MEDITERRANEAN CLIMATE OUTLOOK FORUM
MEDCOF-9 MEETING

ANALYSIS AND VERIFICATION
OF THE MEDCOF-8 CLIMATE OUTLOOK
FOR THE 2017 SUMMER SEASON
FOR THE MEDITERRANEAN REGION (MED)

First draft version

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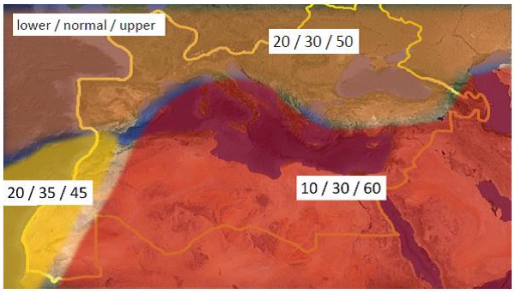
The following MedCOF verification report is based on

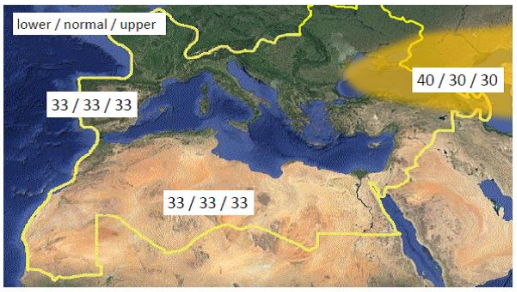
- the outcome of the consensus forecast of MedCOF 8,
- climate monitoring results of RA I NA RCC and RA VI RCC networks,
- the analysis and verification report of SEECOF-18 for 2017 summer season for southeast Europe (SEE)
- national verification reports received from NMHSs or posted in RCOF forums of MedCOF, SEECOF or PRESANORD.

1. MedCOF-8 Climate outlook for the 2017 summer season



2017 SUMMER TEMPERATURE OUTLOOK

(a)



2017 SUMMER PRECIPITATION OUTLOOK

(b)

Figure 1: Graphical presentation of the climate outlook for the 2017 summer season for the Mediterranean region (a) Temperature Outlook; (b) Precipitation Outlook

General circulation

Before summer 2017 the tropical Pacific remained in an ENSO-neutral state, with above-average SSTs present in the eastern Pacific Ocean, and near-average SSTs across the central and east-central part of the basin. The trend of ENSO based on prediction models indicated increasing chances of El Niño into the summer and fall of 2017. Over the Atlantic Ocean the long lasting North Atlantic cold blob extending from Labrador to Newfoundland and south of Iceland should have maintained its strong anomaly. Over the Mediterranean sea SST should have been uniformly warmer than normal. The absence of any clear driver in the climate system and therefore the very weak large-scale signal, together with the low consistency among models made this seasonal forecast particularly uncertain.

Temperature

As stated in MedCOF-08 consensus statement for the seasonal climate outlook for 2017 summer season for the Mediterranean region, there is a tendency for the upper tercile with temperatures warmer than normal over most of the MedCOF domain, which is partly due to the background climatic warming trend (see Fig. 1a).

Within the RA VI part of the domain, the warm tercile was predicted with higher probability (60%) particularly over the Middle East, whereas the probability was slightly lower (50%) in the rest of the RA VI domain. Over North Africa, the warm tercile was more probable over most of the central and eastern part of the domain with probability of 60%, and of 45% elsewhere.

The outlook for temperature distinguished three regions with different tercile distributions, but all with the upper tercile as the most probable scenario, though with decreasing probability to the north and west. This means for verification that a prediction of above-normal temperature (upper tercile) was assumed for the whole MedCOF domain.

Precipitation

Although precipitation uncertainties were larger than for temperature, a strong and persistent drier-than-normal summer was favored over the eastern part of the domain (mainly coming from the ECMWF model). For the rest of the region no large-scale precipitation signal was present in the forecasts (see Fig. 1b).

The outlook distinguished two regions for precipitation. For the yellow region in Fig. 1b the lower tercile has the highest probability with 40% and covers an area of the Black Sea, southeastern Ukraine, South Caucasus (Georgia, Armenia, Azerbaijan), and northeastern Turkey. The other region covering the rest of the MedCOF domain has an equal distribution for all three terciles. This means for verification that below-normal precipitation (lower tercile) was assumed for the yellow region and climatology (middle tercile) for the rest of the MedCOF domain.

Over the North African domain, there was no clear signal, therefore the climatological forecast (33, 33, 33) implied the fact that no meaningful forecast could be provided for these seasonally dry areas.

2. Analysis of the 2017 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 2017 (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-18, 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

In the eastern tropical Pacific, sea surface temperature (SST) anomalies on summer 2017 average were below normal (1981-2010 reference) and increased towards the west (Fig. 3). Looking at individual months, SST anomalies became negative in the easternmost Niño region 1+2 in July, then the negative anomaly spread to Niño 3 and 3.4 regions in August, while Niño 4 region remained with positive anomalies during the whole summer. The El Niño threshold of +0.5°C in Niño 3.4 region was surpassed just in June, when SST anomalies reached a peak, but afterwards they decreased to neutral conditions in late summer (and became even more negative in autumn), in contrast to the expectation.

In the Northern Atlantic the cold blob remained during summer as predicted, but SST were warmer than normal near the European continent and so was also the whole Mediterranean basin as predicted.

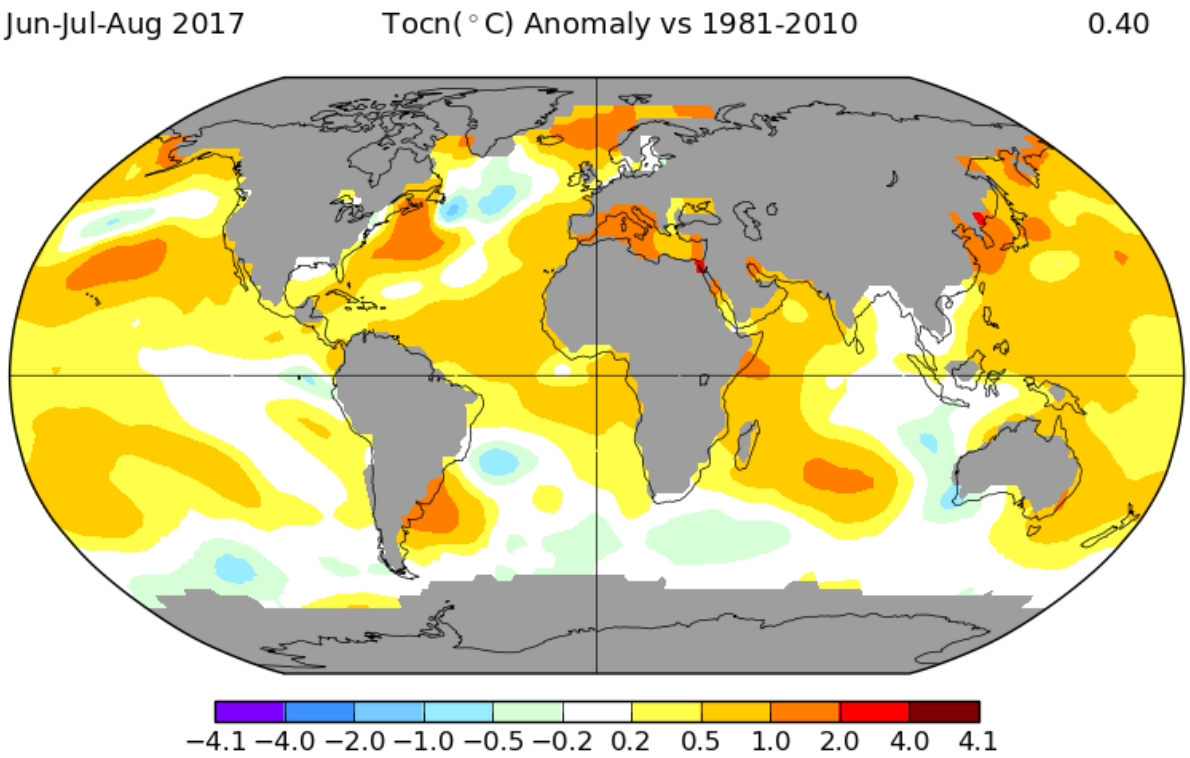


Figure 2: Sea surface temperature anomalies for boreal summer 2017 (June-August), 1981-2010 reference. Data from ERSSTv5 ocean model analysis with 250km smoothing, source: NASA GISS, https://data.giss.nasa.gov/gistemp/maps/

MONTH	NIÑO 1+2		NIÑO 3		NIÑO 4		NIÑO 3.4	
	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM
June 2017	22.98°C	0.10°C	26.73°C	0.30°C	29.39°C	0.55°C	28.19°C	0.55°C
July 2017	21.54°C	-0.07°C	25.85°C	0.23°C	29.21°C	0.40°C	27.61°C	0.39°C
August 2017	20.19°C	-0.45°C	24.82°C	-0.17°C	28.87°C	0.19°C	26.67°C	-0.15°C

Table 1: Sea surface temperature and anomalies for various Niño regions in boreal summer months 2017 (June-August), 1971-2000 reference. Data from ERSSTv4 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 2017 show a ridge over the western Mediterranean and a trough over the eastern basin (Fig. 3). This wave structure is typical for summer, but amplitudes were greater than normal in summer 2017 causing some slight anomalies. Near surface, correspondingly, the Azores High extended far into the western Mediterranean, while the eastern basin and the Middle East were under low pressure (Fig. 4). Anomalies of sea level pressure were weak.

The geopotential patterns of the individual months (Fig. 5) look quite similar. Anomalies were relatively high in June 2017 and partly also in August 2017 when the ridge was shifted more to the Balkans. Also similar for surface pressure (Fig. 6), but in August the high pressure zone extended further up to Eastern Europe.

Looking at weather types, here the Météo France weather type classification (Fig. 7), the most frequent type in summer 2017 was trough over North Atlantic (red bars), which often means ridge over the western Mediterranean. About half of all days in summer 2017 had this weather type, most of them in June. However, in late summer, especially in August, NAO- types were in majority. A typical characteristic of NAO- is a relocation of the low pressure area from the North Atlantic to northwestern Europe and an extension of high pressure to Eastern Europe as can be seen in the geopotential and surface pressure fields for August 2017.

Teleconnection pattern indices of NOAA Climate Prediction Center (Table 1) show an East Atlantic (EA) pattern as the most dominating one for all three summer months. This is characterized by both an intense Icelandic Low and Azores High over the East Atlantic with mostly high pressure extension into the western Mediterranean. For August, however, two more patterns became also important for the MedCOF region: NAO- as described above and the East Atlantic – West Russia pattern, characterized additionally with high pressure anomalies over western Russia.

