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

SEECOF-27 ONLINE MEETING

ANALYSIS AND VERIFICATION OF THE SEECOF-26 CLIMATE OUTLOOK FOR THE WINTER OF 2021/22 FOR SOUTH-EAST EUROPE

CLIMATE OUTLOOK FOR 2021/22 WINTER SEASON FOR THE SEE REGION

As stated in the SEECOF-26 Consensus Statement on the Seasonal Climate Outlook for the 2021/22 Winter Season over South-East Europe (SEE) document:
http://www.seevccc.rs/SEECOF/SEECOF-26/STEP-3/Consensus_Statement-SEECOF-26.pdf

Models showed the typical atmospheric response to La Niña event over the tropics and also over North America with a strong negative PNA. They were in less agreement over North Atlantic and MedCOF domain, some models suggesting a dominant NAO+ circulation and other suggesting blocking as the most frequent regime. A tendency of higher than normal geopotential was suggested by most models over Central Europe and Mediterranean Sea, with areas of low surface pressures over Southern MedCOF domain.

In most of the SEECOF region (Zone 2 in Figure 1, left panel), winter temperature was likely to be near or above-normal, whereas Pannonia Plain, western Balkans, western parts of Turkey, Israel, Jordan, along the coasts of the Adriatic, Ionian, Aegean and Mediterranean Seas with belonging hinterland were forecasted to observe above-normal winter temperature (Zone 1 in Figure 1). As for the precipitation, in Greece, southern and western parts of Turkey, Israel and Jordan, along the coasts of Ionian, southern coasts of the Aegean Sea and Eastern Mediterranean (Zone 1 in Figure 2), winter precipitation totals were likely to be below- or near-normal, while in rest of the SEECOF region (Zone 2 in Figure 2) uncertainty was high: probabilities for below, near- or above-average conditions were approximately equal.

It was noted that seasonal averages could not provide details about short spells of weather during the season. In addition, 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 even during an average season.

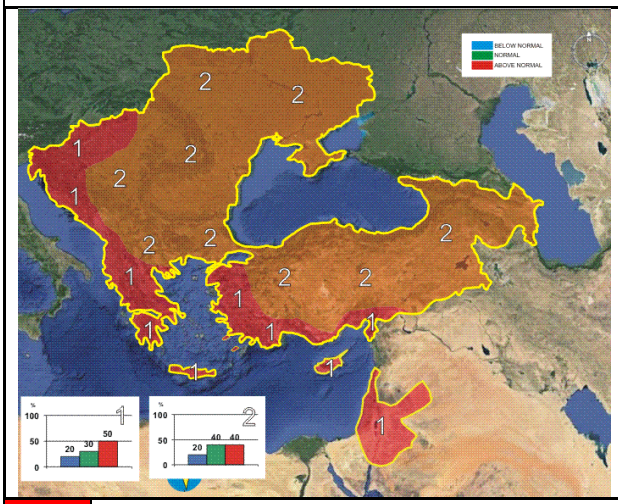
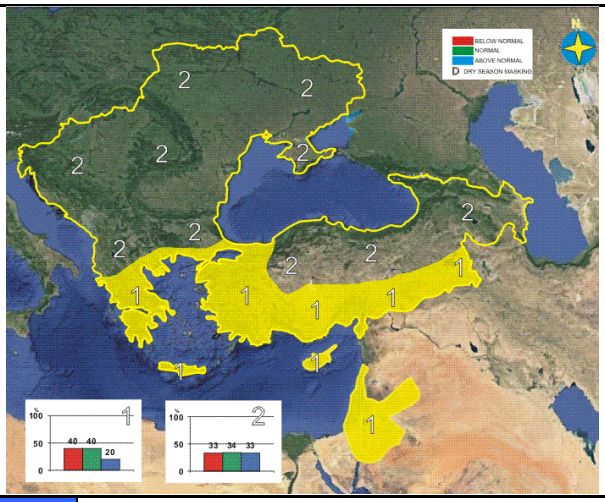
2021/22 Winter Temperature Outlook		2021/22 Winter Precipitation Outlook	
			
	Above Normal		Above Normal
	Normal		Normal
	Below Normal		Below Normal

Figure 1. Graphical presentation of the Climate Outlook for the 2021/22 Winter Season for the SEE Region

