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

SEECOF-25 ONLINE MEETING

ANALYSIS AND VERIFICATION OF THE SEECOF-24 CLIMATE OUTLOOK FOR THE WINTER OF 2020/2021 FOR SOUTH-EAST EUROPE (SEE)

CLIMATE OUTLOOK FOR 2020/2021 WINTER SEASON FOR THE SEE REGION

As stated in the SEECOF-24 Consensus Statement on the Seasonal Climate Outlook for the 2020/2021 Winter Season over South-East Europe (document: http://www.seevccc.rs/SEECOF/SEECOF-24/STEP-3/Consensus_Statement-SEECOF-24.pdf Development of a moderate La Nina event with peak toward the end of year started to decrease as of February. The polar vortex showed some slight reinforcement. Models showed the typical atmospheric response to La Nina event over tropics and also over North America, with less agreement in response over North Atlantic. Many models showed strong negative PNA, and positive phase of NAO, EA and SCAN modes of variabilities. A higher probability of blocking events was expected over Europe with some differences among models in their location.

Winter temperature was expected to be above normal in the whole SEECOF region with probabilities decreasing from western toward eastern parts of the SEECOF region. Hence, winter temperature was expected to be above-normal in most of the SEECOF region (zone 1 and 2 in Figure 1), while it will be near- or above-normal in Caucasian region, Jordan, inlands of the Turkey, Israel and Lebanon, as well as along the eastern and southeastern coasts of the Black Sea (zone 3 in Figure 1).

In Greece, along the coasts of Ionian, Aegean Sea and Eastern Mediterranean with hinterland, Israel, Jordan and Lebanon, as well as in most of the Turkey (zone 1 in Figure 2), winter precipitation totals were expected to be below-normal. In rest of the SEECOF region (zone 2 in Figure 2) the uncertainty is high: with equal probabilities for below, near- or above-average conditions of winter precipitations.

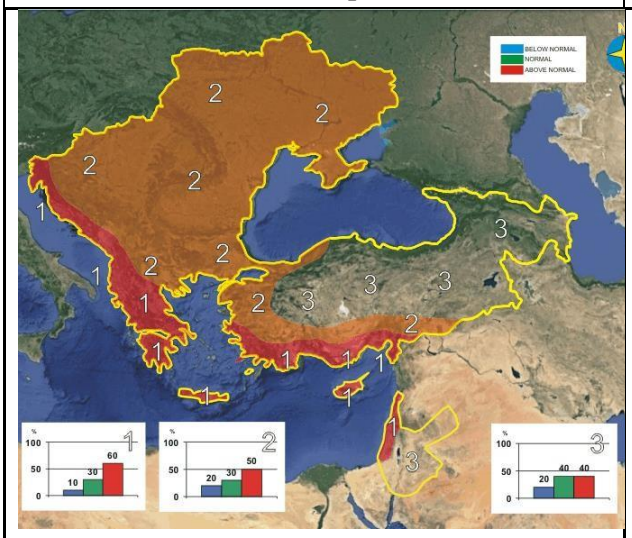
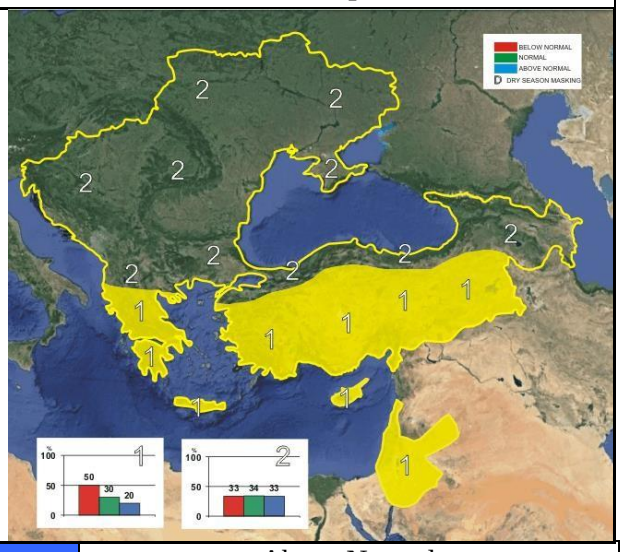
2020/2021 Winter Temperature Outlook		2019/2021 Winter Precipitation Outlook	
			
