Republic Hydrometeorological Service of Serbia
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Republic of Serbia

MONTHLY BULLETIN FOR SERBIA

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Division for Climate Monitoring and Climate Forecast
Department of National Center for Climate Change, Climate Model Development and Disaster Risk Assessment
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- ***Record low number of insolation hours for Loznica, Zajecar and Crni Vrh***

AIR TEMPERATURE

Mean monthly air temperature

Mean air temperature in June ranged from 18,6ºC in Pozega and Kursumlija to 21,8ºC in Belgrade, and on the mountains from 11,4ºC at Kopaonik to 15,5ºC at Zlatibor (*Figure 1*).

Departure of the mean monthly air temperature from the normal[1] for the 1991-2020 base period ranged from -1,4ºC in Zajecar to +0,6ºC in Novi Sad (*Figure 2*).

Mean June air temperature, based on the percentile method[2], was in the normal category in most of the country and cold in Zajecar (*Figure 3*).

[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, 1991 to December 31, 2020

[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

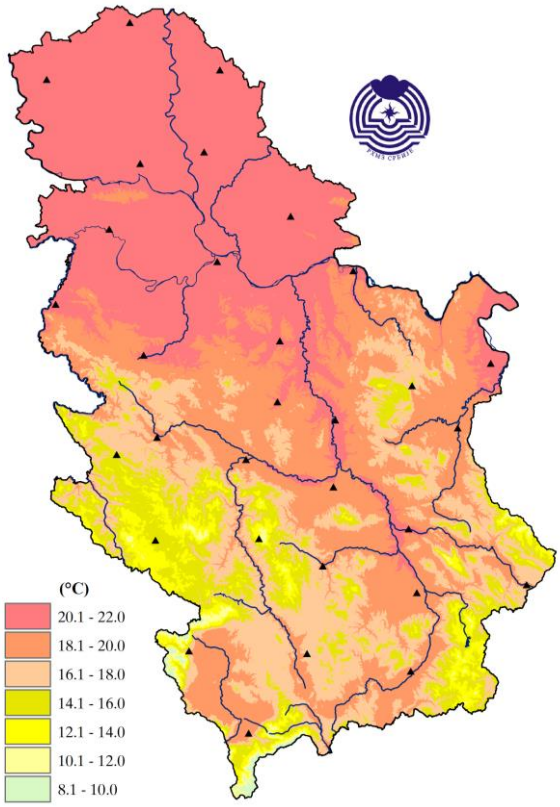


Figure 1. Spatial distribution of mean monthly air temperature (ºC)

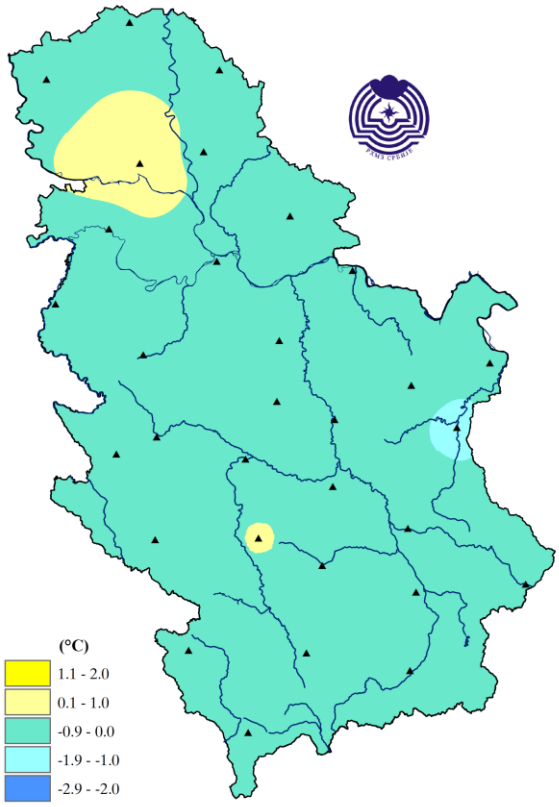


Figure 2. Spatial distribution of mean monthly air temperature anomaly (ºC)

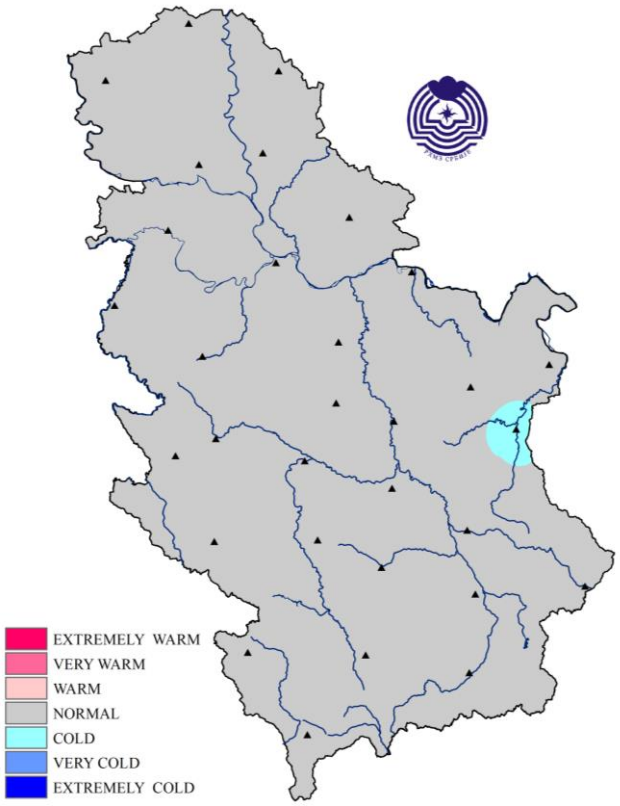


Figure 3. Spatial distribution of the mean monthly air temperature using percentile method

Mean daily air temperature in Belgrade, based on the percentile method, was in the cold and very cold category at the beginning and middle of the second decade of June. At the beginning of the third decade of June, it was in the very warm category (*Figure 4).* Daily course of the mean daily air temperature and the accompanying percentiles for the stations Sombor, Novi Sad, Loznica, Negotin, Kragujevac, Zlatibor, Nis and Vranje are given in the Appendix.

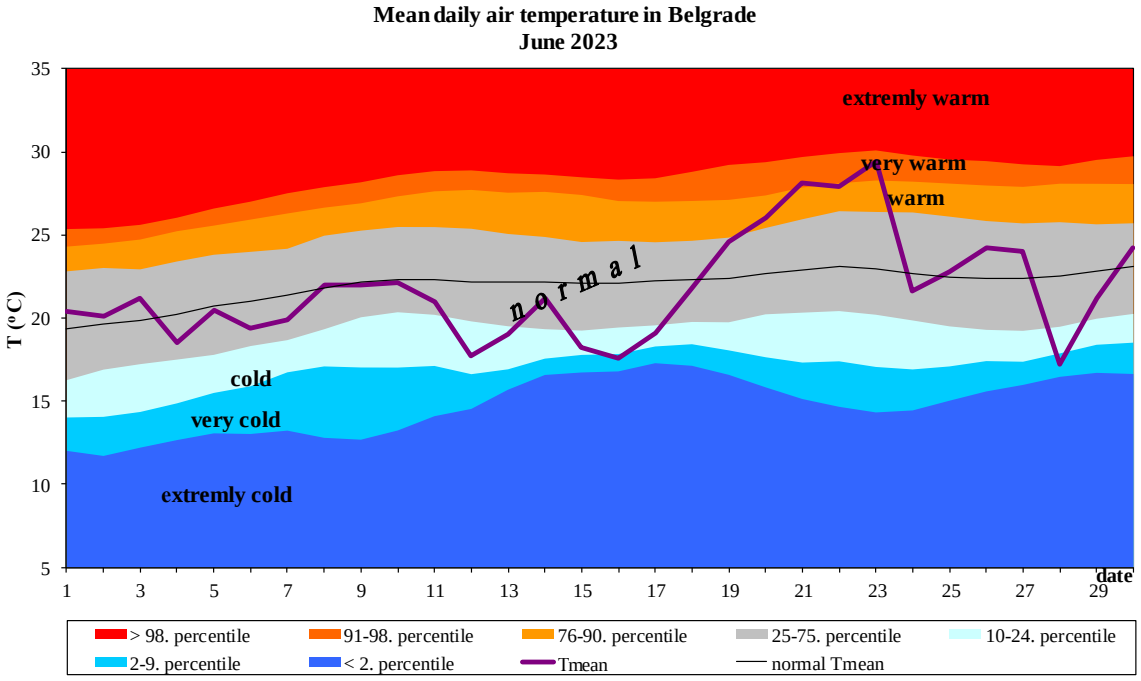


Figure 4. Daily course of the mean daily air temperature and accompanying percentiles for Belgrade

Maximum air temperature

Mean maximum air temperature in June ranged from 24,8ºC in Pozega to 27,3ºC in Sombor, whilst Belgrade observed air temperature of 26,5°C. As for the mountains, mean maximum June air temperature ranged from 15,4ºC at Kopaonik to 21,2ºC in Sjenica.

Based on the percentile method, mean maximum air temperature was in following categories: normal and cold category in most of the country, cold category in Kragujevac, and extremely cold in Zajecar.

In Serbia, the highest maximum daily air temperature of 36,0ºC was measured in Sombor on June 23. On the same day, Belgrade recorded air temprature of 34,7ºC.

Summer days[3] were recorded in entire Serbia apart from Kopaonik. Number of summer days ranged from 13 to 22 days, in the upland up to 5 days were recorded. In most of the country, the observed number of summer days was within the average, apart from western, central and eastern Serbia where there were 3 to 4 days below the June average.

[3] Summer day refers to a day with maximum daily air temperature 25°C and above

Most of the country observed 3 to 7 tropical days[4], which is 3 to 7 days below the June average.

Figure 5 shows daily course of the maximum daily air temperature and the accompanying percentiles for Belgrade in June 2023 and for the stations Sombor, Novi Sad, Loznica, Negotin, Kragujevac, Zlatibor, Nis and Vranje are given in the Appendix.

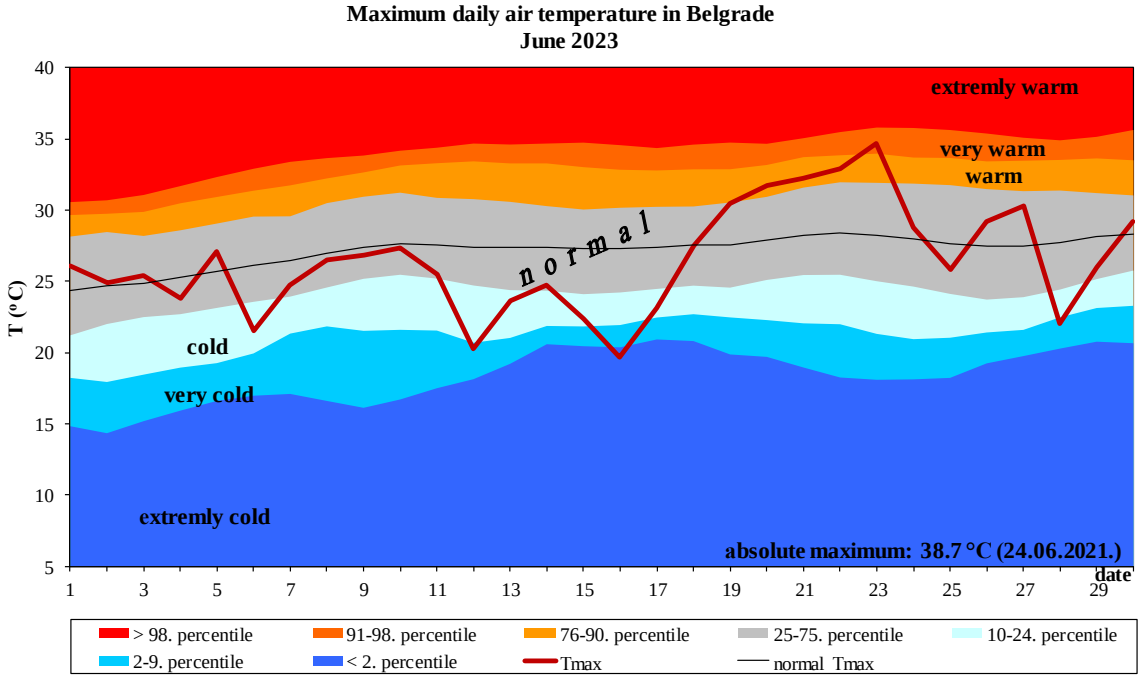


Figure 5. Daily course of the maximum daily air temperature and accompanying percentiles for Belgrade

Minimum air temperature

Mean minimum air temperature in June ranged from 13,6ºC in Dimitrovgrad to 17,0ºC in Belgrade. On the mountains, mean minimum air temperature ranged from 8,0ºC at Kopaonik to 12,1ºC at Crni Vrh.

Based on the percentile method, mean minimum monthly air temperature was in the following categories: normal in most of the country, warm in Sremska Mitrovica and southern parts of the country, very warm in Sjenica and Leskovac, and extremely warm in Dimitrovgrad.

The lowest minimum daily air temperature of 3,3ºC was measured at Kopaonik on June 29. As for the lowland, the lowest daily air temperture of 8,8ºC was recorded in Kursumlija on June 29. On June 5, Belgrade recorded the lowest air temperture of 13,9ºC.

Number of tropical nights[5] was the following: Belgrade recorded three tropical nights, Novi Sad, Loznica and Negotin registered 2, Palic, Sombor, Zrenjanin, Veliko Gradiste, Krusevac, Cuprija and Nis observed 1 tropical night.

Figure 6 shows assessment of the minimum and maximum air temperature in Serbia for June based on the tercile distribution relative to the 1991-2020 base period. It can be noted that the

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

mean minimum air temperature was slightly above the lower tercile, while the mean maximum air temperatue was at the lower tercile boundary.

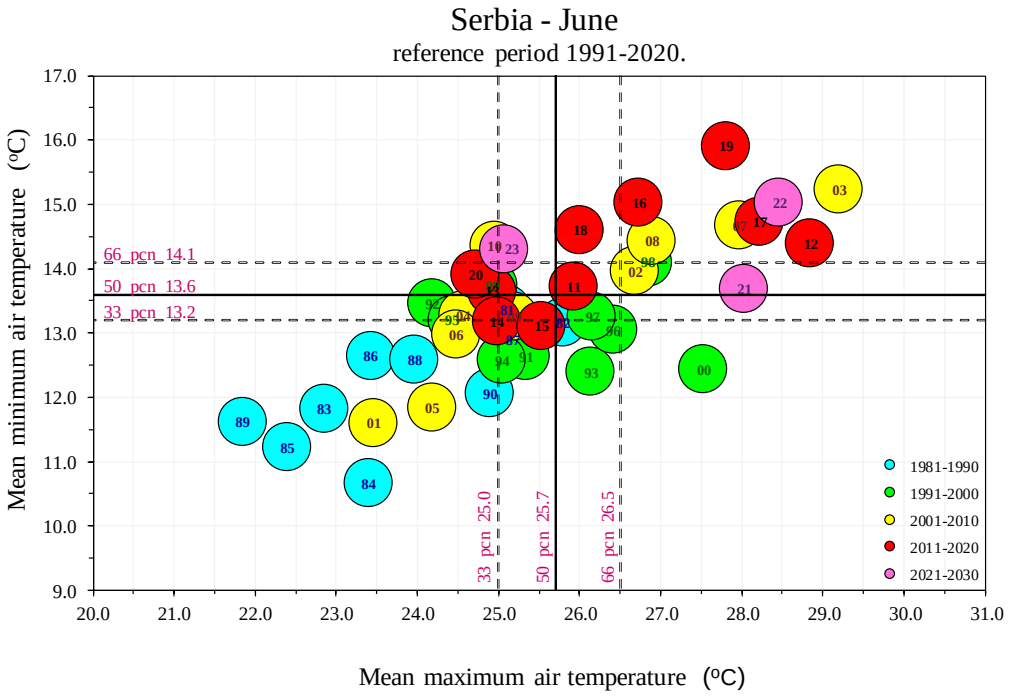


Figure 6. Assessment of minimum and maximum air temperature for Serbia with the accompanying terciles in relation to the 1991-2020 base period

Figure 7 shows daily course of the minimum daily air temperature and the accompanying percentiles for Belgrade in June 2023, and for the stations Sombor, Novi Sad, Loznica, Negotin, Kragujevac, Zlatibor, Nis and Vranje are given in the Appendix.

