



WMO RA I



WMO RA VI
RCC-Network



MEDITERRANEAN CLIMATE OUTLOOK FORUM MEDCOF-11 MEETING

ANALYSIS AND VERIFICATION OF THE MEDCOF-10 CLIMATE OUTLOOK FOR THE 2018 SUMMER SEASON FOR THE MEDITERRANEAN REGION (MED)

Final version

Last update: 27 November 2018

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The following MedCOF verification report is based on

- the outcome of the consensus forecast of MedCOF 10,
- climate monitoring results of RA I NA RCC and RA VI RCC networks,
- the analysis and verification report of SEECOF-20 for 2018 summer season for southeast Europe (SEE)
- national verification reports received from NMHSs or posted in RCOF forums of MedCOF, SEECOF or PRESANORD.

1. MedCOF-10 Climate outlook for the 2018 summer season

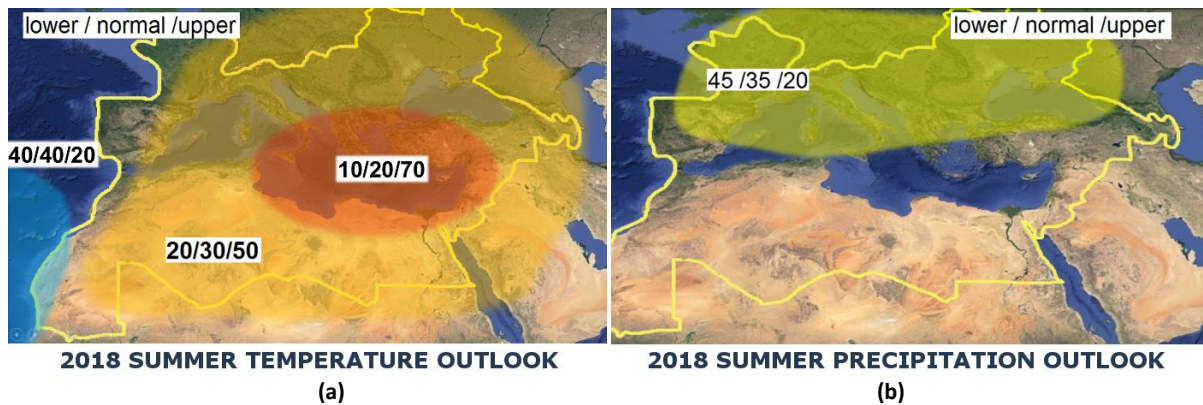


Figure 1: Graphical presentation of the climate outlook for the 2018 summer season for the Mediterranean region
(a) Temperature Outlook; (b) Precipitation Outlook

General circulation

The tropical Pacific was returning to neutral conditions from la Niña Event. Above average temperatures appeared on the western and northern tropical Pacific, and below-average temperatures in the eastern and southern region. The trend of ENSO based on prediction models indicated a neutral state with some slightly above-average temperatures. Over the Atlantic Ocean, cold anomalies were developing over the northern tropical region and the western African Coast, trend confirmed by forecasts. Some models suggested that a warm tongue could develop over the equator. In the extratropics, warm anomalies persisted in the western North Atlantic and north of Europe. Over the Mediterranean Sea SST was warmer than normal, particularly over the eastern part of the basin. Most drivers were in neutral or close to neutral state. TNA seemed to be developing a negative anomaly, but still close to neutral. TASI had below normal values, and was expected to continue like that for the summer.

There was no good agreement between models. Some of them showed a certain trend to a more frequent than normal NAO+ pattern, which was consistent with SST anomalies over the Atlantic, so their forecast was considered more likely than others.

Temperature

As stated in MedCOF-10 consensus statement for the seasonal climate outlook for 2018 summer season for the Mediterranean region, there is a tendency for the upper tercile with temperatures warmer than normal over most of the Eastern MedCOF domain and Southern/Southeastern Europe, with good agreement among most models. Models still showed a relatively high probability of the warm tercile over the rest of MedCOF area, with less agreement for the western end of it. On the other hand, some models forecasted below-normal temperatures over the Atlantic Ocean and western shores of Morocco and Mauritania, which was consistent with SST anomalies.

Within the RA VI part of the domain, the upper tercile was predicted with highest probability (70%) over the eastern Mediterranean region, including southern Italy, southern Balkans, Greece, western half of Turkey, Cyprus, and the Middle East (orange region in figure 1a). The warm scenario was also preferred for the rest of the domain, except the westernmost parts, but with 50% probability. For the

northwestern half of France (mainland), Portugal and Spain (except the east); both the lower and middle tercile was predicted with 40% probability each.

Over the North Africa region, the warm tercile was more probable over most of the central and eastern part of the domain with probability of 70%, and of 50% elsewhere. Below-normal temperatures were predicted over the Atlantic Ocean and western shores of Morocco with probability for the three categories (below normal, normal and above normal) of 40%, 40%, 20%, respectively.

The outlook for temperature distinguished three regions with different tercile distributions. Two of them (orange and yellow region in Fig. 1a) had the highest probability for the upper tercile. This means for verification that a prediction of above-normal temperature (upper tercile) was assumed for these areas. The third region in the westernmost part of the MedCOF domain had a probability of 40% each for the lower and middle tercile. This means for verification that a prediction of either below-normal or around-normal temperature was assumed, which means the outlook was correct, when any of these two scenarios were predicted.

Precipitation

Precipitation forecasts were in less agreement than for temperature. Some models (like ECMWF S5, EUROSIP), showed a trend to a drier-than-normal summer over the northernmost part of the domain, while MF S6 showed a drier-than-normal summer for the Western Mediterranean, associated with NAO+ predominance. Drivers like TASI and TNA suggested a drier-than-normal summer over countries north of the Mediterranean and the Black Sea, and the north-eastern Iberian Peninsula. Combining all these factors, a drier-than-normal summer was forecasted over the northern part of the MedCOF area, with moderate uncertainty.

For the rest of the region no large-scale precipitation signal was present in the forecasts (see Fig. 1b). The climatological forecast (33, 33, 33) over the southern part of the domain also implied the fact that no meaningful forecast could be provided for these seasonally dry areas.

For the RA VI domain, the outlook distinguished two regions for precipitation. For the green region in Fig. 1b the lower tercile has the highest probability with 45% and covers most of the domain. For the remaining parts (Portugal, western and southern Spain, Greece, Turkey (except Black Sea coast), South Caucasus, Middle East and Cyprus) no privileged scenario was predicted. This means for verification that below-normal precipitation (lower tercile) was assumed for the green region and climatology (middle tercile) or dry season for the rest of the domain.

The North African domain was assumed to be on dry season, therefore climatology was assumed for verification.

2. Analysis of the 2018 summer season

Analysis of the summer season temperature and precipitation anomalies and general circulation are based on maps and seasonal bulletins on the climate in the WMO region I – NA and VI for the summer 2018 (WMO RA I RCC Node on Climate Monitoring: <http://www.meteo.tn/htmlen/donnees/climatemonitoring.php>; WMO RA VI RCC Offenbach Node on Climate Monitoring: <http://www.dwd.de/rcc-cm>), contributions from Météo France (<http://seasonal.meteo.fr/>), Regional Climate Outlook Forums for Southeastern Europe (SEECOF-20, <http://www.seevccc.rs>) and North Africa (PRESANORD, <http://acmad.net/rcc/presanord.php>) and national verification reports from MedCOF participants.

2.1. General circulation

2.1.1. Ocean

The western tropical Pacific was more than 0.5 K warmer than normal (1981-2010 reference) in summer 2018, whereas anomalies in the eastern tropical Pacific were closer to normal on summer average (Fig. 2). Significant negative anomalies were still to be found close to the western coast of Peru. In June 2018, the Niño 1+2 region (close to South America) still had negative anomalies, while the Niño 3.4 region, which is located further in the open ocean already switched to positive values (Tab. 1). Later in the summer, anomalies in Niño 1+2 region dropped close to zero, whereas positive anomalies in Niño 3.4 increased slightly, but did not exceed +0.3 K (1971-2000 reference). This means that ENSO was in a neutral state in summer 2018 as predicted; the preceding La Niña ended definitively, and an El Niño event started to develop, but was still not in a mature stage.

In the Atlantic, a warm tongue can be identified over the equator. Further to the north, still in the northern tropical region, an area of cold anomalies extended between the Caribbean and the African west coast (Mauretania). The Tropical Northern Atlantic Index (TNA, anomaly of the average of the monthly SST from 5.5N to 23.5N and 15W to 57.5W) developed a negative anomaly until June 2018, which afterwards weakened to zero during July and August (Tab. 2). Similarly, the Tropical Atlantic SST index (TASI), calculated as the difference of the NAT (North Atlantic Tropical SST index, SSTs in the box 40°W - 20°W, 5°N - 20°N) and SAT (South Atlantic Tropical (SAT) SST index, SSTs in the box 15°W - 5°E, 20°S - 5°S) indices, had a peak of negative anomalies in June 2018 and decreased to zero in August (see <https://stateoftheocean.osmc.noaa.gov/sur/atl/tasi.php>).

In the subtropics, a warm anomaly can be found between North America and Western Europe, extending further to the Biscay and the North Sea up to the Arctic region. The cold blob over the North Atlantic still persisted south of Greenland. The Mediterranean was 1-2 K warmer than normal on summer average, and so was also the Black Sea.

In summary, all oceanic anomalies considered for the MedCOF-10 outlook were predicted correctly or occurred as expected.

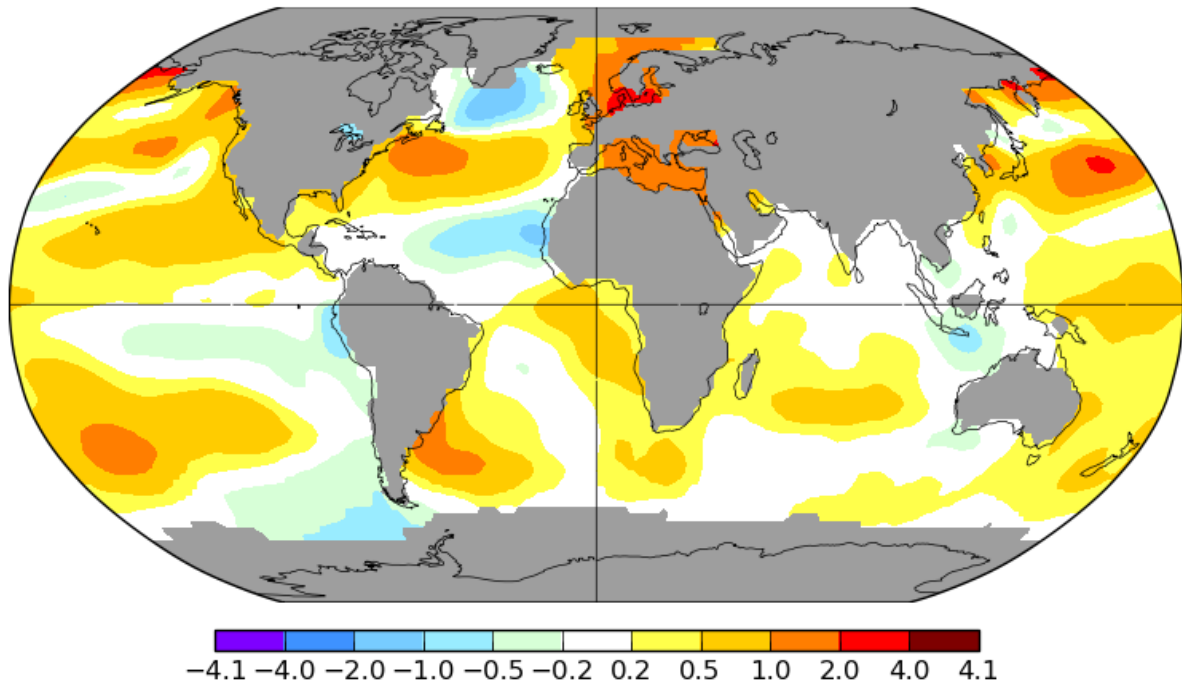


Figure 2: Sea surface temperature anomalies for boreal summer 2018 (June-August), 1981-2010 reference. Data from ERSSTv5 ocean model analysis with 250km smoothing, source: NASA GISS, <https://data.giss.nasa.gov/gistemp/maps/>

MONTH	NIÑO 1+2		NIÑO 3		NIÑO 4		NIÑO 3.4	
	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM
June 2018	22.19°C	-0.69°C	26.72°C	0.29°C	29.16°C	0.32°C	27.85°C	0.20°C
July 2018	21.43°C	-0.19°C	26.05°C	0.43°C	29.10°C	0.30°C	27.52°C	0.30°C
August 2018	20.66°C	0.02°C	25.14°C	0.15°C	29.19°C	0.51°C	27.11°C	0.29°C

Table 1: Sea surface temperature and anomalies for various Niño regions in boreal summer months 2018 (June-August), 1971-2000 reference. Data from ERSST.v4 ocean model analysis, source: NOAA, <https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst.php> with definitions of Niño regions.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
2018	0.28	-0.09	0.02	-0.17	-0.40	-0.48	-0.21	0.01	0.33	0.16

Table 2: Monthly TNA index January – October 2018. Source: NOAA ESRL, <https://www.esrl.noaa.gov/psd/data/climateindices/list/>

2.1.2. Atmosphere

Seasonal averages of 500 hPa geopotential in summer 2018 show a strong zonal flow over the North Atlantic (Fig. 3). Over Europe, the flow was diffluent and a ridge-trough pattern was established on seasonal average especially over the Mediterranean region and extending to North Africa also. In particular, there was a trough close to the western coasts of Iberia and Morocco, a ridge over the Western Mediterranean and a trough over the Eastern Mediterranean. In terms of anomalies, it was more cyclonic than normal over the Mediterranean, clearly separated from anticyclonic anomalies north and south of it. This separation was most distinct in June (Fig. 4). In July, cyclonic anomalies moved to the north, while high pressure anomalies developed over North Africa. In August this anomaly dipole moved to the south again. In summary, although there was some shifting of anomalies within the season, intraseasonal variability was relatively low within the MedCOF domain, which means there was no principal change of large-scale circulation patterns during summer.

