MEDITERRANEAN CLIMATE OUTLOOK FORUM
MEDCOF-10 ONLINE MEETING

ANALYSIS AND VERIFICATION

OF THE MEDCOF-9 CLIMATE OUTLOOK

FOR THE 2017-18 WINTER SEASON

FOR THE MEDITERRANEAN REGION (MED)

Second draft version

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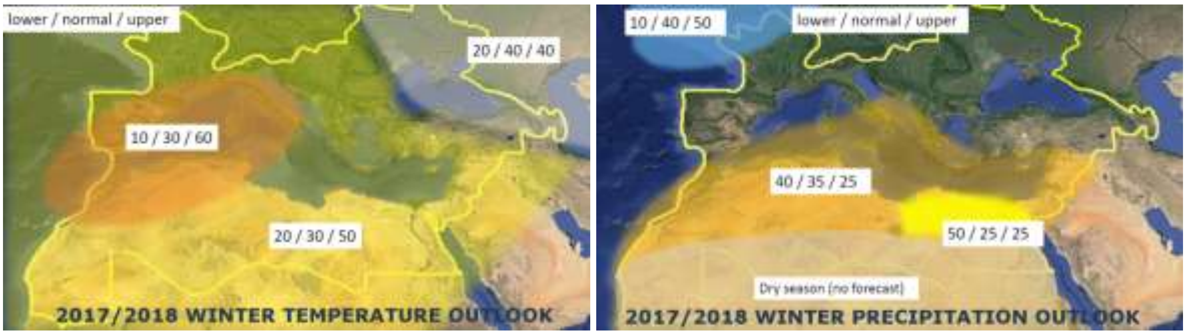
The following MedCOF verification report is based on

- the outcome of the consensus forecast of MedCOF 9,
- climate monitoring results of RA I NA RCC and RA VI RCC networks,
- the analysis and verification report of SEECOF-19 for 2017-18 winter season for southeast Europe (SEE)
- national verification reports received from NMHSs or posted in RCOF forums of MedCOF, SEECOF or PRESANORD.

1. MedCOF-9 Climate outlook for the 2017-18 winter season



(a) **(b)**

Figure 1: Graphical presentation of the climate outlook for the 2017-18 winter season for the Mediterranean region (a) Temperature Outlook; (b) Precipitation Outlook

General circulation

The tropical Pacific reflected weak La Niña conditions, both in SST indices and associated atmosphere variables showing patterns suggestive of weak La Niña conditions. ENSO predictions indicated that La Niña conditions would continue throughout the winter. Dynamical models suggested that La Niña conditions would favor positive North Atlantic Oscillation (NAO) and possibly positive East Atlantic (EA) patterns. These patterns were expected to cause preferably mild winter conditions in the MedCOF region, with the strongest signal over and near the western Mediterranean. The main feature expected for precipitation was a noticeable NW-SE gradient favoring wetter-than-normal conditions over Northern France and drier-than-normal conditions over the southeastern part of the region. Uncertainty, in addition to general predictability of seasonal forecasting, was given in terms of the particular structure of the patterns, subseasonal variability and local factors (for example SSTs in the smaller basins of the region), especially for precipitation.

Eurasian snow cover was above average while Arctic sea ice extent was below average, with the potential to influence the position of the Siberian High. Therefore, it was expected that above-average temperature would be attenuated by the possible influence of Siberian anticyclonic conditions in the northeast of the region.

Temperature

As stated in MedCOF-9 consensus statement for the seasonal climate outlook for 2017-18 winter season in the Mediterranean region, uncertainty for the temperature prediction in most of the MedCOF domain is high. There was a tendency for above-average temperature as the main feature over the whole region; the highest signal was expected to be centered over Western Mediterranean, including most of the Iberian Peninsula and Northern Maghreb. This above-average temperature is attenuated in the most eastern part of the region by the possible influence of Siberian anticyclonic conditions.

The following three regions with different tercile distributions were defined within the MedCOF domain (Fig. 1a):

- **Region 1 (orange):** The **warm** scenario (upper tercile) was favored with **60%** probability over much of Iberia (except the northwest), the western Mediterranean region including Italy and the Adriatic Sea, and northwestern parts of North Africa due to strongest NAO/EA influence and background warming trend.

- **Region 2 (yellow/green):** Again the **warm** scenario (upper tercile) was favored, but with only **50%** probability due to NAO/EA influence but larger uncertainty than in Region 1, and background warming trend. This region covers most of the MedCOF domain, mainly northwest Iberia, France (except the south), the Balkan Peninsula, Hungary, southwestern Ukraine, the eastern Mediterranean basin, Turkey (except the northeast), the Middle East parts of RA VI and entire North Africa (except the northwest).

- **Region 3 (blue/grey):** The **warm and neutral** scenarios (upper and middle tercile) were favored equally by **40% each** due to mixed influence of NAO/EA/climate warming and the Siberian High. This region covers the Ukraine (except the southwest), Moldova, South Caucasus and northeast Turkey.

This means for verification that a prediction of above-normal temperature (upper tercile) was assumed for Region 1 and 2 and normal to above-normal temperature (middle or upper tercile) for Region 3.

Precipitation

Uncertainty in precipitation predictions is generally larger than for temperature. The uncertainty related to the predominance of positive NAO or EA patterns may substantially change the precipitation distribution over the Western façade of the European and African continents. The main feature for precipitation is a noticeable gradient NW-SE favoring wetter-than-normal conditions over northern France and drier-than-normal conditions over the southeastern part of the region.

For precipitation, five regions were defined in the MedCOF-9 outlook (Fig. 1b):

Region 1 (blue): The **wet** scenario (upper tercile) was favored with **50%** due to strong NAO/EA cyclonic influence. It covers only the northwest of France.

Region 2 (no color): This is a region of large uncertainty **without any clear signal** (**33% each tercile**). It extends from Iberia over France (except the northwest), the northern part of the western Mediterranean, northern Italy, the Balkan Peninsula (except the southwest and Greece), Hungary, Romania, Moldova, Ukraine, Turkey (except the south) to South Caucasus.

Region 3 (orange): The **dry** scenario (lower tercile) was favored with **40%** due to NAO anticyclonic influence. This region covers southern and eastern parts of the Mediterranean region including southern Italy, Montenegro, Albania, FYR of Macedonia, Greece, southern Turkey, Cyprus, Middle East, and northern parts of western and central North Africa (northern Morocco, Algeria, Tunisia).

Region 4 (yellow): Again the **dry** scenario (lower tercile) was favored, but with higher probability (**50%**) than Region 3 due to combined NAO and EA anticyclonic influence. It concerns northern parts of eastern North Africa (northern Libya and Egypt).

Region 5 (brown): This is an arid region in southern parts of North Africa, where **no precipitation forecast** was given due to **dry season**.

This means for verification that above-normal precipitation (upper tercile) was assumed for Region 1, climatology (middle tercile) for Region 2 and 5, and below-normal precipitation (lower tercile) for Region 3 and 4.

2. Analysis of the 2017-18 winter season

Analysis of the winter 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 winter 2017/18 (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-19, 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 boreal winter 2017/18 average were below normal (1981-2010 reference); implying clear La Niña conditions as expected (Fig. 2). Looking at individual months and regions (Table 1), negative SST anomalies had their peak value in December 2017 in Niño region 1+2 near the South American coast, and in January 2018 in the other Niño regions (3 and 4) further west. Anomalies of Niño 3.4 region fell below the La Niña threshold of -0.5°C in all three months.

Over the North Atlantic, SST was above normal near Western Europe and around normal near northwest Africa. The Mediterranean SST was around normal in the western basin, but above normal in the east. The Black Sea, too, was warmer than normal, and also the Arctic Sea near northern Europe.

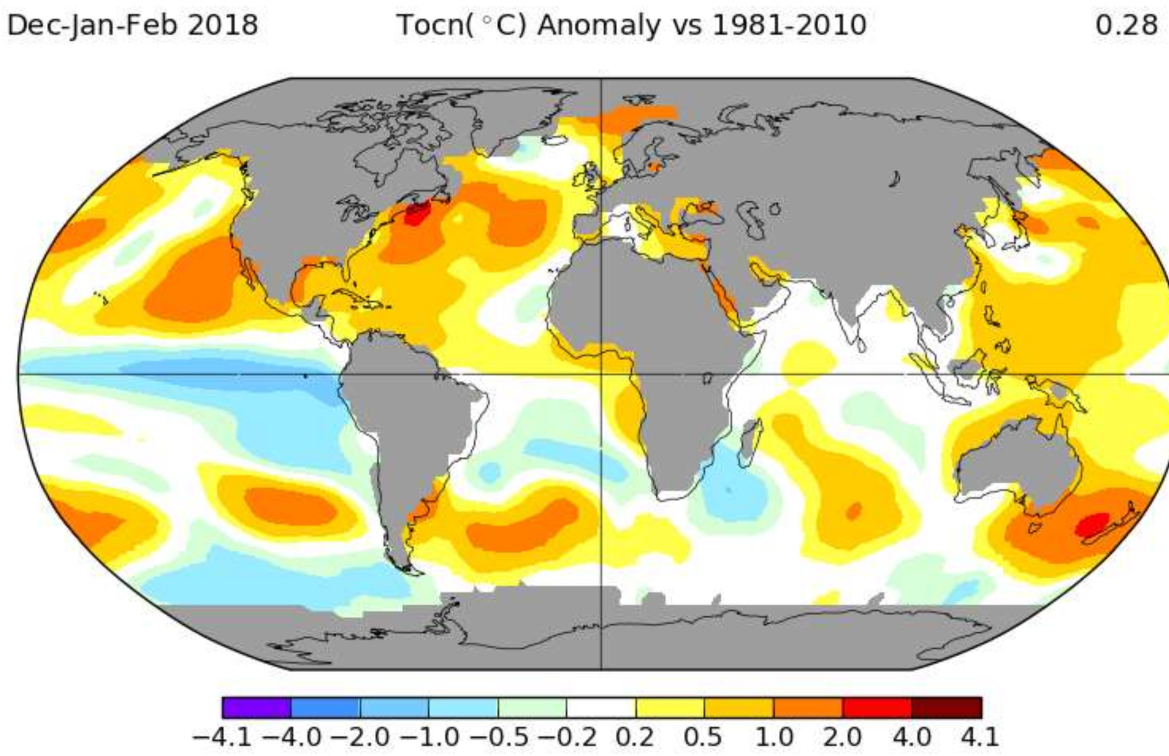


Figure 2: Sea surface temperature anomalies for boreal winter 2017-18 (December-February), 1981-2010 reference. Data from ERSSTv5 ocean model analysis with 250km smoothing, source: NASA GISS, https://data.giss.nasa.gov/gistemp/maps/

MONTH	NIÑO 1+2		NIÑO 3		NIÑO 4		NIÑO 3.4	
	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM	TEMP	ANOM
December 2017	21.44°C	-1.38°C	24.05°C	-1.09°C	28.24°C	-0.25°C	25.80°C	-0.77°C
January 2018	23.71°C	-0.81°C	24.48°C	-1.14°C	28.03°C	-0.27°C	25.82°C	-0.75°C
February 2018	25.57°C	-0.57°C	25.36°C	-1.01°C	27.86°C	-0.24°C	25.83°C	-0.90°C

Table 1: Sea surface temperature and anomalies for various Niño regions in boreal winter months 2017-18 (December-February), 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