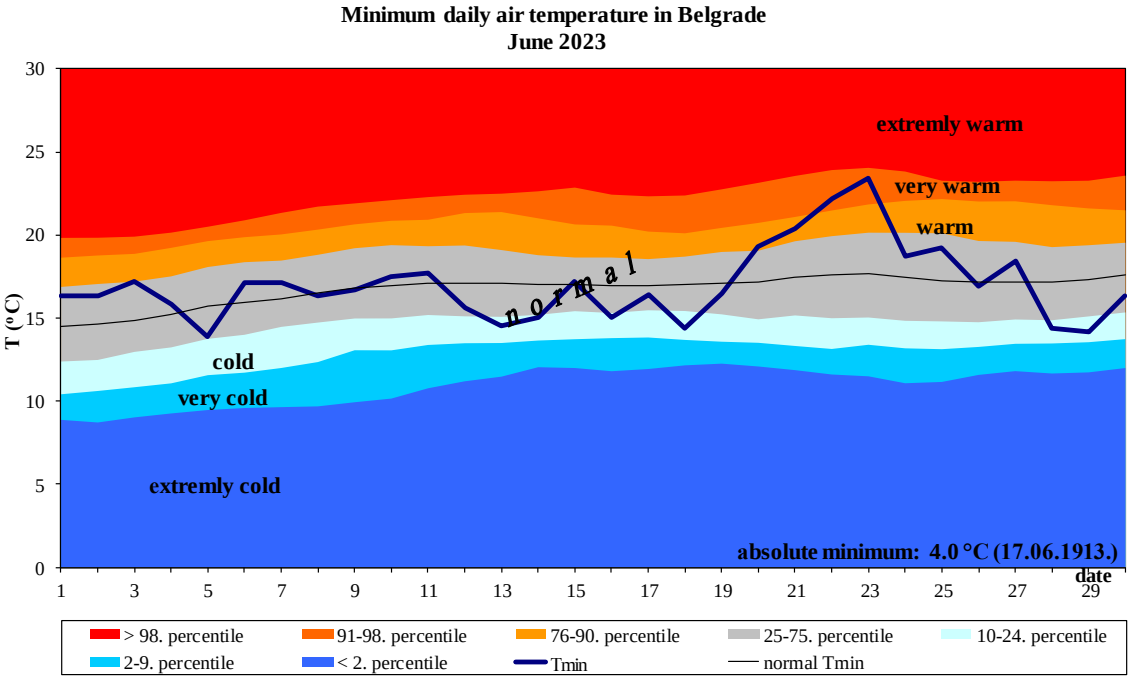


Figure 7. Daily course of the minimum daily air temperature and accompanying percentiles for Belgrade

PRECIPITATION

June 2023 ranks as the wettest for Kursumlija (*Figure 8*) and Sjenica since 1925. Kursumlija observed **fourfold increase** in precipitations sums compared to the June average.

Kursumlija recorded 239,8 mm of precipitation breaking the previous record of 173,0 mm set in June 1953. In June 2023, Sjenica received 198,9 mm of precipitation besting the previous record of 182,0 mm set in 1999.

June 2023 ranks as **the 2nd wettest** for Cuprija (only after June 1969) and Krusevac (only after June 1940), **the 3rd wettest** for Crni Vrh and **the 4th wettest** for Dimitrovgrad (*Table 1*). June 2023 ranks as **the 9th wettest** for Serbia since 1951 (*Figure 9).*

Table 1. June 2023 ranking based on precipitation sums, average and percentage from normal 1991-2020

STATION	historical period	∑RR for June 2023 (mm)	normal for June **1991-2020**	percentage (%) from normal	ranking for June 2023 (descending RR)
KURSUMLIJA	1925-2022	239.8	59.9	400	**1**
SJENICA	1925-2022	198.9	79.7	250	**1**
CUPRIJA	1925-2022	209.1	74.5	281	2
KRUSEVAC	1925-2022	172.6	70.8	244	2
C.VRH	1966-2022	224.8	87.1	258	3
DIMITROVGRAD	1926-2022	170.0	71.4	238	4
ZLATIBOR	1950-2022	215.0	115.1	187	5
NEGOTIN	1941-2022	129.0	61.3	210	7
POZEGA	1925-2022	143.1	89.1	161	8
PALIC	1936-2022	135.8	77.6	175	8

The highest June precipitation sums were recorded during first half of the month. Average precipitation sums for the entire month were reached already until June 17, at most places, mostly in central and southwestern Serbia, precipitation sums were within the domains of very rainy and extremely rainy.

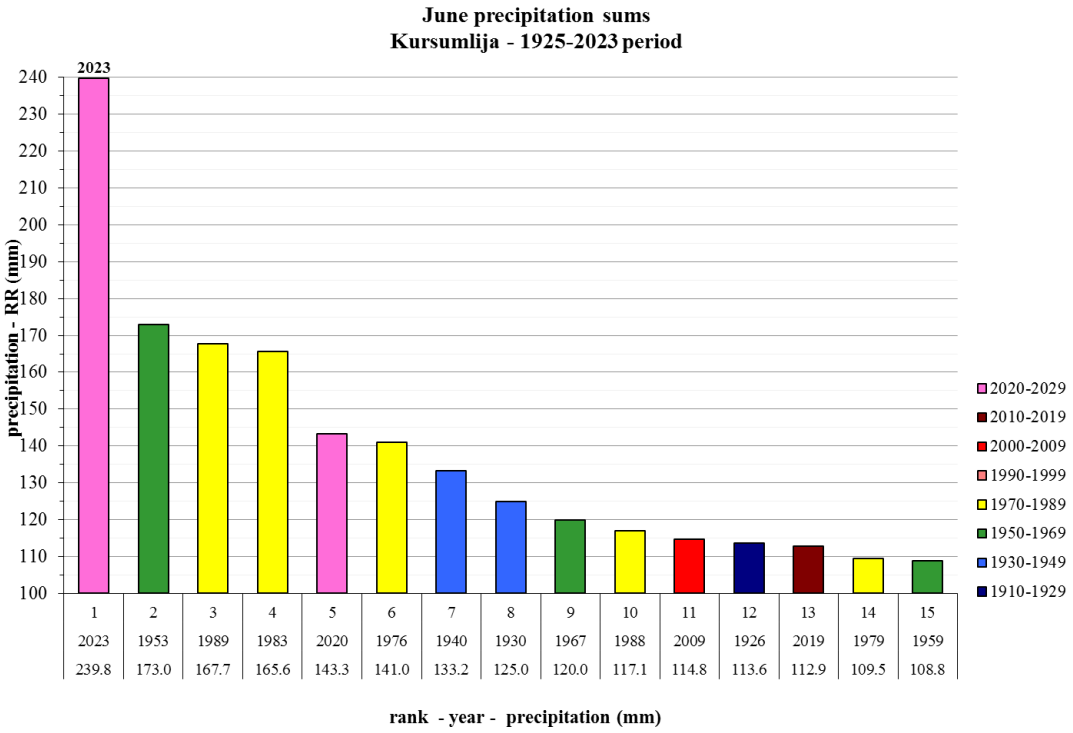


Figure 8. The highest precipitation in Kursumlija

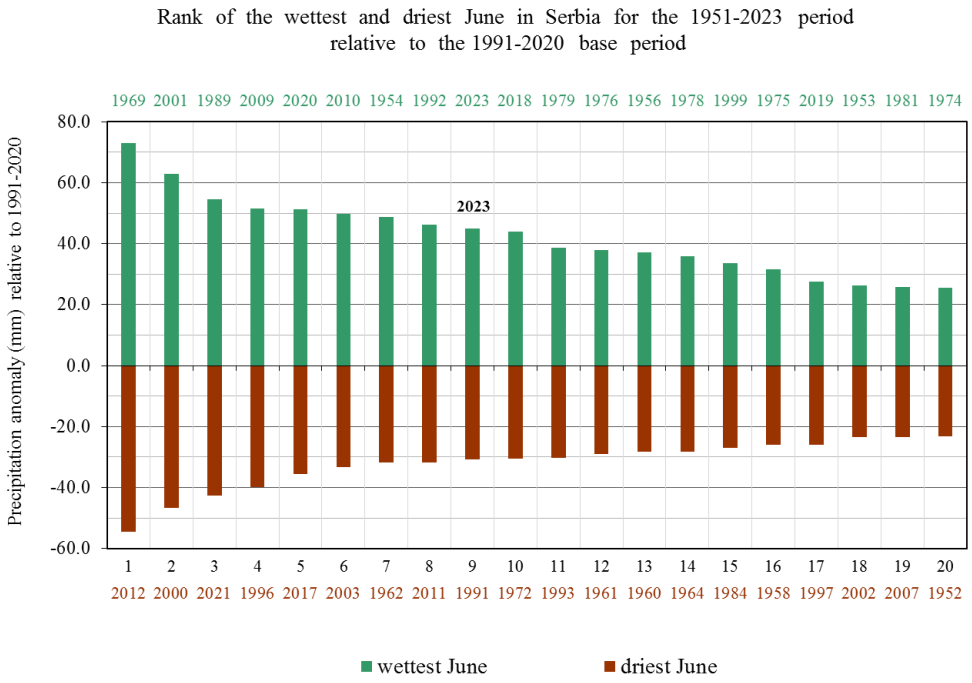


Figure 9. Ranking driest and wettest June in Serbia for the 1951-2023 period

Precipitation sums in June ranged from 35,4 mm in Novi Sad to 239,8 mm in Kursumlija, whilst Belgrade recorded 75,6 mm of precipitation (*Figure 10*).

Precipitation total compared to the normal for the 1991-2020 base period ranged from 38% in Novi Sad to 400% in Kuršumlija (*Figure 11*).

Based on the percentile method, precipitation sums were in the following categories: normal category in most of the northern and northwestern Serbia, as well as Kraljevo, Zajecar and Smederevska Palanka, dry in Novi Sad and Loznica, rainy to extremely rainy in the northernmost, south, southwest and east of Serbia (*Figure 12).*

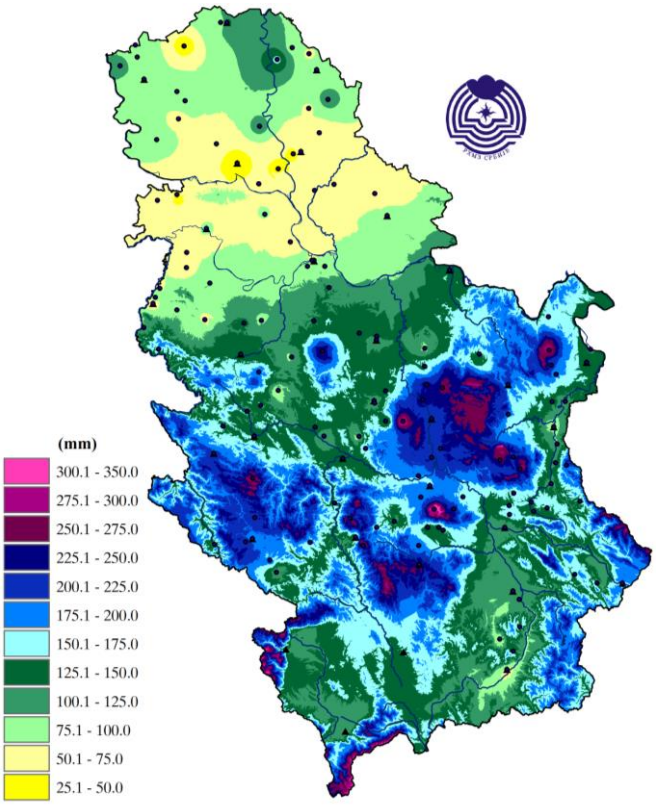


Figure 10. Spatial distribution of the monthly precipitation sums (mm) according to data from 28 major meteorological, 22 climatological and 95 rain gauge stations

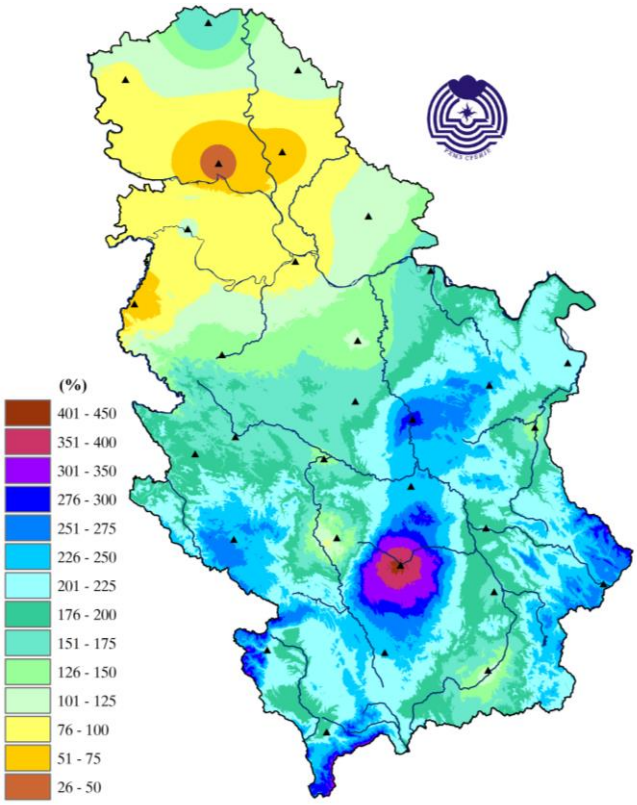


Figure 11. Spatial distribution of the monthly precipitation sums in the percentages of normal for the 1991–2020 base period

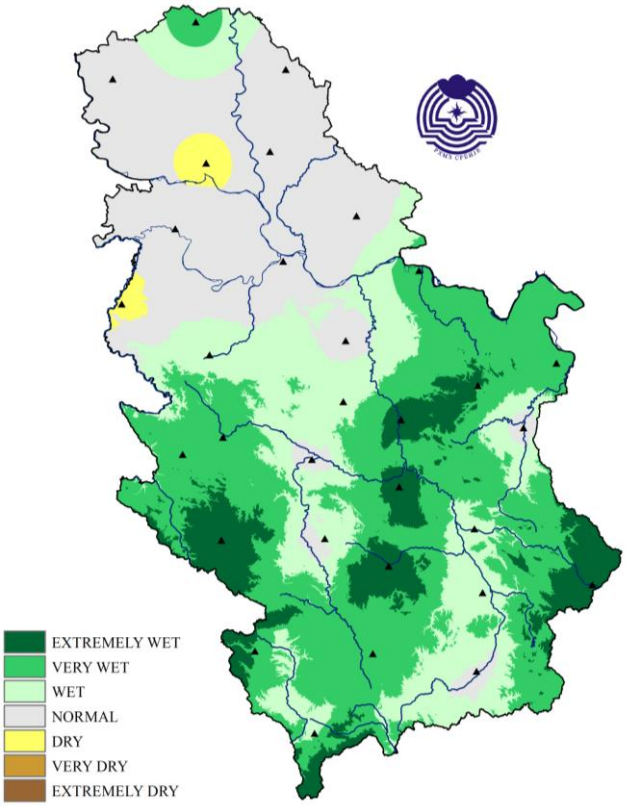


Figure 12. Monthly precipitation sums according to the percentile method

The highest daily precipitation sum of 74,4 mm was measured in Cuprija on June 13. On June 16, Belgrade observed the highest daily precipitation sum of 39,1 mm.

Number of days with precipitation in June ranged from 11 in Novi Sad to 21 in Sjenica, Krusevac, Zlatibor and Kopaonik (*Figure 13).* The observed number of days with precipitation was 2 to 7 days above the average in most of the country, in Krusevac 10 days above the average (*Figure 14).*

One day with precipitation of 50 mm and above was recorded in Cuprija, Valjevo and Kursumlija.

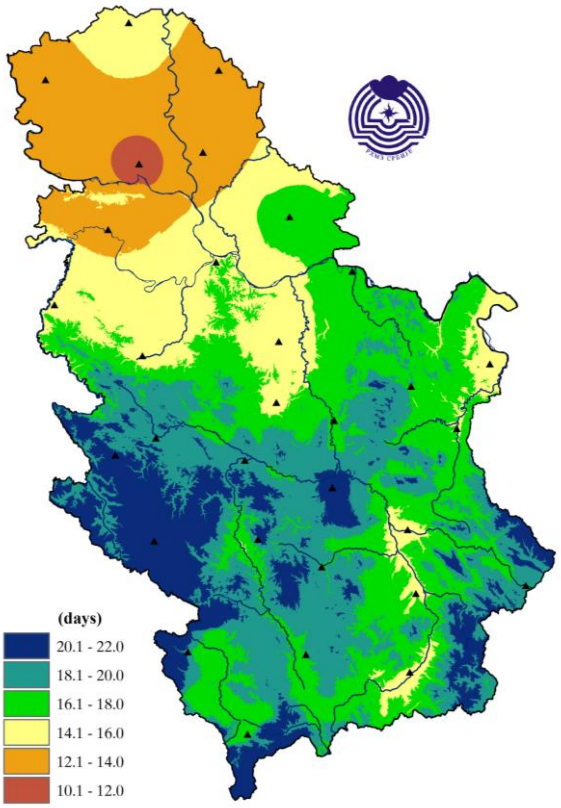


Figure 13. Spatial distribution of number of days with precipitation

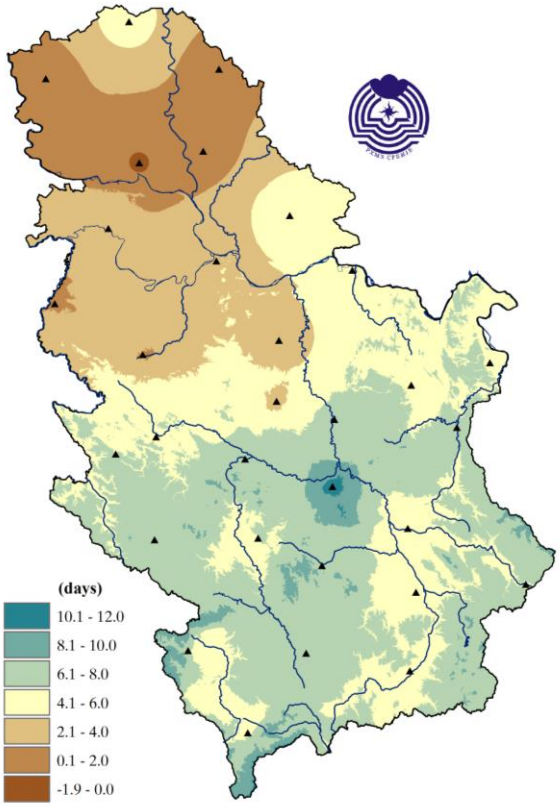


Figure 14. Spatial distribution of deviation of number of days with precipitation

Figure 15 shows assessment of air temperature and precipitation sums for Serbia for June based on the tercile distribution relative to the 1991 – 2020 base period. It can be noted that June 2023 was marked by average air temperature and precipitation sums significantly above the upper tercile boundary.

