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

SEECOF-29 ONLINE MEETING

ANALYSIS AND VERIFICATION OF THE SEECOF-28 CLIMATE OUTLOOK FOR THE WINTER OF 2022/23 FOR SOUTH-EAST EUROPE

CLIMATE OUTLOOK FOR 2022/23 WINTER SEASON FOR THE SEE REGION

As stated in the SEECOF-28 Consensus Statement on the Seasonal Climate Outlook for the 2022/23 Winter Season over South-East Europe (SEE) document:
http://www.seevccc.rs/SEECOF/SEECOF-28/STEP-3/Consensus_Statement-SEECOF-28.pdf

Observed sea surface temperatures and forecast from november for the coming three winter months showed moderate La Niña conditions and negative Pacific Decadal Oscillation. These drivers, together with westerly phase of QBO[1], tend to favor positive phase of North Atlantic Oscillation. Models suggesting higher than normal odds for blocking over Central Europe and Scandinavian Peninsula.

Winter temperature were likely to be near or above-normal in most of the SEECOF region (Zone 1 in Figure 1, left panel), and above-normal in Jordan, Israel, southern parts of Turkey, along the coasts of the Ionian, Aegean, Central and Eastern Mediterranean Seas with belonging hinterland (Zone 2 in Figure 1, left panel). As for the precipitation, in the south of Greece, Turkey, Israel, Jordan, along the coasts of Ionian, southern coasts of the Aegean, southern and eastern coasts of the Black Sea (zone 2 in Figure 1, right panel), winter precipitation totals were likely to be below- normal, while in rest of the SEECOF region (zone 1 in Figure 1, right panel) the uncertainty was high: probabilities for below, near- or above-average conditions were approximately equal.

It was noted that seasonal averages cannot provide details about short spells of weather during the season. It is possible that even in an average season spells of severe wintry weather (for example: winter storms, very cold episodes, very wet spells) could occur and lead to significant local socio-economic impacts.

[1] Quasi Biennial Oscillation, an oscillation in the zonal winds of the equatorial stratosphere having a period that fluctuates between about 24 and 30 months

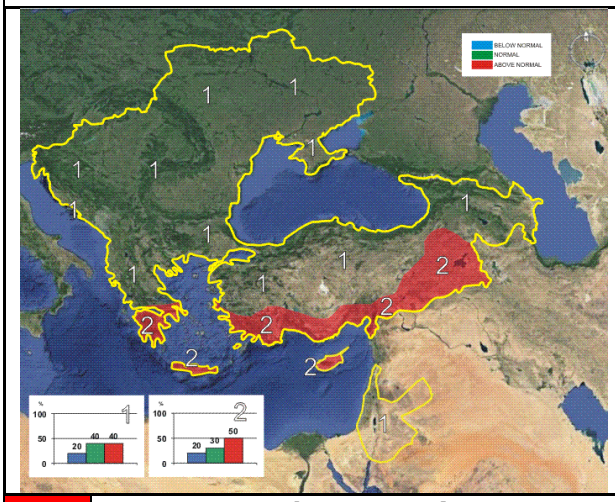
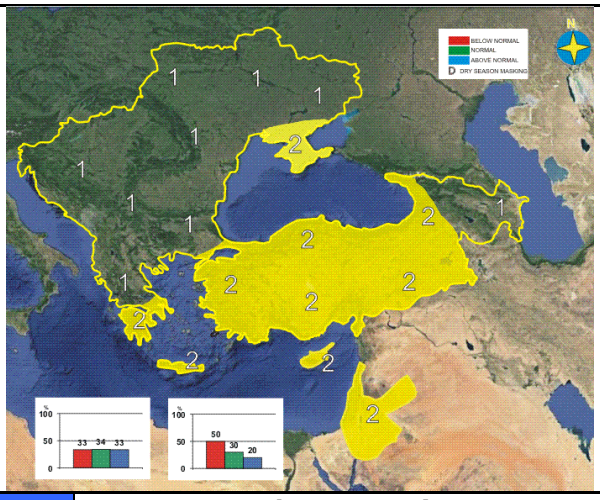
2022/23 Winter Temperature Outlook		2022/23 Winter Precipitation Outlook	
			