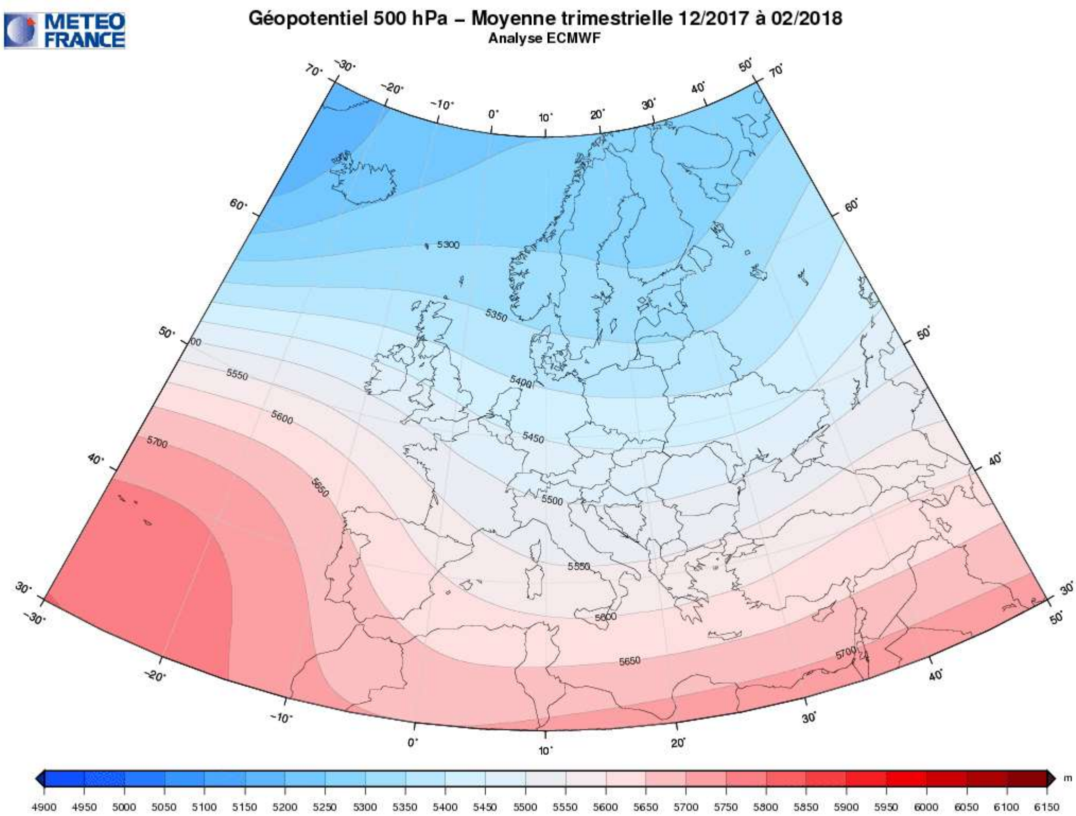
Seasonal averages of both 500 hPa geopotential and sea level pressure in winter 2017/18 show a clear zonal circulation component over the North Atlantic in middle latitudes (Fig. 3 and 4). The Azores High was more intense than normal and extended more to the north, but also the Icelandic Low was more intense. This caused a relatively strong zonal flow from the North Atlantic to northern Central Europe, while anticyclonic conditions extended to Iberia, but not significantly more than normal. A large trough can be seen over the western Mediterranean on seasonal average. The Siberian High, too, was more intense than normal and extended over much of European Russia.

Looking at individual months (Fig. 5 and 6), the westerly flow into Europe was particularly well established in early winter 2017/18. In January, also parts of southern Europe were more affected. The Siberian High was especially intense in late winter, particularly in February, when a cold wave occurred over much of Europe. The Mediterranean region on the other hand mainly had cyclonic conditions in February, especially the western basin.

The Météo France weather type classification (Fig. 7) shows an above-average frequency both for Atlantic ridge (mainly in December, when the Azores High extended far to the north) and NAO+ types (mainly in January and February). In February, when the influence of the Siberian High extended far west to Scandinavia, also an enhanced blocking occurred, resulting in above-normal frequency in Scandinavian blocking, but only for this month, not on seasonal average.

The evaluation of monthly teleconnection indices (Table 2) yields a positive NAO pattern throughout the winter with increasing intensity from December to February. The EA index, in contrast, was positive only in January, but negative in the other two months due to different positions and extensions of the East Atlantic pressure centers. Instead another important pattern this winter was the East Atlantic – West Russia dipole (EA/WR) which was clearly negative throughout the winter, given by both an intense Icelandic Low and Siberian High. Also to be noted the negative phase of the Polar – Eurasia pattern (POL) given by a weak polar vortex, which is related to a relatively warm Arctic region and low Arctic sea ice, and therefore expected influence on the Siberian High position.

Altogether, the main features in the ocean (especially La Niña) and in the atmosphere (NAO, EA, Siberian High influence) occurred as predicted.



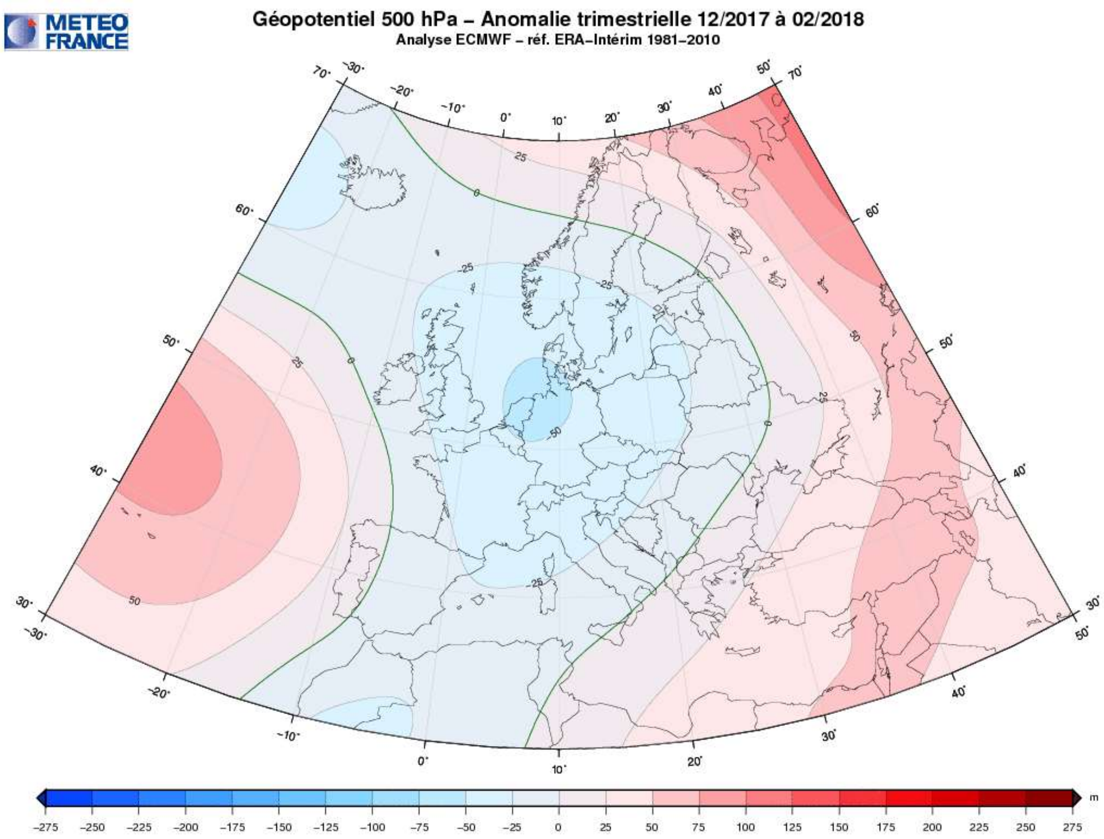
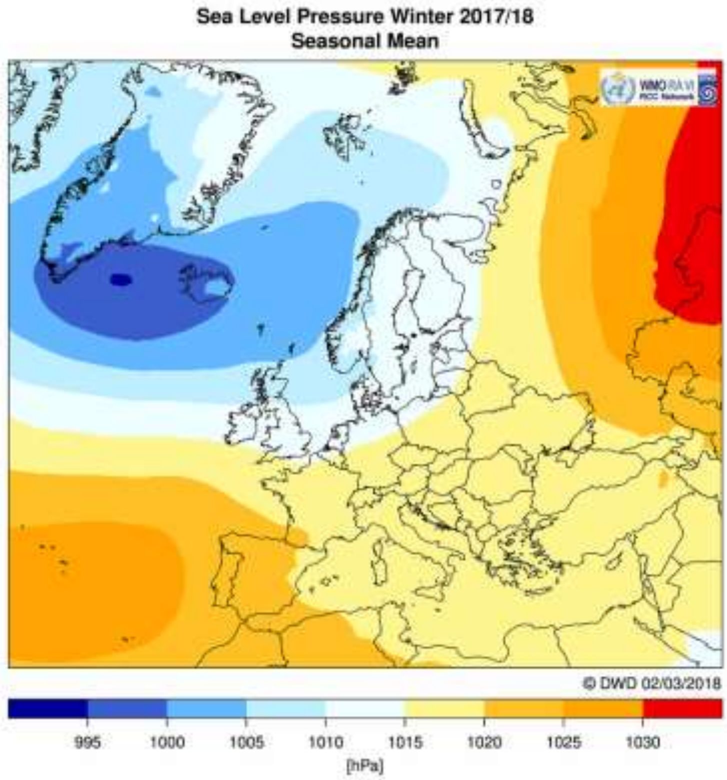


Figure 3: Seasonal mean and anomalies of 500 hPa geopotential for winter 2017-18 (1981-2010 reference). Source: Météo France, data source: ECMWF ERA Interim reanalysis, http://seasonal.meteo.fr/en/content/suivi-clim-cartes



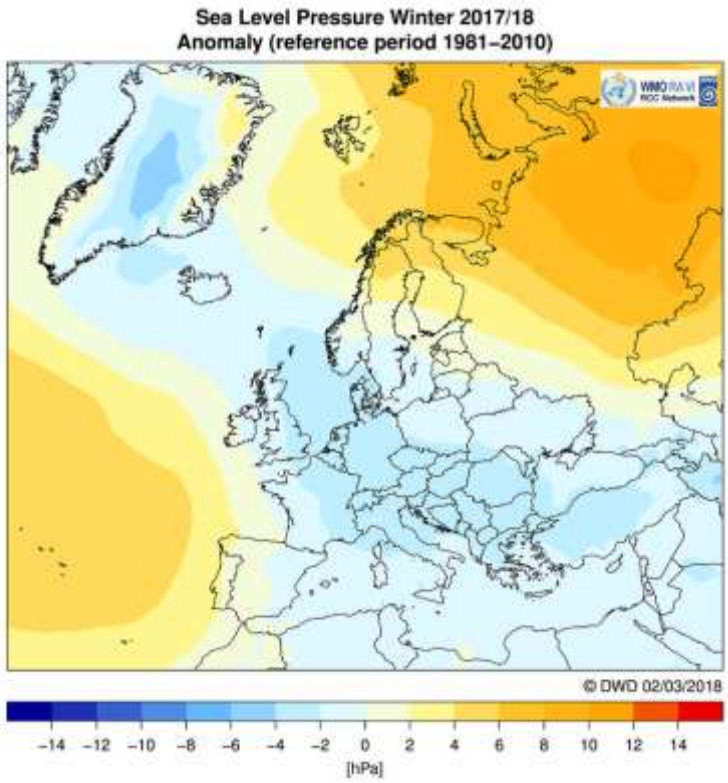


Figure 4: Seasonal mean sea level pressure (upper graph) and its seasonal anomalies (lower graph) for winter 2017-18 (1981-2010 reference). Source: Deutscher Wetterdienst (DWD), data source: DWD numerical ICON model analysis, http://www.dwd.de/EN/research/weatherforecasting/num_modelling/01_num_weather_prediction_modells/icon_description.html?nn=484268

