

Annex

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Assessment of the SEECOF-31 Climate Outlook for Slovenia for the summer season 2024

SEECOF-31 Climate Outlook for Slovenia for the summer season 2024

The consensus statement of SEECOF-31 climate outlook for the summer season of 2024 emphasized that observed sea surface temperatures were showing that the moderate El Niño event presented in winter had rapidly faded away and forecast for the coming three months showed a transition to a moderate La Niña conditions. Indian Ocean dipole was in neutral phase, but some models showed agreement in transition to a positive phase. Most of the Atlantic basin was experiencing above normal temperatures and was expected to continue doing so. In the atmosphere, models showed trend to favour positive summer NAO and East Atlantic patterns, but there were divergences among models on the geopotential anomaly patterns proposed.

The consensus was that in the entire SEECOF region summer temperature was likely to be above normal, with the probability increasing from the north (Zone 2 in Figure 1) towards the rest of the region (Zone 1 in Figure 1). For Slovenia, the probabilities for below-, near- and above-normal temperature were estimated to be 10, 20 and 70 %, respectively.

Uncertainties in regional predictions are higher for precipitation than for temperature. In the southern, eastern and parts of central Balkans and western, central and northern Turkey were likely to experience below-normal conditions in terms of summer precipitation sums (Zone 1 in Figure 2) while in rest of the SEECOF region there was equal probability for summer precipitation (Zone 2 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 1991–2020.