	Above Normal		Above Normal
	Normal		Normal
	Below Normal		Below Normal

Figure 1. Graphical presentation of the Climate Outlook for the 2020/2021 Winter Season for the SEE Region

ANALYSIS OF THE WINTER 2020/2021 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 2020/2021 (WMO RA VI RCC Node-CM, DWD), http://www.seevccc.rs/SEECOF/SEECOF-23/STEP-1/Analyses-Verification-of-the-SEECOF-22-Climate-outlook-for-winter-season-2019-20-RA%20VI_RCC-on-CM.pdf.pdf
- Global Climate Bulletin (Meteo France), http://www.seevccc.rs/SEECOF/SEECOF-25/Step-2/RCC-Bulletin-Meteo-France-26-04-2021.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/202102/
- National climate monitoring reports of the following SEECOF-25 participating countries: Armenia, Bulgaria, Federation of Bosnia and Herzegovina / Bosnia and Herzegovina, Republic of Srpska / Bosnia and Herzegovina, Croatia, Cyprus, Georgia, Greece, Israel, Republic of North Macedonia, Republic of Moldova, Montenegro, Serbia, Slovenia, Turkey and Ukraine are available on:
- http://www.seevccc.rs/SEECOF/SEECOF-25/Step-1/

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

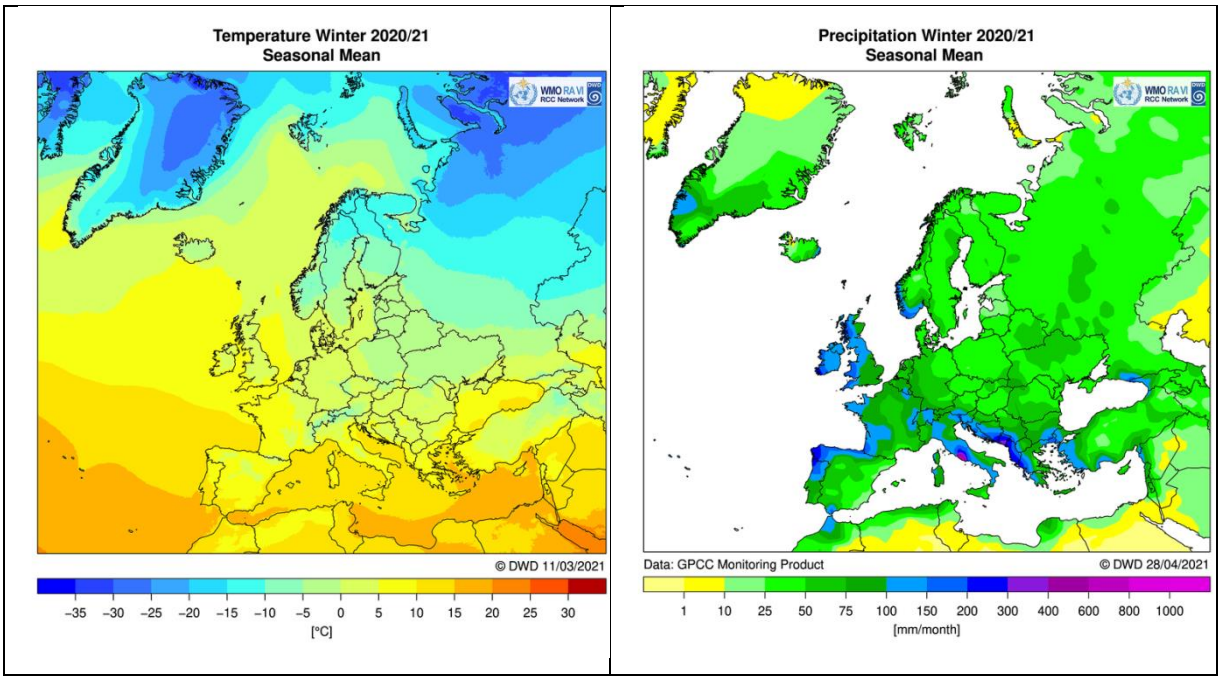


Figure 2. Winter season 2020/2021, Europe – observed temperatures (left panel) and observed precipitation in mm per month (right panel). Source:
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

