



**Twenty-first Session of
SOUTH EAST EUROPEAN CLIMATE OUTLOOK FORUM**

SEECOF-21 ONLINE MEETING

DRAFT VERSION

**ANALYSIS AND VERIFICATION OF THE SEECOF-20 CLIMATE
OUTLOOK
FOR THE WINTER OF 2018/2019 FOR SOUTH-EAST EUROPE (SEE)**

CLIMATE OUTLOOK FOR 2018/2019 WINTER SEASON FOR THE SEE REGION

As stated in the SEECOF-20 Consensus Statement on the Seasonal Climate Outlook for the 2018/2019 Winter Season over South-East Europe (document:

http://www.seevccc.rs/SEECOF/SEECOF-20/COF/Consensus_Statement-SEECOF-20.pdf)

Normal and above normal thermal anomalies were expected to dominate mainly the southern part of the SEECOF region in the previous winter (zone 2 in Figure 1, left). There were equal probabilities for below, near or above normal temperatures in rest of the SEECOF area (zone 1 in Figure 1, left). The main feature for precipitation was a North/South gradient favouring wetter-than-normal conditions over southernmost part of the SEECOF region (zone 2 in Figure 1, right). Wetter-than-normal conditions prevailed in southernmost part of the Balkan Peninsula, along the coasts of the Adriatic Sea, Ionian Sea and Eastern Mediterranean (zone 2 in Figure 1, right).

Regular updates of the forecast were strongly recommended due to sub-seasonal developments and local factors (for example SSTs in the smaller basins of the region) that could shape local variability at a regional level.

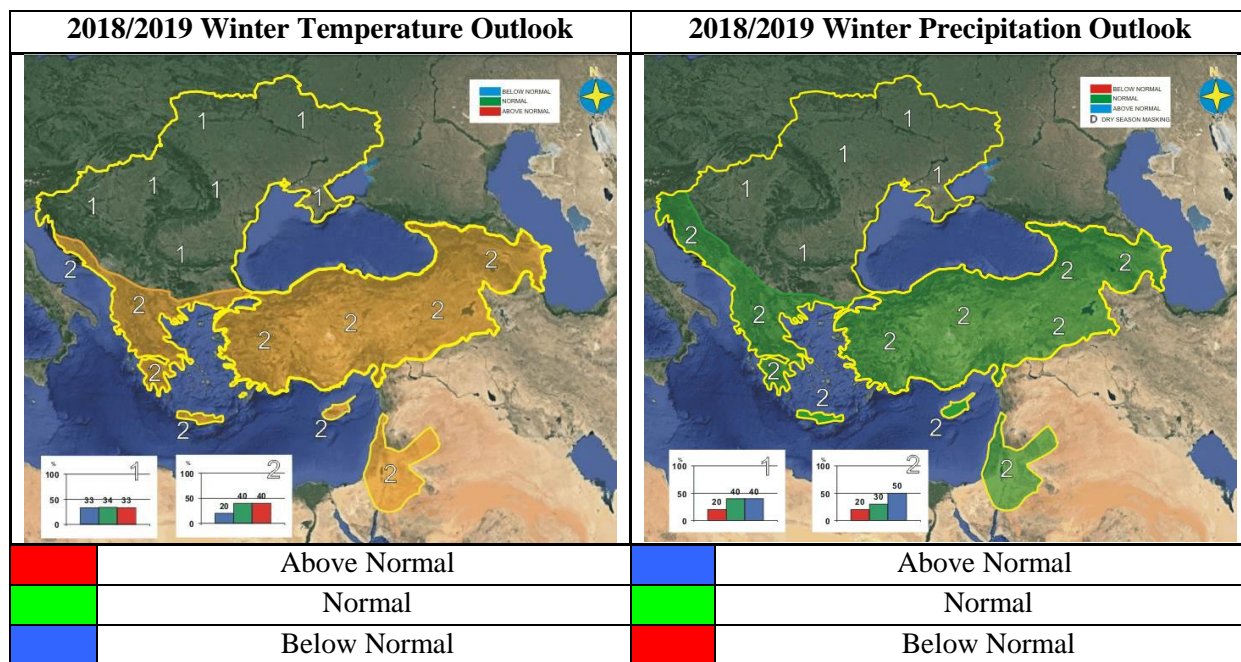


Figure 1. Graphical presentation of the Climate Outlook for the 2018/2019 Winter Season for the SEE Region

