

Annex

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Assessment of the SEECOF-29 Climate Outlook for Slovenia for the summer season 2023

SEECOF-29 Climate Outlook for Slovenia for the summer season 2023

The consensus statement of SEECOF-29 climate outlook for the 2023 summer season emphasized that observed sea surface temperatures and forecast for the coming three months of the summer 2023 showed above normal temperature of the Tropical Pacific evolving towards a moderate El Niño event. Over the Indian Ocean a positive phase of Indian Ocean Dipole was observed. However, models didn't agree on showing a teleconnection towards MedCOF domain. At that time above normal sea surface temperature anomalies over Tropical and Eastern North Atlantic were suggested to continue. In the atmosphere models tended to show more frequency of high latitude blocking, with zonal regimes less favoured. Below normal pressures were showed by most models, although there were spatial differences in the position of the main anomaly patterns. With that general context, above normal temperatures could be expected over most of the domain, with the exception of Northwestern Africa and Northeastern part of MedCOF domain, where normal to above temperatures were expected. The warm signal seemed more intense over the rest of Northern Africa, Mediterranean Sea and parts of the Middle East.

The consensus was, that in the entire SEECOF region, summer temperature was likely to be above-normal, with the probability increasing from the north-eastern (Zone 2 in Figure 1) towards south and south-western regions (Zone 1 in Figure 1). For Slovenia, the probabilities for below-, near- and above-normal temperature were estimated to be 20, 30 and 50 %.

Uncertainties in regional predictions are higher for precipitation than for temperature. Southern parts of Greece as well as southern coasts of Turkey with its hinterland were likely to experience near- or above-normal conditions in terms of summer precipitation sums (Zone 2 in Figure 2) while in most of the SEECOF region there was equal probability for summer precipitation (Zone 1 in Figure 2). It was noteworthy that certain parts of the country, particularly mountainous regions, might observe near- or above-normal summer precipitation totals due to the episodes of enhanced convection accompanied by heavy precipitation. For Slovenia that meant no clear signal or probabilities 33 % for each tercile category.

Figures 1 and 2 show the probabilistic consensus forecast for tercile categories of anomalies of seasonal temperature and precipitation, relative to the period 1981–2010.

