3	156.8	148.6
<b>Kopaonik</b> (1949-2020)	50	34	158.1	204.0	232.1	282.7
<b>Kursumlija</b> (1925-2020)	15	10	123.5	150.9	174.5	94.8
<b>Krusevac</b> (1925-2020)	22	12	115.1	133.2	155.6	98.2
<b>Cuprija</b> (1947-2020)	51	23	127.5	148.1	163.1	160.3
<b>Nis</b> (1925-2020)	24	12	117.7	137.1	150.6	100.6
<b>Leskovac</b> (1925-2020)	39	14	127.3	150.4	161.8	131.3
<b>Zajecar</b> (1925-2020)	15	9	103.7	136.3	146.6	79.8
<b>Dimitrovgrad</b> (1926-2020)	45	19	111.6	120.4	143.9	122.8
<b>Vranje</b> (1926-2020)	62	29	111.7	126.9	137.1	153.2

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

\*\*Rank – 1981-2020 period (lowest seasonal precipitation)

Country	Seasonal temperature DJF		Seasonal precipitation DJF		High Impact Events
	Observed	SEECOF-22 climate outlook for temperature	Observed	SEECOF-22 climate outlook for precipitation	
Serbia (1)	Above normal in entire Serbia	<b>Above-normal</b> (10, 30, 60)  in entire Serbia	Normal and below normal in most of Serbia	<b>No predictive signal</b> (33, 34, 33)  in entire Serbia	<ul style="list-style-type: none"> <li>❖ Fifth warmest winter 2019/2020 for Serbia since 1951, and fifth warmest for Belgrade since 1888</li> <li>❖ Second warmest winter for Negotin, third warmest for Loznica, Cuprija, Zajecar and Crni Vrh</li> <li>❖ Second warmest winter for Serbia based on the maximum air temperature</li> <li>❖ <b>Snow cover wasn't recorded in Sombor, Zrenjanin, Banatski Karlovac and Palic, and for the first time snow wasn't registered in Negotin and Kikinda</b></li> <li>❖ Record late occurrence of snow cover in Belgrade</li> <li>❖ Fifth driest winter in Negotin</li> </ul>

## WINTER 2019/2020 – FIFTH WARMEST, WITHOUT SNOW COVER IN NORTH AND EAST OF SERBIA

- ❖ *Fifth warmest winter for Serbia since 1951, and fifth warmest for Belgrade since 1888*
- ❖ *Second warmest winter for Negotin, third warmest for Loznica, Cuprija, Zajecar and Crni Vrh*
- ❖ *Second warmest winter for Serbia based on the maximum air temperature*
- ❖ *Snow cover wasn't recorded in Sombor, Zrenjanin, Banatski Karlovac and Palic, and for the first time snow wasn't registered in Negotin and Kikinda*
- ❖ *Record late occurrence of snow cover in Belgrade*
- ❖ *Number of ice days with the maximum daily air temperature below 0°C was significantly below the average, for 10 to 17 days below the average; Kursumlija didn't observe any ice days and Dimitrovgrad recorded minimum number of ice days*
- ❖ *Fifth driest winter in Negotin*

### Analysis of the winter season 2019/2020 for Serbia relative to the 1981-2010 base period

#### Temperature

Winter of 2019/2020 ranks as the fifth warmest for Serbia since 1951 and fifth warmest since 1888. Winter mean air temperature in Serbia was 3,0°C, which is 2,4°C above the average for the 1981-2010 period (Figure 1). Belgrade observed winter mean air temperature of 5,2°C, which is 2,8°C above the 1981-2010 period.

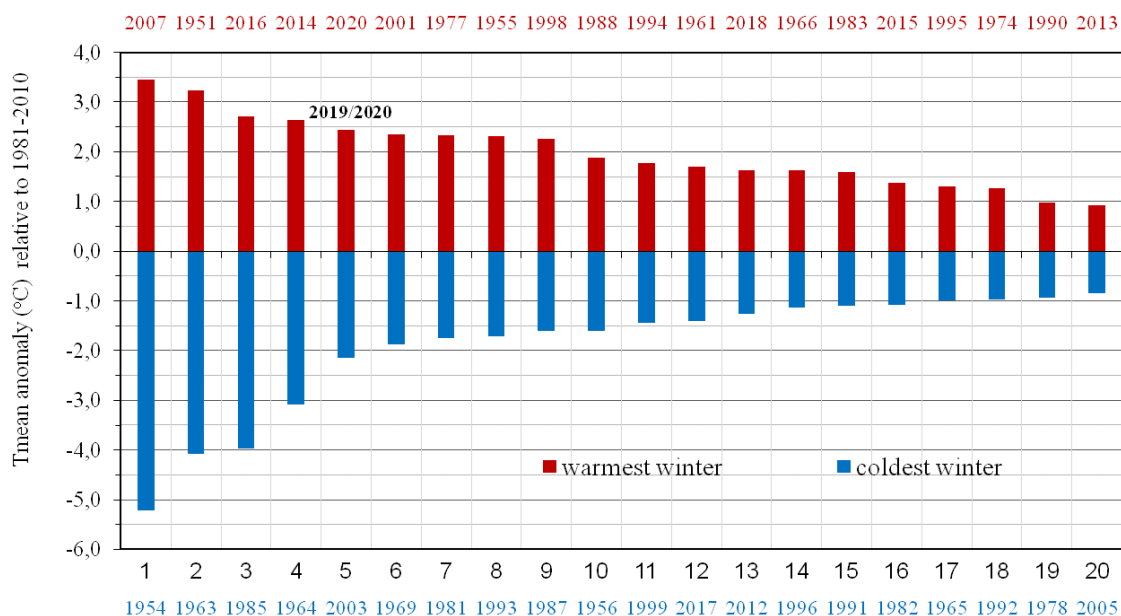


Figure 1. Rank of the warmest and coldest winter seasons in Serbia for the 1951-2020 period