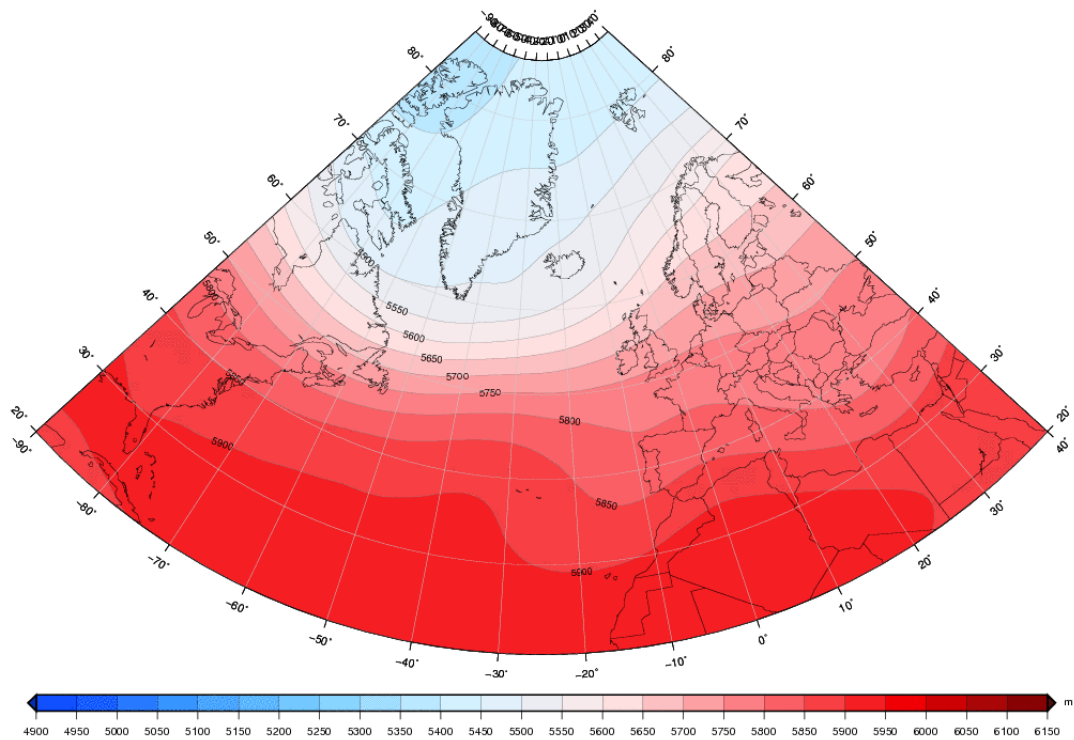
Sea level pressure distribution shows that the Azores High extended far into the European continent, but also to the western Mediterranean and western parts of North Africa. The eastern Mediterranean subregion and the Middle East were rather under cyclonic influence (Fig. 5). This was persistent during all summer months (Fig. 6). Seasonal SLP anomalies were around or slightly negative in the entire MedCOF domain. Highest cyclonic anomalies in June were recorded mainly in the eastern parts of the domain, from southern Italy to South Caucasus. During July, anomalies shifted further to the east, and in August, they became generally weaker.

The Icelandic Low was more intense than normal on seasonal average, and the Azores High was extended to the north. This implies a strong positive NAO phase, which persisted through all the summer months (Table 3). This was also expected in the MedCOF-10 outlook (see first chapter). In addition, a positive, but short EA phase occurred during July and August, implied by higher-than-normal high pressure further south (Iberia, western North Africa).

Weather types of the Météo France classification (Fig. 7) show a high frequency of the type “Atlantic Ridge” in all summer months, highest in June and decreasing to late summer. This type expresses the extension of the Azores High to the north but also high pressure influence over Central Europe, but more cyclonic conditions over the Mediterranean. In July, blocking types became very frequent, which imply cyclonic conditions over the western coasts of the MedCOF domain. In August Atlantic trough situations became more frequent, when high pressure was favored over the Western Mediterranean.



Géopotiel 500 hPa – Moyenne trimestrielle 06/2018 à 08/2018
Analyse ECMWF



Géopotiel 500 hPa – Anomalie trimestrielle 06/2018 à 08/2018
Analyse ECMWF - réf. ERA-Intérim 1981-2010

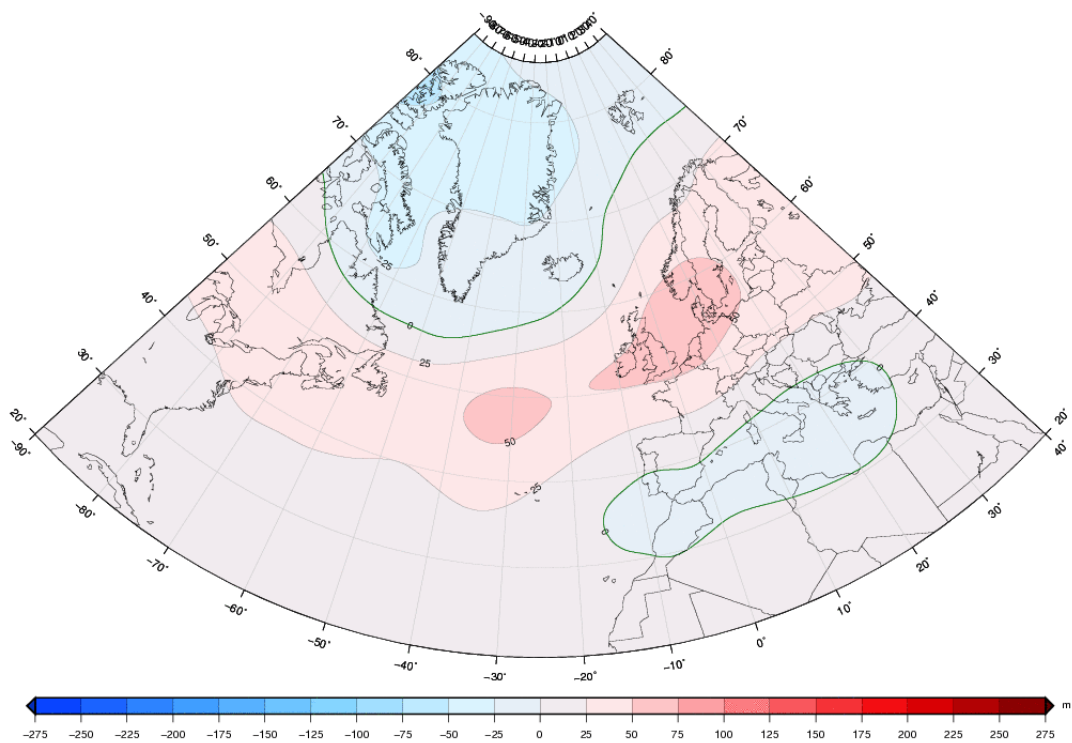


Figure 3: Seasonal mean and anomalies of 500 hPa geopotential for summer 2018 (1981-2010 reference). Source: Météo France, data source: ECMWF ERA Interim reanalysis, <http://seasonal.meteo.fr/en/content/suivi-clim-cartes>

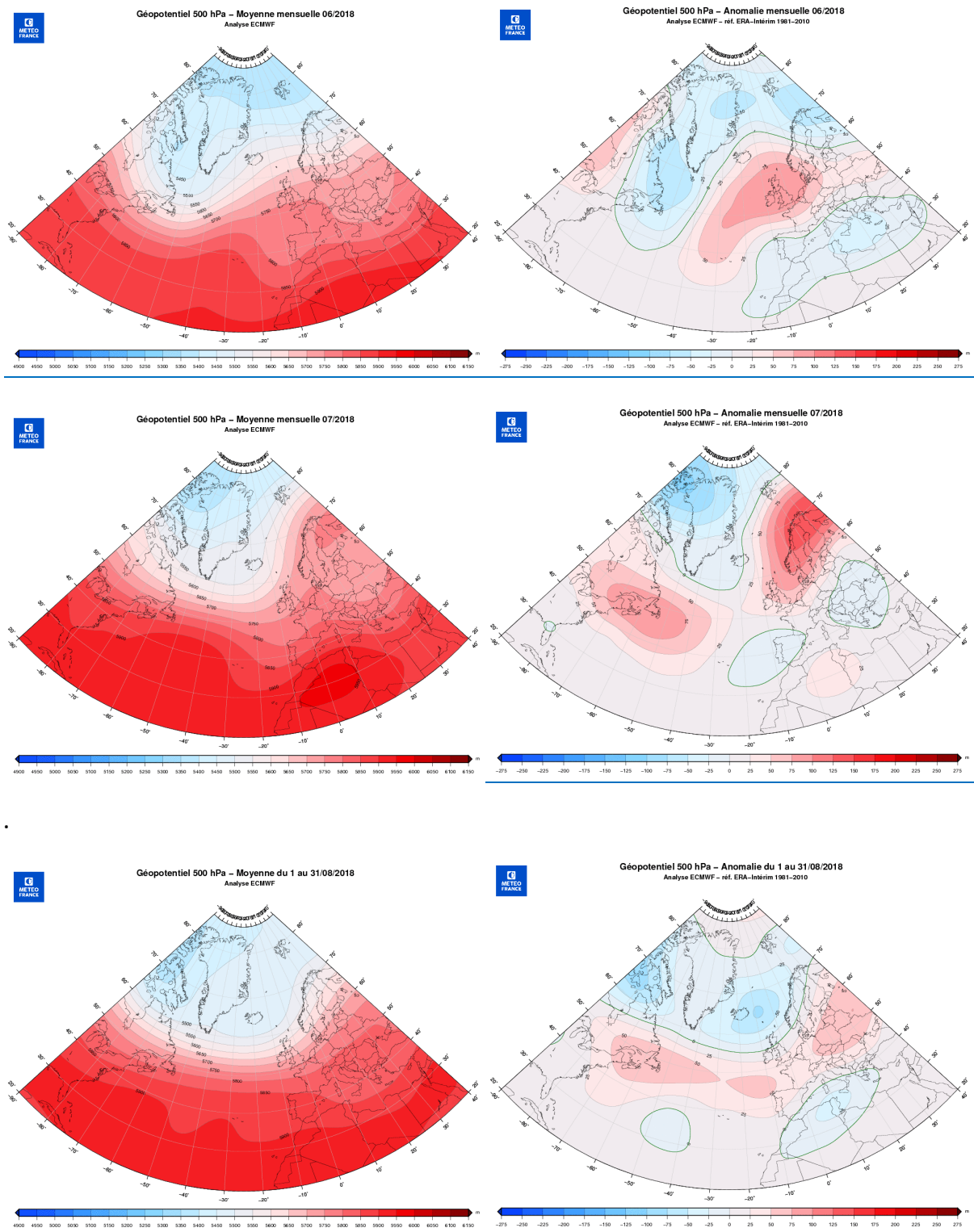


Figure 4: Same as Figure 3, but for the months June, July, August 2018.