ANALYSIS OF THE WINTER 2021/22 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
- El Nino/Southern Oscillation (ENSO) Diagnostic Discussion (CPC/NCEP/NWS/IRI), http://www.seevccc.rs/SEECOF/SEECOF-27/STEP-2/CPC-NCEP-ENSO-diagnostic-discussion-14-April-2022.pdf
- Seasonal bulletin on climate in the WMO Region VI for the wintmer of 2021/22 (WMO RA VI RCC Node-CM, DWD), http://www.seevccc.rs/SEECOF/SEECOF-27/STEP-1/Verification-WINTE-SEASON-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/202202/
- National climate monitoring reports of the following SEECOF-27 participating countries: Bulgaria, Federation of Bosnia and Herzegovina / 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-27/STEP-1/

Winter 2021/22 seasonal mean temperature was in a range from –10 ºC in the mountainous areas of the SEECOF region, to more than 15 ºC in the Middle East. In most of the low-lying regions it was between 0 ºC and 10 ºC, except in northern half of Ukraine where it was lower and eastern Mediterranean coasts where it was higher (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 Romania and south-eastern Ukraine.

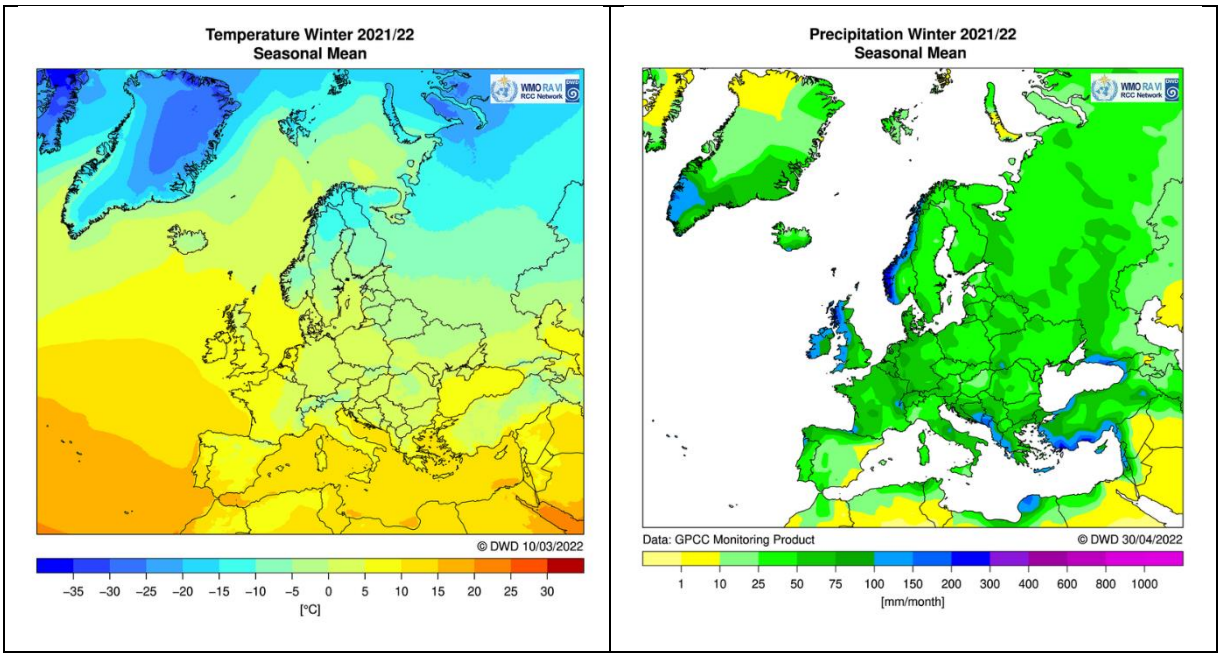


Figure 2. Winter season 2021/22, Europe – observed temperatures (left panel) and observed precipitation in mm per month (right panel). Source:
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

