Twenty-eight Session of the
SOUTH EAST EUROPEAN CLIMATE OUTLOOK FORUM

SEECOF-28 ONLINE MEETING

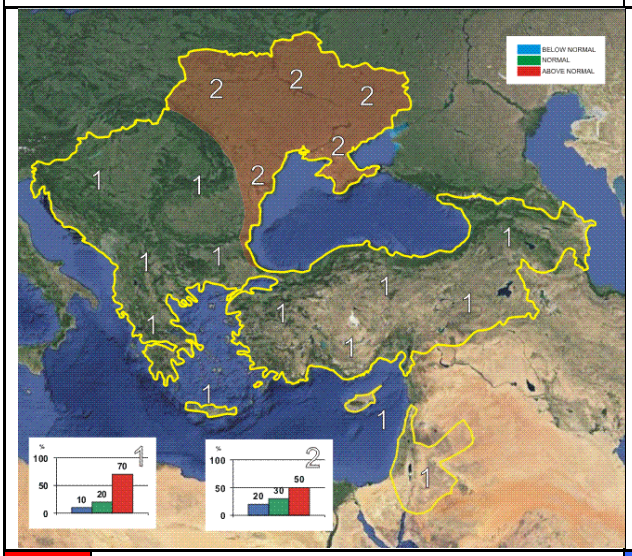
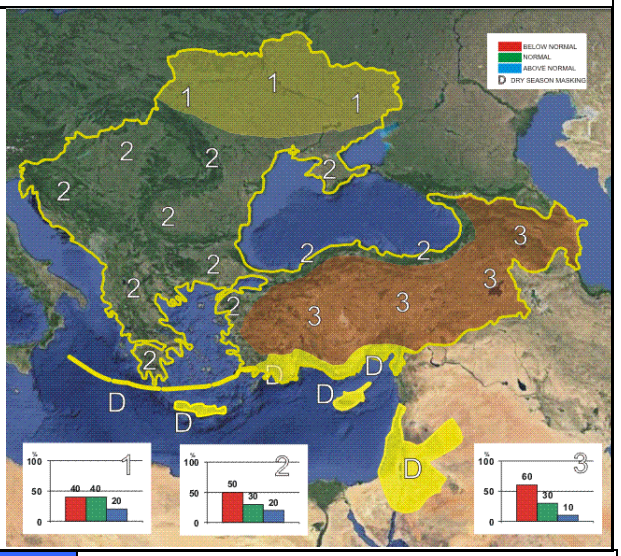
ANALYSIS AND VERIFICATION OF THE SEECOF-27 CLIMATE OUTLOOK FOR THE SUMMER OF 2022 FOR SOUTH-EAST EUROPE (SEE)

CLIMATE OUTLOOK FOR 2022 SUMMER SEASON FOR THE SEE REGION

As stated in the SEECOF-27 Consensus Statement on the Seasonal Climate Outlook for the 2021 Summer Season over South-East Europe (document: http://www.seevccc.rs/SEECOF/SEECOF-27/STEP3/Consensus%20Statement%20SEECOF-27.pdf

In the entire SEECOF region, summer temperature was likely to be above-normal, with the probability increasing from the northern and north-eastern region (Zone 2 in Figure 1) to the remainder of the region (Zone 1 in Figure 1).

Most of the Ukraine was likely to experience below- or near-normal conditions in terms of summer precipitation sums. In most of the SEECOF region below-normal precipitation sums were expected with the probabilities increasing from the north-west (Zone 1 in Figure 2) towards east of the region (Zone 3 in Figure 2). It is noteworthy that certain parts of the country, particularly mountainous regions, might receive near- or above-normal summer precipitation totals due to the episodes of enhanced convection accompanied by heavy precipitation.