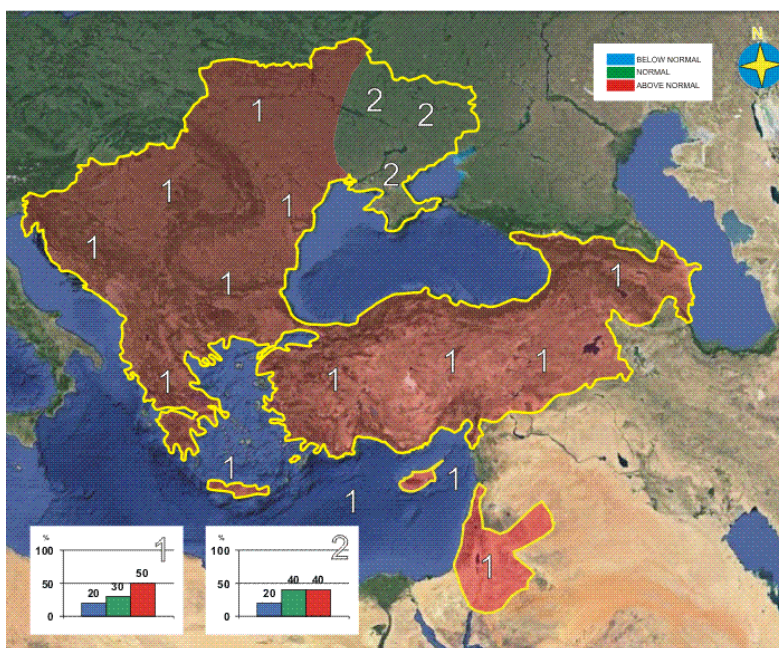


Figure 1. Graphical presentation of the summer 2023 temperature outlook

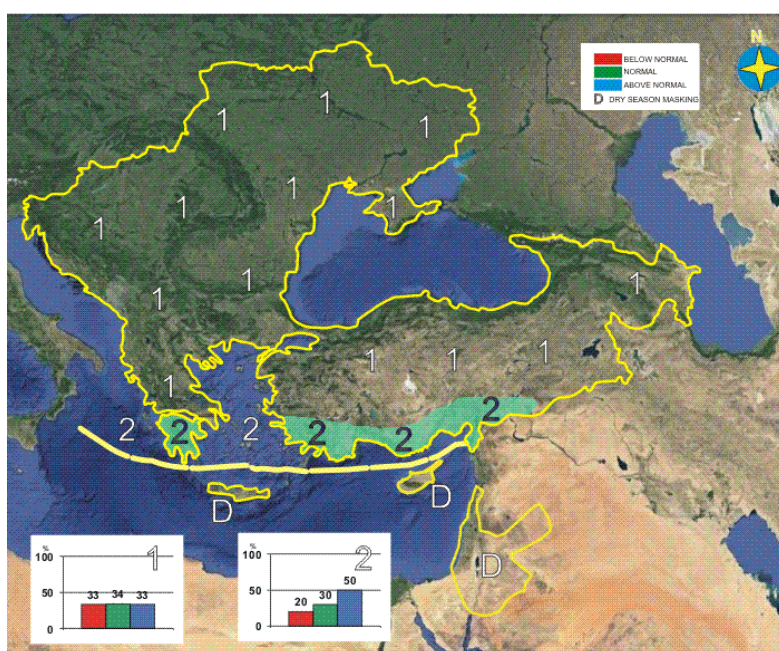


Figure 2. Graphical presentation of the summer 2023 precipitation outlook

Analysis of the summer season 2023

With this year, Slovenian Environment Agency has started to calculate all anomalies relative to the new 1991–2020 reference period. Especially with temperature, the comparison between 1981–2010 reference period of the SEECOF outlook and this new reference period can become difficult. The reference period 1991–2020 is approximately 0.6 °C warmer in Slovenia than the period 1981–2010. For precipitation there are no large differences,

Average air temperature in Slovenia in summer 2023 was above the average of the 30-year period 1991–2020 in whole country (Figure 3). Corresponding air temperature anomalies for

summer 2023 (months June, July and August) were between 0.2 °C and 1.3 °C, average anomaly was 0.8 °C (surface weighted average value). In the Alps and south-east of the country the anomalies were above 1°C, over most of the country between 0.5 and 1.0 °C and in the north-east below 0.5 °C. Summer 2023 has been the ninth warmest since at least 1950.

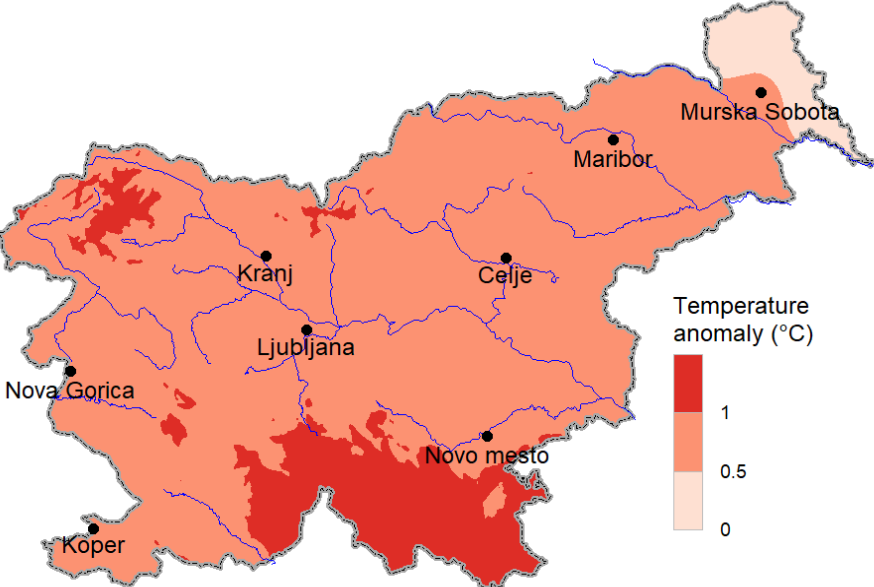


Figure 3. Mean air temperature anomaly in Slovenia in summer 2023, relative to the 1991–2020 average. Data are from 98 meteorological stations.

According to tercile ranks, thermal conditions in Slovenia in summer 2023 were above normal almost everywhere (Figure 4).

