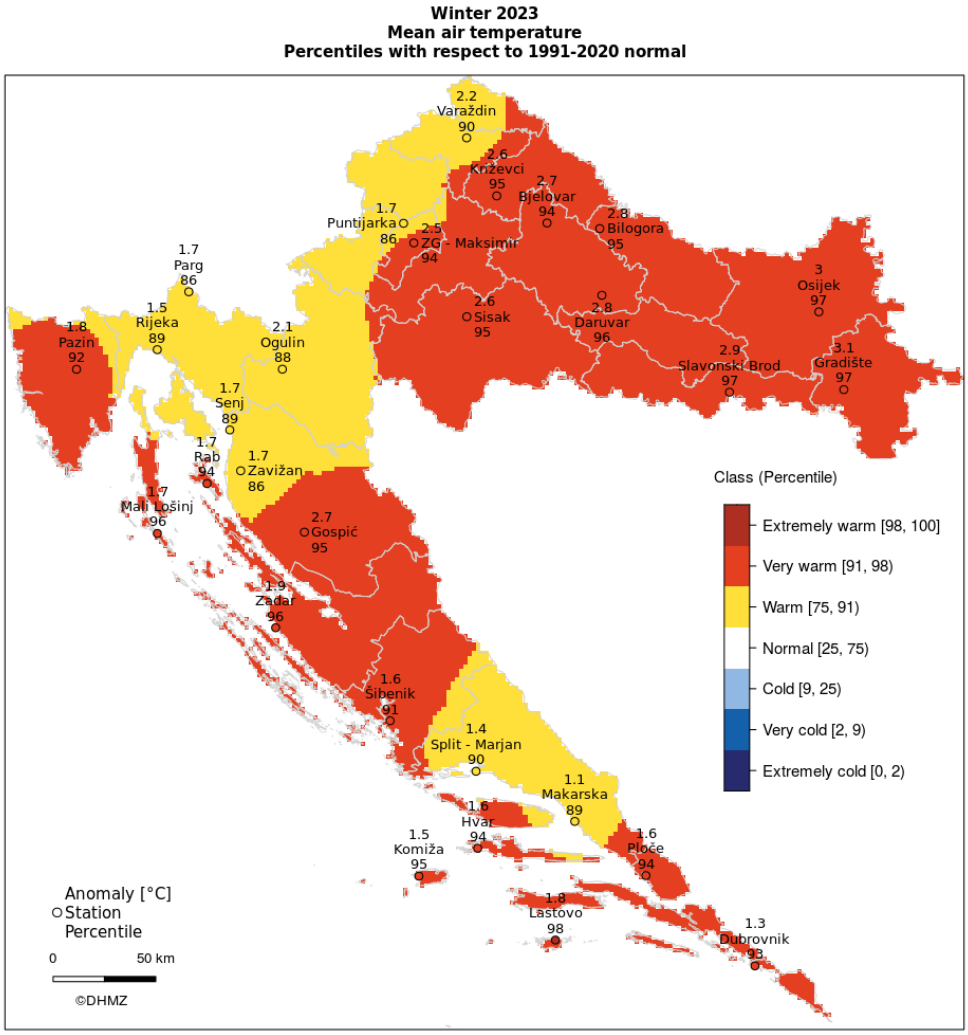
Climate Report for Croatia for Winter 2022/2023

Air temperature anomalies for Croatia in Winter 2022/2023

The average winter air temperature (December 2022, January 2023, February 2023) throughout Croatia was above the multi-annual average (1991 - 2020). Corresponding air temperature anomalies for winter 2022/2023 were within the range from 1,1 °C (Makarska) to 3,1 °C (Gradište).

