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Extremely warm 2015, the warmest one in Valjevo, Negotin and Veliko Gradiste, third warmest in Serbia, six registered heat waves, average precipitation sums across most of Serbia

Temperature

In Serbia, the year of 2015, with the average temperature of 11.8°C ranks as the third warmest since 1951 and the second warmest in Belgrade since the meteorological station commenced work in 1888. The mean annual air temperature ranged from 10.8°C in Pozega up to 14.1°C in Belgrade, and on the mountains from 4.9°C at Kopaonik up to 9.0°C on Zlatibor. The mean annual air temperature anomaly compared to the 1961-1990 base period ranged from 1.3°C in Kursumlija and Dimitrovgrad up to 2.5°C in Negotin. According to the percentile method¹, the year of 2015 was the in the category of extremely warm.

Ten out of fifteen warmest years in Serbia were registered after 2000 (in the 1951-2015 period) and eleven warmest years in Belgrade (in the 1888-2015 period).



Figure 1. Ranking of the warmest years in Serbia

¹ **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 2. Mean annual air temperature trend in Serbia

The highest daily air temperature of 39.0°C in 2015 was measured on September 17 in Valjevo and Loznica. The highest number of tropical days², total of 69, was registered in Nis, which is 33 days above the average number of tropical days.

Belgrade observed 59 tropical days, which is 34 days above the average and 48 tropical nights, which is 40 nights above the average.

² Tropical day refers to a day with maximum air temperature 30°C and above



Figure 3. Daily mean air temperature anomaly for Belgrade compared to the normal for 1961-1990 period

The lowest daily air temperature of -26.2°C was measured on January 1 in Sjenica. There were fewer days with severe frost³ compared to the average values, the low-lying areas observed between 1 to 9 days and on the mountains their number ranged from 9 to 27 days.

The number of ice days⁴ during 2015 ranged from 1 in Loznica up to 9 in Dimitrovgrad, and on the mountains from 29 on Zlatibor and Sjenica up to 66 days on Kopaonik. Kikinda observed 19 days below the average number of 23 days, while 23 days below the average of 89 ice days were recorded on Kopaonik. Belgrade observed 3 ice days, which is 15 days below the average.

Precipitation

Across most of Serbia, the year of 2015 was averagely rainy. Extremely rainy was in Dimitrovgrad, and very dry in Veliko Gradiste and Pozega. Precipitations sums ranged from 423.9 mm in Kikinda up to 947.3 mm at Kopaonik. Percentage of the precipitation sums compared to the normal for the 1961-1990 base period was in a range from 71 in Veliko Gradiste up to 126 in Dimitrovgrad.

 $^{^{3}}$ Day with severe frost is defined as the day with the minimum air temperature below -10°C

⁴ Ice day is defined as the day with maximum air temperature below 0°C

The highest daily precipitation sum of 121.9 mm was registered in Novi Sad on May 25, surpassing the previous daily maximum at that main meteorological station.

The number of days with the snow cover ranged from 9 on Palic up to 33 days in Dimitrovgrad, and on the mountains from 95 days at Crni Vrh up to 162 at Kopaonik. The greatest snow depth of 149 cm was measured at Kopaonik on April 9. In the low-lying areas, the greatest snow depth of 28cm was recorded in Kursumlija on March 8.



Figure 4. Mean monthly precipitation totals for Serbia

Cold and heat waves

Cold spell⁵ was registered in the period from November 1 to 7 in parts of northern, central and eastern Serbia.

During 2015, most of Serbia experienced six heat waves⁶, while certain places observed even nine. The first heat wave was registered in January, with the average duration of 9 days, and the longest duration, total of 13 days, in Kikinda and Zrenjanin. The heat wave recorded between July 16 and 25 encompassed entire Serbia, lasting longest, total of 15 days, in Vranje and Dimitrovgrad. The following heat wave was observed in August, between 5 and 15, lasting 11 days at places. **This was the third longest heat wave in Belgrade, in its period of record since 1890.**

⁵ Cold wave, according to the percentile method, is a period during which minimum daily air temperature is in the very cold and extremely cold categories for 5 days or longer

⁶ Heat wave, according to the percentile method, is a period during which maximum daily air temperature is in the warm and very warm categories for 5 days or longer

Heat wave registered in the period from August 27 until September 4, lasted for 9 days at most places. Most of Serbia experienced heat wave in the middle of September and November.

