

Republic Hydrometeorological Service of Serbia

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Risk Assessment

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- ❖ *Averagely warm and rainy August in most of Serbia*
- ❖ *8th warmest August for Crni Vrh*
- ❖ *Record-breaking number of tropical nights during August for Palic and Loznica*
- ❖ *3rd wettest August for Veliko Gradiste, 5th wettest for Banatski Karlovac, 9th wettest for Zrenjanin*
- ❖ *6th driest August for Sremska Mitrovica*
- ❖ *Record-breaking daily precipitation sums during August in Banatski Karlovac*

AIR TEMPERATURE

Mean monthly air temperature

Mean August air temperature ranged from 20.5°C in Pozega to 24.7°C in Belgrade, and on the mountains from 14.2°C at Kopaonik to 19.3°C at Crni Vrh (*Figure 1*).

Departure of the mean monthly air temperature from the normal¹ ranged from –0.1°C in Zajecar to +1.5°C at Crni Vrh (*Figure 2*).

Mean August air temperature, based on the percentile method², was in the following categories: normal across most of the country, warm in Sombor, Sremska Mitrovica, Cuprija and Dmitrovgrad, Palic and Crni Vrh (*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

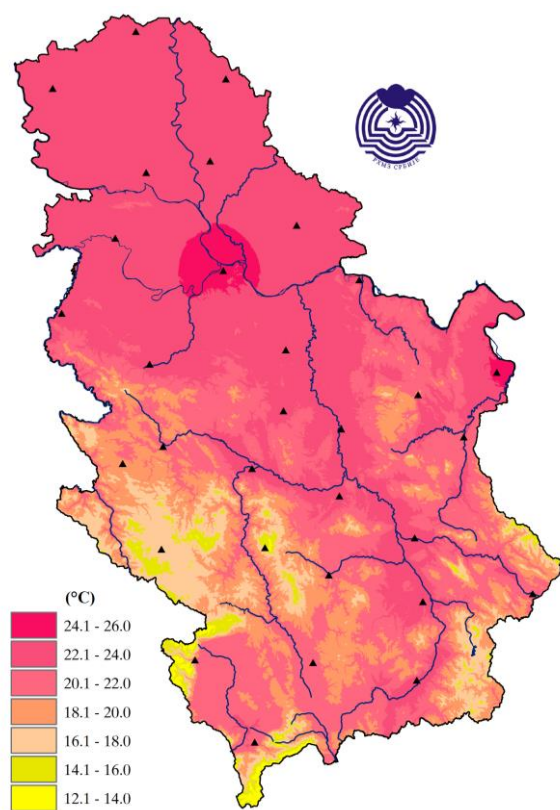


Figure 1. Spatial distribution of mean monthly air temperature (°C)

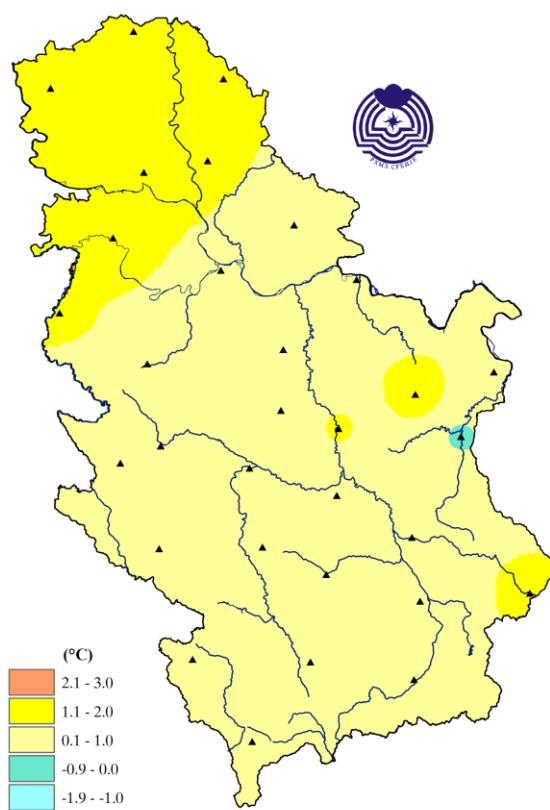


Figure 2. Spatial distribution of mean monthly air temperature anomaly (°C)

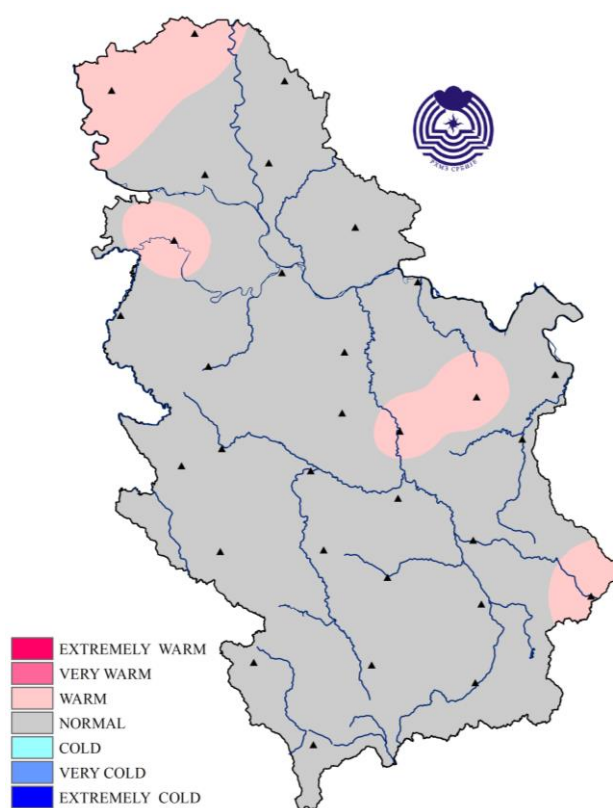


Figure 3. Spatial distribution of the mean monthly air temperature using percentile method

August 2023 ranks as **the 15th warmest for Serbia** since 1951 (Figure 4), **8th warmest for Crni Vrh**, 9th warmest for Sombor and Palic since the record-keeping at these stations began.

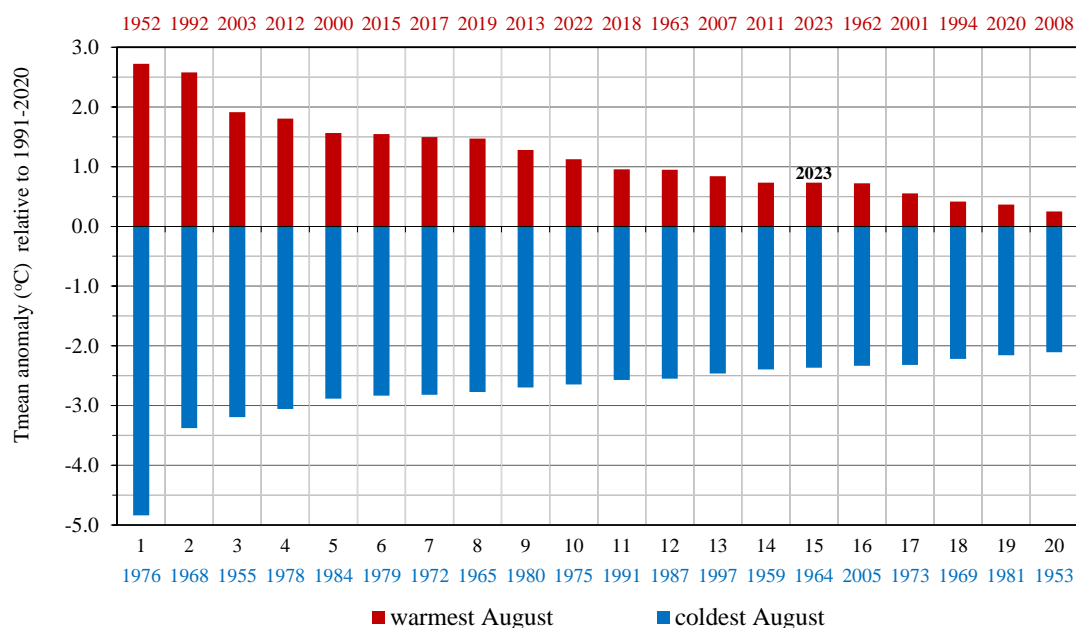


Figure 4. Rank of the warmest and coldest October for Serbia for the 1951-2022 base period

Mean daily air temperature in Belgrade, based on the percentile method, was in the normal category at the very beginning of the month as well as mid-month and at the end of August, in the warm category at the end of the second and beginning of the third decade, in the very warm and extremely warm category at the beginning of the month, in the middle of the third decade, and in the very cold and cold category in the second half of the first decade of August (Figure 5). 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](#).

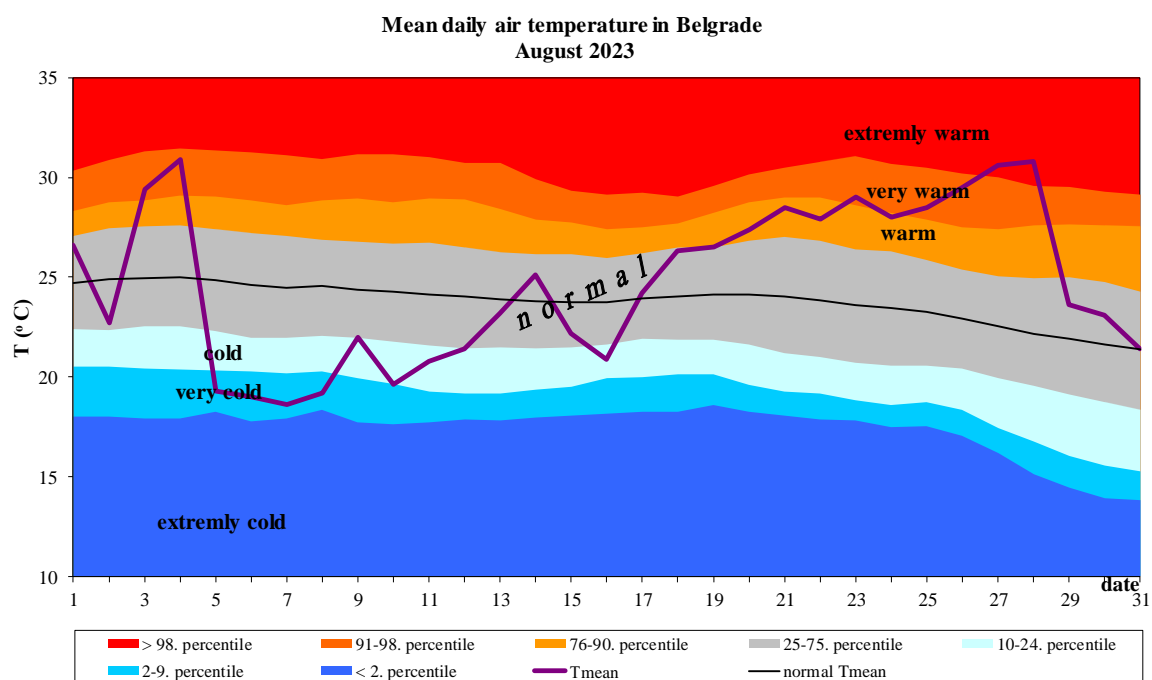


Figure 5. Daily course of the mean daily air temperature and accompanying percentiles for Belgrade

Maximum air temperature

Mean maximum air temperature in August ranged from 21.1°C in Pozega to 31.9°C in Leskovac, while Belgrade recorded 30.4°C. On the mountains, mean maximum air temperature ranged from 18.8°C at Kopaonik to 25.3°C in Sjenica.

Based on the percentile method, mean maximum air temperature was in the normal category in most of the country and warm category on Palic, Sombor, Sremska Mitrovica and Negotin.

In Serbia, the maximum daily air temperature of 39.0°C was measured in Nis on August 4. On August 27, Belgrade recorded the highest daily air temperature of 37.2°C.

Kopaonik is the only place where summer days³ were not recorded. Their number ranged from 12 at Crni Vrh to 30 in Negotin. Departure of the number of summer days was positive in the north, east and certain parts of Serbia, up to 3 days above the average in Sombor, Kikinda and Sremska Mitrovica. Kragujevac recorded 1 day below the average.

Tropical days⁴ were not recorded at Crni Vrh and Kopaonik. Their number ranged from 3 at Zlatibor to 20 in Leskovac and Vranje. Departure of the number of tropical days was positive across most of Srebia, up to 4 days above the average in Sombor, Kikinda and Dimitrovgrad, whilst Nis recorded 2 days below the average, and Crni Vrh 1 day below the average.

Heat wave⁵ was recorded in Sombor lasting from August 21 to 28 and Negotin lasting from 22 to 28 August.

Figure 6 shows daily course of the maximum daily air temperature and the accompanying percentiles for Belgrade in August 2023 and for the stations Sombor, Novi Sad, Loznica, Negotin, Kragujevac, Zlatibor, Nis and Vranje are given in the [Appendix](#).

³ Summer day is defined as the day with the maximum daily air temperature of 25 °C and above

⁴ Tropical day is defined as the day with the maximum daily air temperature of 30 °C and above

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

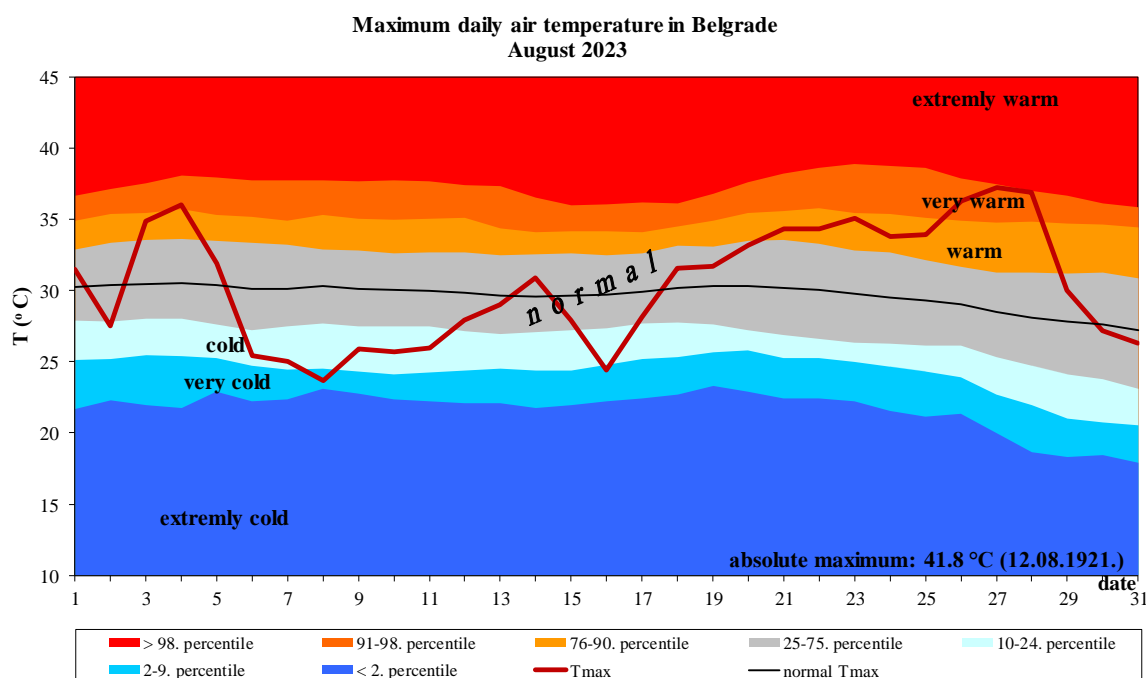


Figure 6. Daily course of the maximum daily air temperature and accompanying percentiles for Belgrade

Minimum air temperature

Mean minimum air temperature in August ranged from 14.5°C in Kursumlija and Požega to 19.3°C in Belgrade. On the mountains, mean minimum air temperature ranged from 10.4°C at Kopaonik to 15.4°C at Crni Vrh.

Based on the percentile method, mean minimum monthly air temperature was in the following categories: warm across most of country, normal in Belgrade, Kragujevac, Smederevska Palanka, Veliko Gradiste, Kraljevo and Zlatibor, and very warm in Sremska Mitrovica and Cuprija, and extremely warm in Kursumlija and Dimitrovgrad.

The lowest minimum daily air temperature of 3.3°C was measured at Kopaonik on August 9. On the same day, Belgrade observed the lowest daily air temperature of 13.5°C.