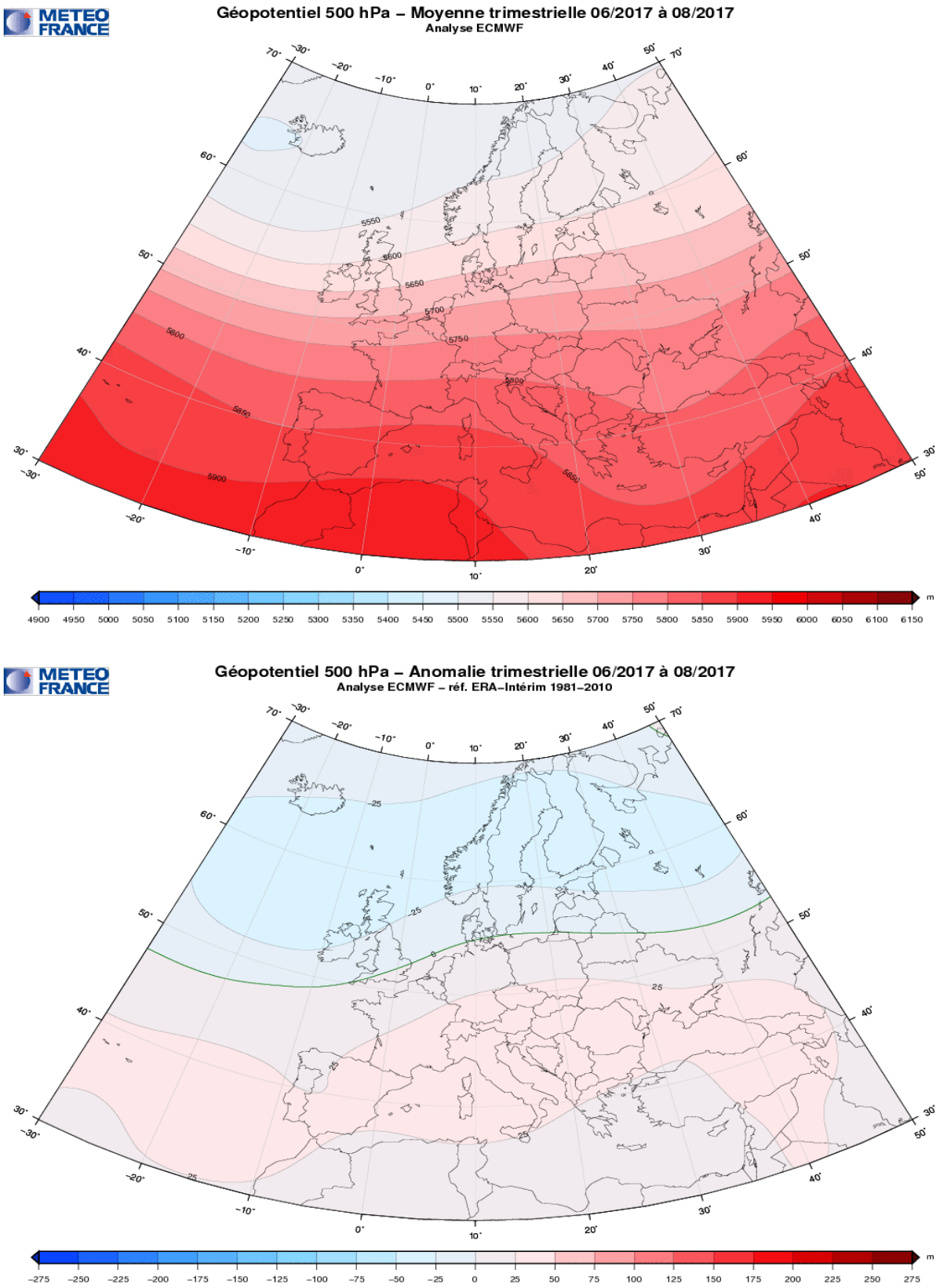


Figure 3: Seasonal mean and anomalies of 500 hPa geopotential for summer 2017 (1981-2010 reference). Source: Météo France, data source: ECMWF ERA Interim reanalysis, http://seasonal.meteo.fr/en/content/suivi-clim-cartes

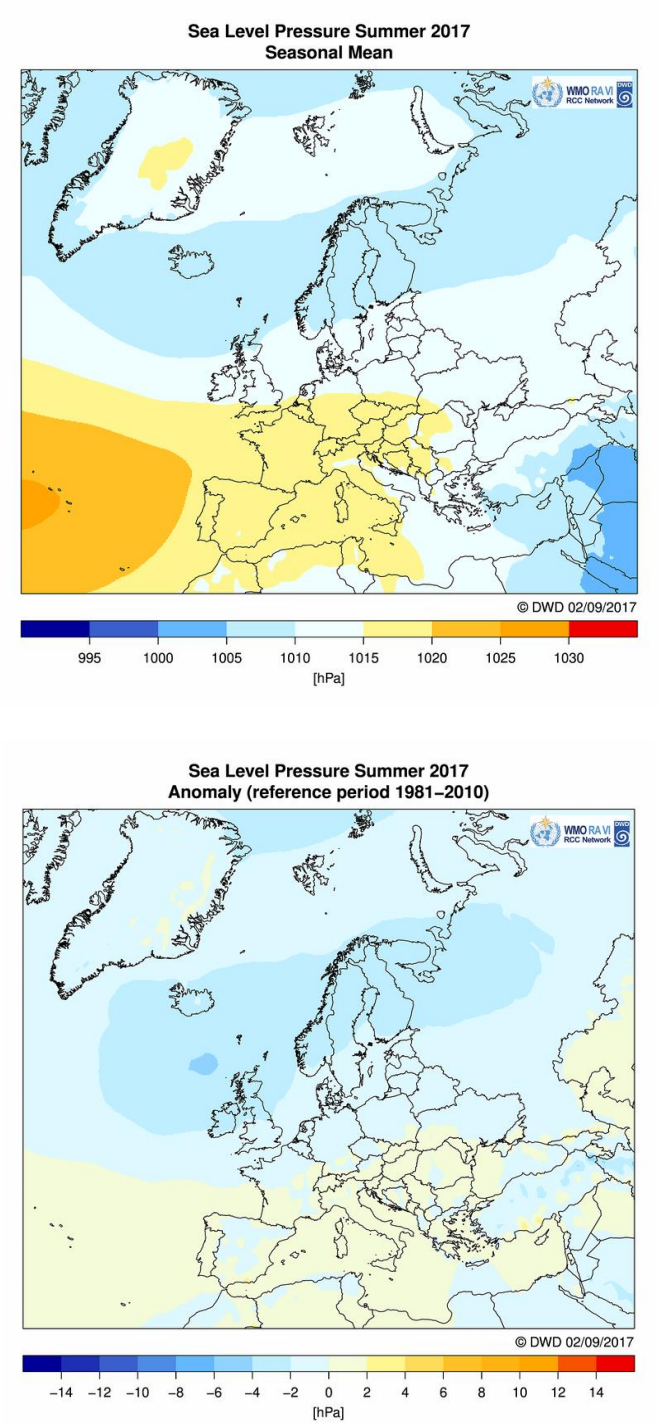


Figure 4: Seasonal mean sea level pressure (upper graph) and its seasonal anomalies (lower graph) for summer 2017 (1981-2010 reference). Source: Deutscher Wetterdienst (DWD), data source: DWD numerical ICON model analysis, http://www.dwd.de/EN/research/weatherforecasting/num_modelling/01_num_weather_prediction_modells/icon_description.html?nn=484268

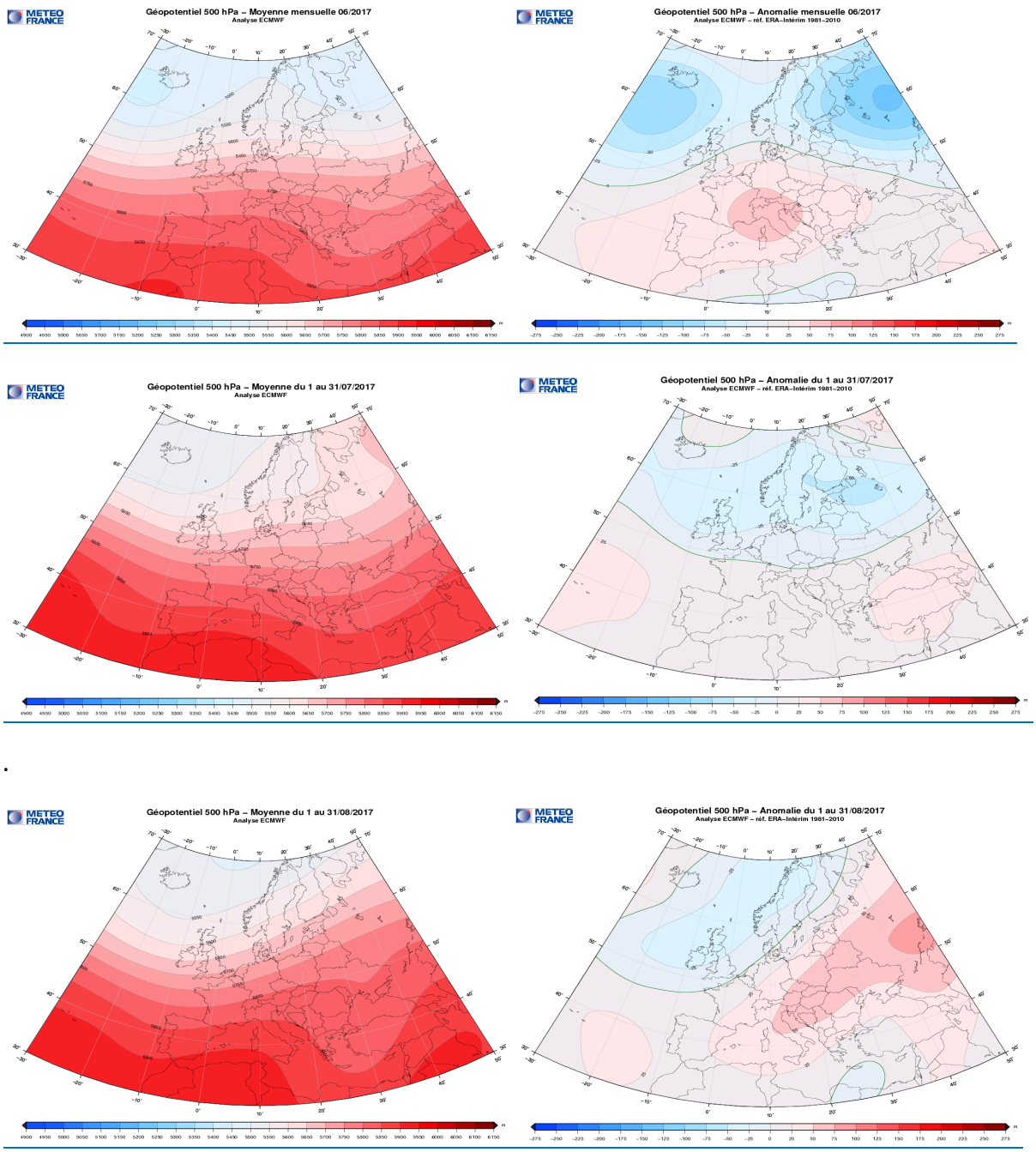


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Figure 5: Same as Figure 3, but for the months June-August 2017

