South East European Climate Outlook Forum

SEECOF-22 ONLINE MEETING

ANALYSIS AND VERIFICATION OF THE SEECOF-21 CLIMATE OUTLOOK FOR THE 2019 SUMMER SEASON FOR SOUTHEAST EUROPE (SEE)

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Contribution by

WMO RA VI RCC Offenbach Node on Climate Monitoring

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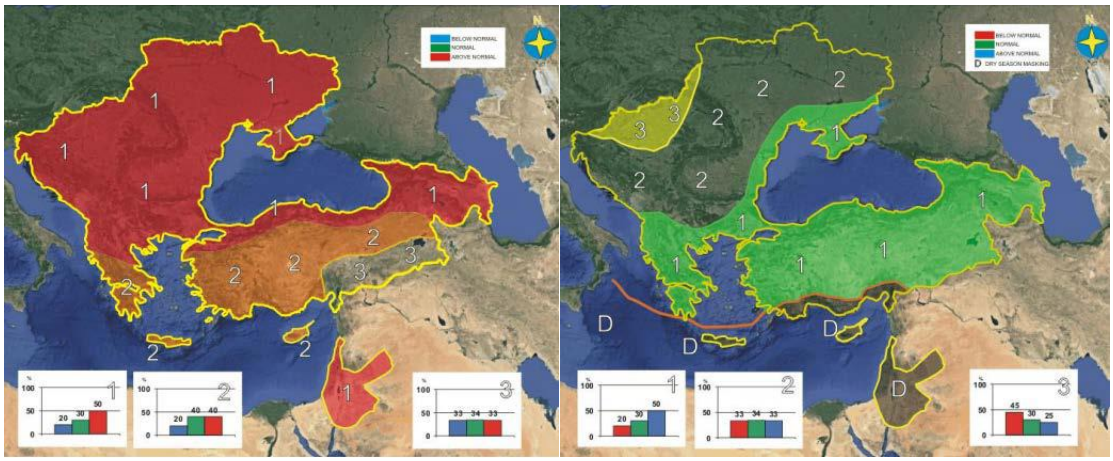
The following SEECOF verification report is based on

1. the outcome of the consensus forecast of SEECOF 21,
2. climate monitoring results of the RA VI RCC network.

1. SEECOF-21 Climate outlook for the 2019 summer season



(a) (b)

Figure 1: Graphical presentation of the climate outlook for the 2019 summer season for the SEECOF region (a) Temperature Outlook; (b) Precipitation Outlook

Sea surface temperatures and general circulation

The sea surface temperatures in the Niño 3.4 and Niño 3 regions, both of which are often used to characterize El Niño/Southern Oscillation (ENSO) conditions, were predicted to be approximately 0.7 to 0.9 °C above average during the June-August 2019 season, and hence were expected to remain at weak El Niño levels. This tendency towards weak El Niño conditions was consistently predicted by a majority of dynamical models. However, the spread between models was rather high, with a considerable number of simulations overpassing the +1°C anomaly.

No extra-tropical connections were visible, and consequently the signal seemed to be trapped in low latitudes. Differences between models were noticeable for the North Atlantic and Europe circulation; however, a blocking pattern and relative low geopotential over Central Atlantic were foreseen by most of them.

Temperature

As stated in SEECOF-21 consensus statement for the seasonal climate outlook for the 2019 summer season, probability for above-average summer temperature was decreasing across the SEECOF region spreading from northern-northeastern toward southeastern parts. The most of the SEECOF region was likely to experience above-average summer temperature (zone 1 in Figure 1), while central and southern Greece, Ionian Sea, Aegean Sea, Eastern Mediterranean, as well as western, southern and central parts of Turkey were likely to have near- or above-normal conditions. On the other hand, in the southeastern part of Turkey (zone 3 in Figure 1) there were approximately equal probabilities for below-, near- or above-normal averages of the summer temperature. The generalized relatively high warm signal was probably partly due to the background climatic warming trend.

Precipitation

Uncertainties in regional predictions are higher for precipitation than for temperature.
The coasts of the Aegean and Black Sea, as well as the Southern Balkans, South Caucasus region and most of Turkey were expected to receive above-normal summer precipitation sums (zone 1 on Figure 2).
On the other hand, Pannonia Plain and the northwestern slopes of the Carpathian region (zone 3 on Figure 2) were likely to experience a precipitation deficit. In most of the SEECOF region (zone 2 in Figure 2), there were approximately equal probabilities for below-, near- or above-normal averages.
It should be noted that certain parts of the country, particularly mountain regions might observe near- or above-normal summer precipitation due to episodes of enhanced convection accompanied by heavy precipitation. Due to dry season masking, it was not possible to forecast summer precipitation totals for the Eastern Mediterranean with belonging coasts and hinterland, Crete as well as Israel and Jordan.

2. Analysis of the 2019 summer season

Analysis of the summer season temperature and precipitation anomalies and general circulation are based on maps in the WMO region VI for the summer 2019 (WMO RA VI RCC Offenbach Node on Climate Monitoring: http://www.dwd.de/rcc-cm) and other sources taken from the web.

2.1. General circulation

2.1.1. Ocean

While the western tropical Pacific still was warmer than normal (1981-2010 reference) in summer 2019 at the ocean surface, sea surface temperatures (SST) in the eastern tropical Pacific mostly were closer to normal on summer average, close to the South American coast even below normal (Fig. 2).

The Niño 1+2 region (close to South America) started with negative SST anomalies in June 2019, which further intensified until August (Tab. 1). Anomalies in Niño 3 region, which is located further in the open ocean, decreased to around zero in July/August 2019. In contrast, Niño 4 region, which is located even further to the west, had persisting positive anomalies from June to August 2019 at around +0.8 to +0.9 K. Hence, the combined Niño 3.4 region still had positive, but rapidly decreasing anomalies, from +0.6 K in June 2019 to +0.2 K in August 2019. In summary, SST was overestimated by predictions taken in SEECOF-21. Instead of ongoing weak El Niño conditions, the situation changed very quickly to neutral conditions in JJA 2019. However, this confirmed the hypothesis, that no extratropical connections due to ENSO were to be expected.