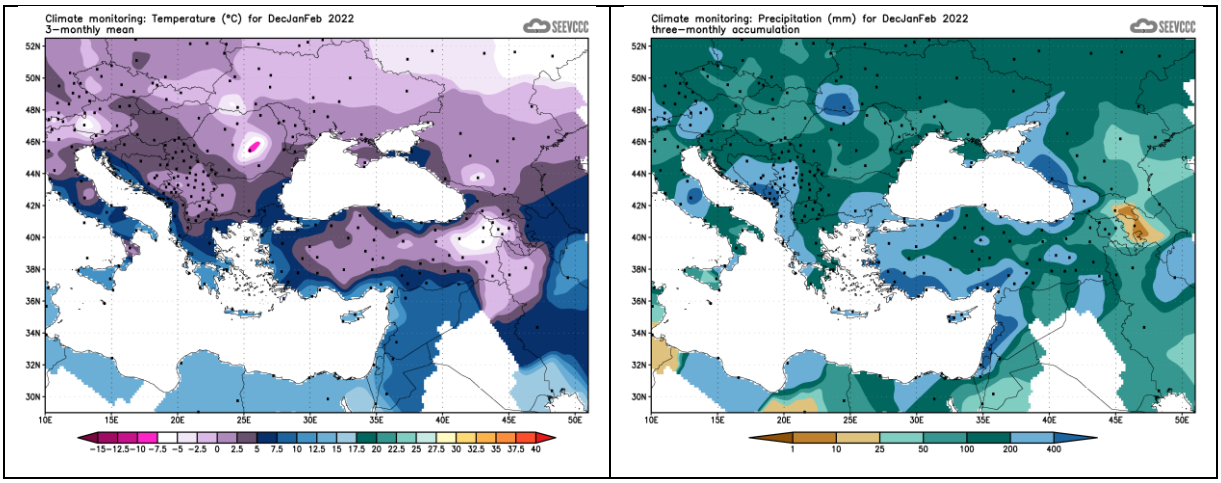


Figure 3. Winter season 2021/22, SEECOF region – observed temperature (left panel) and observed precipitation (right panel). Source:
http://www.seevccc.rs/imgsrc/clim_mon/202202/temp_av1m.gif (left panel)
http://www.seevccc.rs/imgsrc/clim_mon/202202/prec_tot1m.gif (right panel)

Seasonal precipitation totals were in a range from less than 10 mm in some parts of South Caucasus, up to 750 mm in the Carpathian Mountains and southern Turkey (Figures 2 and 3, right panel). They were characterized by positive anomalies (more than 250% of the long-term average) in the Carpathian Mountains, southern Turkey, northwestern Ukraine, central and southeastern Balkans, Israel and southern Jordan. It was drier than normal (less than 25% of the long-term average) in the South Caucasus and southeastern Turkey (Figures 4 and 5, right panel).

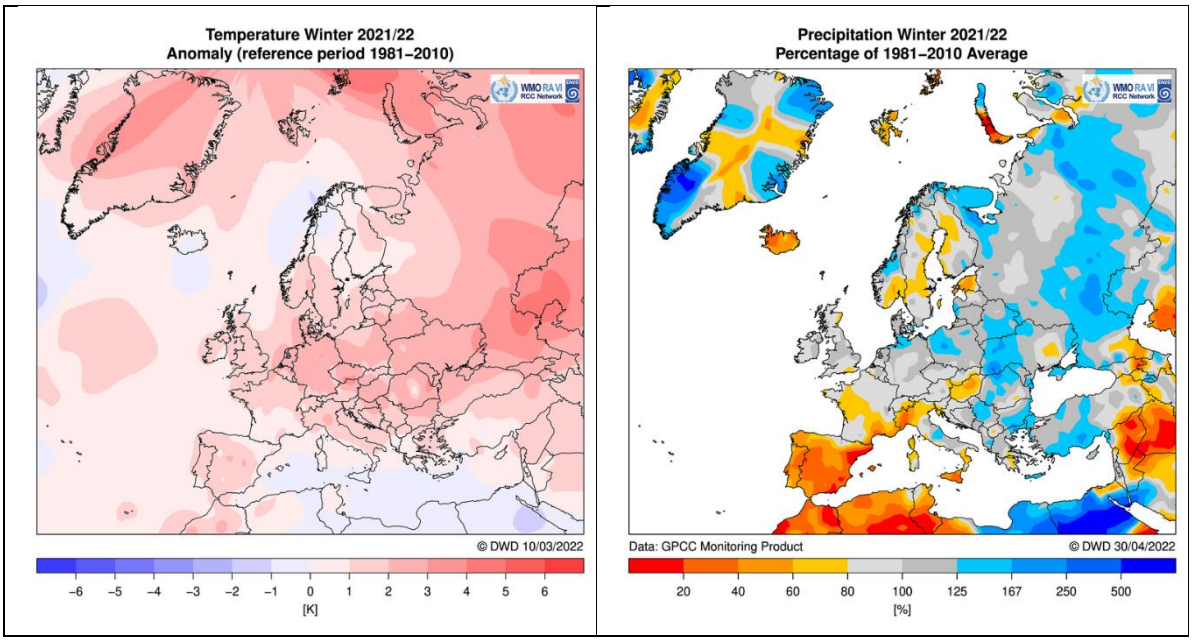


Figure 4. Winter season 2021/22, Europe – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1981-2010 normal (right panel). Source: https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