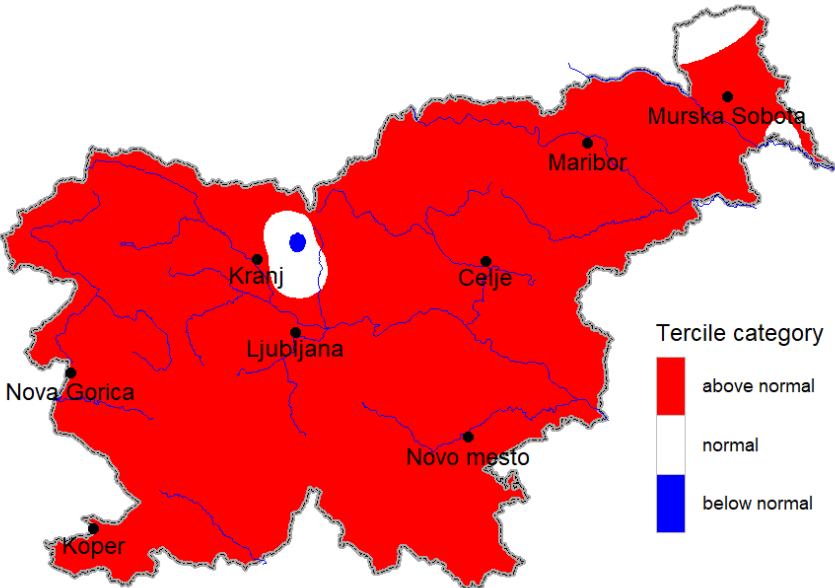


Figure 4. Mean air temperature tercile category of anomaly in Slovenia in summer 2023, relative to the period 1991–2020. Data are from 98 meteorological stations.

Precipitation in summer is usually very heterogeneous due to its convective nature. Precipitation index in Slovenia in summer 2023 was above average in whole country, which is very unusual for such a warm season (Figure 5). Precipitation index was within the range from 100 % to 231 %, with surface weighted average value of 163 %. Summer 2023 has been the wettest since at least 1950.

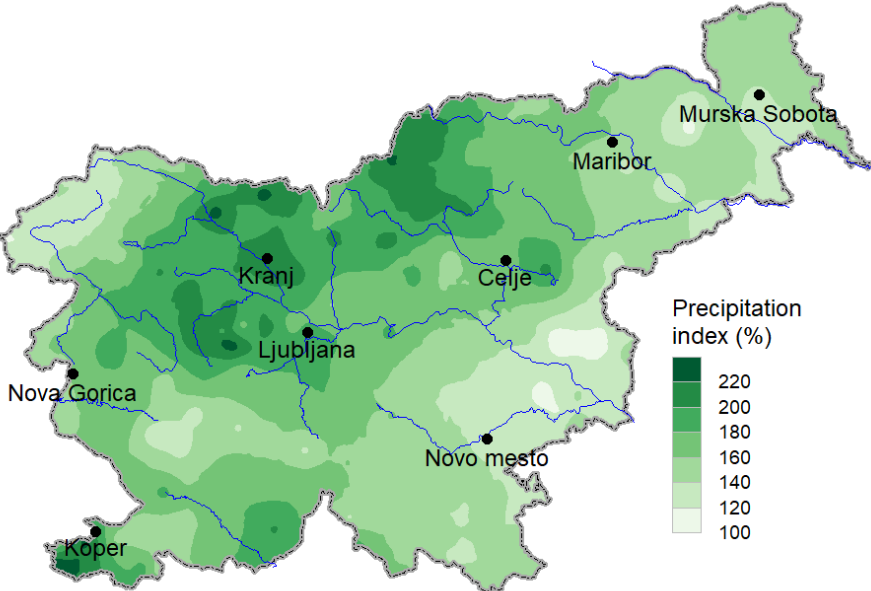


Figure 5. Precipitation index in Slovenia in summer 2023, relative to the 1991–2020 average. Data are from 229–236 meteorological stations.