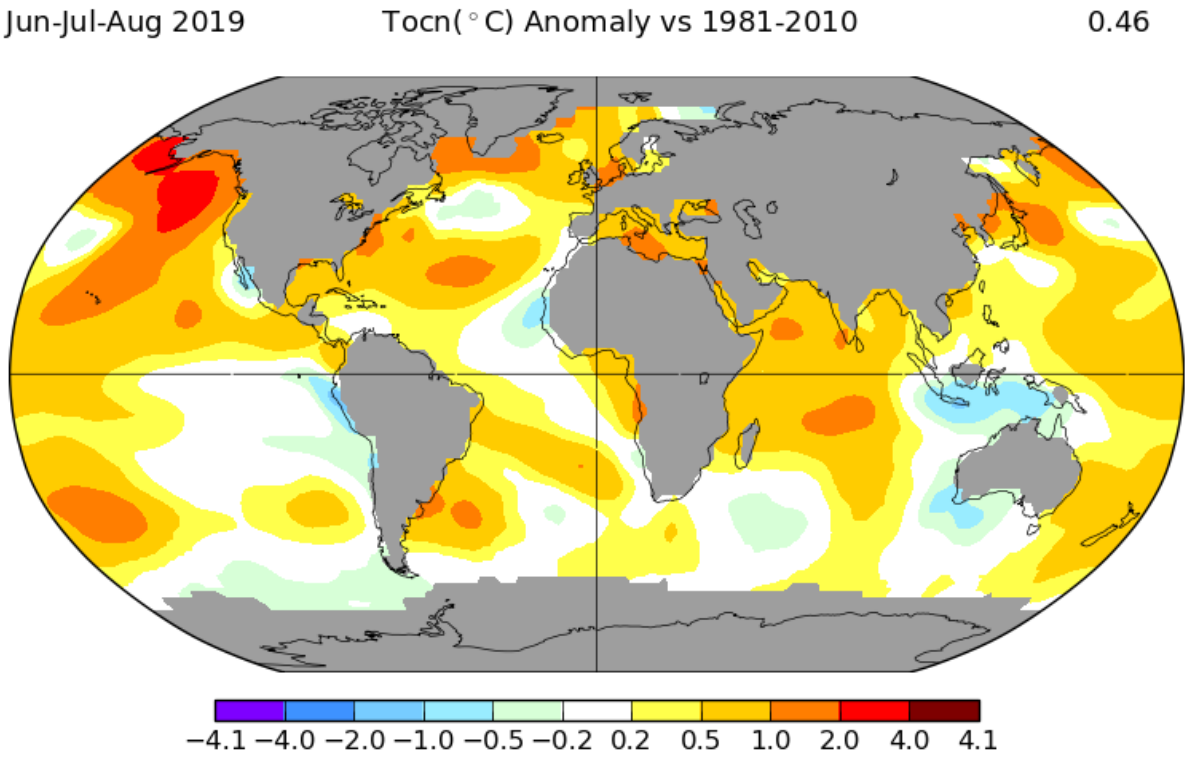


Figure 2: Sea surface temperature anomalies for boreal summer 2019 (June-August), 1981-2010 reference. Data from ERSSTv5 ocean model analysis with 250km smoothing, source: NASA GISS, https://data.giss.nasa.gov/gistemp/maps/

MONTH	NIÑO 1+2		NIÑO 3		NIÑO 4		NIÑO 3.4	
	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM
June 2019	22.62°C	-0.26°C	26.81°C	0.38°C	29.62°C	0.78°C	28.24°C	0.59°C
July 2019	21.34°C	-0.28°C	25.68°C	0.06°C	29.73°C	0.92°C	27.63°C	0.41°C
August 2019	20.20°C	-0.44°C	24.89°C	-0.10°C	29.50°C	0.82°C	26.97°C	0.15°C

Table 1: Sea surface temperature and anomalies for various Niño regions in boreal summer months 2019 (June-August), 1971-2000 reference. Data from ERSST.v5 ocean model analysis, source: NOAA, https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst.php with definitions of Niño regions.

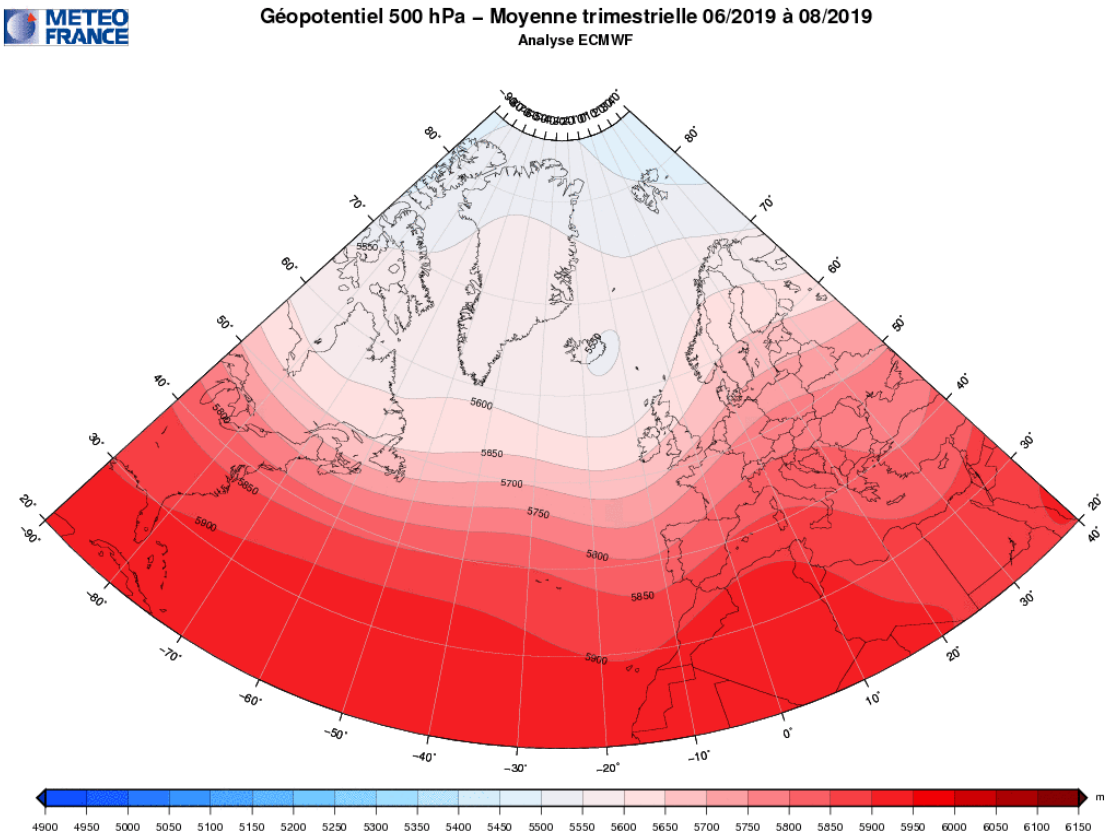
2.1.2. Atmosphere

Seasonal averages of 500 hPa geopotential in summer 2019 show a characteristic trough-ridge pattern over the eastern North Atlantic and Europe, especially for southern parts over the Mediterranean region (Fig. 3). It consists of a trough over the eastern North Atlantic, then a blocking ridge over much of Europe and the western and central Mediterranean, and again a trough over the eastern Mediterranean. This is also reflected by the summer 2019 anomalies of 500 hPa geopotential. It is in line with model predictions taken by SEECOF-21 (see above in chapter 1). The pattern can be seen more or less in all three summer months (Fig. 4), most intense in June.