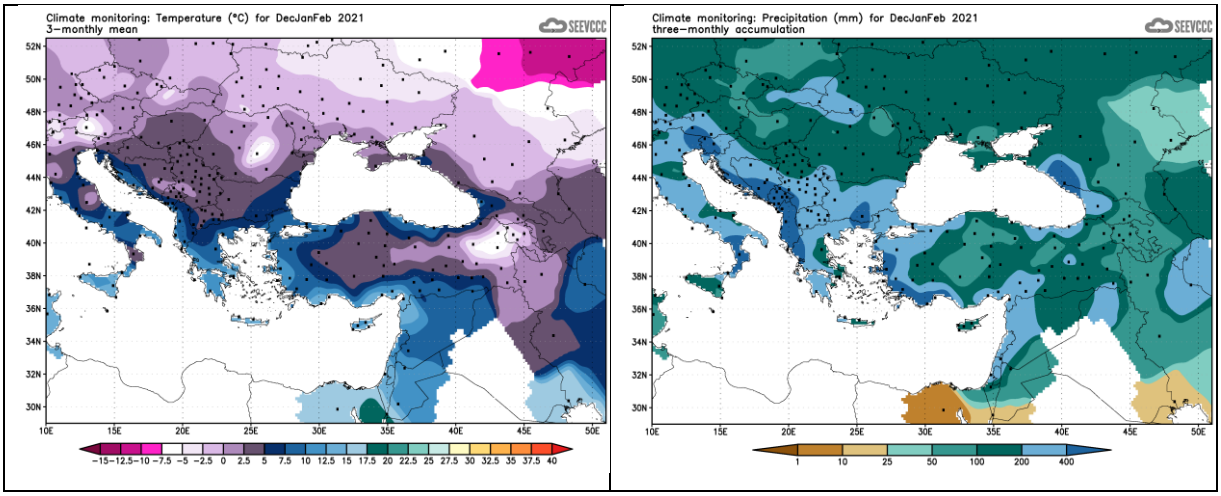


Figure 3. Winter season 2020/2021, SEECOF region – observed temperature (left panel) and observed precipitation (right panel). Source: http://www.seevccc.rs/?p=6

Seasonal precipitation was characterized by positive anomalies (more than 125% of the long-term average) in most of the Balkans, Ukraine and most of Georgia and Azerbaijan. It was drier than normal (less than 75% of the long-term average) in the central and northeastern Turkey, Cyprus, Israel, Lebanon and most of Jordan. The winter precipitation anomalies are presented in Figures 4 and 5 (right panel).