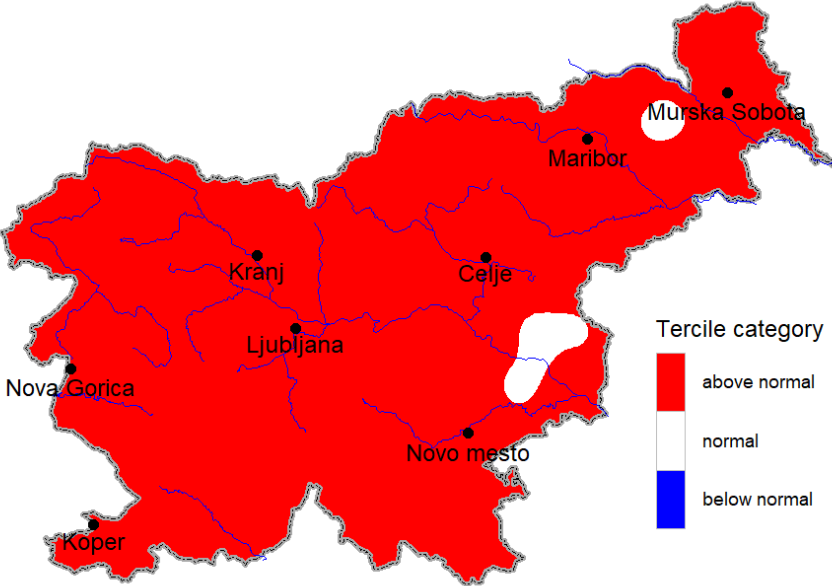


Figure 6. Precipitation tercile category of anomaly in Slovenia in summer 2023, relative to the period 1991–2020. Data are from 228 meteorological stations.

According to this, the precipitation was within the third tercile (above-normal) almost everywhere (Figure 6).

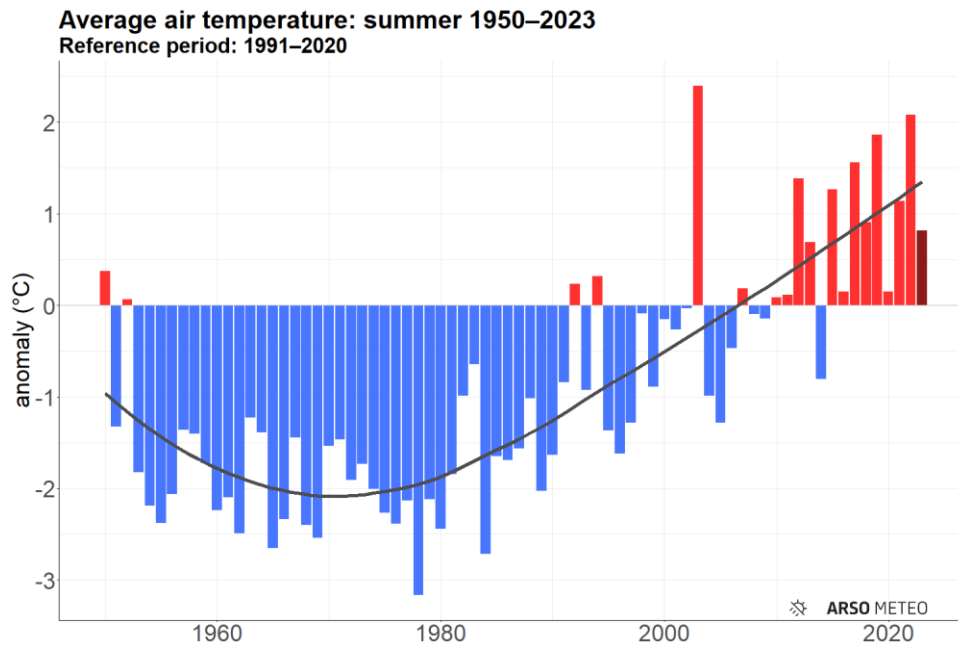


Figure 7. Summer mean air temperature anomaly in Slovenia in the period 1950–2023, relative to the 1991–2020 average. Summer 2023 is marked with dark red colour.