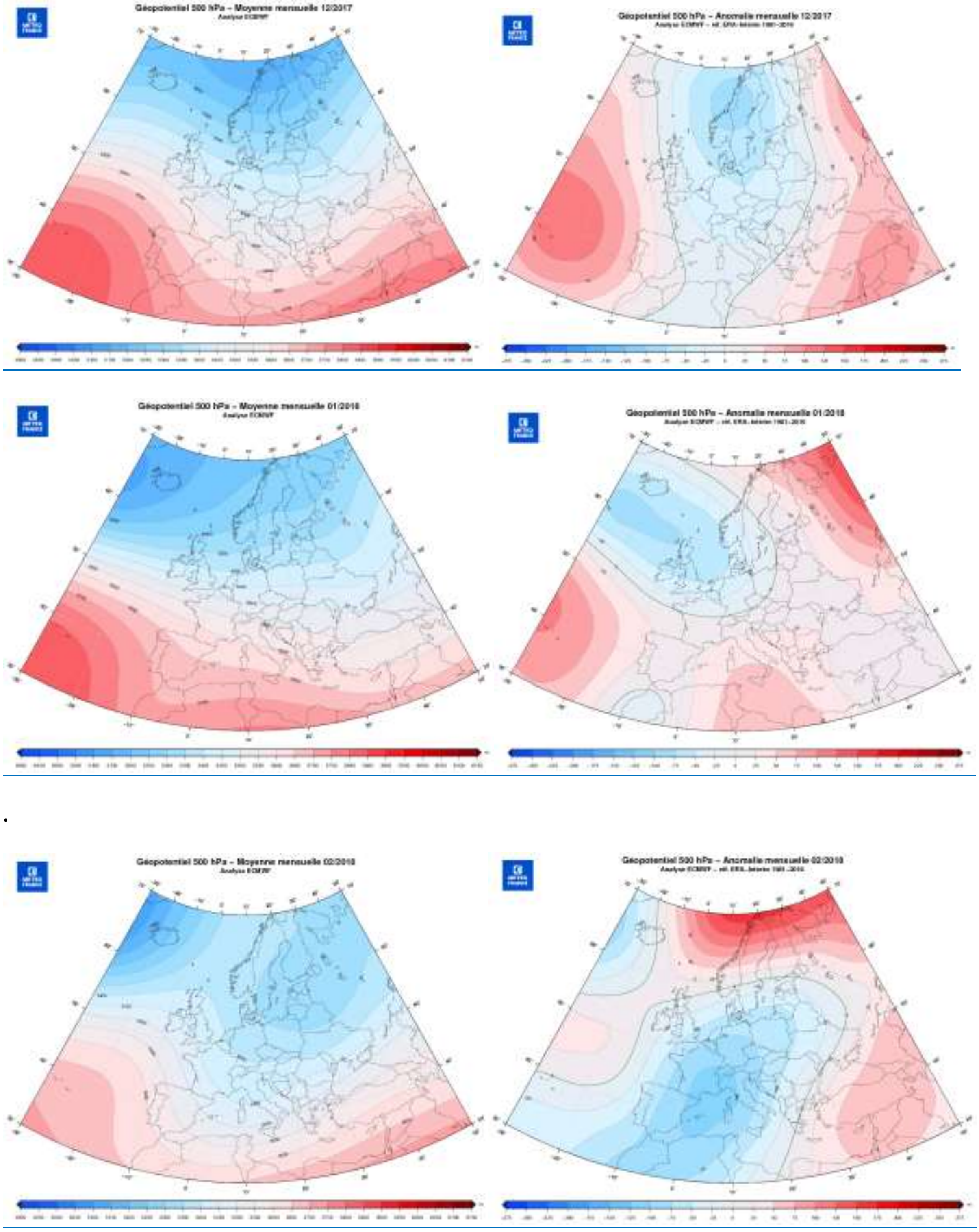


Figure 5: Same as Figure 3, but for the months December 2017, January 2018, February 2018

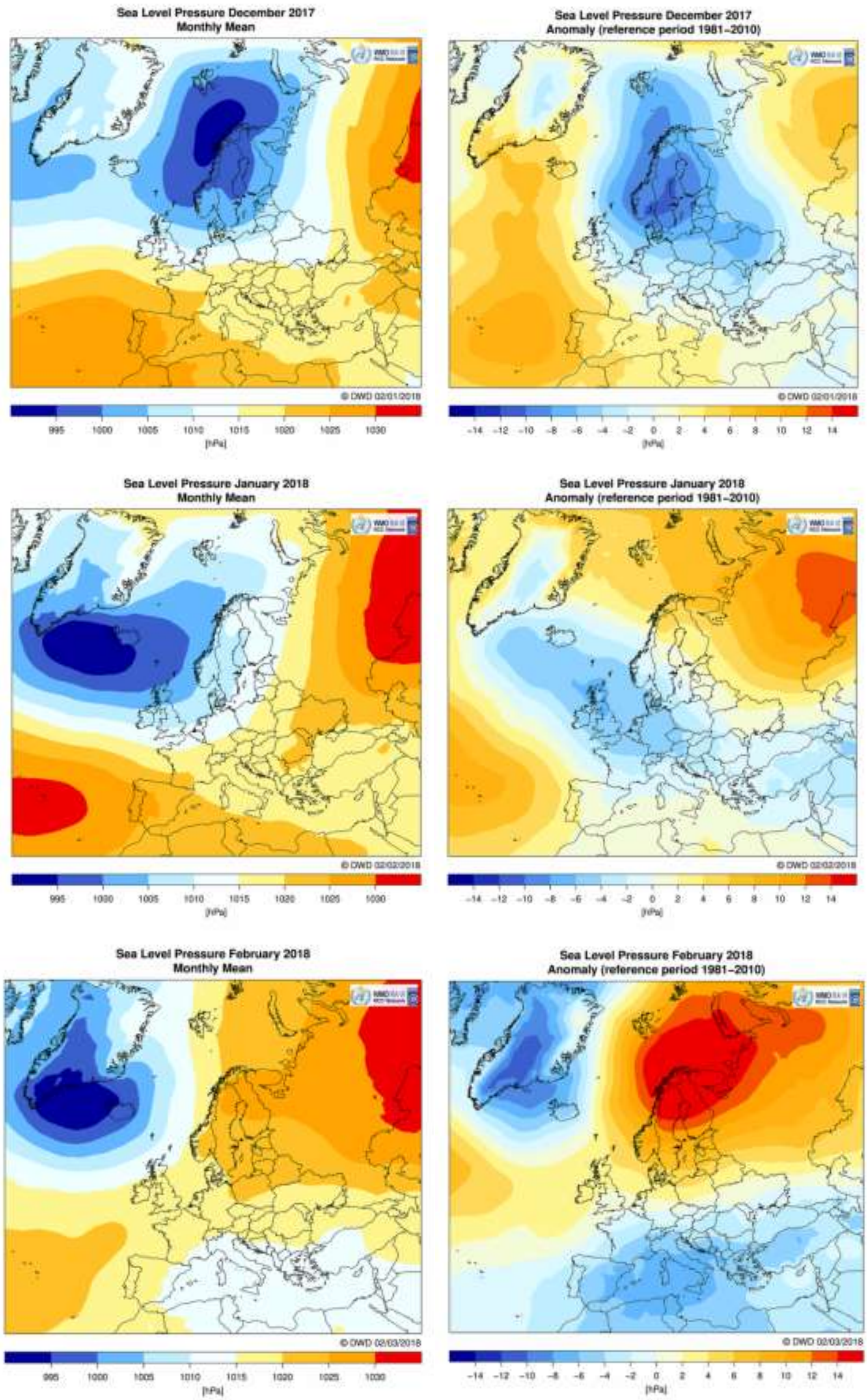


Figure 6: Same as Figure 4, but for the months December 2017 - February 2018

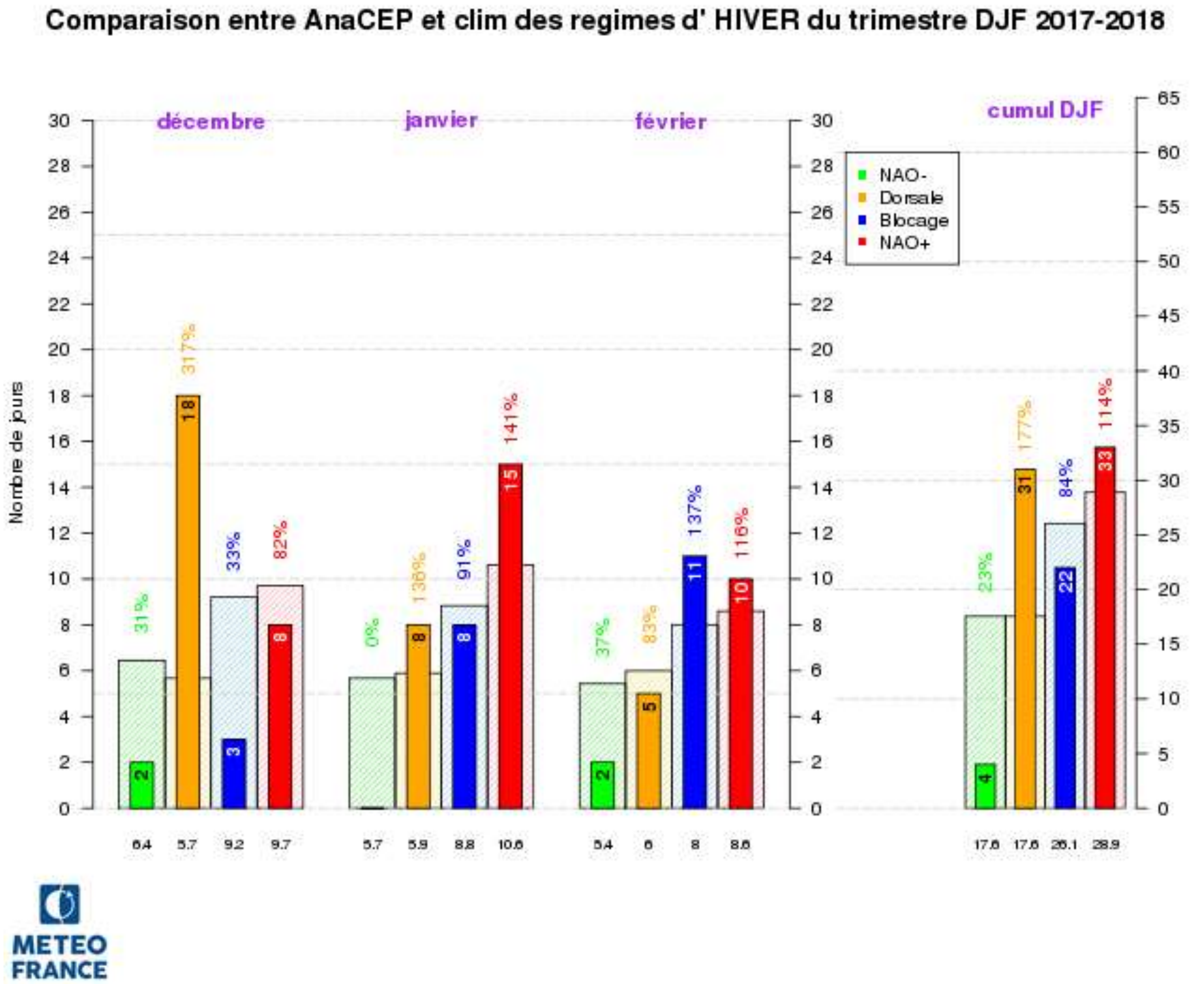


Figure 7: Number of days with circulation types of the Météo France classification for each month of the winter 2017-18 season and for the whole season (right), and in percent of the climatological frequency distribution 1981-2010. Circulation types are: negative North Atlantic Oscillation phase (NAO-), Atlantic ridge (Dorsale), Scandinavian Blocking (Blocage) and positive North Atlantic Oscillation phase (NAO+). 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	12	0.73	-0.50	0.33	-99.90	0.58	-1.63	-0.48	1.04	-1.95	-99.90	55.9
2018	1	1.17	0.55	0.43	0.66	-0.14	-1.62	0.44	-0.33	-1.48	-99.90	47.3
2018	2	1.34	-1.38	0.40	0.23	-1.67	-1.40	0.43	2.20	-2.24	-99.90	68.5

Table 2: Circulation indices of NOAA CPC patterns for the winter months 2017/18.