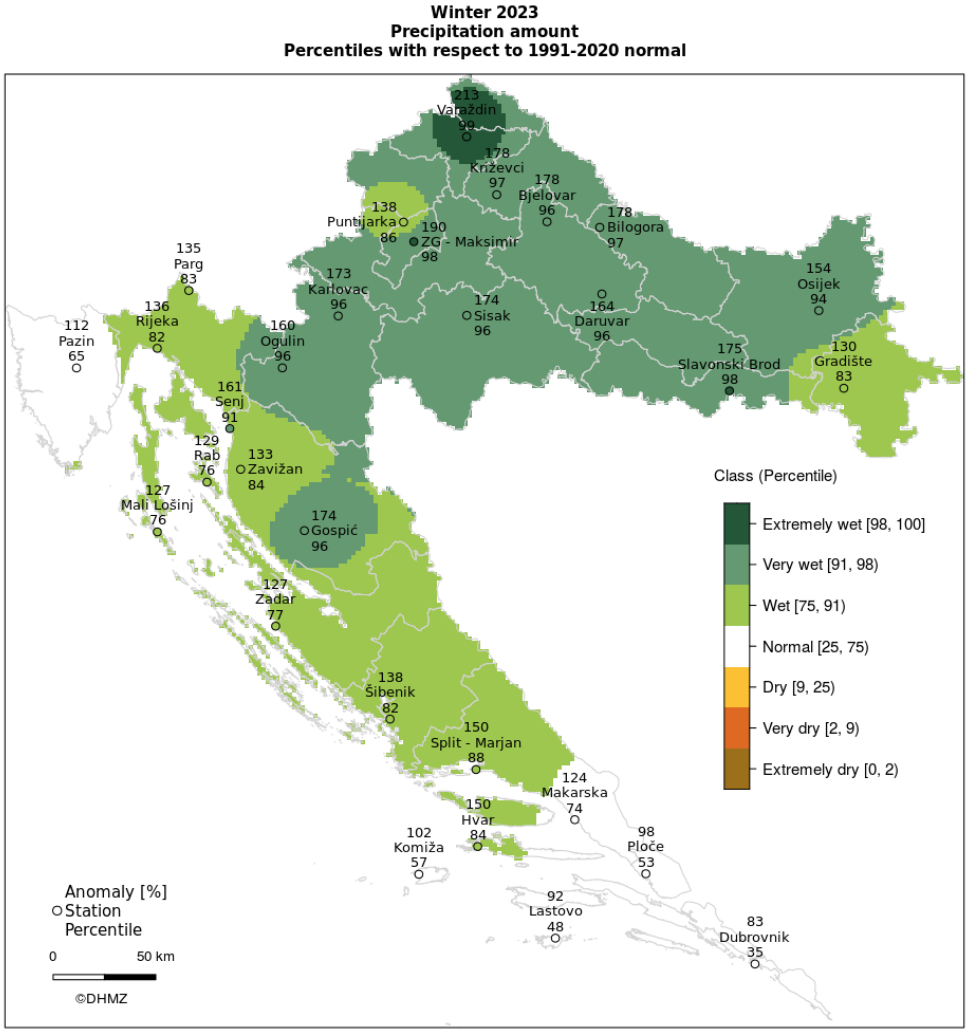
According to percentile ranks and classification ratings, thermal conditions in Croatia for winter 2022/2023 have been described by the following categories: **warm** (Northwest part of Croatia, a large part of mountainous Croatia, Kvarner and some islands of North Adriatic, part of Istra, and part of Dalmatia), **very warm** (the rest of Croatia except Lastovo) and **extremely warm** (Lastovo).



Precipitation anomalies for Croatia in Winter 2022/2023

An analysis of the precipitation amounts for winter 2022/2023 expressed as percentages (%) of 1991 - 2020 average, shows that these precipitation amounts were mainly above the average. Corresponding precipitation amounts for winter 2022/2023 were within the range of 83 % (Dubrovnik – 297,6 mm) to 213 % (Varaždin – 304,3 mm) of the multi-annual average for this season.

According to percentile ranks and classification ratings, the precipitation amounts for winter 2022/2023 have been described by the following categories: **normal** (Istra, south part of middle Dalmatia, south Dalmatia), **wet** (far east part of Croatia, wider area of Puntjarka, part of mountainous Croatia, Kvarner, north Dalmatia and part of middle Dalmatia), **very wet** (part of eastern Croatia, majority of central Croatia, Senj, part of mountainous Croatia) and **extremely wet** (Slavonski Brod, Zagreb, wider area of town Varaždin).



Air temperature anomalies for Croatia in December 2022

The anomalies of the mean air temperature in December 2022 with respect to the normal 1981 - 2010 were within the range from 2,4 °C (Varaždin i Rijeka) to 4,9 °C (Gospić). At all stations air temperature were higher than the respective multi-annual average. Absolute maximum temperature for December was recorded at Dubrovnik (Table 1).