Tropical nights⁶ were registered in the north, east and certain parts of the western and central Serbia. The highest number, total of 15 tropical nights, was recorded in Belgrade. **The previous record was broken on Palic with 9 tropical nights above the average, and in Loznica with 7 tropical nights above the average.** The departure of the tropical nights was 2 days below the average in Kragujevac, Veliko Gradiste and Nis.

Figure 7 shows assessment of the minimum and maximum air temperature in Serbia for August based on the tercile distribution relative to the 1991-2020 base period. It can be noted that August 2023 was marked by maximum air temperature above average values and mean minimum air temperature at the upper tercile boundary.

⁶ Tropical night is defined as the day with the minimum daily air temperature of 20 °C and above

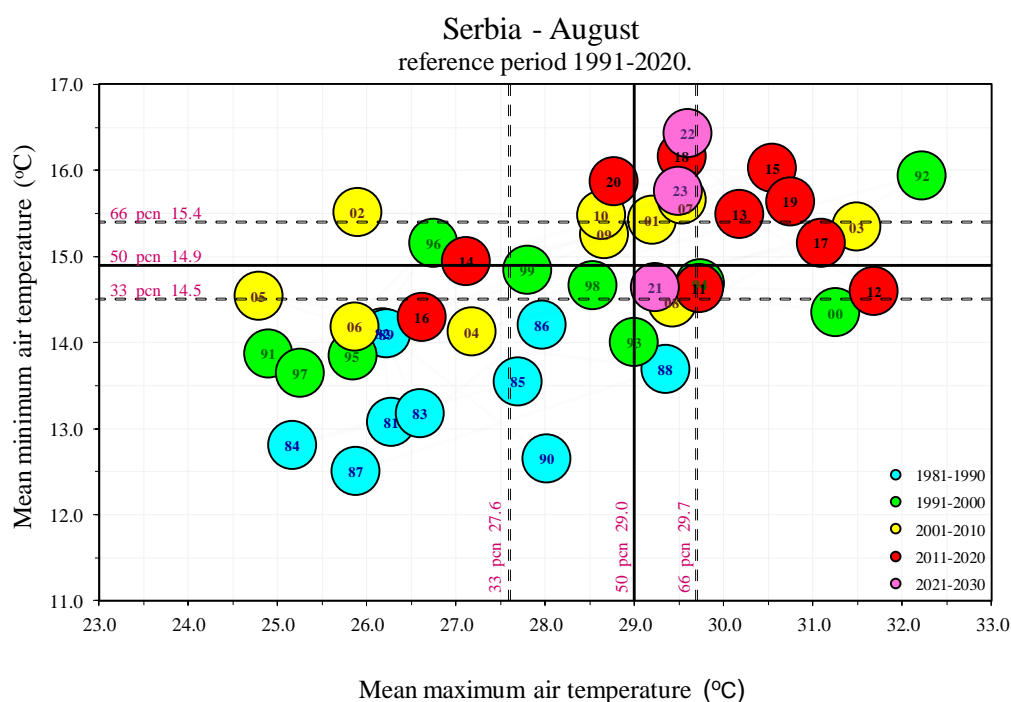


Figure 7. Assessment of minimum and maximum air temperature in October for Serbia with the accompanying terciles in relation to the 1991-2020 base period

Figure 8 shows daily course of the minimum daily air temperature and the accompanying percentiles for Belgrade in August 2023, and for the stations Sombor, Novi Sad, Loznica, Negotin, Kragujevac, Zlatibor, Nis and Vranje are given in the [Appendix](#).

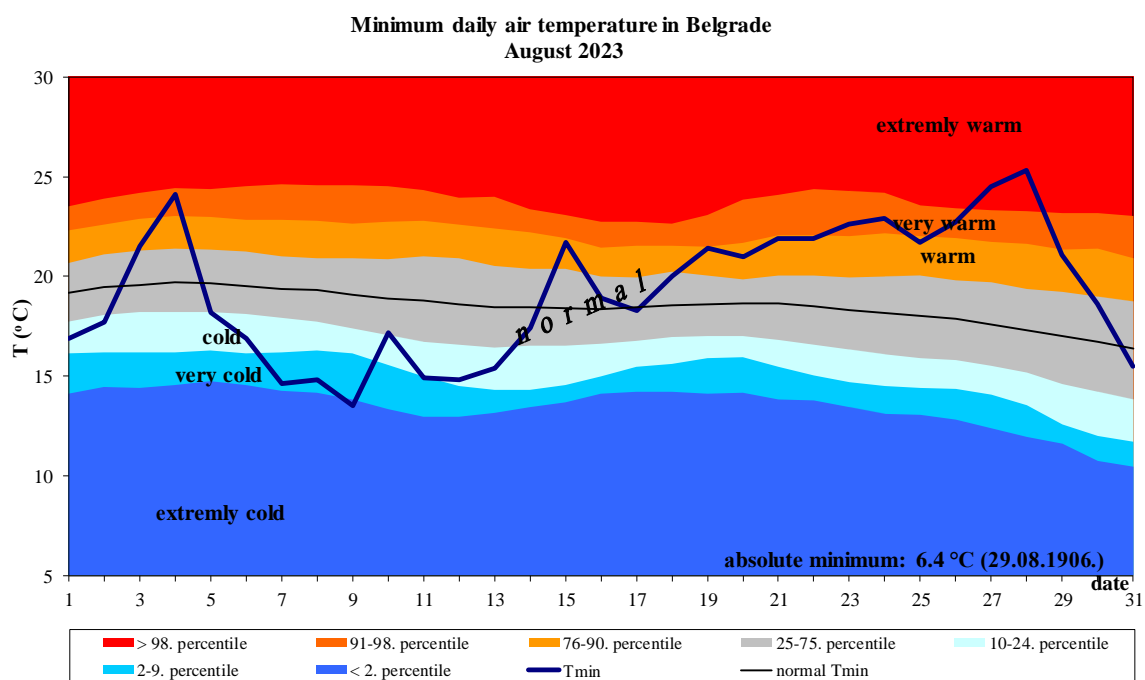


Figure 8. Daily course of the minimum daily air temperature and accompanying percentiles for Belgrade

PRECIPITATION

August precipitation sums ranged from 8.8 mm in Sremska Mitrovica to 167.4 mm in Veliko Gradiste while Belgrade recorded 87.8 mm of precipitation (*Figure 9*).

Precipitation totals relative to the normal for the 1991-2020 base period ranged from 17% in Sremska Mitrovica to 320% in Veliko Gradiste (*Figure 10*).

Based on the percentile method, precipitation sums were in the following categories: normal and rainy in most of the country, very rainy in Zrenjanin, Banatski Karlovac and Krusevac, and extremely rainy in Veliko Gradiste, and dry category in Sremska Mitrovica, Valjevo and Pozega (*Figure 11*).

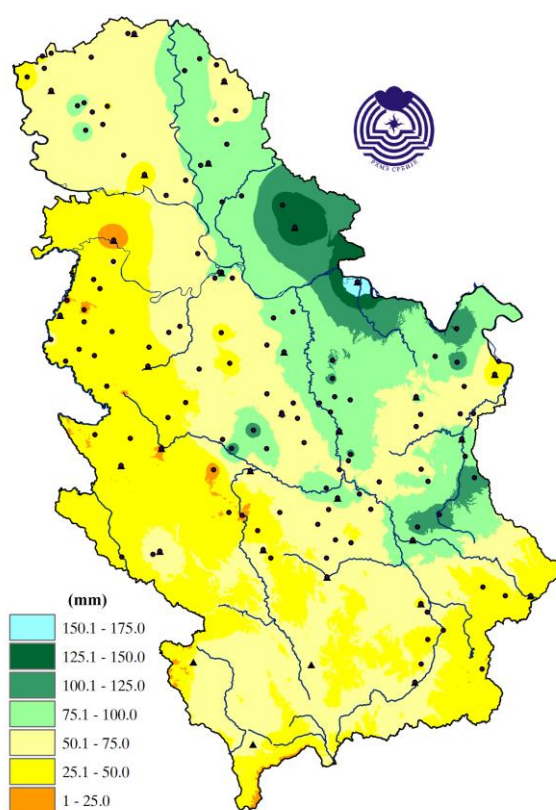


Figure 9. Spatial distribution of the monthly precipitation sums (mm) according to data from 28 major meteorological, 25 climatological and 86 rain gauge stations

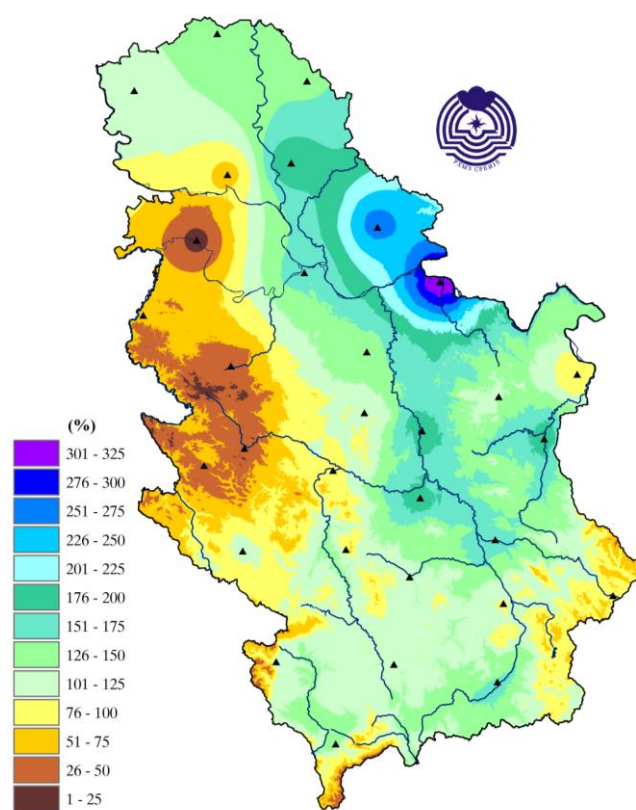


Figure 10. Spatial distribution of the monthly precipitation sums in the percentages of normal for the 1991–2020 base period

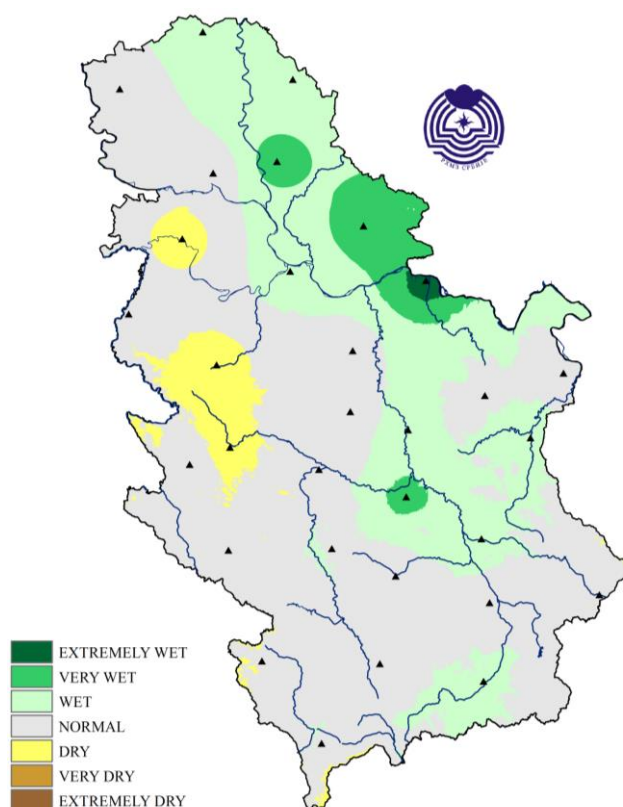


Figure 11. Monthly precipitation sums according to the percentile method

August 2023 ranks as the 23rd for Serbia since 1951.

August 2023 ranks as **the 3rd wettest** for Veliko Gradiste (*Figure 12*), 5th wettest for Banatski Karlovac, 9th wettest for Zrenjanin and **6th driest** for Sremska Mitrovica since record-keeping began (*Figure 13*).

The highest daily precipitation sum of 78.8 mm was measured in Banatski Karlovac on August 16 breaking the previous August record of 59.1 mm set on August 16, 2020. On August 6, Belgrade recorded highest daily precipitation sum of 39.0 mm.

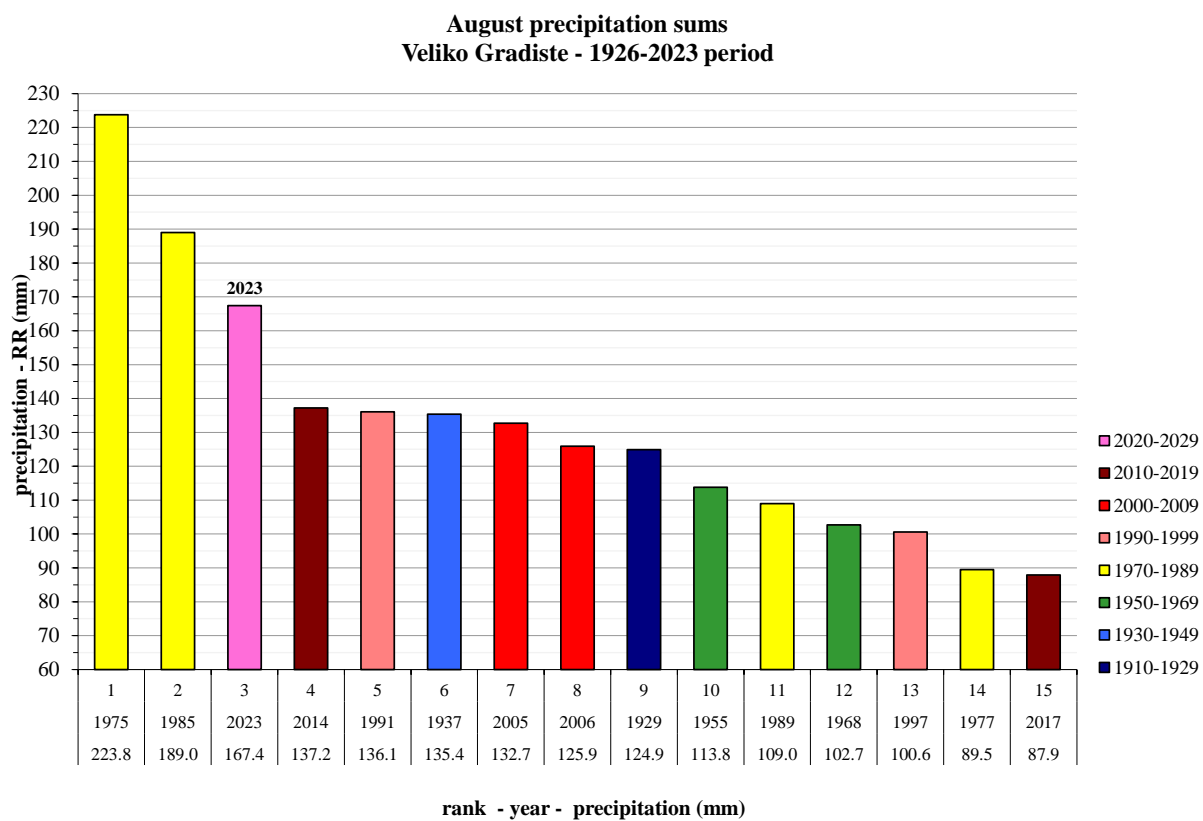


Figure 12. The highest precipitation sums in Veliko Gradiste for the period 1926-2023

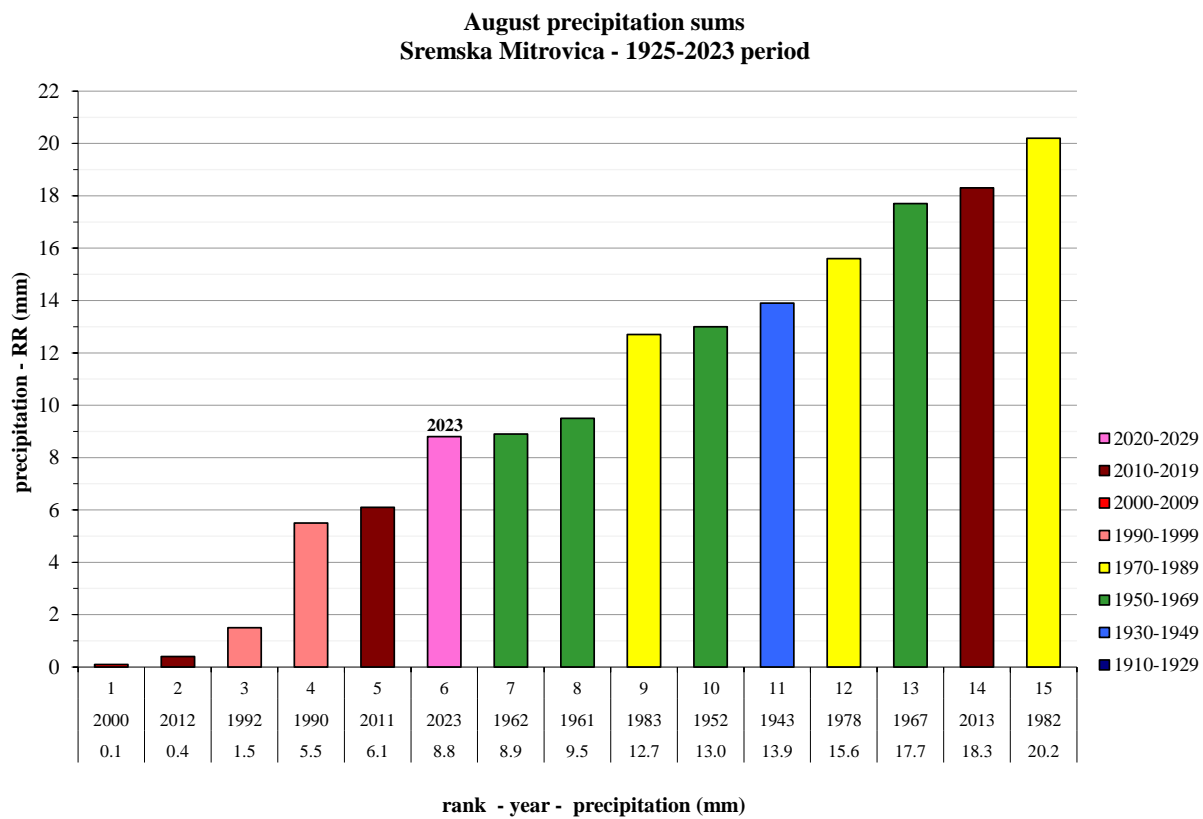


Figure 13. The lowest precipitation sums in Sremska Mitrovica for the period 1925-2023

Number of days with precipitation in August ranged from 5 in Vranje to 12 in Zajecar (*Figure 14*). Departure of the number of days with precipitation ranged from 4 days below the average at Kopanik to 5 days above the average in Zajecar (*Figure 15*).