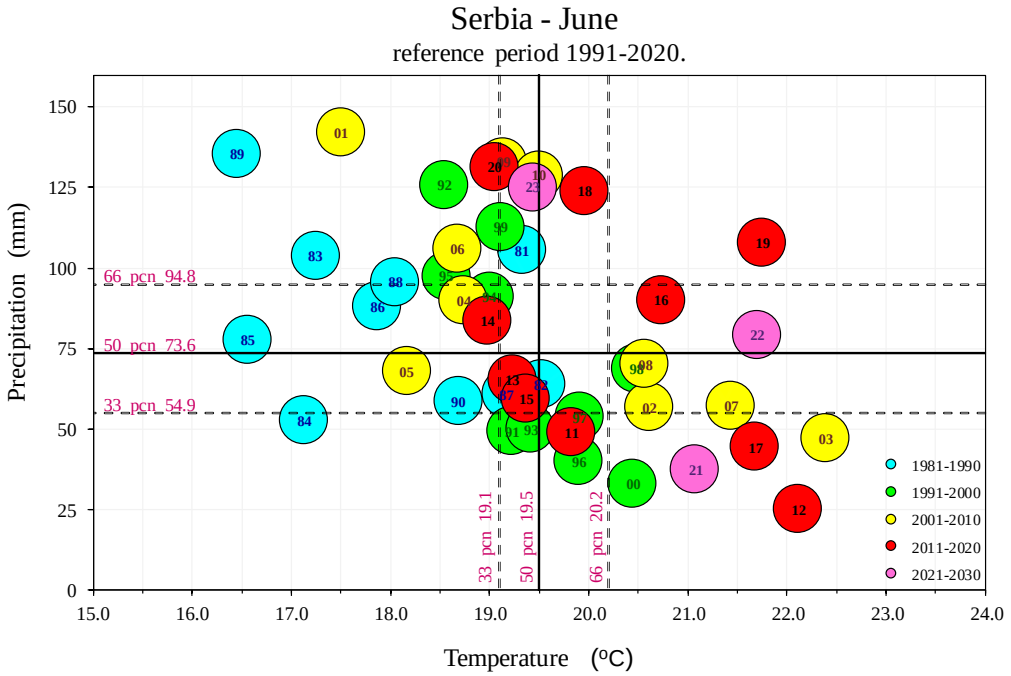


Figure 15. Assessment of air temperature and precipitation for Serbia with the accompanying terciles in relation to the 1991-2020 base period

Figure 16 show daily and cumulative precipitations sums with averaged normal 1991-2020 for June in Belgrade, and for the stations Sombor, Novi Sad, Loznica, Negotin, Kragujevac, Zlatibor, Nis and Vranje precipitation sums are given in Appendix.

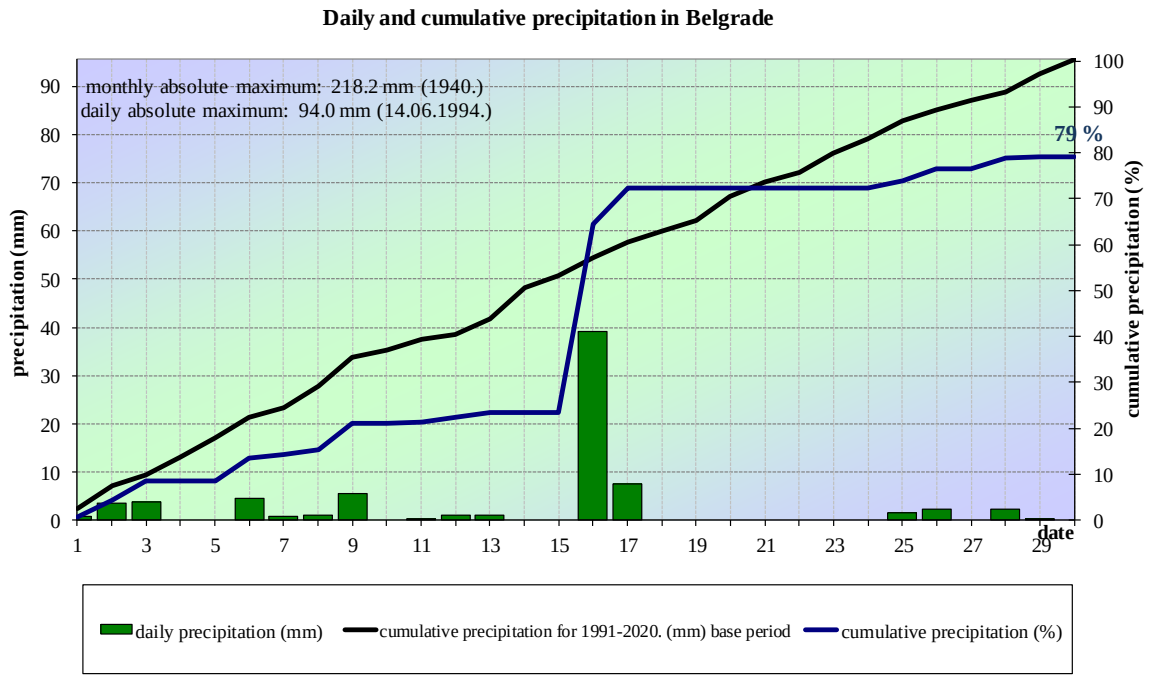


Figure 16. Daily and cumulative precipitation in Belgrade

CLOUD COVER, BRIGHT AND CLOUDY DAYS

Mean June cloud cover in Serbia was around or slightly above the average, ranging from 5/10 to 7/10. Figures 17, 18 and 19 show average daily cloud cover in June for Belgrade, Sjenica and Sombor.

Bright days[6] were not recorded in Pozega. The highest number of bright day, total of 8, was recorded in Sombor. Belgrade recorded 6 bright days. The observed number of bright days was 4 days below June average.

The fewest number of cloudy days[7] was recorded in Belgrade, total of 4 days, whilst the highest number of cloudy days, total of 17, was recorded in Sjenica. Number of cloudy days ranged from 2 to 5 in the north, elsewhere it was between 6 and 11 above June average. There was r**ecord-breaking number of cloudy days** in Sjenica, Dimitrovgrad and Kursumlija since the record-keeping at these stations began. Sjenica observed 17 days breaking the previous record of 16 days set in 1989. Dimitrovgrad observed 13 days besting the previous record of 12 days set in June 1949. Kursumlija observed 12 days besting the previos record of 11 days set in June 1983 and 2013.

[6] Bright day refers to a day with cloud cover less than 2/10
[7] Cloudy day refers to a day with cloud cover over 8/10

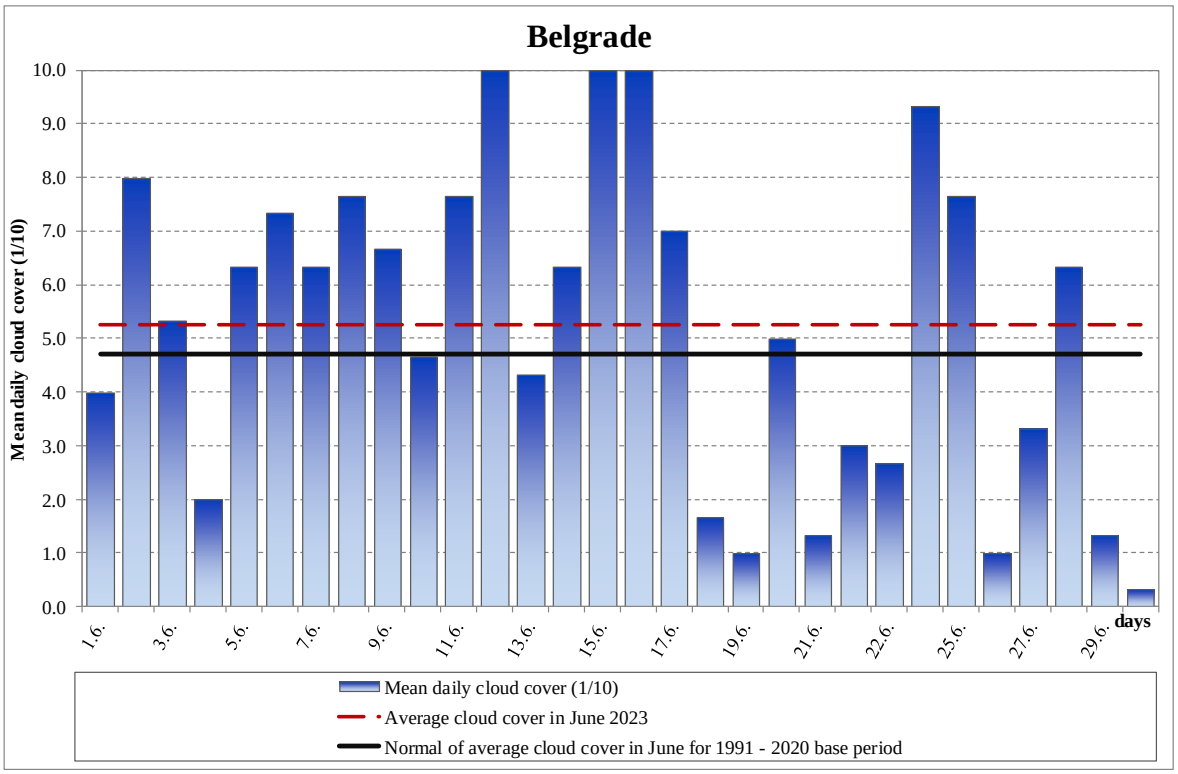


Figure 17. Mean daily cloud cover in Belgrade

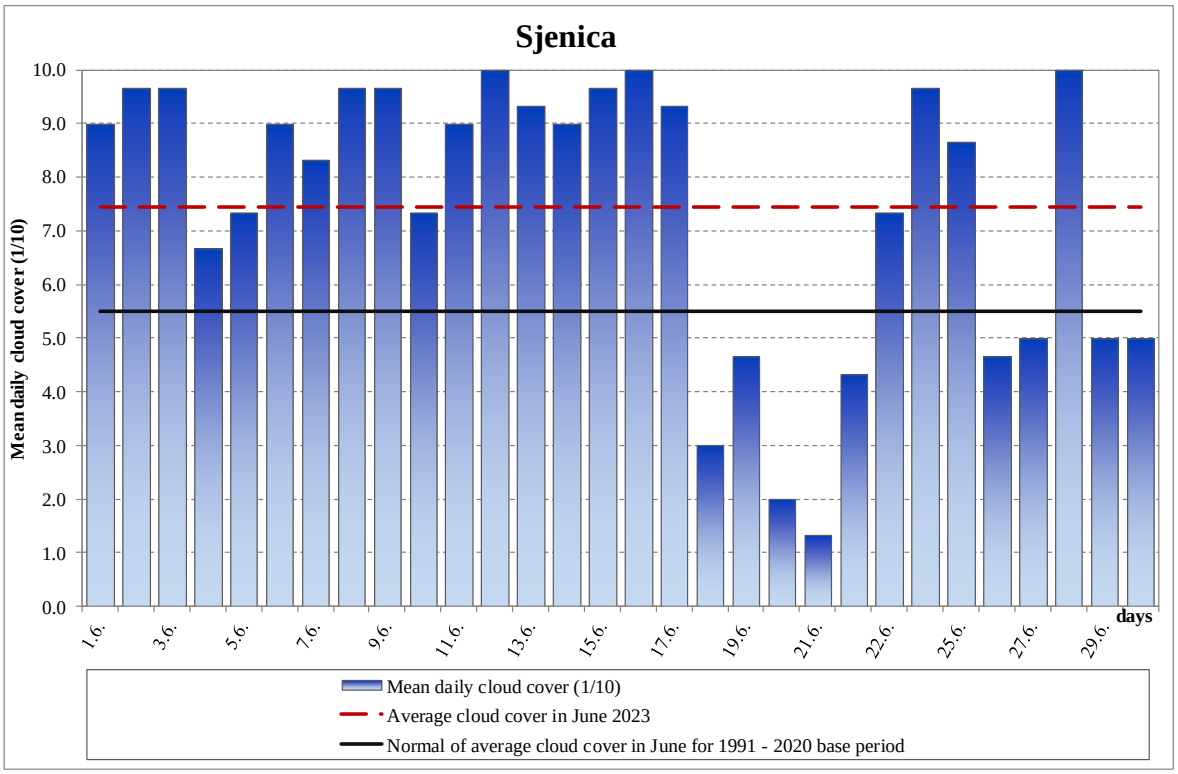


Figure 18. Mean daily cloud cover in Sjenica

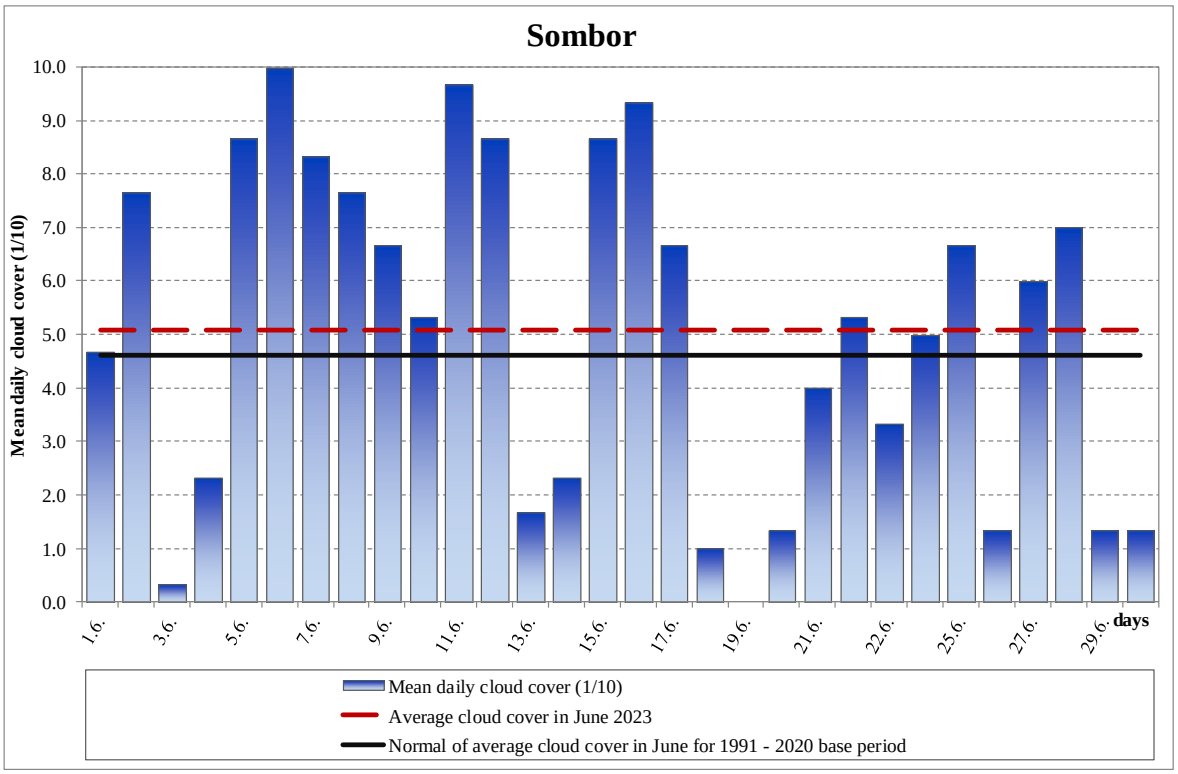


Figure 19. Mean daily cloud cover in Sombor

SUNSHINE DURATION (INSOLATION)

Sunshine duration in June ranged from 137,9 hours at Crni Vrh to 271,4 hours in Kikinda (*Figure 20*).

In Loznica, Zajecar and Crni Vrh, **the minimum number of insolation hours was exceeded.** Insolation in Loznica was 161,8 hours, breaking the previous June record of 177, 5 set in June 1969. Insolation in Zajecar was 154,3 hours breaking the previous record of 174,9 hours set in 1989. Insolation at Crni Vrh was 137,9 hours besting the previous record of 157,9 set in June 1992.