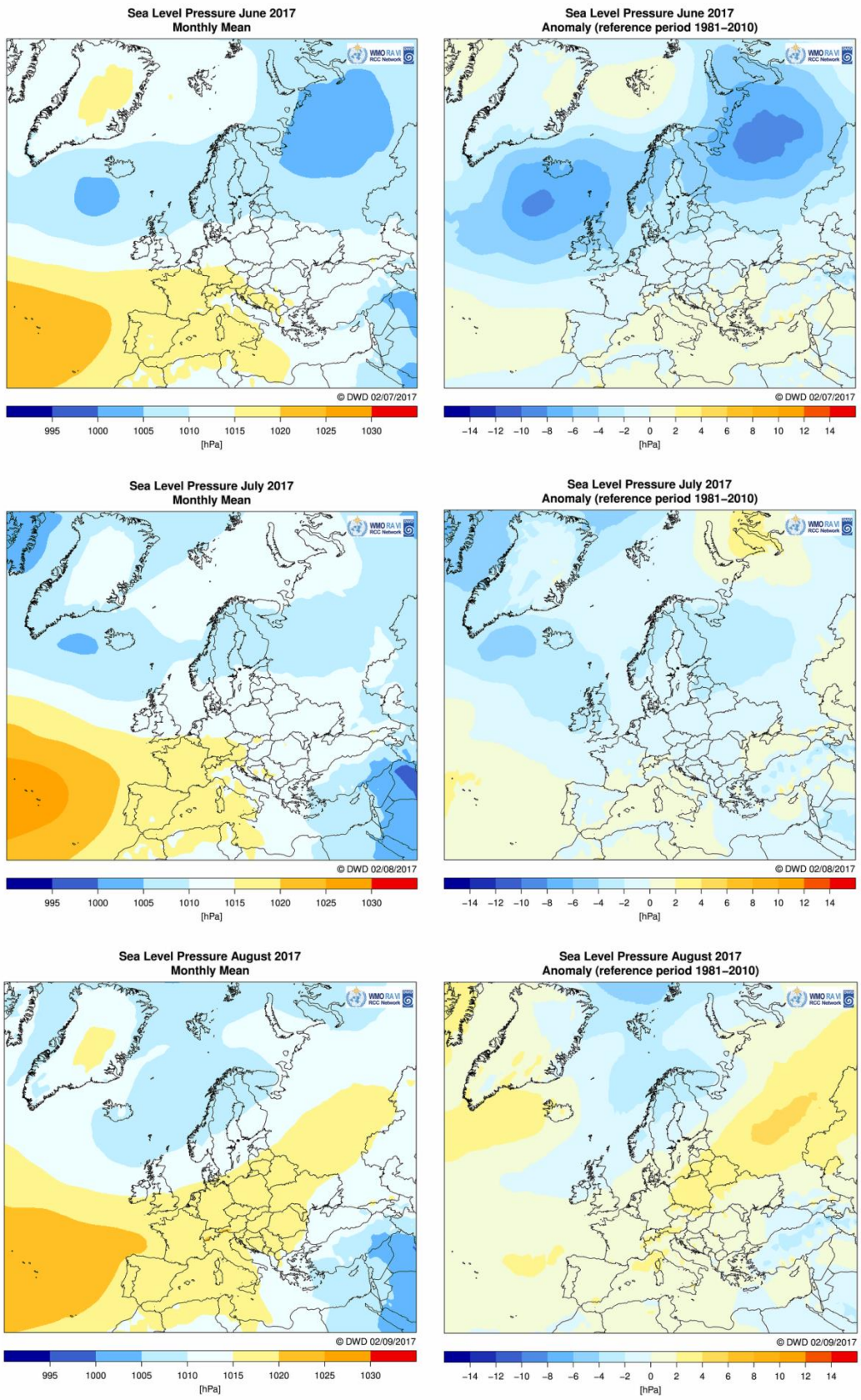


Figure 6: Same as Figure 4, but for the months June-August 2017

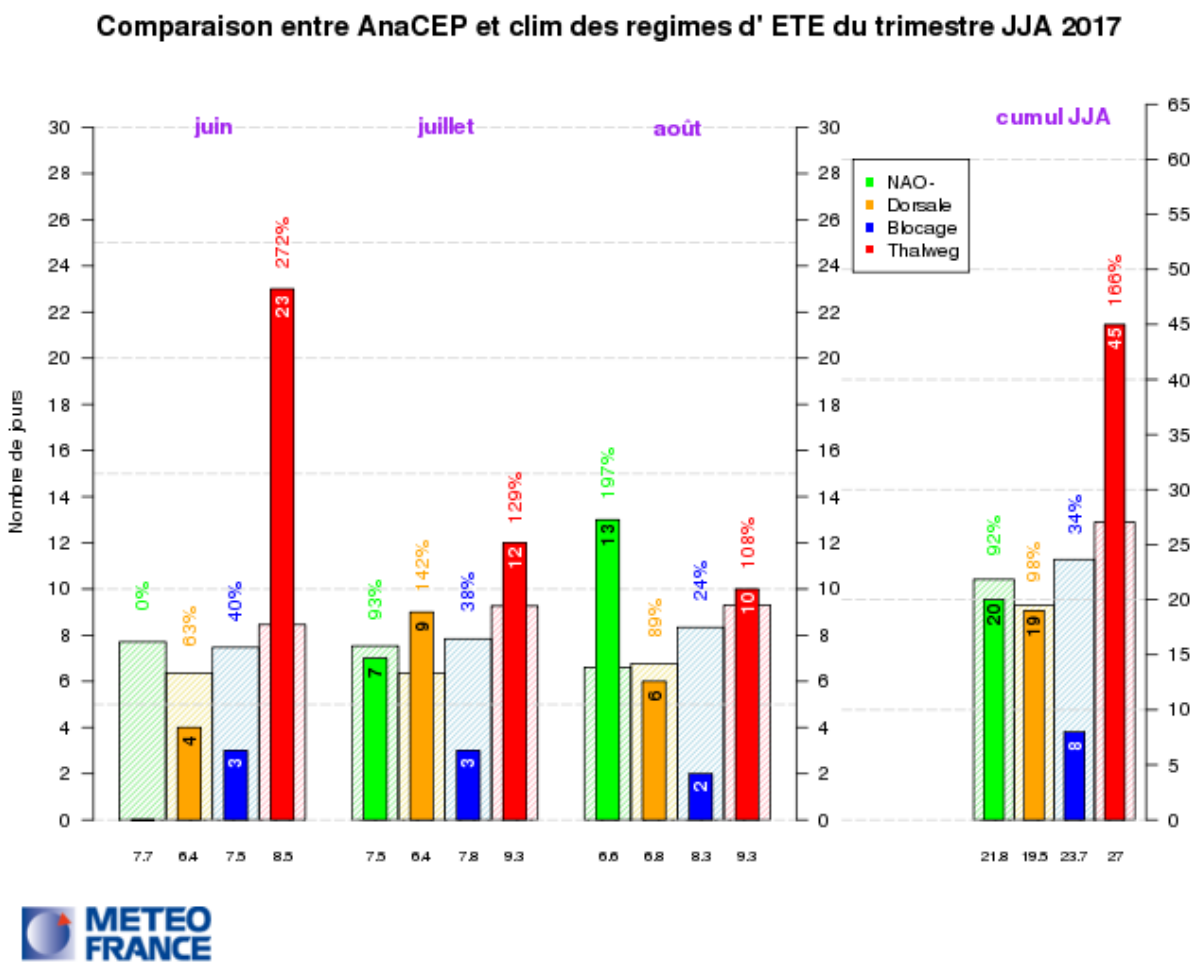


Figure 7: Number of days with circulation types of the Météo France classification for each month of the summer 2017 season and for the whole season (right), and in percent of the climatological frequency distribution 1981-2010. Circulation types are: negative North Atlantic Oscillation phase (NAO-, green), Atlantic ridge (Dorsale), Scandinavian Blocking (Blocage) and positive North 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
2017	6	0.35	2.03	-0.75	0.50	1.18	0.34	-1.43	-99.90	-0.11	-99.90	90.0
2017	7	1.28	1.83	0.46	0.00	1.33	-0.58	0.03	-99.90	-0.05	-99.90	84.2
2017	8	-1.53	2.02	-1.38	-1.65	0.20	-2.93	-1.57	-99.90	1.83	1.46	71.5

Table 2: Circulation indices of NOAA CPC patterns for the summer months 2017.

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

2.2. Temperature

Europe and Middle East (RA VI)

Summer seasonal temperature means were in the upper tercile over almost the entire MedCOF RA VI domain (Fig. 8) with only a few exceptions over western Portugal / northwestern Spain, over parts of the eastern Mediterranean / western Turkey and some isolated small areas. The warming should be due mainly to high pressure subsidence and in the west also to subtropical advection. North Atlantic cooling seemed to have affected occasionally the westernmost areas of Europe. Cyclonic situations over the eastern Mediterranean should have produced at least some local or subregional cooling. These features are supported by ERA Interim Reanalysis, but also ECA&D stations and E-OBS (Fig. 9-10). Any differences between these datasets should be mainly due to missing values in either of these data. Much of the seasonal mean temperatures even exceeded the 90th percentile (Fig. 11), which means quite extremely warm conditions. Mean seasonal temperatures in the lowlands within the domain ranged from about 13°C in northern France to above 30°C in eastern parts of the Middle East. Maxima surpassed 40°C in many places. Anomalies were above the 1961-1990 normal everywhere in the domain, particularly high over the Balkans (up to above +4°C, Fig. 12). Several heatwaves occurred throughout the domain and in all three summer months.

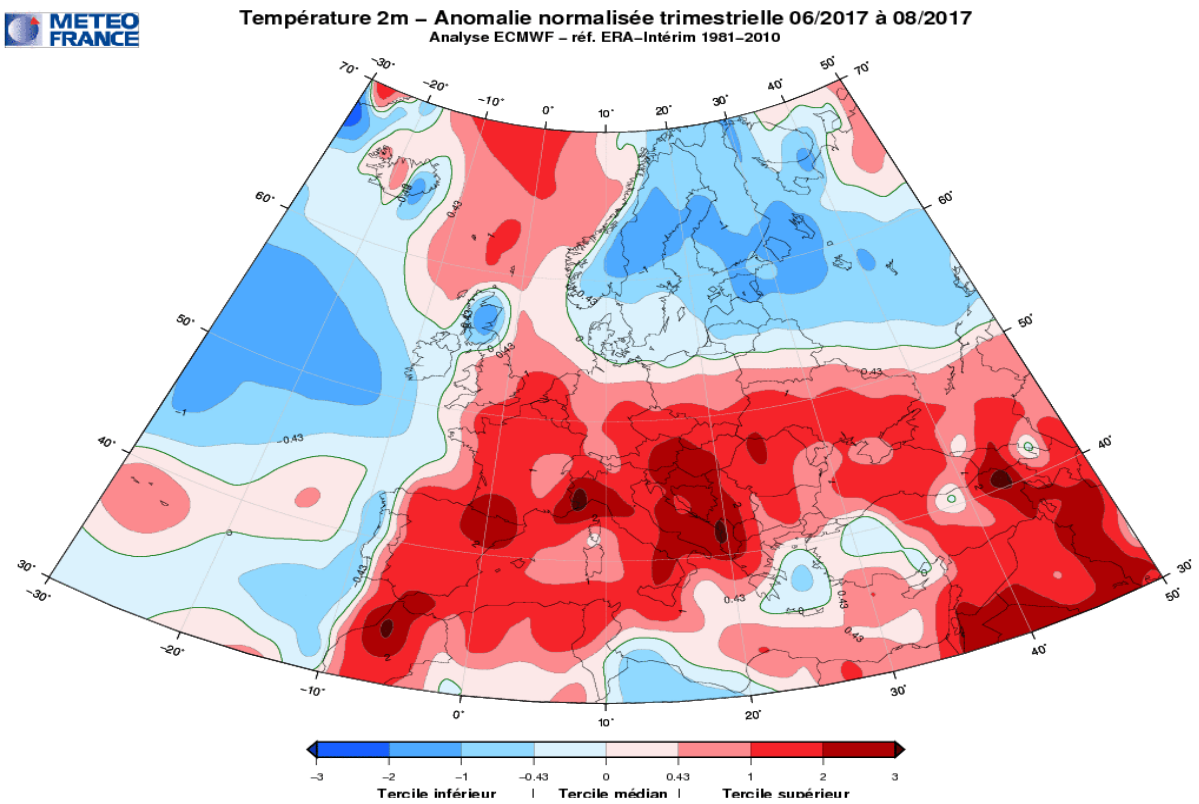


Figure 8: Seasonal normalized temperature anomalies of summer 2017 surface air temperature based on ECMWF / ERA-INTERIM grid data, 1981-2010 reference. The data range between -0.43 and +0.43 represents the middle tercile, below -0.43 the lower tercile and above +0.43 the upper tercile. Source: Météo France, data reference: http://www.ecmwf.int/en/research/climate-reanalysis/era-interim