	Above Normal		Above Normal
	Normal		Normal
	Below Normal		Below Normal

Figure 1. Graphical presentation of the Climate Outlook for the 2022/23 Winter Season for the SEE Region

ANALYSIS OF THE WINTER 2022/23 FOR THE SEE REGION

Analyses of the winter 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
- Seasonal bulletin on climate in the WMO Region VI for the winter of 2022/23 (WMO RA VI RCC Node-CM, DWD), http://www.seevccc.rs/SEECOF/SEECOF-29/STEP-1/MedCOF-20-Verification_DJF_2021-2022_RA%20I+VI_draft1.pdf
- 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/202302/
- National climate monitoring reports of the following SEECOF-29 participating countries: Bulgaria, Federation of Bosnia and Herzegovina / Bosnia and Herzegovina, Croatia, Cyprus, Greece, Republic of North Macedonia, Republic of Moldova, Montenegro, Republika Srpska / Bosnia and Herzegovina, Serbia, Slovenia, Turkey and Ukraine are available on:

  http://www.seevccc.rs/SEECOF/SEECOF-29/STEP-1/

Winter 2022/23 seasonal mean temperature was in a range from –10 ºC in the mountainous areas of the SEECOF region, to more than 17 ºC in the Middle East. In most of the low-lying regions it was between 0 ºC and 10 ºC, except in northeastern Ukraine where it was lower than 0 ºC and eastern Mediterranean where it was up to 20 ºC (Figures 2 and 3, left panel). Almost the entire region observed above-normal winter temperatures (Figures 4 and 5, left panel). Temperature anomalies reached up to +4 ºC above normal, relative to the 1981-2010 base period, in most of the Balkans, Hungary, Romania, Moldova, western and southern Ukraine.