Geopotential anomalies show a dipole over the eastern North Atlantic with higher-than-normal geopotential over Greenland and lower-than-normal geopotential over the central North Atlantic, implying a NAO- pattern. This pattern also persisted during all summer months (see table 3). In June and in August, but not in July, the low anomaly was located close to Western Europe, which was part of an EA+ pattern. Differences in summer months can also be seen for western Russia extending to the Balkan region: June and August had high pressure anomalies, July low pressure, which resulted in weak positive anomalies for the seasonal mean in the Balkans and Eastern Europe. Consequently, the EA/WR pattern changed from the positive phase in July to a negative phase in August.

Sea level pressure distribution over the North Atlantic shows a very intense Greenland High, a very weak Icelandic Low, while the Azores High was weaker than normal in its northern part (Fig. 5). On the other hand, there was a slight positive anomaly of extension of the Azores High into Europe. The extension was largest in June and August, reaching much of Eastern Europe, but was weaker in July (Fig. 6). Over the eastern Mediterranean region and the Middle East, cyclonic influence was active, which was normal for summer, but did not have much impact in the dry season except some parts of Turkey.

Circulation statistics of Météo France (Fig. 7) confirm a domination of NAO- patterns, but also Atlantic Low patterns were more frequent than normal in all summer months. In contrast, there were very few zonal and Scandinavian Blocking patterns in summer 2019.



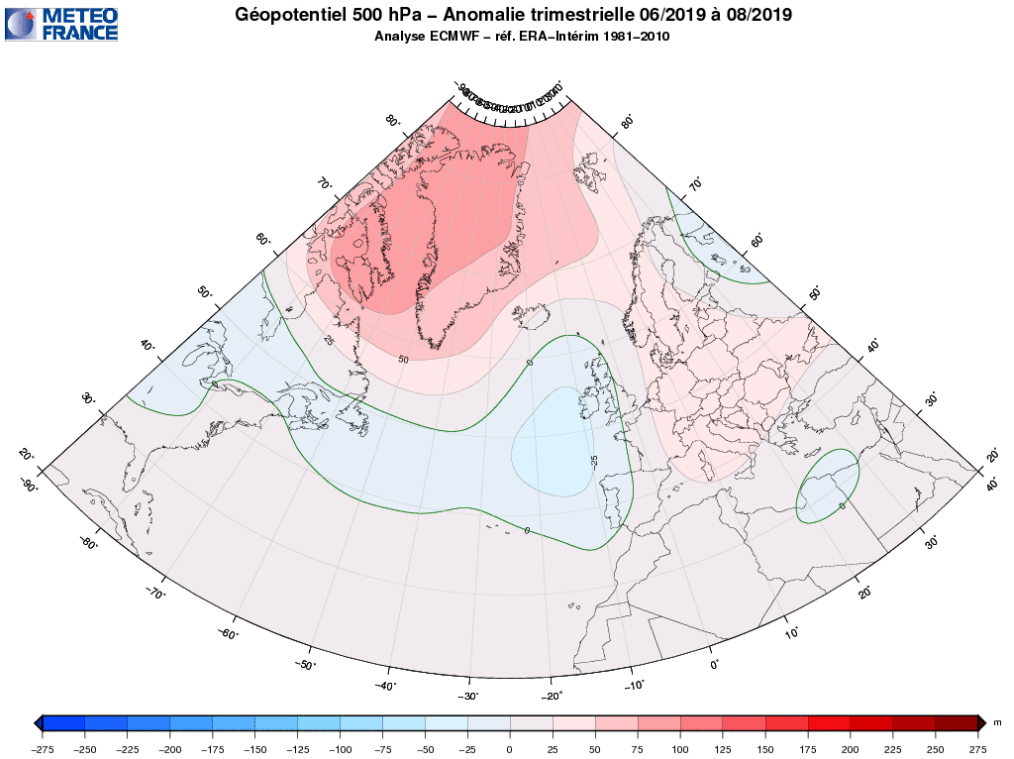


Figure 3: Seasonal mean and anomalies of 500 hPa geopotential for summer 2019 (1981-2010 reference). Source: Météo France, data source: ECMWF ERA Interim reanalysis, http://seasonal.meteo.fr/en/content/suivi-clim-cartes (login required)