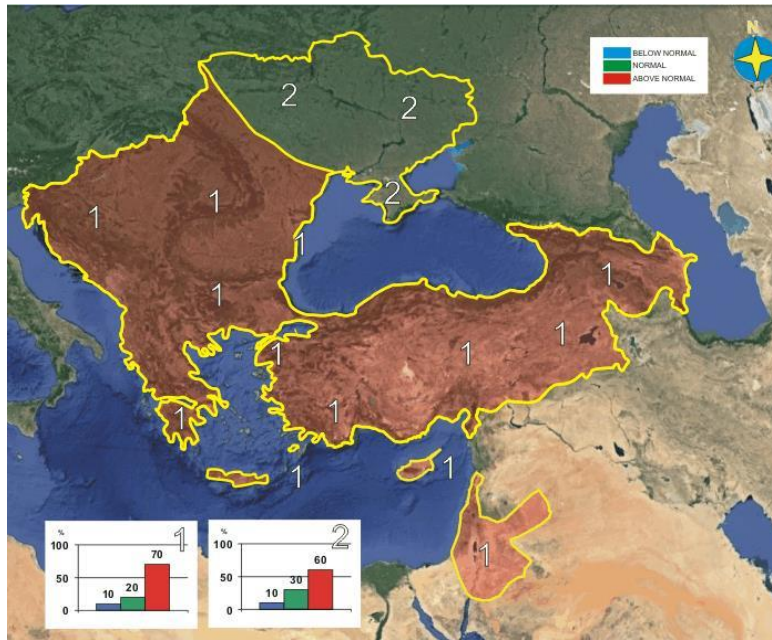


Figure 1. Graphical presentation of the summer 2024 temperature outlook

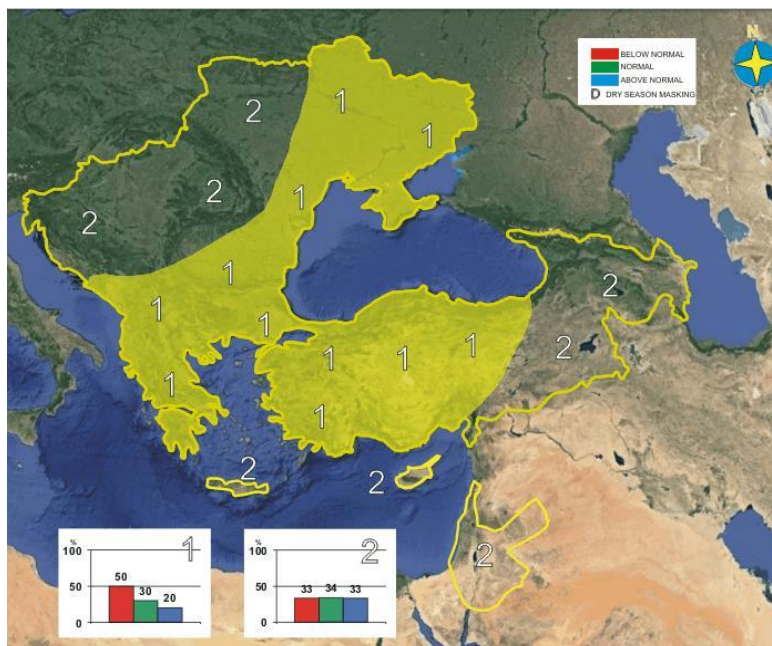


Figure 2. Graphical presentation of the summer 2024 precipitation outlook

Analysis of the summer season 2024

The average air temperature in Slovenia during summer 2024 was above the 1991–2020 average across the entire country (Figure 3). The temperature anomalies for summer 2024 (June, July, and August) ranged from 1.2 °C to 2.9 °C, with a national average anomaly of 2.4 °C (surface-weighted average). In the Alps, as well as the southeast, east, and northeast regions, anomalies exceeded 2.5 °C. In parts of central and western Slovenia, anomalies ranged between 2.0 and 2.3 °C, while elsewhere they were between 2.3 and 2.5 °C. Summer 2024 has been the warmest on record at the national level since at least 1950.

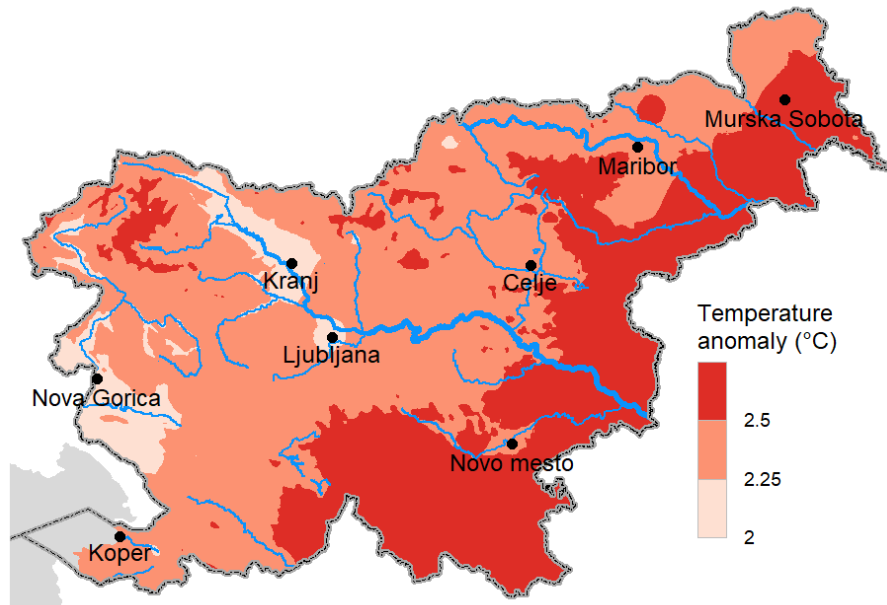


Figure 3. The mean air temperature anomaly in Slovenia during summer 2024, relative to the 1991–2020 average. It was calculated using data from 98 meteorological stations.

According to tercile ranks, thermal conditions in Slovenia in summer 2024 were everywhere above normal (Figure 4).

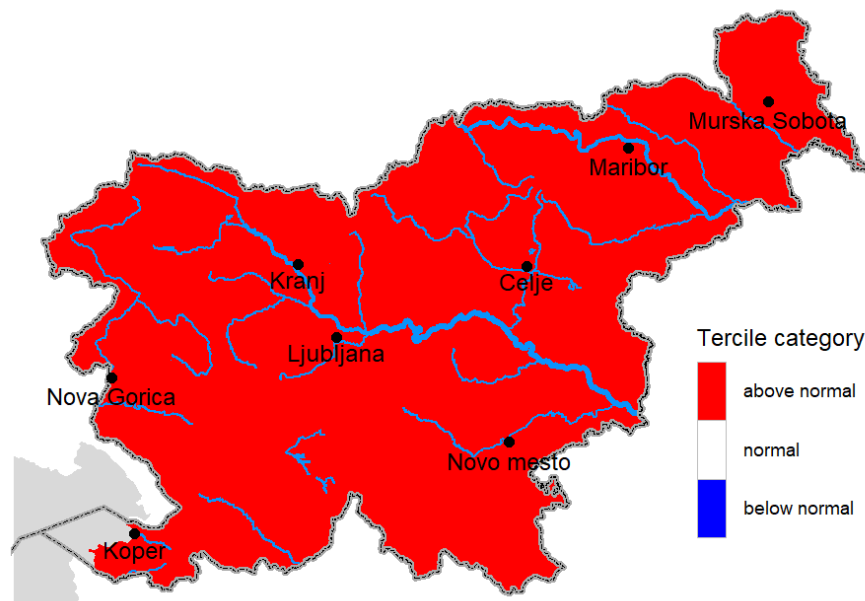


Figure 4. The mean air temperature tercile category of anomaly in Slovenia during summer 2024, relative to the 1991–2020 average. It was calculated using data from 98 meteorological stations.