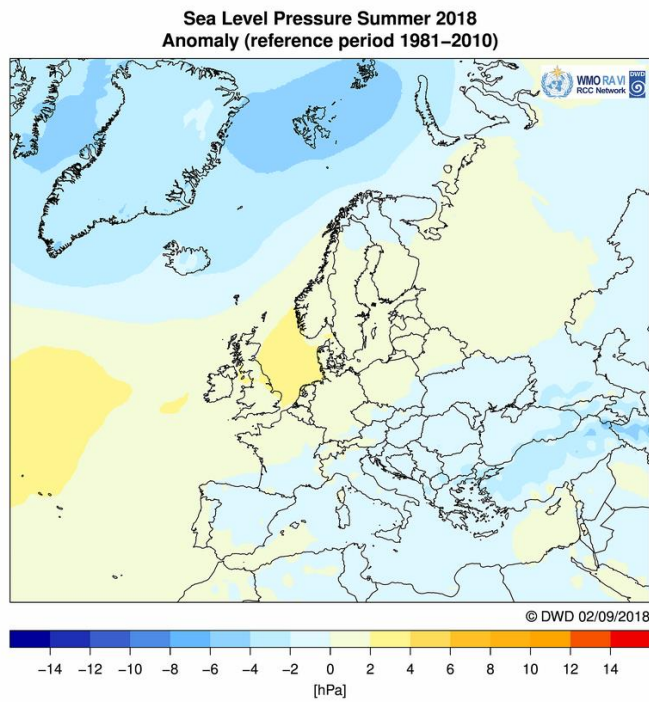
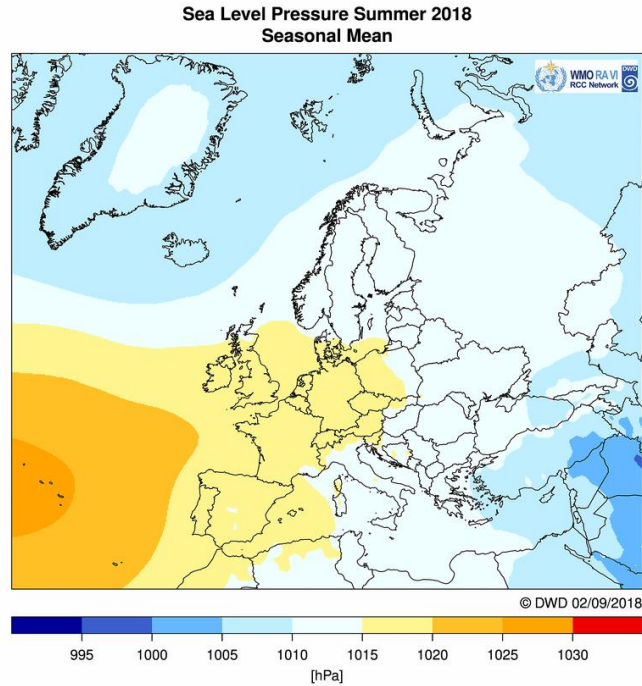


Figure 5: Seasonal mean sea level pressure (upper graph) and its seasonal anomalies (lower graph) for summer 2018 (1981-2010 reference). Source: Deutscher Wetterdienst (DWD), data source: DWD numerical ICON model analysis, http://www.dwd.de/EN/research/weatherforecasting/num_modelling/01_num_weather_prediction_modells/icon_description.html?nn=484268

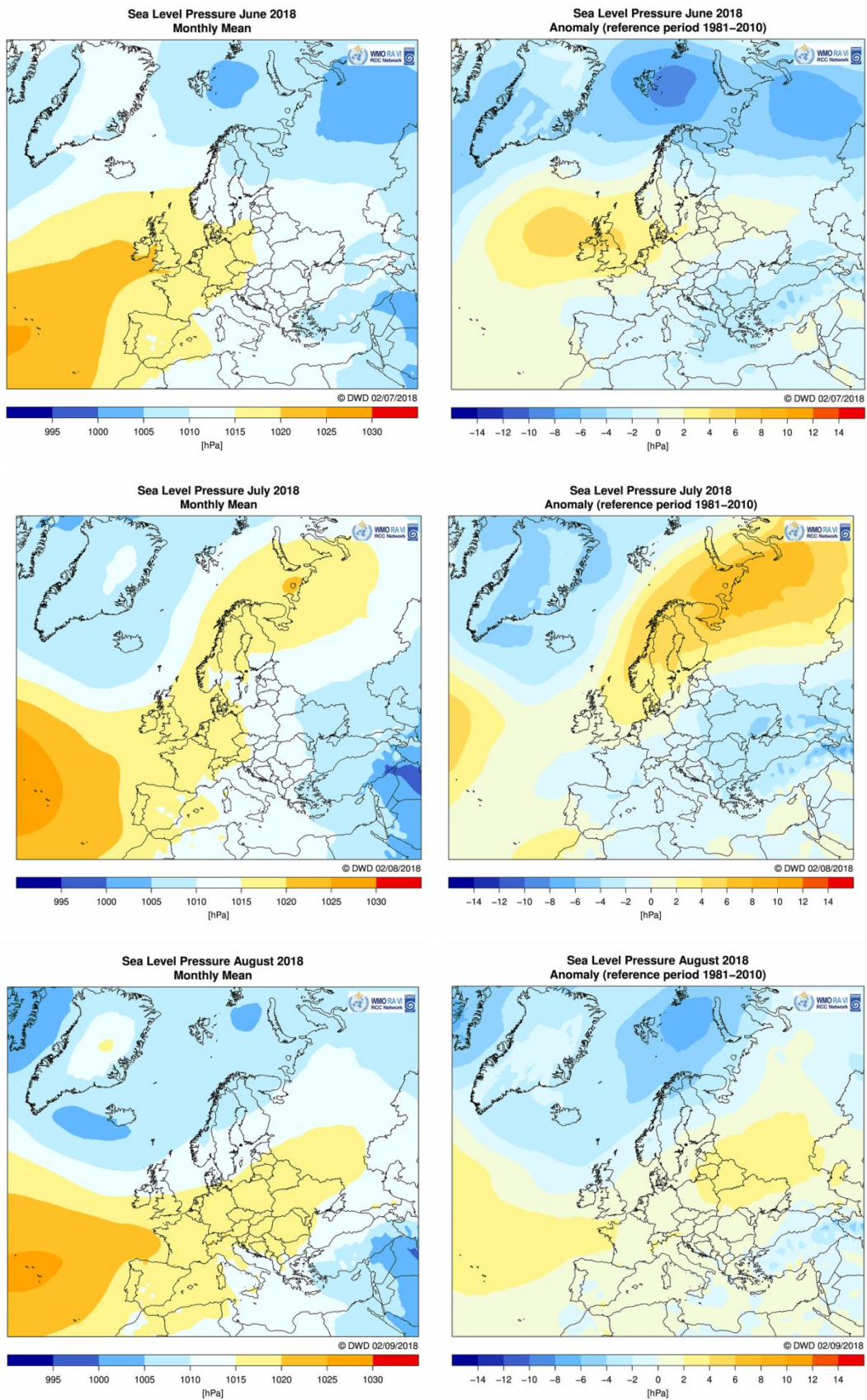


Figure 6: Same as Figure 5, but for the months June-August 2018.

Comparaison entre AnaCEP et clim des regimes d' ETE du trimestre JJA 2018

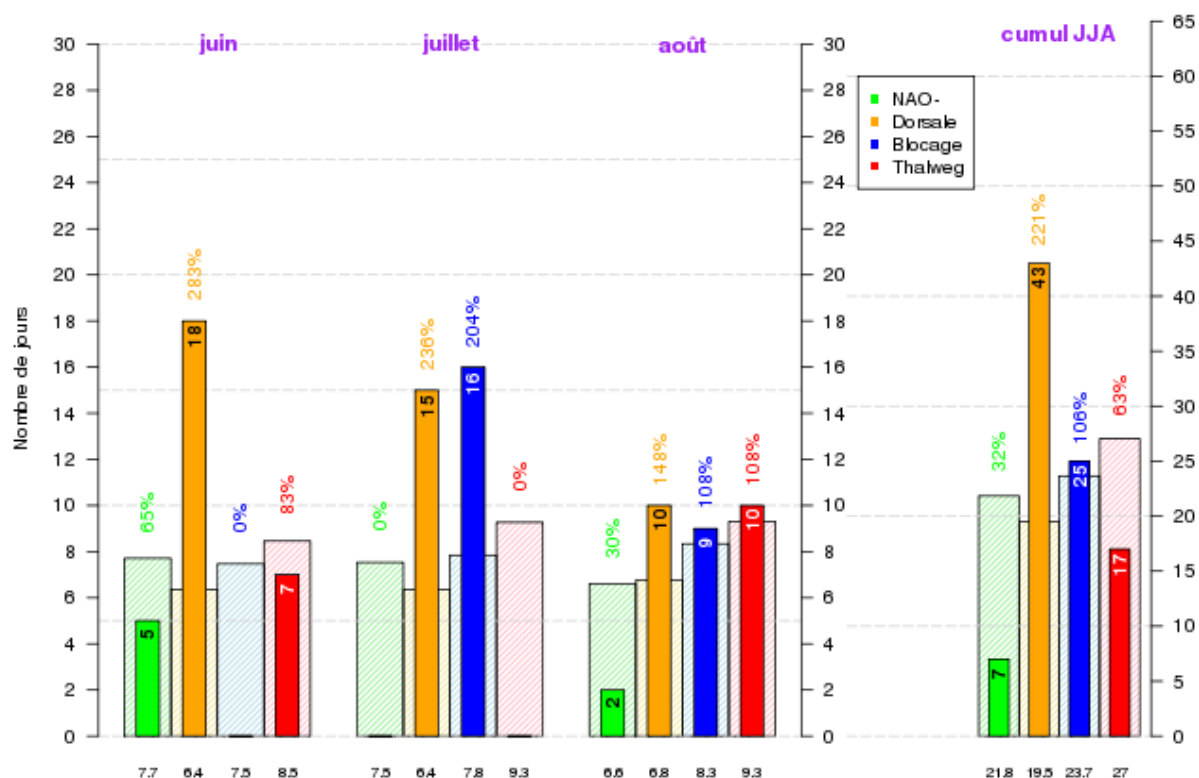


Figure 7: Number of days with circulation types of the Météo France classification for each month of the summer 2018 season and for the whole season (right), and in percent of the climatological frequency distribution 1981-2010. Circulation types are: negative North Atlantic Oscillation phase (NAO-), Atlantic ridge (Dorsale), Scandinavian Blocking (Blocage) and Atlantic trough (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
2018	6	1.41	-0.54	-0.44	0.05	0.66	-0.24	-0.77	-99.90	-0.93	-99.90	51.6
2018	7	1.42	2.36	-0.81	-0.16	-0.76	-2.16	2.27	-99.90	-0.15	-99.90	64.5
2018	8	2.40	1.82	-1.38	-0.78	1.24	-0.47	-1.05	-99.90	0.01	-0.92	58.8

Table 3: Circulation indices of NOAA CPC patterns for the summer months 2018.

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

2.2. Temperature

Europe and Middle East (RA VI)

Much of the domain was warmer than normal with seasonal temperatures in the upper tercile (Fig. 8ff). Especially the northern parts of the domain had a very warm summer; even the 90th percentile was exceeded like in much of Central Europe. France recorded the second warmest summer on record since 1900 behind 2003. In the southwestern half of Iberia, temperatures were in the middle or lower tercile, and also in places in Sicily, the southern Balkan Peninsula and Greece, southwestern Turkey and Middle East the middle tercile was reached. For E-OBS data, even in the latter areas the lower tercile was displayed.

Seasonal temperature anomalies in summer 2018 show a high spatial variability. In most of the domain, they ranged between 0 and +2°C (1981-2010 reference), locally higher. Negative anomalies were recorded in a few places in Iberia, southern Italy and over the central Mediterranean. Seasonal mean temperature for summer 2018 mostly ranged between 20 and 25°C in the lowlands, 15-20°C in most mountainous regions, 25-30°C in parts of Spain, at many Mediterranean coasts, over most of the sea and the islands and in the Middle East, above 30° in some eastern and southern parts of the Middle East.