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

2.2. Temperature

Europe and Middle East (RA VI)

Winter 2017/18 was warmer than normal over most of the area (Fig. 8-10). According to ERA-Interim Reanalysis, especially all eastern parts of the RA VI MedCOF region had seasonal means in the upper tercile. Over Italy, the Balkans, and further northeast (Hungary, Romania, Moldova, Ukraine), but also in parts of the Middle East, Cyprus, southern Turkey the seasonal means exceeded the 80th or 90th percentile (1951-2010 reference, Fig. 11). Towards the west, the situation was diverse. Temperature means were in the middle tercile over most of mainland France and even in the lower tercile in places of Spain and Portugal. The colder temperatures in southwestern Europe mainly occurred in December and February, while January was mild there due to a more southerly position of the westerly flow and more EA+ like conditions. February was cold in most of the European part of the domain due to cold inflow from the east related to the position of the Siberian High, but except the southeast (eastern Mediterranean region).

Mean seasonal temperature in the lowlands ranged from slightly below 0°C in the northern Ukraine up to more than 15°C in Jordan (Fig. 12). Seasonal anomalies increased mainly from the southwest to the northeast from -1°C in southwestern Europe to above +5°C in eastern Turkey.

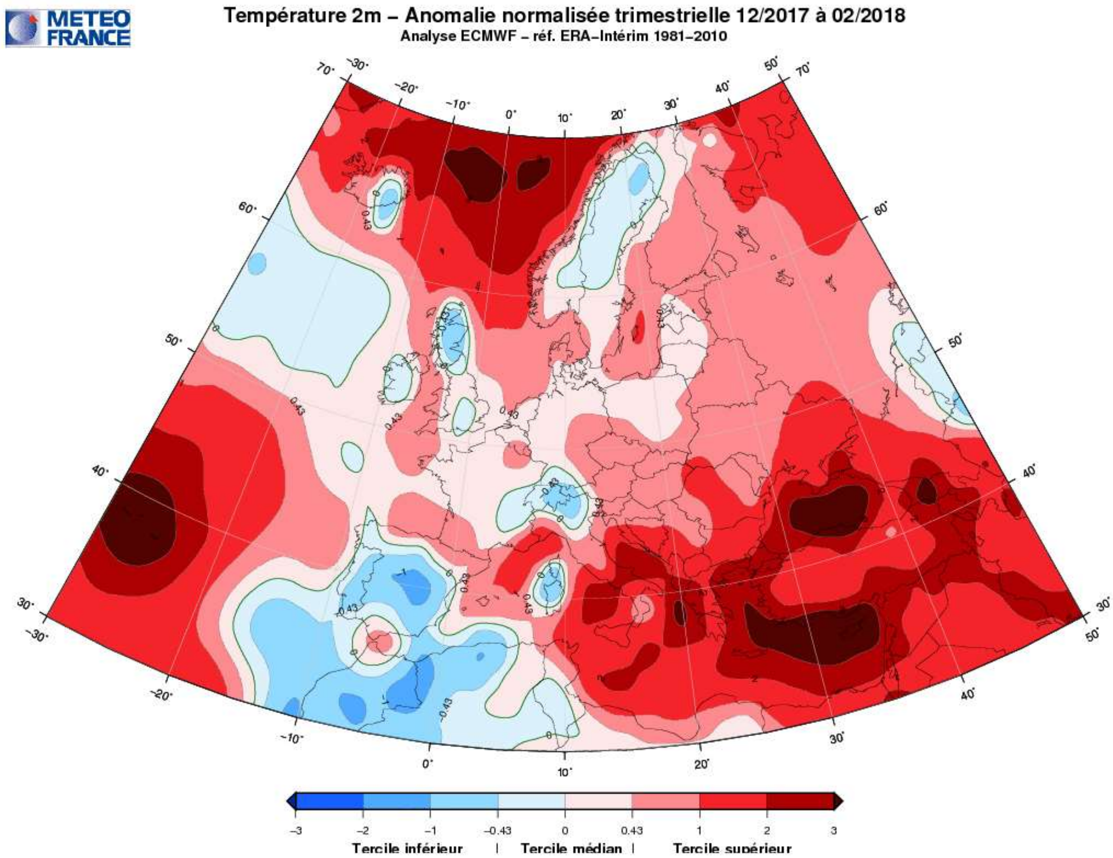


Figure 8: Seasonal normalized temperature anomalies of winter 2017/18 surface air temperature based on ECMWF / ERA-INTERIM grid data, 1981-2010 reference. The data range between -0.43 and +0.43 represents the middle tercile, below -0.43 the lower tercile and above +0.43 the upper tercile. Source: Météo France, data reference: http://www.ecmwf.int/en/research/climate-reanalysis/era-interim

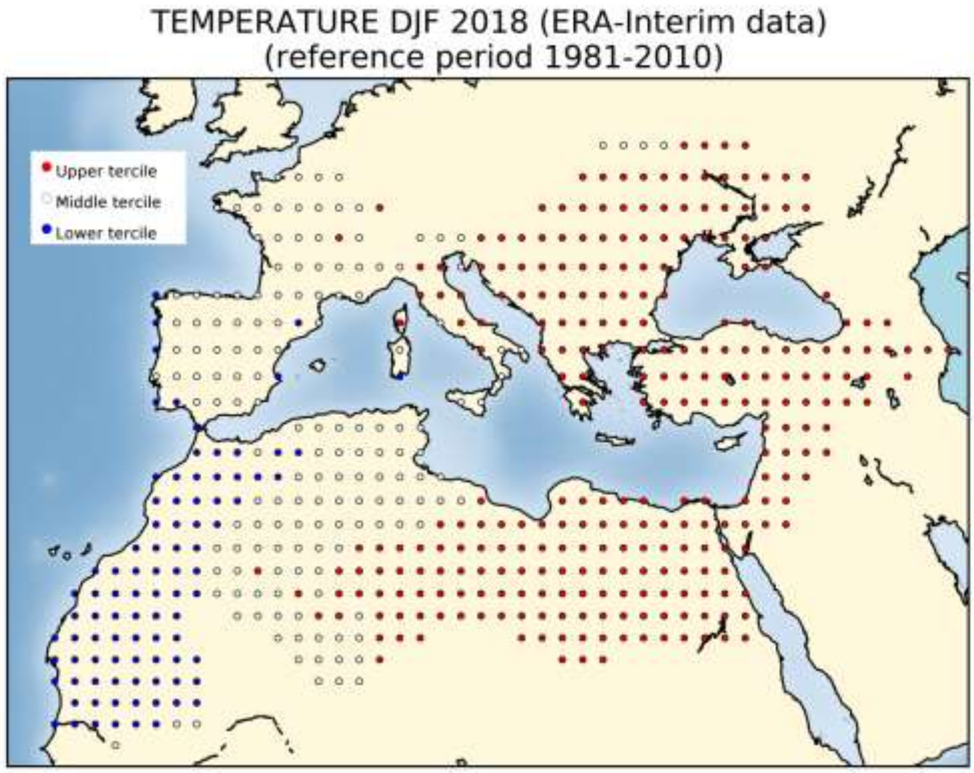
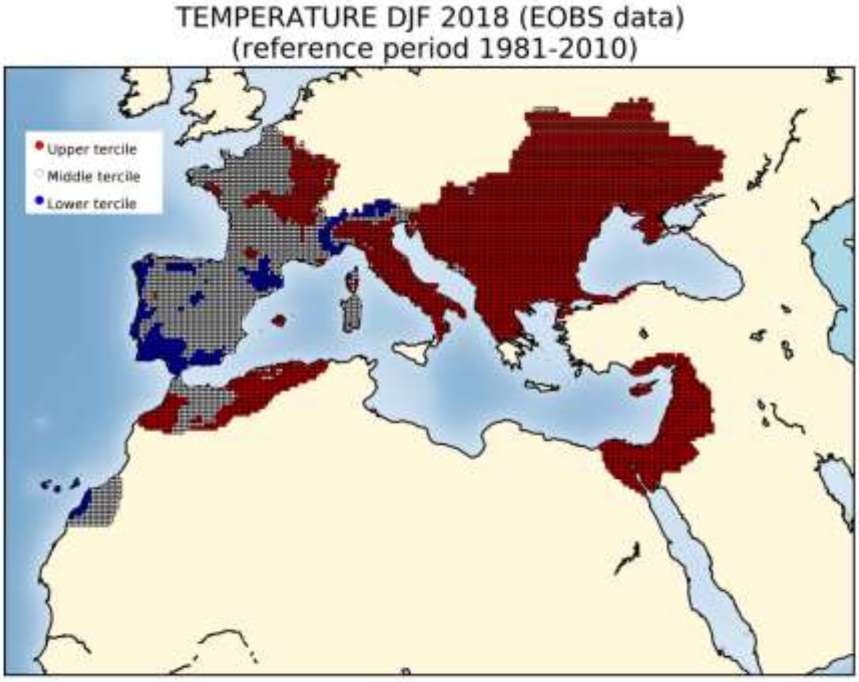


Figure 9: Terciles of winter 2017/18 surface air temperature based on ERA-Interim Reanalysis, 1981-2010 reference. Source: AEMET, data source http://www.ecmwf.int/en/research/climate-reanalysis/era-interim



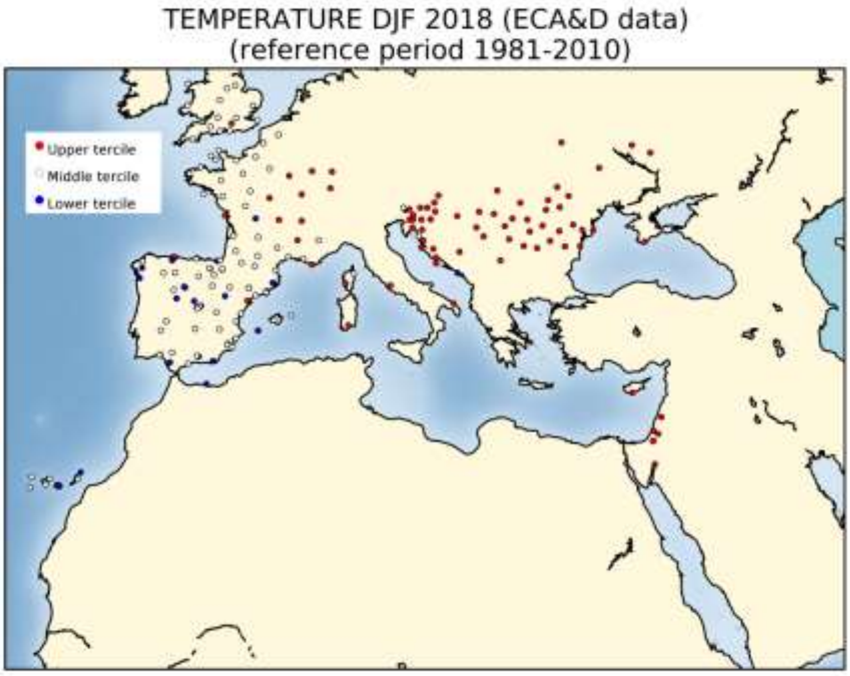


Figure 10: Terciles of winter 2017/18 surface air temperature based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Source: AEMET, data source: http://www.ecad.eu/