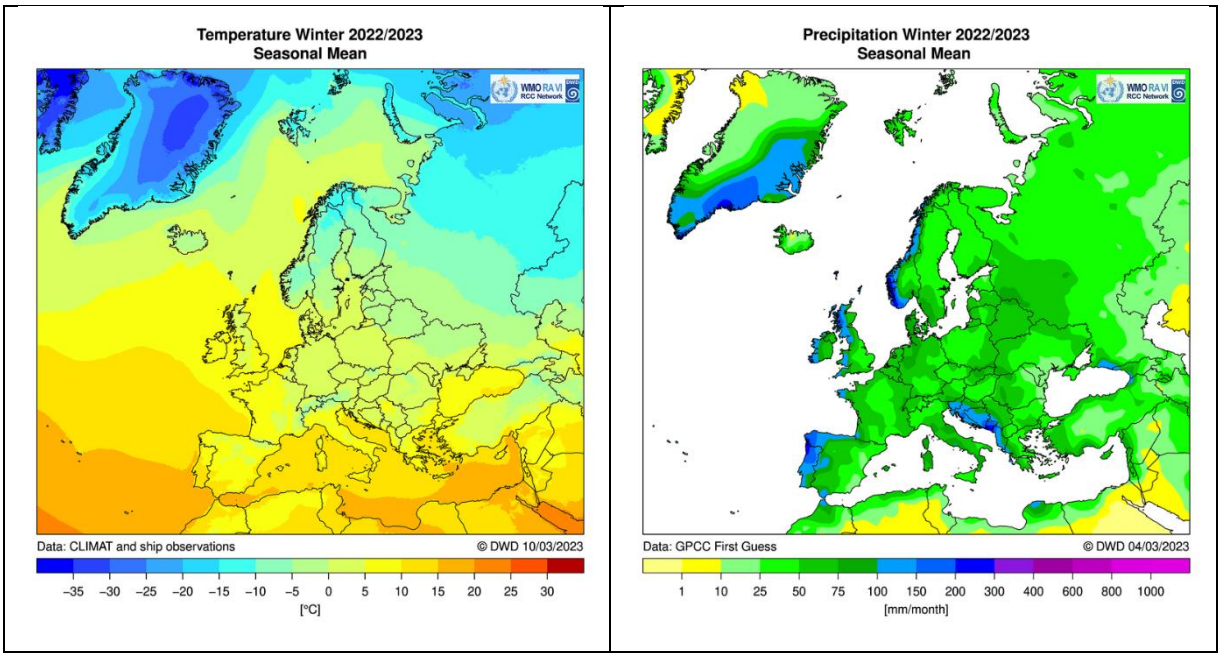


Figure 2. Winter season 2022/23, Europe – observed temperatures (left panel) and observed precipitation in mm per month (right panel). Source:
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

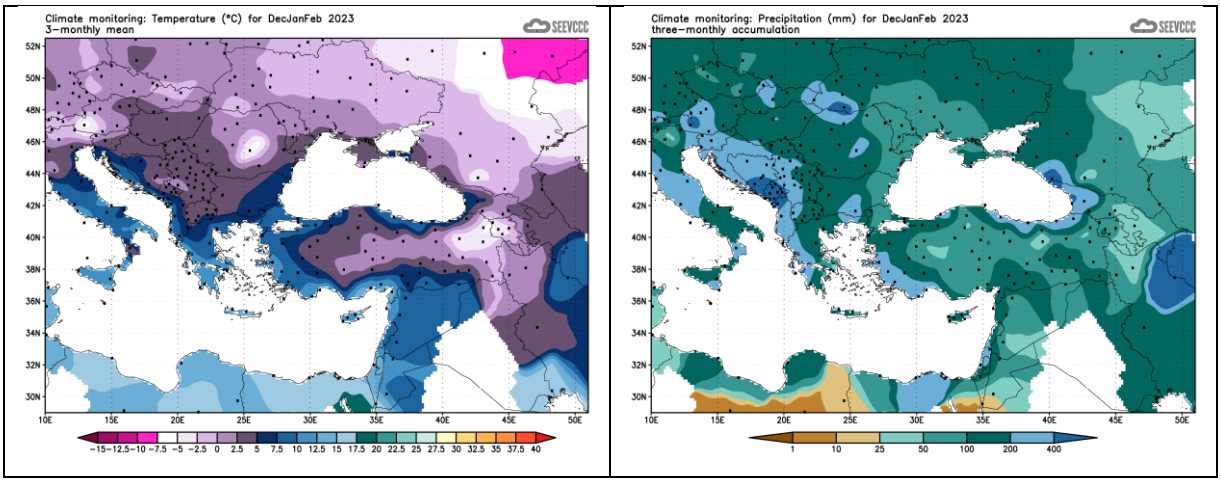


Figure 3. Winter season 2022/23, SEECOF region – observed temperature (left panel) and observed precipitation (right panel). Source:
http://www.seevccc.rs/imgsrc/clim_mon/202302/temp_av3m.gif (left panel)
http://www.seevccc.rs/imgsrc/clim_mon/202302/prec_tot3m.gif (right panel)

Seasonal precipitation totals (Figures 2 and 3, right panel) were in a range from 16 mm in Eilat (Israel) up to 1405 mm in Cetinje (Montenegro). They were characterized by positive anomalies in central and western Balkans, Pannonian Plain and western Ukraine, up to 200% of the long-term average in the Carpathian Mountains. It was drier than normal in southern and eastern Balkans, Moldova, southwestern Ukraine, Cyprus, Turkey, South Caucasus and Middle East, with less than 50% of the long-term average (Figures 4 and 5, right panel).