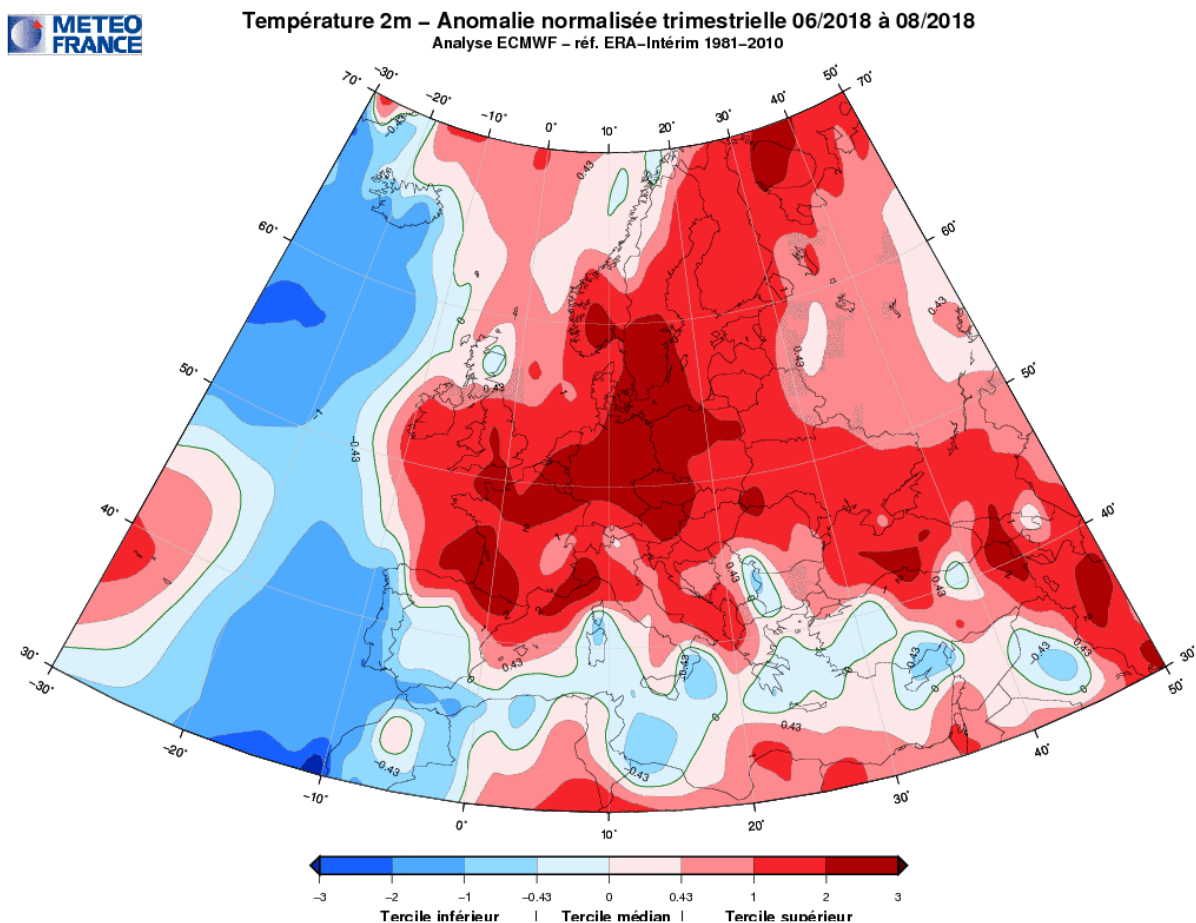


Figure 8: Seasonal normalized temperature anomalies of summer 2018 surface air temperature based on ECMWF / ERA-INTERIM grid data, 1981-2010 reference. The data range between -0.43 and +0.43 represents the middle tercile, below -0.43 the lower tercile and above +0.43 the upper tercile. Source: Météo France, data reference: <http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>

TEMPERATURE JJA 2018 (ERA-Interim data)
(reference period 1981-2010)

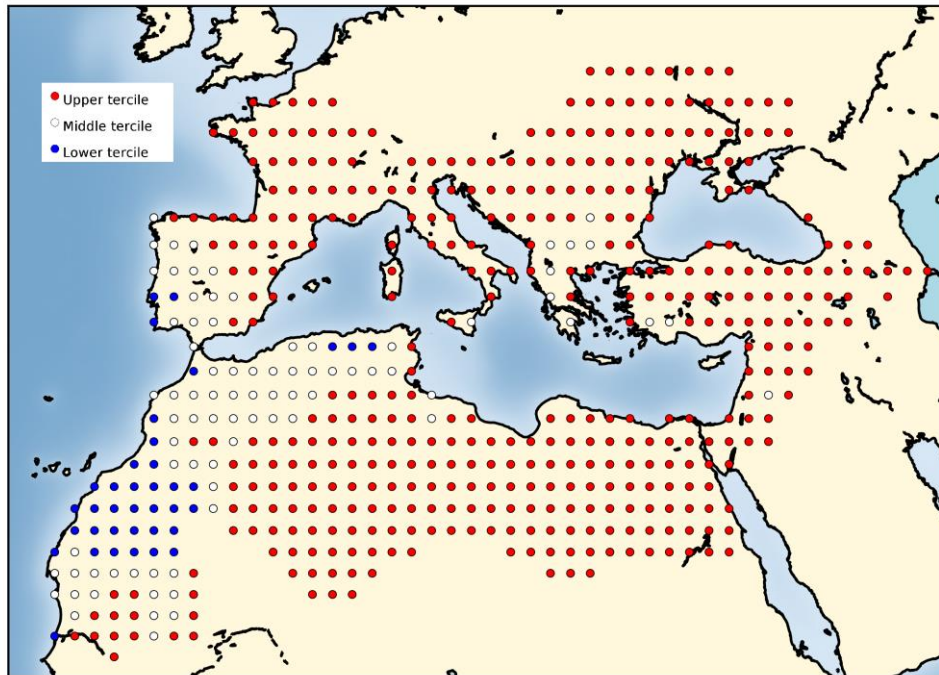
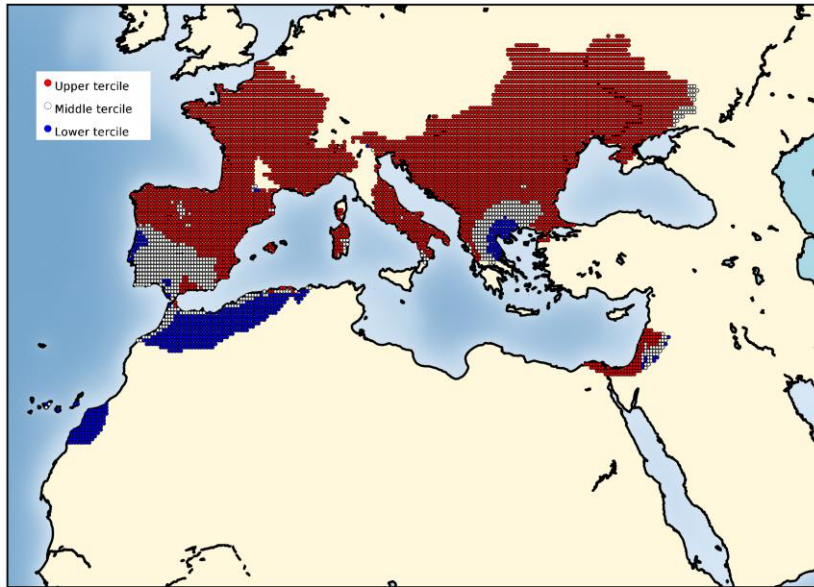


Figure 9: Terciles of summer 2018 surface air temperature based on ERA-Interim Reanalysis, 1981-2010 reference.
Source: AEMET, data source <http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>

TEMPERATURE JJA 2018 (EOBS data)
(reference period 1981-2010)



TEMPERATURE JJA 2018 (ECA&D data)
(reference period 1981-2010)

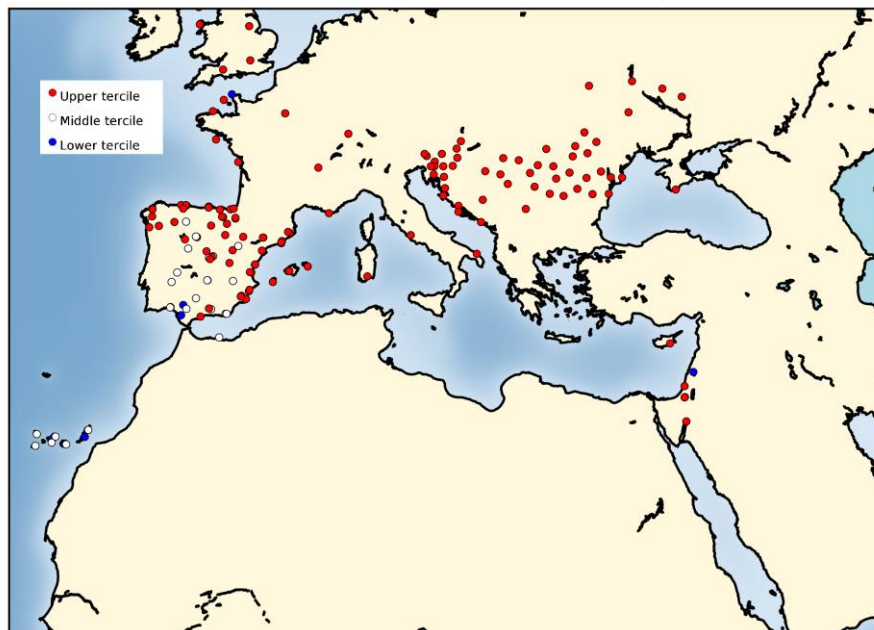


Figure 10: Tertiles of summer 2018 surface air temperature based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Note: E-OBS uses a higher number of stations than those which are freely available at ECA&D. Source: AEMET, data source: <http://www.ecad.eu/>

Temperature Summer 2018 Percentiles (reference period 1951–2010)

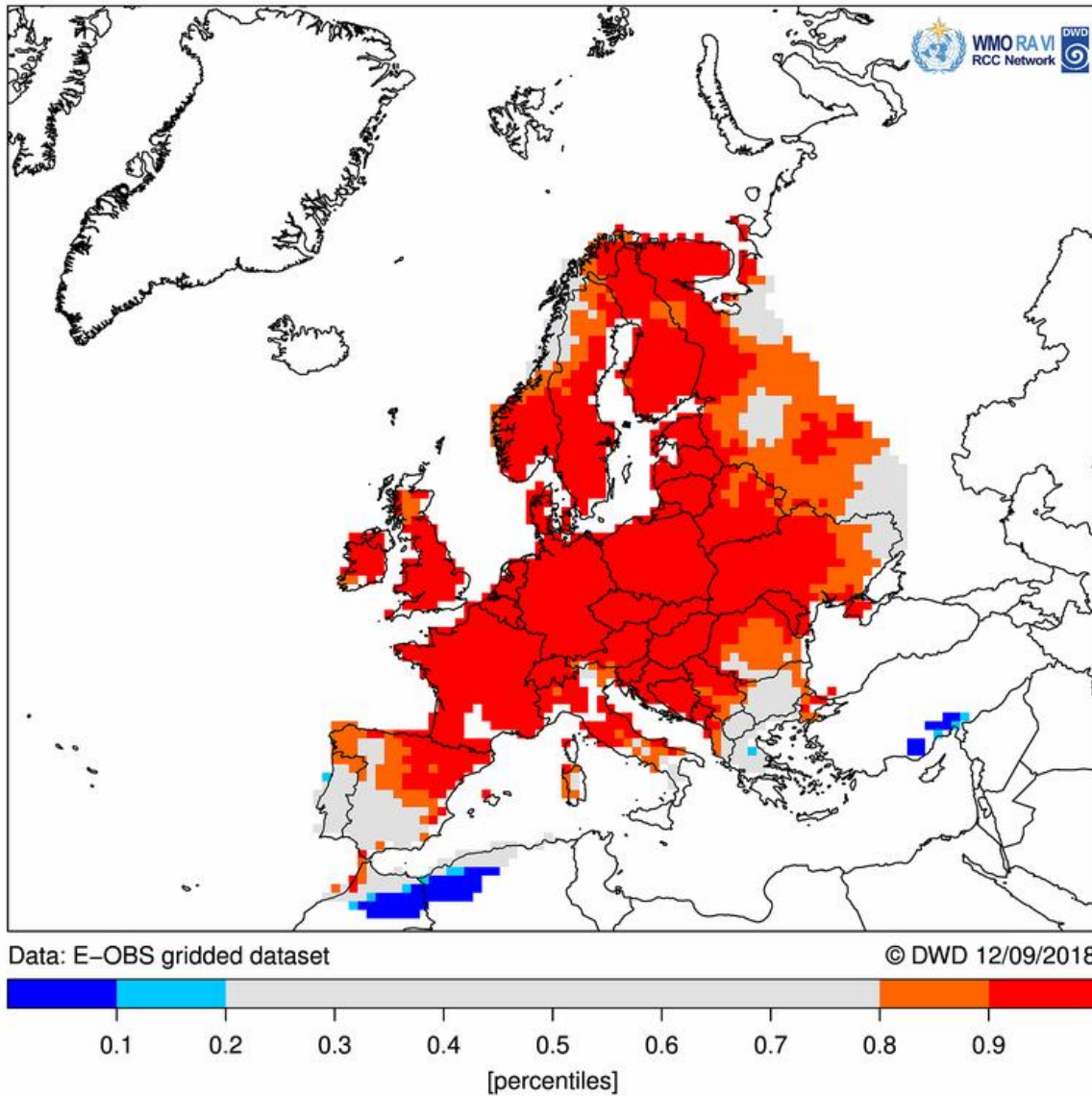


Figure 11: Percentiles of summer 2018 surface air temperature based on interpolated E-OBS gridded data, 1951-2010 reference. Source: DWD, data source: <http://www.ecad.eu/>