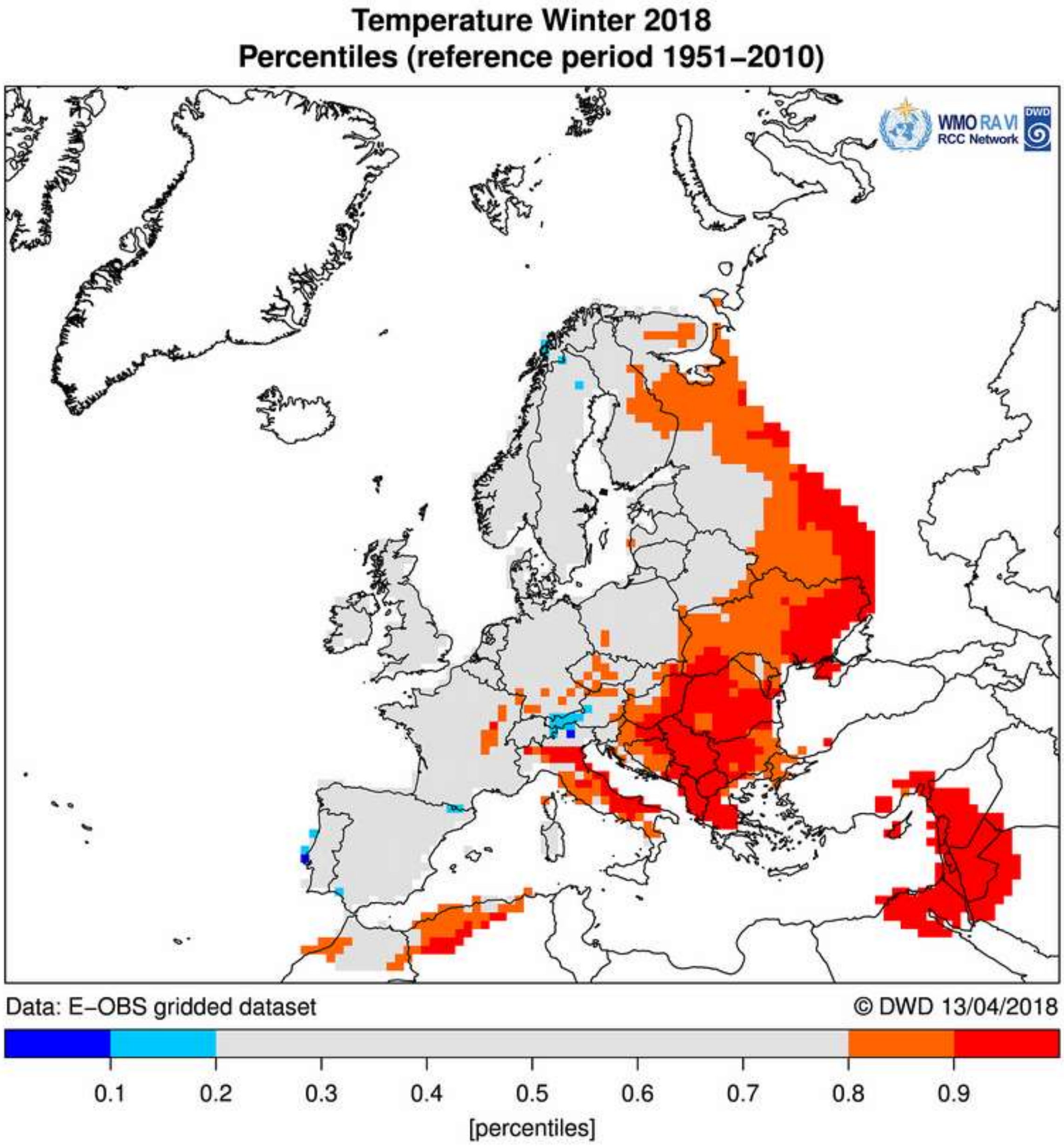


Figure 11: Percentiles of winter 2017/18 surface air temperature based on interpolated E-OBS gridded data, 1951-2010 reference. Source: DWD, data source: http://www.ecad.eu/

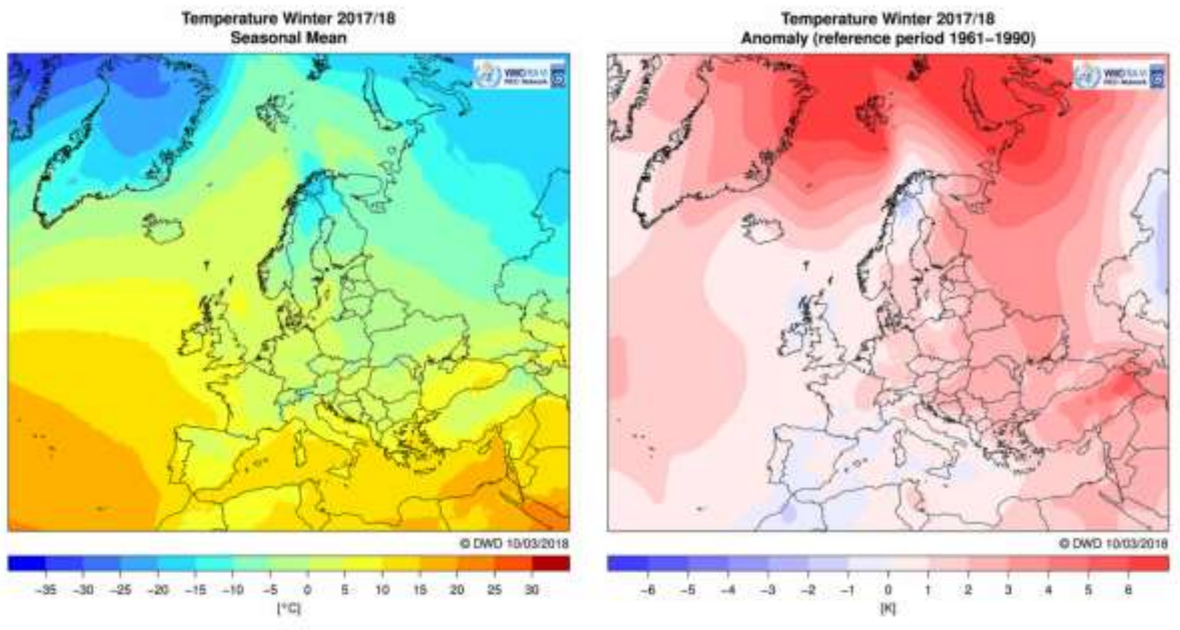


Figure 12: Surface air temperature for winter 2017/18. Left: seasonal mean, right: anomalies, 1961-1990 reference, source of both maps: WMO RAVI RCC, based on interpolated CLIMAT data, www.dwd.de/rcc-cm

North Africa (RA I)

In winter 2017-18 the seasonal mean land temperature ranged from 2.5 °C over the north of Algeria and Morocco to 23 °C in the south of Morocco and Egypt (Fig. 13).

In Libya, mean temperature of this season was around 13.0 °C. The lowest mean was in the western parts with 11° C. Mean seasonal temperature anomalies over the whole country were above normal (Fig. 14).

In Tunisia, the winter seasonal mean temperature was at its minimum over north-western regions and the center of Tunisia. The lowest value of seasonal mean temperature was 7°C measured in Thala in the north-west of Tunisia. The south and the 3 eastern parts of Tunisia were mainly the hottest region in the 2017-18 winter season. The highest values of absolute maximum temperature were registered during January 2018. Mean temperature was slightly above the 1981-2010 normal nearly over the whole country with anomalies ranging from -0.14 °C in the extreme north-west and +1°C in the center of Tunisia.

Below normal conditions were observed over most parts of Morocco except the eastern part where near normal conditions prevailed.

Winter 2017-18 was colder than normal in almost whole of Algeria.

According to the map of observed tercile distribution for winter 2017-18, below-normal conditions were observed over most parts of Morocco, the south-west and the extreme north of Algeria. Above-average temperatures were observed over all of Egypt and Libya. In Tunisia the mean temperature was near normal over all the country.

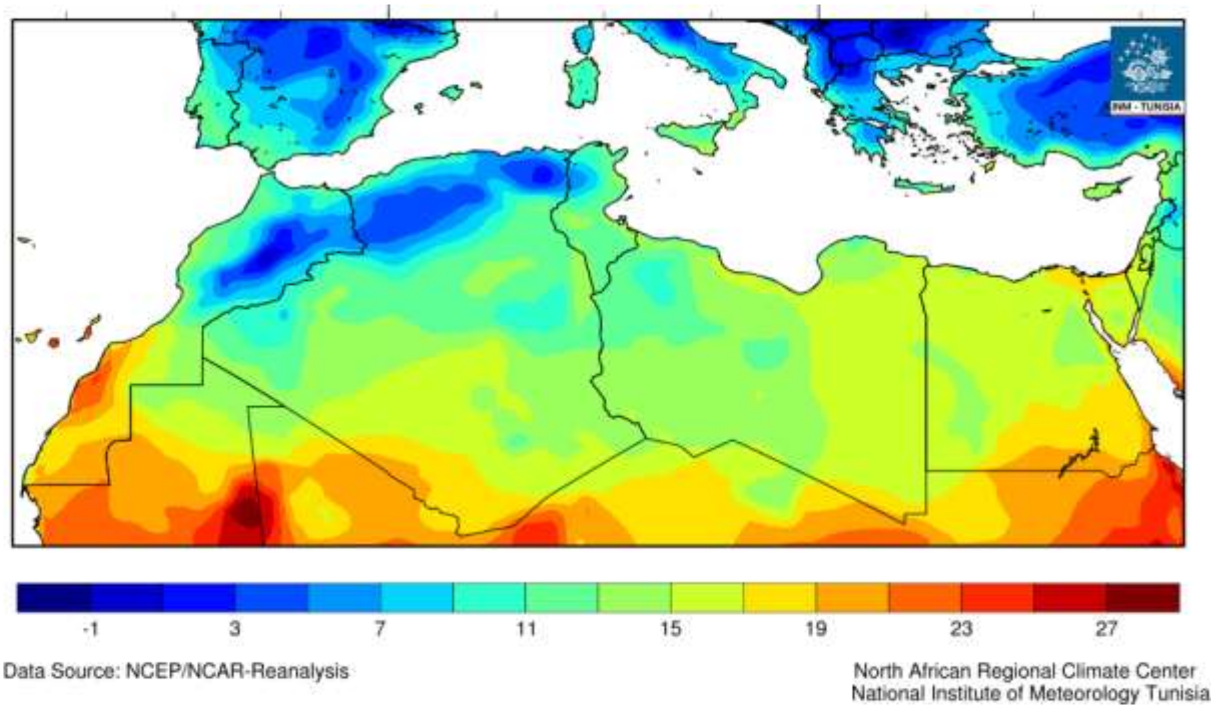


Figure 13: Mean temperature for winter season 2017/18 in North Africa (in °C). Source: INM, (Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov)