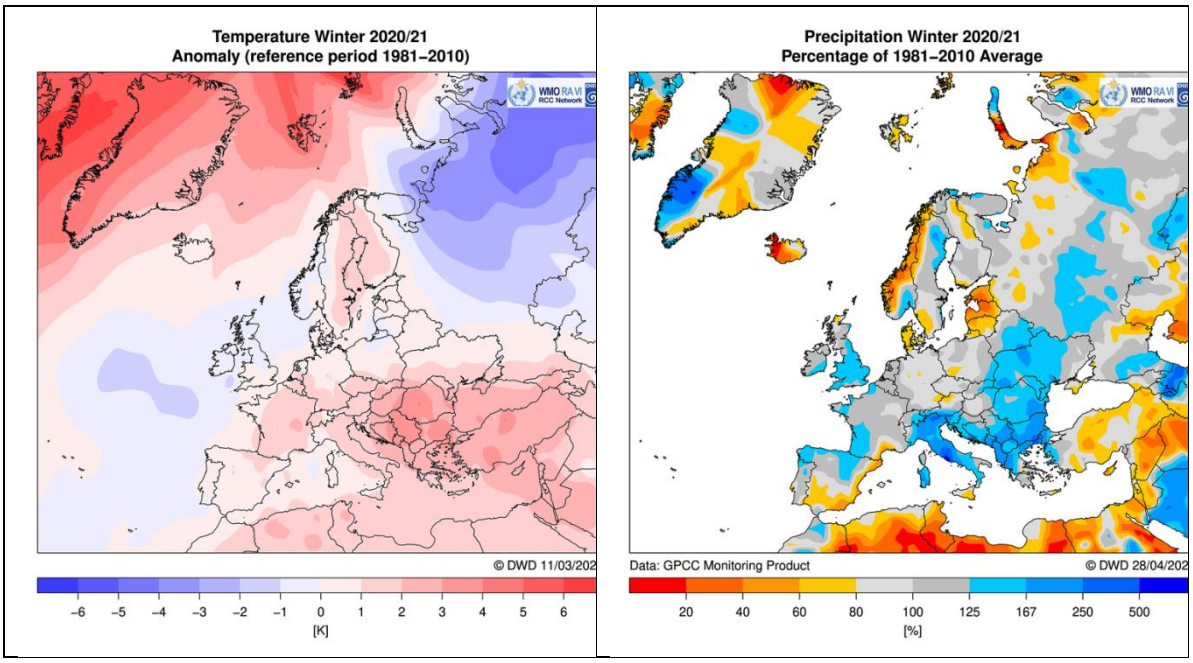


Figure 4. Winter season 2019/2020, Europe – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1981-2010 normal (right panel). Source: https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html (left panel)
https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html (right panel)

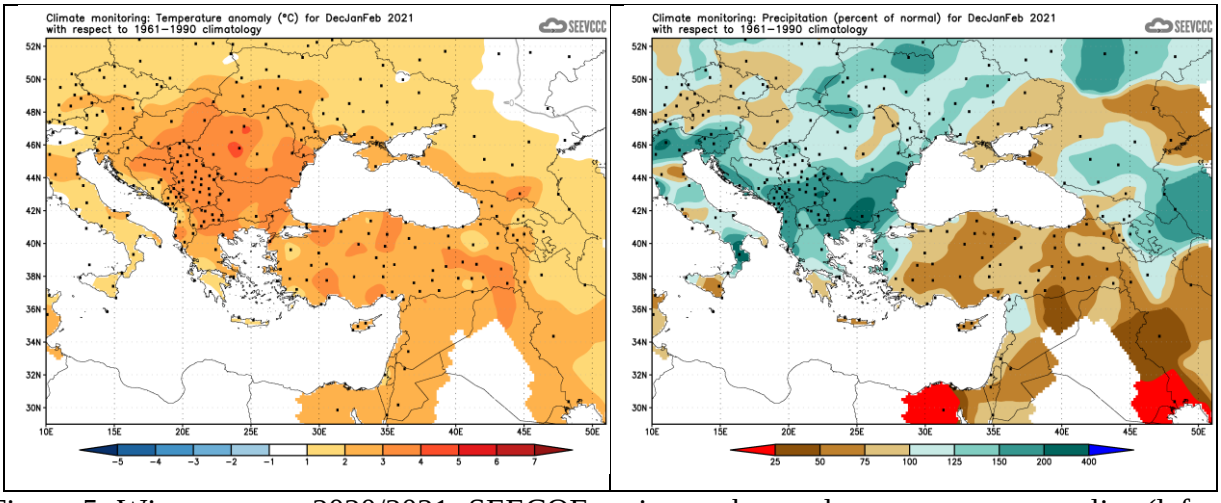


Figure 5. Winter season 2020/2021, SEECOF region – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1961-1990 normal (right panel). Source: http://www.seevccc.rs/?p=6

VERIFICATION OF CLIMATE OUTLOOK FOR THE 2020/2021 WINTER

As it was stated in SEECOF-24 Climate outlook for the winter 2020/2021, moderate La Nina event occurred with peak toward end of the 2020 and it decreased toward February 2021. In addition, during most of the winter season the negative phases of both NAO and EA were developed (Table 1) - resulting with cyclonic geopotential anomaly on the winter MSLP maps over the Balkan Peninsula.

Table 1: Circulation indices of NOAA CPC patterns for the winter months 2020/21. Source: ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/tele_index.nh

yyyy	mm	NAO	EA	WP	EP/NP	PNA	EA/WR	SCA	TNH	POL	AO
2020	12	-0.37	-0.80	0.99	-99.9	1.28	-1.11	2.33	0.17	0.09	-1.74
2021	1	-1.80	-0.04	2.45	-0.71	-0.41	-1.34	0.31	-0.07	-1.59	-2.48
2021	2	-0.29	1.22	0.76	-0.80	-0.71	0.83	0.31	1.27	-3.23	-1.19

Winter 2020/2021 temperature was in the above normal category in most of the SEECOF region, consequently, the outlook was correct for most of the region. The exception to that were northern parts of Ukraine with near-normal winter temperatures, which was not correct.

In most of the SEECOF region, SEECOF-24 Climate outlook for winter precipitation suggested no predictive signal – so we do not verify it. The outlook correctly indicated below normal seasonal precipitation sums for the Cyprus, Israel, Jordan and Lebanon, as well as in most of Turkey. On the other hand, in the southern parts of Balkan Peninsula, winter precipitations sums were near- or above-normal, which was incorrect given that Climate outlook predicted below-normal winter precipitation conditions.