Precipitation in summer is typically very heterogeneous due to its convective nature. In summer 2024, the precipitation index in Slovenia was above average only in parts of central and eastern Slovenia, while it was below average in northeast, west and southeast (Figure 5). The precipitation index ranged from 41 % to 150 %, with surface-weighted average value of 92 %. Summer 2024 ranks among the driest third of summers since 1950.

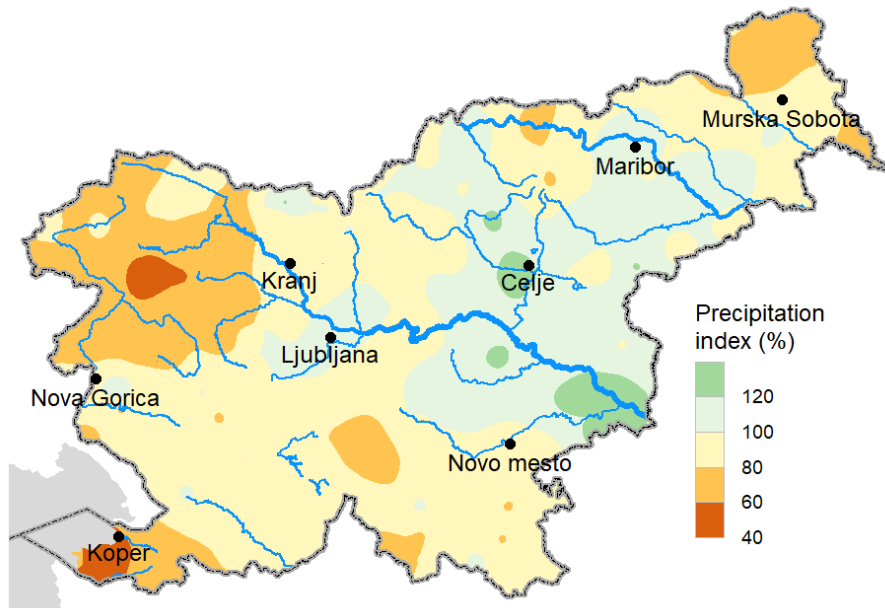


Figure 5. The precipitation index in Slovenia during summer 2024, relative to the 1991–2020 average. It was calculated using data from 227–230 meteorological stations.

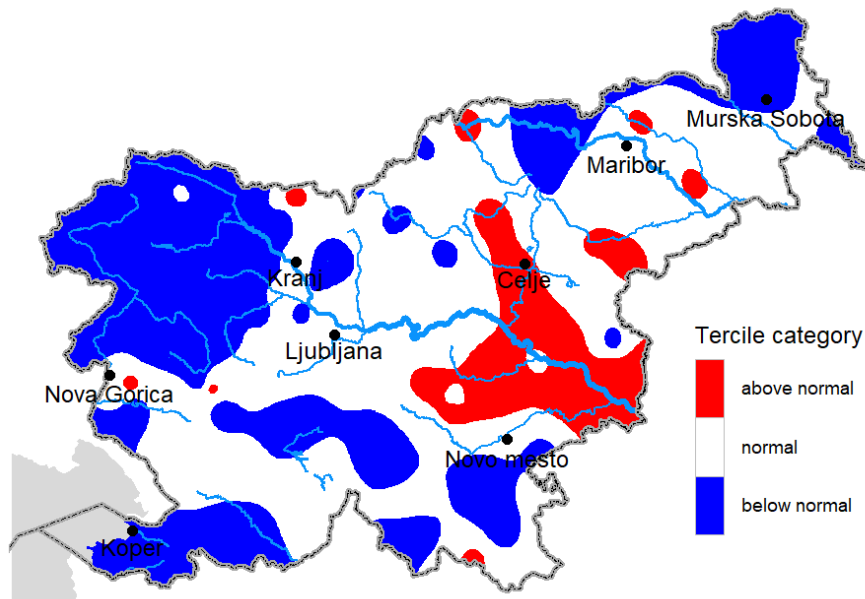


Figure 6. The precipitation tercile category of anomaly in Slovenia in summer 2024, relative to the 1991–2020 average. It was calculated using data from 227 meteorological stations.