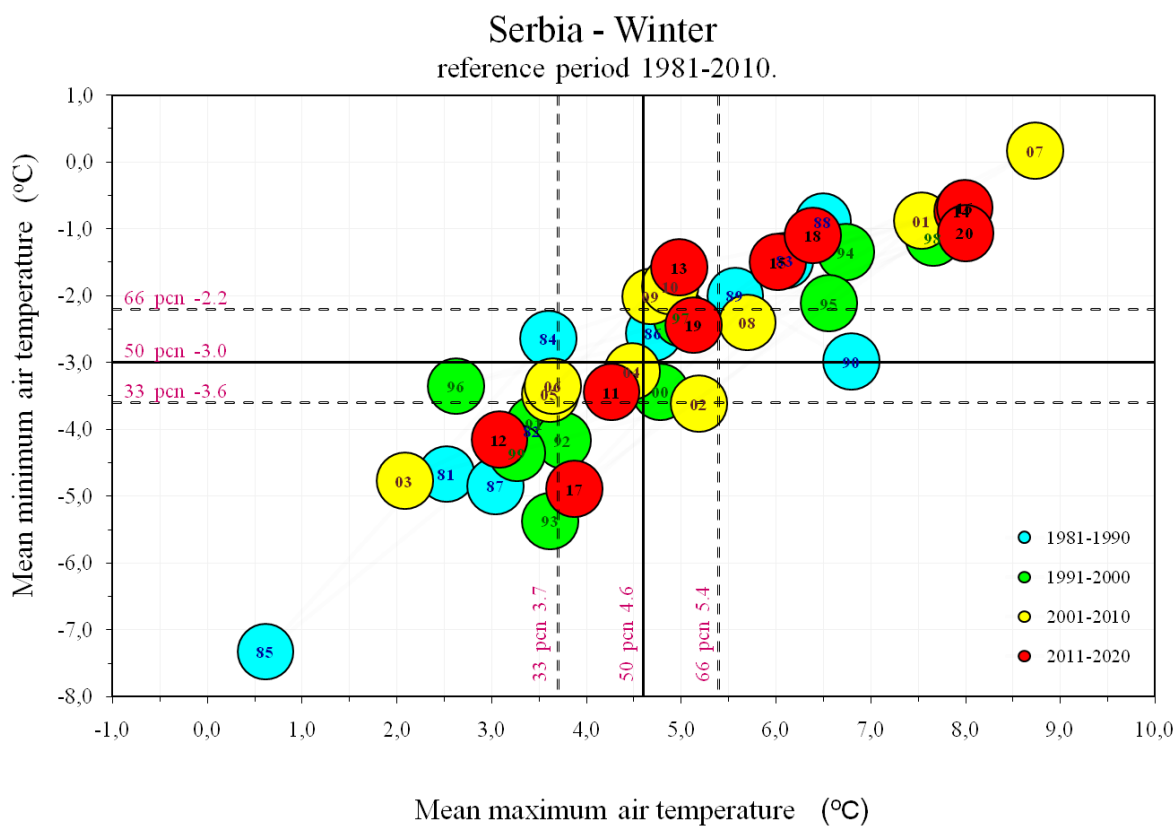


Figure 2. Assessment of the maximum and minimum air temperature based on the accompanying terciles relative to 1981-2010 base period

Winter of 2019/2020 ranks as the second warmest based on the maximum air temperature (Figure 2).

Winter mean air temperature ranged from 1,1°C in Pozega to 5,2°C in Belgrade and on the mountains from -2,3°C at Kopaonik to 0,8°C at Zlatibor (Figure 3).

Departure of the mean air temperature from the normal<sup>1</sup> in winter for the 1981-2010 base period ranged from 1,7°C in Pozega to 3,5°C in Negotin, and in the upland from 1,5°C in Sjenica to 3,2°C at Crni Vrh (Figure 4).

Based on the percentile method, winter mean air temperature was in the very warm category in most of Serbia, and extremely warm category in Negotin and Dimitrovgrad (Figure 5).

Based on the tercile method, mean air temperature in winter was in the warm category across entire Serbia (Figure 6).

The highest air temperature in winter of 22,2°C was measured in Krusevac on February 25.

<sup>1</sup> Term normal refers to climatological standard normal, that is, the average value of a particular climate element, calculated for the period from January 1, 1981 to December 31, 2010

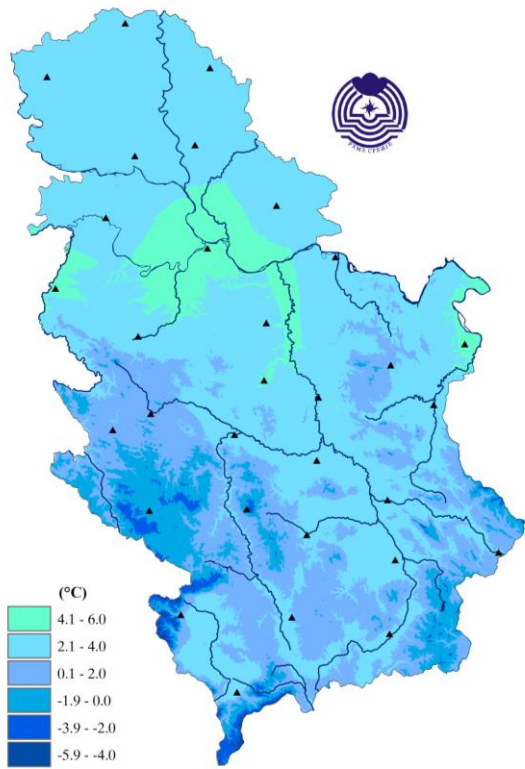


Figure 3. Mean seasonal air temperature

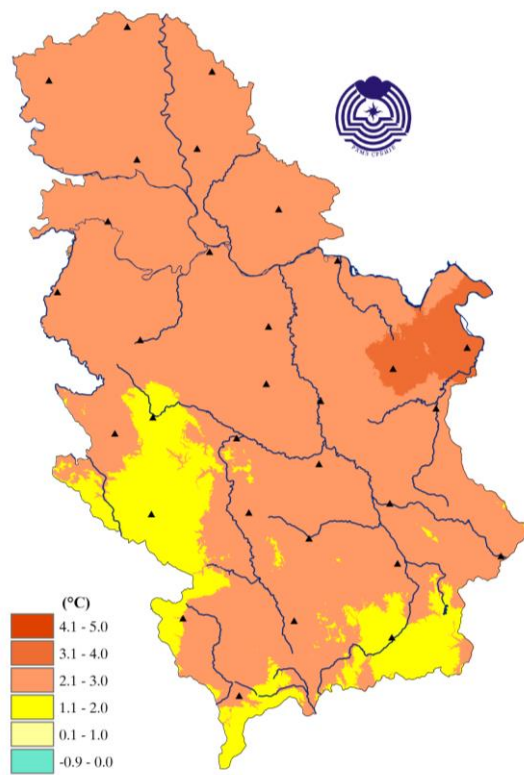


Figure 4. Departure of the mean seasonal air temperature relative to the 1981-2010 base period