According to the percentile ranks and classification ratings, thermal conditions in Croatia for December 2022 are described in the following categories: **very warm** (the eastern, central and north part of mountainous Croatia and part of Kvarner) and **extremely warm** (wider area of Slavonski Brod, Istra, wider area of Rijeka and part of islands, south part of mountainous Croatia and Dalmatia).

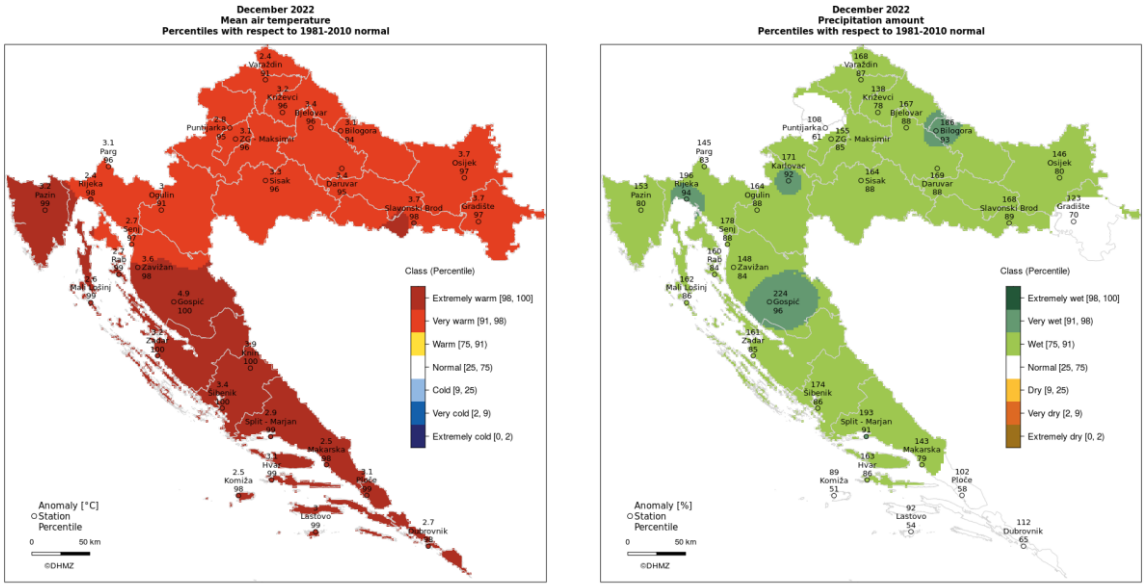
Table 1 - Absolute maximum temperature in December 2022 and comparison with available series of measurement (these stations are included in the analysis of climate anomalies in Croatia)

Naziv meteorološke postaje	Godina od kada su raspoloživi podaci	Vrijednost najviše izmjerene temperature (°C) u prosincu (do 2021.) u razdoblju od kada su raspoloživi podaci	Datum kada je postignuta najviša vrijednost (* označava nepotpuni niz)	Vrijednost najviše izmjerene temperature zraka (°C) u prosincu 2022.	Datum kada je postignuta vrijednost najviše izmjerene temperature zraka u prosincu 2022.
Dubrovnik	1961.	20.3	3.12.2014.*	20.4	17.12.
Senj	1948.	20.9	13.12.1957.*	19.0	9.12.
Šibenik	1949.	20.3	18.12.1989.	19.7	16.12.
Slavonski Brod	1963.	23.0	19.12.1989.	18.1	26.12.
Knin	1949.	21.6	5.12.1979.	18.8	16.12.
Rijeka	1948.	20.4	4.12.1979.	15.8	23.12.
Karlovac	1949.	23.4	18.12.1989.	18.6	31.12.
Osijek	1899.	21.3	25.12.2009.*	16.5	31.10.
Hvar	1858.	20.6	7.12.1967.*	18.8	17.12.
Pazin	1961.	21.6	4.12.1979.	14.0	9.12.
Split - Marjan	1948.	18.6	1.12.2014.	17.2	16.12.
Ogulin	1949.	20.9	17.12.1989.	16.3	31.12.
Komiža	1981.	21.6	9.12.2010.	20.4	16.12.
Sisak	1949.	23.7	18.12.1989.	18.8	31.12.
Daruvar	1978.	23.5	17.12.1989.	17.6	31.12.
Mali Lošinj	1961.	18.9	25.12.2009.	15.8	9.12.
Poreč	1981.	19.4	21.12.1989.*	15.7	9.12.
Zagreb - Maksimir	1949.	22.5	17.12.1989.	17.9	31.12.
Bjelovar	1949.	22.5	17.12.1989.	17.5	31.12.
Varaždin	1949.	21.4	17.12.1989.	18.0	31.12.
Gospić	1872.	16.9	18.12.1989.*	15.5	16.12.
Lastovo	1948.	18.8	1.12.2010.*	16.8	17.12.
Zadar	1961.	18.7	1.12.2014.	17.4	16.12.
Parg	1950.	17.1	5.12.1979.*	12.2	24.12.
Puntijarka	1981.	16.1	9.12.2016.	9.8	25.12.
Zavižan	1953.	14.6	13.12.1994.*	6.2	16.12.