Sunshine duration in June ranged from 53% at Crni Vrh to 96% in Kikinda relative to the normal for the 1991-2020 base period (*Figure 21).*

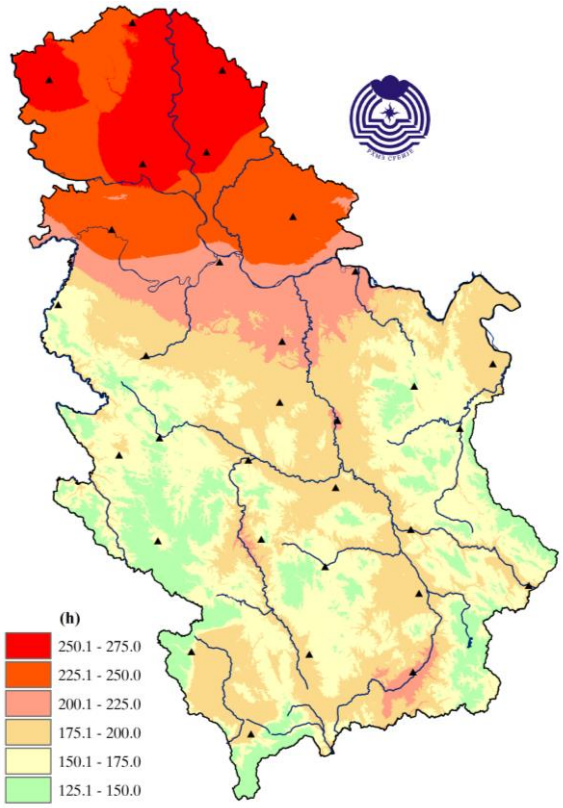


Figure 20. Insolation, expressed in hours

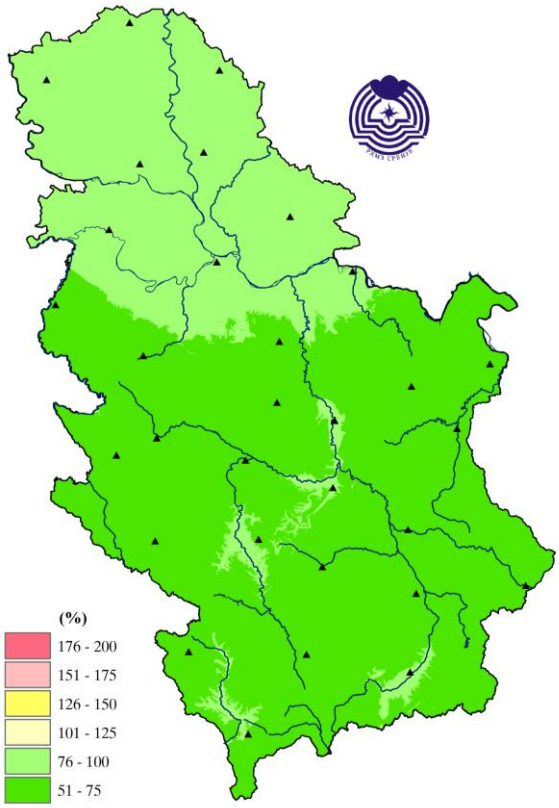


Figure 21. Insolation expressed in the percentages of normal

*** Note:** Climate analysis of meteorological elements was done based on the preliminary data obtained from 28 main meteorological stations

OVERVIEW OF THE SYNOPTIC SITUATION*

Prevailing influence of the eastern Atlantic and Mediterranean as the permanent source of moisture and frequent cyclogenesis in the Genoa Bay, Adriatic and Ioannina Sea, at the end of the second and beginning of third decade, ridge from the south, 7-day summer, warm and mostly dry

First half of the month was marked by weakly gradient and spatial geopotential field spanning from central-eastern Atlantic towards Mediterranean including parts of central Europe as the permanent source of humidity. Accordingly, occasionally pronounced ground low pressure in the Genoa Bay, Adriatic and Ioannina Sea, produced by incursion of warm air from the south and meridional ill-formation from the north of the continent brought, aside from changeable and unsettled weather, isolated heavy downpours and severe weather events.

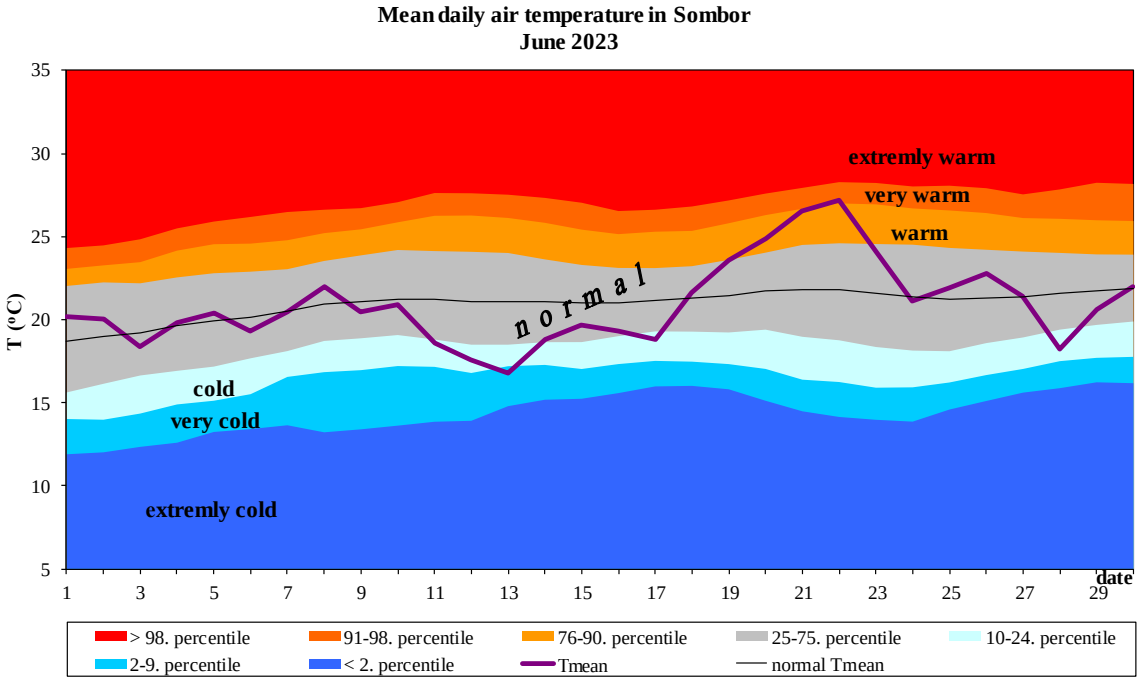
Establishing of the ridge geopotential and warm air across the central Mediterranean spreading towards the Balkans and Pannonia Plain was observed in the second part of the second decade producing sunny and mostly bright weather across the entire country.

Following the strong development of low pressure in the northwest of the continent as well as western Mediterranean, the third week was marked by series of frontal waves from the west and northwest accompanied by rain, showers and thunderstorms, briefly with considerable temperature drop.

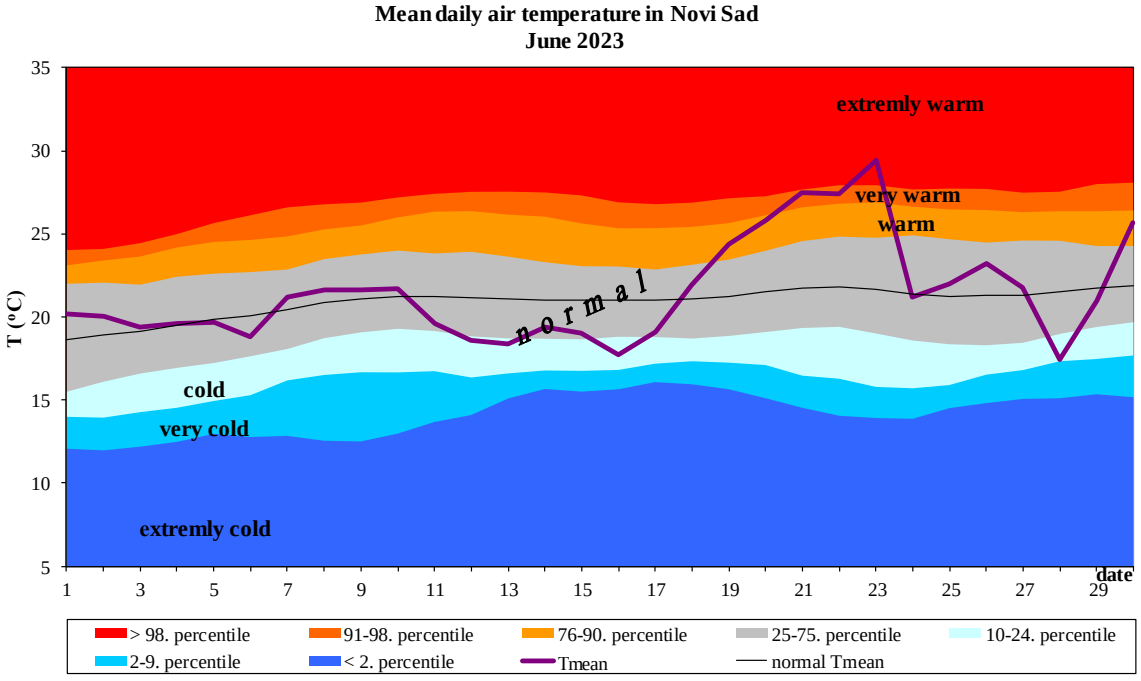
* National Center for Hydrometeorlogical Early Warning System

APPENDIX

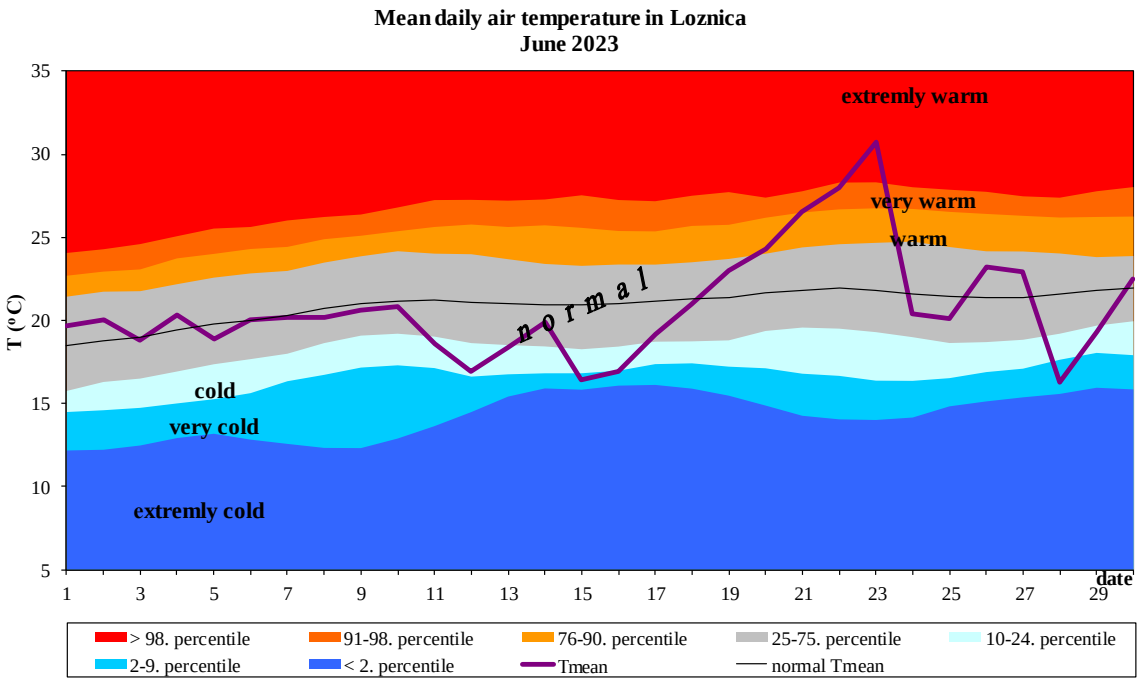
Mean air temperature



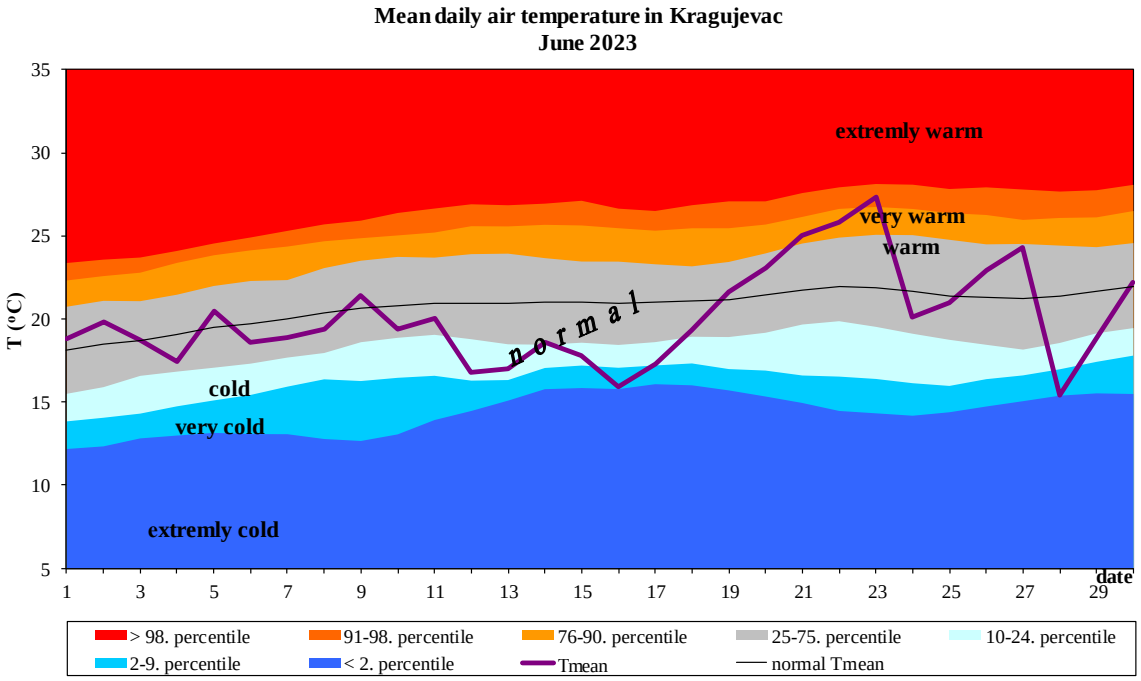
Appendix 1. Daily course of the mean daily air temperature and accompanying percentile for Sombor



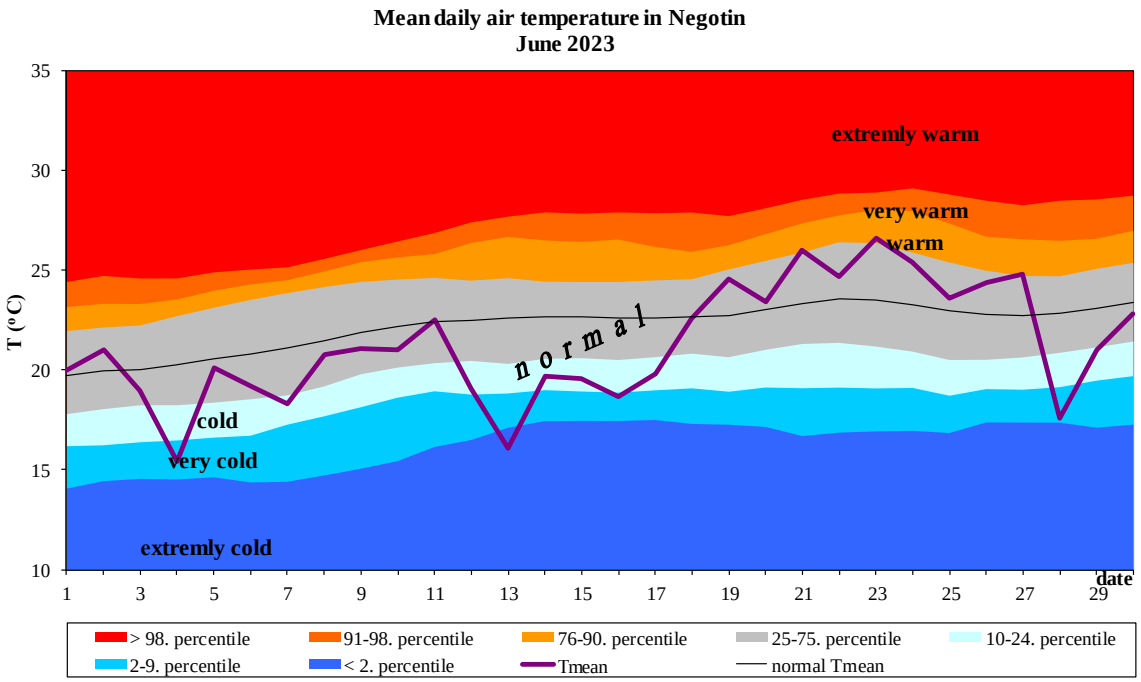
Appendix2. Daily course of the mean daily air temperature and accompanying percentile for Novi Sad