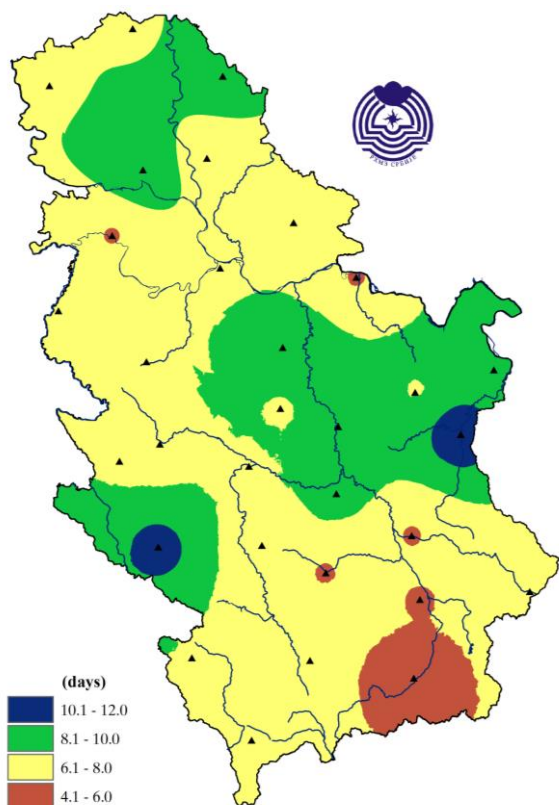


Figure 14. Spatial distribution of number of days with precipitation

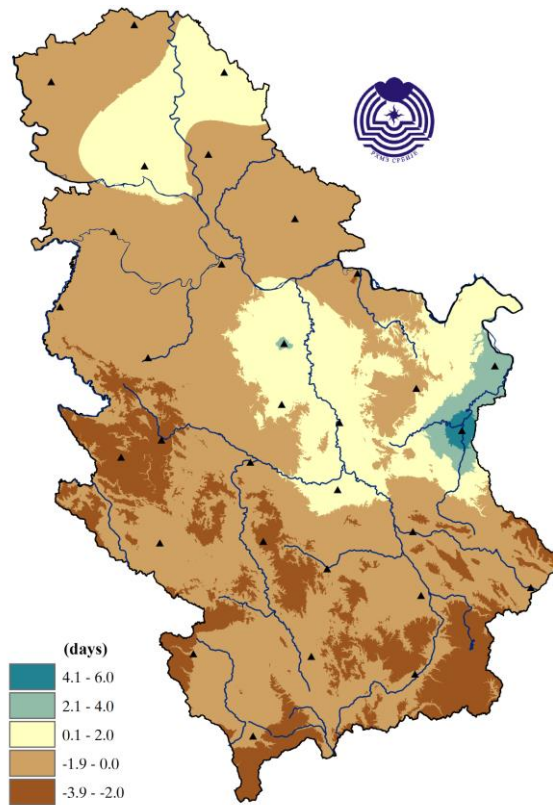


Figure 15. Spatial distribution of deviation of number of days with precipitation

Figure 16 shows assessment of the air temperature and precipitation sums for Serbia for August based on the tercile distribution relative to the 1991-2020 base period. It can be noted that August 2023 was marked by mean air temperature at the upper tercile boundary and precipitation sums slightly above the upper tercile boundary.

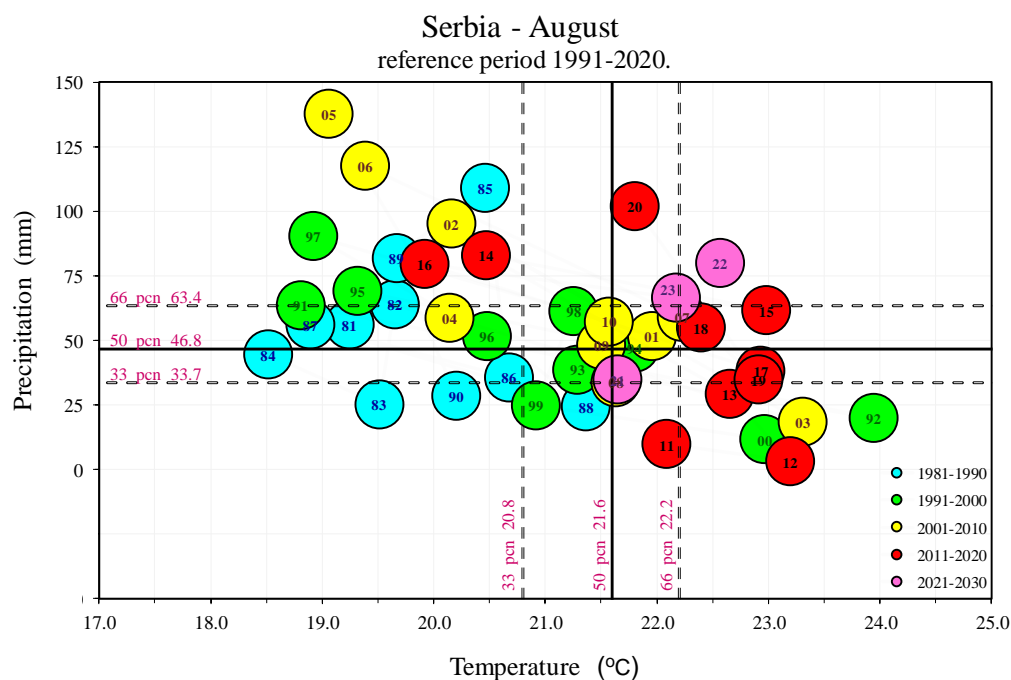


Figure 16. Assessment of air temperature and precipitation in October for Serbia with the accompanying terciles in relation to the 1991-2020 base period

Figure 17 show daily and cumulative precipitations sums with averaged normal 1991-2020 for August in Belgrade, and for the stations Sombor, Novi Sad, Loznica, Negotin, Kragujevac, Zlatibor, Nis and Vranje precipitation sums are given in [Appendix](#).

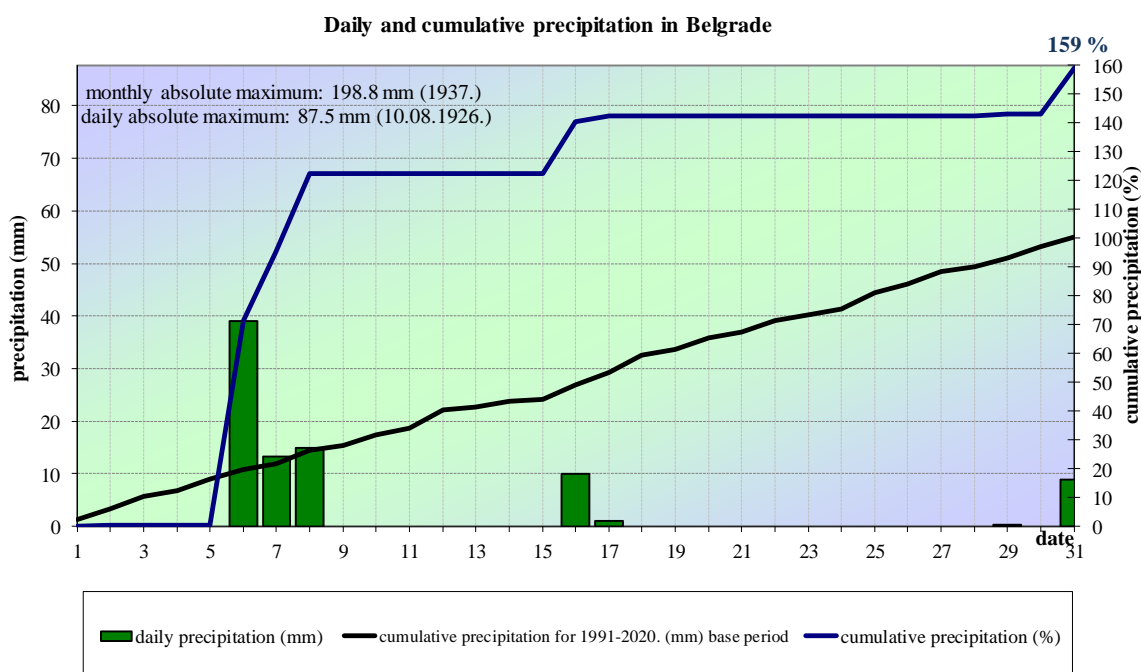


Figure 17. Daily and cumulative precipitation in Belgrade

SUNSHINE DURATION (INSOLATION)

Sunshine duration in August ranged from 215.6 hours in Zaječar to 323.2 hours in Kikinda (Figure 18).

August insolation ranged from 82% in Novi Sad to 108% in Kikinda relative to the normal for the 1991-2020 base period (Figure 19).

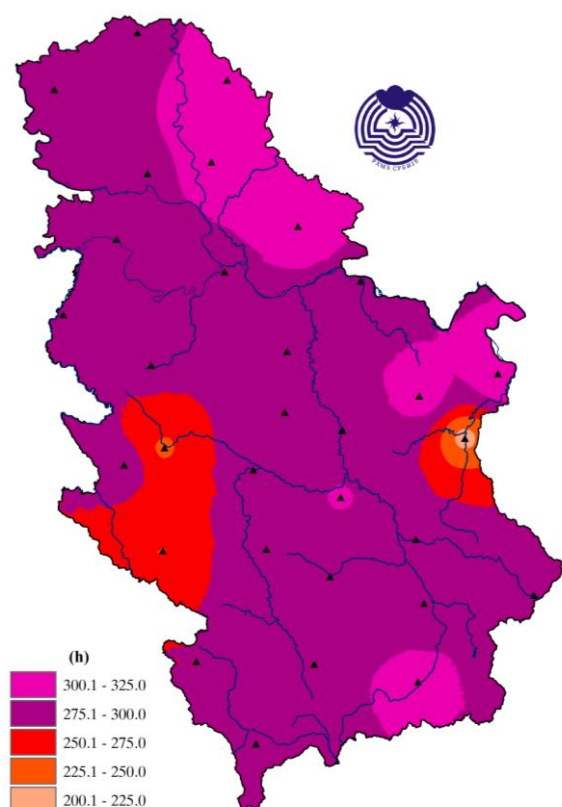


Figure 18. Insolation, expressed in hours

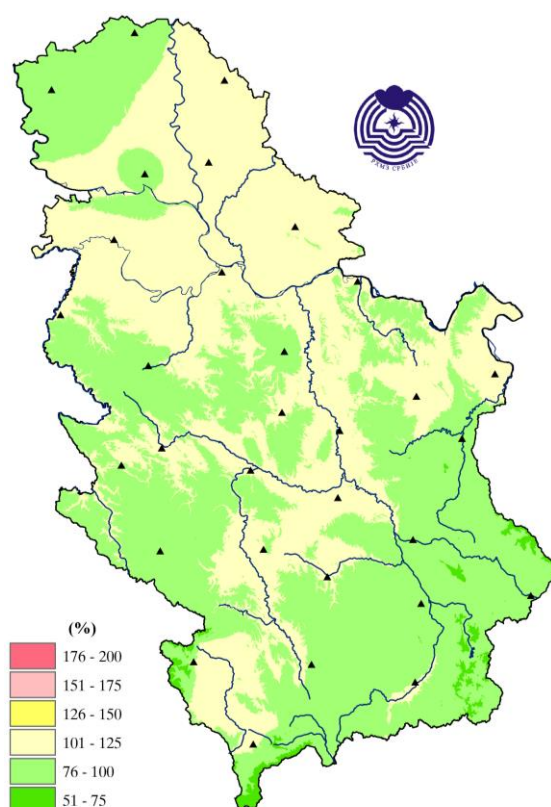


Figure 19. Insolation expressed in the percentages of normal

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

OVERVIEW OF THE SYNOPTIC SITUATION*

Series of waves from the northwest and west, shallow depression from the southeast and south of the continent, occasionally unsettled and humid weather with intermittent patches of heavy rain and severe weather events; period of very warm weather, particularly in the north and west of the country influenced by very warm air mass within the ridge from the northern Africa, western Mediterranean across the Alps and central Europe.

Period at the beginning of the first decade was marked by warm and very warm weather influenced by ridge and warm air mass at the front side of the low pressure from the northwestern and western Mediterranean. In the period during mid-decade, following further development of low pressure with the accompanying frontal systems and their transfer toward east and northeast caused shift in weather conditions, that is, rain with thundershowers and isolated heavy downpours, particularly affecting north and northeast of the continent and Banat, with considerable temperature drop in the entire country. Period until the end of the first decade was marked by changeable weather with scattered showers, mostly in central and southern areas.

Period of moderately warm and predominantly sunny weather remained until the half of the month influenced by increased ground air pressure field and weakly pronounced northwesterly, and then northerly upper air circulation.

Period at the beginning of the second decade was marked by development of new low pressure on the Atlantic and the British Isles and intensive advection of warm air mass emanating from the northern Africa across the Pyrenean peninsula, western Mediterranean and Alps leading to cutoff of upper air depression within the Ioannina Sea. In the ensuing days, mostly from the middle of the month, the upper air cyclone circulation affected weather in most of country producing unsettled air mass and thundershowers, at places with severe weather events, mostly in the northeast and central areas.