Precipitation anomalies for Croatia in December 2022

Precipitation anomalies expressed as a percentage (%) of the multi-annual average (1981-2010) were in December 2022 within the range from 89 % in Komiža (95,9 mm) to 224 % in Gospić (338,9 mm). Analysis of precipitation anomalies in December 2022, expressed as a percentage (%) of the multi-annual average shows that precipitation amounts at most stations were above the multi-annual average at the most stations and slightly lower at stations Komiža and Lastovo.

Precipitation conditions in December 2022 are described in more details in the following categories: **normal** (far east part of Croatia, wider area of Puntjarka, south Dalmatia and islands and island Vis), **wet** (most of Croatia) and **very wet** (wider area of Karlovac, Bilogora, Rijeka, Gospić and Split).



Mean air temperature (left) and precipitation amount (right) - December 2022- percentiles with respect to 1981-2010 normal

Air temperature anomalies for Croatia in January 2023

The anomalies of the mean air temperature in January 2023 with respect to the normal 1991 - 2020 were within the range from 0,9 °C (Zavižan) to 4,1 °C (Osijek). At all stations air temperature were higher than the respective multi-annual average. Absolute maximum temperature for January was recorded at Bjelovar (Table 2).

According to the percentile ranks and classification ratings, thermal conditions in Croatia for January 2023 are described in the following categories: **normal** (wider area of Zavižan), **warm** (part of central Croatia, mountainous Croatia, most of Croatian Primorje and Dalmatia) and **very warm** (eastern and most of central Croatia, stations Rab, Lošinj, wider area of Zadar, islands Korčula and Lastovo).

Table 2 - Absolute maximum temperature in January 2023 and comparison with available series of measurement (these stations are included in the analysis of climate anomalies in Croatia)