2022 Summer Temperature Outlook	2022 Summer Precipitation Outlook
	

	Above Normal		Above Normal
	Normal		Normal
	Below Normal		Below Normal

Figure 1. Graphical presentation of the Climate Outlook for the 2022 Summer Season for the SEE Region

ANALYSIS OF THE SUMMER 2022 FOR THE SEE REGION

Analyses of the summer season temperature and precipitation anomalies are based on:

- Operational products of the RCC Node-CM (Regional Climate Centre on Climate Monitoring) provides maps for the World Meteorological Organization (WMO) Region VI (Europe and Middle East), http://rcccm.dwd.de/DWD-RCCCM/EN/products/europe/europe_node.html
- El Nino/Southern Oscillation (ENSO) Diagnostic Discussion (CPC/NCEP/NWS/IRI), http://www.seevccc.rs/SEECOF/SEECOF-28/STEP-2/CPC-NCEP-ENSO-diagnostic-discussion-13-October-2022.pdf
- Seasonal bulletin on climate in the WMO Region VI for the summer of 2021 (WMO RA VI RCC Node-CM, DWD)
- Climate monitoring products of the South East European Virtual Climate Change Center – SEEVCCC (Member of the WMO RA VI RCC Node-CM), http://www.seevccc.rs/imgsrc/clim_mon/202208/
- National climate monitoring reports of the following SEECOF-28 participating countries: Armenia, Bulgaria, Federation of Bosnia and Herzegovina / Bosnia and Herzegovina, Republic of Srpska / Bosnia and Herzegovina, Croatia, Cyprus, Greece, Georgia, Israel, Republic of North Macedonia, Republic of Moldova, Montenegro, Serbia, Slovenia, Turkey and Ukraine are available on:

  http://www.seevccc.rs/SEECOF/SEECOF-28/STEP-1/

The entire SEECOF region observed above-normal summer temperatures. Temperature anomalies reached up to +4ºC above normal relative to the 1981-2010 base period at some locations in northern and southern Balkans. The summer temperature anomalies are shown in Figures 4 and 5 (left panel).

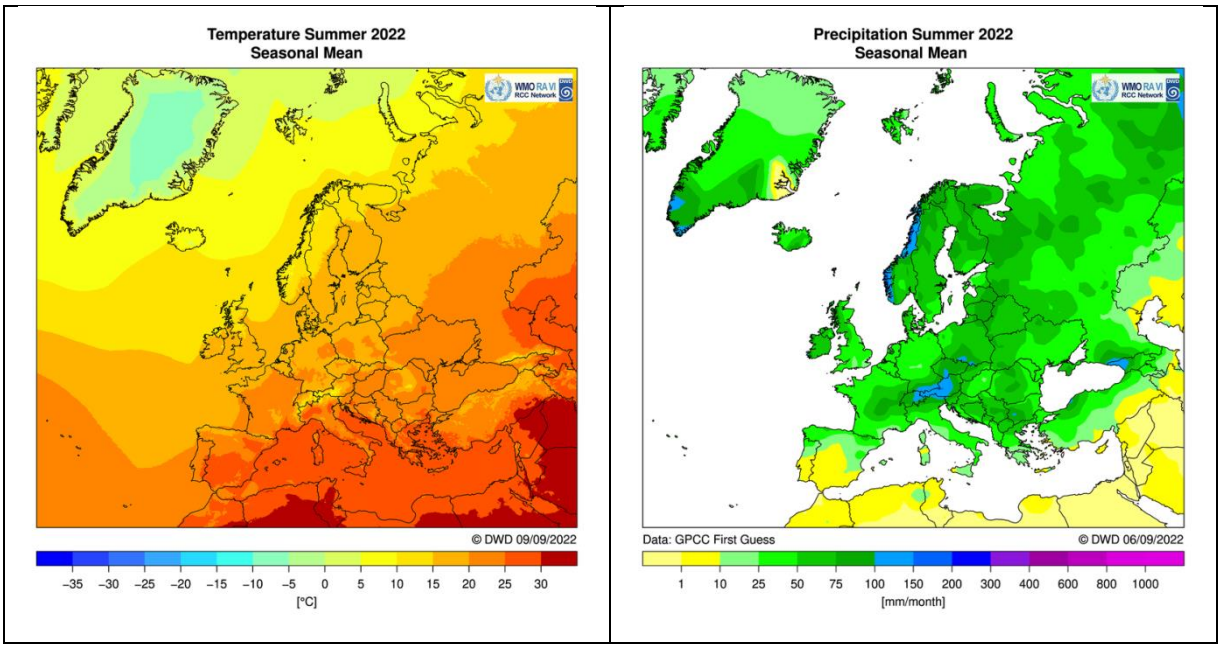


Figure 2. Summer season 2022, Europe – observed temperatures (left panel) and observed precipitation in mm per month (right panel). Source:
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