ANALYSIS OF THE WINTER 2018/2019 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 2018/2019 (WMO RA VI RCC Node-CM, DWD), http://www.seevccc.rs/SEECOF/SEECOF-21/STEP-1/MEDCOF-10-Verification-DJF-2018-19_RA%20I+VI_DRAFT1-RCC-CM-DWD.pdf
- Global Climate Bulletin (Meteo France), http://www.seevccc.rs/SEECOF/SEECOF-21/STEP-2/RCC_Bulletin-Meteo-France-04-2019.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/201902/
- National climate monitoring reports of the following SEECOF-21 participating countries: Armenia, Bulgaria, Bosnia and Herzegovina/Federation of Bosnia and Herzegovina, Bosnia and Herzegovina/Republic Srpska, Croatia, Cyprus, Georgia, Greece, Israel, the Former Yugoslav Republic of Macedonia, Republic of Moldova, Montenegro, Serbia, Slovenia, Turkey and Ukraine are available on: <http://www.seevccc.rs/SEECOF/SEECOF-21/STEP-1/>

Winter 2018/2019 in the SEECOF region was mainly characterised by very wet January and warm February in most of the SEECOF region. Teleconnection indices show NAO in a slightly positive phase during December and January and negative phase during February, which was suggested in climate outlook for 2018/2019 winter. Blocking area moved from the eastern Atlantic Ocean to central and western Europe, resulting in advection of warm air over most of the SEECOF region (Figure 2).