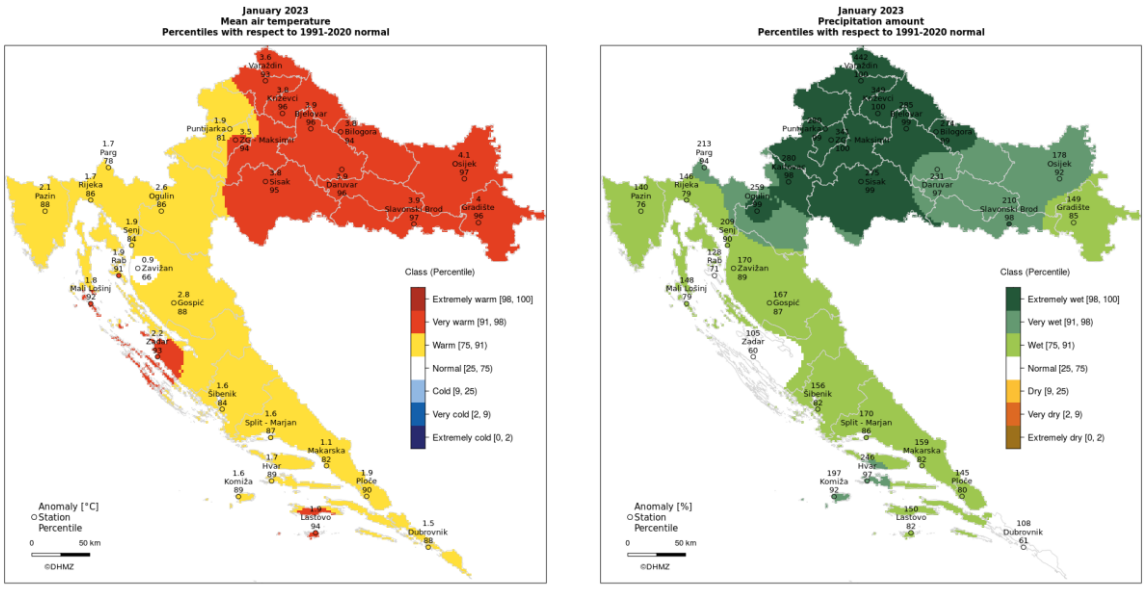
Naziv meteorološke postaje	Godina od kada su raspoloživi podaci	Vrijednost najviše izmjerene temperature (°C) u siječnju (do 2023.) u razdoblju od kada su raspoloživi podaci	Datum kada je postignuta najviša vrijednost (* označava nepotpuni niz)	Vrijednost najviše izmjerene temperature zraka (°C) u siječnju 2023.	Datum kada je postignuta vrijednost najviše izmjerene temperature u siječnju 2023..
Dubrovnik	1961.	19.2	2. 1. 2022.*	16.9	18. 1.
Senj	1948.	20.3	20. 1. 1974.*	17.0	9. 1.
Šibenik	1949.	21.4	31. 1. 1989.	18.1	1. 1.
Slavonski Brod	1963.	19.5	5. 1. 2022.	17.8	1. 1.
Rijeka	1948.	20.0	20. 1. 1974.	16.1	4. 1.
Karlovac	1949.	19.3	7. 1. 2001.	18.1	1. 1.
Osijek	1899.	19.0	11. 1. 1903.*	16.7	1. 1.
Hvar	1858.	19.6	30. 1. 1949.*	18.6	1. 1.
Pazin	1961.	21.4	31. 1. 1989.	13.6	14. 1.
Split - Marjan	1948.	17.4	20. 1. 1974.	16.1	4. 1.
Ogulin	1949.	19.8	17. 1. 2011.	14.8	1. 1.
Komiža	1981.	20.2	10. 1. 2016.	18.1	1. 1.
Sisak	1949.	21.4	7. 1. 2001.	18.8	1. 1.
Daruvar	1978.	18.8	23. 1. 1985., 5. 1. 2022.	18.4	1. 1.
Mali Lošinj	1961.	17.4	20. 1. 2007.	15.5	8. 1.
Poreč	1981.	16.6	19. 1. 2014.*	13.7	8. 1.
Zagreb - Maksimir	1949.	19.4	7. 1. 2001.	17.7	1. 1.
Bjelovar	1949.	17.8	28. 1. 1979.	18.0	1. 1.
Varaždin	1949.	19.1	29. 1. 2002.	17.7	1. 1.
Gospić	1872.	16.0	19. 1. 2007.*	14.3	2. 1.
Lastovo	1948.	19.3	15. 1. 1993.*	16.3	1. i 2. 1.
Zadar	1961.	17.4	10. 1. 2016.	16.2	1. 1.
Parg	1950.	17.8	29. 1. 2002.*	11.4	1. 1.
Puntijarka	1981.	14.1	29. 1. 2002.	9.6	6. 1.
Zavižan	1953.	13.0	1. 1. 2022.*	9.8	6. 1.

Precipitation anomalies for Croatia in January 2023

Precipitation anomalies expressed as a percentage (%) of the multi-annual (1991. -2020.) average were in January 2023 within the range from 105 % in Zadar (81,3 mm) to 442 % in Varaždin (175,0 mm). Analysis of precipitation anomalies in January 2023, expressed as a percentage (%) of the multi-annual average shows that precipitation amounts were above the multi-annual average at all stations.

Precipitation conditions in January 2023 are described in more detail in the following categories: **normal** (wider area of Zadar, the coast of south Dalmatia, island Rab), **wet** (the far east part of Croatia, most part of mountainous Croatia, Croatian Primorje, the most of

Dalmatia and hinterland), **very wet** (eastern Croatia, small part of central Croatia, parts of islands Brač, Hvar, Vis) and **extremely wet** (Slavonski Brod, central Croatia).