During 2015, the strongest heat wave intensity⁷, was recorded in Loznica and Zrenjanin, whereas the lowest one was registered in Nis and Pozega.



Figure 5. Ranking of the 15 longest heat waves in Belgrade

Records set in 2015

January - record-breaking minimum number of frost days in Kursumlija; record-breaking daily precipitation sums in Leskovac and Nis.

March - wettest March on record for the 1925 – 2015 period in Loznica, Valjevo, Kraljevo and Kursumlija; record-breaking daily precipitation totals on Zlatibor and Belgrade.

April - 5th driest on record in Novi Sad and Zrenjanin.

⁷ Heat wave intensity represents a sum of maximum air temperature departures (for the days belonging to that heat wave) from the mean maximum air temperature for the reference period

May - record-breaking monthly air temperatures in Sjenica and Kopaonik; record-breaking daily precipitation sums for May in Novi Sad and Cuprija.

June - the lowest precipitation sums on record in Kikinda.

July - second warmest and second driest July on record across most of the country; in Zrenjanin as warm as July of 2012; two heat waves recorded, with exceptionally high mean daily air temperature anomalies.

August - record-breaking daily precipitation sums for August on Palic.

September - record-breaking daily air temperatures for September at 7 main meteorological stations; record-breaking number of tropical days for September on Zlatibor; record-breaking number of tropical nights in Zrenjanin, Loznica, Belgrade and Veliko Gradiste.

October - second wettest October on record for the 1926-2015 period in Vranje;

November - second warmest on record in Negotin and the third warmest on Crni Vrh.

December - driest one at seven main meteorological stations, and the warmest one in Negotin and Kopaonik.

Winter 2014/15 - the least number of frost days on record in Pozega.

Spring 2015 - record-breaking daily air temperatures in Kopaonik and Sjenica; record-breaking precipitation sums for spring in Novi Sad.

Summer 2015 - extremely warm; in Belgrade second warmest on record.

Autumn 2015 - record-breaking daily air temperatures for autumn at the 8 main meteorological stations in Serbia.

Appendix

Chart 1.