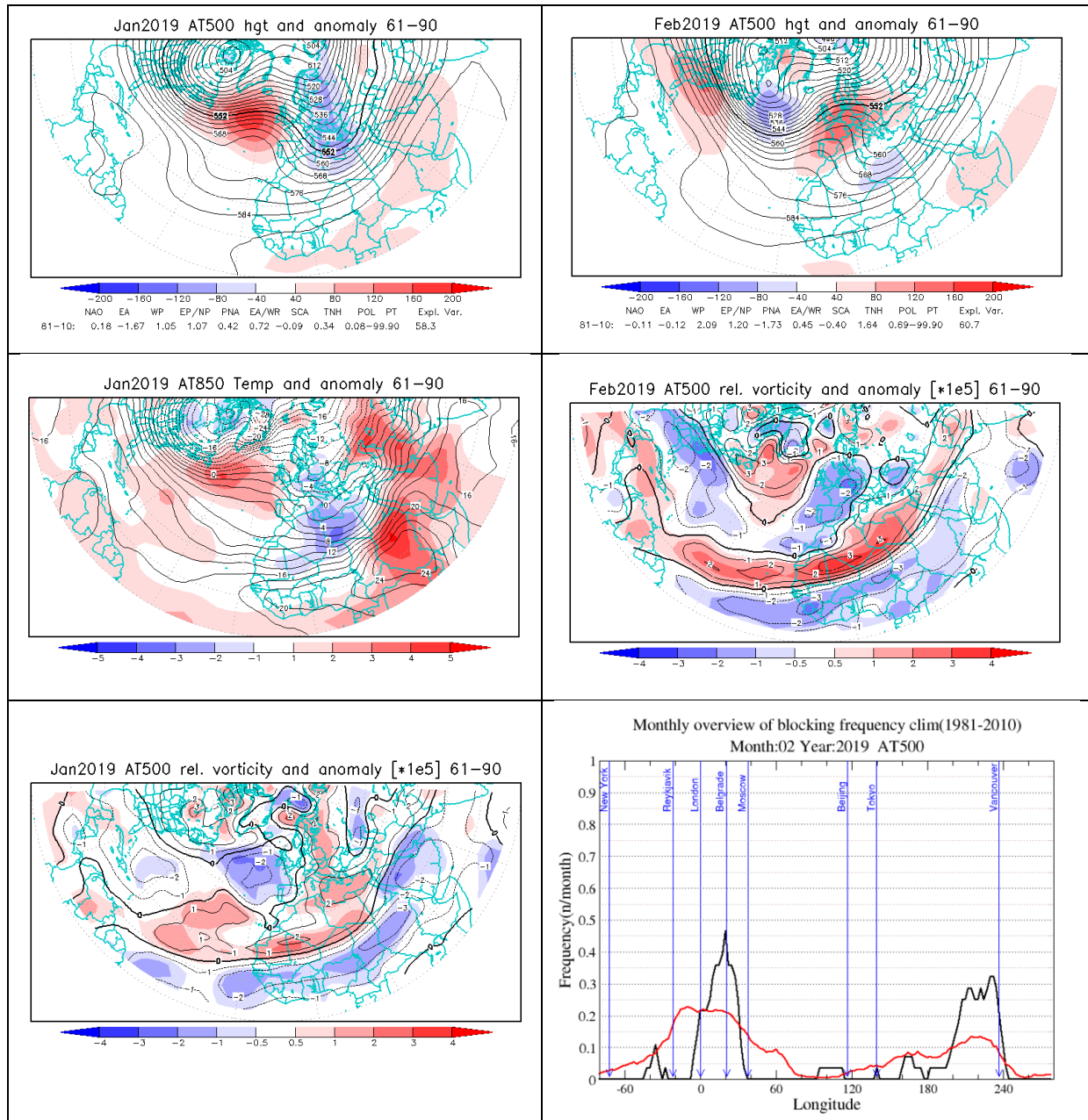


Figure 2. Geopotential height and its anomaly for 500 mb (upper left) in January, temperature and its anomaly at 850 mb pressure levels (centre left) in January, relative vorticity and its anomaly at 500 mb (lower left) in January, geopotential height and its anomaly for 500 mb (upper right) in February, temperature and its anomaly at 850 mb pressure levels (centre right) in February, Blocking persistence – duration of pressure difference between 40 N and 60 N (lower right) in February (Tibaldi-Monten)

Almost the entire SEECOF region observed above-normal winter temperatures. Only in the southern Balkans below-normal winter temperatures were registered.

Temperature anomalies reached up to +3°C above normal relative to the 1961-1990 base period in most of the SEECOF region. In eastern Turkey and south Caucasus, they were up to +4°C above normal. The winter temperature anomalies are shown in Figures 5 and 6 (left panel).

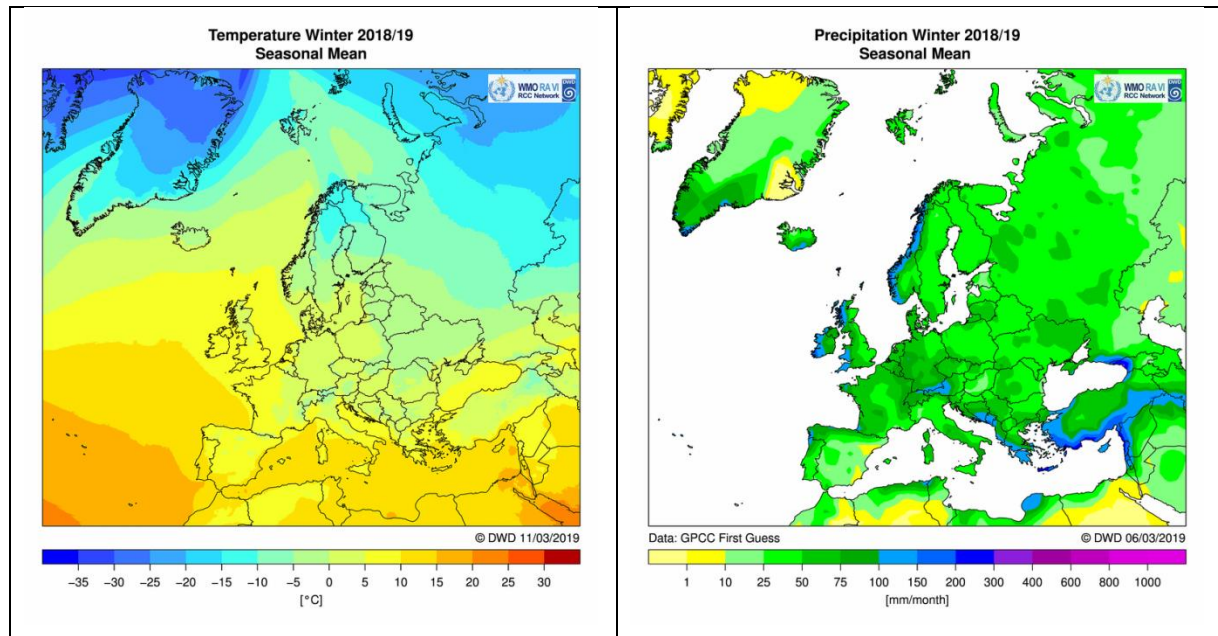


Figure 3. Winter season 2018/2019, Europe – observed temperatures (left panel) and observed precipitation in mm per month (right panel). Source: https://www.dwd.de/EN/ourservices/rccm/int/rccm_int_tt.html (left panel) https://www.dwd.de/EN/ourservices/rccm/int/rccm_int_rrr.html (right panel)

In most of the Balkans, Ukraine and some parts of central and northern Turkey, December conditions were average. Above normal monthly air temperature, reaching up to +3°C was observed in the north-western Balkans and south Caucasus, and even up to +6°C in eastern Turkey and Middle East. Below-normal monthly air temperature, reaching up to -2°C, was registered in the southern Balkans and western Turkey.