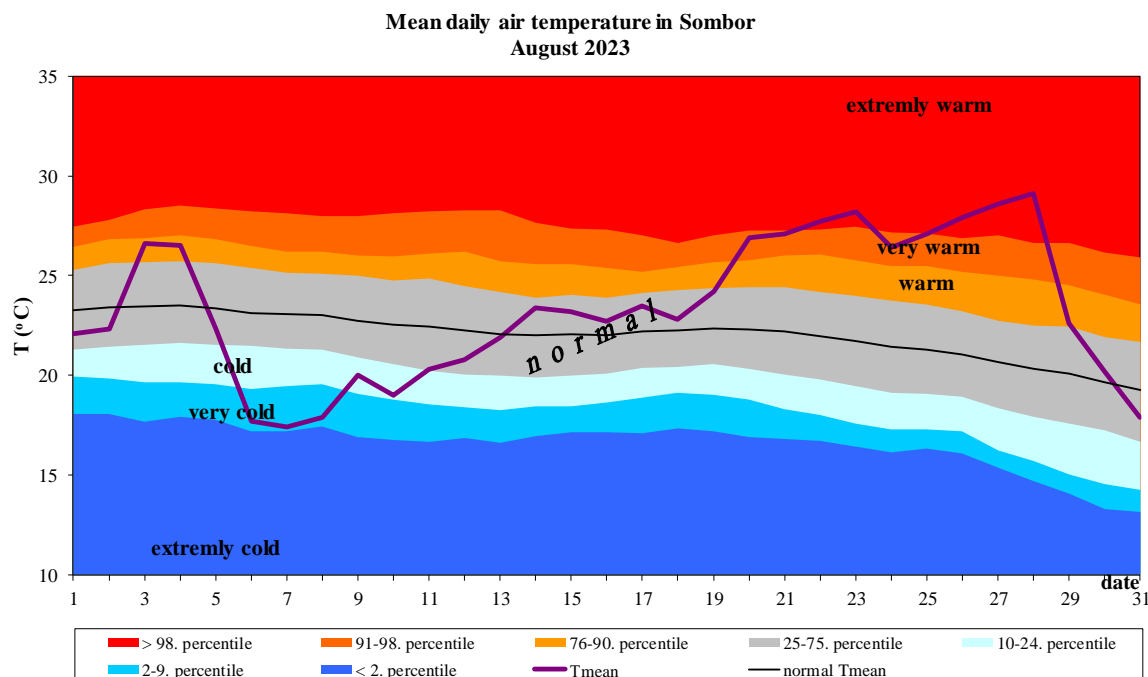
At the beginning of the third decade, one intensive development of low pressure took place at the Atlantic and northwest of the continent along with the advection of very warm air mass from the north of Africa across the Pyrenean peninsula and western Mediterranean, and then the Alps and central Europe. In the west and north, it was very warm. Simultaneously, weakly pronounced upper air depression lingered within the central Mediterranean, southeastern Balkans and Aegean Sea. In the middle of the third decade, mostly in hilly-mountainous regions as well as in the southeast of the continent, it caused humid and unsettled weather with afternoon thundershowers at places accompanied by episodes of extreme weather, strong to stormy wind and hail.

Period at the end of the month was characterized by thermal ridge and warm conditions across the entire country, followed by cold front emanating from the northwest and west within the low pressure from the central Europe and Genoa Bay accompanied by cloudiness and rain, thundershowers, with intermittent patches of heavy rain, hail and stormy wind with significant drop in temperature.

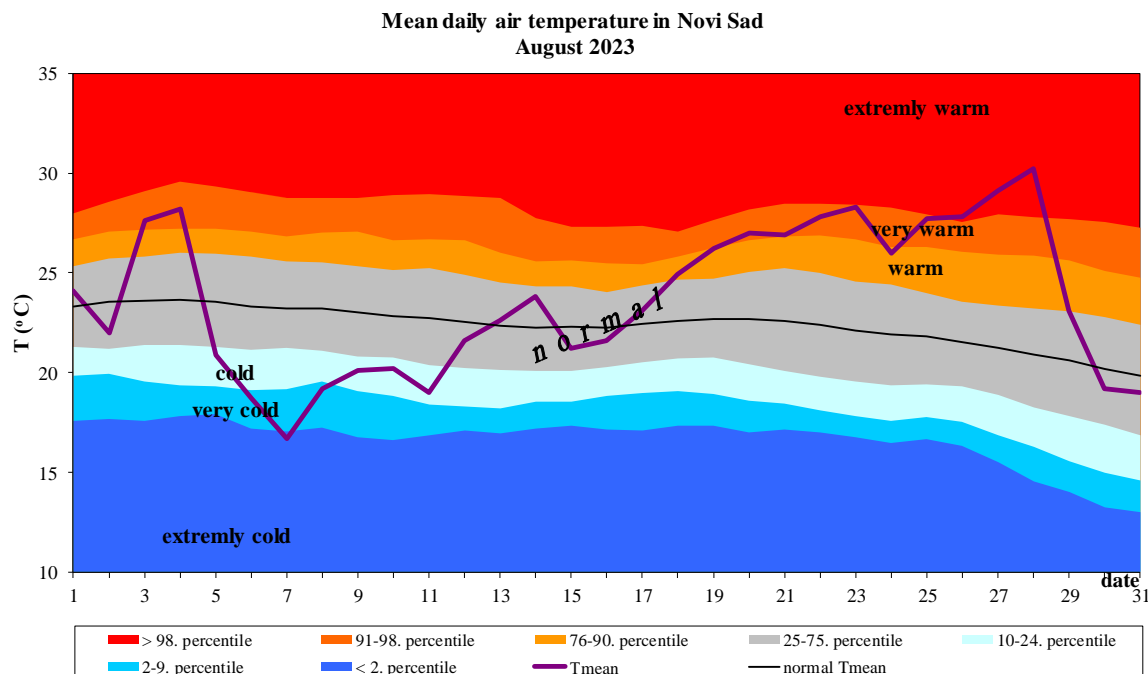
* National Center for Hydrometeorological Early Warning System

APPENDIX

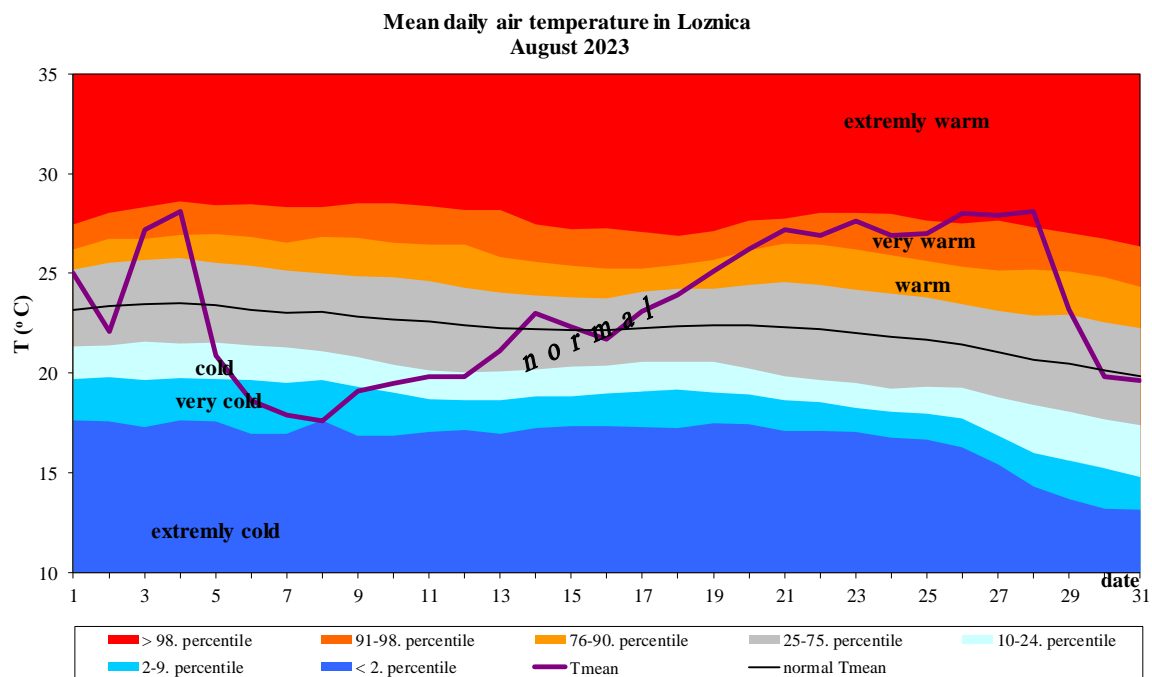
Mean air temperature



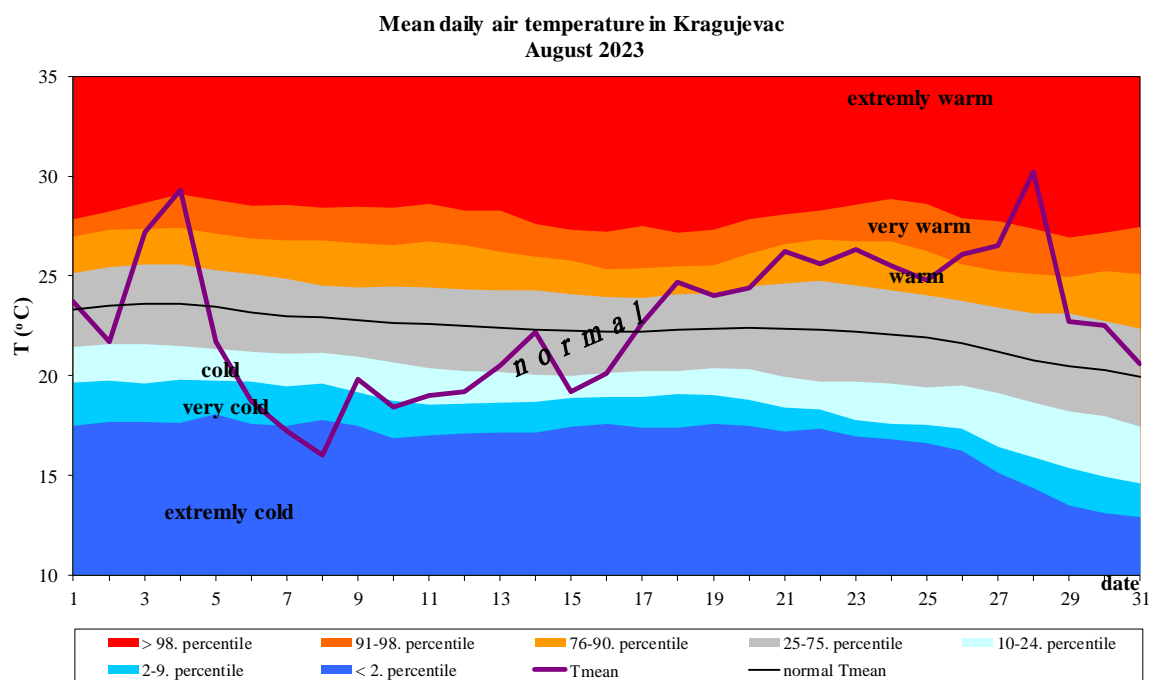
Appendix 1. Daily course of the mean daily air temperature and accompanying percentile for Sombor



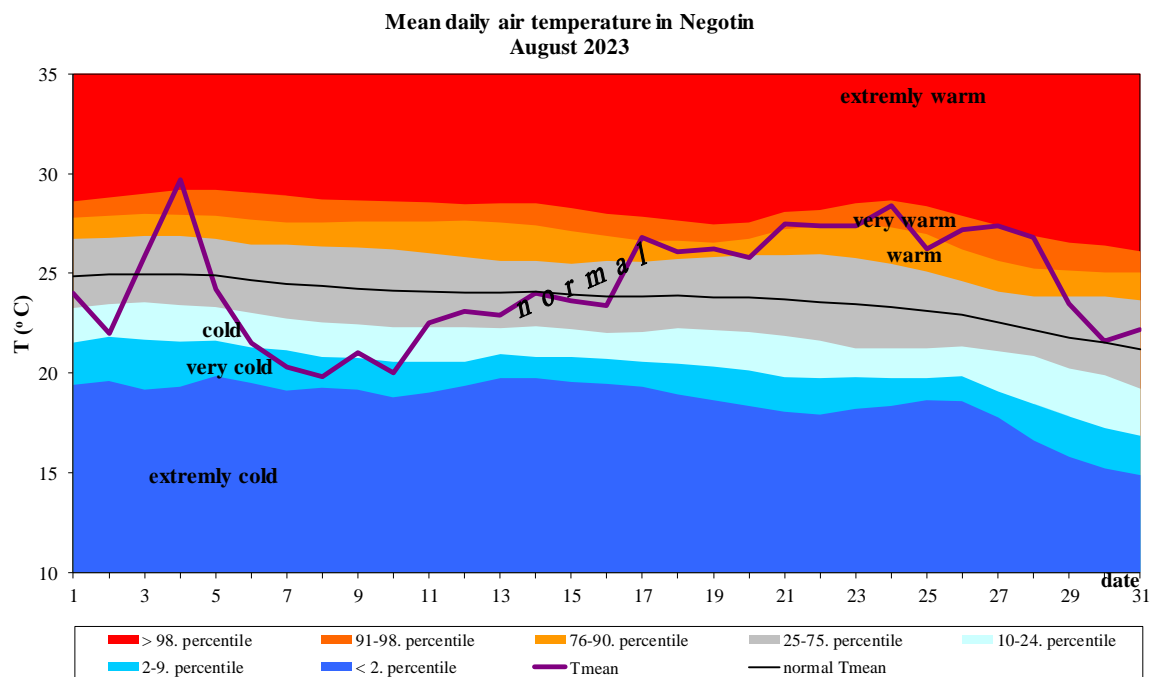
Appendix2. Daily course of the mean daily air temperature and accompanying percentile for Novi Sad



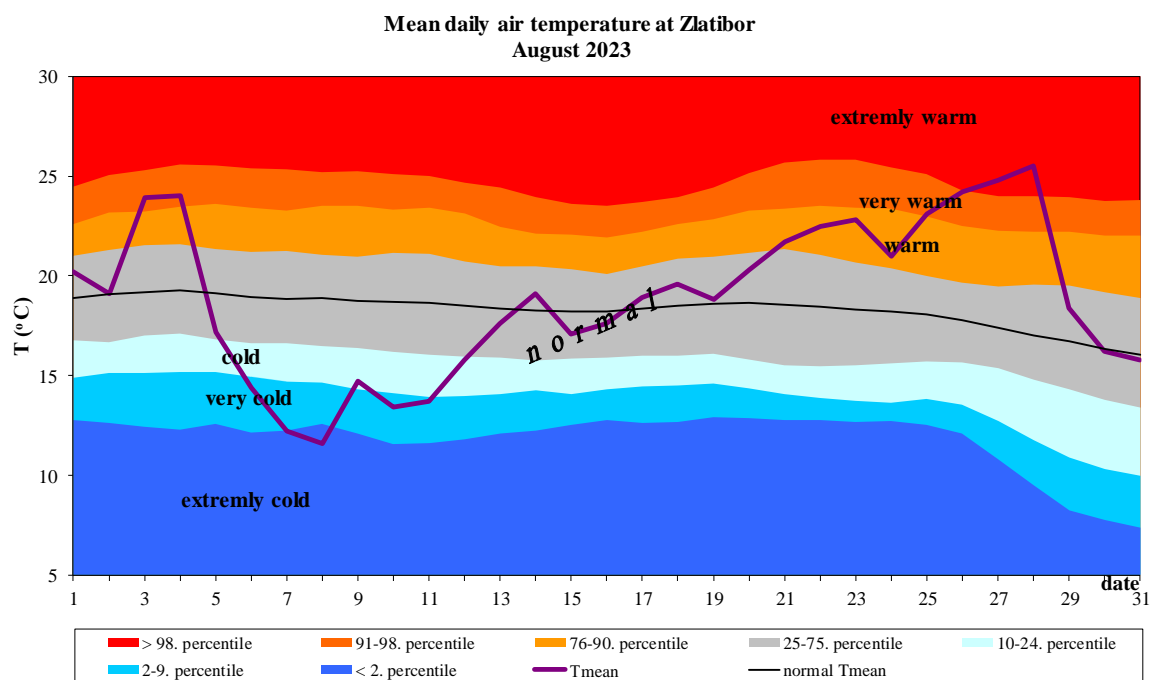
Appendix 3. Daily course of the mean daily air temperature and accompanying percentile for Loznica