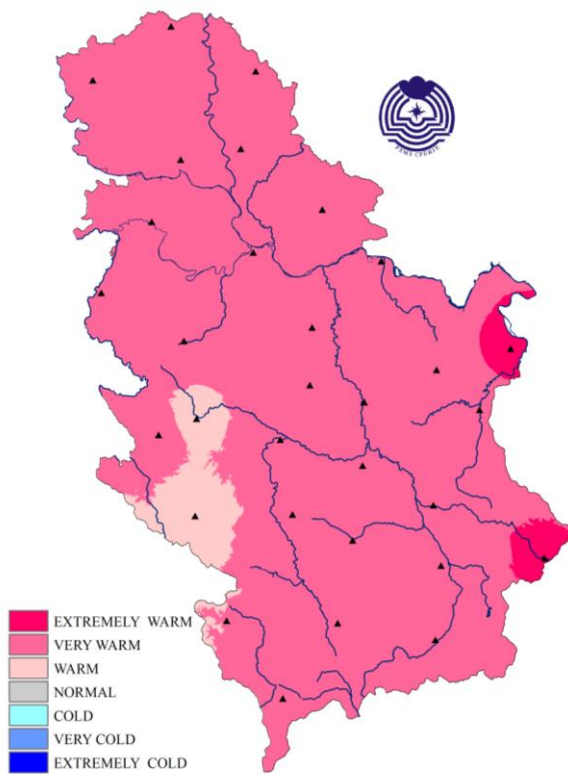


Figure 5. Mean seasonal air temperature based on percentile method

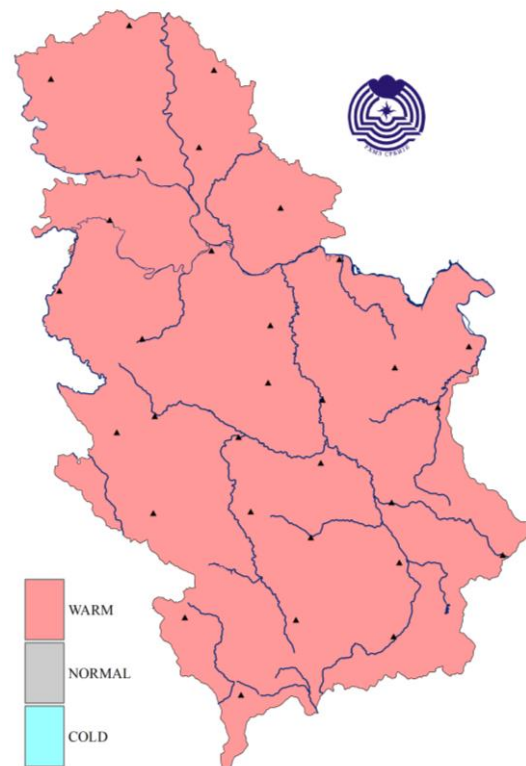


Figure 6. Mean seasonal air temperature based on tercile method

Number of ice days with the maximum daily air temperature below 0°C was significantly lower than the average, for 10 to 17 days below the average. Number of ice days ranged from 1 in parts of southern, eastern and central Serbia to 8 days in northern regions. Number of ice days on the mountains ranged from 16 days at Zlatibor to 33 days at Kopaonik (Figure 7). Kursumlija didn't observe any ice days, and Dimitrovgrad registered 1 ice days thereby breaking the previous record of 2 days set in 1951.

The lowest air temperature in winter of -20,8°C was measured in Sjenica on January 8.

Number of ice days, with the minimum daily air temperature below 0°C ranged from 29 days in Belgrade to 64 days in Zajecar, and on the mountains from 65 days at Zlatibor to 84 days in Sjenica. Number of ice days was 4 to 17 days below the winter average across most of the country (Figure 8).

Serbia didn't experience any days with severe frost, with the minimum daily air temperature below -10°C. Valjevo, Kragujevac, Kraljevo, Kursumlija and Leskovac observed one day with severe frost, whereas Dimitrovgrad and Zajecar recorded 3 days. On the mountains, their number ranged from 3 days at Zlatibor to 23 days in Sjenica.

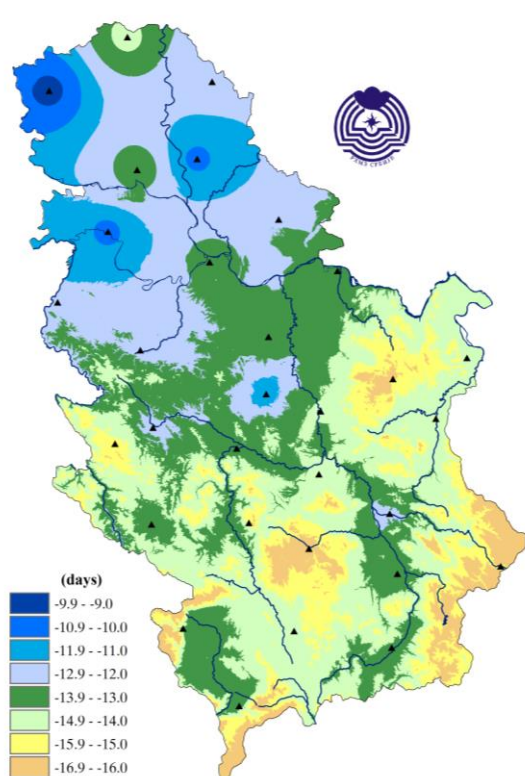


Figure 7. Deviation of the number of ice days relative to the 1981-2010 base period

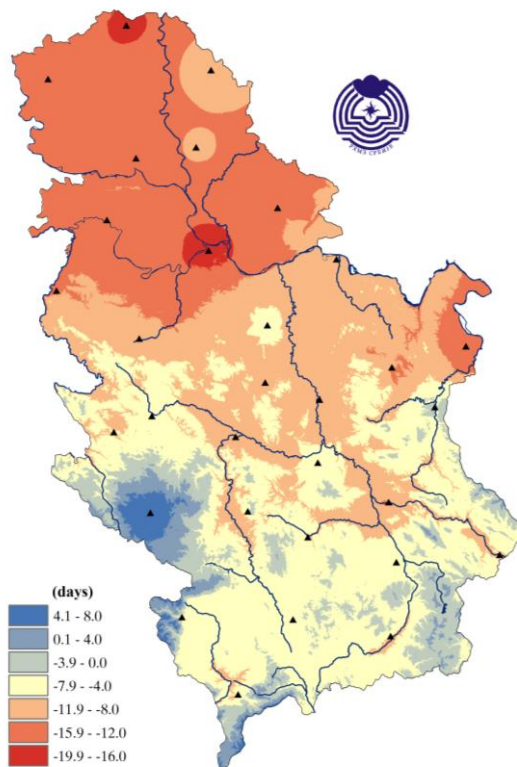


Figure 8. Deviation of the number of frost days relative to the 1981-2010 base period

Warmer periods in Belgrade, with the mean, minimum and maximum air temperature above the multiannual average, were recorded most of December, third decade of January as well as most of February. Colder periods, with the air temperature below the multiannual average were registered at the beginning and end of December, first half of January as well as the end of first decade of February (Figure 9).