January was characterized by warmer than normal conditions in most of the SEECOF region with highest positive anomalies observed in south Caucasus and eastern Turkey reaching +5°C. Colder than normal conditions, with up to -2 °C anomaly, were registered in the southern and south-western Balkans.

During February warmer than normal conditions were observed in almost the entire SEECOF region. The highest positive anomalies above +6°C were recorded in northern Ukraine.

Seasonal precipitation sums were mostly in a range from 50 to 400 mm, while Cyprus, parts of the southern Balkans, northern Israel, western and southern Turkey, received more than 400 mm of precipitation, Figures 3 and 4 (right panel).

Precipitation was characterized by positive anomalies (>125% of the long-term average) in the central and southern Balkans, Carpathian Mountains, south-eastern Ukraine, Cyprus, most of Turkey, Armenia, Azerbaijan and parts of Middle East. It was drier than normal (<75% of the long-term average) in the western and eastern Balkans, Pannonia Plain and Georgia. The winter precipitation anomalies are presented in Figures 5 and 6 (right panel).

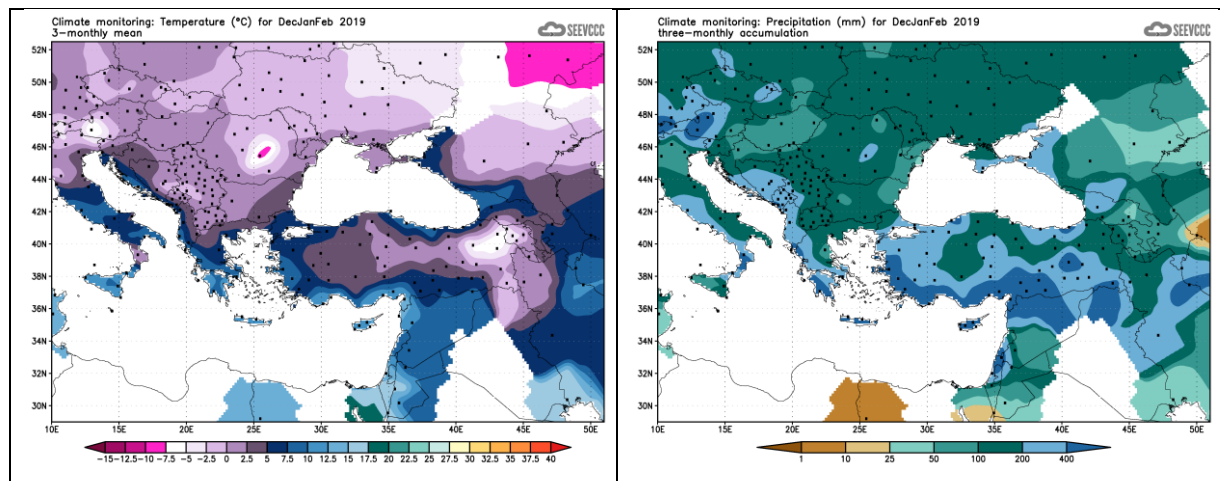


Figure 4. Winter season 2018/2019, SEECOF region – observed temperature (left panel) and observed precipitation (right panel). Source: <http://www.seevccc.rs/?p=6>

During December, wetter than normal conditions were registered in Romania, Ukraine, Cyprus, most of Turkey, central parts of south Caucasus and northern parts of Middle East. Considerably drier conditions compared to the normal were recorded in the north-western, southern and eastern Balkans, western Georgia, eastern Azerbaijan and southern parts of Middle East.

January was wetter than normal in the central and southern Balkans, Carpathian Mountains, Moldova, southern Ukraine, Cyprus, western and southern Turkey. January precipitation sums were below the average in the north-western Balkans, Pannonia Plain, South Caucasus and Middle East.

February was drier than normal in most of the SEECOF region, with relative anomaly reaching even below 25% in parts of the western, southern and eastern Balkans, south-eastern Ukraine and eastern Azerbaijan. Wetter than normal conditions were recorded in Crete, Cyprus, southern Turkey, central Azerbaijan and parts of Middle East, with a relative anomaly of more than 200%.