APPENDIX A: **Analysis and verification of the SEECOF-24 climate outlook for the 2020/2021 winter season:**
Verification summary based on the national reports and contributions of the participants of Pre-COF of the SEECOF-25 meeting

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	SEECOF-24 climate outlook for temperature	Observed	SEECOF-24 climate outlook for precipitation	
Armenia (1)	**Above normal**	**Above or near normal** (40, 40,20)	**Near the normal**	**No predictive signal** (33, 34, 33)	2020/2021 winter ranks as the 12th warmest winter for Armenia. Heat waves were observed: during the period of January 9-17, February 1-17, Cold wave was observed in December 14-18, January 1-10, 14-19. -35°C was the absolute minimum air temperature, 23 °C max observed in Kapan city, exceeding the previous max for that time. Strong wind 35 m/sec was observed in Pushkin pass: Dense fog (visibility ≤50m) was observed in Ararat and Shirak regions.
Federation of Bosnia and Herzegovina, Bosnia and Herzegovina (1)	**Above normal** in almost entire Bosnia and Herzegovina	**Above normal (20, 30, 50) in entire Bosnia and Herzegovina)**	**Below normal** north east Bosnia; **Above normal** west, south, south east and central Bosnia and Herzegovina	**No predictive signal** (33,34,33)	4 th warmest winter in Sarajevo since 1888. New temperature max in February.

Republic of Srpska, Bosnia and Herzegovina	**Above normal**	**Above normal**	**Above normal**	**No signal**	No high impact events.
Bulgaria (1)	**Above normal**	**Above normal**	**Above normal**	**Below normal or No signal**	The winter of 2021 was extremely warm and extremely wet, ranking among the three warmest and the three wettest winter seasons in the last 70 years. January 2021 ranks among the three warmest and the three wettest months of January in the last 70 years. There were at least two wet events recorded in the month of January with abundant snow that caused disruption in electricity supply to regions and caused landslides on roads. Great monthly precipitation amounts and the winter warmth resulted with water-filled dams – some of the at low levels due to the previous drought. Some of the water dams overflowed and caused floods downstream. Heavy rains continued at the beginning of February and caused floods in the southeast of the country. There was a big snow event in Southwest Bulgaria in the middle February.
Croatia (1)	**Above normal**	**Above normal** along the Adriatic coast and their hinterland (10,30,60) in the rest of Croatia (20,30,50)	**Above normal** (in most of Croatia) **Normal** (part of Central Croatia)	**No predictive signal (33,34,33)**	**Winter 2020/2021** – a few episodes (mostly in December and February) with hurricane strong bora wind (NE wind) and jugo (SE wind) were recorded. Sea and road traffic between continental part and Adriatic coast were completely interrupted. On 3rd December, 149,6 mm of precipitation was measured in Split (Dalmatia) as a result of heavy rain. That amount of rain fell in a short time so there were flash floods as well.

					In February, absolute maximum temperature was measured on several station. In Knin (hinterland of Dalmatia), the highest temperatsince the measurements took place in Croatia in February was measured – 26,4 °C on 24th of February.
Cyprus (5)	**DEC** Above Normal **JAN** Above Normal **FEB** Above Normall	**DEC** Above Normal mainly over coastal areas **JAN** Above Normal **FEB** Above Normal	**DEC** Slightly Below Normal **JAN** Above Normal **FEB** Below Normal	**DEC** Below Normal **JAN** Below Normal **FEB** Below Normal	DEC: Extremes (deviating by 4°C or more from normal) were also recorded at the majority of the selected meteorological stations. As an example, recorded maximum of Prodromos that was 14.9°C (with a normal of 8.3°C) and the maximum of Athalassa that was 23.5°C (with a normal of 17.3°C). Concerning the mean daily minimum temperatures, note the recorded minimum of Pafos that was 16.4°C (with a normal of 10°C) and the minimum of Larnaka that was 14.8°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 slightly below normal reaching 75,9 mm or 71% of normal of the climatic period 1961-1990 or 81% of normal of the climatic period 1981-2010. During the periods 1-5, 7-11, 13-16 and on the 22nd of December local showers and thunderstorms were recorded. For the dates 1, 4, 5, 16 of December, yellow EMMA warnings were issued, whereas for the dates 14 and 15 of December orange warnings were issued. All of them were about showers, thunderstorms, and wind. Based on the provisional data, hail was recorded on the 13th and on the 14th of the month. Trace of snow was recorded on the 3rd of the month at Troodos. JAN: Extremely high temperatures were recorded, as an example, Prodromos recorded a highest daily maximum of 19.7°C (with the normal being 6.3°C) and Polis Chrysochous