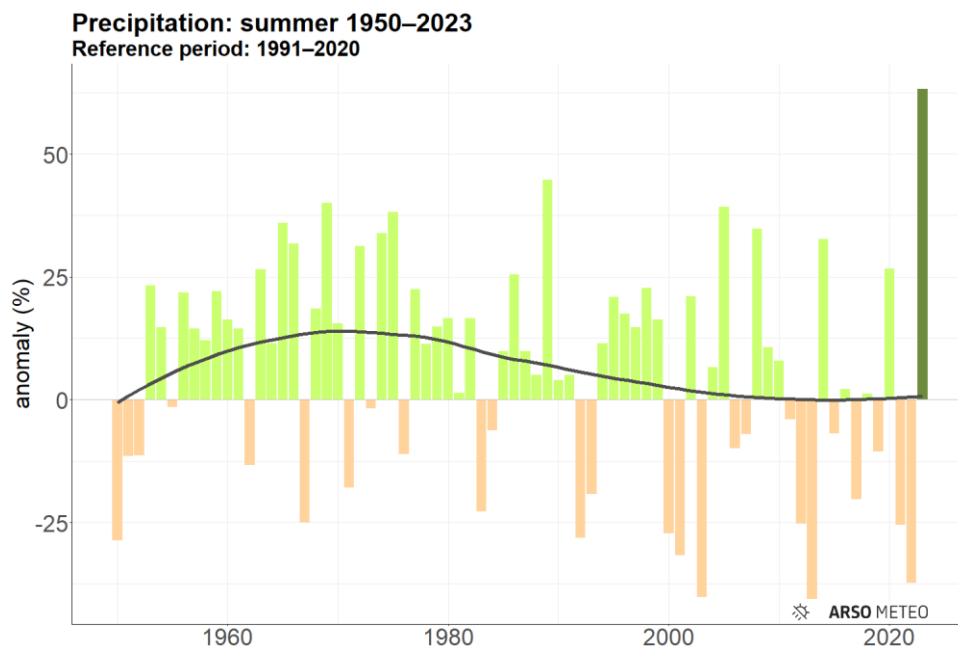


Figure 8. Summer precipitation anomaly in Slovenia in the period 1950–2023, relative to the 1991–2020 average. Summer 2023 is marked with dark green colour.

Since 1950, due to the warm summers of 1950 and 1952, the average summer temperature has been falling until the 1970s, but after that, we can see the distinctive positive linear trend. Summers have warmed by almost 3.5 °C since then. Relative to the most recent 30-year reference period, there were only four above-average summers before 2000, and the 21st century has seen the majority of above-average summers, 15. This summer is the ninth consecutive above-average summer (Figure 8).

June 2023 was warm. Average air temperature was 0.8 °C above the average of the 30-year period 1991–2020. Air temperature anomalies were between 0.1 °C and 1.4 °C (Figure 9). It

has been the ninth warmest June since at least 1950. According to tercile ranks, thermal conditions in Slovenia were above-normal everywhere but in some small parts of north and south-east.

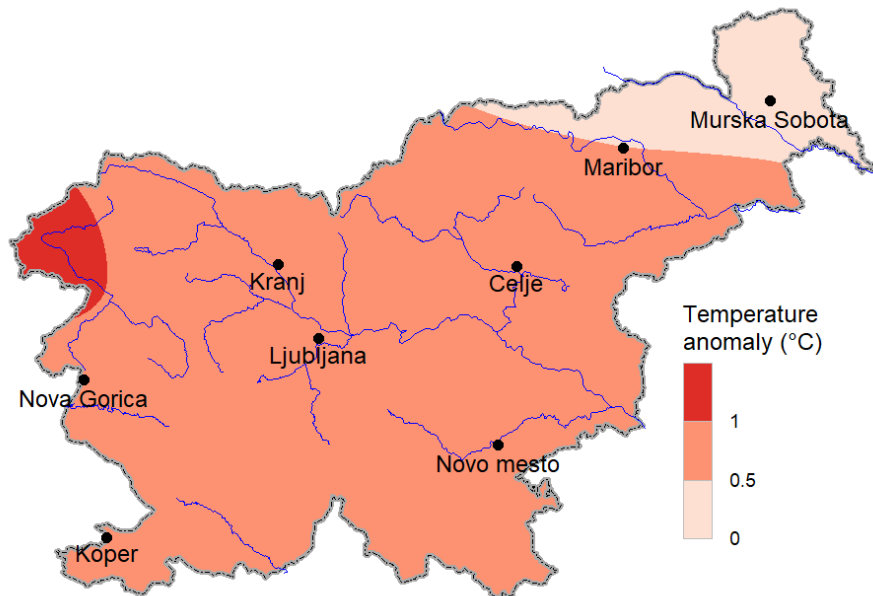


Figure 9. Mean air temperature anomaly in Slovenia in June 2023, relative to the 1911–2020 average. Data are from 98 meteorological stations.