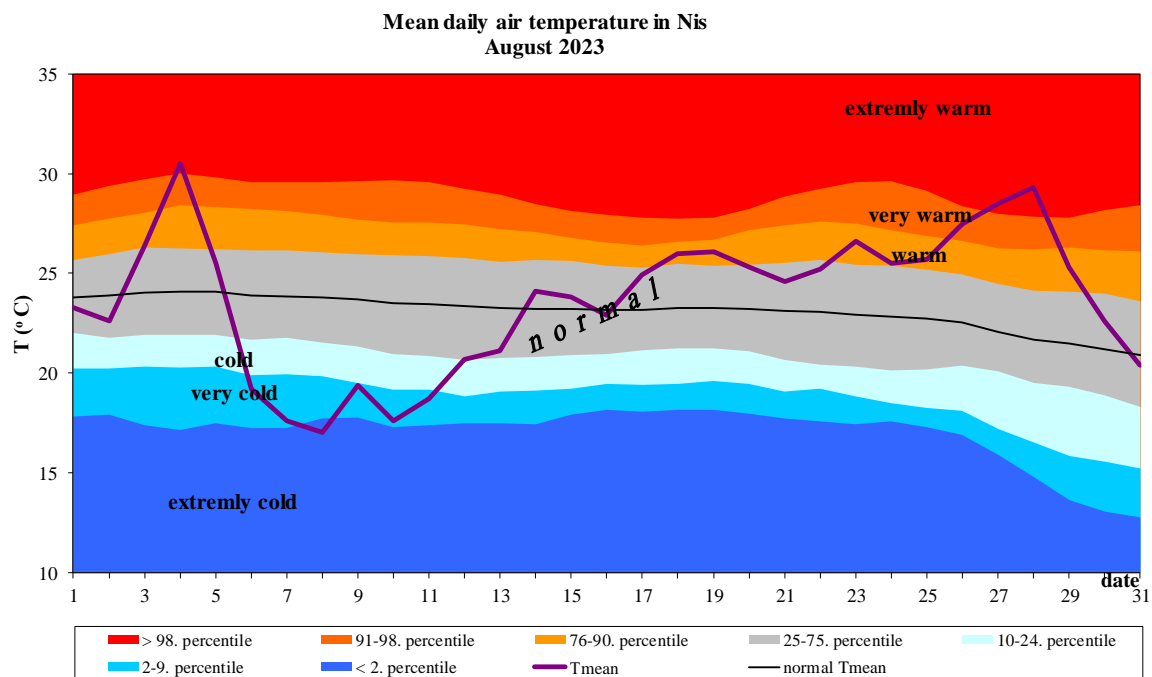
Appendix 4. Daily course of the mean daily air temperature and accompanying percentile for Kragujevac



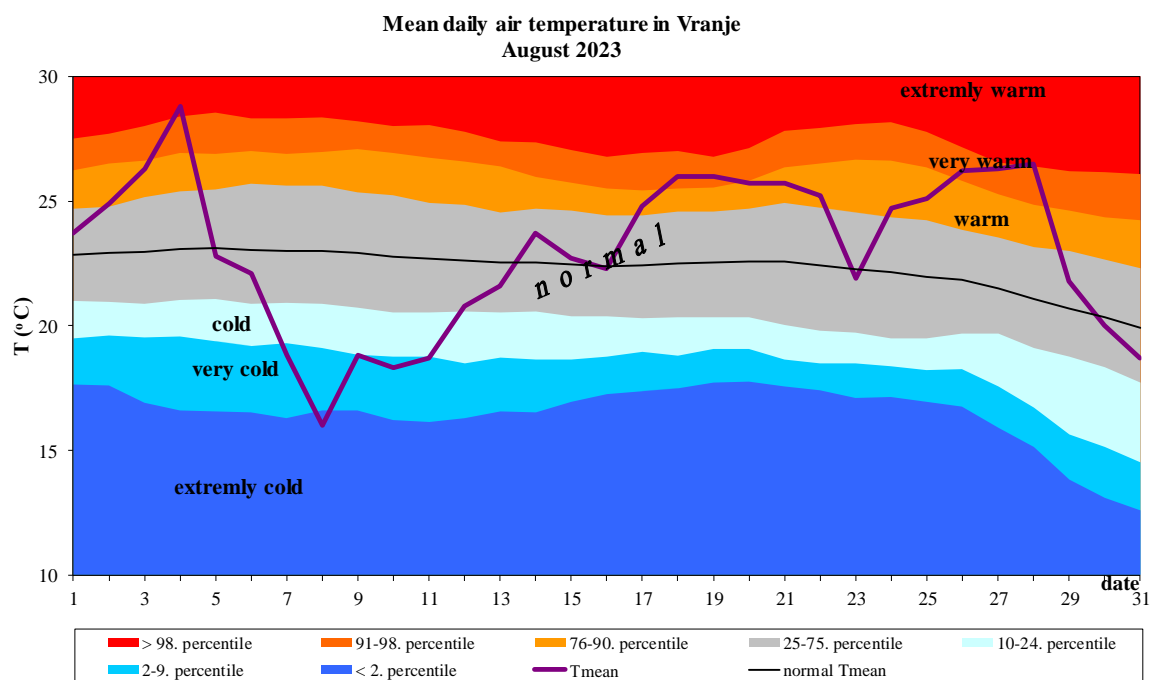
Appendix 5. Daily course of the mean daily air temperature and accompanying percentile for Negotin



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

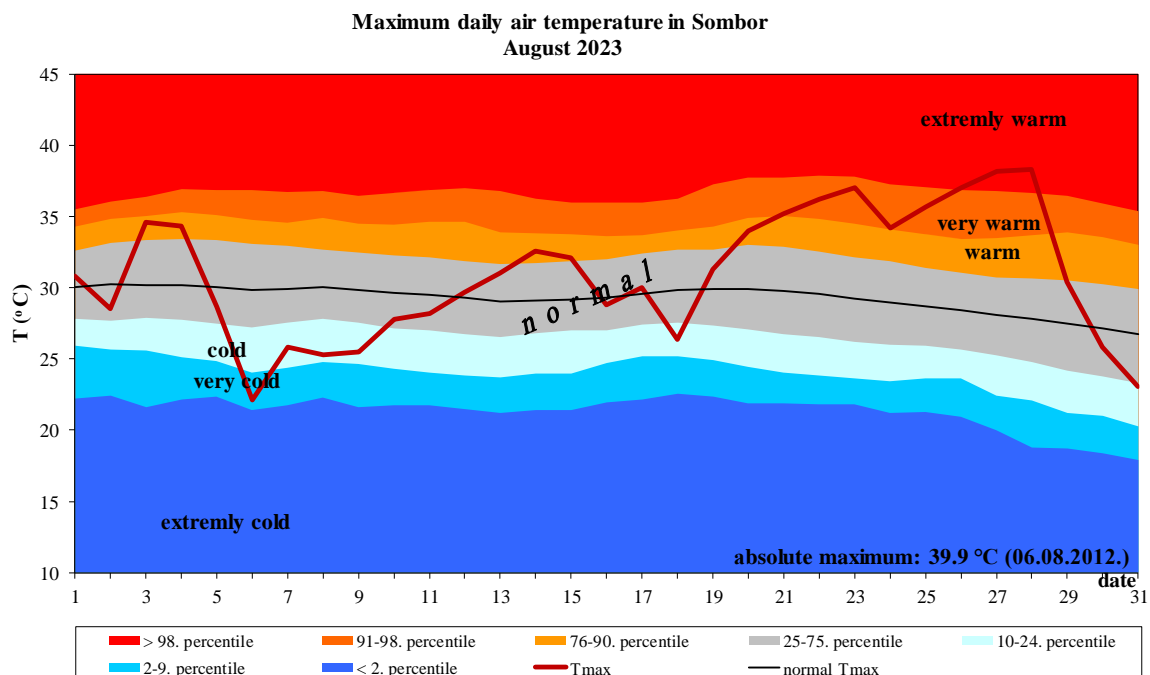


Appendix 7. Daily course of the mean daily air temperature and accompanying percentile for Nis

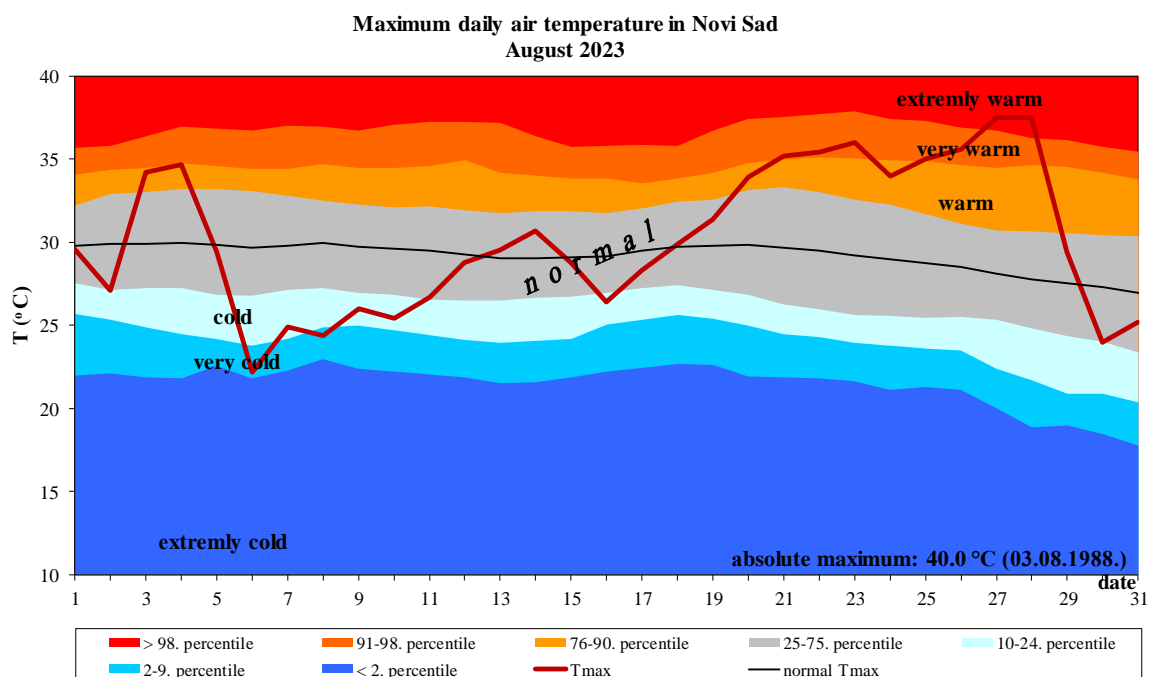


Appendix 8. Daily course of the mean daily air temperature and accompanying percentile for Vranje

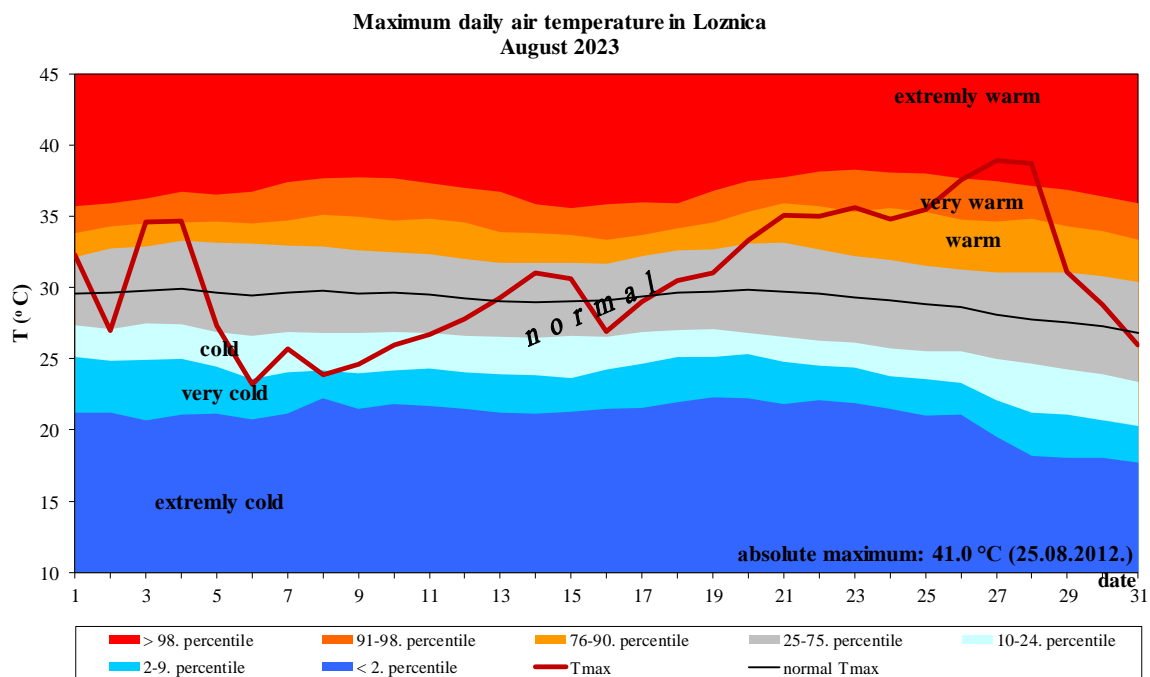
Maximum air temperature



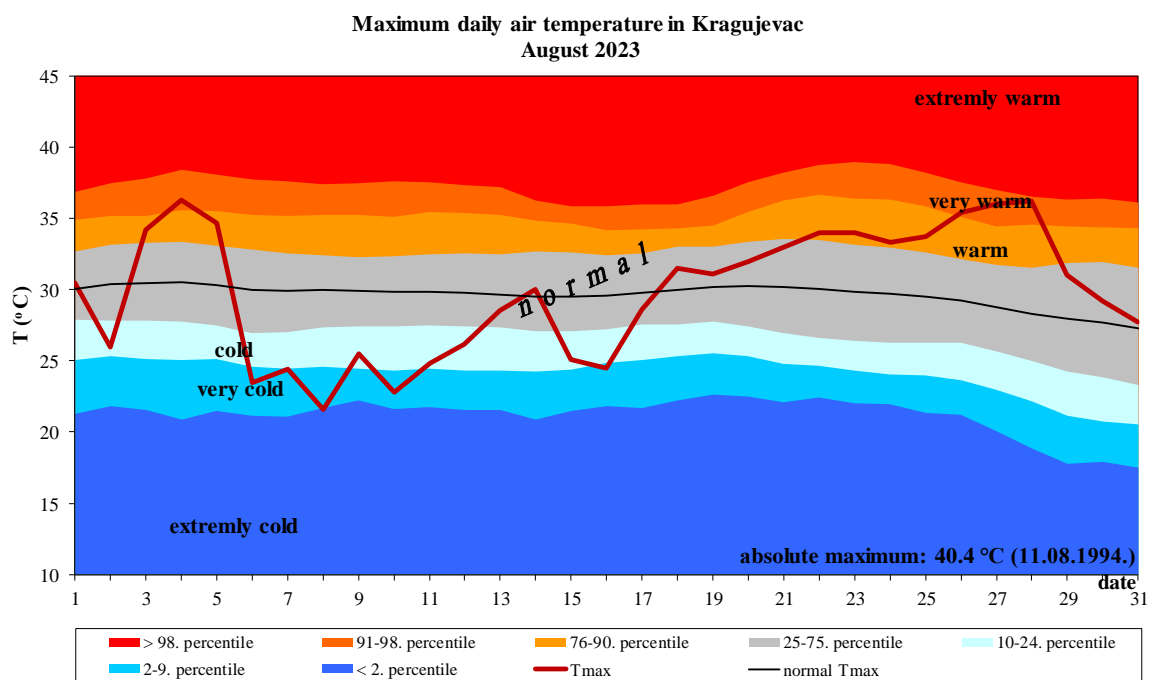
Appendix 9. Daily course of the maximum daily air temperature and the accompanying percentile for Sombor



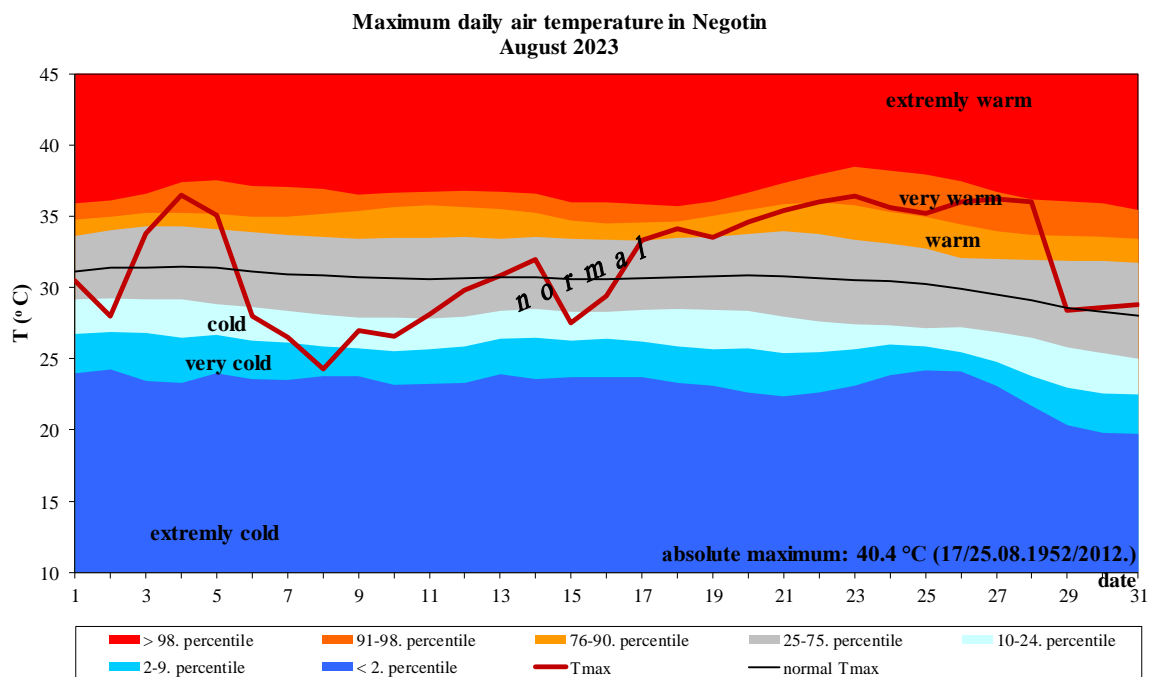
Appendix 10. Daily course of the maximum daily air temperature and the accompanying percentile for Novi Sad