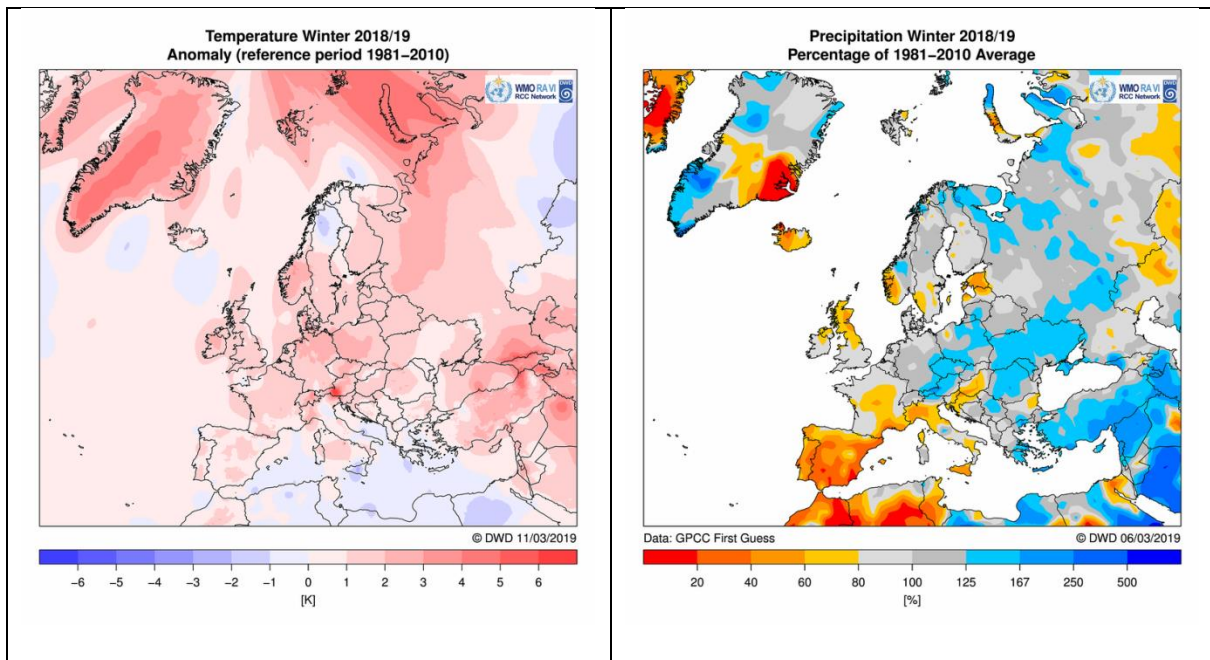


Figure 5. Winter season 2018/2019, Europe – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1981-2010 normal (right panel). Source: https://www.dwd.de/EN/ourservices/rccm/int/rccm_int_tt.html (left panel) https://www.dwd.de/EN/ourservices/rccm/int/rccm_int_rrr.html (right panel).

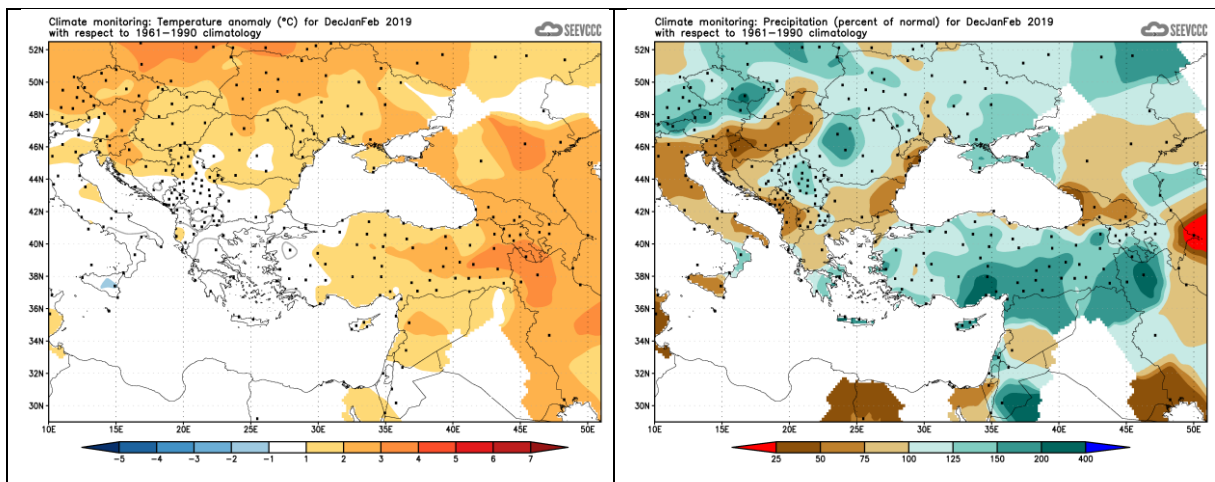


Figure 6. Winter season 2018/2019, SEECOF region – observed temperature anomalies (left panel) and observed precipitation anomalies in percent of 1961-1990 normal (right panel). Source: <http://www.seevccc.rs/?p=6>