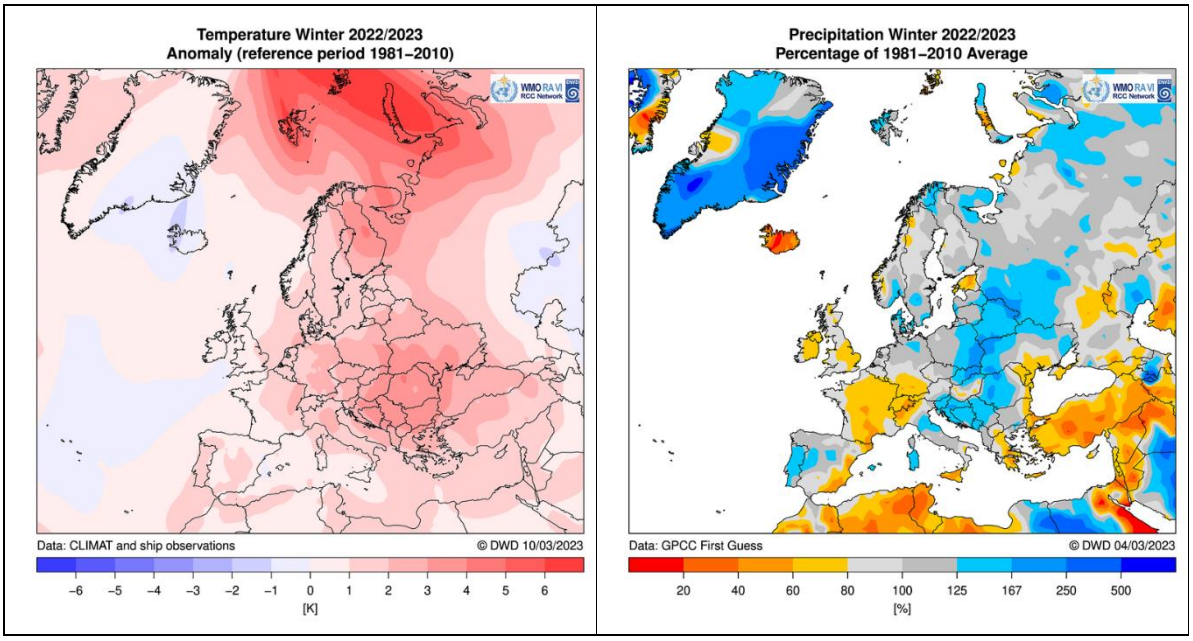


Figure 4. Winter season 2022/23, Europe – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1981-2010 normal (right panel). Source: https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