## Cold wave / heat wave

In winter 2019/2020, two cold waves<sup>2</sup> and two heat waves<sup>3</sup> were registered. The first one was recorded in the period from 13 to 24 December in most of Serbia and the second one was observed in the period from January 31 to February 4, apart from the northern areas and mountain regions.

## Precipitation

Winter precipitation totals were within the average in most of Serbia, above the average in western Serbia and below the average in parts of northern, central and southeastern Serbia. Precipitation totals ranged from 57,5 mm in Negotin to 206,6 mm in Valjevo, and Kopaonik observed 282,7 mm of precipitation (Figure 11). Precipitation sums expressed in the percentages of normal ranged from 38% in Negotin to 130% in Valjevo and Pozega, and on the mountains from 78% to 141% at Kopaonik (Figure 12).

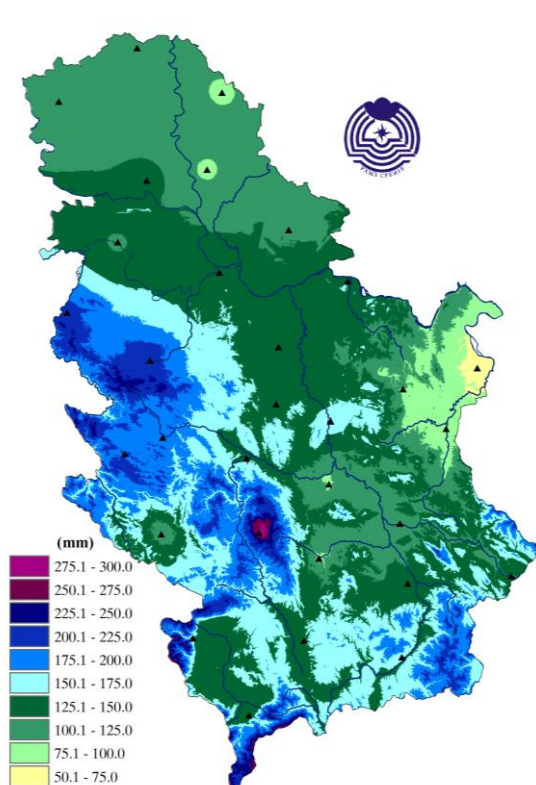


Figure 11. Spatial distribution of winter precipitation sums expressed in mm

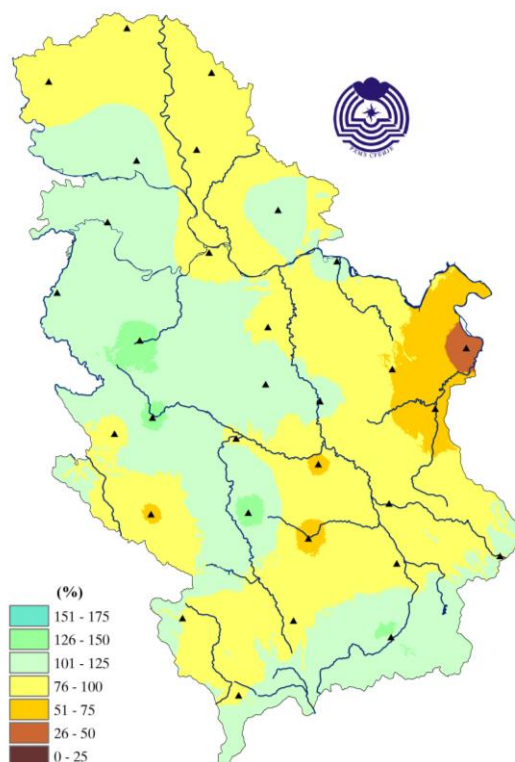


Figure 12. Spatial distribution of the winter precipitation sums expressed in % from 1981-2010 base period

<sup>2</sup> 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

<sup>3</sup> Heat wave is defined as period of 5 or more consecutive days with the maximum daily air temperature in the categories of very warm and extremely warm

Based on the percentile method, winter precipitation sums were in normal category in most of Serbia, dry category in Zrenjanin, Negotin, Sjenica, Kursumlija and Zajecar, rainy in Vranje and very rainy at Kopaonik, Pozega and Valjevo (Figure 13).

Based on the tercile method, precipitation sums were in the normal category in most of Serbia (Figure 14).