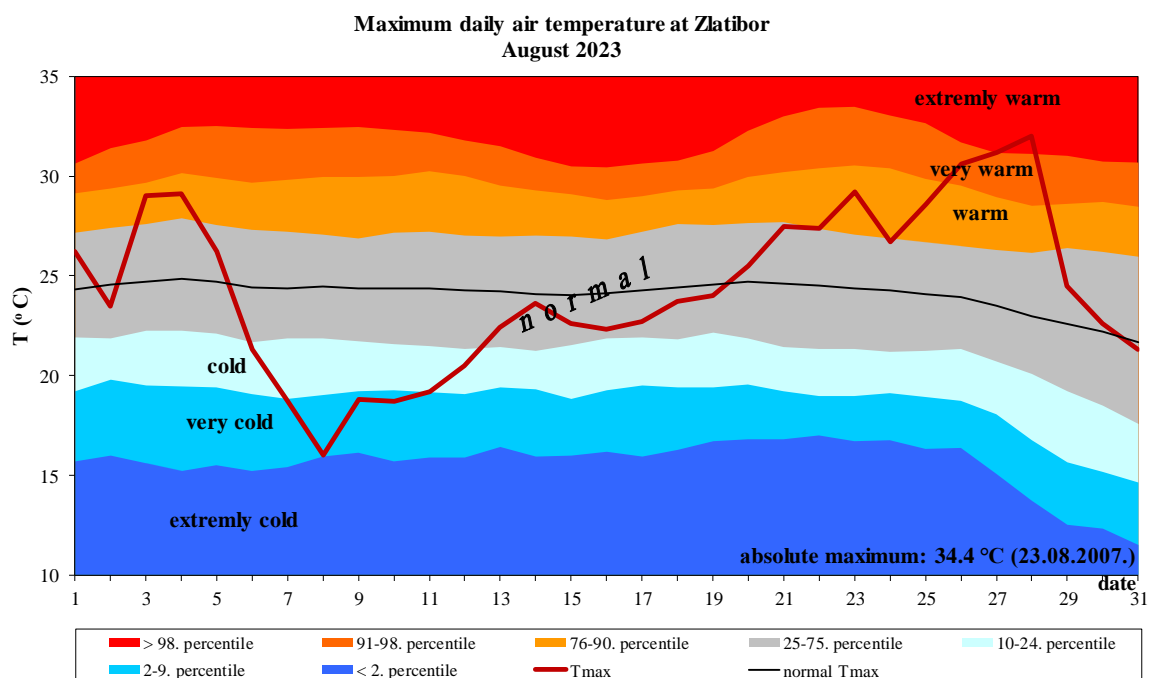
Appendix 11. Daily course of the maximum daily air temperature and the accompanying percentile for Loznica



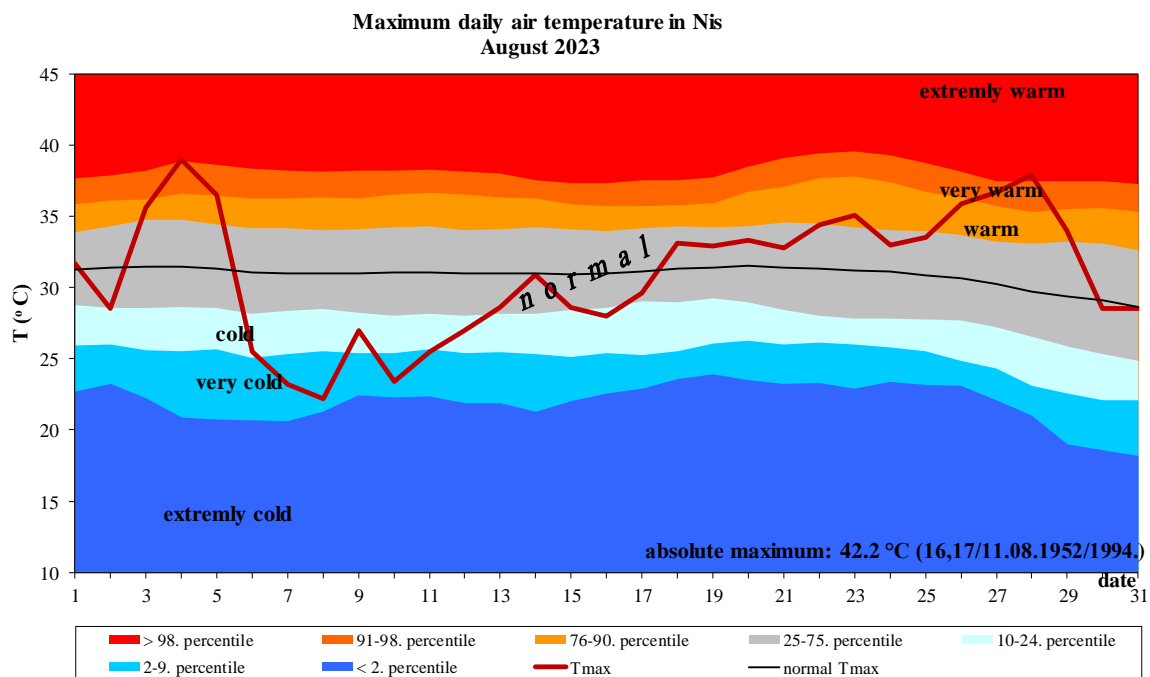
Appendix 12. Daily course of the maximum daily air temperature and the accompanying percentile for Kragujevac



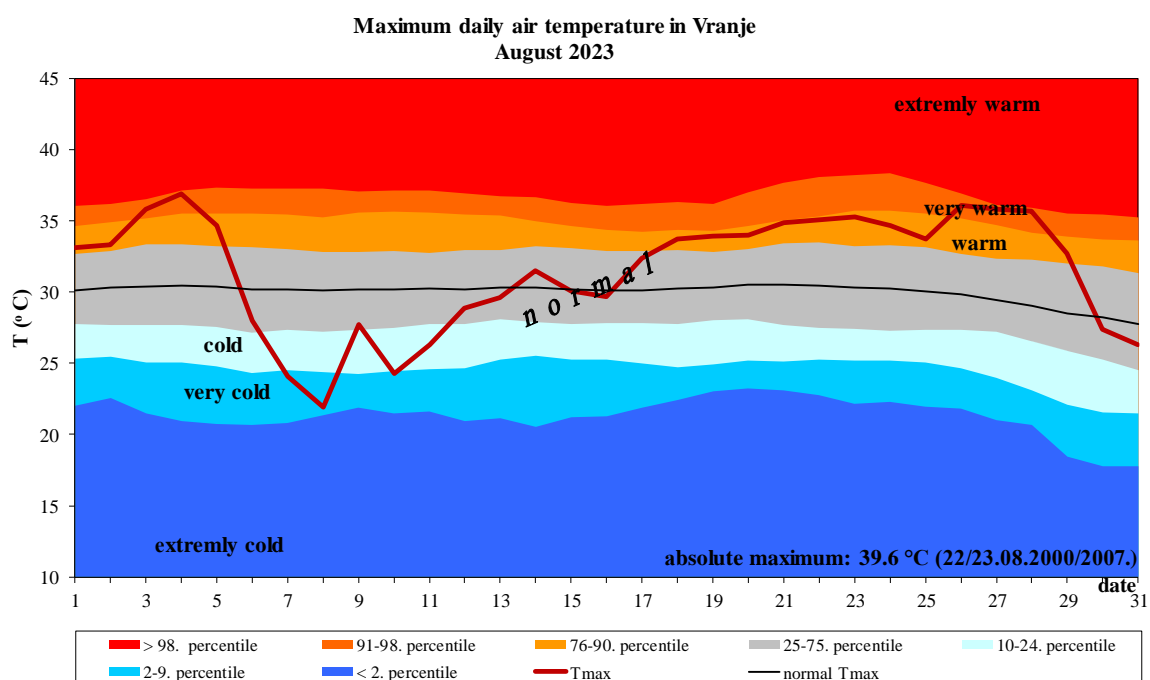
Appendix 13. Daily course of the maximum daily air temperature and the accompanying percentile for Negotin



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

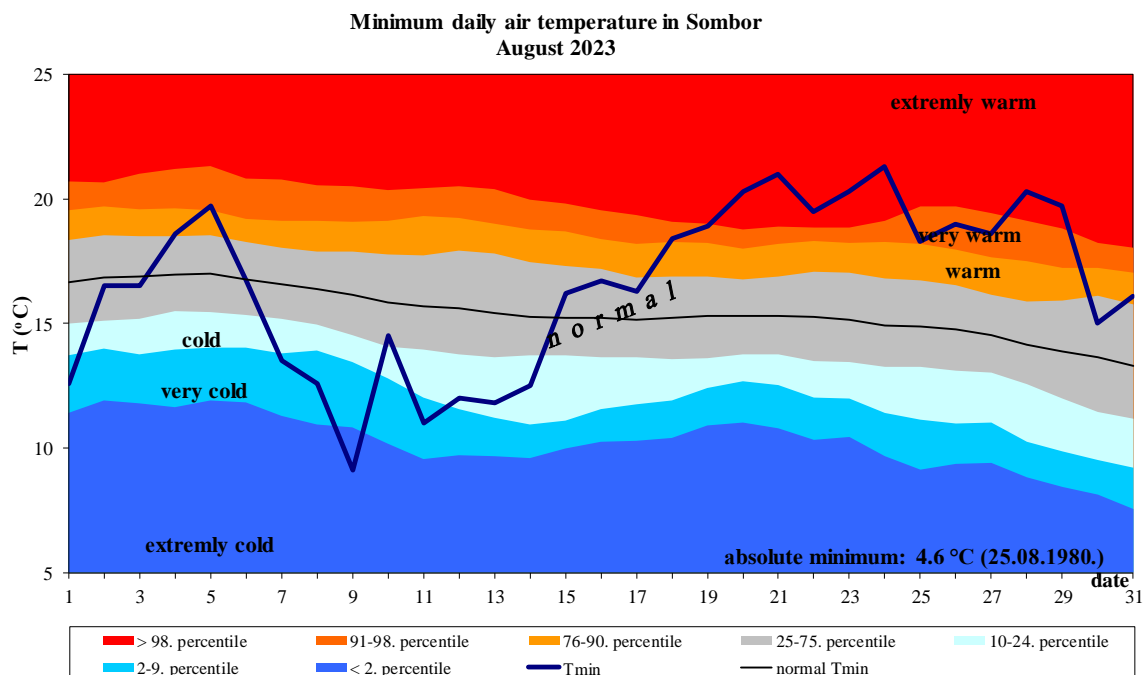


Appendix 15. Daily course of the maximum daily air temperature and the accompanying percentile for Nis

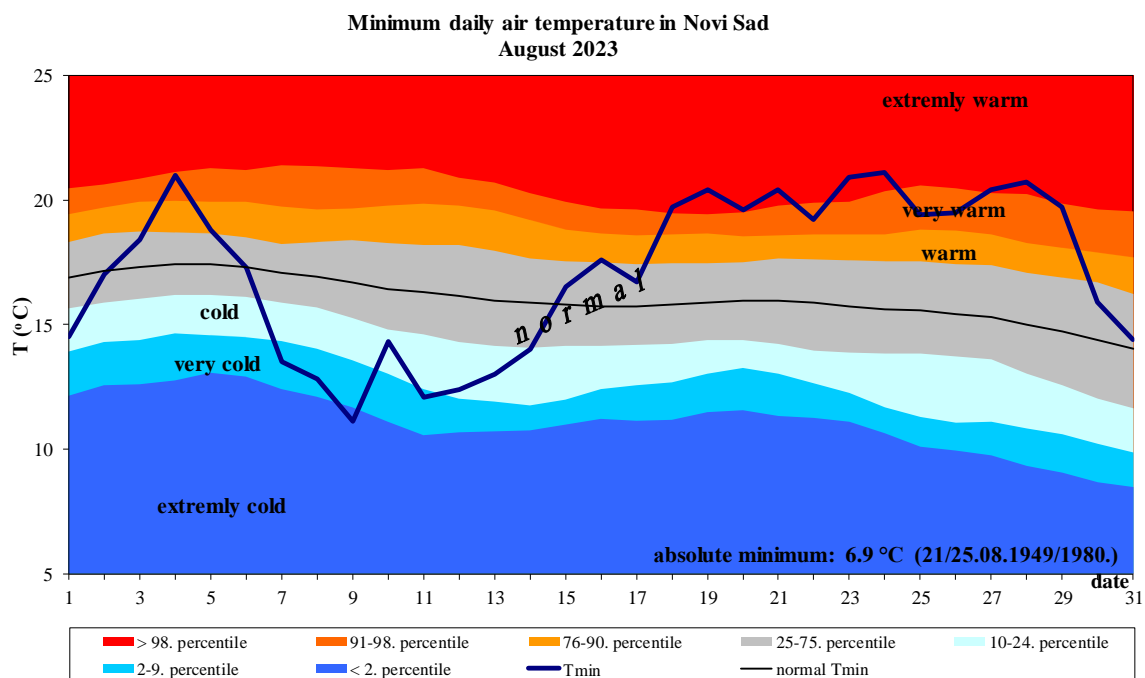


Appendix 16. Daily course of the maximum daily air temperature and the accompanying percentile for Vranje