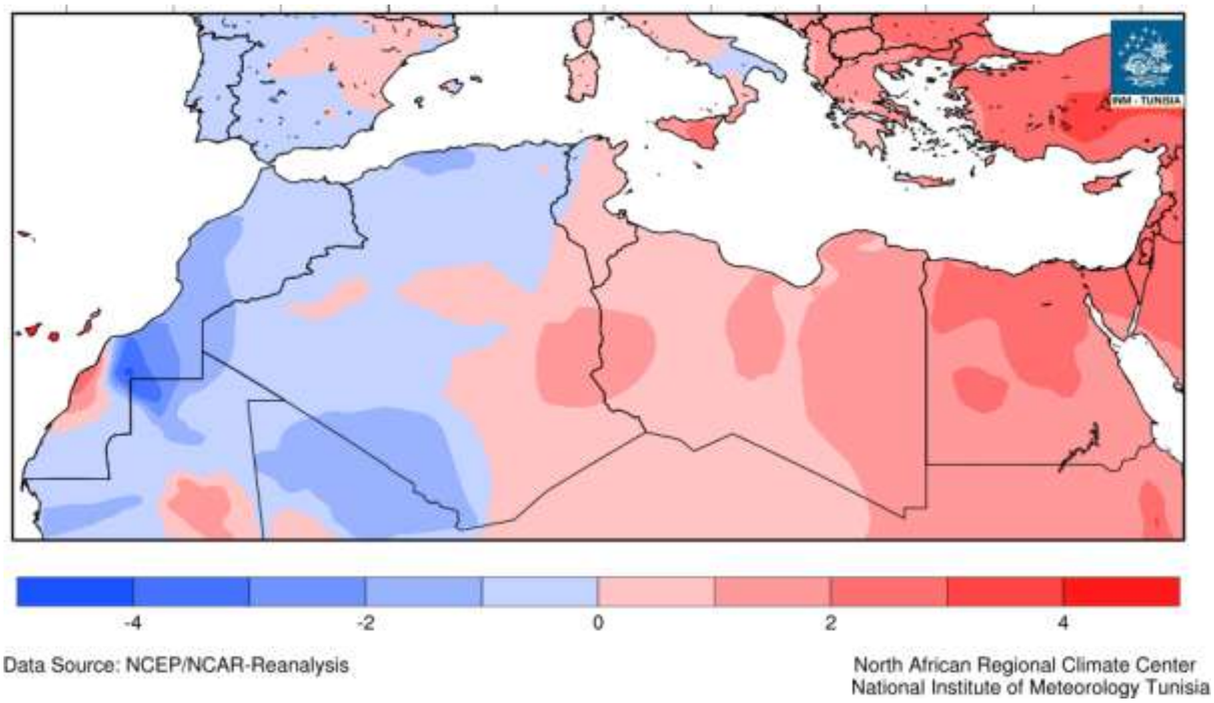


Figure 14: Temperature anomaly for winter season 2017/18 in North Africa (in °C), reference period 1981-2010. Source: INM, Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov

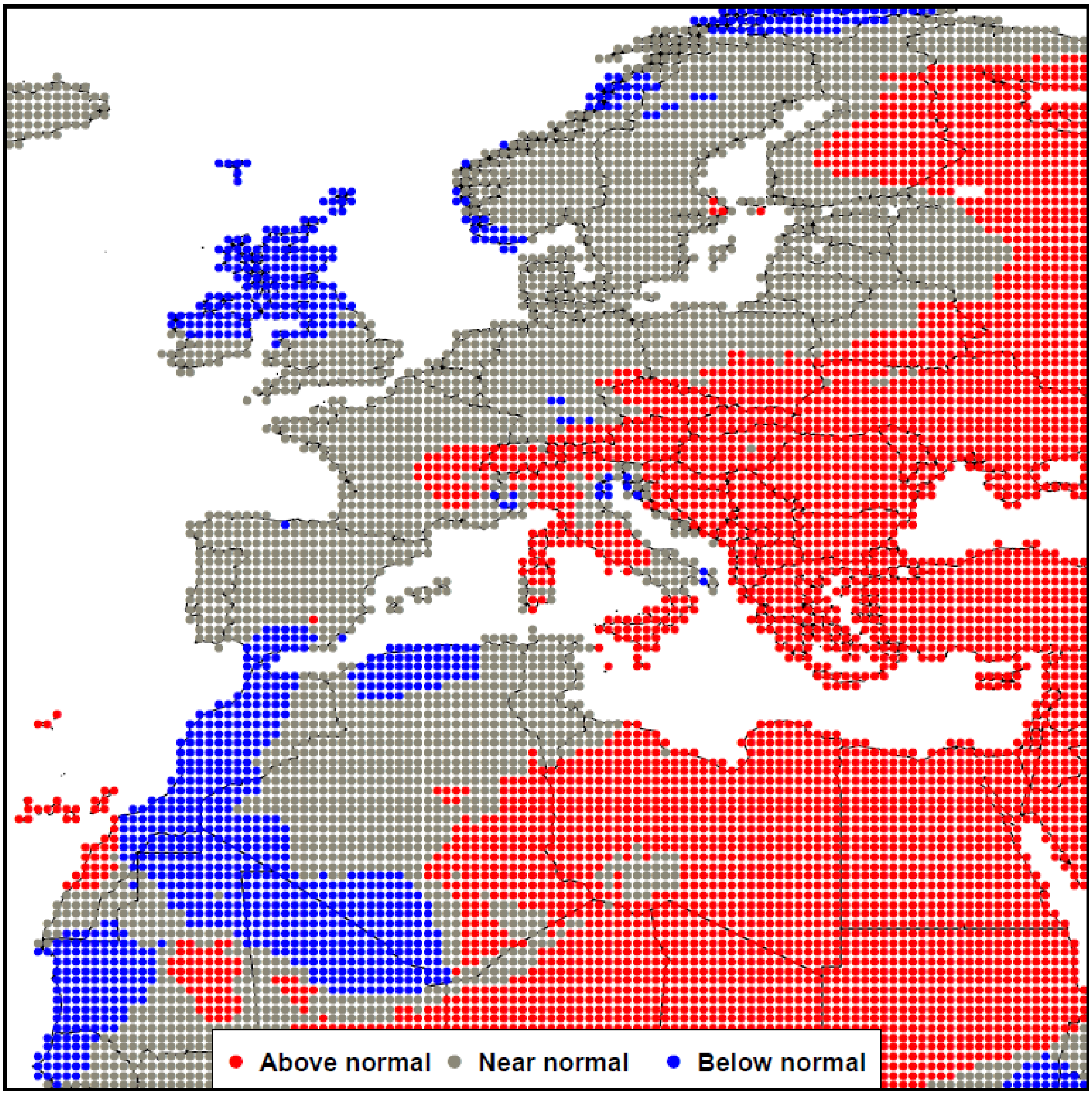


Figure 15: Tercile distribution for temperature of DJF 2017-18, 1981-2010 reference. Source: INM, Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov

2.3.Precipitation

Europe and Middle East (RA VI)

Precipitation distribution in winter 2017/18 was mainly determined by topography and exposition, but also by contributions from atmospheric circulation (Fig. 16). Highest seasonal totals above 450mm within the domain were analysed at the northern coasts of Spain and the Biscay, in the French Alps, at the Dalmatian coast and at the eastern Black Sea. In several other coastal areas, but also in some regions with frequent low pressure in France and southern Italy the totals exceeded 300mm. Lowest totals were to be found in eastern Jordan with less than 30mm.

Precipitation anomalies (Fig. 16-18) were very diverse. The majority of the domain hat above-normal precipitation, especially northern Spain, France, much of Italy, the Balkans, the northeast and the eastern South Caucasus, partly exceeding 150% of the 1981-2010 normal and the 90th percentile. High anomalies occurred in all three winter months, but over different areas in the domain, dependent on the prevailing weather types. Areas of below-normal precipitation were to be found particularly more to the south as expected from an NAO+ pattern, especially in southern Spain, parts of southern Italy, Crete, Cyprus, most parts of Turkey and the Middle East. The rest of the domain had near-normal precipitation.

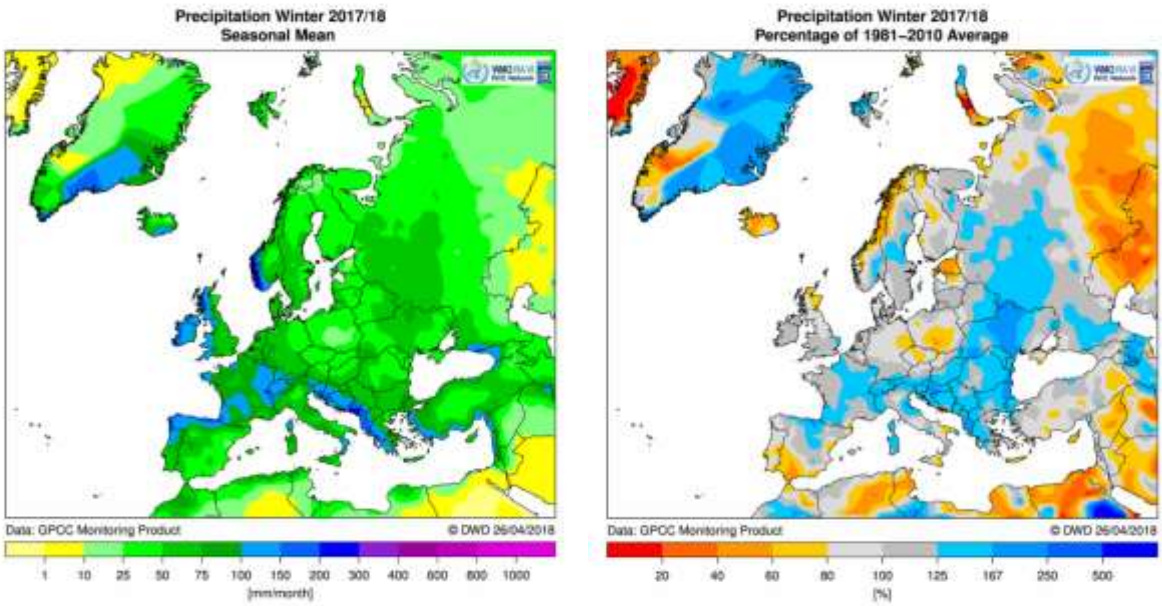
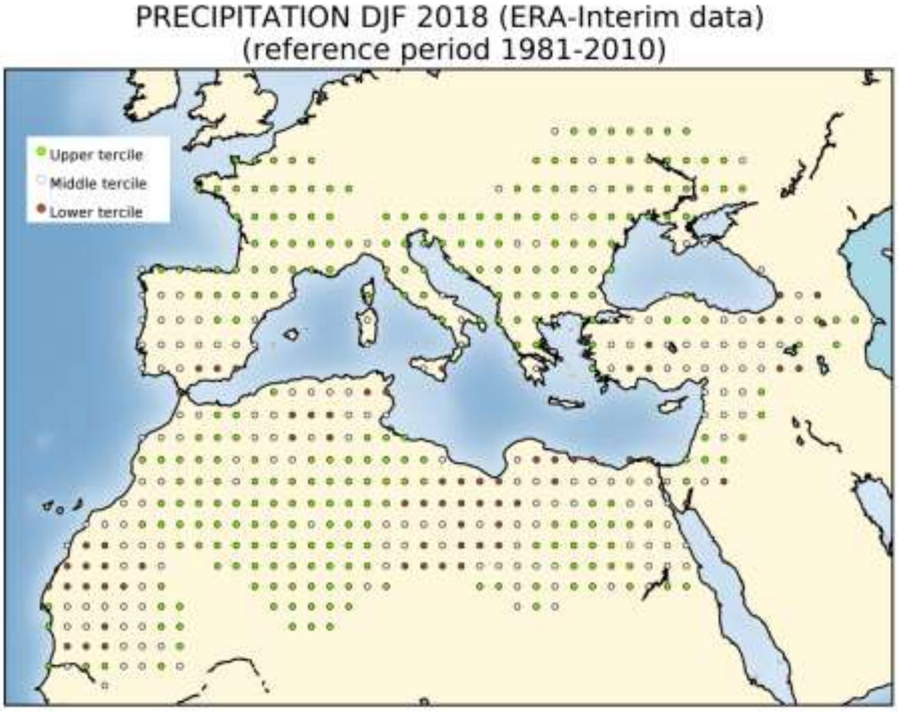