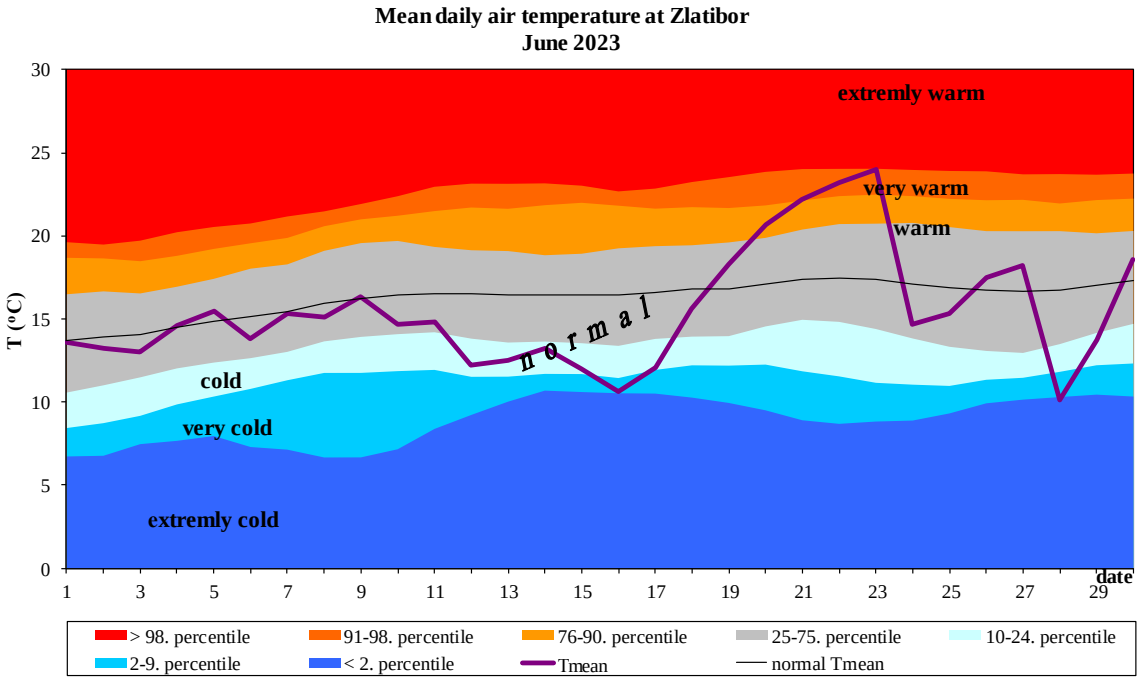
Appendix 3. Daily course of the mean daily air temperature and accompanying percentile for Loznica



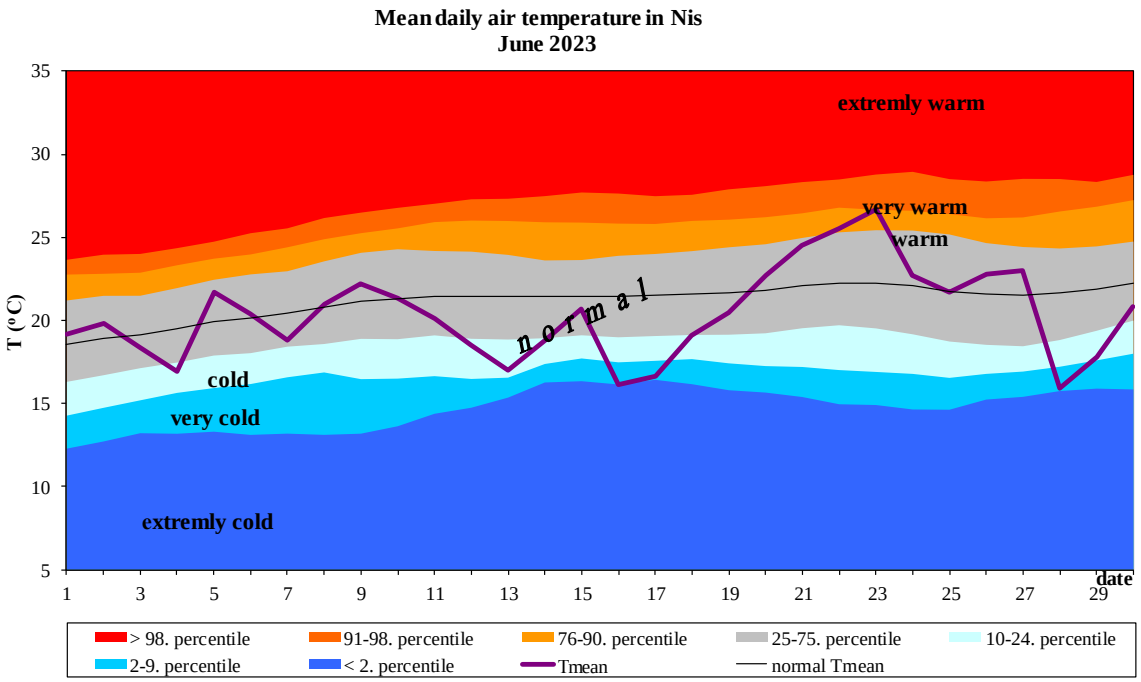
Appendix 4. Daily course of the mean daily air temperature and accompanying percentile for Kragujevac



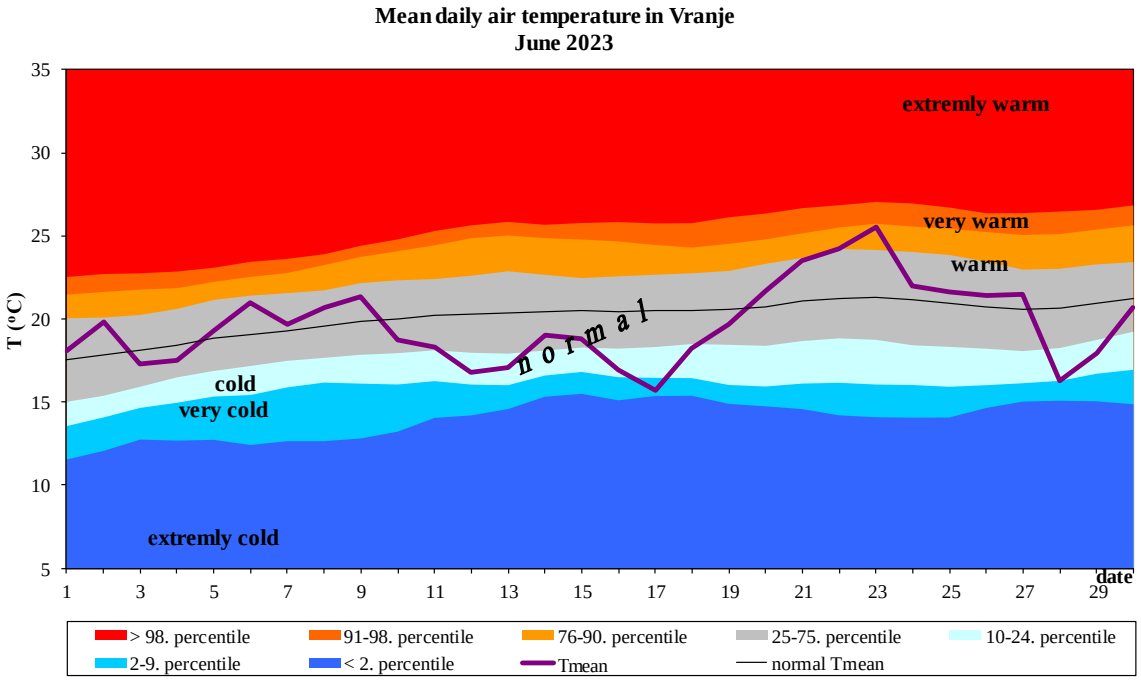
Appendix 5. Daily course of the mean daily air temperature and accompanying percentile for Negotin



Appendix 6. Daily course of the mean daily air temperature and accompanying percentile on Zlatiboru

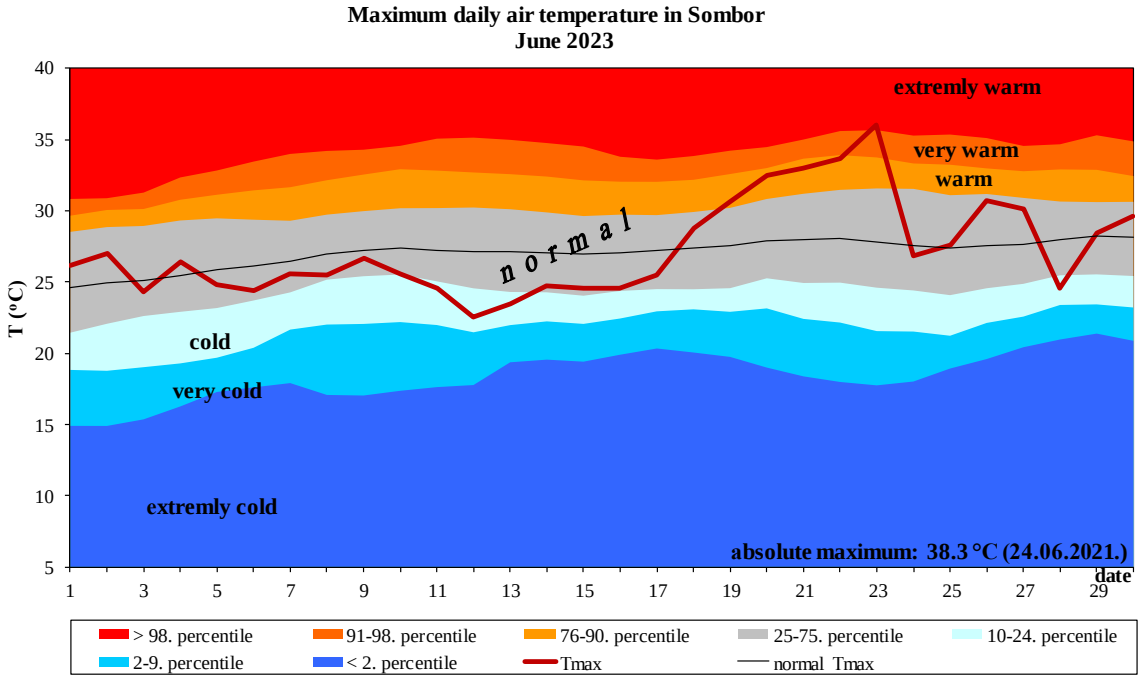


Appendix 7. Daily course of the mean daily air temperature and accompanying percentile for Nis

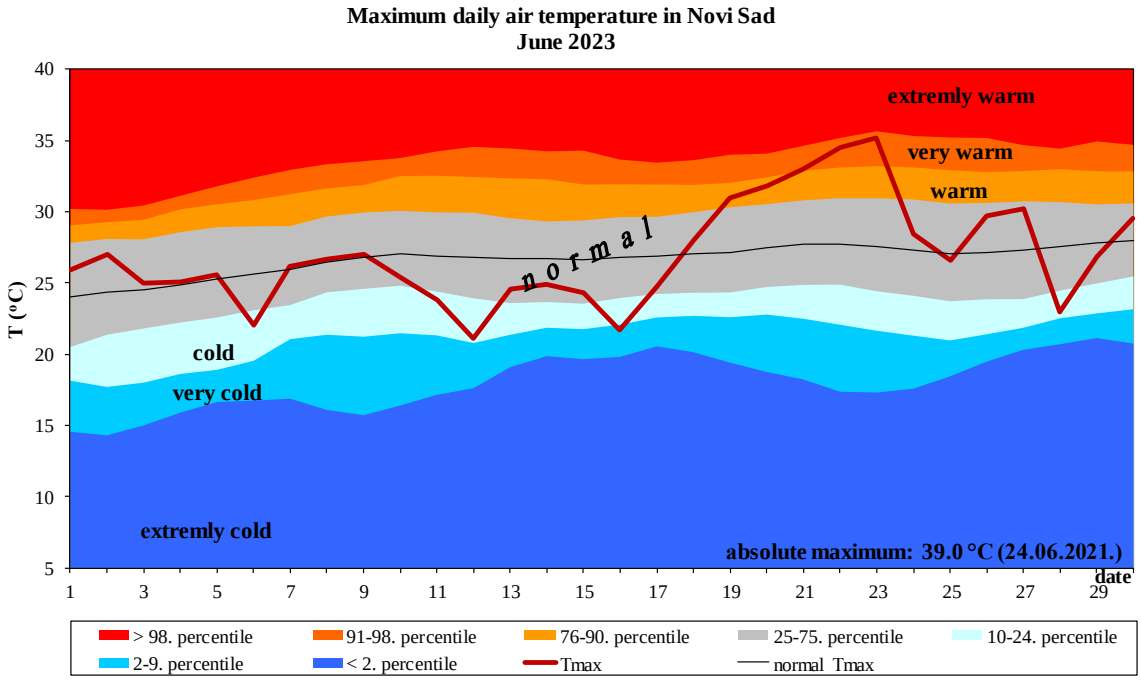


Appendix 8. Daily course of the mean daily air temperature and accompanying percentile for Vranje

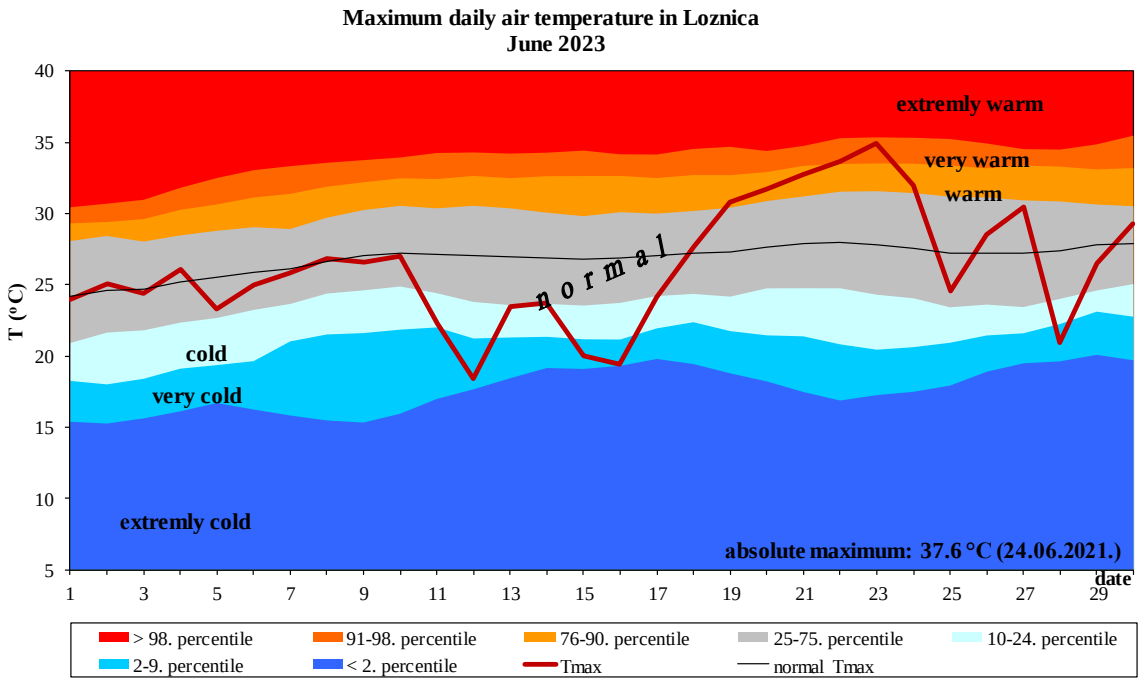
Maximum air temperature



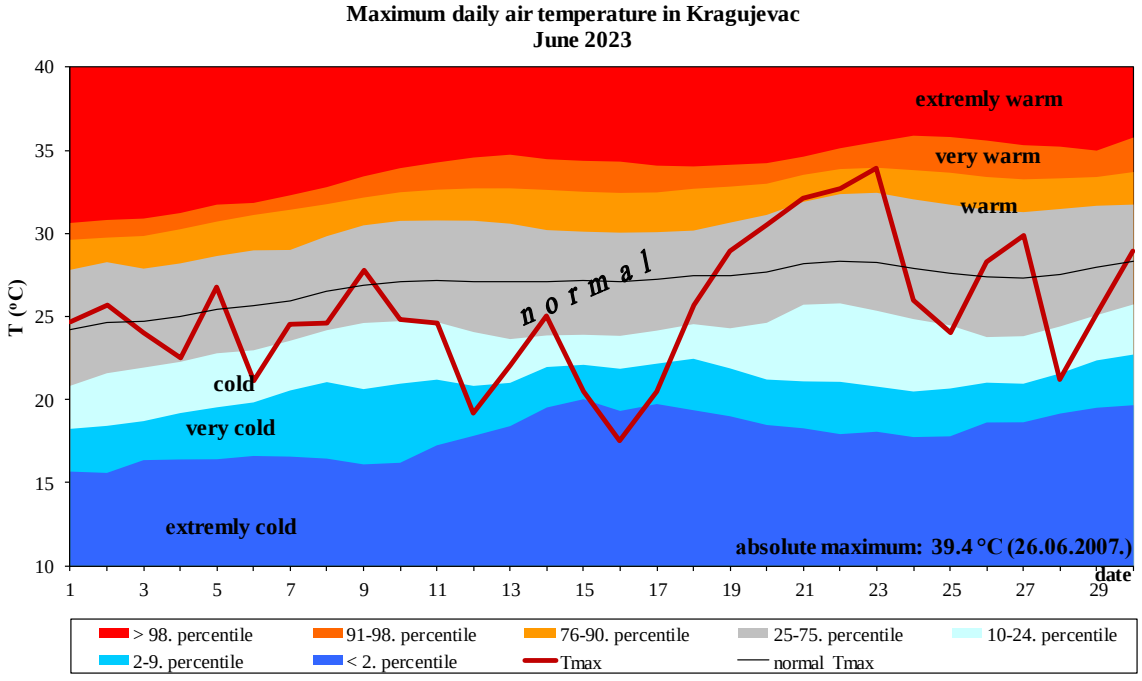
Appendix 9. Daily course of the maximum daily air temeperature and the accompanying percentile for Sombor