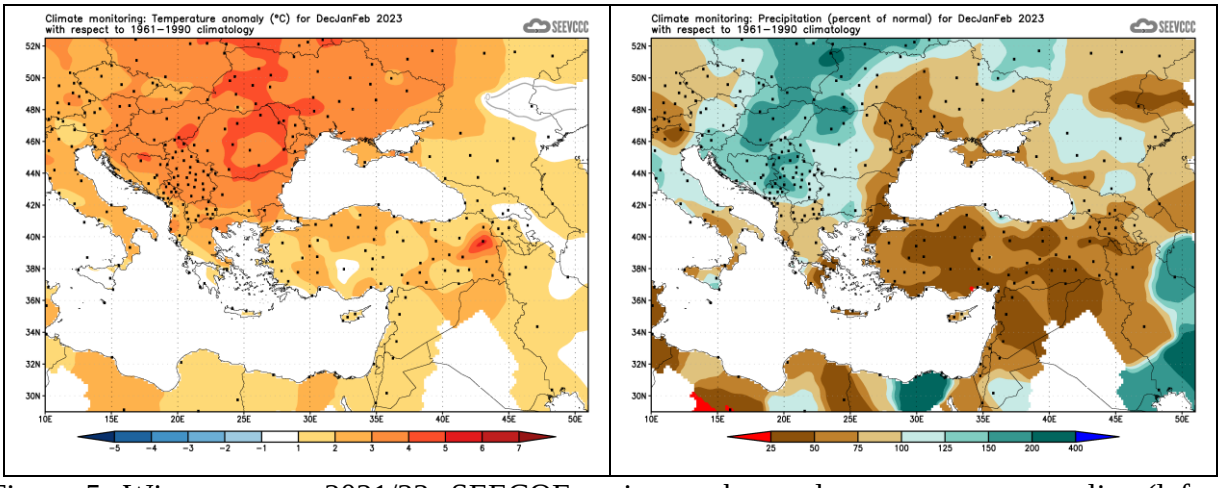


Figure 5. Winter season 2021/22, SEECOF region – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1961-1990 normal (right panel). Source:
http://www.seevccc.rs/imgsrc/clim_mon/202302/temp_an3m.gif (left panel)
http://www.seevccc.rs/imgsrc/clim_mon/202302/prec_pn3m.gif (right panel)

VERIFICATION OF CLIMATE OUTLOOK FOR THE 2022/23 WINTER

Winter 2022/23 temperature was in the above normal category in most of the SEECOF region and in some parts within the normal category. Consequently, the outlook was partly correct for most of the SEECOF region, considering that the equal probabilities for warm and average winter were predicted. In Cyprus and Turkey the winter 2022/23 climate outlook was correct.

In most of the SEECOF region, SEECOF-28 Climate outlook for winter precipitation was relatively correct, forecasting below-normal precipitation sums for southern Greece, Cyprus, Turkey, southern Ukraine and most of Middle East, as well as near normal winter precipitation totals for Adriatic Sea coast, eastern and south-central Balkans, most of Ukraine and South Caucasus. On the other hand, the outlook did not anticipate above-normal winter precipitation totals in the western and central Balkans, Pannonian Plain and Carpathian Mountains.

APPENDIX A: **Analysis and verification of the SEECOF-28 climate outlook for the 2022/23 winter season:**
Verification summary based on the national reports and contributions of the participants of Pre-COF of the SEECOF-29 meeting

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	SEECOF-28 climate outlook for temperature	Observed	SEECOF-28 climate outlook for precipitation	
Federation of Bosnia and Herzegovina, Bosnia and Herzegovina (1)	**Above normal** in almost entire Bosnia and Herzegovina	**Above normal** in entire Bosnia and Herzegovina	**Above normal** in almost entire Bosnia and Herzegovina	**No predictive signal**	• The biggest deviations in relation to average air temperatures were recorded in December. • 6 th warmest winter for Sarajevo since 1888, 6 th warmest winter for Mostar. • 14th wetest winter for Sarajevo since 1888. • The first snow cover recorded in the third decade of January. • The first decade of January without snow cover in Bjelašnica
Republic of Srpska, Bosnia and Herzegovina	**Above normal**	**Normal Above normal**	**Above normal**	**No predictive signal**	**Local floods and landslides** • Gacko, 18.01.2023: water entered the houses, interrupted travel communication with Nevesinje. • Three residential buildings in the village Fojnica near Gacko were flooded and water entered those buildings. Residents of these homes were evacuated.

Bulgaria (1)	**Above normal**	**Near or Above normal**	**Near or Below normal**	**No predictive signal**	• The winter of 2023 was very warm – among the warmest for the last 20 years. • December 2022 and February 2023 was even drier. J • anuary 2023 was marked by heavy rain in part of Central Bulgaria which lead to local floods. There was a state of emergency declared in a number of municipalities in South central Bulgaria. The zonality of the winter circulation favored strong wind events and there was a number of them in all three winter months. • The biggest snow event was in February but it was not exceptional.

Croatia (1)	**Above normal**	**Above normal** throughout Croatia	**Normal** (Istra and souther part of Croatia; part of Dalmatia) **Above normal** (the rest of territory)	**No predictive signal**	**Wind** • A few episodes (mostly in January and February, once in December) with gale and hurricane force gusts of bora wind (NE wind) was recorded along the Adriatic coast. Traffic between continental part and Adriatic coast were partly or completely 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 bora 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 caused 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 caused 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.