					recorded a highest daily maximum of 23.7°C (with the normal being 16.3°C). Extremely low temperatures were also recorded, as an example note the lowest daily minimum temperature of Achna that was -0.7°C (with a normal of 6.6°C) and the lowest daily minimum temperature of Athalassa that was -0.7°C (with a normal of 5.4°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. During the periods 13-20, 25 and 27-30 of January local showers and thunderstorms resulted in accumulated precipitation of 99.3mm or 120% of normal. It is worth mentioning that on the 13th of January hail was reported. Also, for the 13, 16-19, 28-29 and 30-31 of January, EMMA yellow level warnings for rainfall, wind and thunderstorms were issued. It is worth mentioning that based on the provisional data there were 8 days with snow during January, 13-14, 17-19 and 27-29 of January. FEB: Extremely high temperatures were recorded at all the selected meteorological stations, like Prodromos that recorded a highest daily maximum of 17.5°C (with the normal being 6.7°C) and Polis Chrysochous that recorded a highest daily maximum of 25.6°C (with the normal being 16.3°C). Extremely 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 15.6°C (with a normal of 7.1°C) and -7.7°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 mainly the mountains received high accumulation score. As regarded from the same chart the mean surface distribution was well below normal (reaching only 18.9mm or 27% of normal). During the periods 2-3, 15-19 and on the 25th of February local showers and thunderstorms were recorded. Based on the provisional data, hail was recorded on the 15th of the month, while snow was recorded during the period 15-18 of the month. For the dates 15-16 of February, yellow EMMA warning was issued concerning showers and thunderstorms, whereas for the dates 17-18 of February, yellow EMMA warning was issued concerning low temperatures.
Georgia (1)	**In the most territory of the country, above- and near-normal**	**Near-normal or above for over all Georgia**	Precipitation was near the norm in the most territory of the country, on the several stations it was below and on the several stations above the norm	**No Signal**	No high impact events
Greece (2, **5**)	**Above normal**	**Above normal** 10% below normal, 30%	**Below normal** in the area of Greece (50%	**Below normal** in the area of Greece (50%	During 13 to 17 February 2021 heavy snowfall hit most parts of Greece. With the exception of the Ionian Islands and the

		around normal and 60% above normal in the southern, central and western parts of Greece and 20% below normal, 30% around normal and 50% above normal in the north, northeastern parts of Greece	below normal, 30% around normal and 20% above normal) (zone 1), except of the northern northeastern parts where the uncertainty is high, with equal probabilities for below, near- or above-average conditions of winter precipitation	**below normal**, 30% around normal and 20% above normal) (zone 1), except of the northern northeastern parts where the uncertainty is high, with equal probabilities for below, near- or above-average conditions of winter precipitation	west coast, it even snowed in coastal areas of mainland, the Aegean islands and Crete, where it rarely snows. The total duration of snowfall in Attica was 36 hours, with the strongest intensity in the center of Athens. The storm disrupted most public transportation in the country. Thousands of households were left without electricity due to downed trees, especially in Attica and the island of Evia. Three human lives were lost (2 in Evia and 1 in Crete). Based on the historical data of HNMS, the snowfall is classified as one of the most intensive in the last 40 years.
Israel (5)	**Above normal**	**Above normal** (60,30,10)	**Below normal** (50, 30, 20)	**Above normal**	No high impact events
Montenegro (1,5)	**Above normal**	**60% above normal 30% normal 10% below normal**	**Above normal** in most of the country **Normal** in Budva and narrow belt around it	**No predictive signal (33, 34, 33)**	December 2020: Strong storms along the coastal region especially in Ada Bojana and Budva where the impact was highest. Losses of properties near the seaside. February 2021: Strong north wind in Podgorica lasting for several days in February affected facades and roofs on buildings, houses,