According to this data, precipitation in parts of eastern Slovenia was within the third tercile (above-normal). In the northeast, parts of the south, and the northwest, it was within the first tercile (below-normal). Elsewhere, precipitation was within the second tercile (normal) (Figure 6).

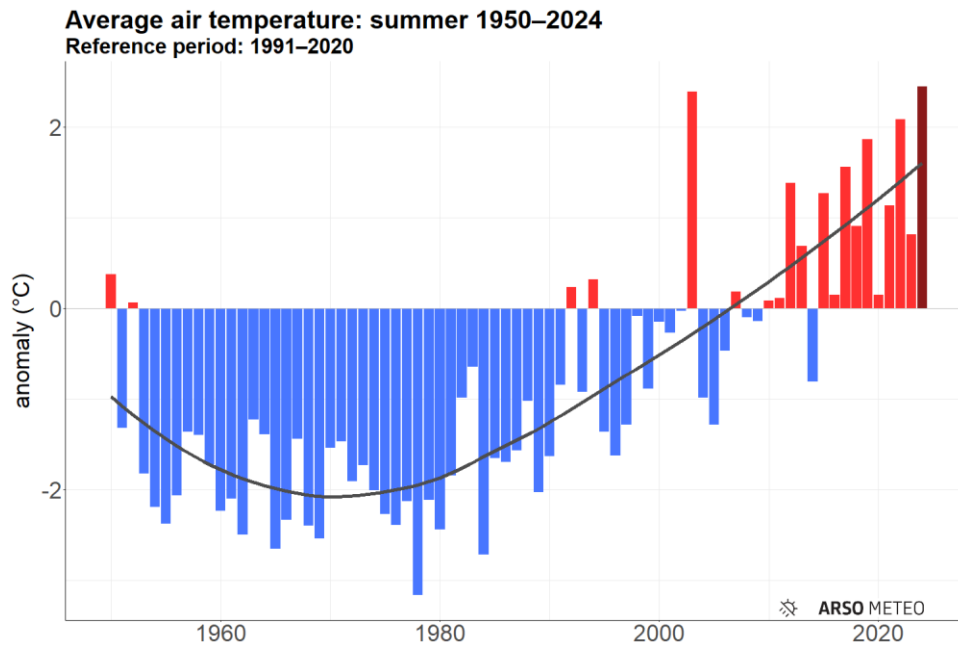


Figure 7. Summer mean air temperature anomaly in Slovenia from 1950 to 2024, relative to the 1991–2020 average. Summer 2024 is highlighted in dark red.

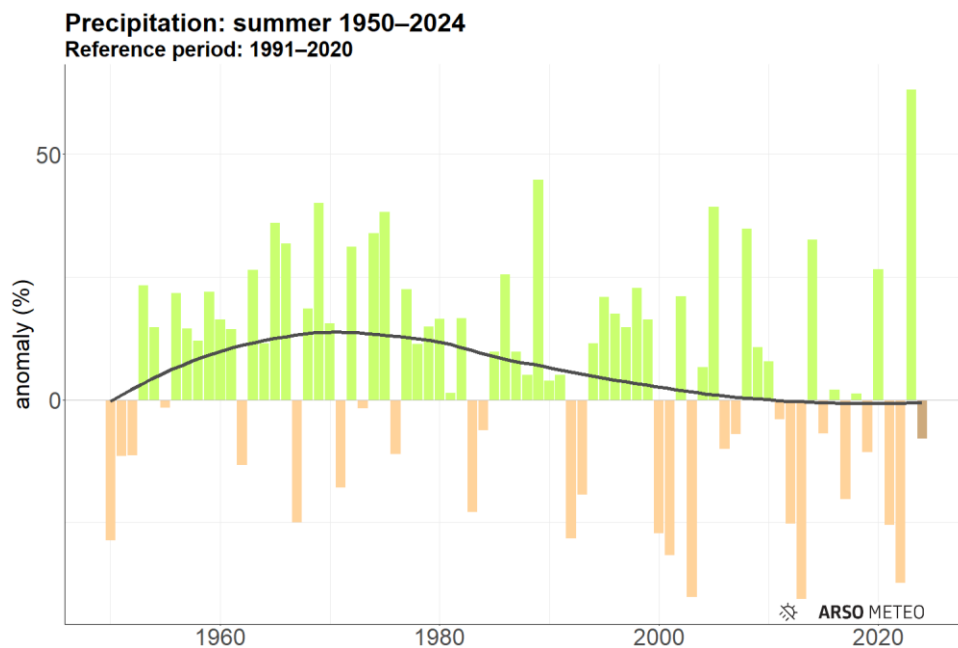


Figure 8. Summer precipitation anomaly in Slovenia from 1950 to 2024, relative to the 1991–2020 average. Summer 2024 is highlighted in dark green.