VERIFICATION OF CLIMATE OUTLOOK FOR 2018/2019 WINTER

Winter 2018/2019 outlook for temperature was correct for central and eastern Turkey, south Caucasus, Cyprus and Middle East, where it was in the above normal category. The outlook was also correct for the central Balkans, Moldova and central Ukraine, where no privileged scenario was forecasted and climatology had to be assumed. The SEECOF-20 Climate Winter Outlook was not correct for the north-western and southern Balkans, Pannonian Plain, Carpathian Mountains, western Turkey, eastern and western Ukraine.

Based on the SEECOF-20, precipitation outlook was correct for parts of Greece, Turkey, most of south Caucasus and the Middle East, where precipitation totals were in the upper tercile range. In the central Balkans, Romania, Moldova and Ukraine where above normal precipitation was observed, the outlook was partly correct since equal probabilities for normal and above normal precipitation were suggested. Western and eastern Balkans observed below-normal precipitation which was not captured by the outlook.

APPENDIX B: Analysis and verification of the SEECOF-20 climate outlook for the winter season 2018/2019:

Verification summary based on the national reports and contributions of the participants of Pre-COF of the SEECOF-21 meeting

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	SEECOF-20 climate outlook for temperature	Observed	SEECOF-20 climate outlook for precipitation	
Armenia (1)	Above normal	Above normal (20,40,40)	Above normal	Above normal (20,30,50)	Foggy weather was observed in December and January in Shirak Region, in Ararat valley, very low visibility conditions, less than 50 m were recorded. Strong wind reaching 26m/s was observed on 12 December in Aragacotn, and in January in Gekgarquniq, reaching 28m/s.
Bulgaria (1)	Above normal	No signal	Below normal	Near or above normal (20,40,40)	In the period 23-27 January 2019, a Mediterranean cyclone led to stationary precipitation event in the mountainous region of southern Bulgaria. The 24-hour precipitation amounts in the Rhodope reached 70-80 mm on 26 January and the snow depth exceeded 150 cm.
Croatia (1)	Normal (Eastern Croatia, the greater part of Northern Adriatic, Dalmatia and its hinterland) Above normal (the rest of Croatia)	Normal or above normal (Dalmatia and its hinterland) (20,40,40) No predictive signal (in the rest of Croatia) (33,34,33)	Normal (Dalmatia and its hinterland and wider areas of towns Pazin, Senj, Slavonski Brod) Below normal (in the rest of Croatia)	Normal or above normal (in the north part of Croatia) (20,40,40) Above normal (along the Adriatic coast, in the hinterland and in the mountainous part of Croatia) (20,30,50)	Winter 2018/2019 – a few episodes with hurricane strong bora wind (NE wind along the Adriatic coast) were recorded. Marine and road traffic between continental part and Adriatic coast was completely interrupted. The measured wind gusts on the Pag bridge reached 220 km/h on January 6. In Dalmatia, on February 23 the wind gusts reached 176 km/h and 191 km/h, in Split nad Makarska respectively. February 2019 was warmer than normal in the entire country. The absolute maximum temperature was measured in north-west part of Croatia – in Sisak 23,5°C (record keeping from 1949) and in Varaždin 22,5°C (record keeping from 1949) on 28 February.
Cyprus (5)	DEC Above Normal	Normal or above normal (20,40,40)	DEC Well above normal	Above normal (20,30,50)	DEC: Extremes (departure of 4°C or more from the normal) were also recorded at nearly all selected meteorological stations. As an example, note the recorded maximum of Polis Chrysochou of 24°C (compared with a normal of 18°C) and the maximum of Paphos of 24.8°C (compared with a normal of 18.9°C). As for the mean daily minimum temperatures, note