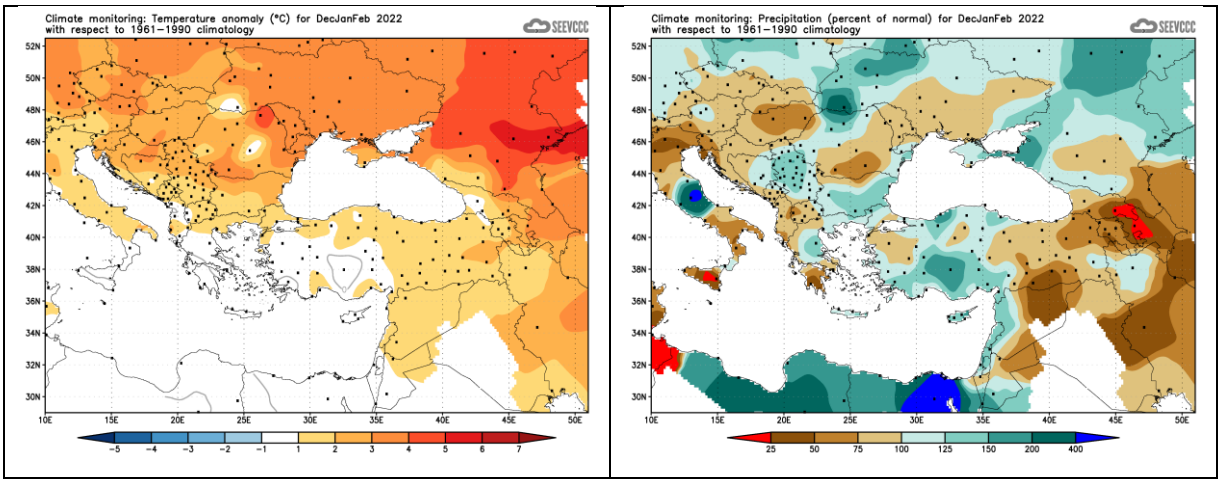


Figure 5. Winter season 2021/22, SEECOF region – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1961-1990 normal (right panel). Source:
http://www.seevccc.rs/imgsrc/clim_mon/202202/temp_an3m.gif (left panel)
http://www.seevccc.rs/imgsrc/clim_mon/202202/prec_pn3m.gif (right panel)

VERIFICATION OF CLIMATE OUTLOOK FOR THE 2021/22 WINTER

Winter 2021/22 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 correct for most of the SEECOF region, beside Ukraine where it was warmer than expected, as well as southern Balkans, Cyprus, western Turkey and parts of Middle East where it was colder than expected.

In most of the SEECOF region, SEECOF-26 Climate outlook for winter precipitation was relatively correct, forecasting below-normal precipitation sums for parts of Greece, southeastern Turkey and most of Middle East. On the other hand, the outlook did not anticipate above-normal winter precipitation totals in the Carpathian Mountains, southern Turkey and Israel.

APPENDIX A: **Analysis and verification of the SEECOF-26 climate outlook for the 2021/22 winter season:**
Verification summary based on the national reports and contributions of the participants of Pre-COF of the SEECOF-27 meeting

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	SEECOF-26 climate outlook for temperature	Observed	SEECOF-26 climate outlook for precipitation	
Federation of Bosnia and Herzegovina, Bosnia and Herzegovina (1)	**Above normal** in almost entire Bosnia and Herzegovina	**Above normal** Above normal (20, 40, 40) in entire Bosnia and Herzegovina)	**Normal** Normal in almost entire Bosnia and Herzegovina; **Above normal** only in Gradacac region	**No predictive signal** (33,34,33)	• New absolute maximum temperature at 4 weather stations in January (Mostar, Zenica, Stolac and Livno). • 27th warmest winter for Sarajevo since 1888, • 14th warmest winter for Mostar. • 43rd wettest winter for Sarajevo since 1888. • The highest height of snow cover in the cities was 20 cm
Bulgaria (1)	**Above normal**	**Above normal**	**Near or above normal**	**No signal or below normal**	• The winter of 2022 was very warm – similarly to the last two winters of 2020 and 2021. There was a very wet event in December 2021. • During the night from 11 to 12 December significant rainfall in the Rhodopes – the south of the country – caused sudden flooding which destroyed roads, bridges, caused damage on houses near rivers. • Fallen trees caused cuts of electricity supply, etc. It was followed by significant snowfall which caused additional stress in the mountainous region. • The biggest snow event though was in the very last days of February but it was not exceptional.