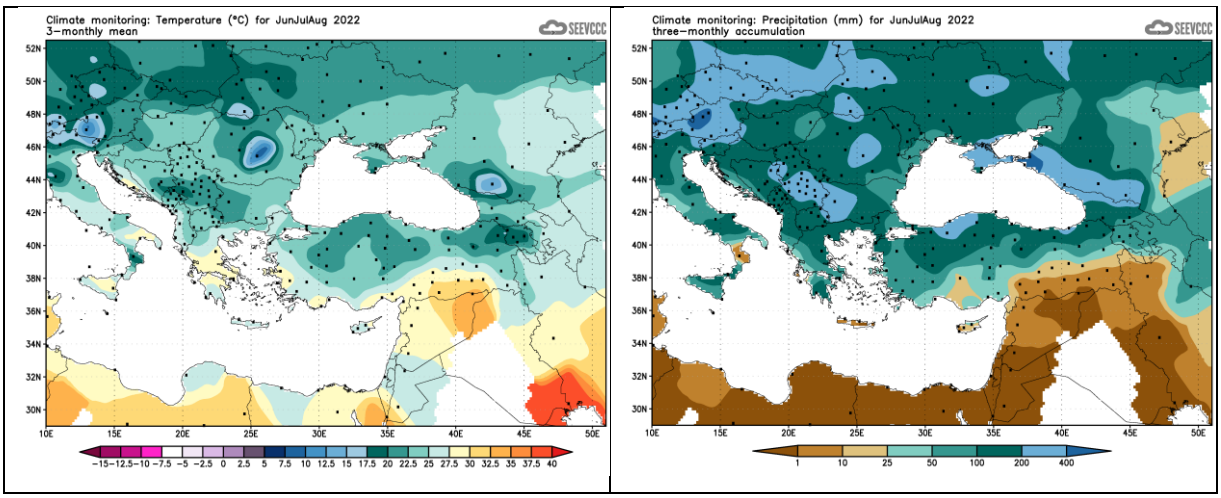


Figure 3. Summer season 2022, SEECOF region – observed temperature (left panel) and observed precipitation (right panel). Source:
http://www.seevccc.rs/imgsrc/clim_mon/202208/temp_av3m.gif (left panel)
http://www.seevccc.rs/imgsrc/clim_mon/202208/prec_tot3m.gif (right panel)

Seasonal precipitation was characterized by positive anomalies in the southern Balkans, Aegean Sea and western and northern part of Turkey (more than 125% of the long-term average). It was drier than normal (less than 75% of the long-term average) in the northern and western Balkans, Pannonian Plain, most of Ukraine, Moldova, western and eastern Romania, western Turkey and most part of Middle East. The summer precipitation anomalies are presented in Figures 4 and 5 (right panel).