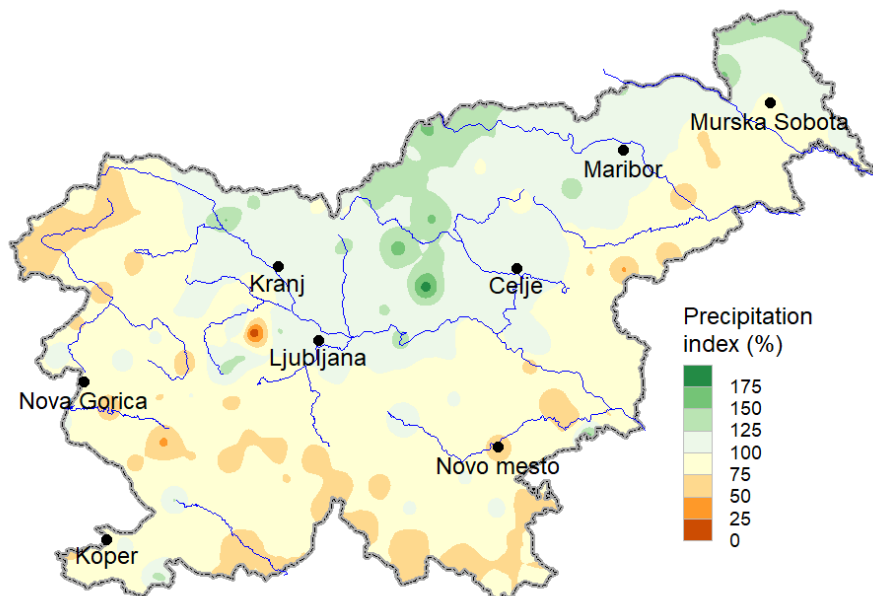


Figure 10. Precipitation index in Slovenia in June 2023, relative to the 1911–2020 average. Data are from 236 meteorological stations.

June 2023 was dry in the south, west and east and wet in the north and north-east (Figure 10). Precipitation index at the national level was 96 % (surface weighted average value). It was within the range from 38 % to 196 %. It has been among the 25 driest Junes since 1950. Precipitation index was within first (below normal) tercile in the south-west, east and north-

west, within third (above normal) tercile in parts of the north, north-east and coastal area, and within second (average) elsewhere.

Average air temperature in *July 2023* was above the multi-annual average of the 30-year period 1991–2020 in whole Slovenia. Anomalies were between 0.4 °C and 1.9 °C (Figure 11), their average value was 1.0 °C (surface weighted average value). It has been the 11th warmest July since at least 1950. According to tercile ranks, thermal conditions in Slovenia were above normal almost everywhere and normal only in parts of central-north and north-east of Slovenia.

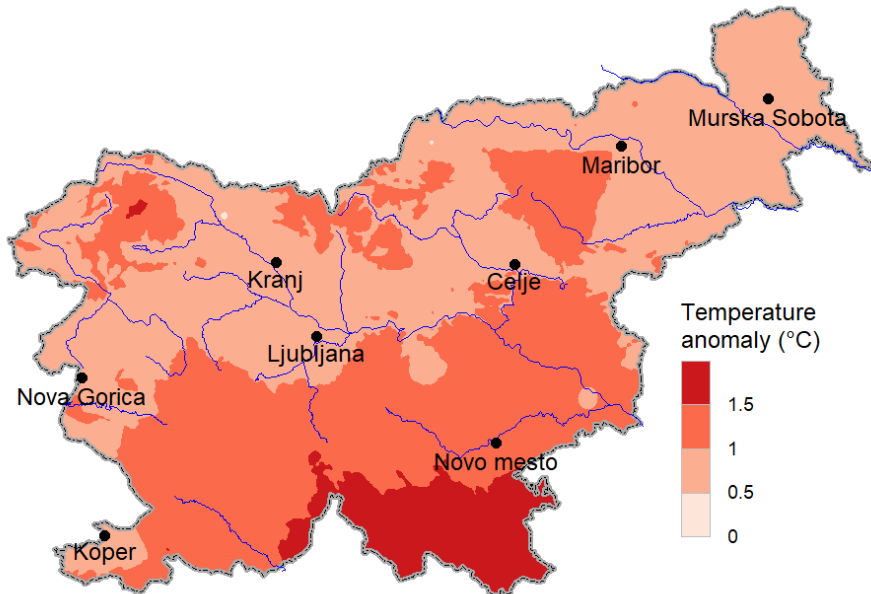


Figure 11. Mean air temperature anomaly in Slovenia in July 2023, relative to the 1991–2020 average. Data are from 98 meteorological stations.