Since 1950, the average summer temperature initially declined due to the warm summers of 1950 and 1952, continuing this trend until the 1970s. However, a distinctive positive linear trend has been observed since then, with summers warming up by nearly 3.5 °C. Compared to the most recent 30-year reference period, there were only four above-average summers before the year 2000. In contrast, the 21st century has experienced the majority of above-average summers, totaling 16. This summer marks the tenth consecutive above-average summer (Figure 8).

June 2024 was warm, with average air temperature being 1.4 °C above the 1991–2020 average. Air temperature anomalies ranged from 0.6 °C to 2.1 °C (Figure 9). It was the sixth warmest June since 1950. According to tercile ranks, thermal conditions in Slovenia were above-normal everywhere.

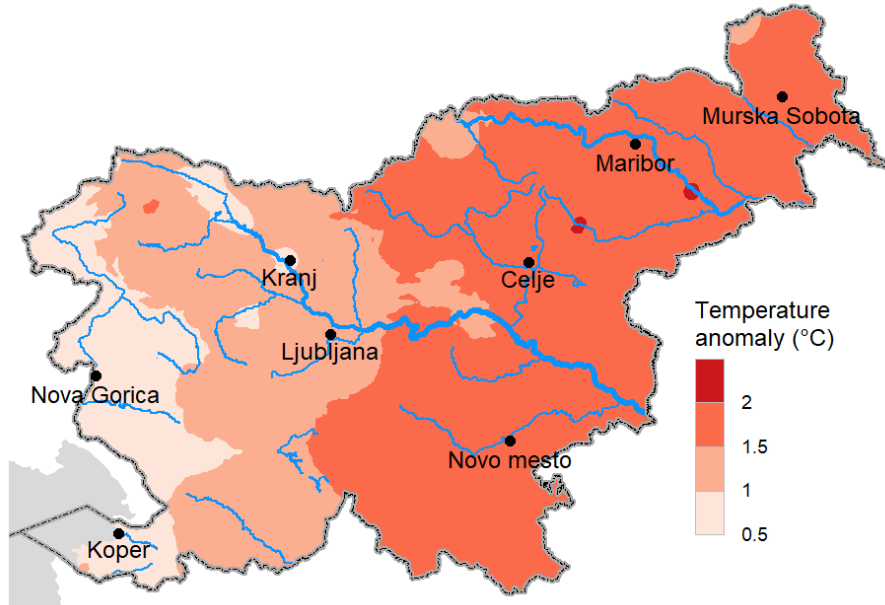


Figure 9. The mean air temperature anomaly in Slovenia during June 2024, relative to the 1991–2020 average. It was calculated using data from 98 meteorological stations.

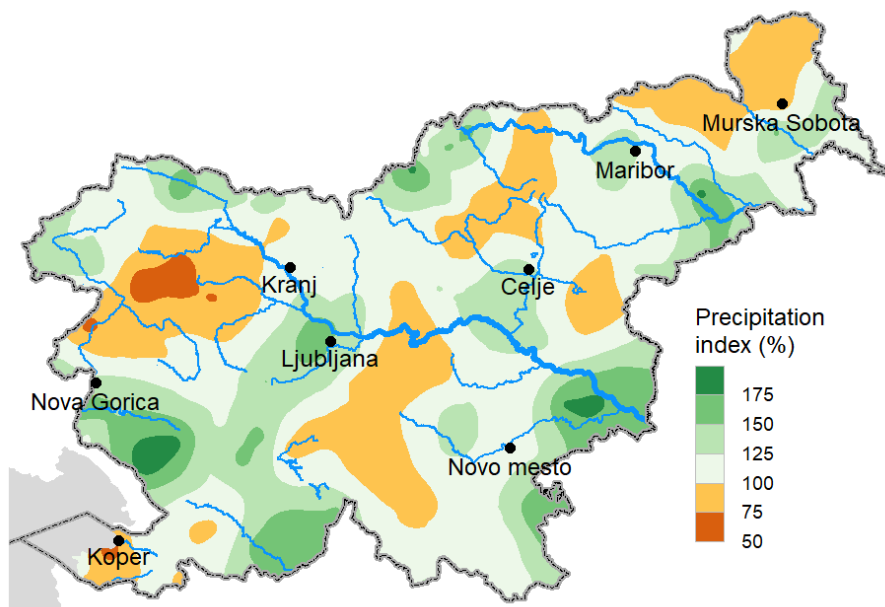


Figure 10. The precipitation index in Slovenia during June 2024, relative to the 1991–2020 average. It was calculated using data from 230 meteorological stations.