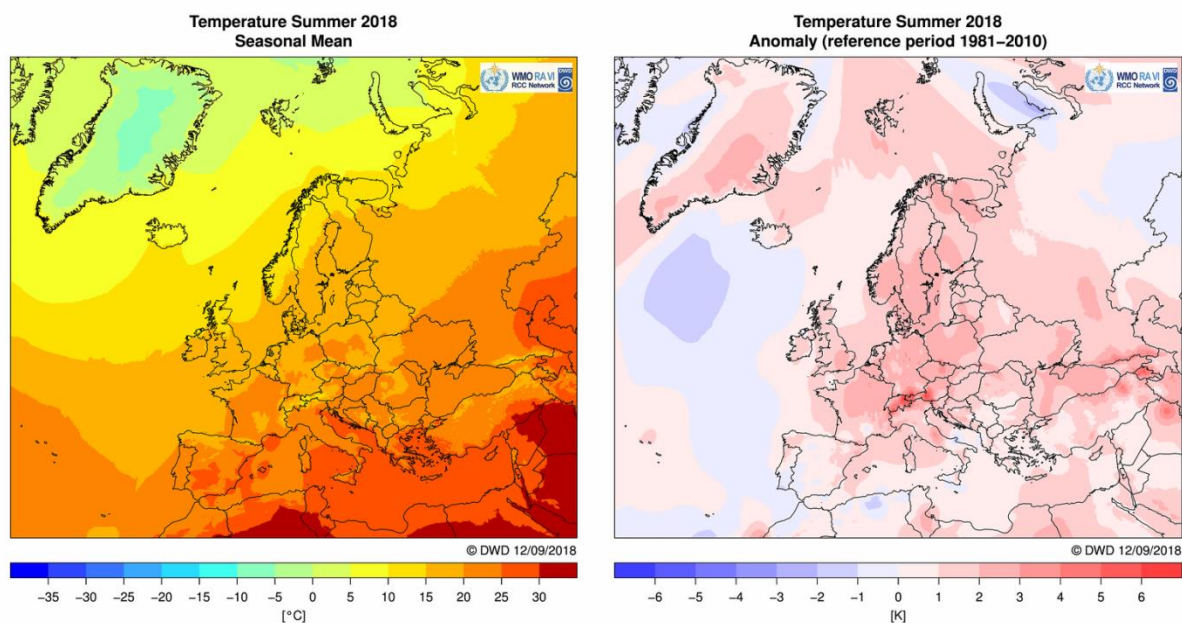


Figure 12: Surface air temperature for summer 2018. Left: seasonal mean, right: anomalies, 1981-2010 reference, source of both maps: WMO RAVI RCC, based on interpolated CLIMAT data, www.dwd.de/rcc-cm

North Africa (RA I)

Summer 2018 was above normal in almost all North Africa. Mean temperatures were ranging between 17°C and 45°C. The seasonal mean temperature was at its minimum over north-western regions and the coastal areas of North Africa.

In Tunisia, the mean temperature of summer 2018 was at its minimum over north-western regions and the coastal areas. The seasonal minimum temperature was 10.5 °C measured in Jendouba. During the summer 2018, the southwest of Tunisia was mainly the hottest region. The seasonal maximum temperature was registered in EL Borma with 40.5°C and the absolute maximum temperature (49.2°C) was registered in Tozeur (south of Tunisia). Temperature was near normal over the north and the center-west of Tunisia. Elsewhere the mean temperature was above normal.

Over Morocco, the mean temperature was near normal to below normal (1981-2010 reference period) except some stations in the northeast (Houceima-Errachidia and Bouarfa) where the temperature was above normal. In fact, some records were broken in July in Errachidia and Bouarfa.

In Egypt the mean temperature was above normal over all 12 stations with except of Port Said.

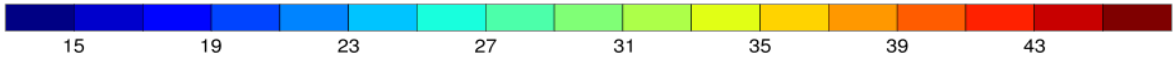
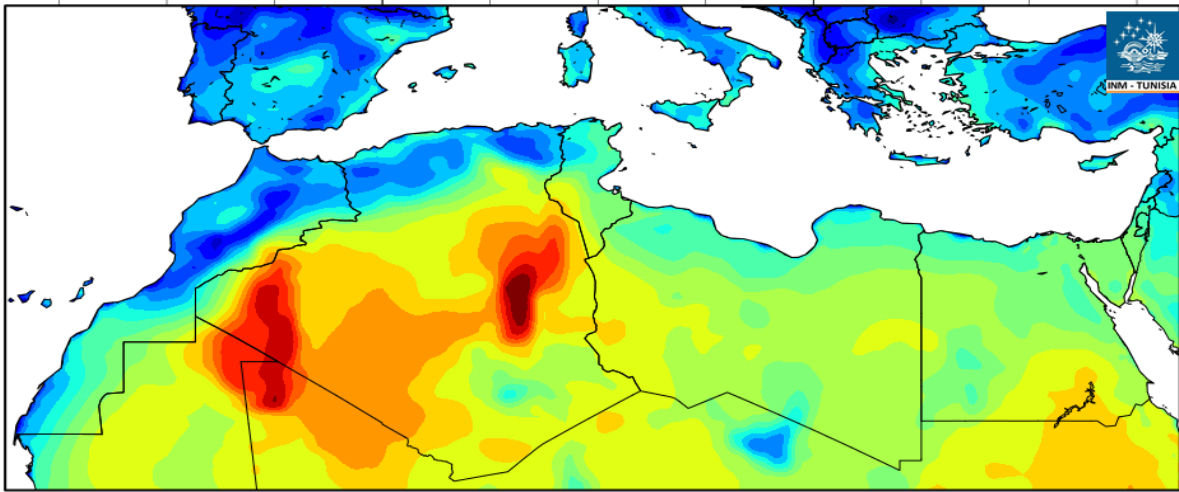
For Algeria, anomalies were below normal over the southwestern regions; elsewhere mean temperature was above normal.

In Libya the mean temperature was above normal.

Most of the domain had temperatures in the upper tercile. Only in western parts, mainly in Morocco, northern Algeria and Tunisia, temperatures were in the lower or middle tercile.

Average Temperature (°C)

Summer 2018



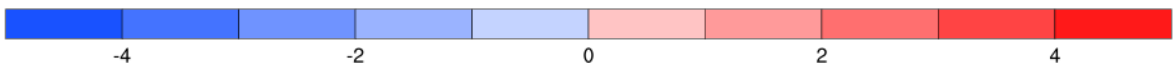
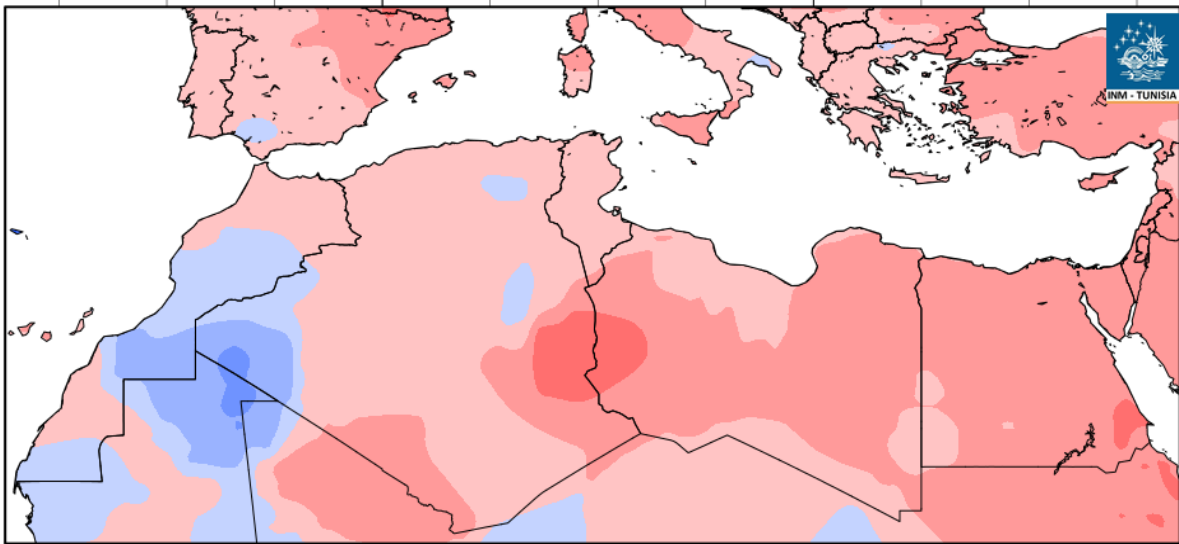
Data Source: NCEP/NCAR-Reanalysis

North African Regional Climate Center
National Institute of Meteorology Tunisia

Figure 13: Mean temperature for summer season 2018 in North Africa (in °C). Source: INM, (Data from NCEP/NCAR reanalysis, <http://www.esrl.noaa.gov>)

Anomaly Temperature in °C (Base period: 1981-2010)

Summer 2018



Data Source: NCEP/NCAR-Reanalysis

North African Regional Climate Center
National Institute of Meteorology Tunisia

Figure 14: Temperature anomaly for summer season 2018 in North Africa (in °C), reference period 1981-2010. Source: INM, Data from NCEP/NCAR reanalysis, <http://www.esrl.noaa.gov>

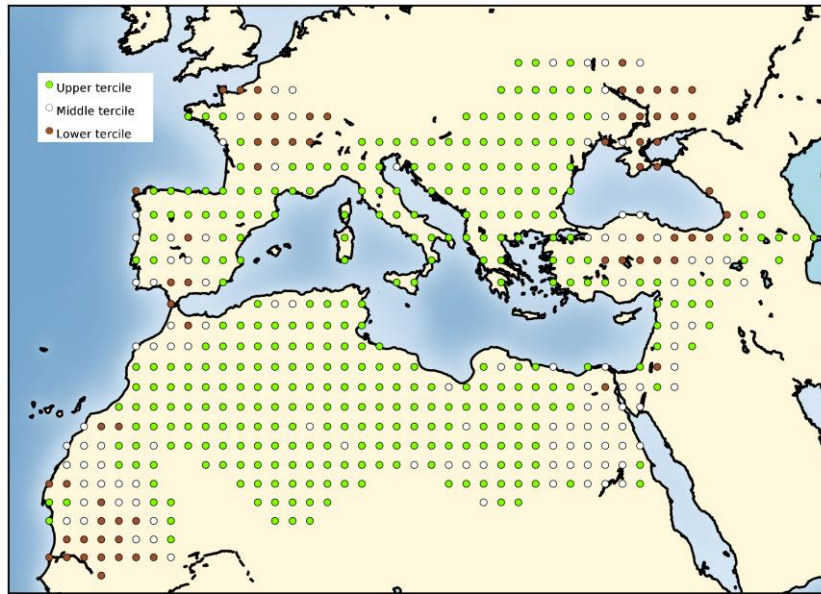
2.3.Precipitation

Europe and Middle East (RA VI)

Correspondent to the cyclonic anomalies over the Mediterranean, much of the domain had a wetter-than-normal summer and most of the area had precipitation totals in the upper tercile (Fig. 15ff). However, there were also areas with around-normal or even below-normal in between, especially in western, central and southern Iberia, central and north-eastern France, eastern Ukraine, western Georgia, parts of Turkey and the Middle East, partly experiencing long drought periods affecting seriously agriculture and water traffic. The wet areas came especially from frequent heavy precipitation over the warm water of the Mediterranean, while the dry areas from partly anticyclonic conditions in Western Europe (Atlantic Ridge) and Eastern Europe (Blocking High). E-OBS shows some additional dry areas, e.g. in Hungary, Slovenia and Croatia, which are not confirmed by ERA-Interim, maybe due to spatial resolution or missing stations. However, looking at anomalies, deviations from normal are relatively low there. GPCC also shows a dry area in eastern Azerbaijan, where data from the other data sets were not available or not complete, and in the western Ukraine.

Highest seasonal precipitation totals in the domain were recorded from areas of the northern and eastern Balkans, Romania, southwestern Ukraine and western Georgia with above 300mm. Much of southern Iberia, the Middle East, Cyprus, parts southern Turkey and eastern Azerbaijan received totals of less than 30mm or no precipitation at all.