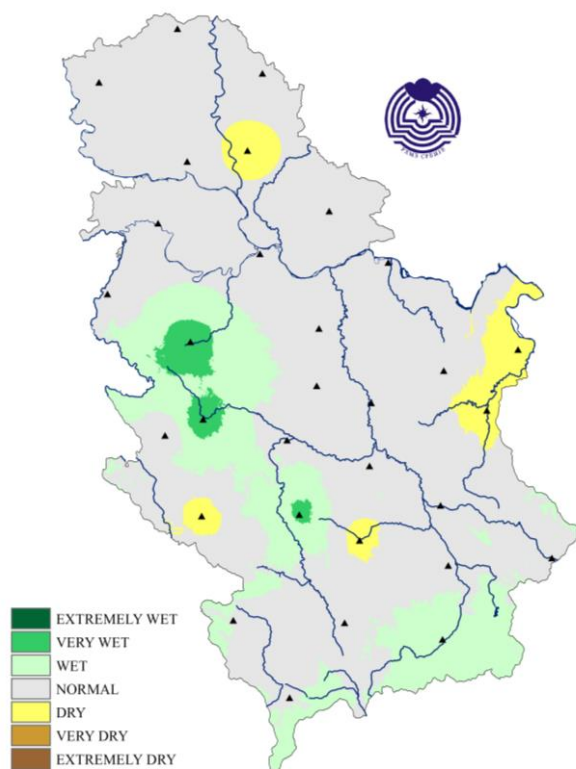


Figure 13. Precipitation sums based on percentile method

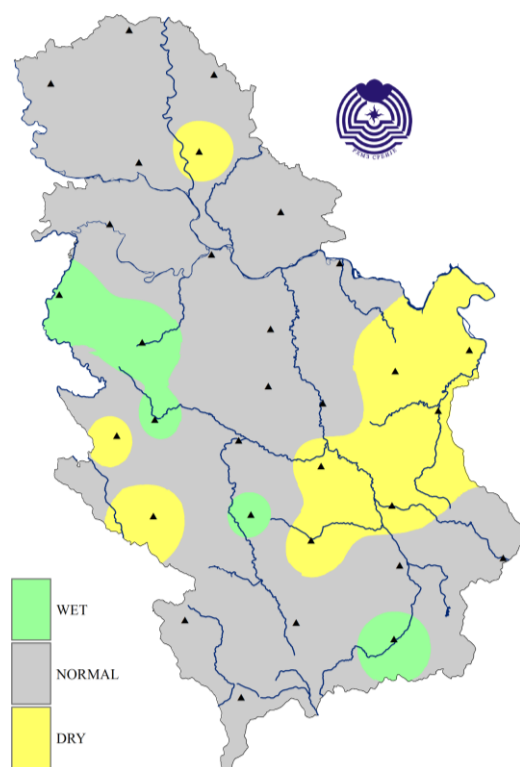


Figure 14. Precipitation sums based on tercile method

Number of days with precipitation of 0,1 mm and above that were registered during the winter season ranged from 20 in Negotin to 42 in Kraljevo. The observed number of days with precipitation was below the average in most of Serbia, up to 12 days below the average in Negotin (Figure 15).

**In winter 2019/2020, snow cover wasn't recorded in Sombor, Zrenjanin, Banatki Karlovac and Palic, and for the first time Negotin and Kikinda didn't observe any snow cover.** Apart from Negotin and Kikinda, record low number of days with snow cover was registered in Novi Sad, Loznica and Veliko Gradiste. Recorded number of days with snow cover was below the average in entire Serbia, from 17 to 34 days below the average, apart from Kopaonik that observed 4 days above the average (Figure 16). Number of days with snow cover in the lowland of Serbia ranged from 1 in Belgrade, Novi Sad, Sremska Mitrovica and Veliko Gradiste up to 10 days in Valjevo, Dimitrovgrad and Vranje, and up to 30 days in

Pozega. Number of days with snow cover in the hilly-mountainous regions ranged from 63 in Sjenica to 90 days at Kopaonik. Maximum snow depth of 91 cm was measured at Kopaonik on February 29.

**Record late occurrence of snow cover was observed in Belgrade on February 27, thereby breaking the previous record set in January 22, 2001.**

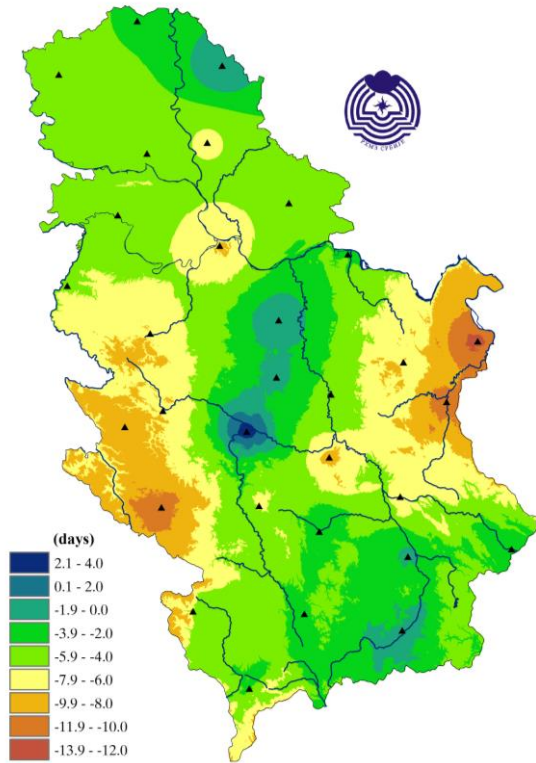


Figure 15. Deviation of the number of days with precipitation of 1.0 mm and above

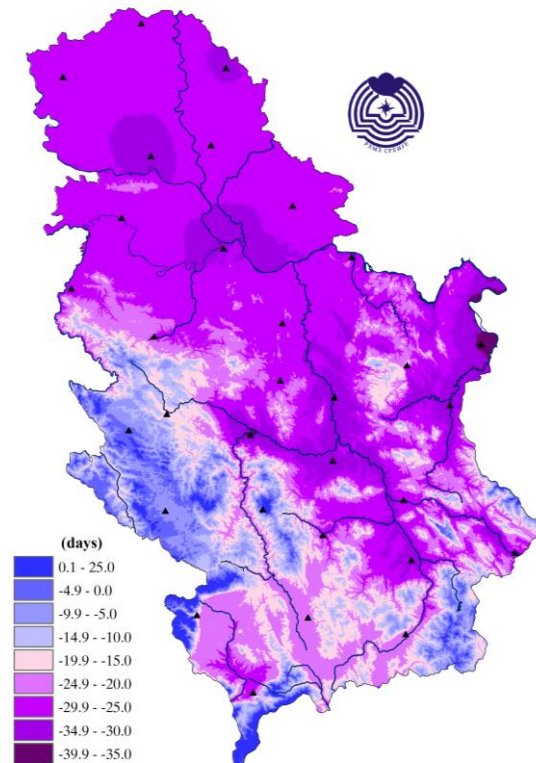


Figure 16. Deviation of the number of days with snow cover

Figures 17 and 18 show cumulative precipitation sums for Belgrade and Kopaonik in winter per months relative to the average cumulative precipitation sums.