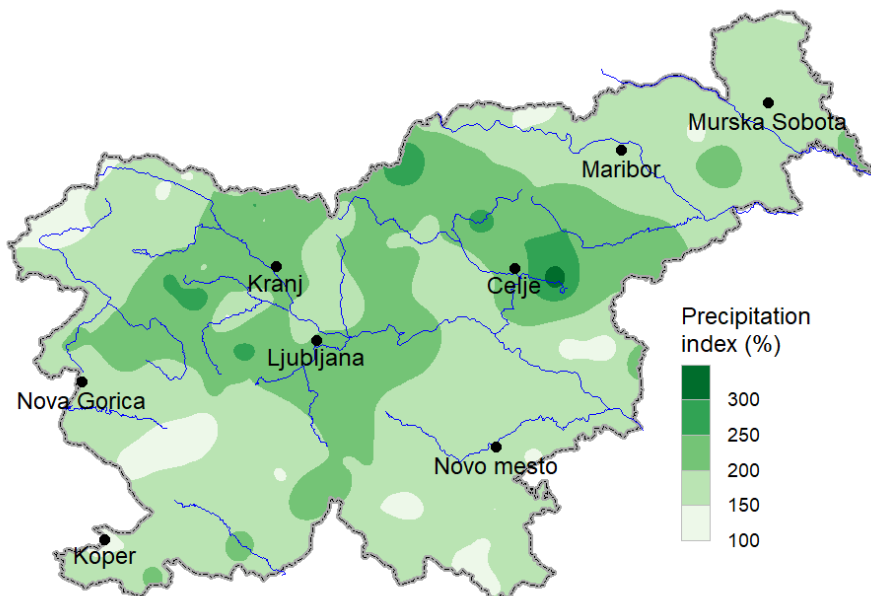


Figure 12. Precipitation index in Slovenia in July 2023, relative to the 1991–2020 average. Data are from 234 meteorological stations.

July 2023 was very wet (Figure 12). The precipitation index was within the range from 116 % to 349 %, its average value was 189 % (surface weighted average value). It has been the third wettest July since 1950. The precipitation index was within the third (above-normal) almost everywhere.

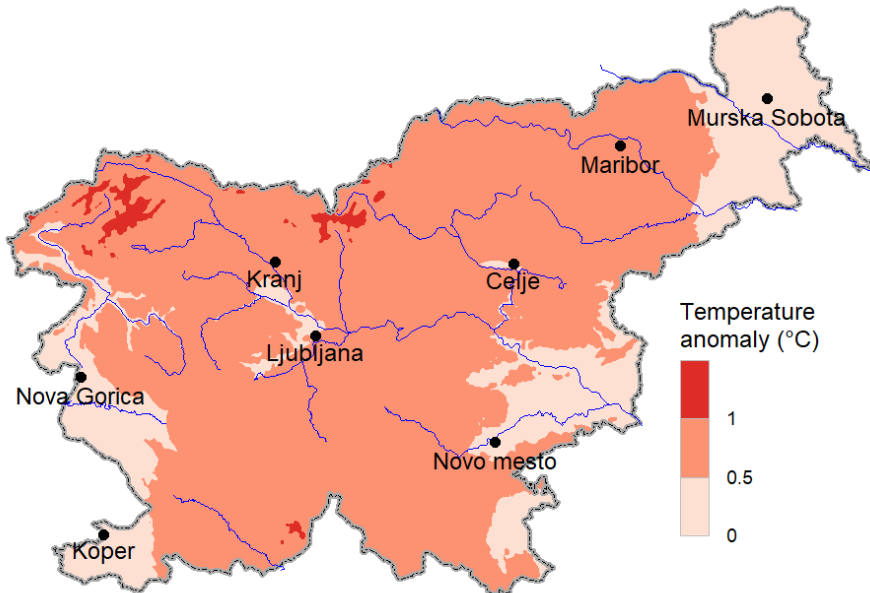


Figure 13. Mean air temperature anomaly in Slovenia in August 2023, relative to the 1991–2020 average. Data are from 98 meteorological stations.