Mean air temperature (left) and precipitation amount (right) - January 2023- percentiles with respect to 1991-2020 normal

Air temperature anomalies for Croatia in February 2023

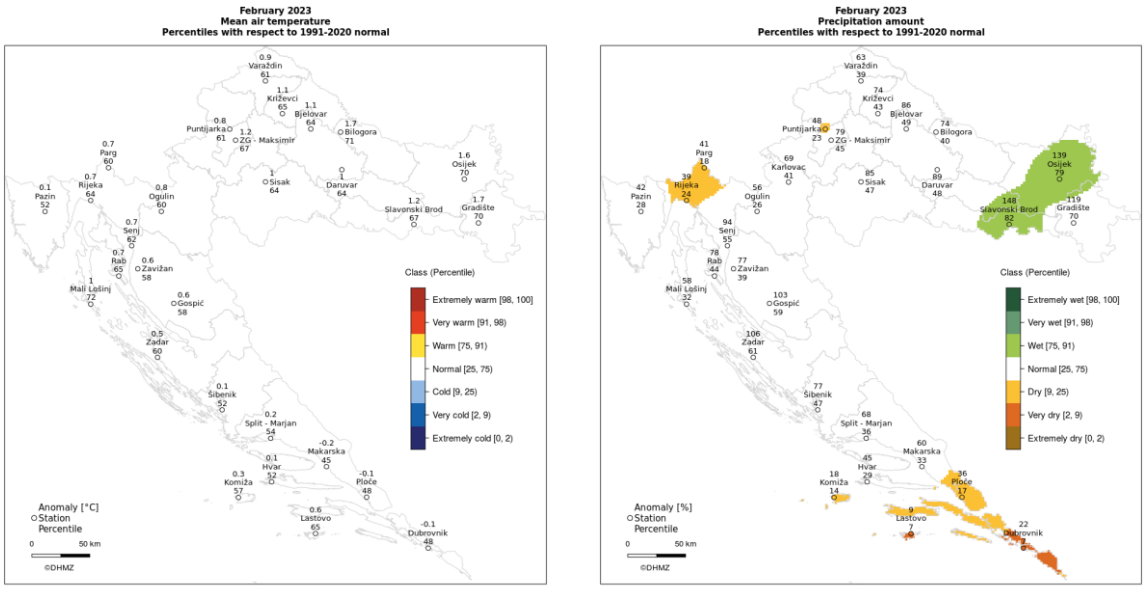
The anomalies of the mean air temperature in February 2023 with respect to the normal 1991 - 2020 were within the range from -0,1 °C (Makarska) to 1,7 °C (Gradište i Bilogora). At all stations air temperature were higher than the respective multi-annual average.

According to the percentile ranks and classification ratings, thermal conditions in Croatia for February 2023 are described as **normal** throughout Croatia.

Precipitation anomalies for Croatia in February 2023

Precipitation anomalies expressed as a percentage (%) of the multi-annual (1991-2020) average were in February 2023 within the range from 9 % in Lastovo (4,7 mm) to 148 % in Slavonski Brod (66,5 mm). Analysis of precipitation anomalies in February 2023, expressed as a percentage (%) of the multi-annual average shows that precipitation amounts were mainly below the multi-annual average.

Precipitation conditions in February 2023 are described in more detail in the following categories: **very dry** (island Lastovo, far south of Croatia), **dry** (wider area of Puntjarka and Rijeka, part of Gorski kotar, island Vis, southern Dalmatia), **normal** (almost the entire Croatia) and **wet** (part of eastern Croatia).



Mean air temperature (left) and precipitation amount (right) - February 2023- percentiles with respect to 1991-2020 normal