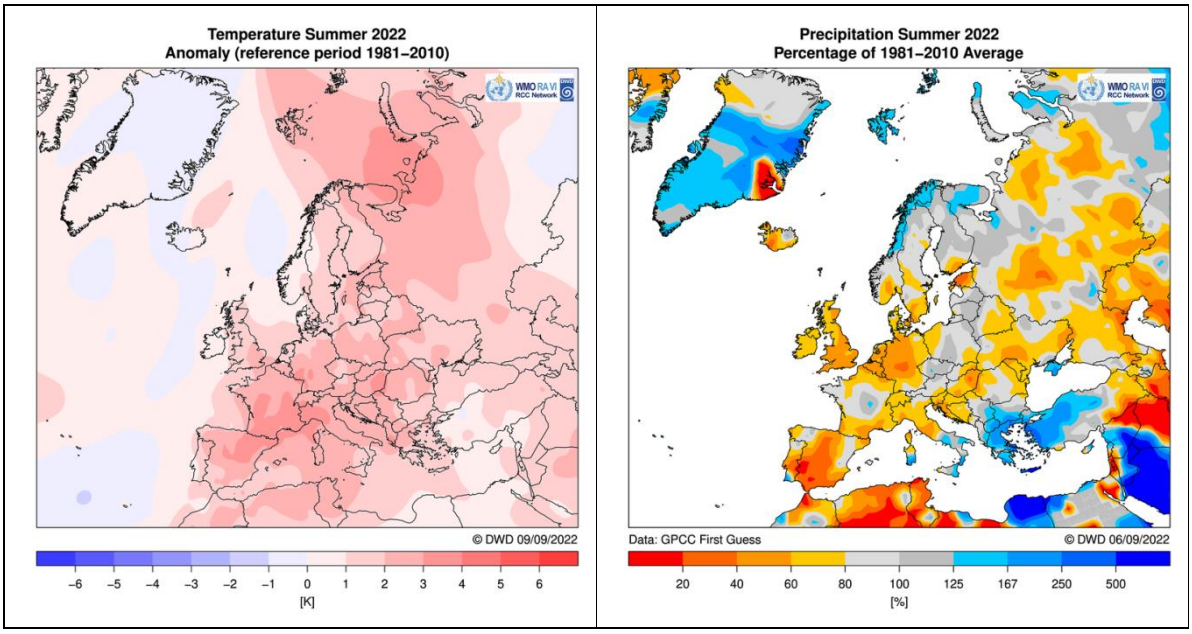


Figure 4. Summer season 2022, Europe – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1981-2010 normal (right panel). Source: https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

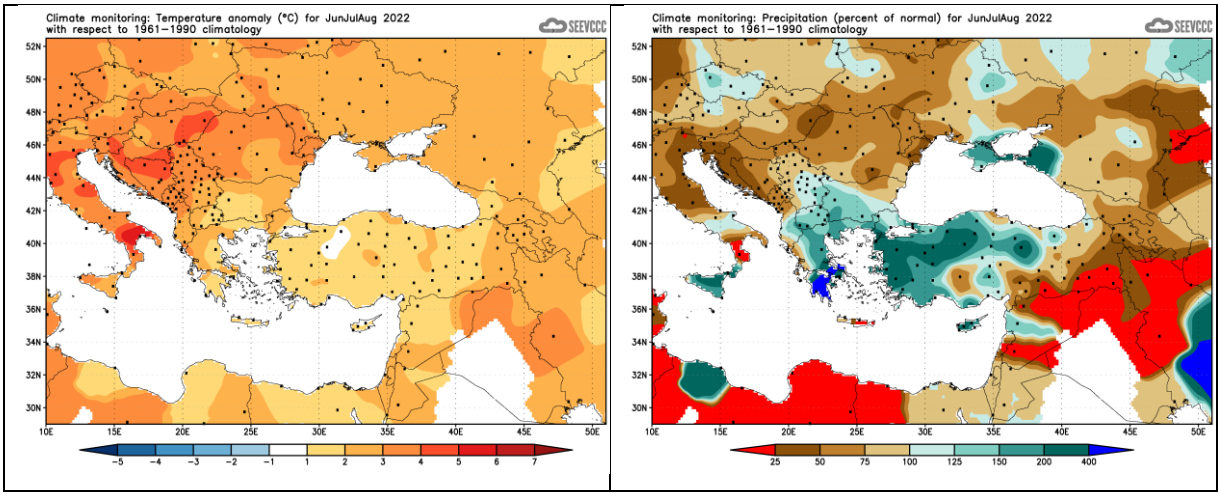


Figure 5. Summer season 2022, SEECOF region – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1961-1990 normal (right panel). Source:
http://www.seevccc.rs/imgsrc/clim_mon/202208/temp_an3m.gif (left panel)
http://www.seevccc.rs/imgsrc/clim_mon/202208/prec_pn3m.gif (right panel)

VERIFICATION OF CLIMATE OUTLOOK FOR THE 2022 SUMMER

Summer 2022 temperature was in the above normal category in the entire SEECOF region, consequently, the outlook was correct for the whole region.

In most of the SEECOF region, SEECOF-27 Climate outlook for summer precipitation was relatively correct. It was drier than normal (less than 75% of the long-term average) in the northern and western Balkans, Pannonian Plain, most of Ukraine, Moldova, western and eastern Romania, western Turkey and most part of Middle East. Consequently, the outlook was correct for that part of SEECOF region.