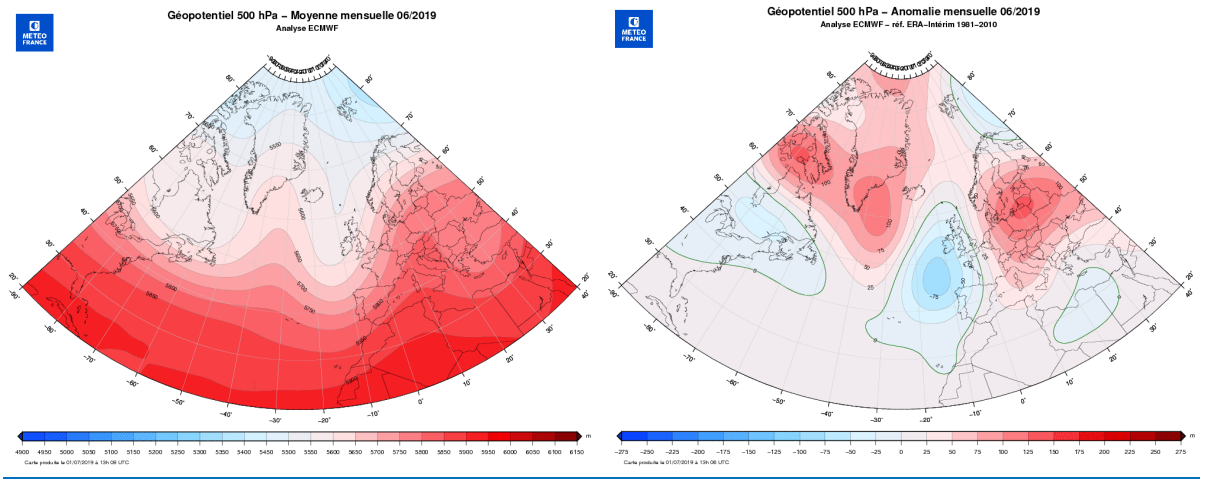


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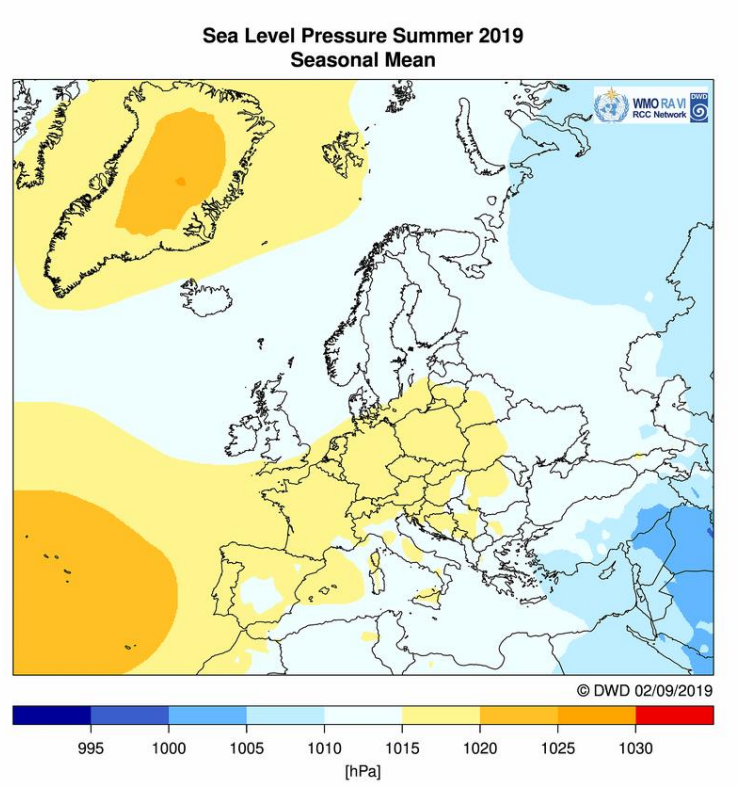
Figure 4: Same as Figure 3, but for the months June, July, August 2019.



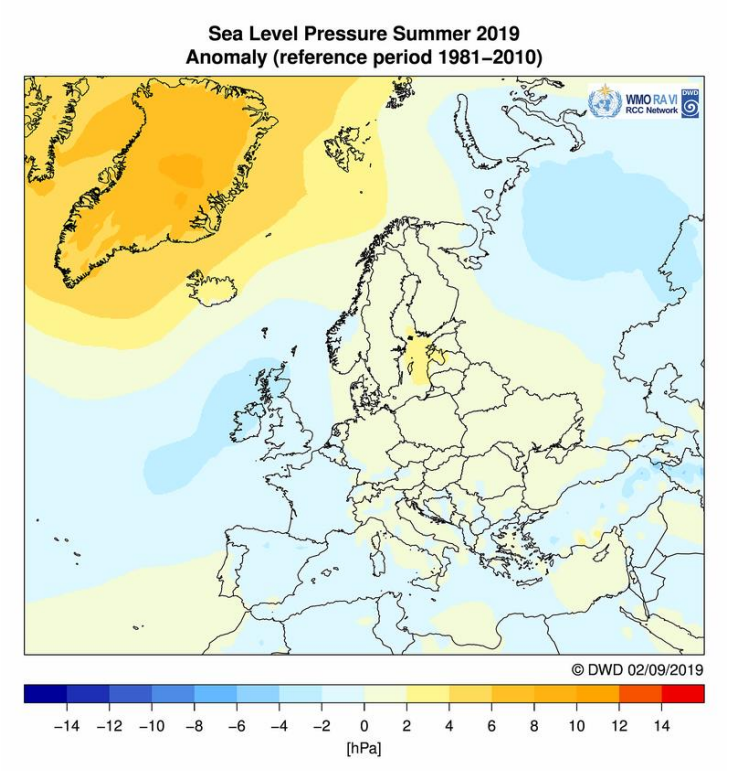


Figure 5: Seasonal mean sea level pressure (upper graph) and its seasonal anomalies (lower graph) for summer 2019 (1981-2010 reference). Source: Deutscher Wetterdienst (DWD), data source: DWD numerical ICON model analysis, http://www.dwd.de/EN/research/weatherforecasting/num_modelling/01_num_weather_prediction_modells/icon_description.html?nn=484268