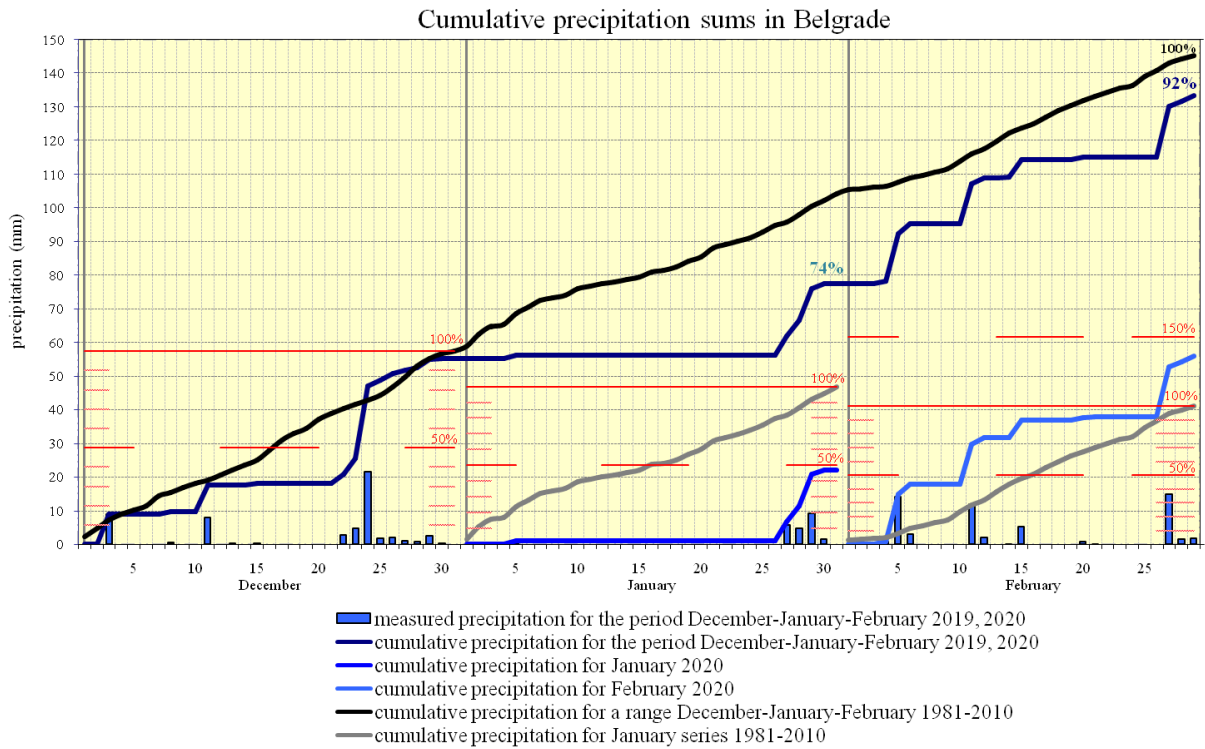


Figure 17. Cumulative precipitation sums for Belgrade

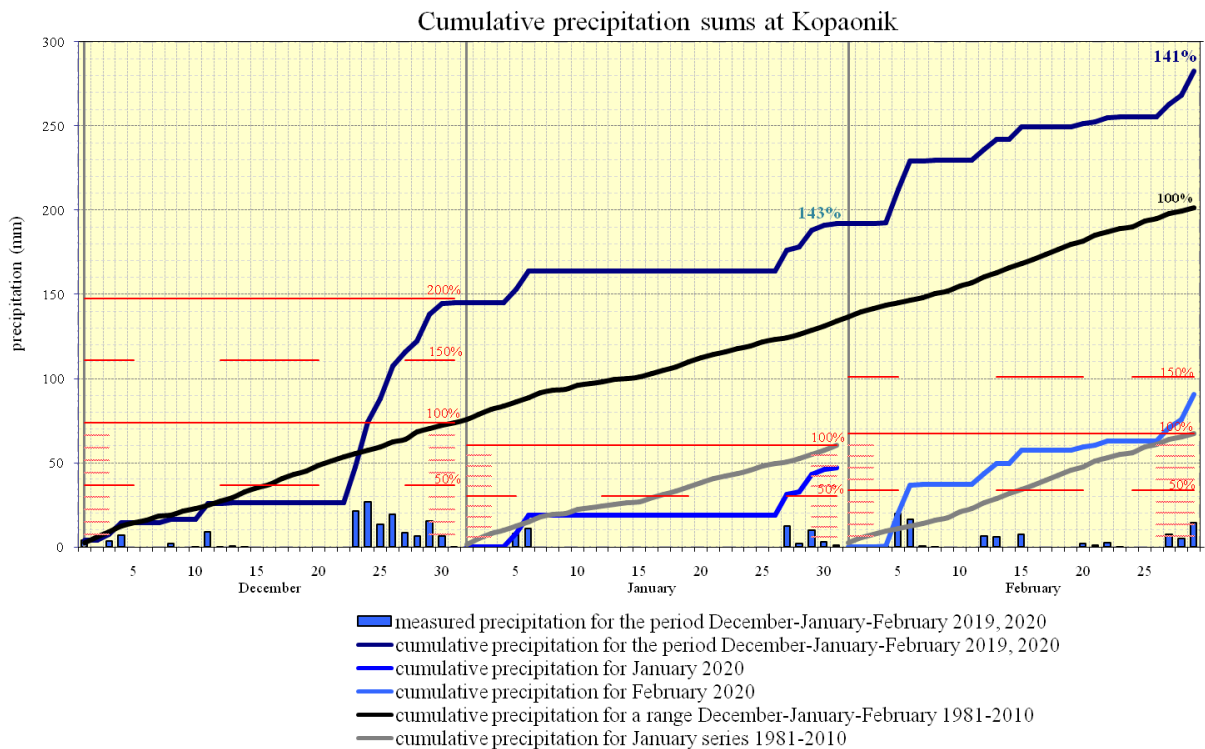


Figure 18. Cumulative precipitation sums for Kopaonik



## Cloud cover, bright and cloudy days

Mean winter cloud cover was below the average in entire Serbia (Figure 19), ranging from 5/10 in Negotin to 7/10 in Pozega.