Cyprus (5)	**DEC** Well **Above normal** **JAN** Well **Above normal** **FEB normal**	**DEC Above normal** mainly over coastal areas **JAN Above normal** **FEB Above normal**	**DEC** Well **Below normal** **JAN** Well **Below normal** **FEB Below normal**	**DEC Below normal** **JAN Normal to Above normal** **FEB** Well **Below normal**	**DEC:** • Extremes (deviating by 4°C or more from normal) were also recorded in all of the selected meteorological stations. As an example, note the recorded maximum of Prodromos that was 16.1°C (with a normal of 8.3°C) and the maximum of Polis Chrysochous that was 25.5°C (with a normal of 18°C). Concerning the mean daily minimum temperatures note the recorded minimum of Larnaca airport that was 16°C (with a normal of 9.2°C) and the minimum of Prodromos that was 9.2°C (with a normal of 2.6°C). • From the distribution (provisional accumulated precipitation chart) of the accumulated precipitation of December is evident that the surface distribution was well below normal reaching 30.8mm or 33% of normal. During the dates 2, 6- 8, 11-16, 20-21, 23-26 and 29 of December local showers and isolated thunderstorms were recorded. • For the 14th of December, yellow EMMA warning was issued concerning showers and thunderstorms. • Based on the provisional data, hail was recorded on the 6 th and 11th of the month. Snow was recorded on the 15th of the month at Troodos. **JAN**: • Extreme high temperatures were recorded, as an example Prodromos recorded a highest daily maximum of 13.3°C (with the normal being 6.3°C) and Polis Chrysochous recorded a highest daily maximum of 24.5°C (with the normal being 16.3°C). Extreme low temperatures were also recorded, as an example note the highest daily minimum temperature of Polis Chrysochous that was 13.7°C (with a

					normal of 2.4°C) and the highest daily minimum temperature of Larnaka Airport that was 16.4°C (with a normal of 7.5°C). • From the provisional data recorded by the Department of Meteorology the model performed moderately over the amount of the accumulated precipitation, as the actual accumulated precipitation was more than the expected over the entire island but below the expected over the area controlled by the government During the periods 6-7, 10-17 and 27-31 of January local showers and thunderstorms resulted in accumulated precipitation of 95.5mm or 115% of normal. It is worth mentioning that on the 11 the of January hail was reported. Also, for the 12-13, 15-16 and 30-31 of January, EMMA yellow level warnings for rainfall and thunderstorms were issued. • It is worth mentioning that based on the provisional data there were 6 days of snow during January, 12-14 and 29-31 of January. **FEB**: • Extreme high temperatures were of course recorded at all the selected meteorological stations, like Prodromos that recorded a highest daily maximum of 17.7°C (with the normal being 6.7°C) and Athalassa that recorded a highest daily maximum of 26.3°C (with the normal being 16°C). Extremes low temperatures (deviating by 4°C or more from normal) were also recorded. As an example, note the highest daily minimum temperatures of Larnaka airport and Prodromos that was 13°C (with a normal of 7.1°C) and 10.5°C (with a normal of 0.5°C) respectively. • From the distribution (provisional accumulated precipitation chart) of the accumulated precipitation of the

					month is evident that the mean surface distribution was just below normal (reaching only 58.7mm or 85% of normal). • During the periods 1-7, 10-13 and 24-25 of February local showers and thunderstorms were recorded. • Based on the provisional data, hail was recorded on the 6 th of the month, while snow was recorded during the period 1-5 of the month. • For the dates 1 and 3-6 of February, yellow EMMA warning was issued concerning showers and thunderstorms, whereas for the dates 8-9 of February, yellow EMMA warning was issued concerning low temperatures over Troodos area.