PRECIPITATION JJA 2018 (ERA-Interim data)
(reference period 1981-2010)



PRECIPITATION JJA 2018 (GPCC data)
(reference period 1981-2010)

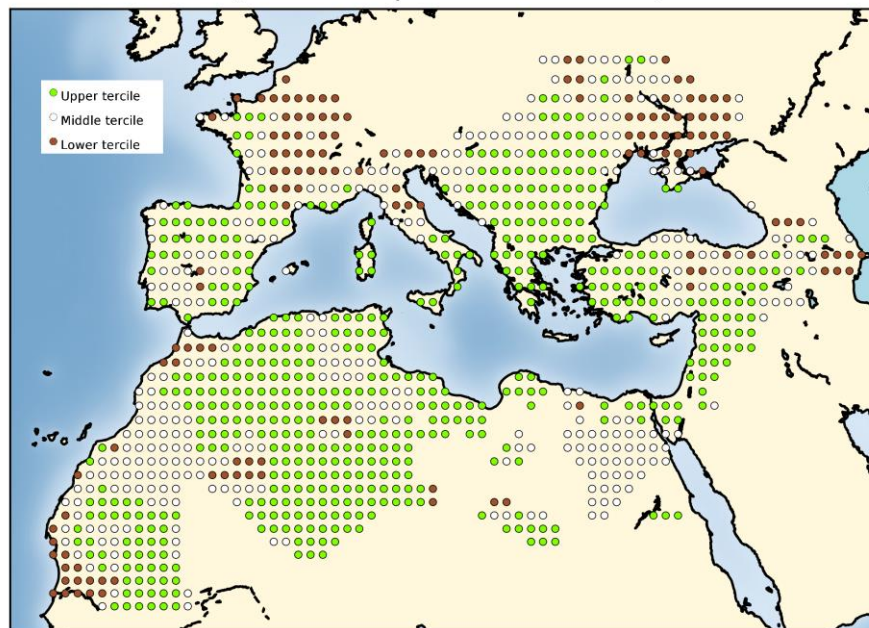
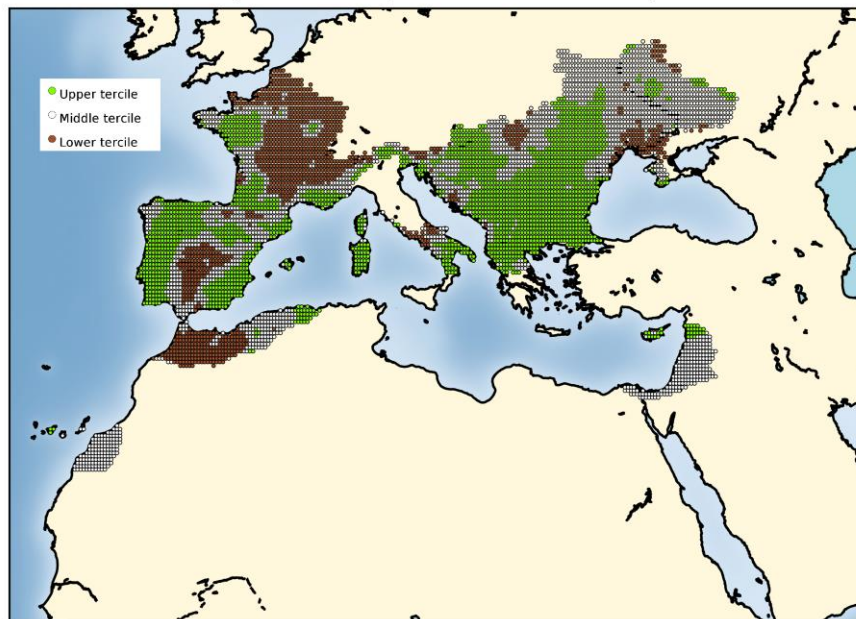


Figure 15: Terciles of summer 2018 precipitation based on ERA-INTERIM Reanalysis (upper graph) and GPCC (lower graph) grid data, 1981-2010 reference. Source: AEMET, data reference: ERA-INTERIM: <http://www.ecmwf.int/en/research/climate-reanalysis/era-interim> , GPCC: <http://gpcc.dwd.de>

PRECIPITATION JJA 2018 (EOBS data)
(reference period 1981-2010)



PRECIPITATION JJA 2018 (ECA&D data)
(reference period 1981-2010)

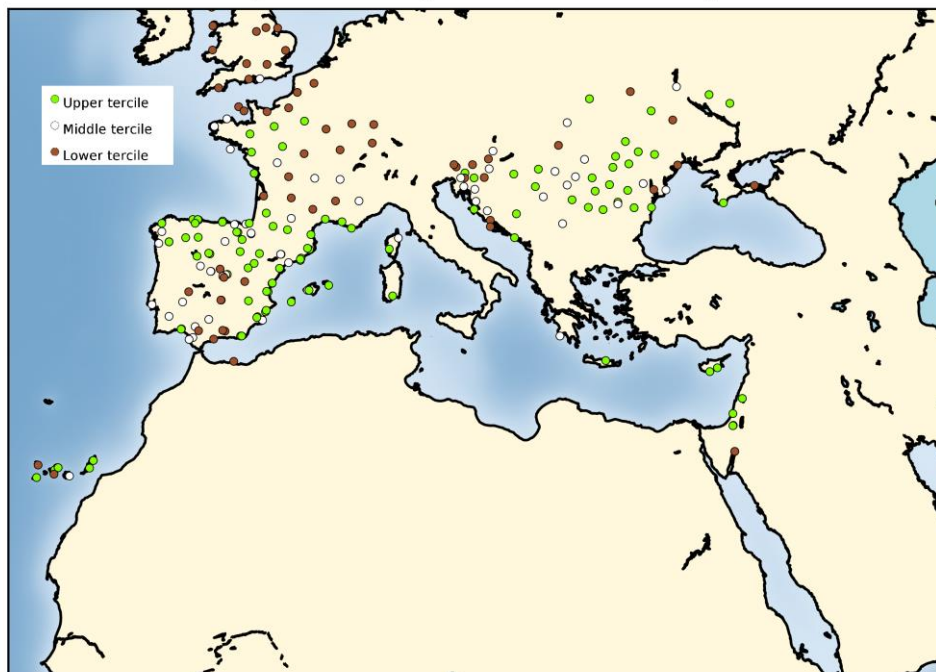


Figure 16: Terciles of summer 2018 precipitation based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Source: AEMET, data source: <http://www.ecad.eu/>

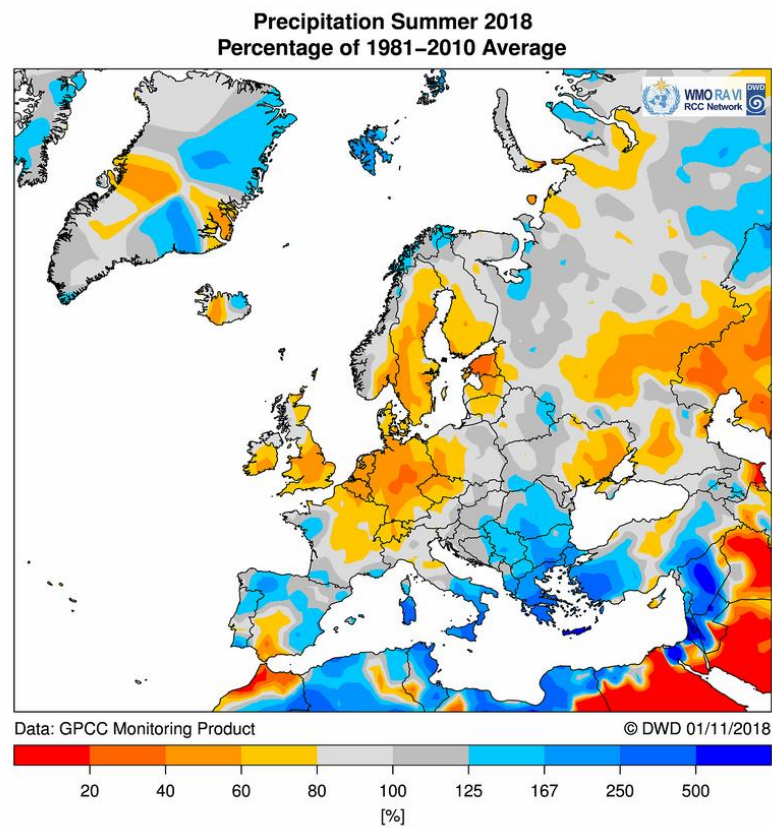
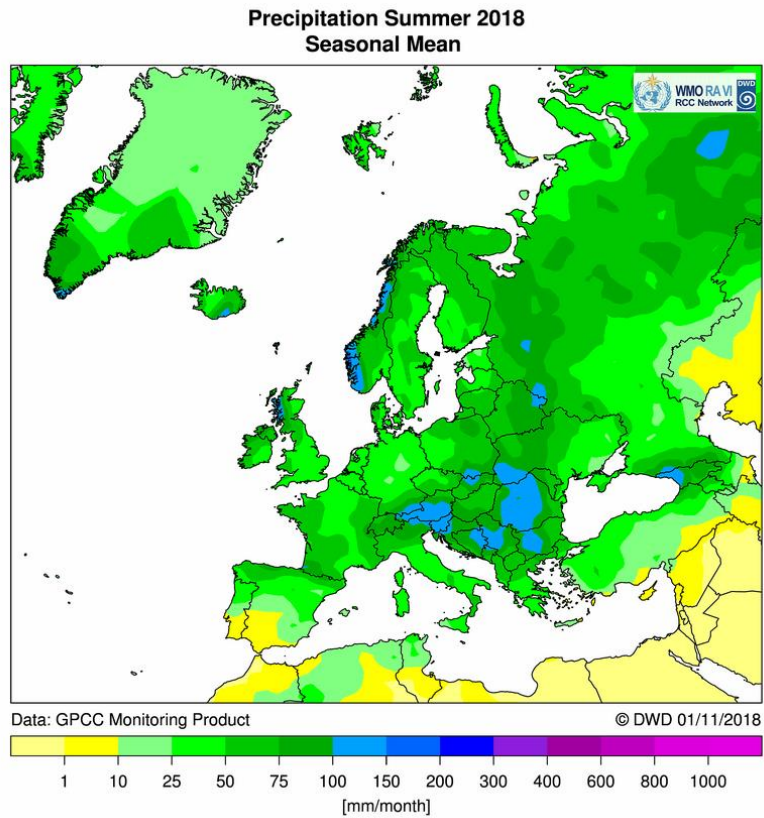


Figure 17: Precipitation for summer 2018 in Europe. Upper map: seasonal total in mm/month, lower map: percentage of 1981-2010 average, source: WMO RAVI RCC, www.dwd.de/rcc-cm, data source: GPCC, <http://gpcc.dwd.de>

A more detailed analysis for south-eastern Europe, including high impact events, is given in the analysis and verification report of the SEECOF-19 CLIMATE OUTLOOK for the 2018 summer season for southeast Europe (SEE), provided by SEECOF-20 (presently draft version):

<http://www.seevccc.rs/SEECOF/SEECOF-20/Pre-COF/Draft-Version-Final-assessment-of-SEECOF-19-climate-outlook-for-summer-season.pdf>

North Africa (RA I)

The seasonal amount of precipitation ranged from 0 mm in the south of Egypt and more than 140 mm in the extreme north of Tunisia. Precipitation in Tunisia was at its maximum in the coastal regions. Extreme values were registered at Bizerte station in the extreme north such as the highest 24-hour total precipitation with a total of 87.2 mm.

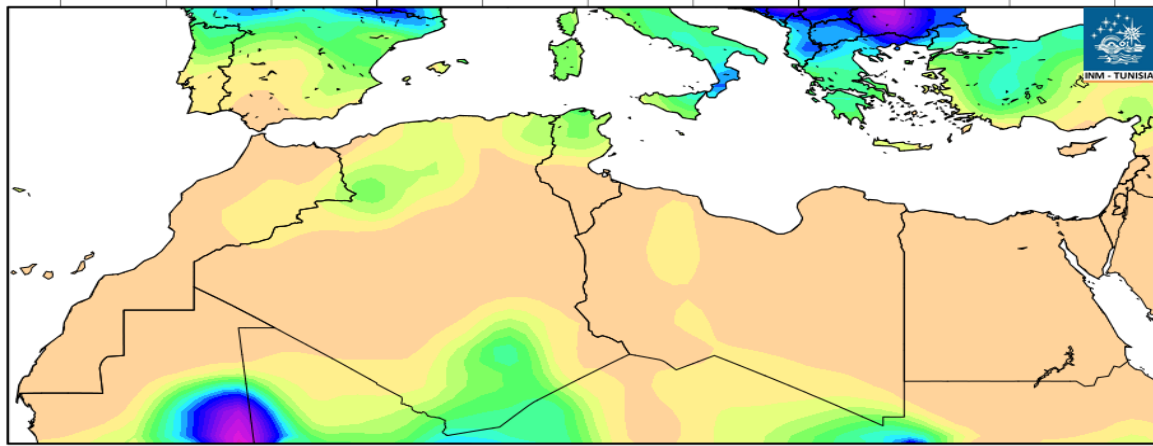
In Tunisia with reference to 1981-2010 period, total precipitation was above normal in the east of the country, below normal in some stations in the north and southwest. Elsewhere, precipitation was near normal to below normal.

In Morocco, total precipitation was normal to below normal over the country with exception of Marrakech, Tangiers, Errachidia and Bouarfa. These stations had known above-normal rainfall due to convective instability near mountains.