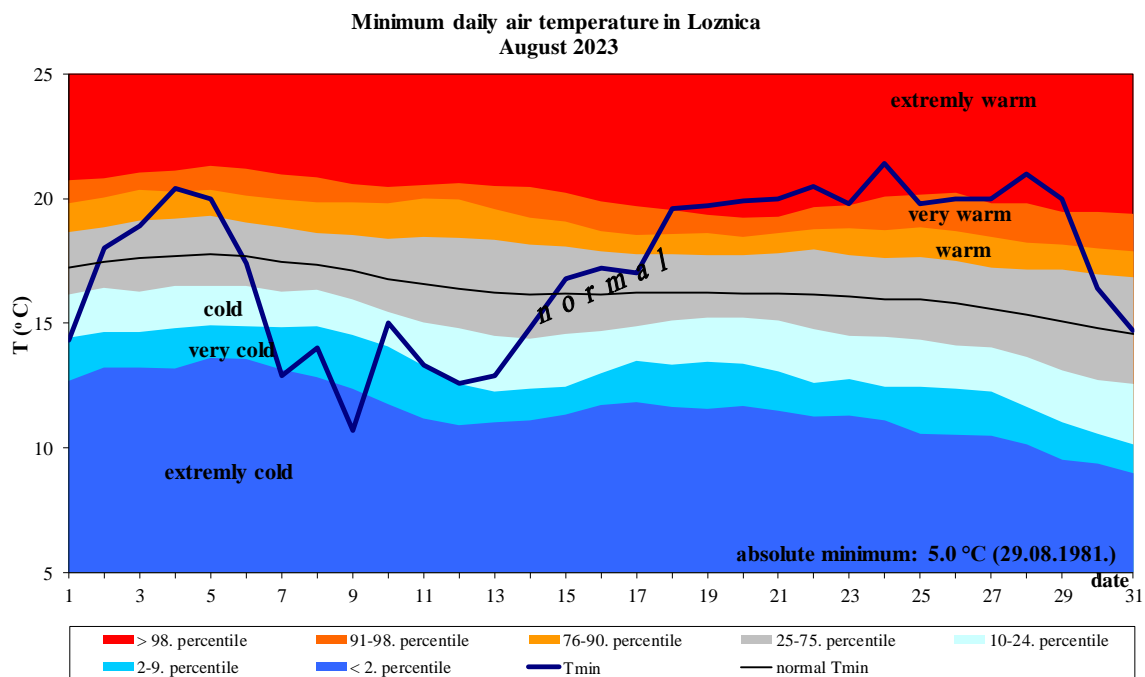
Minimum air temperature



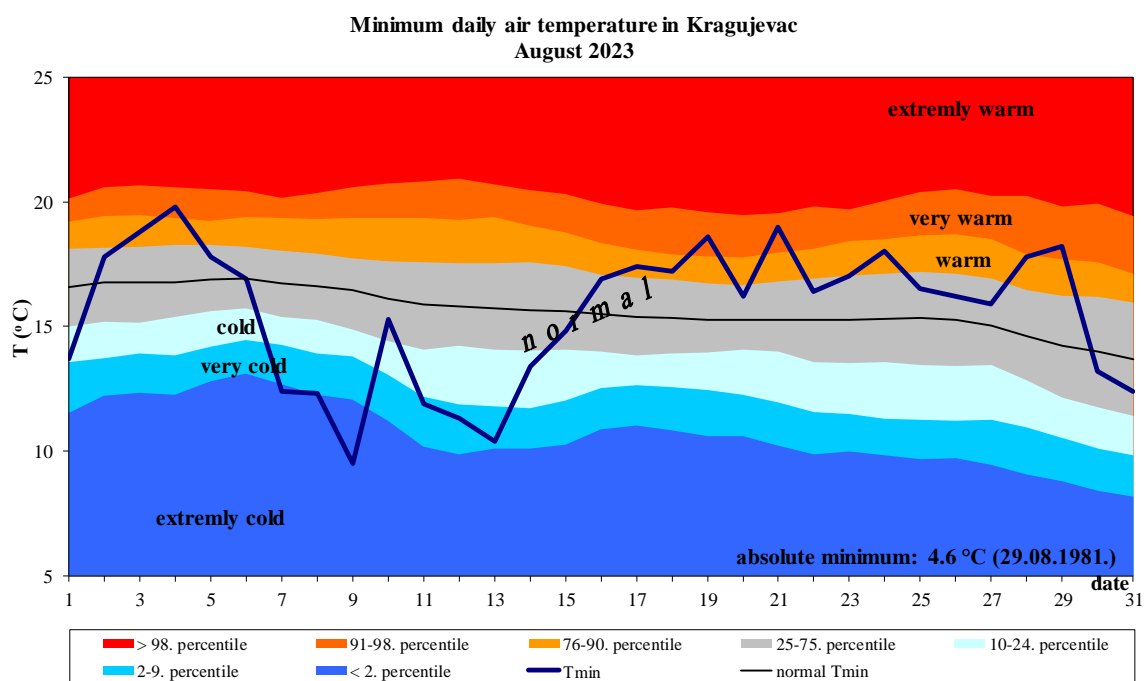
Appendix 17. Daily course of the minimum daily air temperature and the accompanying percentile for Sombor



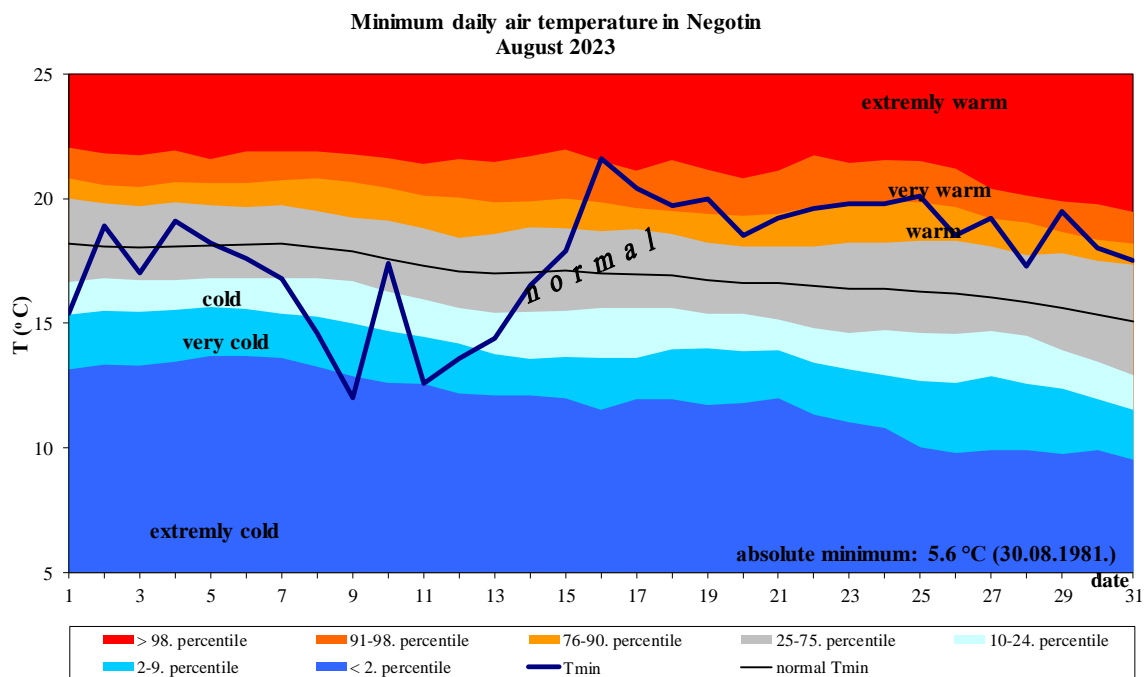
Appendix 18. Daily course of the minimum daily air temperature and the accompanying percentile for Novi Sad



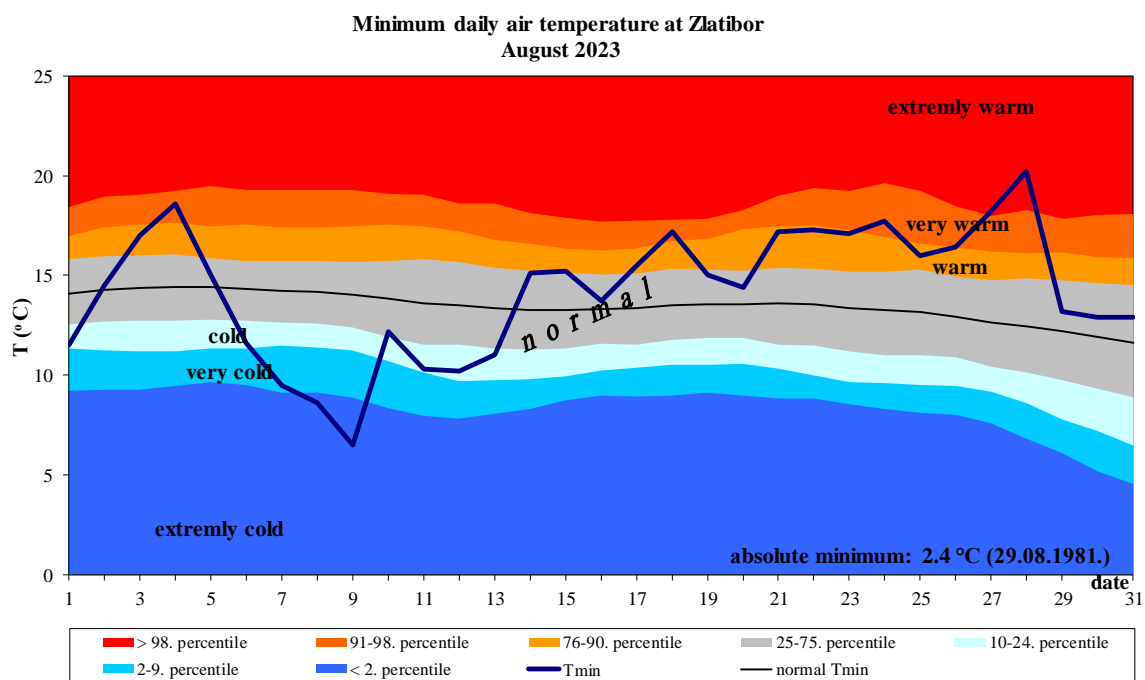
Appendix 19. Daily course of the minimum daily air temperature and the accompanying percentile for Loznica



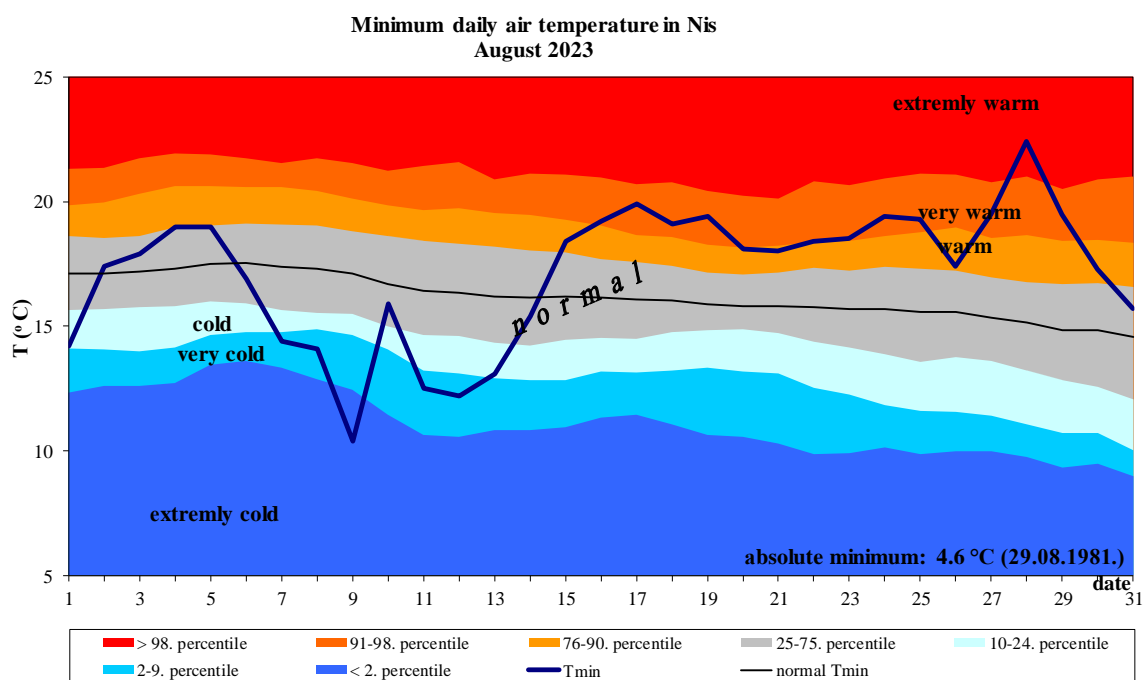
Appendix 20. Daily course of the minimum daily air temperature and the accompanying percentile for Kragujevac



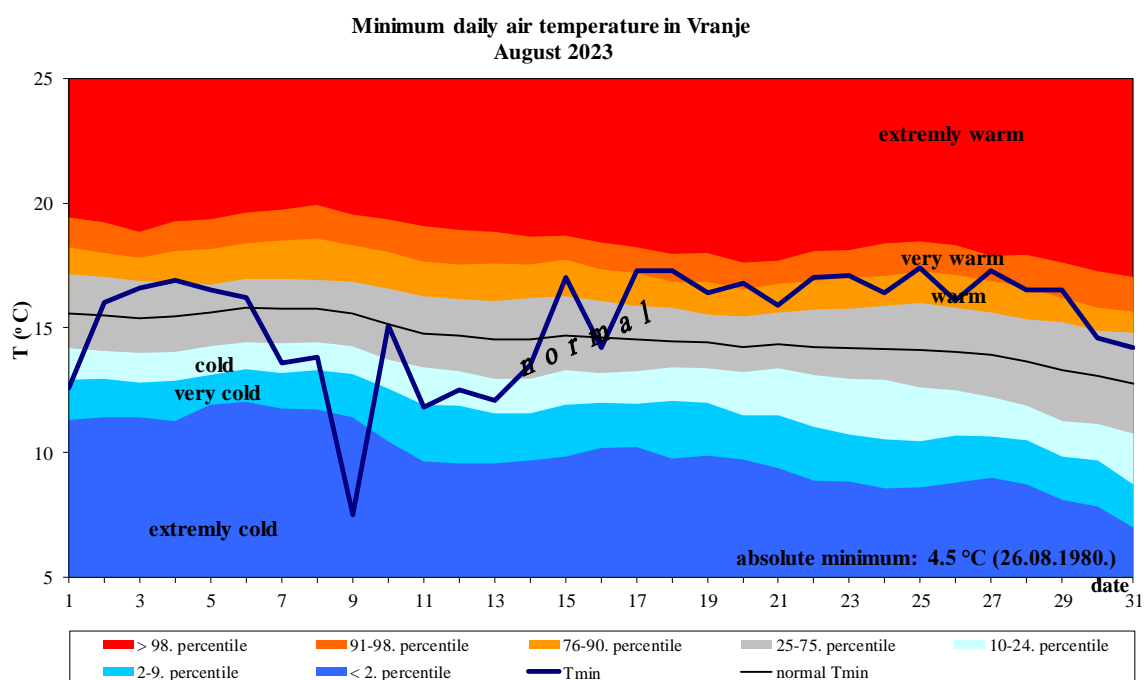
Appendix 21. Daily course of the minimum daily air temperature and the accompanying percentile for Negotin



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

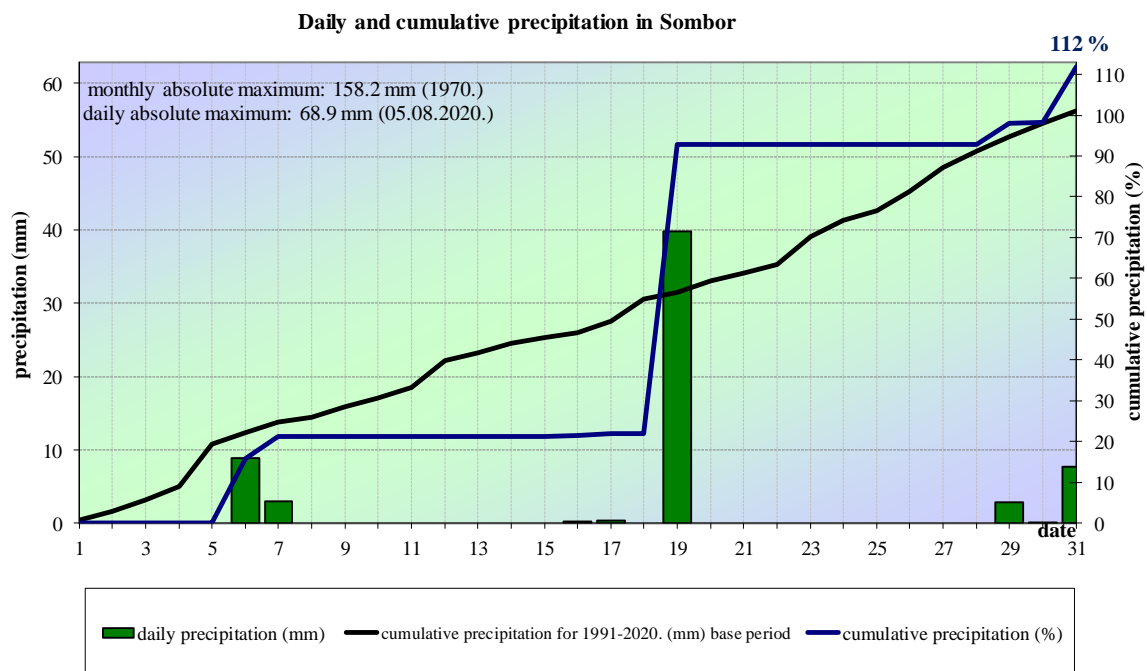


Appendix 23. Daily course of the minimum daily air temperature and the accompanying percentile for Nis