On the other hand, seasonal precipitation was characterized by positive anomalies in the southern Balkans, Aegean Sea and western and northern part of Turkey (more than 125% of the long-term average), consequently, the outlook for summer precipitation totals was incorrect.

APPENDIX A: **Analysis and verification of the SEECOF-27 climate outlook for the 2022 summer season:**
Verification summary based on the national reports and contributions of the participants of Pre-COF of the SEECOF-28 meeting

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	SEECOF-25 climate outlook for temperature	Observed	SEECOF-25 climate outlook for precipitation	
Bosnia and Herzegovina (FBIH) (6)	Above normal in almost entire Bosnia and Herzegovina (very warm and extremely warm)	Above normal (10, 20, 70) In Bosnia and Herzegovina)	Below normal in almost entire Bosnia and Herzegovina; Extremely dry - Mostar	Below normal (50,30,20)	• Summer - At several stations during the summer, precipitation totals were below 90 mm • Sarajevo - the second hottest summer • June. Temperature records were observed at the following Meteorological stations: Zenica. Floods (smaller rivers) in the cities od Tešanj, Maglaj Srebrenik etc. • July. Temperature record was observed at Meteorological station Zenica. Wildfires in Hercegovina • August. Wildfires in Hercegovina • Extremely warm west and central part.
Bulgaria (6)	Above normal	Above normal	Near normal in average	Dry	• July 2022 was characterized by even drier conditions compared to the July 2021 and 2020. The drought recorded in the mid-summer aggravated the fire weather conditions. Extreme levels of the fire weather index were recorded at the end of July and the beginning of August similarly to summer 2021. Fire fighters experienced a hectic fire season again. Figure 5 shows the extreme fire risk on 23 August 2022. • June was marked by wet conditions accompanied by thunderstorms and hail resulting with the flood in Ruse at the Danube on 6 June and other hail storms later in the

					month. Figure 6 shows the lightning in Bulgaria on 26 June – the day with most thunders in the summer.
Croatia (5)	Above normal	Above normal (10,20,70)	Below normal (the largest part of the territory) Normal (wider area of town Varaždin, part of hinterland of Dalmatia and south Croatia)	Below normal (50,30,20)	• Summer 2022 was extremely warm. • During all three months heat waves were observed (one in June, two in July and August). • During all three months absolute maximum temperatures were recorded. During all three months convective related severe weather phenomena (thunderstorms, hail, heavy rains, flash floods, waterspouts) were observed mostly across entire Croatia. • Despite high amount of precipitation sums (locally) in short time, the consequences of the long-term drought were visible in agriculture and at the record low water levels of the Drava river. • In June, northern part of Croatia was hit by severe thunderstorms and hail (hail diameter was around 7 cm at places.) Hail caused flood damage and crops damage as well as traffic disruption. • In June, severe thunderstorms were more common in continental part of Croatia. • In July, convective activity was very frequent all over Croatia. Urban floods as a result of large amounts of precipitation sums in a short time were common. Flood damage and crops along with infrastructural damage were also frequent. Severe thunderstorms were recorded in large parts of Croatia on 26th July. • In August, a few convective episodes hit mostly Dalmatia. Flash floods caused damage on houses and