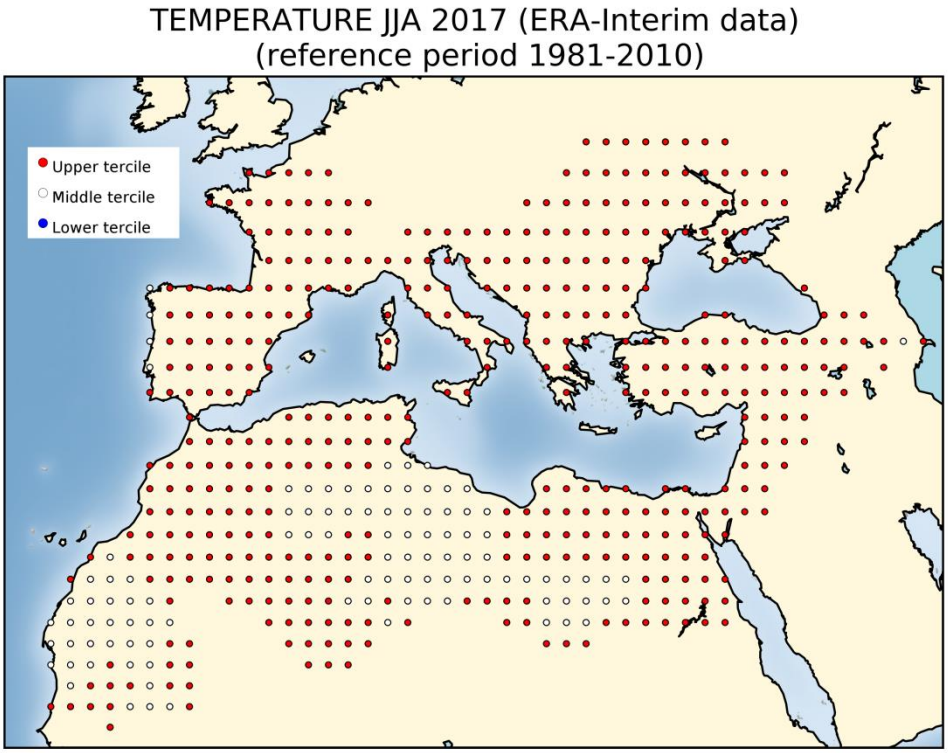
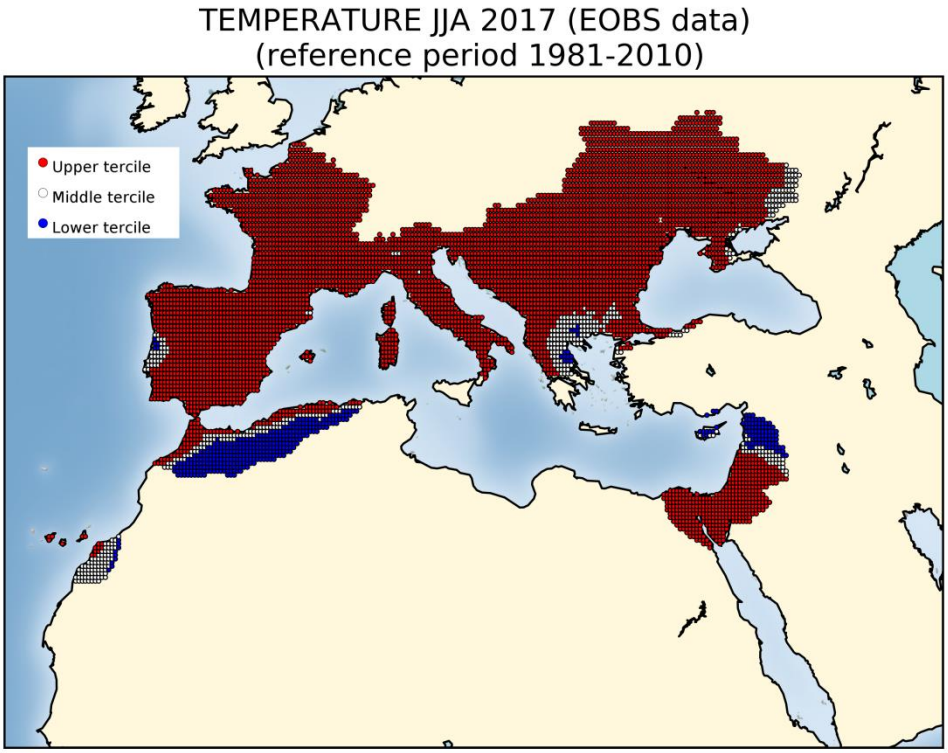


Figure 9: Terciles of summer 2017 surface air temperature based on ERA-Interim Reanalysis, 1981-2010 reference. Source: AEMET, data source http://www.ecmwf.int/en/research/climate-reanalysis/era-interim



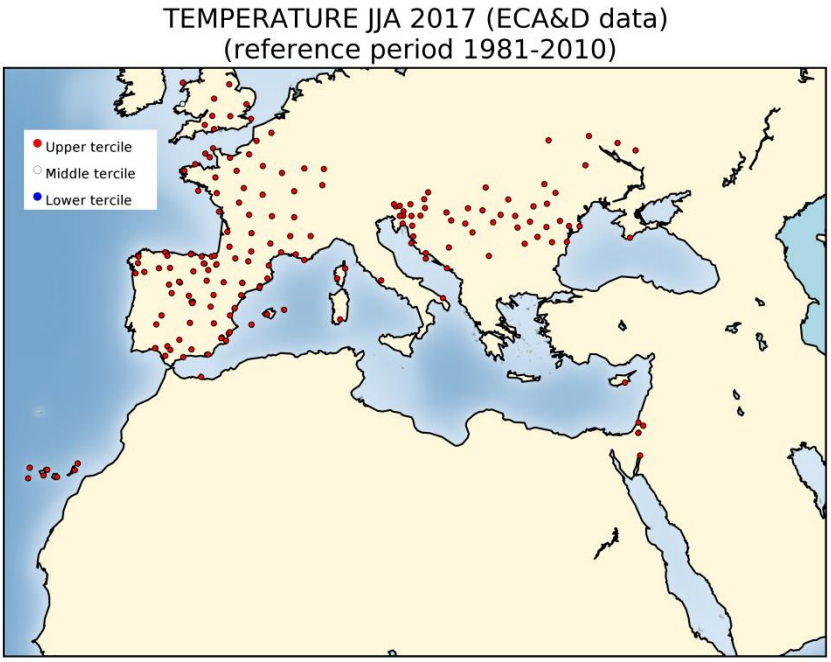


Figure 10: Terciles of summer 2017 surface air temperature based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Source: AEMET, data source: http://www.ecad.eu/

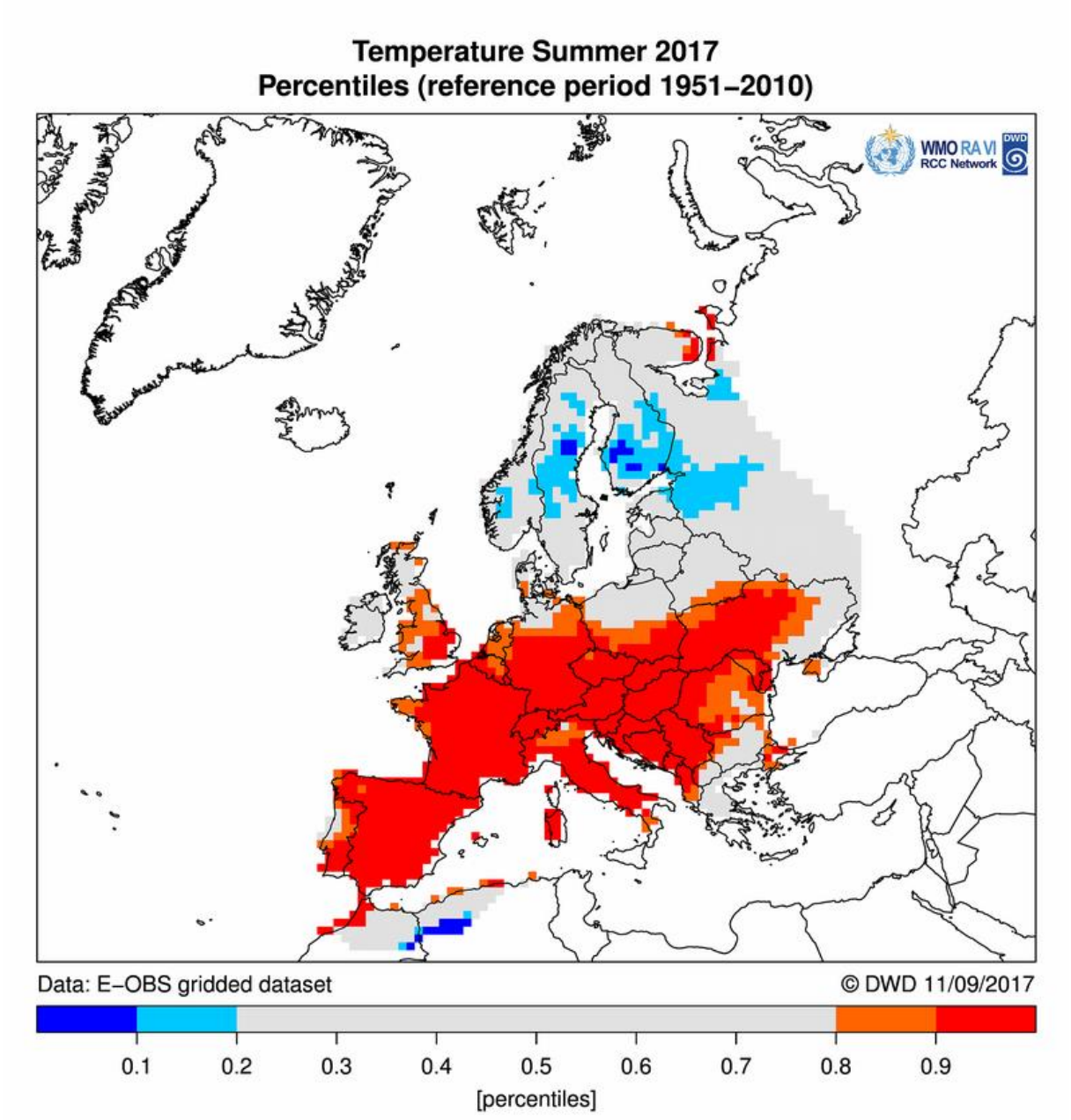


Figure 11: Percentiles of summer 2017 surface air temperature based on interpolated E-OBS gridded data, 1951-2010 reference. Source: DWD, data source: http://www.ecad.eu/