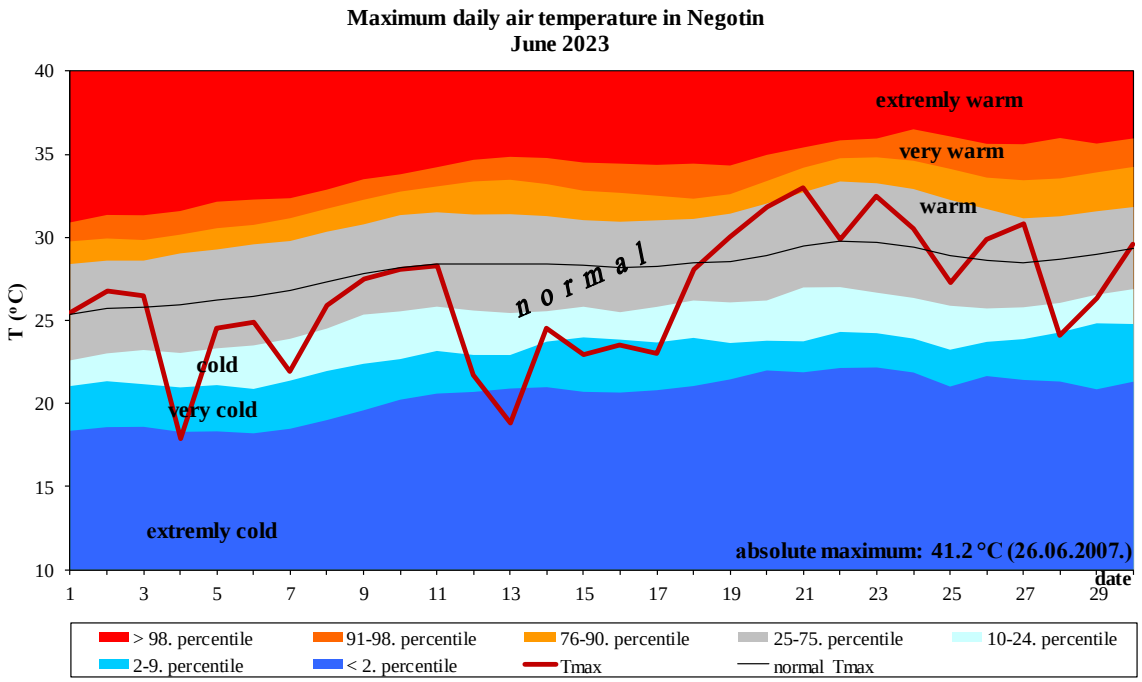
Appendix 10. Daily course of the maximum daily air temeperature and the accompanying percentile for Novi Sad



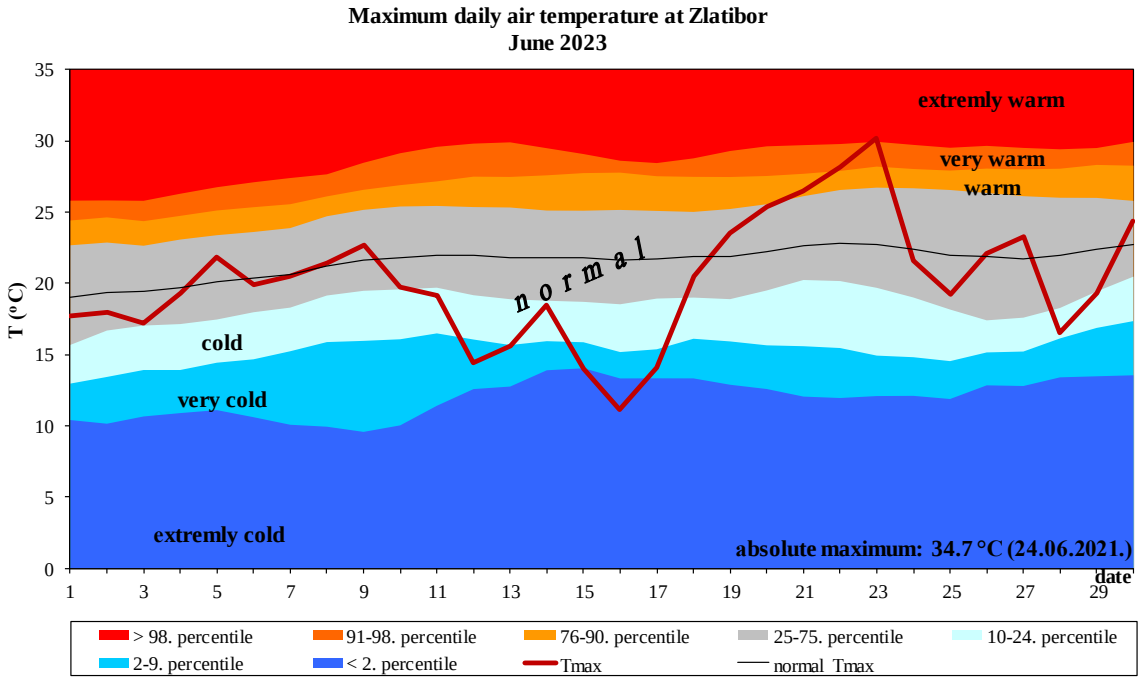
Appendix 11. Daily course of the maximum daily air temeperature and the accompanying percentile for Loznica



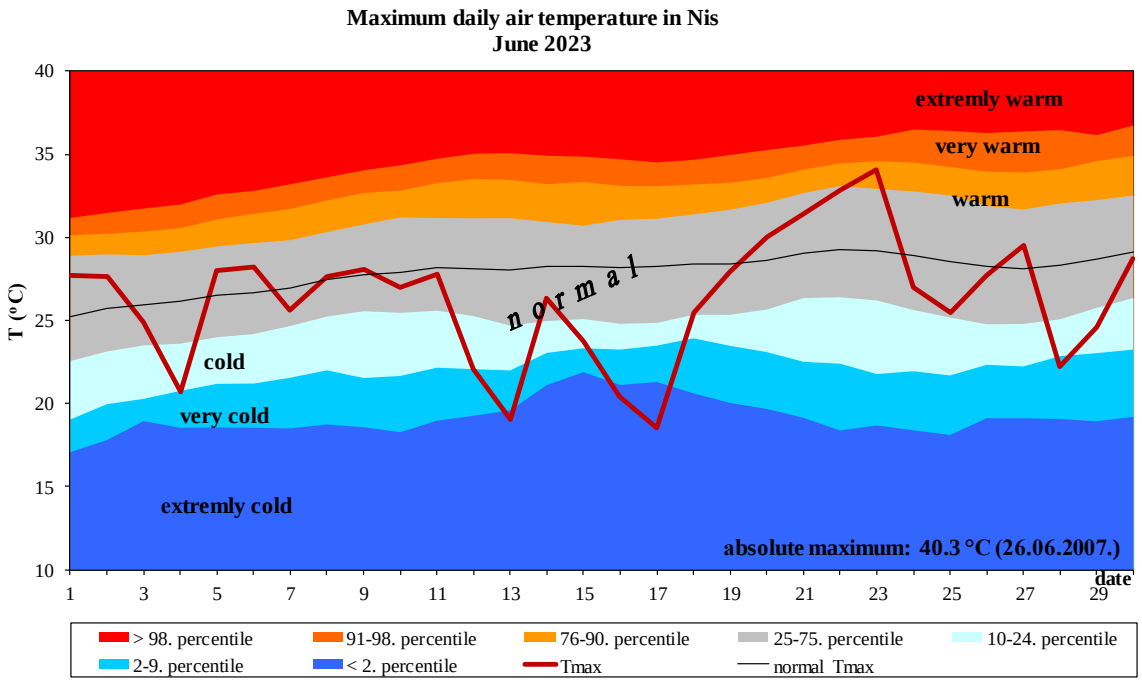
Appendix 12. Daily course of the maximum daily air temeperature and the accompanying percentile for Kragujevac



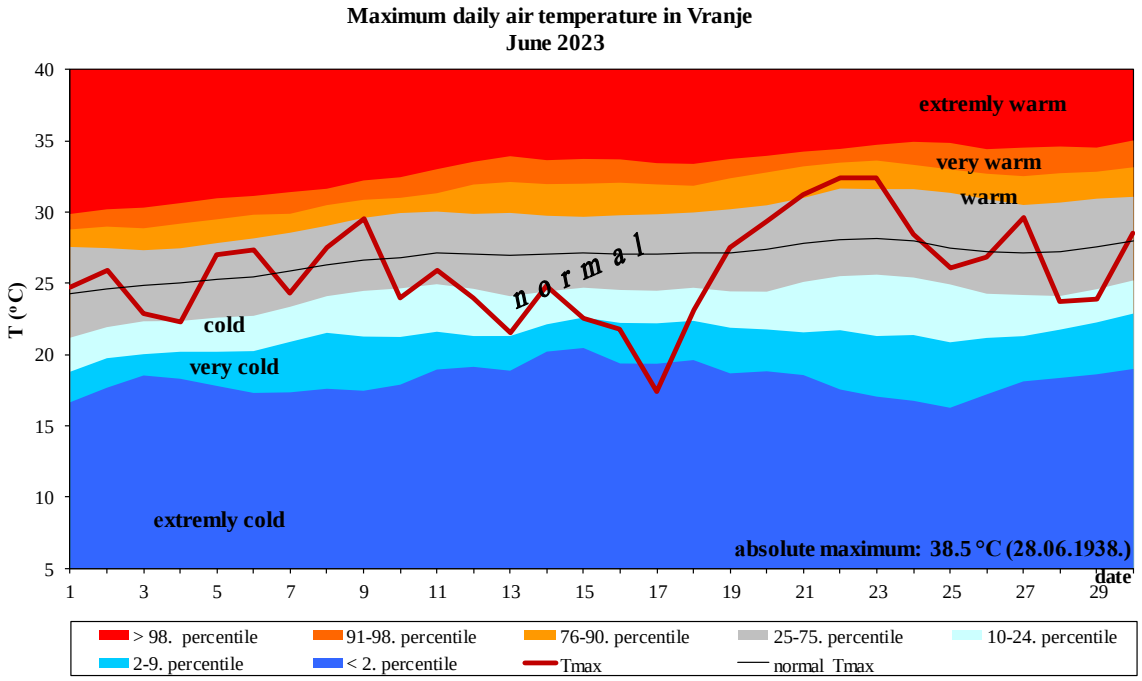
Appendix 13. Daily course of the maximum daily air temeperature and the accompanying percentile for Negotin



Appendix 14. Daily course of the maximum daily air temeperature and the accompanying percentile on Zlatibor

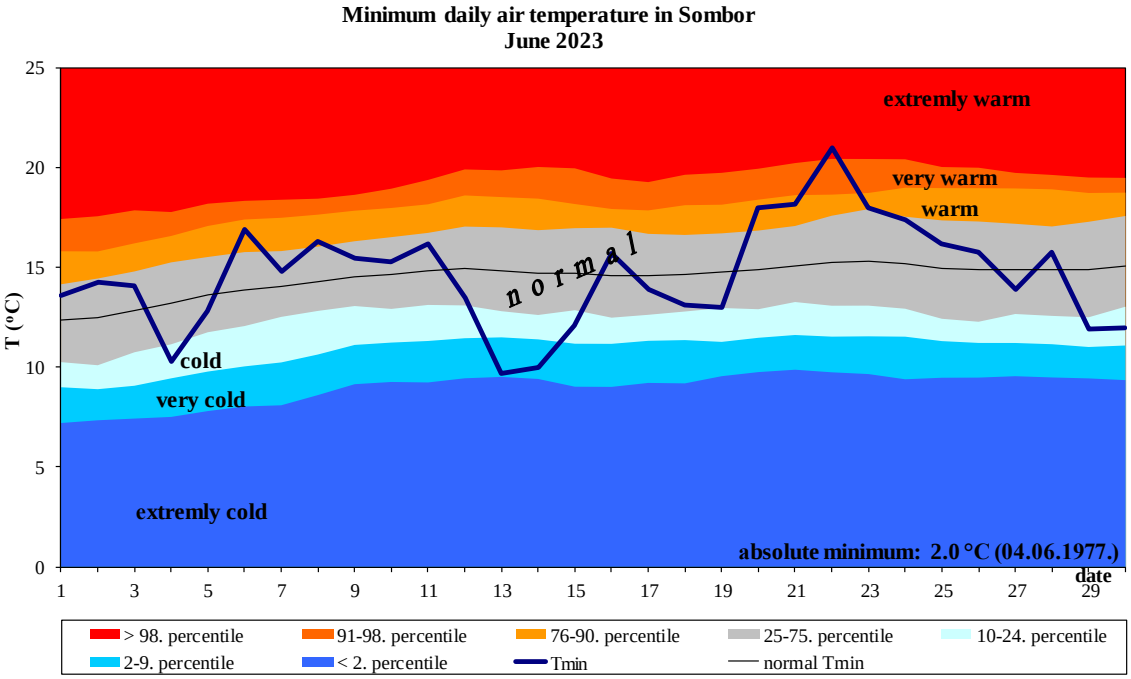


Appendix 15. Daily course of the maximum daily air temeperature and the accompanying percentile for Nis

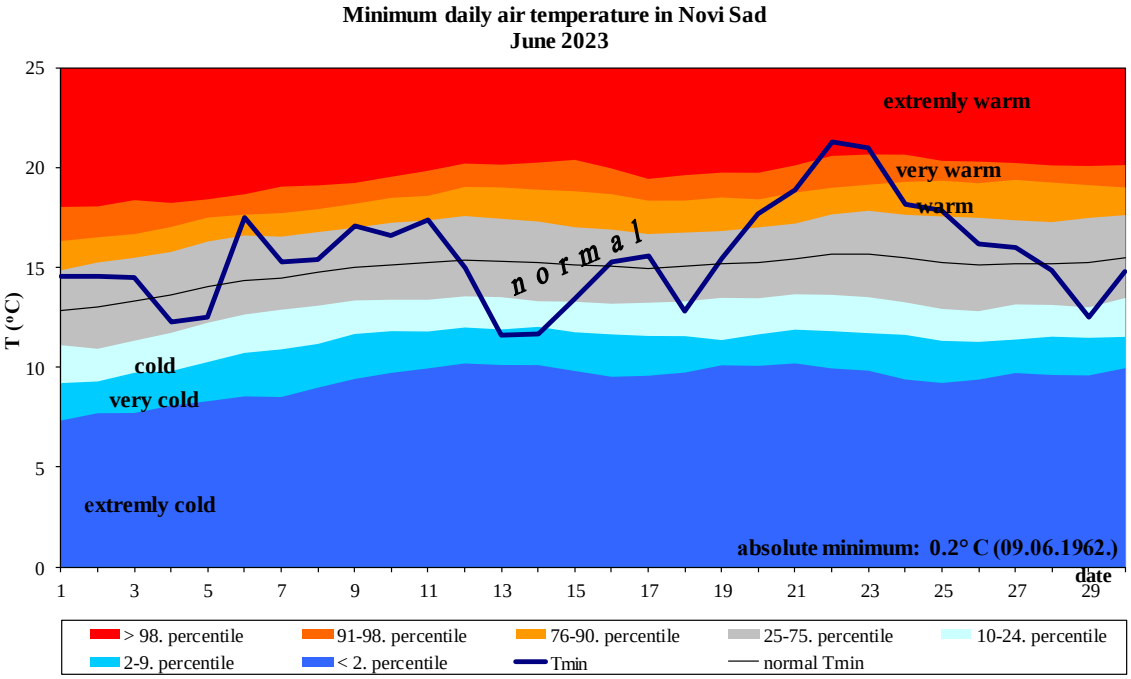


Appendix 16. Daily course of the maximum daily air temeperature and the accompanying percentile for Vranje