In general, Egypt was marked by dry summer season. Summer precipitation during 2018 was below normal over most of synoptic stations except Port Said station, which was above normal.

Summer 2018 was wetter than normal over the west and south-east of Algeria and the east of Morocco. Over most of Libya the precipitation was above normal. Precipitation was below normal over Eastern Libya and most of Egypt. Elsewhere, precipitation was in the near-normal to below-normal terciles.

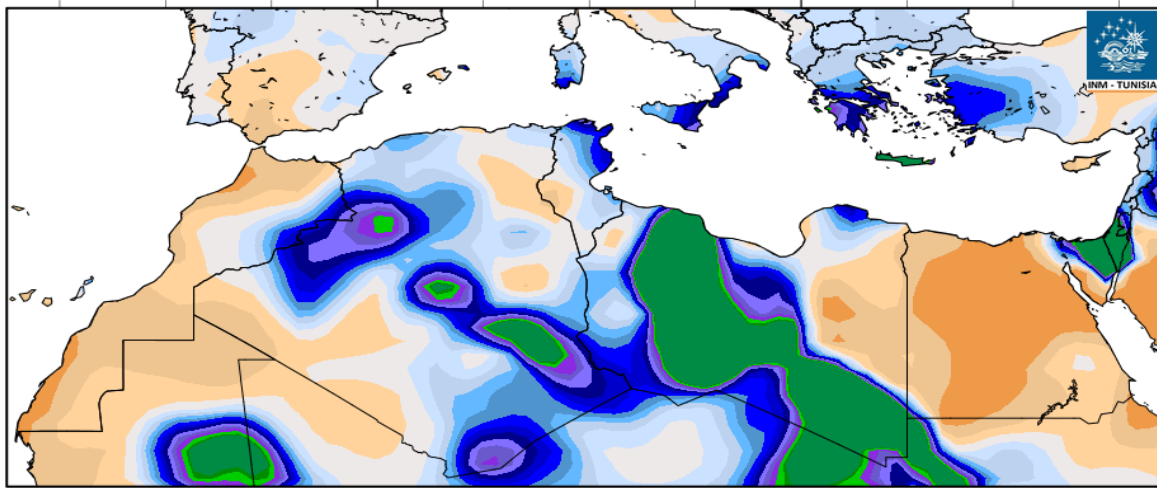
Accumulated Precipitation (mm)
Summer 2018



Data Source: GPCC First Guess Product
North African Regional Climate Center
National Institute of Meteorology Tunisia

Figure 18: Total precipitation for summer season 2018 in North Africa (in mm). Source: INM, Data from GPCC (First Guess Product), <http://gpcc.dwd.de>

Precipitation Anomaly in % (Base Period: 1981-2010)
Summer 2018



Data Source: GPCC First Guess Product
North African Regional Climate Center
National Institute of Meteorology Tunisia

Figure 19: Precipitation anomaly for summer season 2018 in North Africa (in %) (Reference period 1981-2010). Source: INM, data from GPCC, <http://gpcc.dwd.de>

4. Verification of the MedCOF-10 climate outlook for the 2018 summer season

4.1. Temperature

Europe/RA VI

The MedCOF-10 outlook favored the upper tercile for the whole domain except westernmost parts (northwestern half of France and Iberia without the east). In the latter areas the lower or middle tercile was equally preferred.

The warm scenario was predicted correctly for most of the domain. Some areas close to the Mediterranean basin, however, had seasonal averages in the middle or lower tercile, which were not captured by the outlook. The reason might be frequent low pressure areas over the warm Mediterranean water, which produced cooling.

The cold or normal scenario for the westernmost parts of the domain was well predicted for Iberia but not further north in western France, where it was warm instead. A reason might be subsidence warming due to an anomalous extension of the Azores High, which was underestimated in the outlook in its spatial extension.

North Africa (RAI)

The MedCOF-10 climate outlook for the 2018 summer season favored above-normal temperature over the North Africa region with probability of 70% at the coastline east of Tunisia, the north of Libya and the north of Egypt, and with 50% probability elsewhere.

In fact, in almost all regions of North Africa, temperature anomalies were normal to above normal. Maximum anomalies were recorded over the south and west of Algeria, most of Libya and Egypt. Normal to below-normal anomalies were observed over Morocco except some stations. Elsewhere temperatures were in their normal tercile.

This indicates that the MedCOF-10 climate outlook for the summer season temperature has correctly predicted positive anomalies, although some different temperature detail aspects were observed over the North Africa region.

4.2. Precipitation

Europe/RA VI

MedCOF-10 outlook favored a dry scenario (lower tercile) over most of the domain. For western and southern Iberia, Greece, most of Turkey (except Black Sea coast), South Caucasus, Middle East, Cyprus no signal was given, which means climatology was recommended.

The outlook failed in most of the domain. The dry scenario was correctly predicted only for some of the northern parts, particularly in France, northern Italy and the Ukraine. In contrast, much of the domain, especially the southern parts had above-normal precipitation, which was not predicted by the

outlook. A reason might be that the dry area due to high pressure influence was shifted further to the north than expected and precipitation in Mediterranean cyclonic systems over warm water was more intense than expected. However, it has to be considered that the given probability was relatively low with 45% for the dry scenario, which implies uncertainty due to model disagreement. Also especially in some drier regions in the south, the deviations from normal were very small.

North Africa

Over the North African region, there was no preference category.

Summer 2018 was wetter than normal over most of Algeria, Libya and Tunisia, at some stations in the east of Morocco and northeast of Egypt. Precipitation was below normal over west of Libya and most of Egypt.

MedCOF-10 precipitation prediction didn't give valuable information.

4. Users' perceptions of the MedCOF-10 outlook

In most of RA VI feedback was not available. Not all countries provide a national seasonal outlook for external users. In North Africa, no feedback was given by users.

AEMET (Spain) provides seasonal forecasts to the general public on AEMET webpage and on MedCOF webpage.

Croatian Meteorological Service provides seasonal forecast to Croatian Civil Protection (Sector for firefighting in summer season), to Croatian Water Management and in different form (adjusted format) to general public on its web page.

Appendix A: Contributors to verification of MEDCOF-10

- World Meteorological Organization as initiator and supporter of this activity

Europe and Middle East (RA VI)

- Climate Centres:
 - WMO RA VI RCC Offenbach Node on Climate Monitoring, Deutscher Wetterdienst, Germany
 - South East European Virtual Climate Change Center hosted by Republic Hydrometeorological Service of Serbia, Republic of Serbia
- National Meteorological and Hydrological Services:
 - Federal Hydrometeorological Institute, Federation of Bosnia and Herzegovina
 - Meteorological and Hydrological Service of Croatia, Republic of Croatia
 - Météo France, Republic of France
 - National Environmental Agency (NEA), Georgia
 - Deutscher Wetterdienst, Federal Republic of Germany
 - Hellenic National Meteorological Service, Greece
 - Republic Hydrometeorological Service of Serbia, Republic of Serbia
 - AEMET, Spain
 - Turkish State Meteorological Service, Republic of Turkey
 - Ukrainian Hydrometeorological Center, Ukraine
- **Further National Meteorological and Hydrological Services via SEECOF-20:** <http://www.seevccc.rs/SEECOF/SEECOF-20/Pre-COF/Draft-Version-Final-assessment-of-SEECOF-19-climate-outlook-for-summer-season.pdf>

APPENDIX B: Analysis and verification of the MedCOF-10 climate outlook for the summer season 2018:

Verification summary based on the national reports and contributions of the participants of the SEECOF-20 and MedCOF-11 meetings

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Albania *	Above normal	Above normal	Above normal	No signal	No events
Armenia (1)	Above normal	Above normal	Below normal (extremely dry)	No signal	Heat Wave was observed in the period from the end of June until the end of August. The maximum temperature of 43.7 C was observed on July 12 in Yerevan. Drought was registered from 21st June up to the 24th October Wind storm: On 17th August, strong wind (25m/sec) was observed in Gumry. Extreme precipitation (41mm/hour) was recorded on 6th July in Shirak region. Forest fires: Vayots Dzor region (July, August)
Azerbaijan *	Above normal	Above normal	Below normal	No signal	No events

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Federation of Bosnia and Herzegovina (1)	Above normal in whole country (Bosnia and Herzegovina)	Above normal (20, 30, 50)	Above normal in the center of Bosnia and Herzegovina, Below normal in the southwest of Bosnia and Herzegovina	Below normal (45, 35, 20)	June – Extremely warm (Bugojno, Drvar, Gradacac, Livno, Neum and Zenica) July – Extremely wet (Zenica). 1st wettest July for Zenica. August – Extremely warm (Bihac, Bugojno, Gradacac, Neum, Sanski Most, Tuzla and Zenica) 7th warmest for Gradacac.
Rep. Srpska, Bosnia and Herzegovina (*)	Above normal	Above normal (20, 30, 50)	Above normal	Below normal (45, 35, 20)	No events
Bulgaria (1)	Near or above normal	Above normal	Above normal	Near or below normal	June and July 2018 were very wet.


Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Croatia (1)	Above normal	Above normal (20,30,50)	<p>Below normal (the wider areas of the city of Zagreb, part of the Northern, Middle and Southern Adriatic and their hinterland)</p> <p>Above normal (the wider areas of the towns of Osijek and Šibenik)</p>	Below normal (45,35,20)	<p>Summer 2018 was extremely warm in the whole country.</p> <p>Two heat waves were observed during summer – both in August, but here were no temperature records observed. In all three months convective related severe weather phenomena (thunderstorms, hail, heavy rains, flash floods, waterspouts) were observed mostly all over Croatia.</p>

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Cyprus (5)	<p>June Normal</p> <p>July Above Normal</p> <p>August Above Normal</p>	above normal	<p>June Above Normal</p> <p>July Below normal</p> <p>August Below Normal</p>	No signal	<p>June</p> <p>June ranked as 6th from all Junes available in high accumulated precipitation, (mean area average accumulated precipitation) a record of 27.1mm of accumulated precipitation resulting to 411% of the climatological precipitation (6.6mm).</p> <p>The accumulated precipitation was a result of local thunderstorms the period from the 1st to the 5th and from the 11th to the 19th of June which in some cases were accompanied by hail. These thunderstorms caused serious damages in agriculture.</p> <p>July</p> <p>Except the highest daily maximum temperature of Prodromos that was 33.7°C (with a normal of 27.9°C), note the highest daily maximum of Larnaka and Achna that was 37.8°C and 38.5°C respectively (with normal of 32.5°C and 33.2°C).</p> <p>Highest daily minimum temperatures like Polis Chrysochous, where a minimum of 27°C was by 5.9°C above station's normal (21.1°C) and the station of Larnaka, where a minimum of 27.3°C was by 5.3°C above station's normal (22°C).</p> <p>August</p> <p>Extremes were recorded with positive departures higher than 4°C Generally, the highest monthly maximum of 41.1°C was recorded on 1st of August over the inland station of Athalassa breaking the previous record of 36.9°C.</p> <p>Daily minimum temperatures were also recorded, like Prodromos, where a minimum of 12.9°C was 5.2°C below station's normal (18.1°C), a negative departure greater than 4°C.</p> <p>On the 2nd, 4th, 5th, 7th, 8th and 21st of August episodes of local showers and isolated thunderstorms resulted in accumulated precipitation of 55% of normal.</p>

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
France (5)	Mean anomaly of +2.0°C (second warmest summer since 1900) reaching +2.4 °C in the northeast of the country	Probability for the warm tercile in the eastern part of the country (50 %)	Mean anomaly of -10% for France (threshold between “below normal” and normal tercile) , but mean anomaly of -40 % in northeastern France and +75% in the East Mediterranean area	Dry tercile (45%)	<p>Heat wave 24 July-8 August, exceptional, mostly in the northeastern part and Mediterranean area, more intense than that 2006 (10-30 July), but less intense than the 2003 heat wave (2-17 August).</p> <p>Hot, sunny and dry summer in the northeast of the country, sunshine reached exceptional values, near values of summer 2003. Temperatures 2 to 3°C above normal. Rainfall deficit from 30 to 50%, strong dewatering of shallow soils.</p> <p>Many thunderstorms with intense rainfall. Summer 2018 has been one of the stormiest summers of the last 20 years, as summers 2013 and 2006. Floods and overflows in Bretagne, Normandy, west of Pyrénées (June). Up to 20 cm thick hail in the department of Jura (20 July). Floods in the Parisian region (27 July). Hailstones 5 cm in diameter in the southwestern part (12 August).</p>
Georgia (1)	Above normal	Above normal	Near the norm and above the norm in most of the territory of west Georgia, and above the norm over all Georgia	No signal	No events