Greece (2, 5)	**Above normal** mainly in the north of Greece	**Above normal** in the south of Greece and **Near or Above normal** elsewhere	**Below normal** mainly in the south of Greece	**Below normal** in the south of Greece	No high impact events

Montenegro (1,5)	**Above normal**	**Near or Above normal**	**Normal** in coastal region **Above normal** in most of the country	**No predictive signal**	No high impact events

Republic of Moldova (5)	**Above normal**	**Near or Above normal**	Mostly **Below normal**	**No predictive signal**	• On January 28-29, complicated weather conditions were reported in the southern districts of the country. Precipitation fell in the form of snow and sleet. The thickness of the snow layer on the meteorological platforms in the southern half of the country was 4-14 cm, and its maximum height was recorded at the Vulcănești agrometeorological station and reached 24 cm. Wind gusts of up to 14 m/s caused the roads to triple and made road traffic difficult. • Also, during the winter season, there were fogs, snow and ice deposits, blizzards, and wind intensifications of up to 25 m/s (February), on icy roads.
Serbia (1)	**Above normal** in entire Serbia	**Normal - to Above normal** in entire Serbia	**Above normal** in most of Serbia	**No predictive signal** in entire Serbia	• 3 rd warmest winter for Serbia since 1951, WARMEST ON RECORD for Cuprija and Banatski Karlovac, 2nd warmest for Belgrade since 1888, Sombor, Novi Sad, Zrenjanin, Kikinda, Kraljevo, Pozega, Sjenica, Nis, Zajecar, Dimitrovgrad, Vranje and Palic. • First winter without ice days in Novi Sad and Zajecar. • Record low number of frost days in Sombor, Banatski Karlovac, Belgrade, Valjevo, Kragujecac, Smederevska Palanka, Pozega, Negotin and Palic. • 8 th wettest winter for Serbia since 1951, WETTEST ON RECORD for Sjenica since 1926, 3rd wettest for Loznica since 1926. • Maximum daily precipitation sums exceded in Veliko Gradiste and Kopaonik, where for the first time since the record-keeping one day with precipitation sum above 50 mm was registered during winter. • Record low snow depth in Kraljevo and Kursumlija. • Kopaonik observed record few days with snow cover.

Republic of North Macedonia (5)	**Above normal**	**Near or Above normal**	**Normal**	**No predictive signal**	• 19.9°C on 16th of December in Ohrid • 19.9°C on 16th of December in Kriva Palanka • 18.7°C on 18 th of January in Skopje

Slovenia (5)	**Warmer than normal**	**Normal or warmer than normal**	**Wetter than normal, normal** in parts of south and northwest Slovenia	**No predictive signal**	• Temperature above average, the 4th to 7th warmest since the season 1950/51. • Warm December and January, both the sixth warmest since 1950/51, • Precipitation above average, the 12th wettest since 1950/51, • Wet December, the 14th wettest since 1950/51, the wettest January since 1950/51, February among 10 driest since 1950/51.

Turkey (2)	**Near or Above normal**	**Near or Above normal**	**Below normal**	**Below Normal**	• The 2022/23 winter season was the second driest in the last 63 years with a decrease of 44%. • December 2022 was the hottest December on record with an anomaly of 3.2°C. • January 2023 was the second hottest January on record with an anomaly of 2.4°C. • 14 stations reached new monthly maximum temperature record in in the 2022/23 winter season

Ukraine (5)	**Above Normal**	**Above or near Normal**	**Above or near Normal**	**No predictive signal**	• In **December** 10-11 th - heavy rain (amount of precipitation 60-88 mm) in Zakarpattia regions, heavy snowfall (30-57 mm, snow depth 20-30 sm) in Volyn and Lviv regions. • In **January** were recorded 18-19th heavy snowfalls (60-80 mm) in Carpathian mountains, heavy rain (60-80 mm) in Zakarpattia region. • In **Fabruary** were recorded 18, 21th - strong wind 25 m/c in Khmelnytsk region, 25 th - strong wind 26 m/c in Ivano-Frankivsk region. 18-19th - heavy snowfalls (60-82 mm) in Carpathian mountains, heavy rain (60-70 mm) in Zakarpattia region. 25th - heavy rain (30-52 mm) in Zakarpattia region, heavy snowfalls (20-48 mm) in Carpathian mountains. • Unfavorable weather conditions caused loss power, telecommunications, utilities and transport.

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 – No information about the basic climatological period