Figure 16: Precipitation for winter 2017/18 in Europe. Left: seasonal total in mm/month, right: percentage of 1981-2010 average, source: WMO RAVI RCC, www.dwd.de/rcc-cm, data source: GPCC, http://gpcc.dwd.de



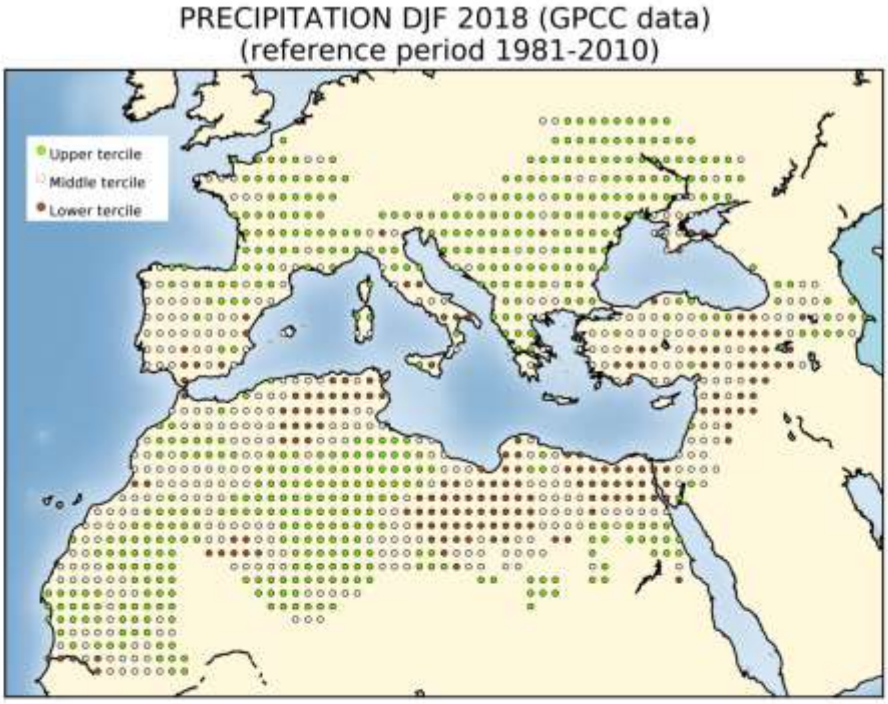
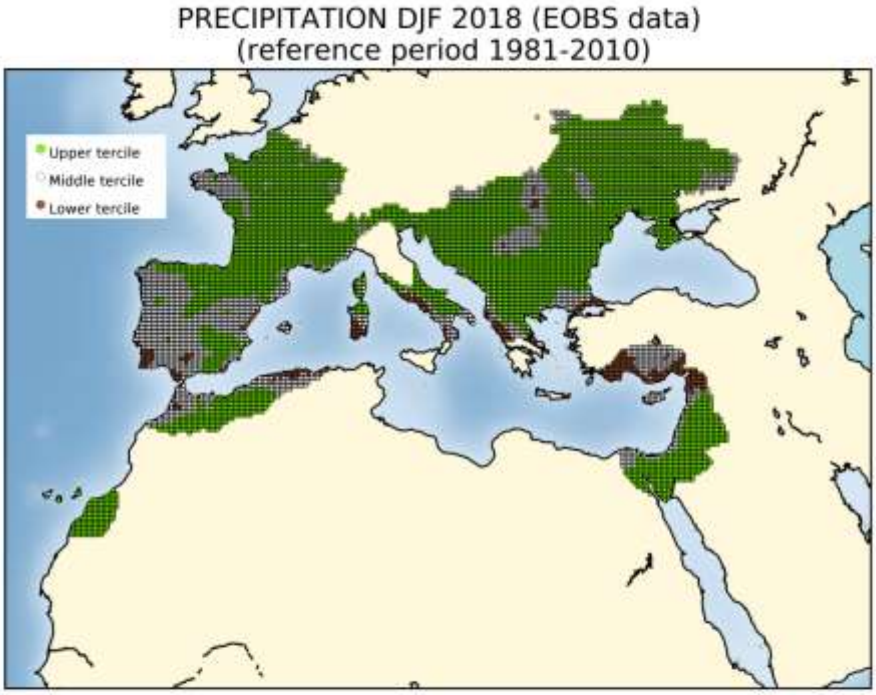


Figure 17: Terciles of winter 2017/18 precipitation based on ERA-INTERIM Reanalysis (upper graph) and GPCC (lower graph) grid data, 1981-2010 reference. Source: AEMET, data reference: ERA-INTERIM: http://www.ecmwf.int/en/research/climate-reanalysis/era-interim , GPCC: http://gpcc.dwd.de



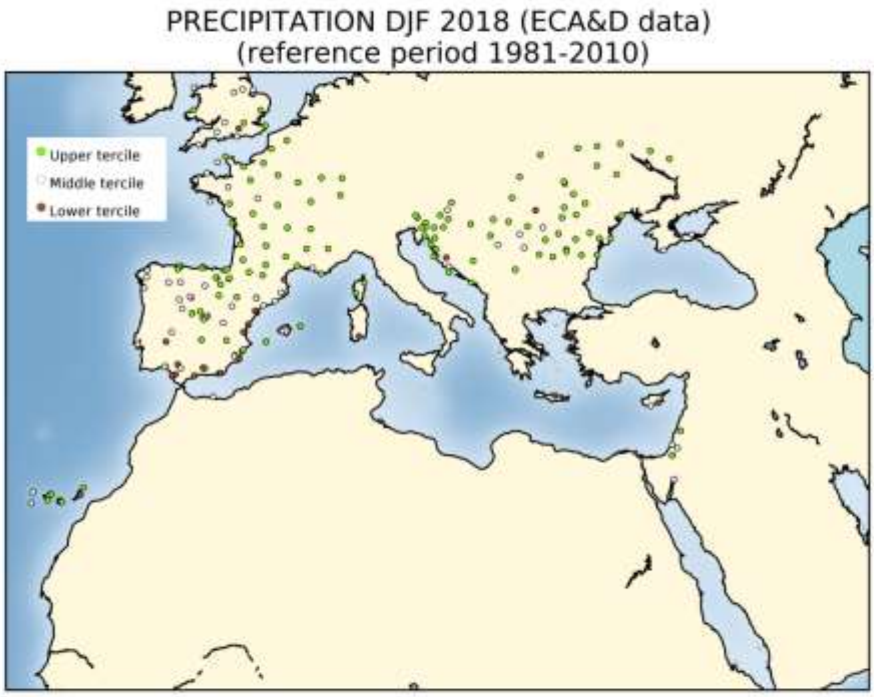


Figure 18: Terciles of winter 2017/18 precipitation based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Source: AEMET, data source: http://www.ecad.eu/

A more detailed analysis for south-eastern Europe, including high impact events, is given in the analysis and verification report of the SEECOF-18 CLIMATE OUTLOOK for 2017-18 winter season for southeast Europe (SEE), provided by SEECOF-19 (presently draft version): http://www.seevccc.rs/SEECOF/SEECOF-19/STEP-1/Draft-Version-Final-assessment-of-SEECOF-18-climate-outlook-for-winter-season.pdf

North Africa (RA I)

During winter 2017-18 the precipitation total was at its minimum in the southern parts and at its maximum in the northern parts of the North Africa domain. Maximum totals of precipitation were registered in the extreme north-west of Tunisia and the north of Morocco.

Winter 2017-18 was wetter than normal in the north-west of Libya, the south of Algeria, the south of Tunisia and especially the south-west of Egypt. It was normal to below normal elsewhere.

In Morocco, precipitations were normal to above normal over all synoptic stations except Tetouan. In particular, in December, total rainfall was generally in deficit for almost all the country. January and February were rainy with new records regarding 24-hour total rainfall since 1972.

In Libya, all precipitation was concentrated over the northern parts of the country.

Precipitation in Tunisia was at its maximum in the north and mainly in the extreme north-west where the seasonal total exceeded 600 mm. The maximum seasonal total (661 mm) was observed in Tabarka in the north-west and the minimum (20 mm) was registered in Kebili in the south of Tunisia. Extreme values were registered in Tabarka such as the highest 24-hour total precipitation with a total of 46 mm. With reference to the 1981-2010 period, total precipitation amount was above normal to near normal all over the country except of some regions in the north where precipitation was below normal.

According to the tercile map (Figure 21), below-average to near-average precipitation was observed across the northern parts of Tunisia, Algeria and Egypt and the eastern parts of Libya. Near-average to above-average precipitation was registered across Morocco, southern Tunisia, Algeria, Egypt and western Libya.

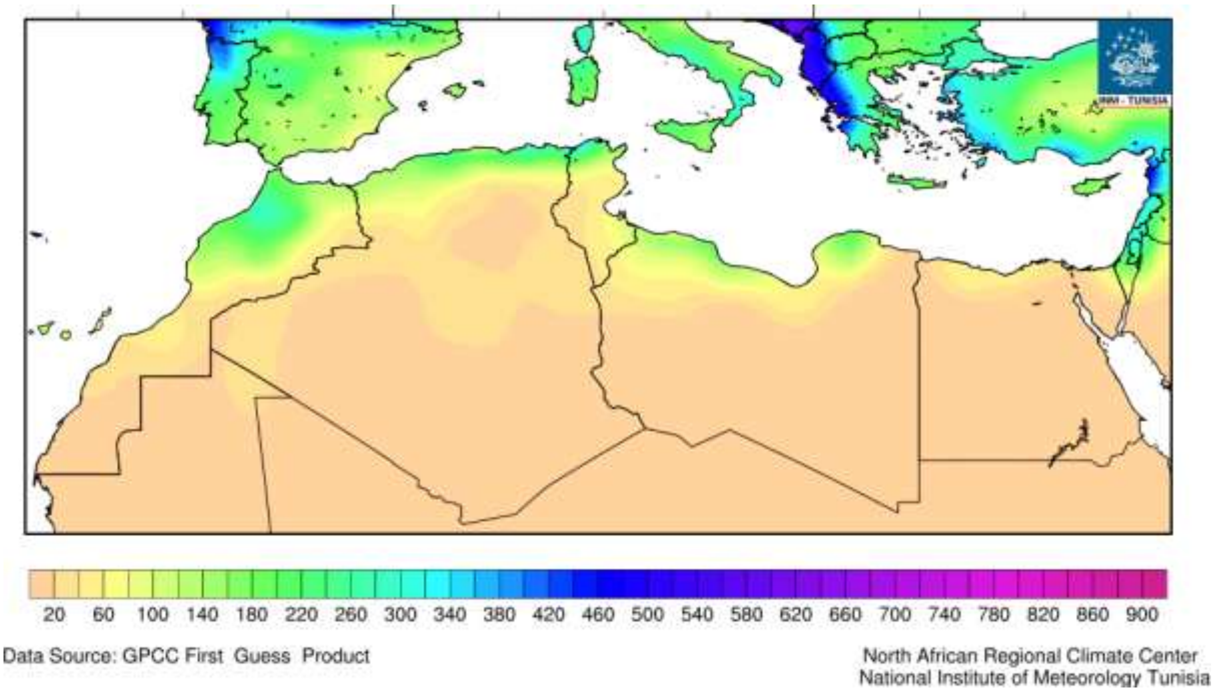


Figure 19: Total precipitation for winter season 2017/18 in North Africa (in mm). Source: INM, Data from GPCC (First Guess Product), http://gpcc.dwd.de