	<p>JAN Above Normal</p> <p>FEB Above Normal</p>		<p>JAN Well above Normal</p> <p>FEB Well above Normal</p>	<p>the recorded minimum of Prodomos of -2.9°C (compared with a normal of 2.6°C) and the minimum of Athalassa of 2.2°C (compared with a normal of 7°C).</p> <p>The accumulated precipitation totals were very high as presented in the table above. Based on the distribution (provisional accumulated precipitation chart) of the accumulated precipitation for December, it is evident that the surface distribution was well above the expected, reaching 166,5mm (177% of normal). December 2018 ranks as the 2nd wettest December in terms of precipitation totals in the last 15 years. The problem with the significant deviation of the seasonal forecast of the accumulated precipitation from the actual was detected in time. That's why the forecast for December was issued with great caution. Most of December, apart from the 21 and the 22, local showers, accompanied with thunderstorms were recorded. Moreover, it is noteworthy that hail was reported on the 3rd, 4th, 17th, 19th and 31st of December. Based on the provisional data, snowfall was recorded on the 19th, 26th, 27th, 29th, 30th and 31st of the month. Also, for the following periods 5-7, 9-10, 17-18 and 31st of December EMMA yellow warnings were issued; except for the period 4-5 December when orange EMMA warning was issued. All the EMMA warnings concerned rain and thunderstorms.</p> <p>JAN: The accumulated precipitation sums were very high as presented in the table above. Based on the distribution (provisional accumulated precipitation chart) of the accumulated precipitation for January, it is evident that the surface distribution was well above the expected reaching 155,5mm (187% of normal). Most of January, apart from the 9th, 11th, 17th, 18th, 20th, 21st and the 25th, local showers, accompanied with thunderstorms were recorded. It is noteworthy that hail was reported on the 1st, 2nd, 5th, 7th, 8th, 13th, 16th, 22nd, 30th, and 31st of January. Based on the provisional data, snowfall was recorded during the periods 1-8, 13-16, on the 19th, 23rd, 27th, 30th and 31st of January. On the 2nd, 14th and 15th of January EMMA yellow warnings were issued for rain and thunderstorms; on the 15th of January EMMA yellow warning was issued for strong wind.</p> <p>FEB: The accumulated precipitation was very high as presented in the table above. Based on the distribution (provisional accumulated precipitation chart) of the accumulated precipitation for February, it is</p>
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					evident that the surface distribution was well above the expected reaching 144mm (208% of normal). For the following periods 5-10, 12-17 and 19-28 of February local showers, accompanied with thunderstorms were recorded. It is noteworthy that hail was reported on the 13th, 21st, 22nd, 23rd, 24th and the 28th of February . Based on the provisional data, snowfall was recorded during the period 7-9, 13-16, 21-24 and 26-28 of February . On the 6th and 14th of February EMMA yellow warnings were issued for rain and thunderstorms.
Federation of Bosnia and Herzegovina (1)	Above normal and normal in almost entire Bosnia and Herzegovina (except below normal mountainous areas)	No predictive signal (33,34,33) North and Central Above normal (20, 35, 45) South Bosnia and Herzegovina)	Below normal and normal in almost Bosnia and Herzegovina, (except above central Bosnia)	No predictive signal (33,34,33) North and Central Above normal (20, 35, 45) South Bosnia and Herzegovina)	- December >20 cold days central and northern Bosnia - January 1-15 day with snowfall and > 25 cold days Central B&H - February South B&H –wind > 100 km/h
Georgia (1)	Above normal	Near norm or above	Near and below the norm In the most territory of Georgia Above the norm on the several stations	Above the norm over all Georgia	No high impact events.
Greece (2)	Near normal in most of Greece	Near or above normal (20,40,40)	Above normal mainly in southern areas of Greece as well as in west Crete	Above normal (20,30,50)	On January 8, 2019 the minimum temperature at the meteorological station of Florina was -23°C, that is the second lowest recorded value. Also during 3-17/1/2019, the same station experienced fifteen consecutive days and nights with total frost (Tmax and Tmin ≤ 0). Moreover, during the period 6-18/1/2019, the minimum temperature recorded at the same station was below -15°C (that is the limit for red alert in the North Greece based on the meteo alarm system). On 9/1 the minimum temperature at the station of Tatoi, Attica was -8.9°C, that is the second lowest recorded value at the specific station. 23-27/1/2019: Heavy rainfalls caused flooding that affected the area of