					roads.
Cyprus (5)					• On the 14th of June an EMMA yellow warning was issued, concerning rain and thunderstorms. • During July EMMA warnings with yellow awareness level were issued, concerning extreme high temperatures on for the periods 13-14, 17-21 and 24-31 of July. • During July no precipitation was recorded. • For the period 1-5 of August EMMA yellow warnings were issued, concerned high temperatures. On the 20th, 21st and 25th of August episodes of local showers resulted in accumulated precipitation of 2.7mm (135% of normal).
june	normal	normal	above normal	below normal	
july	above normal	normal	below normal	below normal	
august	normal	normal	normal	normal	
Georgia (5)	Above the Normal	Above the Normal	Below and Near the Normal	Below the Normal	• The summer 2022 in Georgia was below the normal almost across the entire country. • During the summer season, June was the wettest in Georgia, precipitation was near- and above the normal. • July and August were marked by dry conditions in the country and precipitation sums were below the normal. • Summer was dry almost across entire Georgia.
Greece (5)	Above normal for the whole area of the country	Above normal for the whole area of Greece	Wetter than normal conditions prevailed in most of Greece	Probabilities for below-, near- or above-average conditions are approximately equal (zone 2, 50% below normal, 30% around normal, 20% above normal).	• On 8 and 9 July 2022 a barometric low-pressure system brought severe thunderstorms to the north and central parts of Greece. Skyros island declared state of emergency after significant damage was recorded, including the collapse of two bridges in the north of the island and flooding in areas on the the west and south. • In the period from 21 to 25 August 2022 a cut-off low that remained above Greece for almost a week, coupled with thermal instability and caused thunderstorms accompanied by a high frequency of lightning, heavy rainfall and hail. Intense weather phenomena affected most of the country, mainly the continental Greece and

					the Aegean islands. Tatoi station, in the northern suburbs of Athens, recorded a 5-day precipitation total of 94.8 mm while its monthly total precipitation of a 30-year (1981-2010) historical average amounts to 7.4 mm. Flooded roads and homes were reported in Macedonia, Attica and East Sterea. Hailstorm hit thousands of acres with crops; landslides and damages to the road network were reported in Kalavryta, Trikala and Santorini island.
Israel (5)	above normal	above normal (70,20,10)	-	-	-
Montenegro (5)	Above normal	70% above normal 20% normal 10% below normal	Normal in the large part of Montenegro; Dry in the belt from Podgorica – Cetinje – Herceg Novi	No predictive signal (50, 30, 20)	• On the 23rd June: storm weather in central and northern region – in Podgorica, heavy precipitation and hail affected – the largest fruit plantation and vineyards of AD "Plantaže" enterprise with estimated damage cost to over millions of euros; – crops in the suburbs, – crashed trees.
Republic of North Macedonia (5)	Above average	Above average (10, 20, 70)	Normal to very wet on west mountainous part	Normal (50, 30, 20)	• June - Exceeded maximum daily precipitation amount of 90.3mm on 11th in Mavrovo
Republic of Moldova (5)	Above normal	Above normal	Below normal	Below normal	• The high thermal regime and the lack of precipitation, reported in the period of May-July, caused atmospheric and pedological drought. Due to the dry climate, unfavorable conditions contributed to the formation of fruit in autumn and spring cereal crops, in corn, sunflower, sugar beet, as well as for the growth and development of vegetable crops and other agricultural crops. The Selianinov Hydrothermal Coefficient (CHT),

					which characterizes the level of wetting of the territory, for May was on average 0.4, for June and July it was on average 0.3, which corresponds to very strong drought. • On some days during the season (July 6, 8 and 27, August 9, 16 and 30), extreme weather phenomena were reported in the form of extreme heavy rains and hail causing damage to agricultural crops and damage to objects of the national economy. Thus, according to the data of the automatic weather stations, installed in the municipality of Chisinau, on August 9, within one hour, 80 mm of precipitation (160% of the monthly norm), on August 9 – within one hour, 52 mm of precipitation (105% from the monthly norm).
Serbia (5)	Above normal in entire Serbia	Above-normal (10, 20, 70) in entire Serbia	Below normal in northern and part of western Serbia Above normal in central, southeastern and part of western Serbia	Below-normal (50, 30, 20) in entire Serbia	• 3rd warmest summer for Serbia since 1951 • Warmest summer for Palic, Novi Sad, Kikinda and Banatski Karlovac • 2nd warmest summer for Zrenjanin, Veliko Gradiste and Pozega • 3rd warmest summer for Belgrade, Sombor, Cuprija and Crni Vrh • 2nd warmest summer for Serbia based on the minimum air temperature • Record-breaking number of summer and tropical days for Kikinda, Banatski Karlovac and Veliko Gradiste, in Zrenjanin and Sombor, tropical days and nights, respectively. • Dry summer in parts of northern and western Serbia, rainy in parts of central and southeastern Serbia, within the average elsewhere • 5th wettest summer for Dimitrovgrad and 7th driest for Sombor