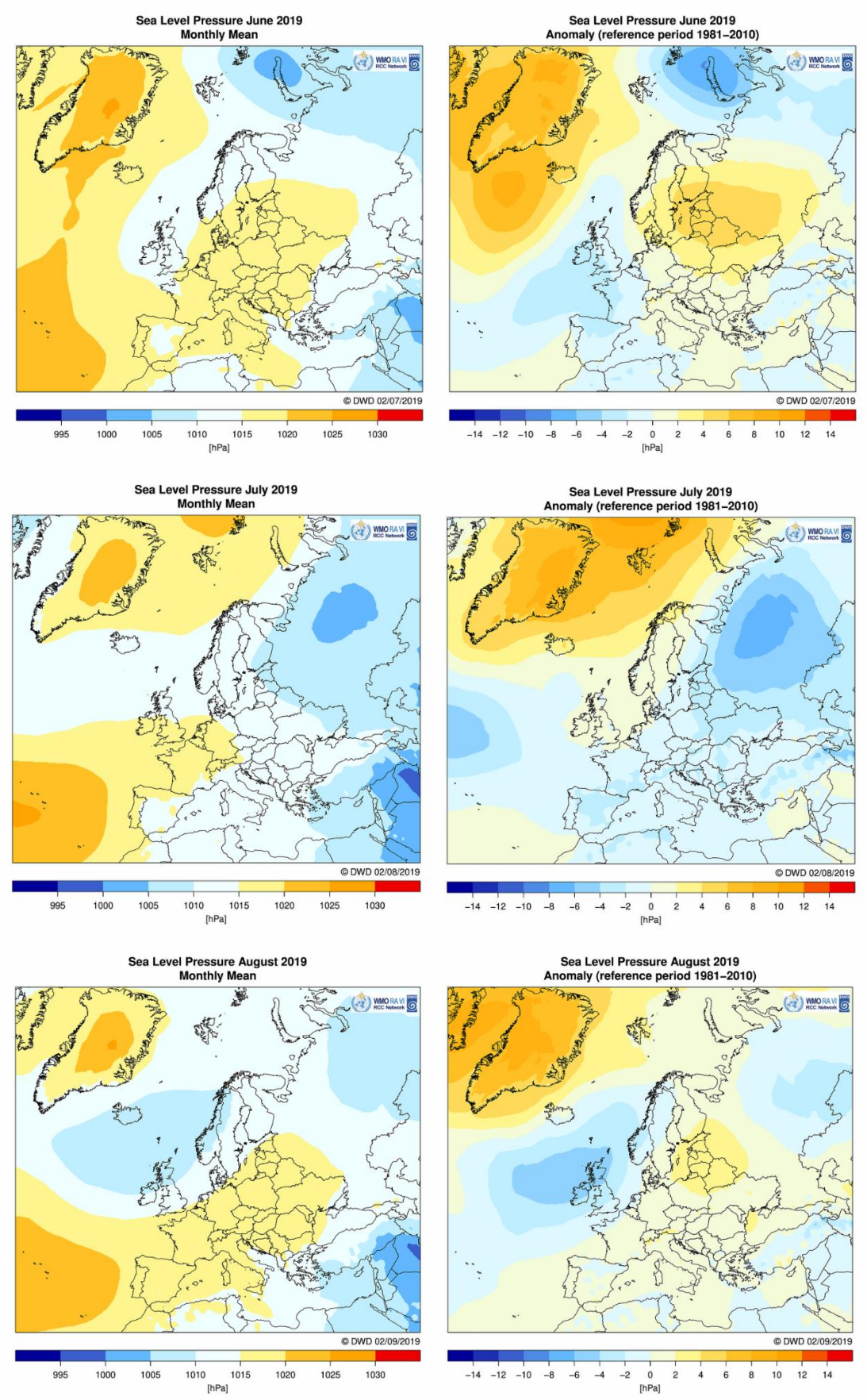


Figure 6: Same as Figure 5, but for the months June-August 2019.

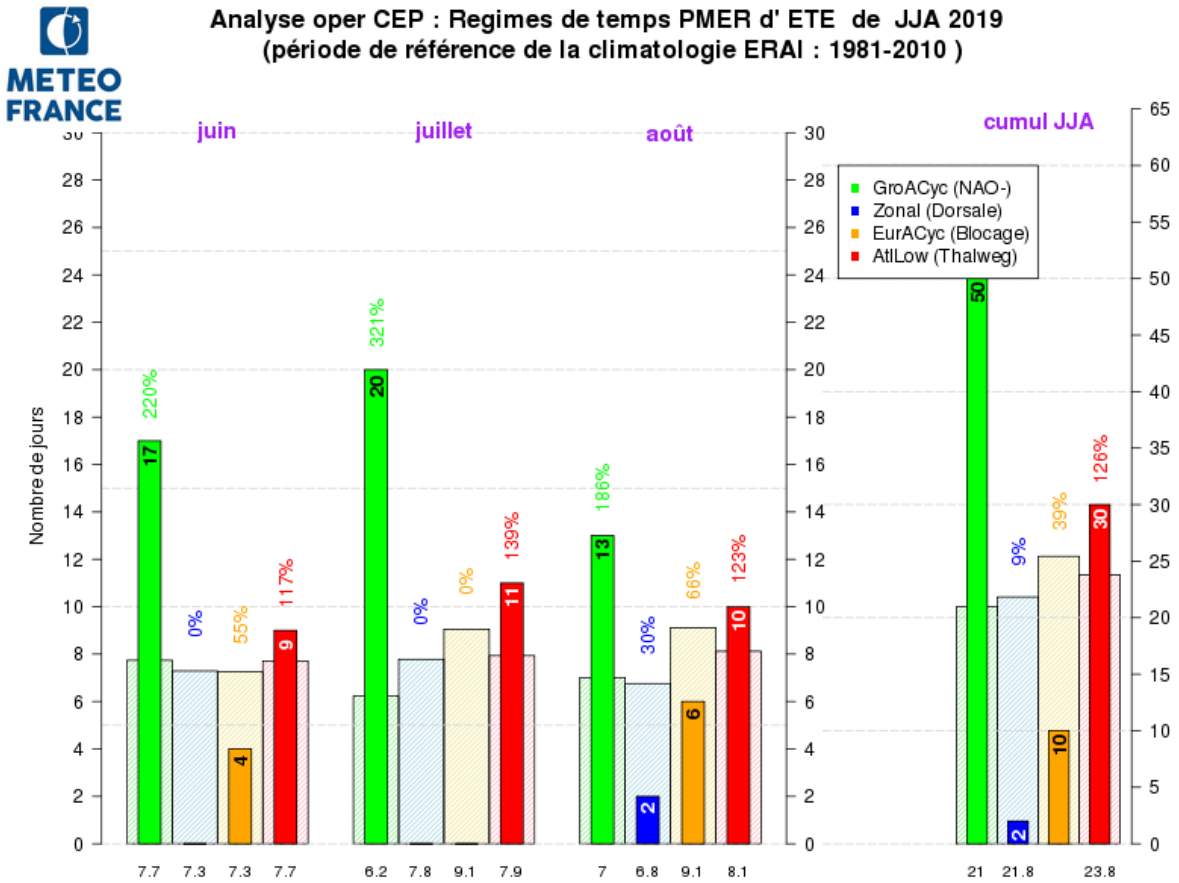


Figure 7: Number of days with circulation types of the Météo France classification for each month of the summer 2019 season and for the whole season (right), and in percent of the climatological frequency distribution 1981-2010. Circulation types are: negative North Atlantic Oscillation phase (NAO-), Atlantic ridge / zonal (Dorsale), Scandinavian Blocking (Blocage) and Atlantic trough/Low (Thalweg). Source: Météo France, http://seasonal.meteo.fr/en/content/suivi-clim-regimes-trim

yyyy	mm	NAO	EA	WP	EP/NP	PNA	EA/WR	SCA	TNH	POL	PT	Expl.Var
2019	6	-0.79	1.28	-1.92	1.74	0.24	0.30	-0.16	-99.90	-0.46	-99.90	44.4
2019	7	-1.39	0.08	-0.27	0.10	0.62	1.02	-0.69	-99.90	-1.48	-99.90	62.2
2019	8	-1.62	1.93	-2.19	-1.18	1.16	-1.68	-2.09	-99.90	0.33	-0.91	51.5

Table 3: Circulation indices of NOAA CPC patterns for the summer months 2019.

ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/tele_index.nh

2.2. Temperature

Temperature was higher than the 1981-2010 normal in the entire SEECOF domain (Fig. 8). Highest anomalies (> +2°C) were recorded in northern and western parts of the domain, which were those with most high pressure influence. Seasonal mean temperatures in the lowlands ranged from 20°C in northern Ukraine to around 30°C in southeastern Turkey, Israel and Jordan, in higher elevations mostly between 15 and 20°C.

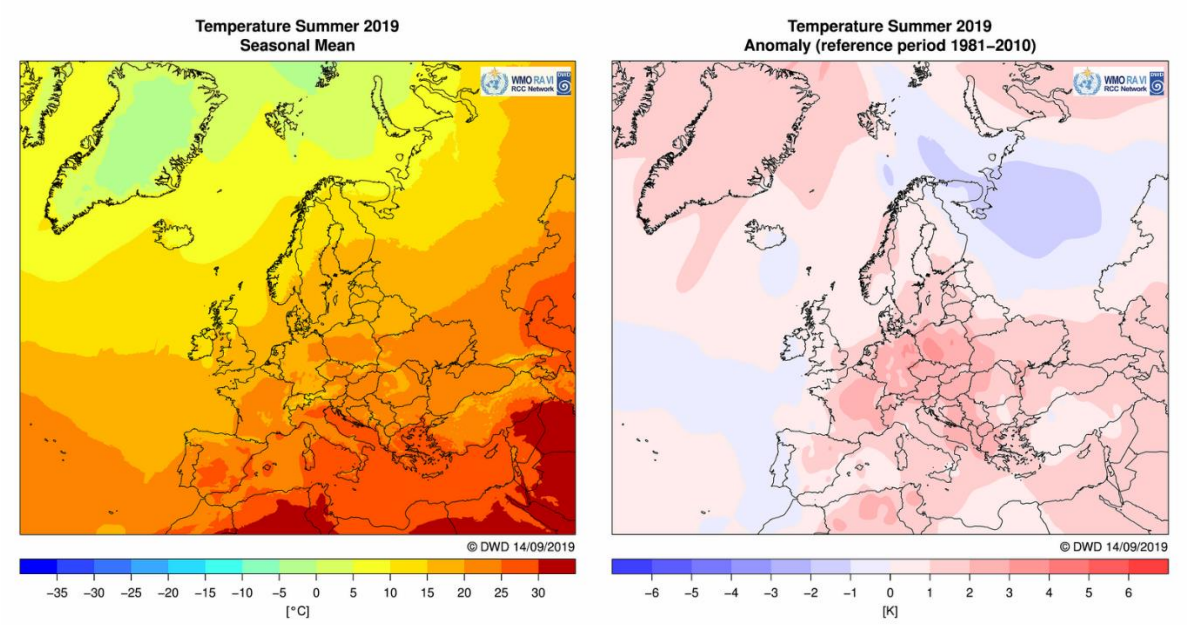


Figure 8: Surface air temperature for summer 2019. Left: seasonal mean, right: anomalies, 1981-2010 reference, source of both maps: WMO RAVI RCC, based on interpolated CLIMAT data, www.dwd.de/rcc-cm

In terms of terciles, almost the whole SEECOF domain temperatures were in the upper tercile (Fig. 9 and 10). Only a few places in Greece, Turkey, Cyprus, and Georgia had seasonal means in the middle or lower tercile.

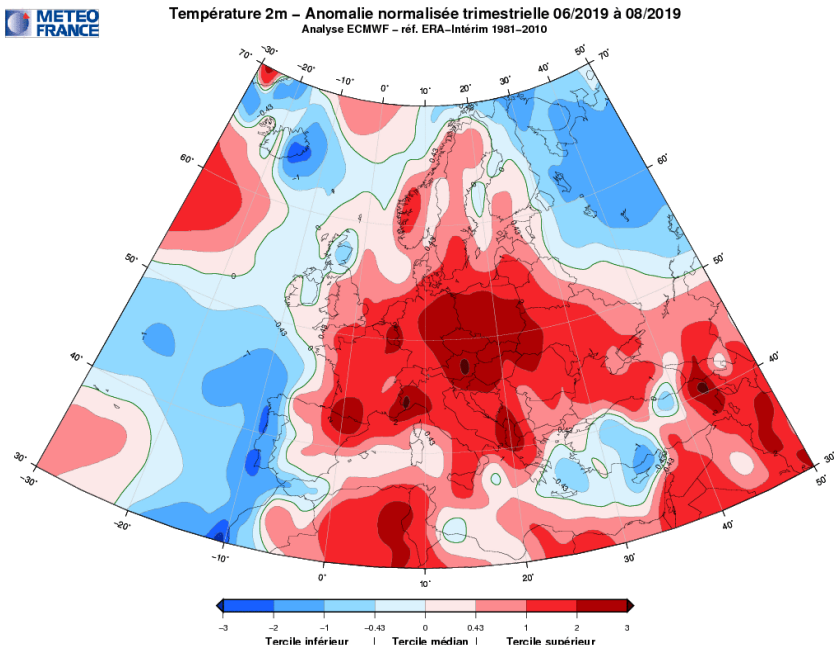


Figure 9: Seasonal normalized temperature anomalies of summer 2019 surface air temperature based on ECMWF / ERA-INTERIM grid data, 1981-2010 reference. The data range between -0.43 and +0.43 represents the middle tercile, below -0.43 the lower tercile and above +0.43 the upper tercile. Source: Météo France, data reference: http://www.ecmwf.int/en/research/climate-reanalysis/era-interim