June 2024 was dry in the parts of western, southwest, central, and northeastern Slovenia, while it was normal to wet elsewhere (Figure 10). The national precipitation index was 117 %

(surface-weighted average), ranging from 52 % to 264 %. It ranked among the driest third of Junes since 1950.

July 2024 was hot, with the national average air temperature 2.5 °C above the 1991–2020 multi-annual average. Anomalies ranged from 2.0 °C to 3.1 °C (Figure 11). It was the warmest July since at least 1950. According to tercile ranks, thermal conditions in Slovenia were above-normal everywhere.

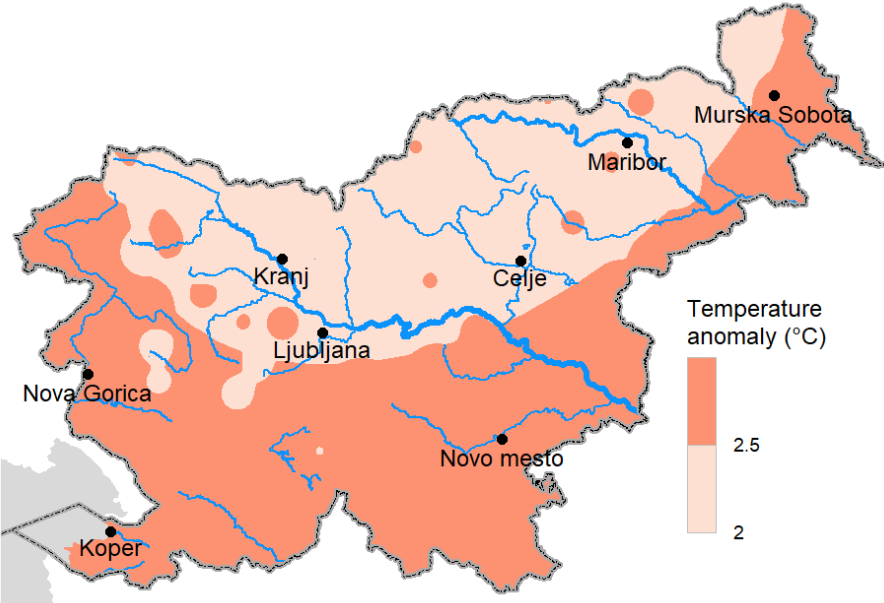


Figure 11. The mean air temperature anomaly in Slovenia during July 2024, relative to the 1991–2020 average. It was calculated using data from 98 meteorological stations.

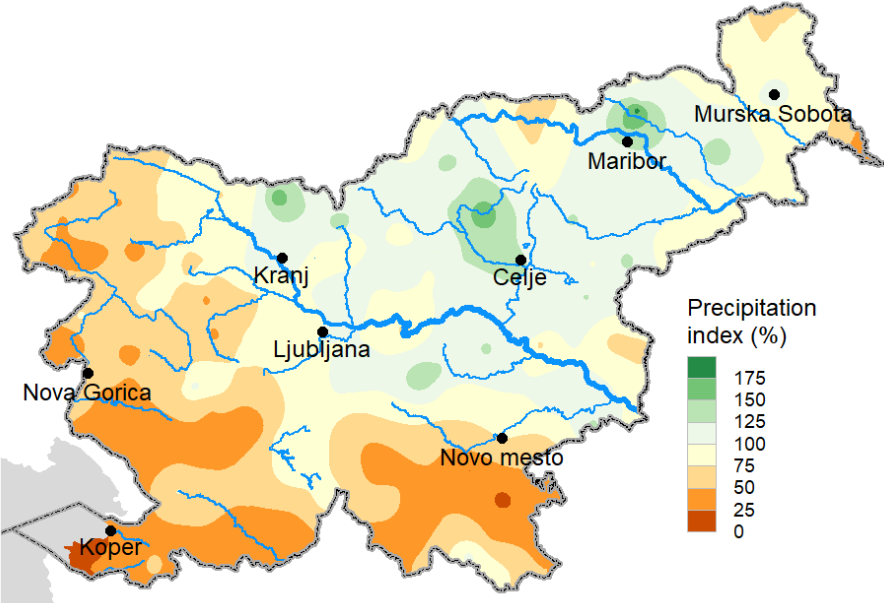


Figure 12. The precipitation index in Slovenia during July 2024, relative to the 1991–2020 average. It was calculated using data from 229 meteorological stations.