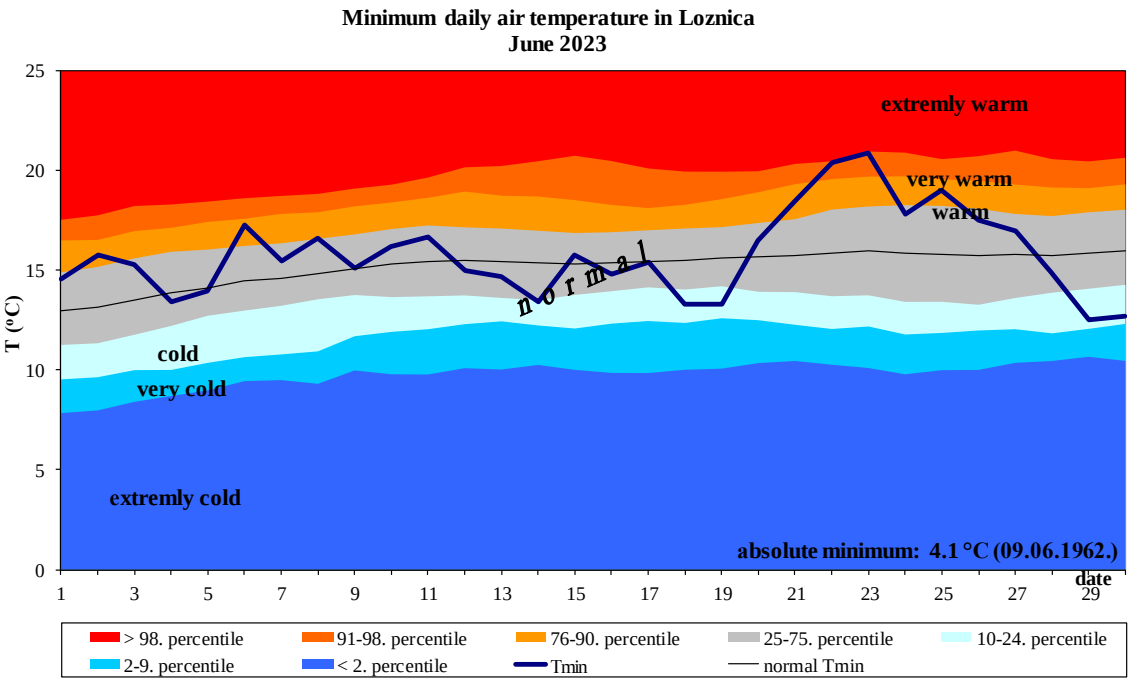
Minimum air temperature



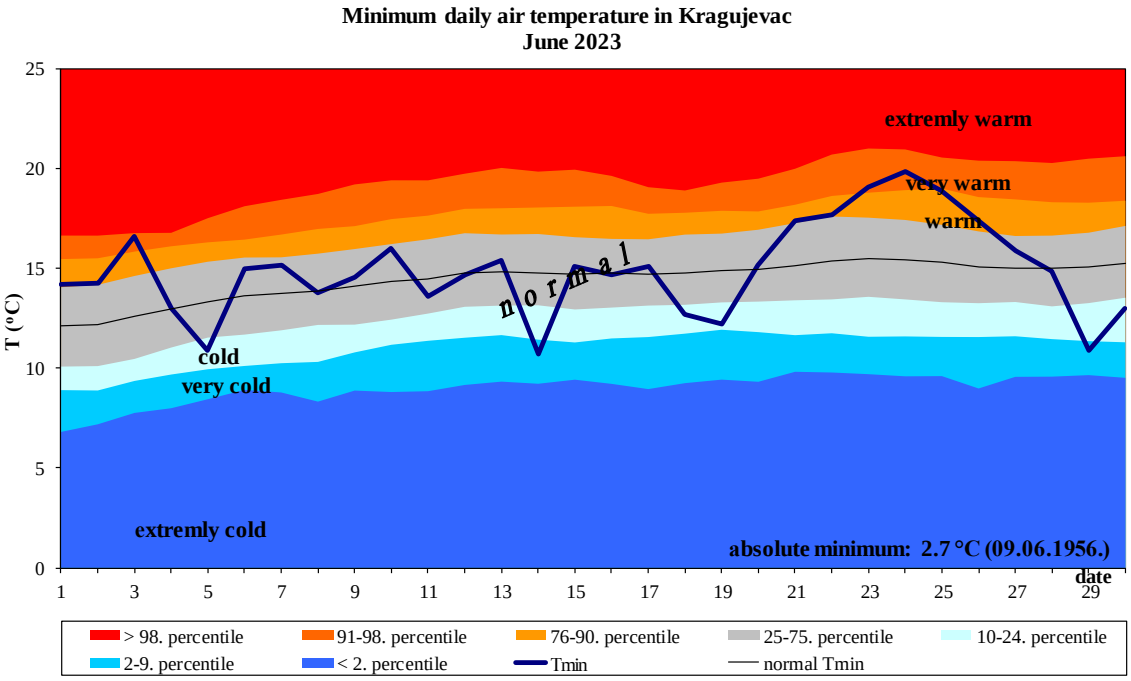
Appendix 17. Daily course of the minimum daily air temperature and the accompanying percentile for Sombor



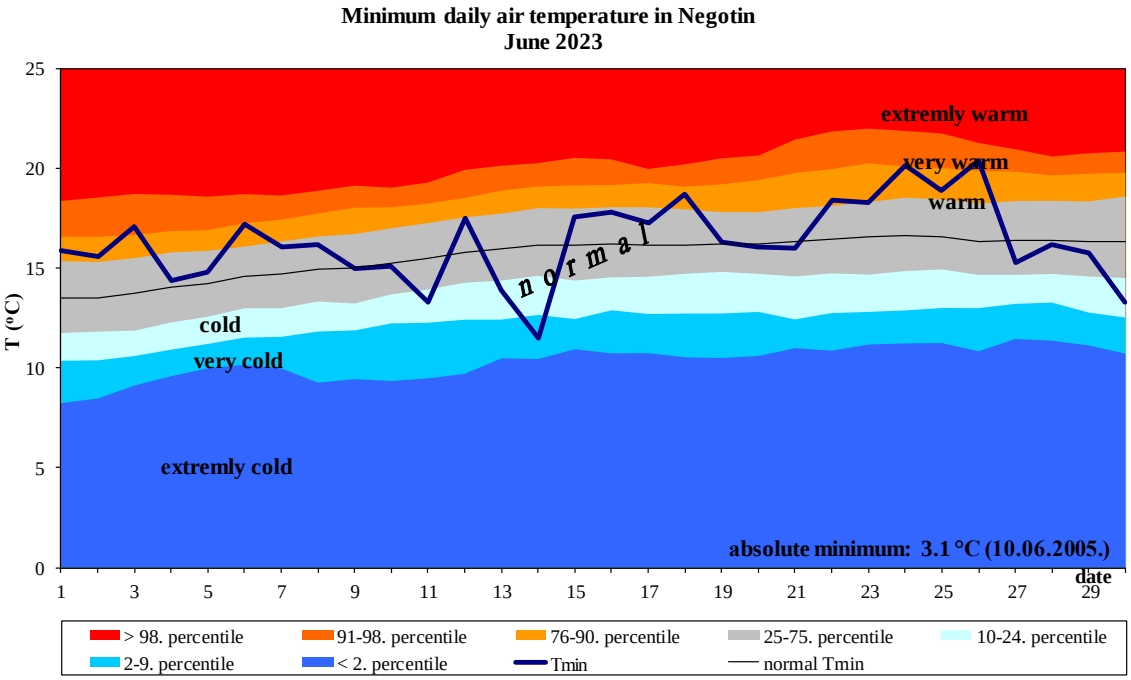
Appendix 18. Daily course of the minimum daily air temperature and the accompanying percentile for Novi Sad



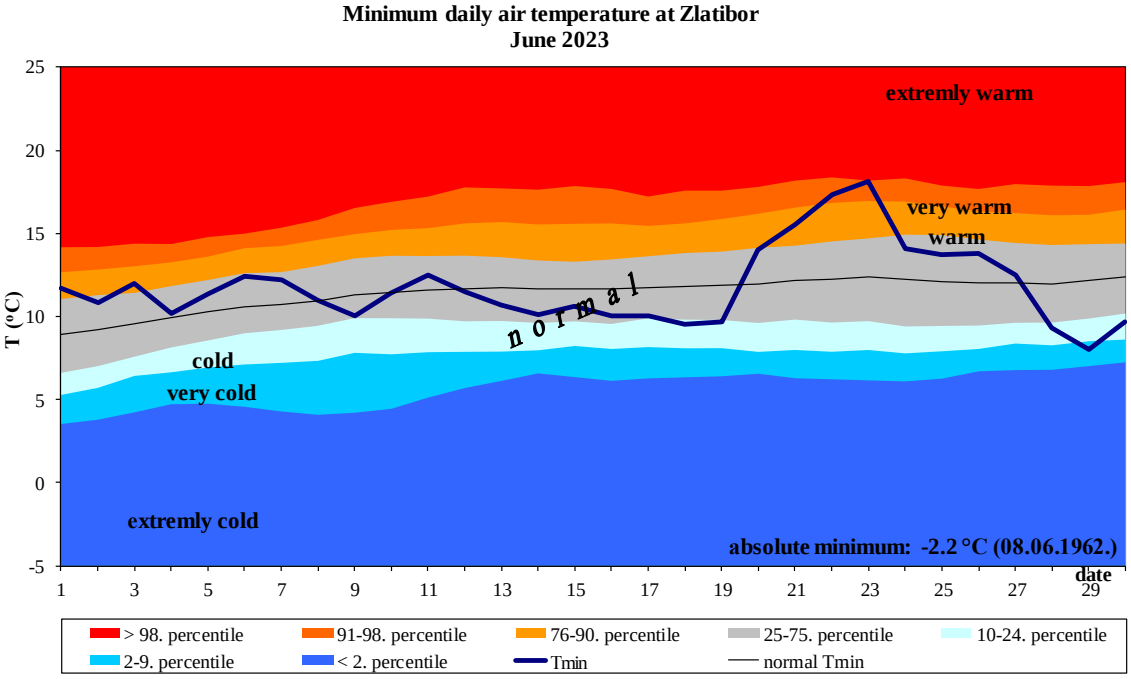
Appendix 19. Daily course of the minimum daily air temperature and the accompanying percentile for Loznica



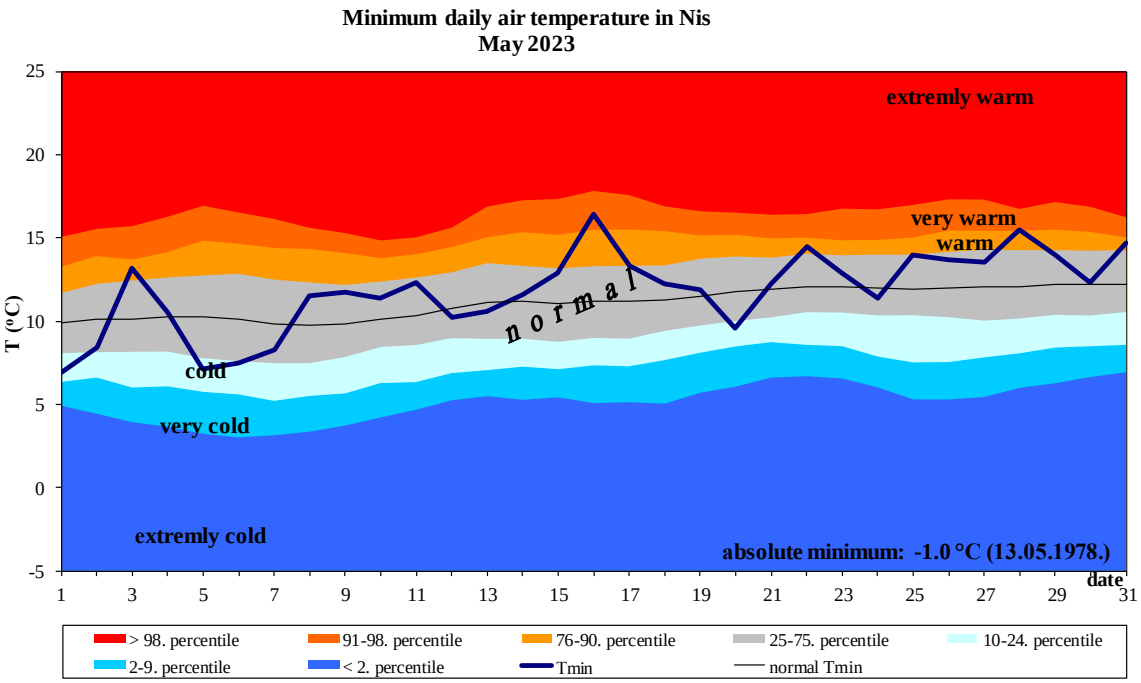
Appendix 20. Daily course of the minimum daily air temperature and the accompanying percentile for Kragujevac



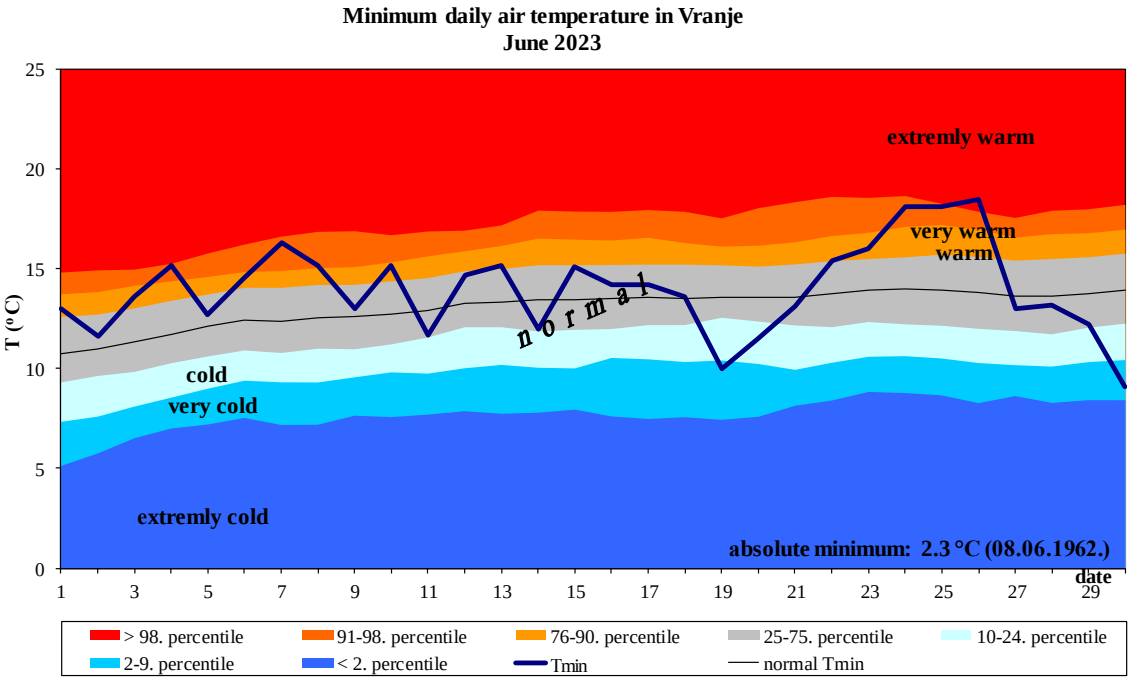
Appendix 21. Daily course of the minimum daily air temperature and the accompanying percentile for Negotin



Appendix 22. Daily course of the minimum daily air temperature and the accompanying percentile on Zlatibor

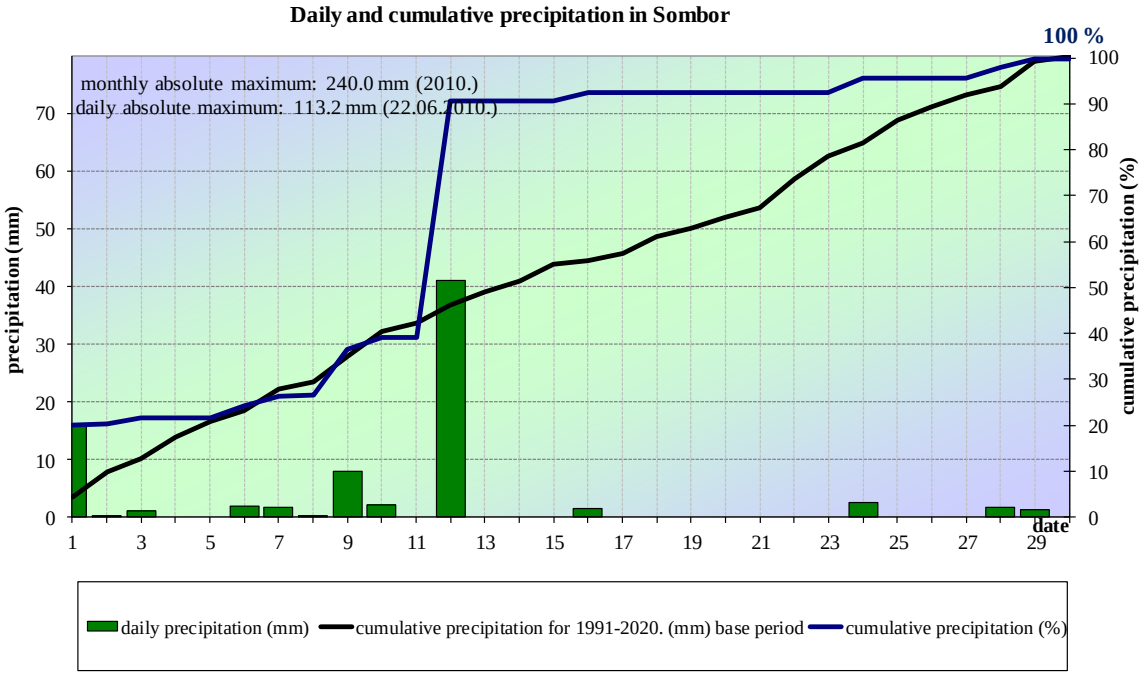


Appendix 23. Daily course of the minimum daily air temperature and the accompanying percentile for Nis