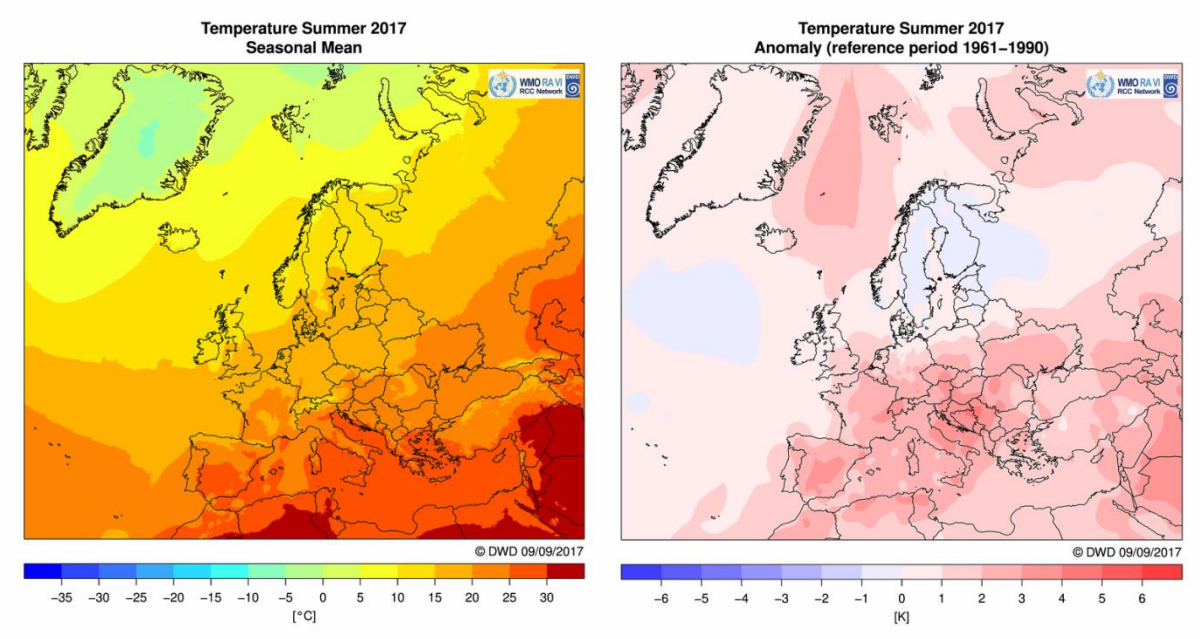


Figure 12: Surface air temperature for summer 2017. Left: seasonal mean, right: anomalies, 1961-1990 reference, source of both maps: WMO RAVI RCC, based on interpolated CLIMAT data, www.dwd.de/rcc-cm

North Africa (RA I)

Summer 2017 was hotter than normal in almost all North Africa. Mean temperatures were ranging between 19°C and 47°C. Summer season mean temperature was at its minimum over north-western regions and the coastal areas of North Africa (Fig. 13-14).

In Tunisia, the summer season mean temperature was at its minimum over north-western regions and the coastal areas. The lowest value of mean minimum temperature was 18.5 °C measured in Beja. The south-west of Tunisia was mainly the hottest region in 2017 summer season. Highest mean maximum temperature was registered in Nafta with 39.56°C while the highest absolute value of maximum temperature registered was 48°C also in Nafta. Mean temperature was above normal in the north and the center west with anomalies up to +2.3°C. Elsewhere temperatures were normal to slightly above normal.

Over Morocco above normal conditions were observed. Positive anomalies were noticed over the whole country. These anomalies varied between +2°C and +4°C in some areas of High and Middle Atlas, exceeded +4°C on Southeast versants and in the east of Saharan provinces. Elsewhere, anomalies did not exceed +2°C.

Anomalies were above normal over the northern and western region of Algeria. Positive anomalies were also registered over the east of Libya, the north and east of Egypt. Elsewhere, temperatures were in the normal tercile.

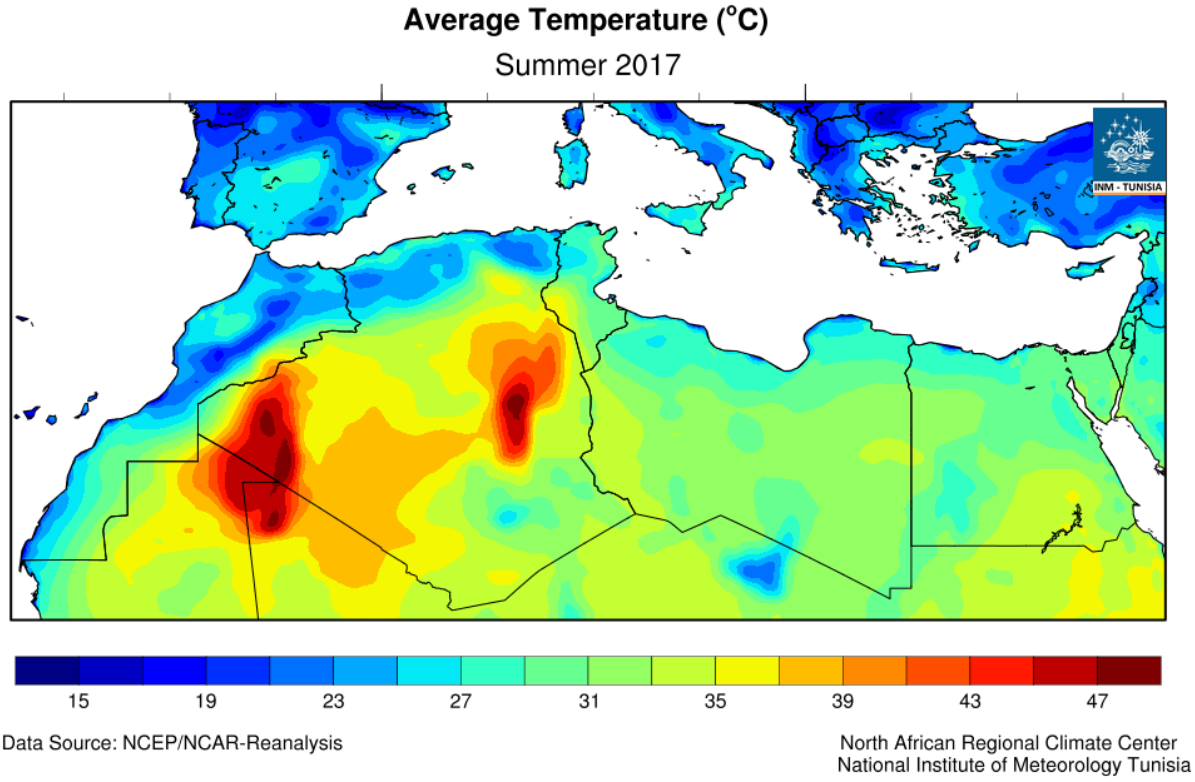


Figure 13: Mean temperature for summer season 2017 in North Africa (in °C). Source: INM, (Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov)

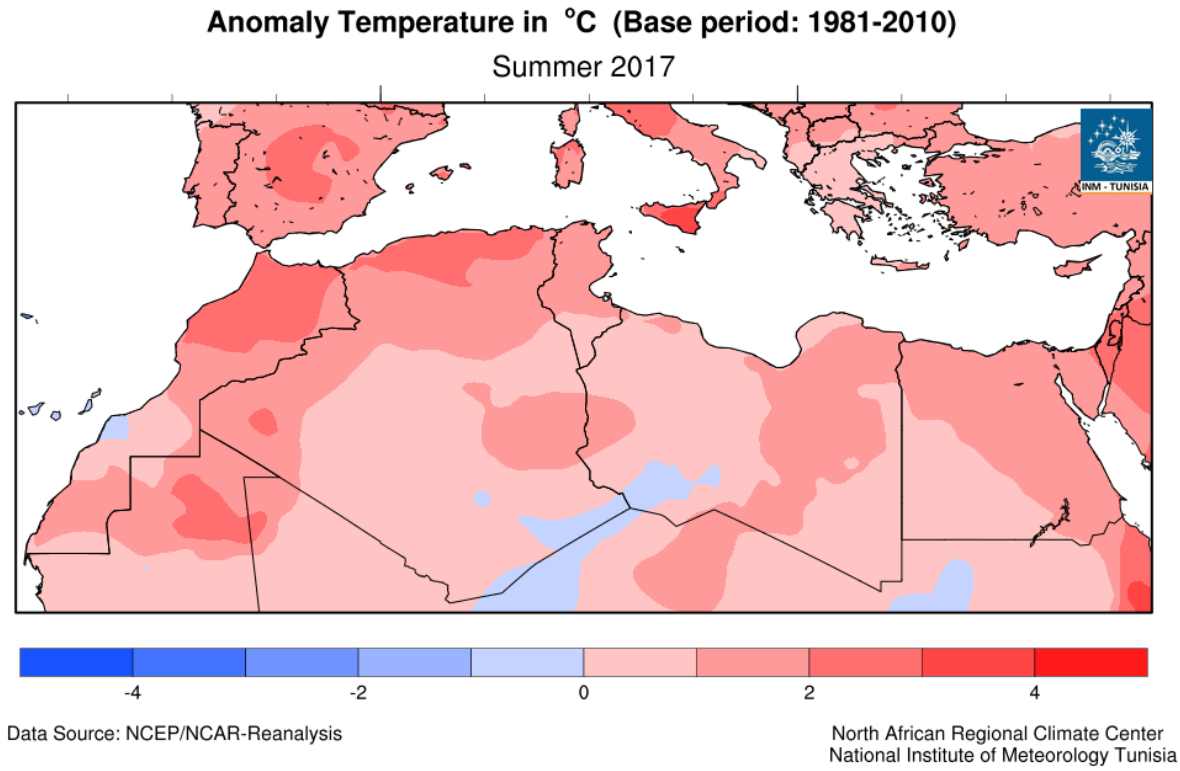


Figure 14: Temperature anomaly for summer season 2017 in North Africa (in °C), reference period 1981-2010. Source: INM, Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov

2.3.Precipitation

Europe and Middle East (RA VI)

Summer seasonal precipitation within the RA VI MedCOF domain was very diverse in terms of percentiles (Fig. 15-16). All three percentiles were represented in the domain from the local to subregional scale. Wet areas (upper tercile) due to some intense thunderstorms were to be found particularly over Iberia, France, northern Italy, Romania and Greece / western Turkey. In contrast, it was particularly dry (lower tercile) north-western Iberia, south-eastern France, much of Italy, parts of the Balkans, much of Ukraine, eastern Turkey, western South Caucasus. Again differences within datasets are mostly due to missing data. Seasonal precipitation totals ranged from zero in the Middle East to above 400mm in the Alps, but also locally elsewhere, especially close to mountains and close to the Black Sea, due to heavy convective precipitation (Fig. 17). Compared to the climatological normal, some areas had a very dry summer with extended drought conditions, especially Portugal, southern Spain, south-eastern France, Italy, western Balkans, Ukraine. Other parts suffered from extreme precipitation excess, e.g. central Spain, Greece / western Turkey, eastern Romania.