July 2024 was dry in the western, southern, and northeastern Slovenia. Elsewhere, it was normally dry, with only isolated spots experiencing wet conditions (Figure 12). The precipitation index ranged from 15 % to 186 %, with a surface-weighted average value of 84 %. It ranked among the third wettest Julys since 1950.

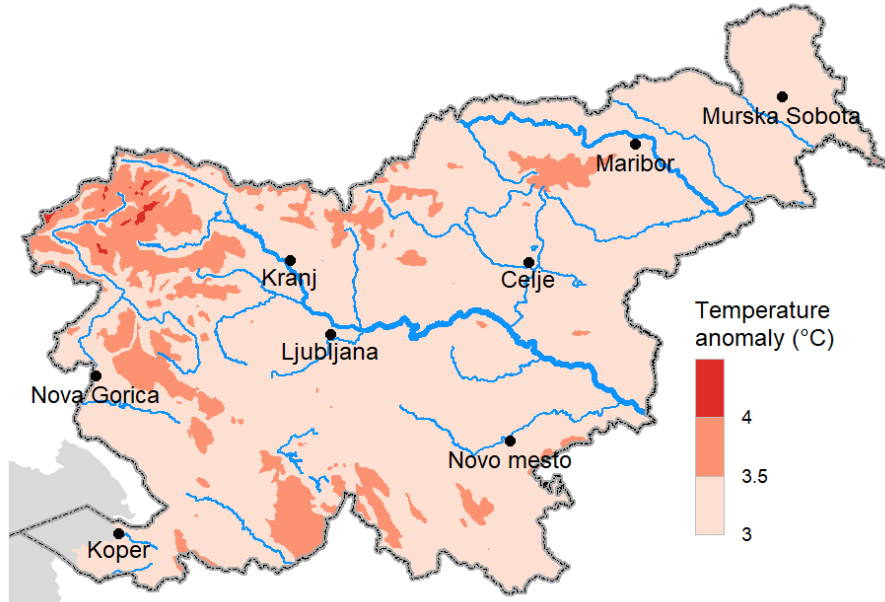


Figure 13. The mean air temperature anomaly in Slovenia during August 2024, relative to the 1991–2020 average. It was calculated using data from 98 meteorological stations.

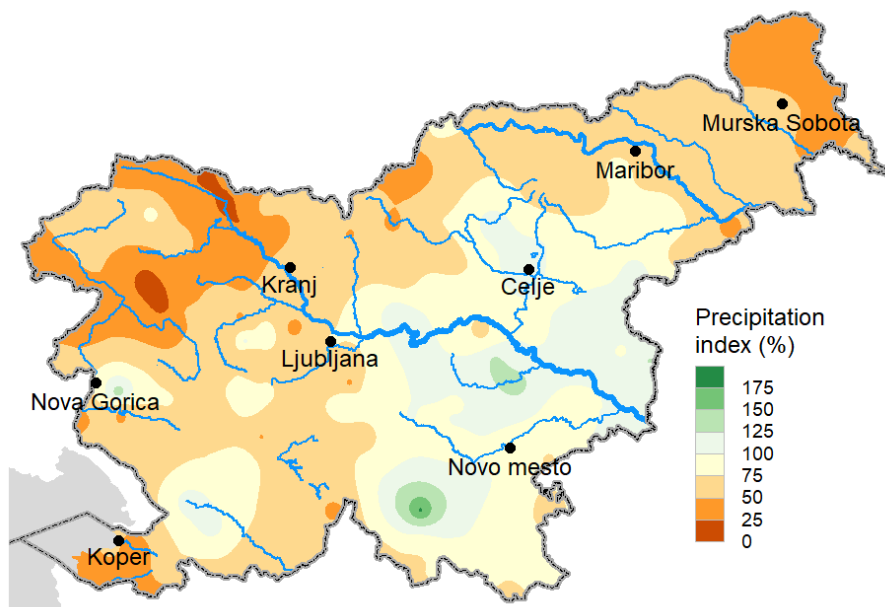


Figure 14. The precipitation index in Slovenia during August 2024, relative to the 1991–2020 average. It was calculated using data from 227 meteorological stations.