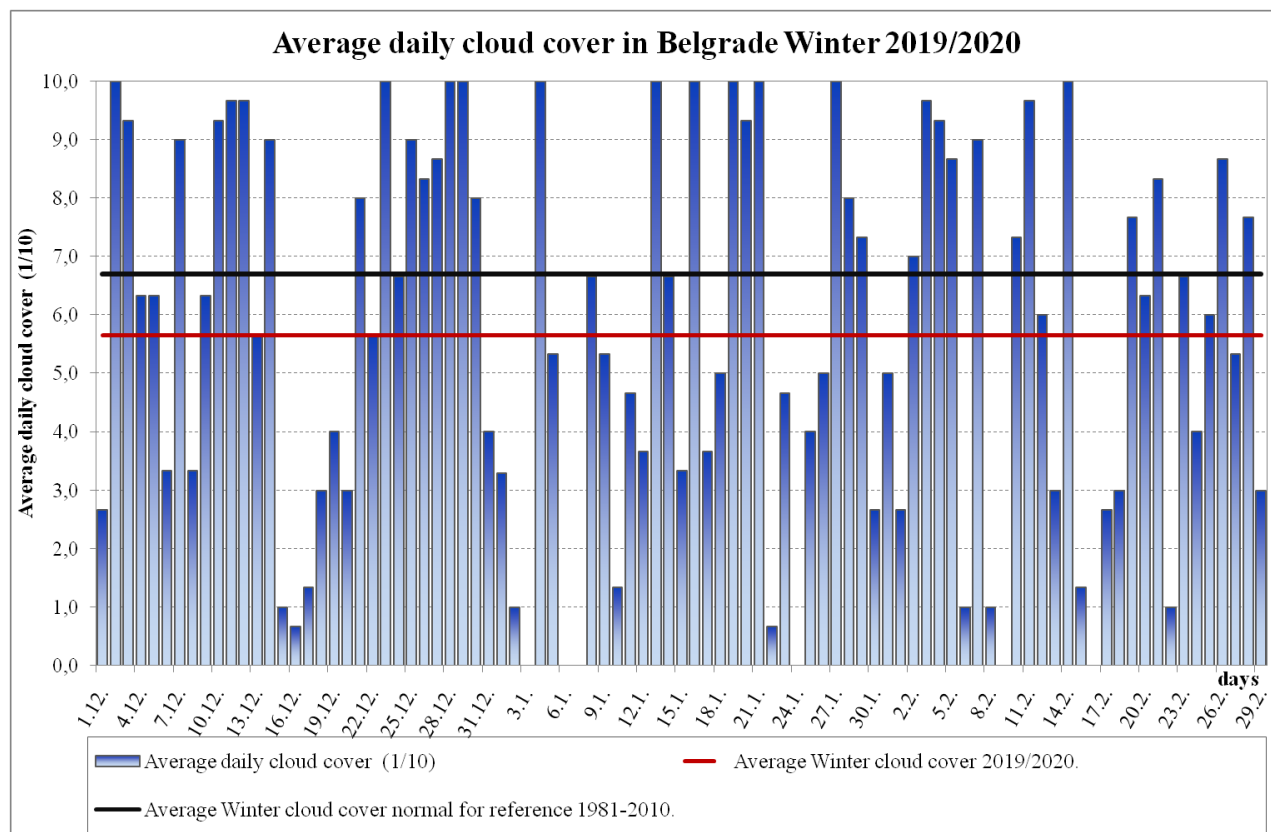


Figure 19. Average daily cloud cover in Belgrade

In winter, number of bright days<sup>4</sup> ranged from 4 in Pozega to 13 days in Negotin and Sombor. Departure of the number of bright days from the winter average ranged from 2 days below the average in Smederevska Palanka to 13 days above the average in Negotin. Number of cloudy days<sup>5</sup> ranged from 22 days in Negotin to 40 days in Pozega. In winter, entire Serbia observed fewer cloudy days than usual, 2 to 18 days below the winter average.

<sup>4</sup> Bright day is a day with average daily cloud cover of less than 2/10

<sup>5</sup> Cloudy day is a day with average daily cloud cover of more than 8/10

## Sunshine duration (insolation)

In winter, sunshine duration ranged from 209,6 in Leskovac to 366,7 hours in Negotin (Figure 20).

Relative to the normal for the 1981-2010 base period, sunshine duration ranged from 101% in Leskovac and 152% in Negotin (Figure 21).

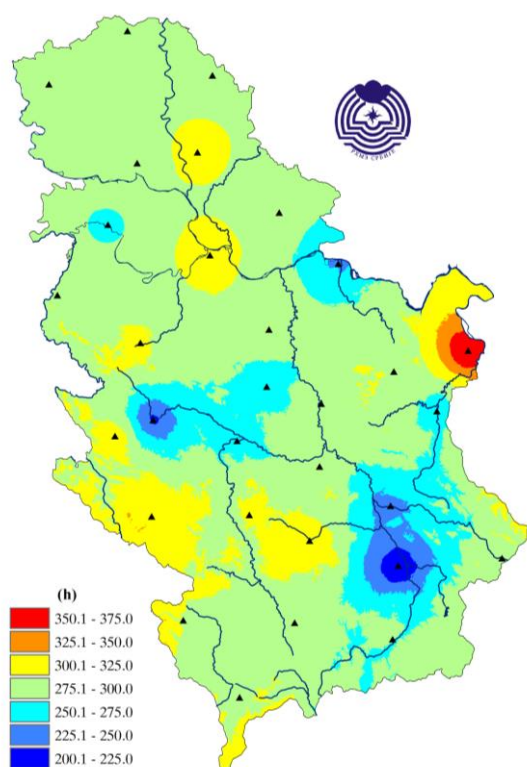


Figure 20. Insolation during winter in hours

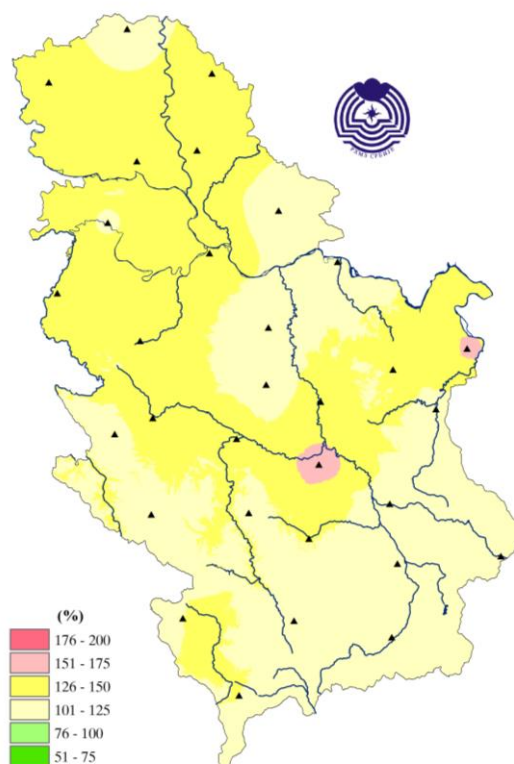


Figure 21. Insolation during winter as percentage of 1981-2010 base period

## Analysis of the winter season 2019/2020 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 2,0°C in Pozega and Sjenica to 4,1°C in Negotin, and on the mountains from 2,8°C at Zlatibor to 3,4°C at Crni Vrh (Figure 22).

Based on the percentile method, mean air temperature was in the extremely warm category in most of Serbia (Figure 23).

Based on the tercile method, mean air temperature was above the average in entire Serbia.