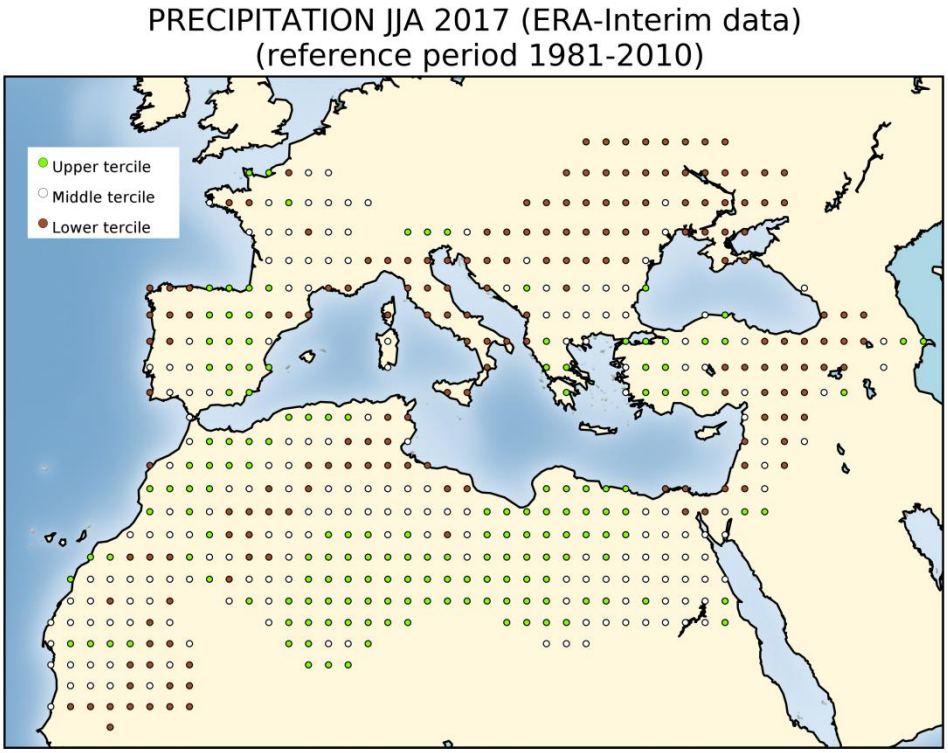
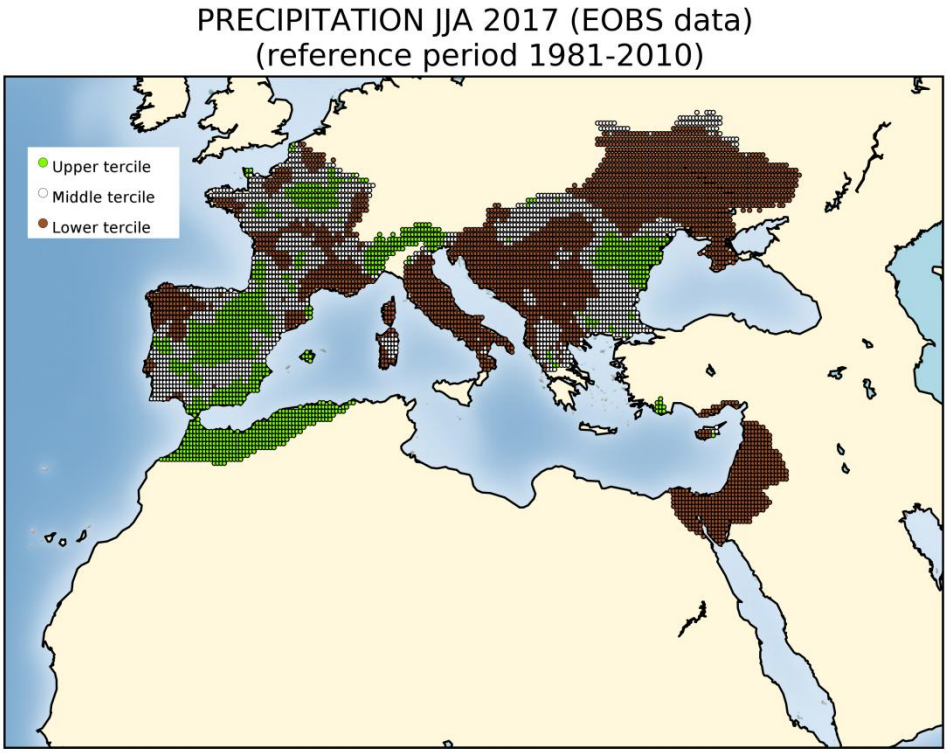


Figure 15: Terciles of summer 2017 precipitation based on ERA-INTERIM Reanalysis (upper graph) grid data, 1981-2010 reference. Source: AEMET, data reference: ERA-INTERIM: http://www.ecmwf.int/en/research/climate-reanalysis/era-interim



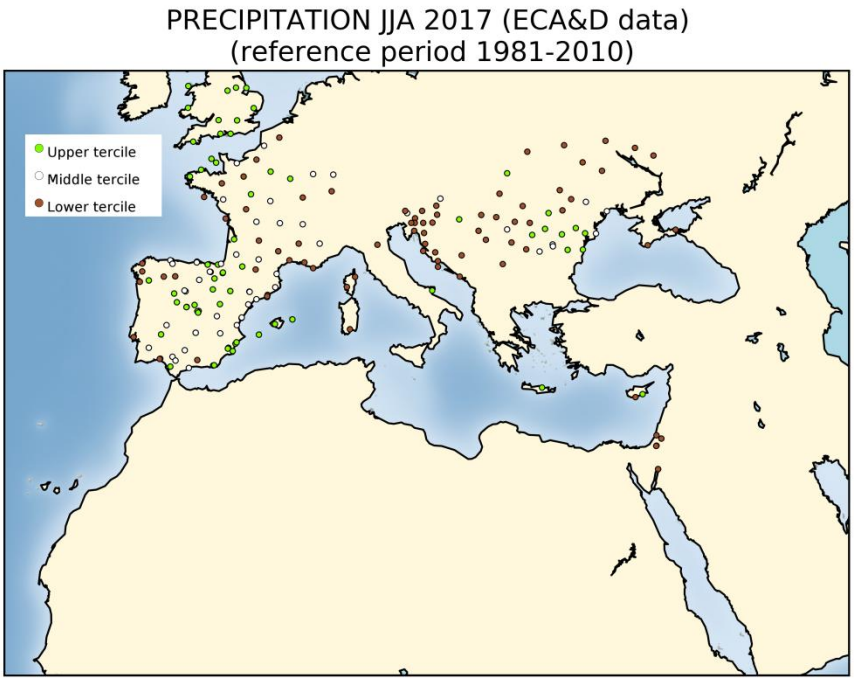
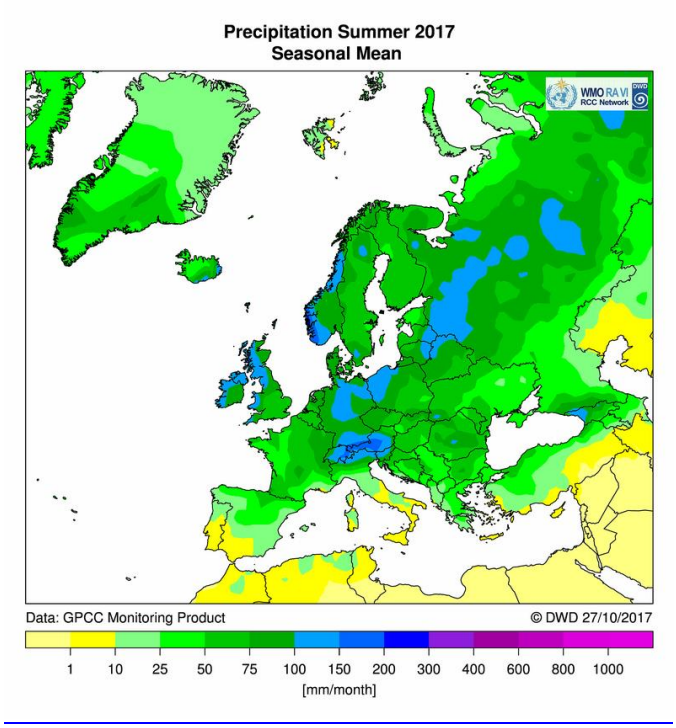


Figure 16: Terciles of summer 2017 precipitation based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Source: AEMET, data source: http://www.ecad.eu/



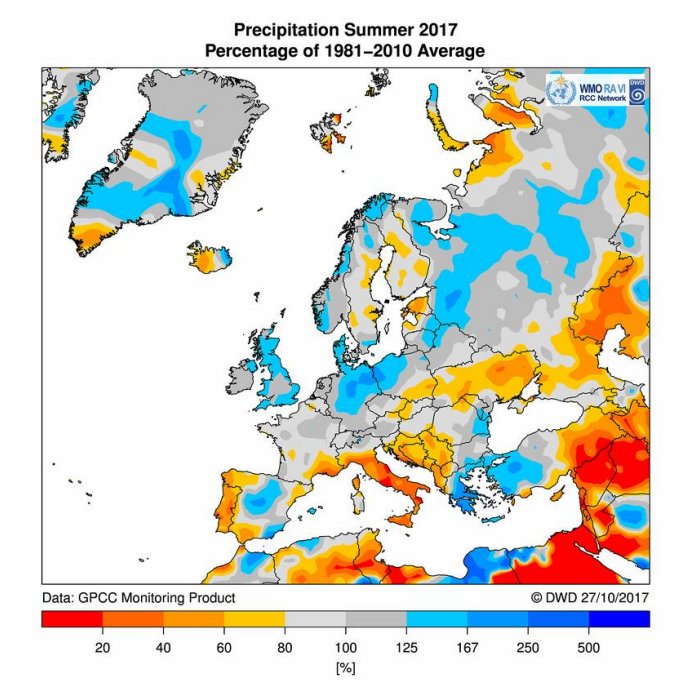


Figure 17: Precipitation for summer 2017 in Europe. Upper map: seasonal total in mm/month, lower map: percentage of 1981-2010 average, source: WMO RAVI RCC, www.dwd.de/rcc-cm , data source: GPCC, http://gpcc.dwd.de

A more detailed analysis for south-eastern Europe, including high impact events, is given in the analysis and verification report of the SEECOF-17 CLIMATE OUTLOOK for 2017 summer season for southeast Europe (SEE), provided by SEECOF-18 (presently draft version):

http://www.seevccc.rs/SEECOF/SEECOF-18/Pre-COF/Draft-Version-Final-assessment-of-SEECOF-17-Climate-outlook-for-summer-season.pdf

North Africa (RA I)

Summer precipitation was very low over North Africa during summer season (Fig. 18). Precipitation registered over the Mediterranean coastline of the domain ranged between 20mm and 40mm. Over the south of the domain quantities reached 100mm. Summer 2017 was wetter than normal over the center and south of Algeria, and in a small region in the north and the south-east of Morocco. Precipitation was below normal over Libya and Egypt. Elsewhere, precipitation was in the normal to below-normal tercile range (Fig. 19).

Precipitation in Tunisia was at its maximum over a gradient north-east center-west. Extreme values were registered at Tunis-Carthage station in the north-east such as the highest 24-hour total precipitation with a total of 31 mm. With reference to 1981-2010 period, total precipitation amount was above normal in the south-west and in a small region in the north-east. Elsewhere, precipitation was in the normal to below-normal category.

In Morocco, summer precipitations were below normal conditions in most parts of the country. The maximum deficit exceeded 80% of the seasonal normal in the extreme north of Morocco, at most of the Atlantic coast and in northern Saharan provinces. While in some areas in Middle Atlas, east and southeast of Saharan provinces, precipitations were above normal conditions with a maximum surplus exceeding 80%.