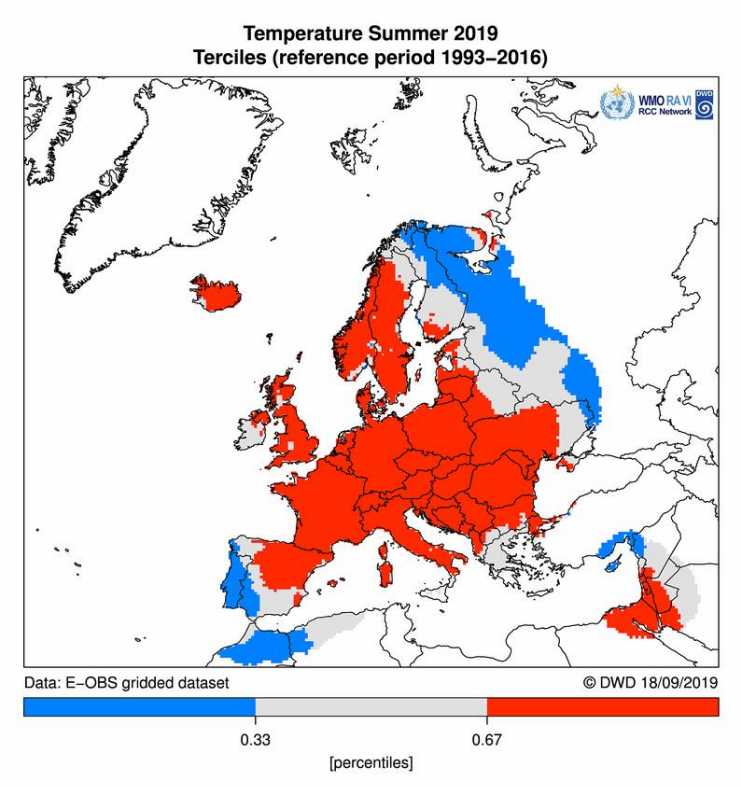


Figure 10: Terciles of summer 2019 surface air temperature based on interpolated E-OBS gridded data, 1993-2016 reference (period used by seasonal forecast models). Source: DWD, data source: http://www.ecad.eu/

2.3. Precipitation

Precipitation was well below normal in the Ukraine and Moldova, around normal in much of the Balkans and the South Caucasus and above normal in places in Bulgaria, northeastern Greece and Turkey (Fig. 11). Seasonal totals ranged from zero in Israel and Jordan to above 100mm in the Julian Alps, at the eastern Black Sea coast and over the Caucasus mountain chain.

In terms of percentiles, Slovenia, much of the Ukraine, eastern Turkey and the South Caucasus region had temperatures in the lower tercile, parts of central Turkey and northeastern Greece in the upper tercile. This is in line with the surface pressure distribution (see above).

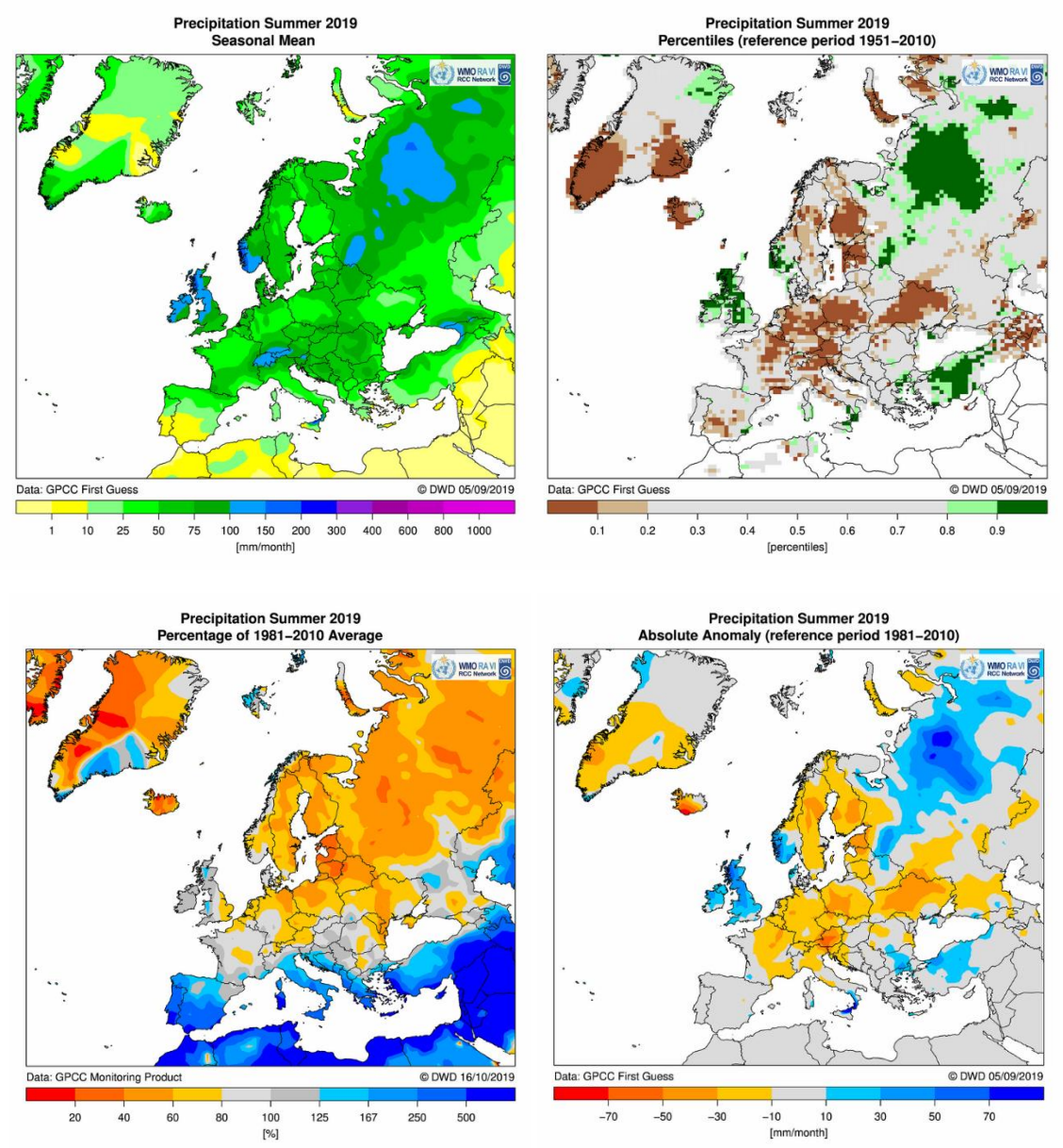


Figure 11: Precipitation for summer 2019 in Europe. Upper maps: seasonal total in mm/month and percentiles, lower maps: percentage of 1981-2010 average and absolute anomalies, source: WMO RAVI RCC, www.dwd.de/rcc-cm , data source: GPCC, http://gpcc.dwd.de

3. Verification of the SEECOF-21 climate outlook for the 2019 summer season

3.1. Temperature

The SEECOF-21 outlook favored the upper tercile for most of the domain. This includes the entire Balkan Peninsula except central and southern Greece, Eastern Europe (Romania, Moldova, Ukraine), the South Caucasus region, Israel and Jordan. For central and southern Greece, Cyprus and most of Turkey, the middle and upper tercile was favored equally. No privileged scenario was given for southeastern Turkey.