					damaging trees in parks and boulevards in the center. Heavy precipitation in Podgorica and Bar. Extremely warm in whole country in December, warm in January in most regions, and very warm in whole country in February.
Republic of Moldova (5)	**Above normal**	**Above normal**	90% of the territory - near normal 10% of the territory - above normal	**Below, near or above normal (33%,33%,33 %)**	Complicated meteorological conditions were observed on February 8-9: precipitation in the form of sleet and snow, frost and icy deposits, icy roads resulting with damage in most of the territory causing disruption in power lines and traffic. On February 8, an extreme meteorological phenomenon was reported on MS Chisinau. There were ice deposits with a diameter of 23 mm. Also during the winter season, there were fogs, frost, and icy deposits, blizzard, wind gusts of up to 21 m/s (MS Cornești), and icy roads.
Serbia (1)	**Above normal** in entire Serbia	**Above-normal** (20, 30, 50) in entire Serbia	**Above normal** in most of Serbia	**No predictive signal** (33, 34, 33) in entire Serbia	• 3 rd warmest winter for Serbia since 1951, and 2nd warmest for Belgrade since 1888 • 2 nd or 3rd warmest winter for most places since recordkeeping began • Record-breaking minimum number of frost days in Kikinda, Novi Sad, Valjevo, Kragujevac, Kraljevo, Kursumlija and Dimitrovgrad • 4 th wettest winter for Serbia since 1951 ϖ Record-breaking wet winter for Nis, Leskovac, Sjenica and Kopaonik, 2 nd wettest for Dimitrovgrad and Vranje, and 3rd wettest for Kursumlija since the recordkeeping began • Record-breaking number of winter days with daily precipitation sum of 20 mm and more for Nis, Leskovac and Dimitrovgrad

Republic of North Macedonia (5)	**Above normal**	**Above normal (20, 30, 50)**	**Above normal**	**No signal (33, 34, 33)**	No high impact events.
Slovenia (5)	**Warmer than normal**	**Warmer than normal**	**Wetter than normal** in most of the country, **Normal** in parts of east and north-east Slovenia	**No clear signal**	• Temperature above average (among the seven warmest winter seasons since 1961), very warm February (among the seven warmest since 1961); • Precipitation above average (among the seven wettest winter seasons since 1961), wet December (among five wettest since 1961) and January (among 10 wettest since 1961); • Very warm period between 22 and 26 February with daily maximum temperature around 20 °C, unusually high value for the month of February. On 24 and 26 February, many record-breaking temperatures were measured and also the first exceeding 25 °C in February (Bilje near Nova Gorica and Dolenje near Ajdovščina, both in Vipava valley in south-west Slovenia, 25.1 °C on 24 February).
Turkey (2)	**Above normal** in most of Turkey **Near normal** in the eastern part	**Above normal** in most of Turkey **Near normal** in the eastern part	**Below normal** in most of Turkey **Above normal** in the western part of Turkey	**Below normal** in most of Turkey **No clear signal** for the northern part of Turkey	• December 2020 was the sixth warmest December in the long term period (1971- 2020). In Turkey, December mean air temperature was 4.6°C, in December 2019 mean temperature was 7.2°C. • January 2021 was the second warmest January in the long term period (1971-2020). In Turkey, January mean air temperature was 2.7°C, in January 2021 mean temperature was 5.4°C. •72 stations reached new monthly maximum temperature record in January 2021. • 6 stations reached new monthly maximum temperature record in February 2021.

Ukraine (5)	**normal** (53% stations) and **above normal** (47% stations)	**Above normal** (50%)	**Above norma**l (78% stations) **norma**l (20% stations) **below normal** (2% stations)	**Above** (33%) **normal** (34%) **below** (33%)	Meteorological extraordinary phenomena were observed on December 29th - strong wind 26-27m/c in Ivano-Frankivsk region. Heavy snowfalls and strong blizzard (for 12 hours with wind gust 15-25 m/c) were recorded on January 26-28th (20-36 mm precipitation per 12 hours) in Odesa and Mykolaiv regions. Heavy snowfall was recorded (20-22 mm precipitation per 10-12 hours) in Zakarpattia, Lviv and Ternopil regions on February 9-12th; on 12th of February strong wind 25 m/c was registered in southern part of Odesa region. Unfavorable weather conditions caused disruption in power, telecommunications, utilities and transport sector. Summer was arid in the former regions of Ukraine, with the exception of the western regions, areas in the central part recorded driest conditions 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 – No information about the basic climatological period