MEAN MONTHLY AND ANNUAL TEMPERATURE (°C) ACCORDING TO THE PERCENTILE METHOD REFERENCE PERIOD1961-1990



station/month	January	February	March	April	May	June	July	August	September	October	November	December	Year
PALIC	2.4	2.5	7.2	11.8	17.4	21.2	24.7	23.8	18.5	10.7	7.2	2.9	12.5
SOMBOR	2.6	2.2	7.0	12.1	17.6	20.8	24.1	23.4	17.9	10.6	7.3	3.2	12.4
NOVI SAD	2.8	2.6	7.2	11.9	18.0	20.8	24.8	24.5	18.8	11.2	7.8	3.2	12.8
ZRENJANIN	2.9	3.0	7.4	12.1	18.3	21.5	25.5	25.1	19.2	11.5	7.6	3.2	13.1
KIKINDA	2.4	2.8	7.2	11.6	17.6	21.4	25.1	24.5	18.9	11.0	7.3	3.0	12.7
LOZNICA	3.6	2.9	6.8	12.4	18.1	20.7	24.7	24.0	18.9	12.0	7.9	3.7	13.0
S.MITROVICA	2.4	2.7	7.1	11.9	18.2	20.7	24.1	23.3	18.5	11.5	6.9	3.1	12.5
VALJEVO	3.0	3.0	6.7	11.9	18.0	20.6	25.3	23.9	18.9	11.9	7.6	3.3	12.9
BELGRADE	4.0	4.1	8.2	13.5	19.0	21.9	26.7	26.0	19.9	12.3	9.2	4.3	14.1
KRAGUJEVAC	3.1	2.9	6.8	11.6	17.3	19.9	24.4	23.6	19.4	11.6	7.5	3.3	12.6
S.PALANKA	2.9	3.2	7.0	11.8	17.7	20.5	25.0	24.1	19.5	11.4	7.3	3.2	12.8
V.GRADISTE	2.1	3.2	7.1	11.5	17.6	20.7	24.9	24.5	20.0	11.7	6.8	2.8	12.7
CRNI VRH	-1.7	-3.0	0.5	6.4	13.0	15.1	19.9	19.3	14.3	5.9	6.1	1.7	8.1
NEGOTIN	2.5	1.9	7.2	13.1	19.6	22.4	26.7	24.3	19.6	11.1	9.5	5.7	13.6
ZLATIBOR	-0.8	-0.7	1.9	6.5	13.9	15.7	20.7	20.1	15.3	8.9	5.9	0.4	9.0
SJENICA	-3.0	-2.6	1.5	5.5	12.9	14.4	18.9	17.8	14.2	8.3	3.5	-1.6	7.5
POZEGA	0.0	1.8	5.4	10.0	16.5	18.2	22.3	21.6	17.6	10.7	4.8	0.5	10.8
KRALJEVO	2.3	3.0	6.3	11.6	17.5	19.7	24.6	23.8	19.4	11.6	7.3	2.3	12.5
KOPAONIK	-3.7	-4.8	-3.2	0.9	8.6	10.3	15.4	15.1	11.3	5.3	3.4	-0.3	4.9
KURSUMLIJA	1.8	2.1	5.1	10.0	16.6	18.0	22.7	21.7	17.8	11.0	6.9	2.1	11.3
KRUSEVAC	1.9	2.9	6.2	11.4	17.7	19.8	24.4	23.7	19.3	11.4	7.1	2.2	12.3
CUPRIJA	2.0	2.6	6.5	11.2	17.5	19.7	24.3	23.8	19.4	11.4	6.4	2.6	12.3
NIS	1.9	3.6	6.9	11.6	18.3	20.1	25.2	24.8	20.1	12.1	7.6	2.9	12.9
LESKOVAC	1.3	3.0	6.2	10.8	17.8	19.7	24.4	23.6	18.8	11.5	6.5	1.7	12.1
ZAJECAR	1.1	1.1	6.0	11.4	17.4	20.0	24.6	22.7	18.6	10.0	8.2	3.8	12.1
DIMITROVGRAD	0.7	2.1	4.9	9.2	16.2	17.6	22.5	22.2	18.1	10.7	7.0	2.0	11.1
VRANJE	0.9	3.5	5.7	10.7	17.7	19.6	24.7	23.9	19.4	12.1	7.8	2.4	12.4
	EXTREMELY WARM		VERY WARM		WARM	NORMAL		COLD	VERY COLD		EXTREMELY COLD		

Chart 2.

MONTHLY AND ANNUAL PRECIPITATION (mm) ACCORDING TO THE PERCENTILE METHOD REFERENCE PERIOD1961-1990





Graph 1. Ranking of the warmest years in descending order for Negotin



Graph 2. Ranking of the warmest years in descending order for Belgrade



Figure 1. Spatial distribution of the mean annual air temperature (°C)





Figure 2. Spatial distribution of the mean annual air temperature anomaly (°C)

Figure 3. Spatial distribution of the mean annual air temperature using percentile method



Figure 4. Spatial distribution of the annual precipitation sums expressed in mm



Figure 5. Spatial distribution of the annual precipitation sums expressed in the percentages of normal for the 1961-1990 base period





Figure 6. Spatial distribution of the annual precipitation sums using percentile method

Figure 7. Insolation expressed in hours



Figure 8. Insolation expressed in the percentages of normal for the

1961-1990 base period



Figure 9. Spatial distribution of the heat waves intensity registered during summer 2015