The warm scenario was predicted correctly for most of the domain. Only southern Greece had clearly temperatures in the middle tercile (which was one of the preferred scenarios in SEECOF-21), while Cyprus and some places in Turkey had temperatures in the lower tercile, which was not predicted. Temperatures in southeastern Turkey were in the upper tercile, which was not predicted because climatology (middle tercile) is assumed when no privileged scenario is given.

In summary, the outlook was mostly correct except some areas particularly in Turkey.

3.2. Precipitation

SEECOF-21 outlook favored a wet scenario (upper tercile) in Albania, Greece, Turkey except the southern coast, South Caucasus, and an area along the western and northern Black Sea coast. For the northernmost part of the Balkans, the lower tercile was preferred. No privileged scenario was given for the rest of the domain (other parts of the Balkans, Romania, Moldova, Ukraine). The Eastern Mediterranean region including Crete, southern coast of Turkey, Cyprus, Israel, Jordan was assumed seasonally dry.

Precipitation in much of the Ukraine and much of the South Caucasus and eastern Turkey was in the lower tercile, which was not predicted by the outlook. Most of the Balkan Peninsula had near-normal precipitation, which was correctly predicted in parts. The wet scenario was correctly predicted in parts of northeastern Greece and Turkey.

In summary, the outlook was correct for several parts of the domain, but over-estimated precipitation particularly in some eastern parts (Ukraine, South Caucasus, eastern Turkey).

4. High impact events

DWD records high impact events in a so-called event calendar, which can be seen on the DWD website: https://www.dwd.de/DE/leistungen/rcccm/int/rcccm_int_sse.html. It is updated monthly.

The following events in the SEECOF domain have been recorded in summer 2019:

- Several cities and municipalities had declared a state of emergency in early June 2019 after heavy rain caused flooding and landslides in parts of northern Bosnia and Herzegovina (BiH) and western/central Serbia. Thousands of houses had been fully or partially destroyed and more than 11,000 people in total affected by the floods. Many people had no access to safe drinking water. Several hundreds of hectares of agricultural land had been destroyed.

- A tornado hit several parts of Iasi County (northeastern Romania) on 5 July. According to media reports, three people had been injured and several houses damaged. The event lasted just a few minutes. The twister tore rooftops apart, downed numerous trees and streetlights.
- Central-western Bulgaria and southern Romania, too, saw widespread flooding with damage at the beginning of June. Over 260 people in Romania had to leave their homes, at least 3 fatalities, more than 680 buildings damaged to varying extents. Power outages and traffic disruption were reported across central Bulgaria.
- Major floods hit Ankara, Turkey one week later on 09 June 2019, damaging houses, businesses and roads. The districts of Çankaya and Etimesgut districts were the among the hardest-hit areas. Three people reportedly died in the floods.
- Intense hailstorm with hail the size of grapefruits hit parts of Slovenia on June 11, 2019, damaging hundreds of homes and cars. The biggest measured was 11 cm, which was two to three hours after the storm. In that time they would have melted by 2 cm to 3 cm so in reality, the hailstones were probably up to 14 cm in diameter. The same hail size was also measured in northern Croatia (Brod Maravice).
- At least 7 people were killed after heavy rain hit Trabzon's Arakli district (northeast Turkey) on June 18, causing two streams to overflow. Firefighters were immediately dispatched to the scene but had difficulty reaching the affected areas as debris brought by the floods blocked the roads. Floods and landslides destroyed homes and cars and seriously damaged at least one school building. 70 people were displaced. Pipes of a hydroelectric plant exploded following the floods and landslides, causing additional local flooding.
- Torrential rainfall also hit Serbian capital Belgrade on Sunday, June 23, 2019, submerging parts of the metropolis and creating traffic chaos. The worst affected were areas left of River Danube where meteorological stations registered 100 mm (3.9 inches) of rain within 45 minutes - approximately 1 month worth of June rain.
- On 27 June 2019, a hailstorm damaged almost all yield capacity of 14 communities in Shirak region in Armenia.
- On 7-9 July, heavy rain, strong winds and hailstorms affected 12 of the country's 20 counties in Croatia, resulting in casualties and widespread damage to homes, cars and agriculture. Severe storms also hit Serbia, Bosnia and Herzegovina and other neighboring countries. At least one person was killed in Serbia.
- Very strong winds, tornadoes and violent hailstorms also hit northern Greece on July 10, 2019. Such severe weather is extremely unusual in Greece for this time of year, which is normally mostly calm and dry. Trees were uprooted and roofs collapsed after a 'sudden and unexpected' storm with wind gusts up to 100 km/h (62 mph) hit the area, claiming lives of 7 people and injuring more than 100. Only a few days later, on 14 July 2019, a storm bringing heavy rain swept through Achaia and Aetolia-Acarnania in western Greece, causing severe damage. The Greek overflowing Volinaios River caused flooding in Achaea. Flood water and debris blocked roads and around 60 people were evacuated. Homes and shops had been damaged and roads closed.
- Floods and landslides occurred in northwestern Turkey in many districts in Düzce Province on 17-18 July 2019, leading to at least 3 fatalities.
- Several wildfires in Israel in mid-July, hundreds of home were evacuated

- Flash floods hit Rize Province in the Black Sea Region of Turkey on 04 August 2019. 120mm of rain fell in 4 hours, flooding areas around the city of Rize, inundating roads and buildings.
- Two weeks later, it was Istanbul and other cities in northwest Turkey, which were hit by flash flooding. Streets and buildings were flooded, including parts of the Grand Bazaar market, which had to be evacuated.
- A large forest fire broke out on Evia Island (approximately 50 km north of Athens) on 13 August. The fire lasted 3 days until having taken it under control and was estimated to be more than 2,000 hectares in size.

5. Users' perceptions of the SEECOF outlook

DWD uses seasonal forecasts internally for climate diagnostics. SEECOF outlooks are particularly welcome because they are based on expert consensus.

Seasonal forecasts are also distributed to some selected authorities by DWD, where SEECOF outlooks are considered when the target area is southeast Europe.

References:

SEECOF Online Forum: http://www.seevccc.rs/forum/

WMO RA VI RCC Node on Climate Monitoring Website with monitoring results: http://www.dwd.de/rcc-cm

Météo France climate monitoring products: http://seasonal.meteo.fr/en/content/suivi-clim-cartes (password protected)

ECA&D, E-OBS: http://www.ecad.eu

GPCC: http://gpcc.dwd.de