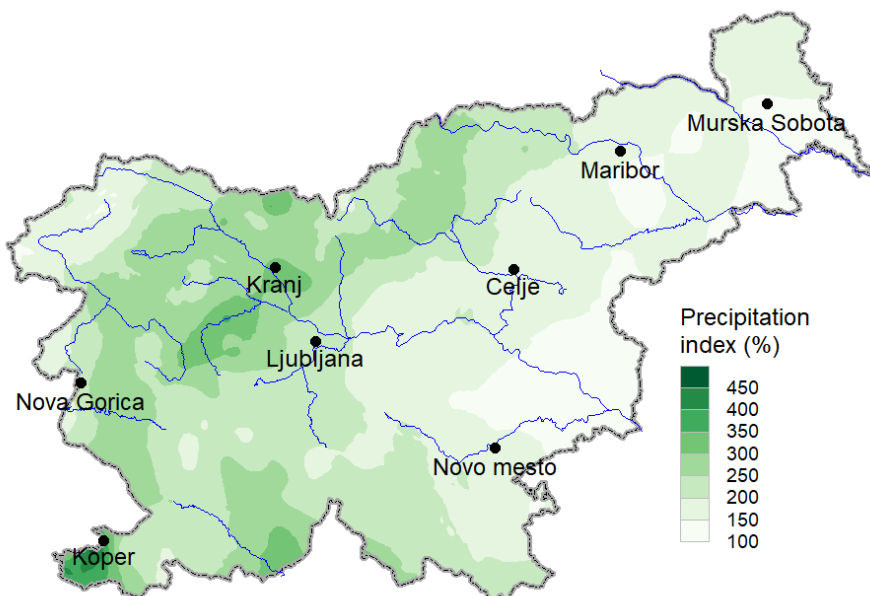


Figure 14. Precipitation index in Slovenia in August 2023, relative to the 1991–2020 average. Data are from 229 meteorological stations.

August 2023 temperature was also above average. Air temperature anomalies were between 0.0 °C and 1.5 °C (Figure 13), the average anomaly was 0.6 °C (surface weighted average value). It has been among the 16 warmest since at least 1950. According to tercile ranks,

thermal conditions in Slovenia were normal (second tercile) almost everywhere in the country.

August 2023 was also very wet. Precipitation index was above average everywhere (Figure 14). It was within the range from 110 % to 490 %, its average value was 209 % (surface weighted average value). It was the second wettest August since 1950. In the most of the country the precipitation was within the third (above-normal) tercile.

The summary for summer 2023 and monthly (June, July and August) temperature and precipitation conditions can be found in Table 1.

Table 1. The summary for summer 2023 temperature and precipitation in Slovenia

SLOVENIA	Temperature anomaly, relative to the period 1991–2020	Average temperature anomaly	Precipitation index, relative to the period 1991–2020	Average precipitation index
June 2023	0.1 to 1.4 °C	0.8 °C	38 to 196 %	96 %
July 2023	0.4 to 1.9 °C	1.0 °C	116 to 349 %	189 %
August 2023	0.0 to 1.5 °C	0.6 °C	110 to 490 %	209 %
Summer 2023	0.2 to 1.3 °C	0.8 °C	100 to 231 %	163 %

High Impact Events

Highlights for the summer 2023 in Slovenia:

- Temperature above average, the ninth warmest summer since at least 1950, precipitation above average, the wettest summer since at least 1950. Very unusual combination of high temperature and wet conditions.
- Precipitation above average in the north of Slovenia in all three summer months, very wet June and August at the national level.

Most noticeable high impact events:

- Very frequent thunderstorms in July, especially on 3, 12–13, 15–19, 20–22 and 24–26 July. Heavy rain, strong wind and hail caused damage over large part of Slovenia.
- On 1 August an isolated thunderstorm over Brkini (south west Slovenia), which later strengthened over the Ilirska Bistrica basin, hit Koseze near Ilirska Bistrica with a tornado. Several buildings were damaged.
- Severe storms with extreme rainfall from 3 to 6 August over the belt from Trnovski gozd to Gorenjska and the Kamnik-Savinja Alps and after that towards Koroška and north of Štajerska, causing multiple landslides, heavy floods and damage to transport infrastructure. There were reports of six casualties. The floods turned out to be the worst natural disaster since Slovenian independence in 1991, with multibillion-euro damage. Extreme extent of damage was caused by a combination of antedecedent high soil moisture and very heavy downpours during the event.

Verification of the SEECOF-29 Climate Outlook in Slovenia for summer season 2023

In the table 2 a verification summary of the SEECOF-29 climate outlook for the summer season 2023 (JJA) can be found. The climatological reference period of the SEECOF outlook is 1981–2010 while for Slovenian data the 1991–2020 period is used.

Table 2. SEECOF-29 climate outlook verification summary for Slovenia for summer 2023

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)	
	Observed	SEECOF-29 climate outlook for temperature	Observed	SEECOF-29 climate outlook for precipitation
SLOVENIA	warmer than normal (1991–2020 reference period)	warmer than normal (1981–2010 reference period)	wetter than normal (1991–2020 reference period)	no signal (1981–2010 reference period)

Users' Perception of the SEECOF-29 Outlook

Meteorological Service at the Slovenian Environment Agency for the time being doesn't provide seasonal outlook for the country.