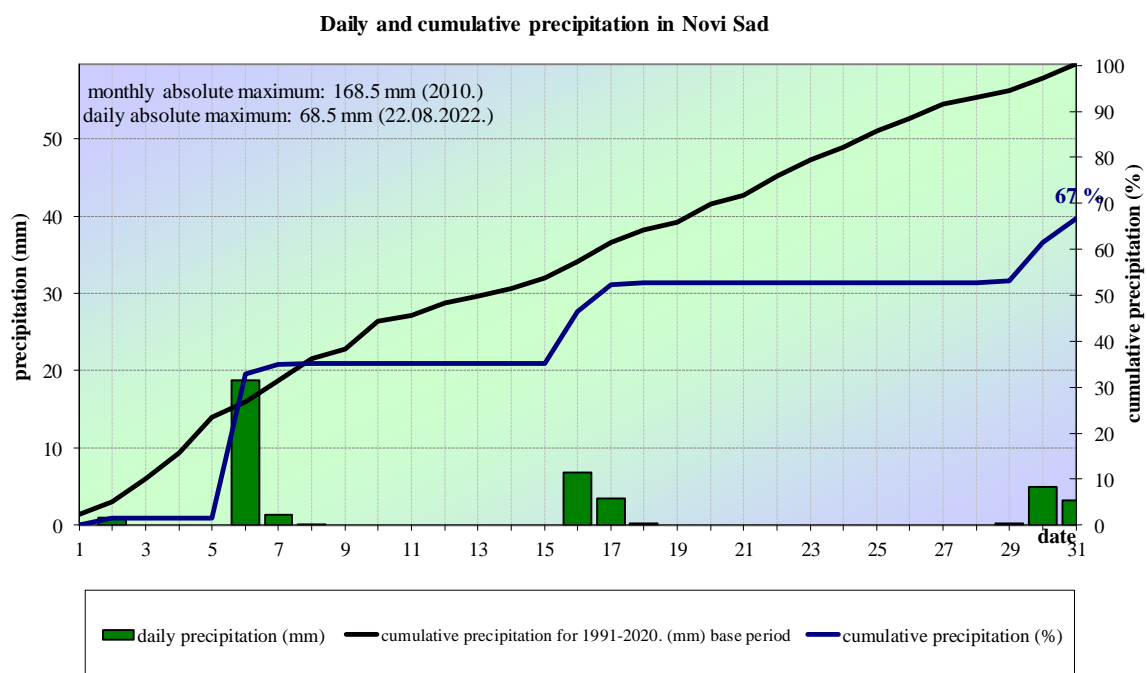


Appendix 24. Daily course of the minimum daily air temperature and the accompanying percentile for Vranje

Precipitation

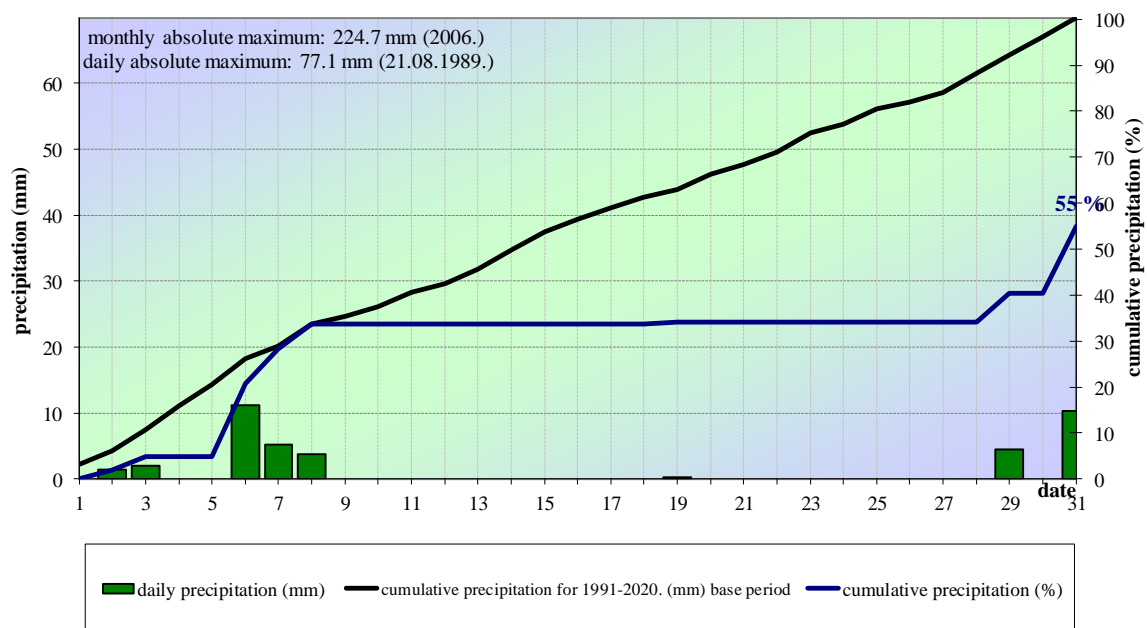


Appendix 25. Daily and cumulative precipitation sums for Sombor



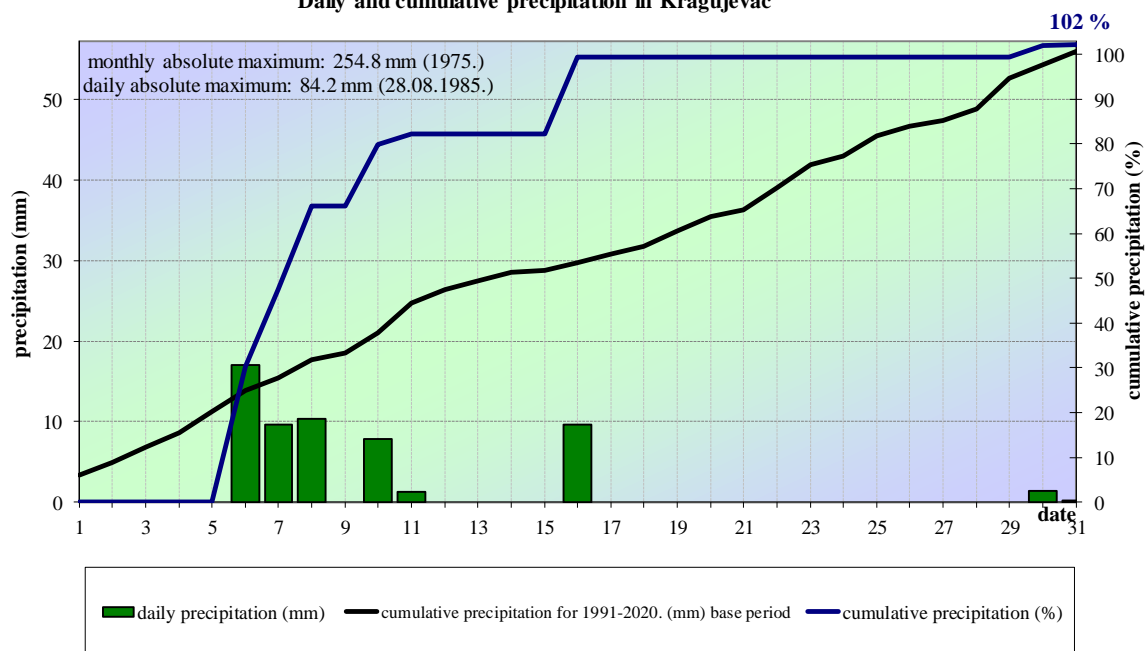
Appendix 26. Daily and cumulative precipitation sums for Novi Sad

Daily and cumulative precipitation in Loznica

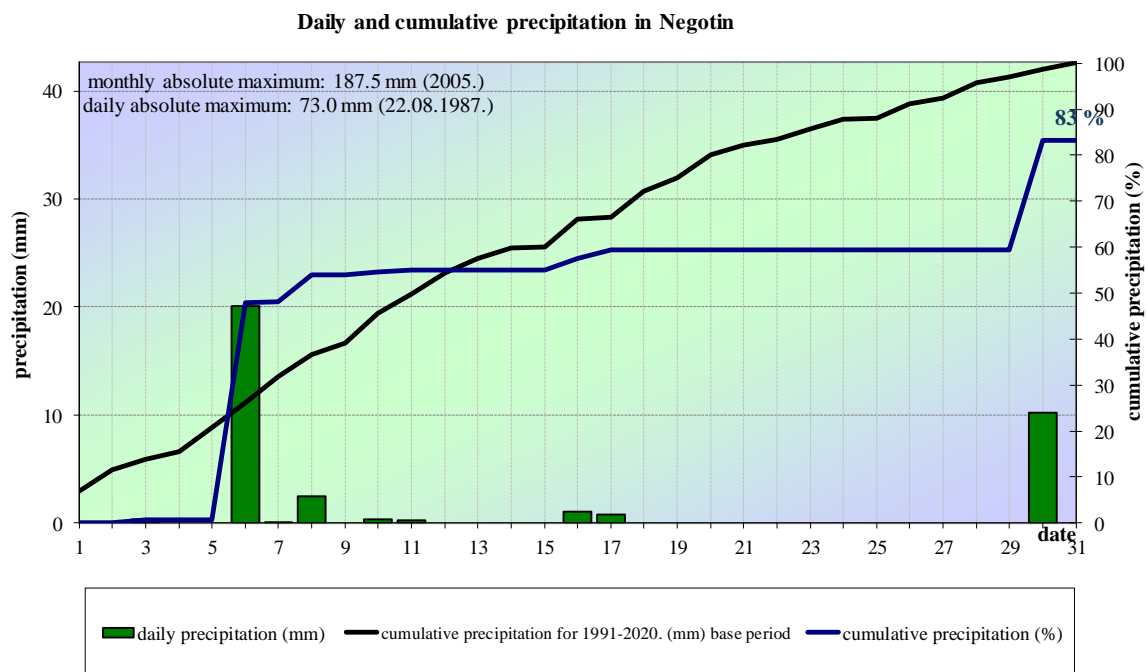


Appendix 27. Daily and cumulative precipitation sums for Loznica

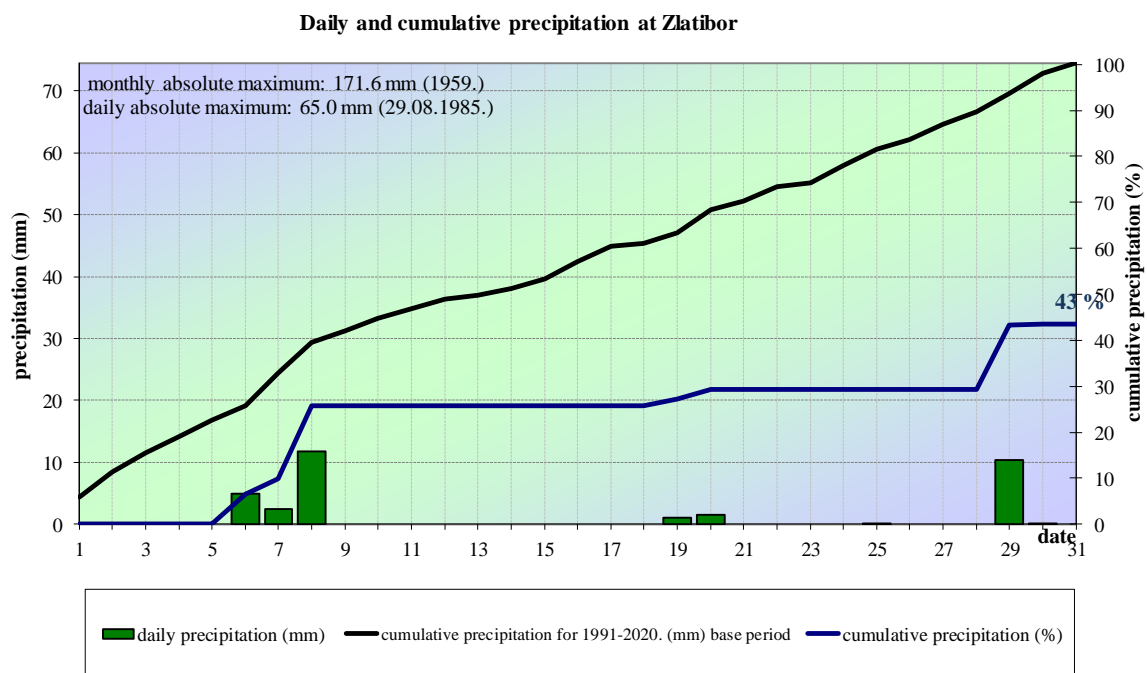
Daily and cumulative precipitation in Kragujevac



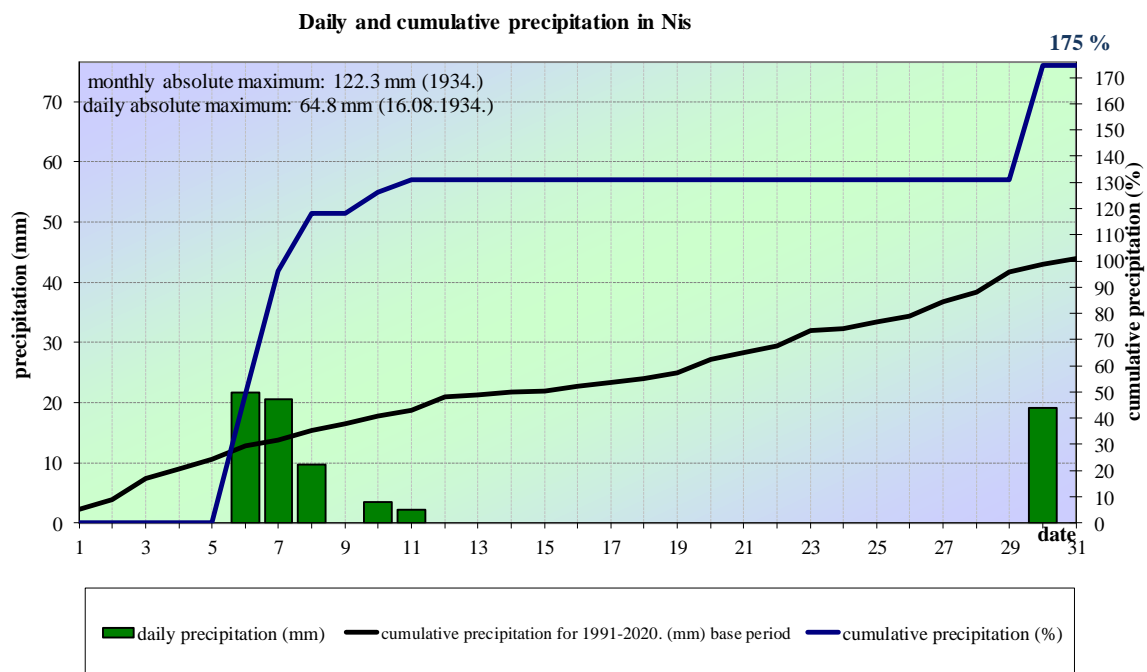
Appendix 28. Daily and cumulative precipitation sums for Kragujevac



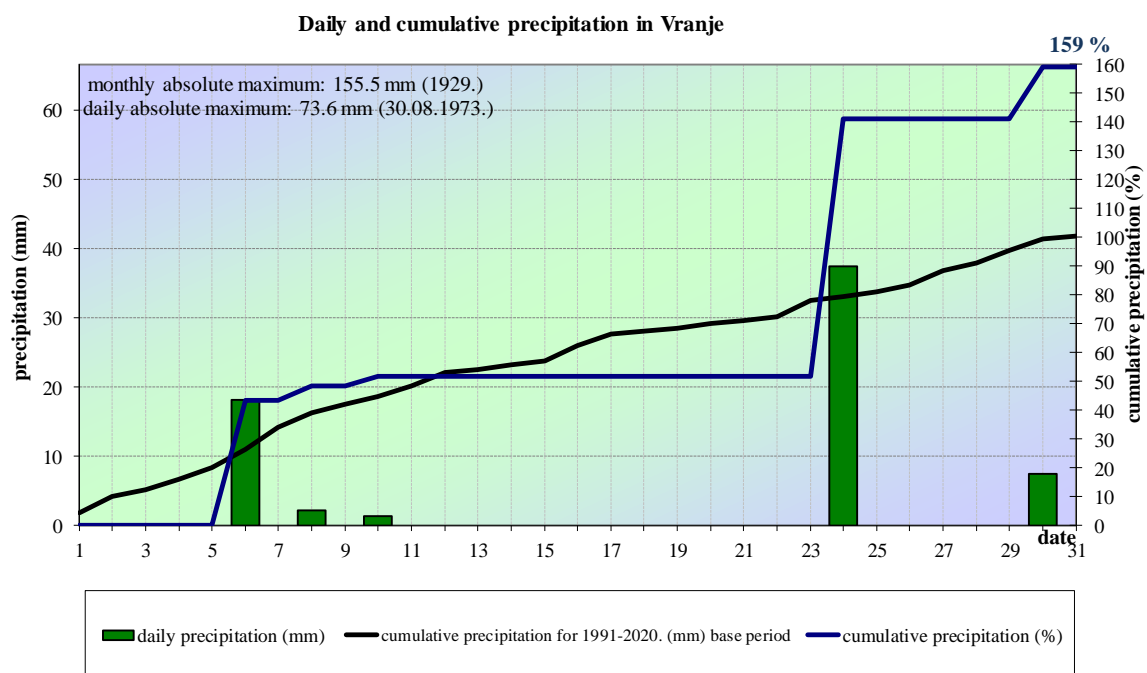
Appendix 29. Daily and cumulative precipitation sums for Negotin



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