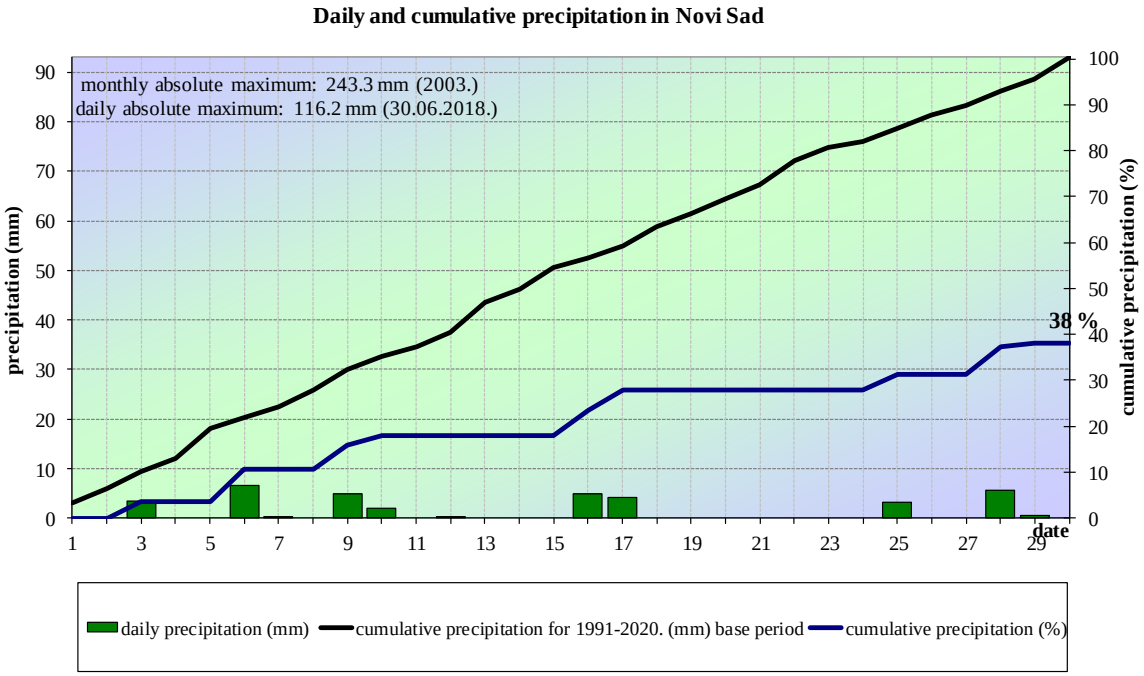


Appendix 24. Daily course of the minimum daily air temperature and the accompanying percentile for Vranje

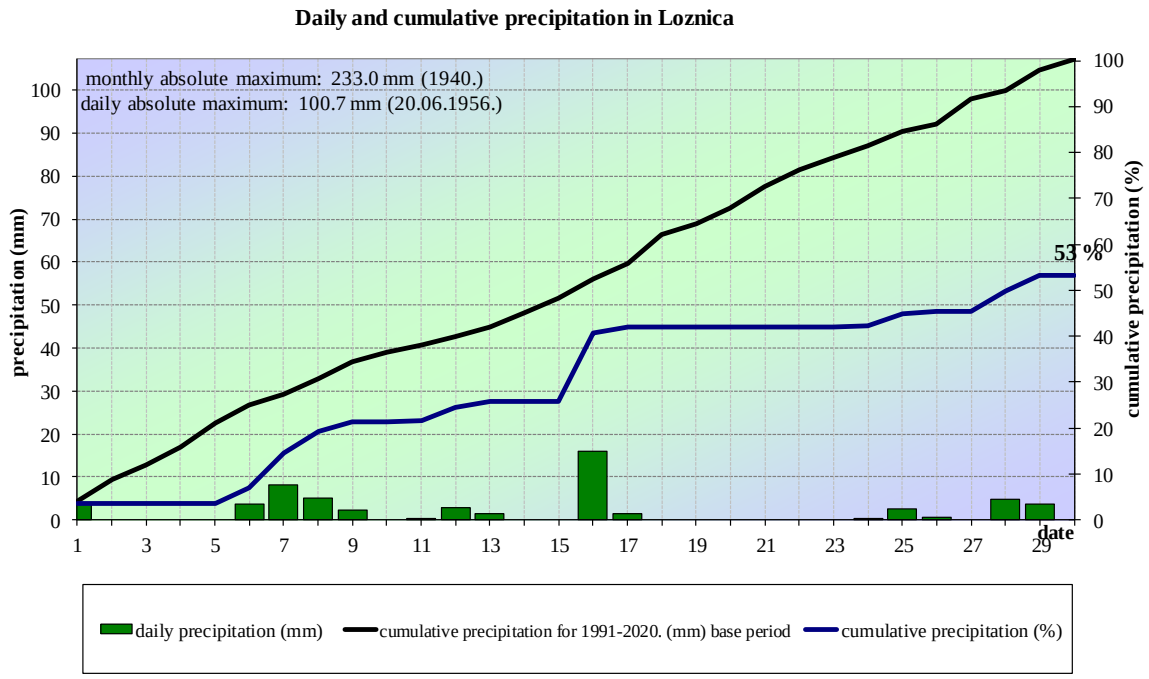
Precipitation



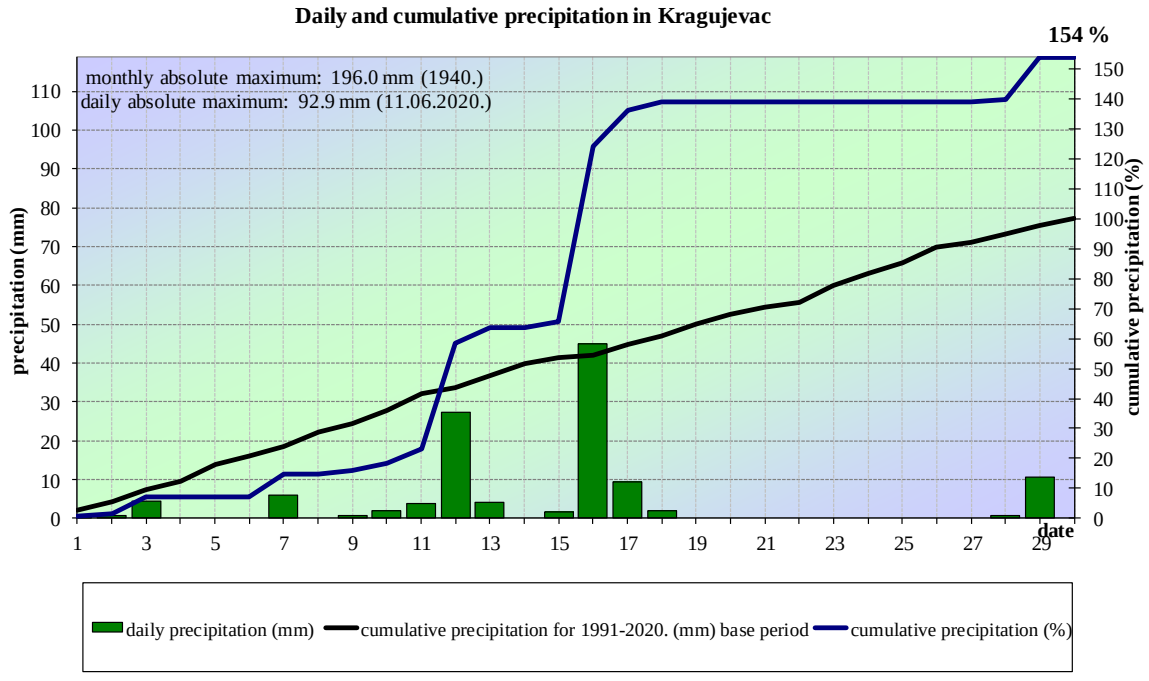
Appendix 25. Daily and cumulative precipitation sums for Sombor



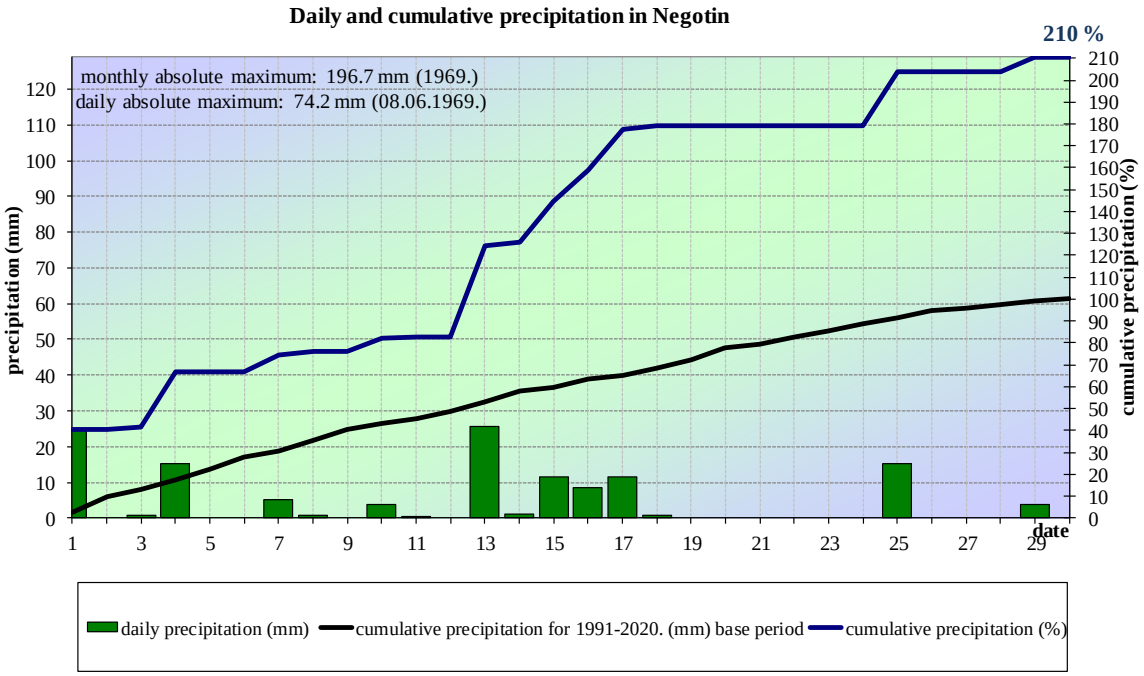
Appendix 26. Daily and cumulative precipitation sums for Novi Sad



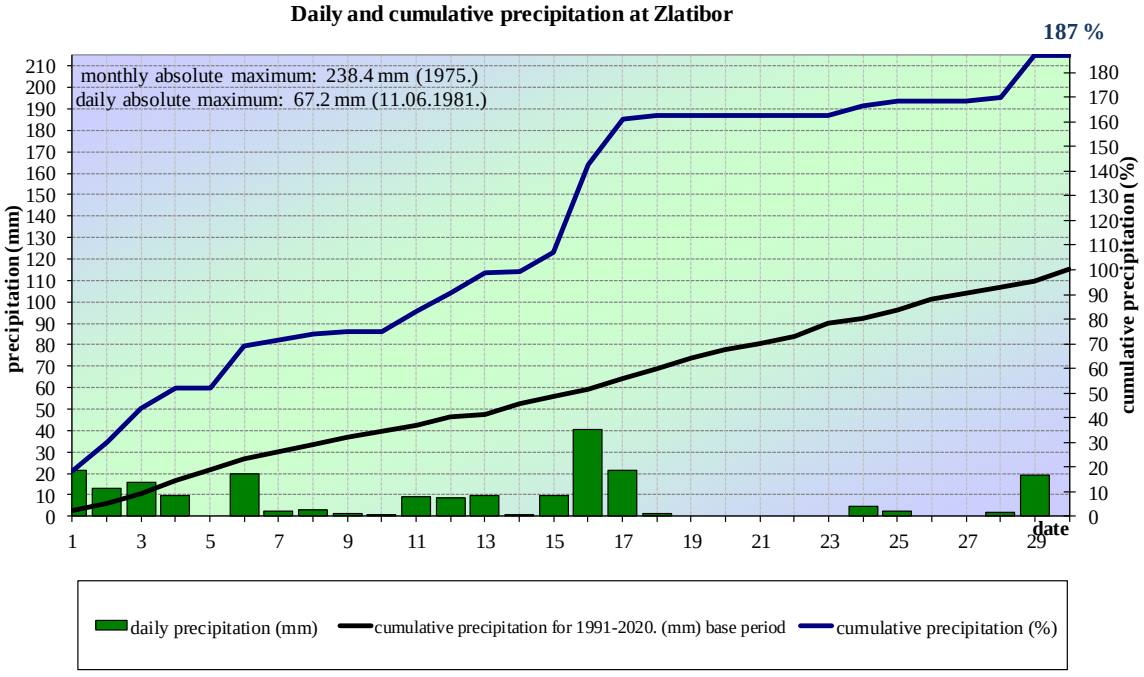
Appendix 27. Daily and cumulative precipitation sums for Loznica



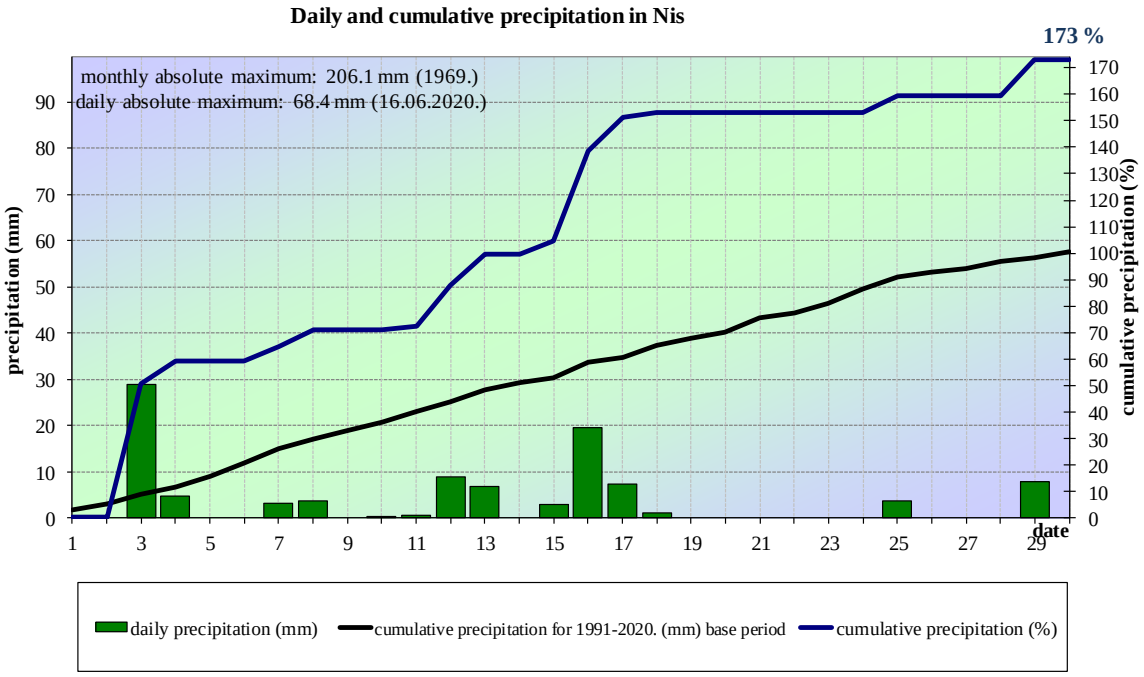
Appendix 28. Daily and cumulative precipitation sums for Kragujevac



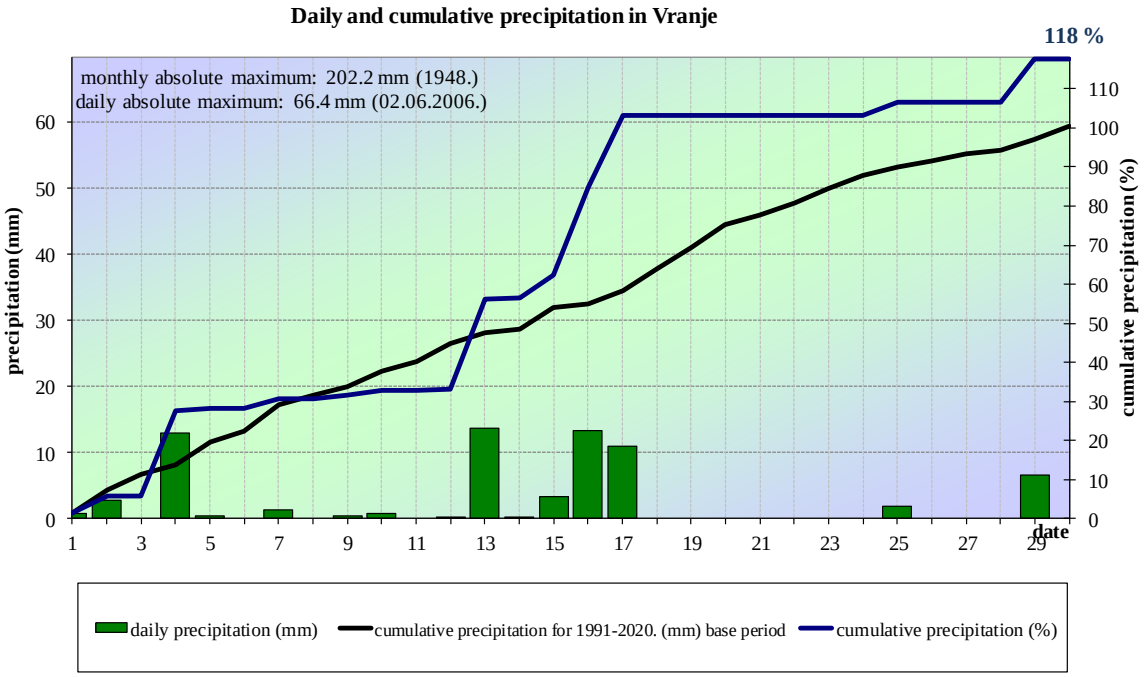
Appendix 29. Daily and cumulative precipitation sums for Negotin



Appendix 30. Daily and cumulative precipitation sums on Zlatibor



Appendix 31. Daily and cumulative precipitation sums for Nis



Appendix 32. Daily and cumulative precipitation sums for Vranje