SEECOF-28 CLIMATE OUTLOOK VALIDATION

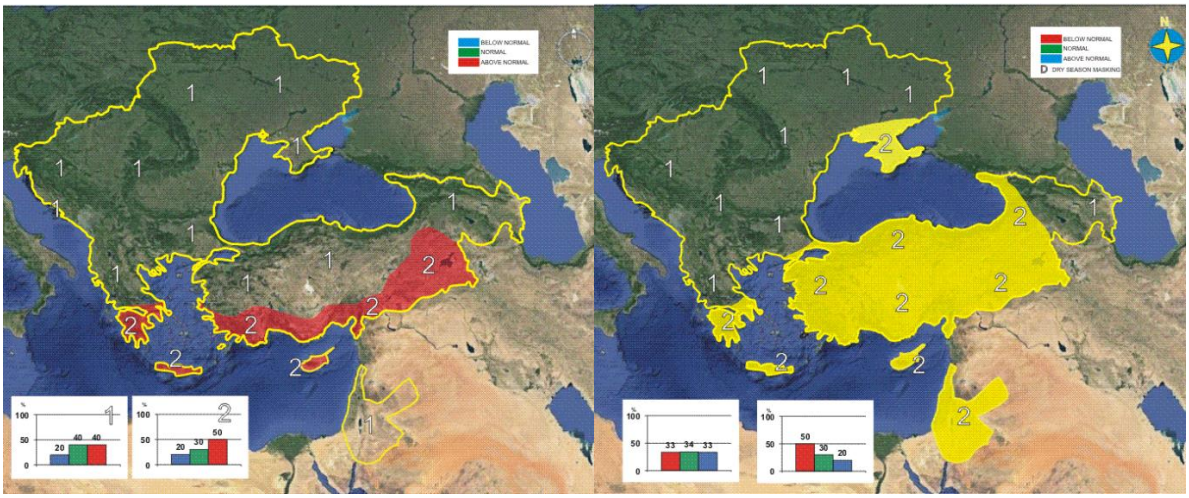


Figure 1: Graphical presentation of the climate outlook for the 2022-2023 winter season for the SEECOF region; Temperature outlook (left), Precipitation outlook (right)

Air temperature anomalies for Croatia in Winter 2022/2023

According to the SEECOF-28 climate outlook, for all Croatian teritory, winter temperature

was expected to be near or above-normal. Probability for exceeding the average winter season temperature was 40 %.

We can conclude that the outlook for the Winter 2022/2023 according the temperature was correct.

Precipitation amounts for Croatia in Winter 2022/2023

According to the SEECOF-28 climate outlook, winter precipitation sum in the whole Croatia had no privileged scenario, which means that climatology (middle tercile) had to be taken as the most likely result.

The actual precipitation amounts were mainly above the average. Only in some parts of Croatia the precipitation sum was around or below the average.

We can conclude that the outlook for the Winter 2022/2023 according the precipitation can be considered successful in some (smaller) parts of Croatia.

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	SEECOF-28 climate outlook for **temperature**	Observed	SEECOF-28 climate outlook for **precipitation**	
Croatia	**Above normal**	**Above normal** throughout Croatia (20,40,40)	**Normal** (Istra and souther part of Croatia; part of Dalmatia) **Above normal** (the rest of territory –	**No predictive signal** (33,34,33)	**Winter 2022/2023** **Wind** – a few episodes (mostly in January and February, once in December) with gale and hurricane force gusts of bura wind (NE wind) was recorded along the Adriatic coast. Traffic between continental part and Adriatic coast were partly or complitely interrupted. Maritime traffic was also partially or completely interrupted. There was damage on houses, fields, cars and

			most of Croatia)		roads. There was an interruption in the power supply. (One boy was injured.) The strongest gusts of bura wind were at the Krk bridge on 26th February (168 km/h). On 4th February very strong N wind with gale force gusts hit also the continental part of Croatia. Great damage was caused to greenhouses and agricultural areas, so natural disaster was declared for the county of Križevci. **Precipitation and floods** Episodes with heavy precipitation, thunderstorms and floods were rather frequent. On 5th December, absolute maximum of daily precipitation was recorded at station Krk (north Adriatic, measurement from 1981.) – 194 mm. In the first half of the month heavy rain, thunderstorms, often with hail, hit continental and coastal Croatia coused floods and flash floods. Due to high amount of precipitation, the water levels of the rivers have risen. The Kupa River flooded the area of Hrvatska Kostajnica, which was declared a state of natural disaster. Many houses, fields and roads were flooded. In January, on 17th heavy thunderstorms hit Dalmatia and its hinterland with heavy precipitation (up to 150 mm/24 h) and hail. Many fields, vineyards and roads were flooded. During the winter there were several

					episodes with snow that caused traffic problems and power outages mainly in mountainous Croatia (January 23rd). On February 25th and 26th heavy snow together with strong wind coused disruption of traffic through mountainous Croatia, so Dalmatia was cut off from the rest of Croatia. Shelters have been opened in Lika for people stuck in the snow. On February 27th, at station Gospić (Lika, mountainous Croatia) 70 cm of new snow was measured. There was a lot of damage to the property and a huge number of people were without electricity throughout Croatia. **Cold wave** In February, in the first half of the month (7. – 11.2.), cold wave hit Croatia.