					• 2 days with precipitation of 50 mm and more are recorded in Loznica, 1 day in Novi Sad, Kragujevac, Smederevska Palanka and Zlatibor

Slovenia (5)	Warmer than normal	Warmer than normal	drier than normal	drier than normal	• Temperature above average, the second warmest summer since at least 1950. • Very hot June, the third warmest since at least 1950, very hot July, the second warmest since at least 1950, hot August, among the seven warmest since at least 1950. • Precipitation below average, the third driest summer since 1961, the driest at some weather stations in central and west Slovenia. • Very dry June, the eighth driest since 1961, very dry July, the fifth driest since 1961, dry August. • Drought/Dry spell from approx. 28 April to 7 September in the entire country, especially in central and western Slovenia. There were significant regional differences as May was wet in some parts of eastern Slovenia. In some regions, especially in the western Slovenia, this drought was actually a part of a drought starting in June 2021. Huge losses in agriculture were reported, probably around 100 million euro. Ongoing damage in spruce forests due to massive bark beetle attack (due to water stress and high temperature). • Thunderstorm/Squall lines on 2 June at several places in eastern part of Slovenia. Severe supercell thunderstorms, raging from Austrian Carinthia through Koroška, Štajerska and Dolenjska regions in Slovenia to northwestern Croatia. One severe thunderstorm also in extreme northwestern Slovenia. Supercell storms brought

					heavy downpours, severe wind gusts and devastating hail at some places. Damaged cars and infrastructure by hail. Heavy damage by hail, downpours and severe wind gusts in agriculture. Many trees were down and roofs damaged due to wind. Many building flooded, some landslides. • Heatwave from 15 June to 25 August. Intense heatwave, especially in the littoral region (Bilje recorded seven consecutive days with daily maximum temperature over 35 °C, station record). Peak of heatwave on 22 and 23 July. Some stations recorded highest July temperature ever: Dobliče 39.4 °C, Tolmin 38.9 °C and Ljubljana 37.9 °C. Heat stress and drought heavily affected agriculture.
Turkey (6)	Near normal at western and inner parts Above normal at eastern parts Above normal at eastern parts	Above normal	Above normal at the western and inner parts - Below normal at eastern parts	Below normal	• The summer season of 2022 was the 8th hottest summer season in the last 52 years (1971-2022). • The August 2022 was the 3th hottest month in the last 52 years (1971-2022). • Maximum temperature record was broken at 6 stations in the 2022 summer season. • Extreme drought conditions recorded in the southeaster part of the Türkiye.
The Republika Srpska (5)	Above over entire RS entity	Above (70,20,10%)	Below-normal over the most area of the RS entity	Below (50,30,20%)	• High impact events: long lasting drought and high temperatures caused wild fires in the Southern area of the Republika Srpska. • Long lasting drought from January to July, with 3rd lowest 7-month amount of precipitation over the historical period 1950-2022 with high impact on agricultural production and hydro potential.

Ukraine (5)	above normal	above normal	above normal (18% stations) normal (23% stations) below normal (59% stations)	above normal 33 normal 34 below normal 33 southern part above normal 20 normal 30 below normal 50	• During summer, meteorological extraordinary phenomena were observed in many regions across the country. • Heavy rains 30-77 mm of precipitation per 2-12 hours were recorded in • Heavy showers (30-35 mm/hour), Botievo (Zaporizhzhia region) recoded 88 mm/hour 04/08/22. • Storm winds and squalls (with speed 25-26 m/c) were recorded in Ivano-Frankivsk, Khmelnitsky Odesa regions, locally causing disruption in power, telecommunications, utilities and transport. Summer was dry across most regions in Ukraine, with the driest conditions at some places in the western and southern parts. Yavoriv and Rava-Ruska (Lviv region), Play (Zakarpattia region), Uman (Cherkasy region), Izmail (Odesa region) recorded minimum precipitation sums since 1961.

Note:
1 – Basic climatological period (1961-1990)
2 – Basic climatological period (1971-2000)
3 – Basic climatological period (1951-2000)
4 – Basic climatological period (1980-2009)
5 – Basic climatological period (1981-2010)
6 – Basic climatological period (1991-2020)
7 – No information about the basic climatological period