Croatia (1, 5)	**Above normal**	**Above normal** along the Adriatic coast and their hinterland (20,30,50) in the rest of Croatia (20,40,40)	**Below normal** in most of Croatia **Normal** part of Eastern Croatia	**No predictive signal** (33,34,33)	• Wind – a few episodes (mostly in January and February) with gale and hurricane force gusts of bora wind (NE wind) was recorded along the Adriatic coast. In January (on 10th and 11th), sea and road traffic between continental part and Adriatic coast were completely interrupted. There was damages on houses, fields and roads. There were casualties - one man died. On 11th January at Krk bridge (the north Adriatic), wind gusts of 180 km/h was measured. Similar situation was on 26th and 27th February when gusts of bora wind at Krk bridge was 195 km/h. • Precipitation: On 5th and 26 th December, around Split (Dalmatia and its hinterland), after heavy rain (50 to 60 mm of rain), flash floods were observed. Many houses, fields and roads were flooded. In February, on 7th and 15th heavy thunderstorms hit north Dalmatia and its hinterland with heavy precipitation and hail. There was damages on houses, cars, olive groves and roads. At north Adriatic waterspout was observed.
Cyprus (5)	**DEC** **Normal to Above Normal** **JAN** **Around Normal** **FEB** **Above Normal**	**DEC** **Above Normal** mainly over coastal areas **JAN** **Above Normal** mainly over coastal areas **FEB** Above Normal mainly over coastal areas	**DEC** **Well Below Normal** **JAN** **Well Below Normal** **FEB** **Not Available**	**DEC** Below Normal **JAN** Below Normal **FEB** Not available	• **DEC:** Extremes (deviating by 4°C or more from normal) were also recorded at most of the selected meteorological stations. As an example, note the recorded maximum of Prodromos that was 17.2°C (with a normal of 8.3°C) and the maximum of Polis Chrysochous that was 25°C (with a normal of 18°C). Concerning the mean daily minimum temperatures note the recorded minimum of Pafos that was 17.2°C (with a normal of 10°C) and the minimum of Larnaka that was 17.9°C (with a normal of 9.2°C). From the distribution (provisional accumulated precipitation chart) of the accumulated precipitation of December is evident that the surface distribution was well above normal reaching 162.4mm. During the periods 1-2, 5-8,

					13-23 and 26-31 of December local showers and thunderstorms were recorded**.** For the dates 5th, 7th and 8th of December, yellow EMMA warnings were issued, whereas for the periods 18-20 and 30-31 of December orange warnings were issued. The warnings were about showers and thunderstorms. Based on the provisional data, hail recorded on the 5th, 13th, 14th and on the 30 of the month. Snow was recorded on the 8th, 15th, 17-21 and 29 the month at Troodos. • **JAN:** Extreme high temperatures were recorded, as an example note the station of Athalassa that recorded a highest daily maximum of 21.4°C (with the normal being 15.5°C) and Polis Chrysochous that recorded a highest daily maximum of 23.2°C (with the normal being 16.3°C). Extreme low temperatures were also recorded, as an example note the lowest daily minimum temperature of Achna that was -0.4°C (with a normal of 6.6°C) and the lowest daily minimum temperature of Prodromos that was - 8.6°C (with a normal of 0.7°C). From the provisional data recorded by the Department of Meteorology the model did not perform well over the amount of the accumulated precipitation, as the actual accumulated precipitation was more than the expected. January is generally considered to be a rainy month, as the cumulative precipitation reached 143.4mm or 173% of normal. During the periods 1-2, 4-6, 9-15, 17-19 and 21-31 of January local showers and thunderstorms resulted in accumulated precipitation of 99.3mm or 120% of normal. It is worth mentioning that on the 9th, 10th, 12th and 22nd of January hail was reported. Also, for the 9-10, 12-13, 18-20, 22-23, 25 and 27-28 of January, EMMA yellow level warnings for rainfall, wind,