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Greece (2)	Above normal relative to the period 1971-2000, especially in the areas of Aegean and Ionian Sea and closer to normal values in central mainland.	Above normal (70 % above normal, 20% around normal and 10% below normal).	Above normal especially in the central and southern areas of Greece as well as in the Ionian Sea islands.	Below normal conditions for the northern and central parts of Greece (45% below normal, 35% around normal, 20% above normal). No clear signal for the southern parts of the country.	<p>June 2018:</p> <ul style="list-style-type: none"> • During 2-3/6 two people lost their lives due to thunderstorm in the areas of Kozani and Thessaloniki. • On 23 of July strong westerly winds caused destructive wildfires in the eastern parts of Attica and Peloponnese region. The worst incident took place in the area of Mati in the region of Attica, where a major destructive wildfire, due to very strong westerly winds, caused the death of 99 people while 164 people were injured. • During 25-29/6, heavy rainfall affected several areas of Northern and Central Greece. Flash flooding occurred in the area of Mandra in Attica region that caused destructions.
Hungary*	Above normal	Above normal	Around normal	Below normal	No events
Israel (5)	Above normal	Above normal (10, 20, 70)	No precipitation	Dry season masking	No high impact events

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Italy*	Above normal, in the south normal to below normal	Above normal	Southern parts, Sardinia, Liguria above normal, other parts mostly around normal, locally below normal	Below normal	No events
Jordan*	Above normal in the west, around normal in the east	Above normal	Above normal, but arid region	Dry season	No events
Lebanon *	Around normal in the north, above normal in the south	Above normal	Above normal, but arid region	Dry season	No events
The Former Yugoslav Republic of Macedonia (5)	Normal	Above normal (10, 20, 70)	Above normal variable precipitation regime	No predictive signal (33, 34, 33)	June - Exceeded daily precipitation 39.6mm on 15th in Skopje

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Montenegro (1,5)	<p>Above normal</p> <p>very warm in NW parts to extremely warm from N-NE to coastal region</p>	<p>Above normal</p> <p>(10, 20, 70)</p>	<p>Below normal</p> <p>dry in the belt from the central to coastal area</p> <p>Normal</p> <p>in most of the country</p> <p>Above normal</p> <p>wet in the N and E mountainous region</p>	<p>No predictive signal</p> <p>(33, 34, 33)</p>	<p>1. HEAVY PRECIPITATION followed by wind and hail 13.06.2018:</p> <p><u>Rozaje</u>: a lot of water on the streets – difficulties with the traffic;</p> <p><u>Niksic</u>:</p> <p>- around 105 mm of rainfall accompanied by hail in approximately one hour affected agriculture, moreover streets were flooded, traffic was disrupted in the city and its surroundings, problems with energy supply, basements were under the water, roofs were damaged.</p>  <p>Source: Svetlana Mandić, daily newspaper „Vijesti“ http://www.vijesti.me/vijesti/pogledajte-u-niksicu-grad-padao-gotovo-sat-nevrijeme-unistilo-baste-ulice-pop-992563</p> <p>2. Slow onset of hydrological DROUGHT:</p> <p>-from central to southern parts of the country (Podgorica, Bar, Ulcinj) consecutive decrease of water level in the rivers, see http://www.meteo.co.me/misc.php?text=135&sektor=1</p>

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Portugal *	Below normal	Normal or below normal	Normal to above normal	No signal	No events
Romania *	Above normal	Above normal	Mostly above normal	Below normal	No events
Serbia (1,5)	Above normal in almost entire Serbia	Above normal (10, 20, 70) in entire Serbia	Above normal in most of Serbia, except in north-eastern part	Below-normal (45, 35 20) in entire Serbia	<p>* Summer 2018 The 10th warmest summer for Belgrade. The 6th wettest summer for Serbia. The warmest summer for Serbia based on the minimum air temperature. There were 74 days with apparent temperature above 30 degrees, which is 7 days more compared to the previous summer which ranked as the second warmest since 1951 up to date.</p> <p>* June The second wettest June for Zlatibor, third wettest for Veliko Gradiste. On June 30, Novi Sad observed record-breaking daily precipitation sum for June. Sjenica registered 27 rainy days, thereby breaking the previous record</p> <p>* July 7th wettest July for Serbia, wettest on record for Kraljevo, 2nd wettest for Pozega, Sjenica and Kopaonik. Record-breaking number of days with precipitation above 0.1 mm registered at 6 MMS.</p> <p>* August August 2018 was the 3rd warmest for Palic and 4th warmest for Banatski Karlovac. The wettest August on record for Crni Vrh. Record-breaking daily precipitation sums in Zrenjanin and Crni Vrh. The number of tropical nights was surpassed in Sombor, Palic and Belgrade.</p>

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Slovenia (5)	Warmer than normal	Warmer than normal	Drier than normal in the north wetter than normal in the south-east and central Slovenia	Drier than normal	Ranks in the 5 warmest summer seasons since 1961. August among 5 warmest since 1961. Precipitation normal for the whole country but wetter than normal in the south-east and central Slovenia and drier than normal in the north of the country. On 8 June, thunderstorm with very large hail (up to 10 cm) damaged more than 1000 buildings and great number of vehicles in Bela Krajina (south-east of Slovenia).

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Spain (5)	<p>Summer 2018 (1 June-31 August 2018) was characterized by warm conditions. Average temperature over Spain was 23.6 °C, 0.6 °C above summer average (reference period: 1981-2010), with this summer ranking as the 13th warmest for Spain (dating back to 1965) and the eleventh warmest from the beginning of XXI century.</p>	<p>Warmer temperatures above normal are favored over most of Eastern MedCOF domain. Models still show relatively high probability of warm tercile over the rest of MedCOF area, with less agreement for the Western End of it. On the other hand, some models forecast below normal temperatures over Atlantic Ocean and western shores of Morocco and Mauritania, which is consistent with SST anomalies.</p>	<p>Overall, summer was very wet though prone to wet, with a mean precipitation over Spain of 91 mm, 22% wetter over the 1981-2010 season average. June was very wet with precipitations very high over the normal value of the season (61 % wetter than normal); July was wet (5% wetter than normal) and finally, August was normal. (Though it was less than 11% of the normal value of the month).</p>	<p>Drivers like TASI and TNA suggest drier than normal summer over countries north of Mediterranean and Black Seas, and North Eastern Iberian Peninsula. For the rest of the region no large-scale precipitation signal is present in the forecasts.</p>	<p>During the 2018 summer, there have been several warm events, emphasizing this taking place on: a) August (1-7), were both maximum and minimum temperatures were well above than normal for this season of the year, exceeding 40 °C in wider parts of southern and central areas of mainland Iberia; exceeding 45 °C in some stations of Andalusia and Extremadura. Based on the available temperature registers, one can talk in a provisional way, that a heat wave has been taken place during the 1-7 August, b) other warm events, though less intense took place b1) second part of June and b2) July (28-31). There is worth mentioning the cold event affecting the first fifteen days of June, with temperatures extremely low, especially as regards maximum temperatures for this season of the year.</p> <p>Regarding heavy precipitation events during the summer, there have been several events, the most noticeable were: a) in June, from 1st to 3rd, precipitations affected Iberian Peninsula and Balearic Islands, being especially heavier around Sistema Ibérico, eastern and southeastern mainland Spain, b) in June, from 28th to 29th, with precipitations in the northern third of mainland Spain, especially heavier in northern Catalonia and in an area located between Teruel and Castellon.</p> <p>In July, a) from 11th to 12th with precipitations in the Cantabrian fringe and northeastern quadrant and b) from 15th to 20th, with precipitations in the third northern fringe, being heavier in eastern Galicia and northeastern Catalonia.</p> <p>In August, a) from 15th to 17th, precipitations affected much part of IP, being more heavier in northern Catalonia, center and south of Aragon, southeastern mainland Iberia and Balearic Islands.</p>

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Syria *	Around normal, in the southwest above normal	Above normal	Above normal, but arid region	Dry season	No events
Turkey (5)	Above normal	For western part of country: 70% above normal, 20% normal, 10% below normal For eastern part of country: 50% above normal, 30% normal, 20% below normal	40% higher than normal	45% below normal, 35% around normal and 20% above normal (at the northern coast) 33% below normal, 34% normal and 33% above normal (in the whole country except the northern coast)	<ul style="list-style-type: none"> • June 2018 was the fifth hottest June in the long term period (1971-2018). • July 2018 was the sixth hottest July in the long term period (1971-2018). • August 2018 was the tenth hottest August in the long term period (1971-2018). • 8 stations reached new maximum temperature record in June 2018. • 5 stations reached new maximum temperature record in July 2018. • In June 2018, hail caused damage in agricultural areas in 3 provinces (in the western part of Turkey). Lightning damaged livestock in one city during thunderstorm. • In July 2018, heavy rain caused difficulties in transportation in İstanbul. • In August 2018, lightning damaged livestock. In Ordu province (Black Sea Region) 3 days of heavy rain caused landslide and one person lost his/her life.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Ukraine (1,5)	above normal	above normal	below normal (38% stations) normal (35% stations) abow normal (27% stations)	below normal 45% normal 35% above normal 20%	<p>During the summer season, meteorological extraordinary phenomena were observed in many regions of the country.</p> <p>Very heavy rain (30-98 mm precipitation per 2-10 hours) was recorded in Novodnistrovsk (116 mm per 13 hours), showers (30-42 mm per hour), squalls (speed 25-38 m/s), big hail (diameter 22-35 mm), tornado 29/06/2018 in Zaporizhya region.</p> <p>Unfavorable weather conditions locally caused power loss, damage of telecommunications, utilities and transport.</p> <p>August was arid in most regions of Ukraine and in the southern and the eastern parts were areas without precipitation at all.</p> <p>The highest daily precipitation of all observations was recorded in Rahiv (Zakarpattya region) – 82 mm on 17 th of August and in Selyatyn (Chernivtsi region – 98 mm) on 26 th of August.</p>

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

*Data base: ERA-Interim 1981-2010 for temperature, GPCC 1981-2010 for precipitation

North Africa (RA I)

Appendix A: Contributors to the Pre-COF of MEDCOF-11

National Institute of Meteorology, Tunisia
 National Meteorological Directorate, Morocco
 Egyptian Meteorological Authority, Egypt
 National office of Meteorology, Algeria

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High impacts events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Algeria (1)	Below normal in the southwestern regions, elsewhere above normal.	Above normal tercile	wetter than normal in the west and south-east	No clear signal	New records days 05 & 06 July 2018 - (+51.3)in OUARGLA - (+49.7) in EL-OUED - (+49.5) in TOUGGOURT - (+47.4)in GHARDAIA - (+44.8) in BECHAR

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High impacts events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Egypt (1)	Above normal, only Port Said station was normal	Above normal tercile	Below normal, only Port Said station was above normal	No clear signal	<p>a) Minimum temperature: the lowest value of minimum temperature over Egypt was about 15°C on 22 June 2018 at Dabaa station.</p> <p>b) Maximum temperature: The highest value of maximum temperature over Egypt was about 49°C on 16 June 2018 at Kharga station.</p> <p>c) Maximum precipitation: The station of Port Said recorded 2.03 mm on 16 June 2018, the highest 24 hour rainfall.</p>
Libya *	Above normal	Above normal tercile	Below normal in the east Above normal elsewhere	No clear signal	No comment
Morocco (1)	Normal to below normal conditions over Morocco except at some stations over the NE (Errachidia, Bouarfa and Houceima)	Normal to below-normal conditions over the Atlantic coast and the south-west (40%, 40%, 20%). No special scenario elsewhere (33%, 33%, 33%)	Normal to below-normal conditions except Marrakech, Tangiers, Errachidia and Bouarfa	Dry mask (no forecast)	No high impact event at all except at some stations in the NE (Errachidia and Bouarfa) where some records of temperature were broken in July 2018. Important rainfall over Errachida and Bouarfa.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High impacts events
	Observed	MedCOF-10 climate outlook for temperature	Observed	MedCOF-10 climate outlook for precipitation	
Tunisia (1)	Near normal in the north and center west Above normal elsewhere	Above normal tercile	Above normal in the east. Below normal at some stations in the northwest and the south. Normal elsewhere	No clear signal	24/08/2018: floods in the extreme north of the country (Bizerte) causing damage

Note:

(1) Basic climatological period (1981-2010)

* Data source: NCEP/NCAR Reanalysis data, Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS)

References:

MedCOF 10 Outlook: http://medcof.aemet.es/images/doc_events/medcof10/step3/docStep3/Consensus_Statement_MedCOF-10_final.pdf

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

PRESANORD: <http://nwp.gov.eg/index.php/rcof/presanord>

WMO RA I RCC Node on Climate Monitoring Website with monitoring results: <http://www.meteo.tn/htmlen/donnees/climatemonitoring.php>

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)

ECMWF ERA Interim reanalysis: <http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>

NOAA-NCEP-CPC northern hemisphere teleconnection patterns: <http://www.cpc.ncep.noaa.gov/data/teledoc/telecontents.shtml>

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

GPCC: <http://gpcc.dwd.de>