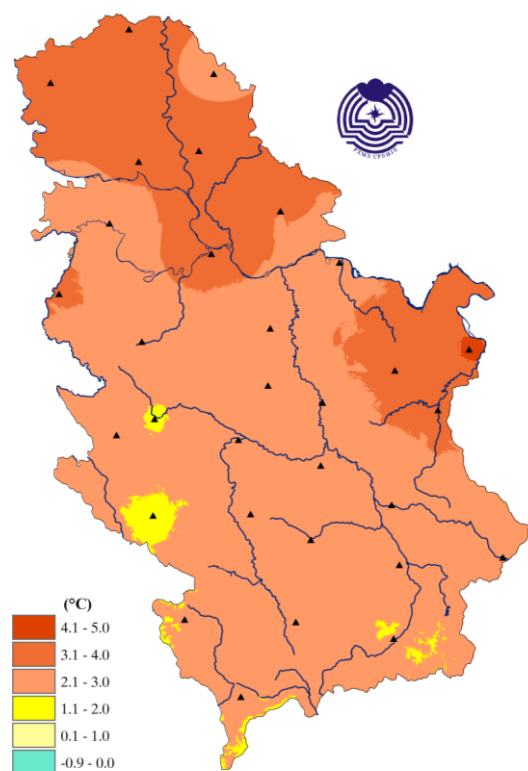


Figure 22. Departure of the mean seasonal air temperature relative to the 1961-1990 base period

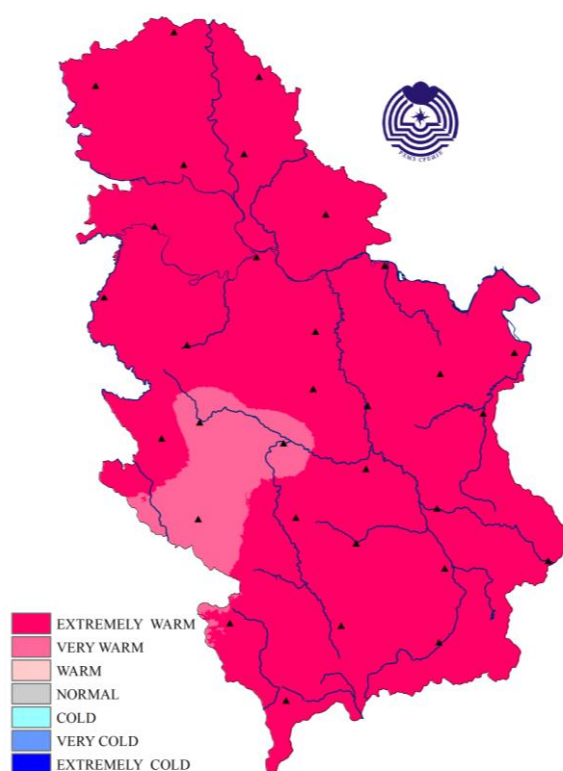


Figure 23. Mean seasonal air temperature based on percentile method relative to the 1961-1990 base period

## Precipitation

Winter precipitation sums in most of Serbia were within the average relative to the normal for the 1961-1990 base period. Precipitation totals expressed in the percentages of normal ranged from 39% in Negotin to 153% at Kopaonik (Figure 24).

Based on the percentile method, winter precipitation sums were in the following categories: normal in most of Serbia, rainy in Loznica and Valjevo, very rainy at Kopaonik, dry in Zajecar, Nis, Krusevac, Kursumlija and Sjenica, and very dry in Negotin (Figure 25).

Based on the tercile method, winter precipitation sums were in the normal category in most of Serbia, rainy category in parts of western, central and southern Serbia, and dry in parts of eastern, southwester and northeastern Serbia.

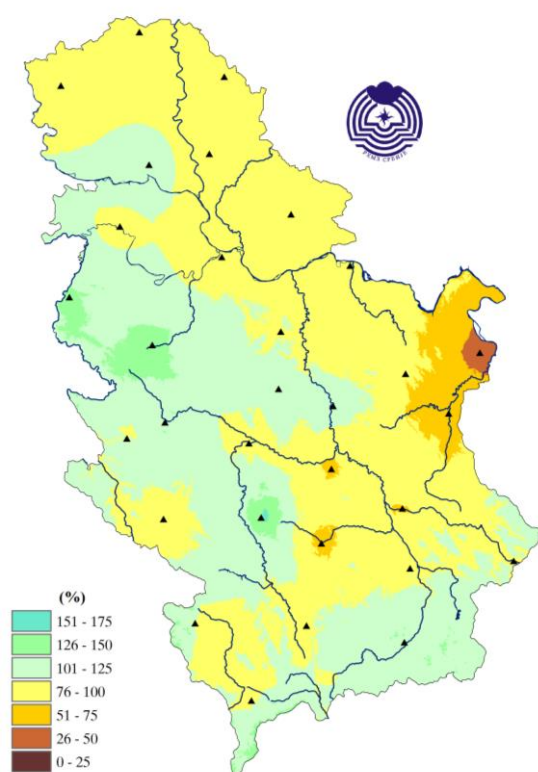


Figure 24. Seasonal precipitation sums expressed as the percentages of normal relative to the 1961-1990 base period

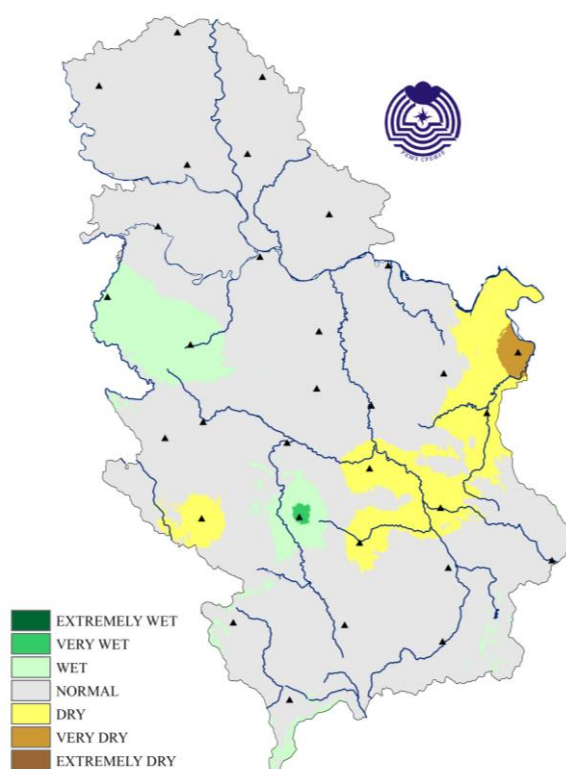


Figure 25. Seasonal precipitation sums based on percentile method relative to the 1961-1990 base

Note: Climatological analysis of the meteorological elements was performed based on the provisional data obtained from 28 main meteorological stations