August 2024 was the hottest month on record, with a national average air temperature of 22,2 °C. Air temperature anomalies ranged from 2.5 °C to 4.2 °C (Figure 13), with an average

anomaly of 3.3 °C (surface-weighted average). According to tercile ranks, thermal conditions in Slovenia were above-normal (third tercile) across entire country.

August 2024 was also quite dry. The precipitation index was below average in most of the country, except for parts of eastern, southeastern, and southwestern Slovenia (Figure 14). The index ranged from 15 % to 185 %, with a surface-weighted average value of 73 %. It was the 14th driest August since 1950.

A summary of summer 2024 and the monthly (June, July, and August) temperature and precipitation conditions can be found in Table 1.

Table 1. The summary for summer 2024 temperature and precipitation in Slovenia

SLOVENIA	Temperature anomaly, relative to the 1991–2020 period	Average temperature anomaly	Precipitation index, relative to the 1991–2020 period	Average precipitation index
June 2024	0.6 to 2.1 °C	1.4 °C	52 to 264 %	117 %
July 2024	2.0 to 3.1 °C	2.5 °C	15 to 186 %	84 %
August 2024	2.5 to 4.2 °C	3.3 °C	15 to 185 %	73 %
Summer 2024	1.2 to 2.9 °C	2.4 °C	41 to 150 %	92 %

High Impact Events

Highlights for the summer 2024 in Slovenia:

- **Temperature:** Above average, marking the warmest summer since at least 1950. June was warm, while July and August were the hottest on record. August was the hottest month since at least 1950.
- **Precipitation:** Above average only in central and eastern Slovenia, while was below average in the northeast, west, and southeast. June had above-average precipitation at the national level, while July and August were below average.

Most noticeable high impact events:

- **Thunderstorms/Squall lines on June 3, 2024:** An extremely severe downpour from a slow-moving thunderstorm occurred between 17:45 and 19:15 CET, with peak rainfall intensity around 18:00 CET (15-minute interval). Although no official stations recorded the event (as they were all outside the rainfall core), radar and damage assessment suggest that approximately 100 mm of rain fell in less than an hour. Around 100 houses were flooded, some very severely.
- **Hail on July 1, 2024:** a supercell thunderstorm developed near Grosuplje and travelled eastwards. Large hail, with a maximum size of around 4 cm (according to ESWD reports), fell particularly in a belt from Ivančna Gorica to Trebnje. Crops and cars were severely damaged. The event lasted less than an hour, from approximately 12:40 to 13:30 CET.

- **Hail on July 13, 2024:** Two supercell thunderstorms developed around 15:00 CET near Celje and travelled in an ENE direction towards Lendava. Both storms produced large hail, with many places experiencing hail up to 5 cm in diameter (according to ESWD reports), and up to 10 cm in the Slovenska Bistrica region. More than 200 roofs were damaged by hail in the municipalities of Slovenska Bistrica and Oplotnica alone. Many vehicles and photovoltaic systems were also severely damaged. Later, both supercells merged near Slovenian-Croatian border and continued towards Lendava. The event ended by 18:00 CET. Rain and wind gusts also caused some damage, although the highest officially measured wind speed was only 21 m/s.
- **Thunderstorms/Squall lines from July 19 to 20, 2024:** A chain of thunderstorms developed over northern Slovenia on the evening of July 19 and travelled southeast towards Croatian border. Many stations reported severe downpours, reaching or exceeding the 100-year return period in some places: for example, Krvavec recorded 66 mm in 60 minutes, and Gačnik near Maribor recorded 66 mm in 90 minutes (some unofficial stations reported even stronger downpours, according to ESWD database). There was flooding in many areas and some landslides, including in Logarska Dolina and near Dravograd. The village of Kokra was severely hit by a landslide, which damaged 10 houses.

Verification of the SEECOF-31 Climate Outlook in Slovenia for the summer season 2024

Table 2 provides a verification summary of the SEECOF-31 climate outlook for the summer season 2024 (DJF), using the climatological reference period 1991–2020.

Table 2. SEECOF-31 climate outlook verification summary for Slovenia for summer 2024

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)	
	Observed	SEECOF-31 climate outlook for temperature	Observed	SEECOF-31 climate outlook for precipitation
SLOVENIA	warmer than normal	warmer than normal	drier than normal in northeastern, western, and southeastern Slovenia; wetter than normal in central and eastern Slovenia	no signal

Users' Perception of the SEECOF-31 Outlook

The meteorological Service at the Slovenian Environment Agency currently doesn't provide a seasonal outlook for the country.