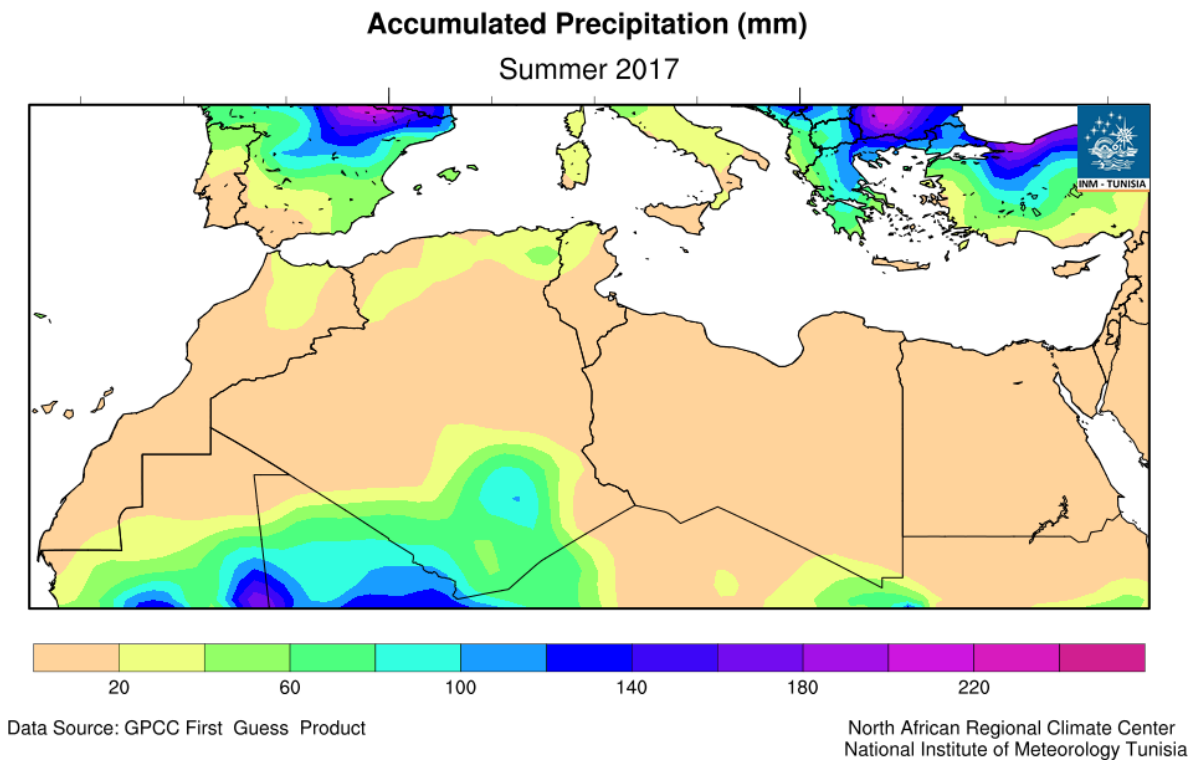


Figure 18: Total precipitation for summer season 2017 in North Africa (in mm). Source: INM, Data from GPCC (First Guess Product), http://gpcc.dwd.de

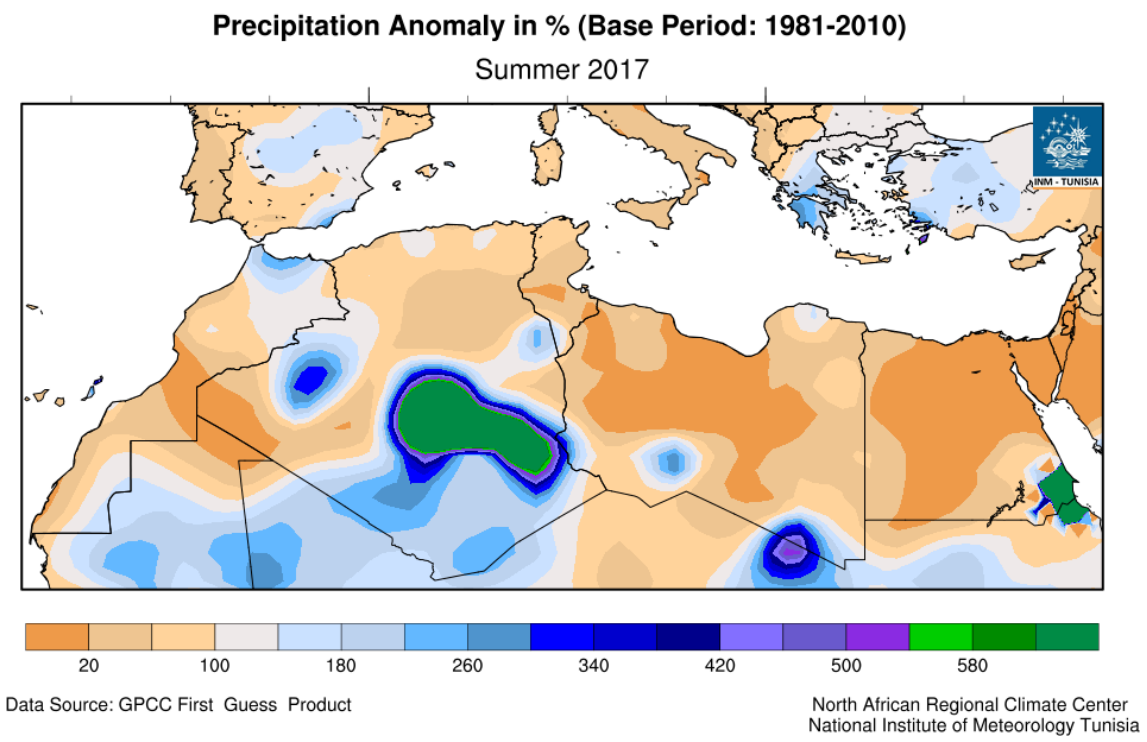


Figure 19: Precipitation anomaly for summer season 2017 in North Africa (in %) (reference period 1981-2010). Source: INM, data from GPCC, http://gpcc.dwd.de

4. Verification of the MedCOF-8 climate outlook for the 2017 summer season

4.1. Temperature

Europe/RA VI

The MedCOF-8 outlook favored the upper tercile in the entire domain with at least 50% probability.

This was mainly correctly predicted. Just the cooling in the westernmost small part of the domain and some local to subregional features in the eastern Mediterranean were not considered by the outlook.

North Africa (RAI)

The MedCOF-8 climate outlook for the 2017 summer season favored an above-normal temperature over the entire North African domain. Probability over the Atlantic coastline of the domain was 45% for the above-normal tercile. Elsewhere this tendency was favored with probabilities of 60% including Tunisia, Algeria, Libya and Egypt.

In fact, in almost all regions of North Africa, temperature anomalies were normal to above normal. Maximum anomalies were registered over the north of Morocco, the northern and western region of Algeria. Positive anomalies were also registered over almost whole Morocco, Tunisia, east of Libya, and the north and east of Egypt. Elsewhere temperatures were in the normal tercile.

This indicates that the MedCOF-8 climate outlook for the summer season temperature was able to predict positive temperature anomalies registered.

4.2. Precipitation

Europe/RA VI

MedCOF-8 did not give a clear signal except in the easternmost part of the domain where the dry scenario (lower tercile) was favored, though with only 40% probability. For the rest of the domain, climatology had to be assumed.

In fact, summer 2017 precipitation was in the lower tercile in this easternmost domain, so the outlook was mainly correct for that part of the domain. For the rest of the region, much of the area received precipitation totals in the middle tercile, but other parts were extremely dry or much wetter than normal. Dryness due to high pressure influence was superposed by locally or subregionally heavy precipitation, which produced signals in a smaller scale. For that reason no clear large-scale signal could be identified, and thus none could be predicted, so the 33-33-33 prediction of the outlook was justified.

North Africa

Over the North African region, there was no preference for any climate defined categories.

Summer 2017 was wetter than normal over the center and south of Algeria, a small region in the south-west of Tunisia, locally in the north and the south-east of Morocco. Precipitation was below normal over Libya and Egypt. Elsewhere precipitation was in the normal to below-normal tercile.

MedCOF-8 precipitation prediction didn't give valuable information.

4. Users' perceptions of the MedCOF-8 outlook

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

Turkish State Meteorological State Service provides seasonal forecasts for all sectors and publishes them on its official web page.

In some countries, the outlook is only used for internal purpose and a national outlook is not provided. In others no feedback was reported or no feedback was given by users.

Appendix A: Contributors to MEDCOF-9

- World Meteorological Organization

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 of Bosnia and Herzegovina
- Republic Hydrometeorological Service of the Republic of Srpska, Bosnia and Herzegovina
- National Institute of Meteorology and Hydrology, Republic of Bulgaria
- Meteorological and Hydrological Service, Republic of Croatia
- Meteorological Service, Republic of Cyprus
- Météo France, Republic of France
- Deutscher Wetterdienst, Federal Republic of Germany
- Hellenic National Meteorological Service, Greece
- Israel Meteorological Service, State of Israel
- State Hydrometeorological Service, Republic of Moldova
- Institute of Hydrometeorology and Seismology, Montenegro
- Republic Hydrometeorological Service of Serbia, Republic of Serbia
- Environmental Agency of the Republic of Slovenia, Republic of Slovenia
- AEMET, Spain
- Turkish State Meteorological Service, Republic of Turkey

- **Further National Meteorological and Hydrological Services via SEECOF-18**

APPENDIX B: **Analysis and verification of the MedCOF-8 climate outlook for the summer season 2017:**

Verification summary based on the national reports and contributions of the participants of the SEECOF-18 and MedCOF-9 Pre-COF

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Albania *	Above normal	Above normal	Around normal	No signal	No events reported
Armenia (1)	Above normal	Above normal	Below normal (extremely dry)	No signal	On **June 6**, strong wind with gusts reaching 25-28 m/sec was observed in Fantan (Kotayk region). On **June 12**, heavy hail was observed (hail diameter exceeding 20 mm) in Yerevan. On **June 22** and **29** heavy rainfall (30mm/12h) was observed in Goris, Sisian and Vorotan (Syuniq region). **July**: Heat wave was observed: in Ararat, the maximum temperature reached 40-41°C on July 4, 22, 23, 24, 29 in Ararat valley and Meghry. **August**: Heat wave and significant precipitation deficit was observed across most of the country. Drought affected the entire territory.
Azerbaijan *	Normal to above normal	Above normal	Normal to above normal	Below normal	No events reported

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Federation of Bosnia and Herzegovina (1)	Above normal	Above normal	Below normal except one station in the center of the country	No signal	Air temperatures (summer 2017): above average summer temperatures between 2.6 and 4.7. Summer 2017 was extremely warm across the entire Bosnia and Herzegovina. MS Bihać – The warmest summer and the warmest July. August 2017 - the absolute maximum temperature was observed in Gradacac, Jajce, Zenica (center Bosnia) and Livno (SW). Summer of 2017 was marked by five heat waves. Drying period July and August in Herzegovina
Rep. Srpska, Bosnia and Herzegovina (1)	Above normal (extremely warm)	Above normal	Below normal in most of the territory, extremely dry in most places	No signal	Extremely sunny, warm and dry in most places of RS: according to the difference evaporation-rainfall, the drought was more intense than relevant indexes of precipitation (SPI, Percentiles) showed given the very sunny to extremely sunny and windy (of southern directions) weather patterns; Six heat waves; -the yields of soybean, corn and others are less by 50%; fruits are also halved for 80% with regard to late spring frost and second driest summer in the last 60 years -wild forest fires Estimated damage is more than 100 million of KM.
Bulgaria (1)	Above normal	Above normal	Near normal on average for the country	No signal	Around 30 June – 1 July the maximum temperatures soared to extreme levels driven by approaching cold front from northwest. They surpassed 40°C at some places for example - Ruse, 43.6°C. Fire weather conditions in the southeast indicated very high risk of wild fires in late August due to long lasting hot and dry weather