					<p>Peloponnese (Ilia, Messinia, Lakonia) where rivers overflowed, crop areas were destroyed and people were trapped in buildings and cars.</p> <p>During 12-17/2 and 23-26/2, heavy rainfalls caused extensive flooding and landslides at the area of Crete island. Infrastructure was destroyed, roads were closed, crops were damaged and people were trapped in their cars. Also, severe flooding claimed 5 lives.</p>
Israel (5)	Above normal	Near or above normal (20,40,40)	Above normal	Above normal (20,30,50)	No high impact events.
Moldova (5)	Above normal	Below, near or above normal (33,34,33)	<p>Above normal 60% of the territory</p> <p>Near normal 30% of the territory</p> <p>Below normal 10% of the territory</p>	Normal or above normal (20,40,40)	<p>During the winter season, extreme meteorological phenomena were observed in a form of heavy snowfalls with precipitation of 20-35 mm in 12 hours (January 11, MS Codrii, Chisinau, HP Chisinau Bic River, Leuseni).</p> <p>In winter period, the following phenomena were also observed: fog, rime ice deposits, blizzard, wind speed reaching up to 24 m/s (December, MS Leova), black ice.</p>
Montenegro (1,5)	Normal to above normal	Above normal (20,40,40)	<p>Normal and dry for the most of the country</p> <p>Very dry in the central part of the coastal region</p>	Below normal (20,30,50)	<p>Strong bora had highest impact in the southern part of the central region and along the coastal region. The trees and facades were mostly affected. (stormy weather in Budva, https://youtu.be/3nkHZ2omdEs and in Podgorici https://youtu.be/U0ilykLFi7g, https://www.youtube.com/watch?v=ipCw6JxO38s& feature=youtu.be)</p>
The Republic of North Macedonia (5)	Normal	Above normal (20,40,40)	Normal	Above normal (20,30,50)	<p>January 2019 Prolonged period with cold weather and low temperatures (almost twenty days with minimum temperatures below 0°C). New record-breaking monthly sums for January were measured in Gevgelija-202 mm and Strumica-127 mm (south-eastern part of the country). Also new record-breaking daily precipitation sums were observed on Jan.26th for D.Kapija-89 mm and Strumica-54 mm (south-eastern part of the country).</p>

Serbia (1)	Normal in most part of Serbia	No predictive signal (33, 34, 33)	Above normal and normal in most of Serbia	Above normal (20, 40, 40)	- Winter of 2018/2019 was the 2 nd wettest for Mnt. Kopaonik - December: record-breaking snow depth in Zrenjanin (Dec 16) - January: record-breaking number of days with precipitation (Valjevo, Kragujevac and Pozega) and cloudy days (Cuprija and Dimitrovgrad) - February: record-breaking daily precipitation sum in Valjevo (Feb 12)
Slovenia (5)	Above normal in the most of the country Normal in the Alps	No predictive signal (33, 34, 33)	Below normal in the east, central Slovenia and parts of the west Normal in parts of the west Above normal on some stations only	Above normal in the west Normal or above normal in the east	- Temperature above average (among the 14 warmest since 1961) - Precipitation below average (among the 10 driest since 1961), snow cover below average - Very warm February (among 8 to 10 warmest since 1961), with record-breaking temperature in the northeast on the last day of the month - Very dry December (among 5 driest since 1961)
The Republika Srpska - Bosnia and Herzegovina (5)	Above normal over the northern area Below normal southern part of the country Normal over the rest of RS	Normal and above normal for the southern part of the country (20,40,40) No signal in the rest of the country	Below normal over the southern RS Normal to above normal over the rest of the country	Above normal in most parts (20, 40, 40) Above normal in the south (20,30,50)	According to 6 months SPI6-index, most of the RS experienced long-lasting drought, slight to moderate, lasting from sep 2018 – feb 2019
Turkey (5)	Normal to above normal	Normal to above normal	Normal to above normal	Normal to above normal	No high impact events.

<p>Ukraine (1,5)</p>	<p>Above normal (66% stations)</p> <p>Normal (34% stations)</p>	<p>No predictive signal</p>	<p>Above normal (81% stations)</p> <p>Normal (18% stations)</p> <p>Below normal (1%)</p>	<p>No predictive signal</p>	<p>Meteorological extraordinary phenomenas were observed on December 25th - very heavy snowfalls (20-32 mm of precipitation in 8-12 hours) and strong blizzard (for 12-15 hours with wind gust of 17-21 m/c) in Poltava, Kharkiv, Kropivnytsky, Dnipro regions, in Odessa strong wind was recorded (gusts reaching 26 m/c).</p> <p>In January among extraordinary phenomenas were heavy snowfalls (20-28 mm of precipitation in 12 hours and strong wind reaching 28 m/s) in Carpathian mountains, only locally.</p> <p>Severe weather conditions caused disruptions in power, telecommunications, utilities and transport.</p>
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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