					thunderstorms and low temperatures were issued. For 10-11 of January, EMMA orange level warning was issued concerning rain and thunderstorms. It is worth mentioning that based on the provisional data there was snowfall during 9-11, 17-19, 21-26 and 28-31 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 14.1°C (with the normal being 6.7°C) and Polis Chrysochous that recorded a highest daily maximum of 22.7°C (with the normal being 16.3°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 Pafos that was 16.8°C (with a normal of 7.1°C) and 15.4°C (with a normal of 8.1°C) respectively. From the distribution (provisional accumulated precipitation chart) of the accumulated precipitation of the month is evident that mainly the mountains received high accumulation score. As regarded from the same chart the mean surface distribution was below normal (reaching only 39.2mm or 57% of normal). During the periods 1-10, 13-15, 18-20, 22-26 and on the 28th of February local showers and thunderstorms were recorded. Based on the provisional data, hail recorded on the 3rd and on the 24th of the month while snow was recorded during the periods 1st, 3-4, 6, 8, 18-19 and 24-25 of the month. For the dates 3-4 and 8-9 of February, yellow EMMA warning was issued concerning showers and thunderstorms.

Greece (2)	**Near or slightly below normal values;** **Above normal** only in central and east Macedonia and Thrace	**Above-normal** in most of Greece **Near normal** in central and northeast Macedonia and Thrace	**Above or near normal** conditions dominated in most of Greece and **Below normal** only few regions, mainly Peloponnese	**Below - or near normal (40,40,20)**	From 22 to 25 February 2022 a severe weather system named ELPIS hit eastern parts of Greece and brought heavy snowfall and snowfalls across Aegean islands, Evia and Attiki. Heavy snowfall disrupted most transportation in Attiki, schools were closed, public services were suspended and thousands of households were left without electricity due to downed trees.
Israel (5)	**Above normal** (50, 30, 20**)**	**Above normal** (10, 30, 60)	**Above normal** (20,30,50)	20% above normal 40% around normal 40% below normal	No high impact events
Republic of North Macedonia (5)	**Normal -** most of the territory **Above Normal** In southeast part	**Above normal** (20, 30, 50)	**Below normal**	**No signal (33, 34, 33)**	• Exceeded absolute maximum temperature 20.7°C on 1st of January in Gevgelija

Republic of Moldova (5)	**Above normal**	**Above normal**	**Mostly close to normal**	**Below, near or above normal** (33, 34, 33)	• During the winter season there were fogs, rime ice and glazed ice, blizzards, wind gusts up to 24 m/s (January), on roads black ice.
Serbia (1)	**Above Normal** in the lowlands, **Near-normal** In the highlands	**Normal – to above normal (**20, 40, 40) in entire Serbia	**Above Normal** in most of Serbia	**No predictive signal** (33, 34, 33) in entire Serbia	• 12th warmest winter for Serbia since 1951, • 13th warmest for Belgrade since 1888, • 3rd warmest for Negotin since 1928, • 5th warmest for Zajecar since 1930 • 17th wettest winter for Serbia since 1951, wettest on record for Kopaonik since 1950 • Record-breaking daily precipitation sum measured at Crni Vrh • Record-breaking winter insolation for Palic
Slovenia (5)	**Above normal**	**Above normal**	**Mostly below normal**	**No signal**	No high impact events
Turkey (2)	**Near or Above normal**	**Near or Above normal**	**Above and near normal** for southern and western parts **Below or near normal** for the inner parts	**Below or near normal** for southern and western parts **No clear signal** for the inner parts	No high impact events

Ukraine (5)	**Above normal** In 97% of country **Near normal** In 3% of country	**Near or Above normal**	**Above normal** in 77% of country **Near-normal** in 30% of country **below normal** in 3% of country	**No predictive signal (33, 34, 33)**	• Meteorological extraordinary phenomena were observed: • In December 02-03 th - heavy rain and snowfall (20-38 mm precipitation per 12 hours) in Zakarpattia and IvanoFrankivsk regions and 28 th in Kharkiv region, 28-30th - heavy ice (diameter 26-35 mm) in Donetsk, Mykolaiv, Kherson regions. • In January were recorded 04-05th heavy snowfalls (20-33 mm/12 hours) in IvanoFrankivsk region and in Zakarpattia region were fixed 102 mm/43 hours • In February were recorded 17, 19 th - strong wind 25-27 m/s in Ivano-Frankivsk and Lviv regions. • Unfavorable weather conditions caused loss power, telecommunications, utilities and transport) were recorded maximum precipitation from 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 – No information about the basic climatological period