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Croatia (1,5)	Above normal	Above normal	Below normal	No signal	Summer 2017 was extremely warm across the entire country. Five heat waves were observed during summer – one in June and August, and three in July. In August, the absolute maximum temperature was measured in Knin (hinterland of middle Adriatic) – 42.3°C on August 10 (the measurements in Knin exist from 1949). During all three months, forest fires hit mostly costal part of Croatia, but few of them were wild fires – especially in July (the town Split in the middle Adriatic was affected by fire). In all three months convective related severe weather phenomena (thunderstorms, hail, heavy rains, flash floods, waterspouts) were observed all over Croatia.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Cyprus (5)	**June** Normal **July** Above Normal **August** Normal	above normal	**June** Below Normal **July** Below Normal **August** Normal	No signal	**June** Temperature extremes were recorded with great positive departures ranging from 6 to 8°C Lowest daily minimum temperatures were also recorded, with positive departures ranging from 5 to 7°C above normal During June local showers and/or thunderstorms caused by thermal instability were recorded on 19 and 21 June resulting in accumulated precipitation of 71% of normal. **July** Extreme highs and lows (both maximum and minimum departing by 4°C of normal) were recorded. On July 1 and 2, maximum temperature departing by at least 4°C of normal was recorded at all stations. All the aforementioned maximum temperatures are considered extremes for July in the past 30-year period. Highest minimums with positive departures higher than 4°C of normal were also recorded. On 24 July episodes of thundery activity and isolated showers over mountainous areas resulted in accumulated precipitation of 4% of normal. **August** Temperature extremes were also recorded with positive departures higher than 4°C, daily maximum temperature (32.6°C) was by 4.6°C higher than the normal (28°C). Daily minimum temperatures were also recorded, with negative departures higher than 4°C below normal On the 4, 5, 6, 12 and 23 August episodes of thundery activity and isolated showers over mountainous areas.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	**MedCOF-8 climate outlook for temperature**	**Observed**	**MedCOF-8 climate outlook for precipitation**	
France (5)	Above normal, second warmest summer since 1900	above normal	Normal, In the Mediterranean below normal	No signal	Exceptional drought period in the Mediterranean area, driest summer since 1959. Heat waves 18-22 June, 5-8 and 17-19 July, 1-6 and 26-29 August either in the whole country or in the southeast/Corsica, partly severe/exceptional
Georgia (1)	Above normal	Above normal	**Normal** In west Georgia **Below normal** in the most territory of east Georgia, excluding several stations, where it was near norm	Near or below normal	Air temperature of +40°C was observed in Zestafoni on July 28 and 12 and August 13; in Qutaisi on August 7; in Lagodekhi on August 9. On June 15 a large amount of rainfall was registered throughout Georgia, which caused floods in the Rioni Basin.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Greece (2,5)	Above normal	Above normal	Above normal In most part of the country except small parts of northwestern and southeastern Greece.	No signal Dry season masking: island of Crete	**June** On 30 June the stations Elefsis (airport) and Larissa (airport) recorded a maximum daily temperature of 44.8°C and 42.6°C, respectively. On 4 June Athens experienced heavy rainfall and hailstorm. As a result some roads in the centre of Athens were closed due to flooding. **July** Heat wave that started at the end of June continued into the beginning of July. Second heat wave was observed between 11 and 13 July. Southwestern, central and northern parts of Greece experienced severe weather event (intense rainfall and flooding) during the 16 and 17 of July. Tanagra (airport) station (located in central Greece) reported its wettest July since 1957 with 68.0 mm while its mean monthly precipitation in July for the normal period 1971-2000 is about 8.26 mm (about 8 times above normal). **August** Destructive forest fires occurred in northeast Attica during 13 and 16 of August.
Hungary*	Above normal	Above normal	below normal to normal	No signal	No events reported
Israel (5)	Above normal	Above normal	No precipitation	Dry season masking	No high impact events

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Italy*	Above normal	Above normal	Below normal, extremely dry	No signal	No events reported
Jordan*	Above normal	Above normal	Dry season	No signal	No events reported
Lebanon *	Above normal	Above normal	Dry season	No signal	No events reported
The Former Yugoslav Republic of Macedonia (5)	Above normal	Above normal	Very variable precipitation regime	No signal	**June** - Extremely warm 3rd decade - Exceeded upper limit of minimal air temperature 22.4°C on 30 in Ohrid, 21.6°C on 30 in Mavrovo, 18.3°C on 3 in Lazaropole **August** - Extremely warm 1st decade with heat waves

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Moldova (5)	Above normal	Above normal	Near or below normal	No signal	Significant meteorological phenomena have been reported in the form of strong showers: – on June 27, MS Soroca received 50 mm of precipitations; – on June 30, MS Leova during 3 hours – received 64 mm of precipitations; – on July 27, MS Comrat during an hour received 47 mm of precipitations, and during 5 hours – 67 mm; – on July 28, MS Dubasari during 6 hours received 66 mm; at HP Molochișul Mare, Doibani, Nezavertailovca, Giurgiulesti during 12 hours – 52-71 mm; – on July 29, MS Ribnita during an hour received 33 mm; – overnight from 6th to 7th August, MS Balti during 6 hours received 73 mm of precipitation The heavy rains during June-July, isolated with hail and wind intensities of up to 25 m/s, caused damage to crops and material damage to the national economy. The high heat and the shortage of precipitation, which marked the month of August, contributed to the drying of the upper layer of the soil leading to unfavourable conditions for the cultivation of the crops, as well as for the preparation of the lands fors sowing the crops of autumn.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Montenegro (1,5)	Above normal	Above normal	**Below normal** (larger part) **Normal** (northeastward) **Above normal** (in Bijelo Polje and its surroundings)	No signal	Second warmest summer for Bar, Pljevlja, Kolasin, Zabljak, Cetinje, Bijelo Polje and Rozaje, fifth warmest in the rest of the country Shift in low water level 2 months earlier (in August instead of October); Favorable conditions for forest fires; Shift in grape harvest 1 month earlier (in September instead in October); Accumulating lakes near minimum; Honey less than normal, and some agricultural products especially tomatoes, cabbage, ca, broccoli and rastan. Their losses are between 30-40%. Preferable conditions for olives.
Portugal *	Around Normal	Above normal	Around normal	No signal	No events reported
Romania *	Above normal	Above normal	Normal to above normal	No signal	No events reported

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Serbia (1,5)	Above normal	Above normal	Below normal in almost entire Serbia	No signal	**June 2017** was the third warmest for Serbia, second warmest for Novi Sad, Zrenjanin and Cuprija. Zajecar and Sremska Mitrovica observed driest June on record, fourth driest for Serbia **July 2017** ranks as the fourth warmest for Serbia and the third warmest for Smederevska Palanka and Banatski Karlovac. Zrenjanin observed third driest July while Novi Sad and Crni Vrh experienced fifth driest July. Two heat waves were observed. Record-breaking number of tropical nights was recorded in Zrenjanin **August 2017** ranks as the third warmest for Belgrade, Cuprija, Novi Sad and Smederevska Palanka, and the seventh warmest for Serbia. Record-breaking number of days with temperature above 38ºC was registered this August. August daily maximum air temperature records were passed in Kikinda, Banatski Karlovac and Zrenjanin. Palic, Sombor, Novi Sad, Zrenjanin, Loznica, Valjevo and Curpija observed record-breaking number of tropical nights. Daily precipitation record was broken at MMS Veliko Gradiste The second warmest summer on record for Serbia, and record warm summer in Banatski Karlovac and Smederevska Palanka. The fourth driest for Novi Sad, and the fifth driest for Zrenjanin

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Slovenia (5)	Above normal	Above normal	**Below normal** in most of the country (except northwest and parts of northern and north-eastern Slovenia) **normal** in western Slovenia and parts of northern and north-eastern Slovenia **Above normal** in small parts of northwestern Slovenia	No signal	-Second to fourth warmest summer since reliable records. -Four heat waves. -Highest observed temperature 40.6 °C in Podnanos (south west of Slovenia). -June was the second warmest (only to June 2003) in most of the country. -Agricultural drought in south west, south east and north east of the country.
Spain (5)	Above normal, Second warmest summer since beginning of 21st century	Above normal	Mostly above normal, in some parts below normal	No signal	3 heatwaves: 13-21 June, 12-16 July, 2-6 August in various parts of the country Several severe precipitation events: 2-5 June, 25-30 June, 5-9 July, 21-23 July, 9-10 August, 25-31 August, parts or whole country affected

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Syria *	Above normal	Above normal	Dry season	No signal	No events reported
Turkey (2)	**Around normal** Mostly in the west **Above normal** in the eastern in coastal regions	Above normal	**Below normal** in the eastern regions, especially in the southeast **Above normal** in the west **Around normal** in the central regions	**Below normal to normal** in the northeast (40, 40, 20) **No signal** elsewhere	In June 2017, buildings were damaged, transportation affected due to heavy rain in the northern part of the country. In the last 10 days of the month heat wave at 47 stations. In July 2017, agricultural areas in the western part of the country affected due to heavy precipitation. Buildings damaged, transportation affected because of heavy rain in Tekirdağ and Istanbul. Heavy rain, hail and strong storm and flood also caused damages on vehicles in Istanbul. 15 stations reached new maximum temperature values. In **August** 2017, agricultural areas were affected due to heavy rain in Aydın and Aksaray. 7 stations reached new maximum temperature values. Heat wave at 15 stations.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	MedCOF-8 climate outlook for temperature	Observed	MedCOF-8 climate outlook for precipitation	
Ukraine (5)	Above normal	Above normal	**Below normal** (77% stations) **Normal** (18%stations) **Above normal** (5%stations)	No signal	During the summer season, meteorological extraordinary phenomena were observed locally in many regions of the country. Among others: very heavy rains (30-81 mm precipitation in 2-11 hours), squalls and wind gusts (with wind speeds 25-29 m/s), tornado in Dnipro region (in Kryvuy Rih 28.07.), big hail (diameter 20-34 mm). Unfavourable weather conditions caused power outage, disruption of telecommunications, utilities and transport in places. Lightning and falling trees killed 8 people. On 8 August, Botievo (Zaporizzhya region) and Henichesk, Strilcove (Kherson region) observed the highest August temperature on record for that day and month. Summer was dry in most part of Ukraine, but in some regions (Lviv, Cherkasy, Poltava, Kharkiv, Kherson regions) stations experienced driest summer conditions since 1961, with 51-148 mm (28..55% of the norm). In Smila (Chercasy region) and Pervomaysk (Mykolaiv region), June ranks as the driest on record since the observations commenced.

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-9

National Institute of Meteorology, Tunisia
National Meteorological Directorate, Morocco

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High impacts events
	Observed	**MedCOF-8 climate outlook for temperature**	**Observed**	**MedCOF-8 climate outlook for precipitation**	
Algeria *	Above normal in the north Normal to above normal elsewhere	Above normal tercile	Above normal in the south Below normal elsewhere	No clear signal	No comment
Egypt *	Normal to above normal	Above normal tercile	Below normal	No clear signal	No comment
Libya *	Normal to above normal	Above normal tercile	Normal to above normal in the south Below normal elsewhere	No clear signal	No comment

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High impacts events
	Observed	**MedCOF-8 climate outlook for temperature**	**Observed**	**MedCOF-8 climate outlook for precipitation**	
Morocco (1)	Above normal	Above normal tercile	Below normal except some areas in the Middle Atlas, the east Sahara	No clear signal	Increase of heat wave frequency, period, intensity The most severe heat wave lasted for 3 weeks. Increase of days with temperature exceeding 40°C Some absolute records of temperature were broken since 1968, 1985 and 1988
Tunisia (1)	Above normal in the north Normal to slightly above normal elsewhere	Above normal tercile	Above normal in the south-west and a small region in the north-east Normal to below normal elsewhere	No clear signal	06/06/2017: floods in the north of the country (Bizerte and Tunis) causing damage 26-28/06/2017: heat wave 10-12/07/2017: heat wave: rise in temperature with Sirocco shots. Maximum temperatures exceeded the normal of July and reached 42°C on the east coast and 46°C in the rest of the country.

Note:
(1) Basic climatological period (1981-2010)
* Data source: The National Climatic Data Center (NCDC)

References:

MedCOF 8 Outlook: http://medcof.aemet.es/images/doc_events/medcof8/step3/docStep3/Consensus_Statement_MedCOF-8_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

RA VI RCC-CM Website with monitoring results: http://www.dwd.de/rcc-cm

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

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