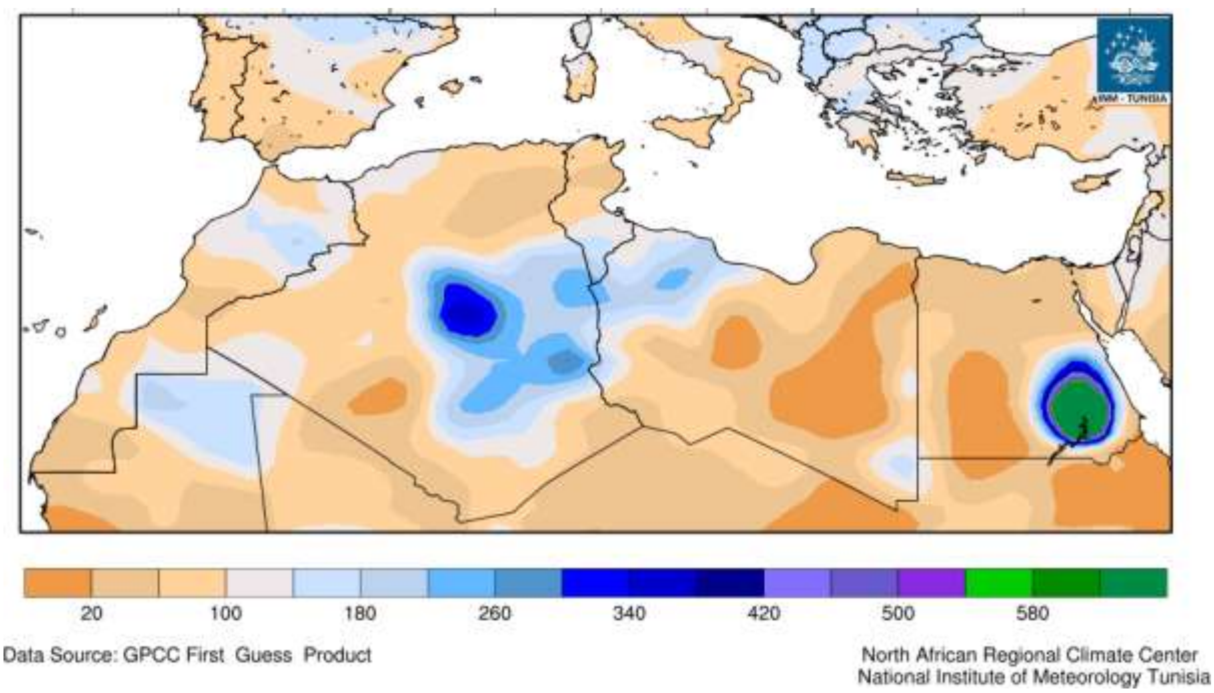


Figure 20: Precipitation anomaly for winter season 2017/18 in North Africa (in %) (Reference period 1981-2010). Source: INM, data from GPCC, http://gpcc.dwd.de

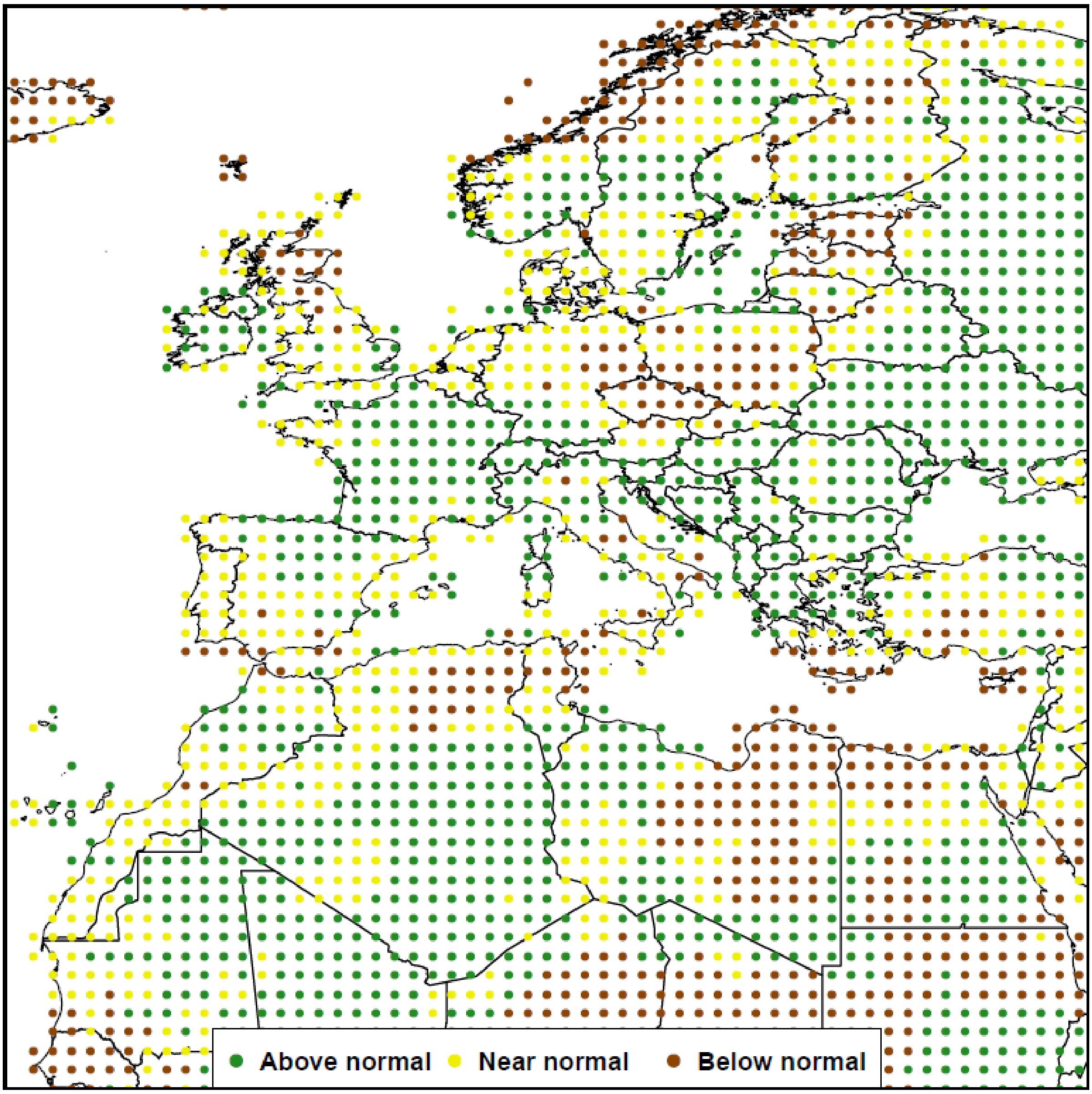


Figure 21: Terciles for precipitation (Reference period 1981-2010). Source: INM, data from GPCC, http://gpcc.dwd.de

4. Verification of the MedCOF-7 climate outlook for the 2016-17 winter season

4.1. Temperature

Europe/RA VI

The MedCOF-9 outlook favored the upper tercile over the whole domain except the northeast, where the upper and middle tercile were favored equally.

The outlook was correct over the eastern part of the domain. However, the cooling over western and southwestern Europe, which took place in December and in February, was not predicted.

North Africa (RAI)

The MedCOF-9 climate outlook for the 2017-18 winter season favored the upper tercile over all North Africa region with probability of 60% over all Tunisia, the North of Algeria and Morocco and 50% elsewhere. In fact, nearly over almost of Morocco, Algeria and Tunisia, temperature anomalies were below to near normal. Above normal anomalies were observed across Libya and Egypt. This indicates that the MedCOF-9 climate outlook for the winter season temperature was not able to predict temperature anomalies registered for Tunisia, Algeria and Morocco. The MedCOF-9 detected the positive anomalies over Egypt and Libya.

4.2. Precipitation

Europe/RA VI

The MedCOF-9 outlook favored the wet scenario (upper tercile) over northwestern France and the dry scenario (lower tercile) over southern parts of the Mediterranean including southern Italy, southwestern Balkans and Greece, southern Turkey, Cyprus and the Middle East. For the rest of the area, no preferred scenario was given.

In reality, the upper tercile dominated not only over northwestern France but over a much larger part of the domain, especially over France, the Balkans and the northeast. Only in some areas also the middle tercile was found. Some areas in the south of the domain were in the lower tercile, so the outlook was correct especially for places in southern Italy, Greece, southern Turkey and Cyprus.

North Africa

MedCOF-9 favored the lower tercile over the northern parts of the region with probability of 40% over all Tunisia and almost all of Algeria and Morocco and 50% over the north of Libya and Egypt. No scenario for the south of the region was favored due to dry season.

Winter 2017-18 precipitation was near normal to above normal over Morocco and was below normal to near normal over the northern parts of Tunisia, Algeria and Egypt. It was above normal over the south of Tunisia and the north-west of Libya. MedCOF-9 precipitation prediction gave valuable information over the northern parts of Algeria, Egypt and Tunisia and was not able to predict precipitation elsewhere.

4. Users' perceptions of the MedCOF-6 outlook

Europe/RA VI:

Some countries provide seasonal forecasts to the general public on their website, or to dedicated authorities (e.g. firefighting, water management). Others do not provide any national seasonal forecasts to users, and use the outlook for internal purposes only. Some claim that the seasonal forecast skill was too low to provide it to decision makers in the government or to public services.

In general, no feedback from users was reported. From those, who received feedback it seems that at least for some countries the most important forecast is for precipitation. However, end users were not satisfied when no signal was given in the forecast because it could not be used (meaning that there would be no added value). Some authorities showed interest in the general circulation linked to precipitation anomalies, snow amount in the mountains and storm occurrence.

North Africa

In North Africa, no feedback was given by users.

Appendix A: Contributors to MEDCOF-10

- 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:

- 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
- National Environmental Agency, Democratic Republic of Georgia
- Deutscher Wetterdienst, Federal Republic of Germany
- Hellenic National Meteorological Service, Greece
- Israel Meteorological Service, State of Israel
- Republic Hydrometeorological Institute, Former Yugoslav Republic of Macedonia
- State Hydrometeorological Service, Republic of Moldova
- 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

North Africa (RA VI)

- Climate Centres:

- WMO RA I North Africa RCC Tunisian Node, Institut National de la Météorologie (INM), Tunis, Tunisia

- National Meteorological and Hydrological Services:

- National Meteorological Directorate, Morocco
- National Institute of Meteorology, Tunisia

APPENDIX B: **Analysis and verification of the MedCOF-9 climate outlook for the winter season 2017/2018:**

Verification summary based on the national reports and contributions of the participants of the SEECOF-19 and MedCOF-10 online meetings

Europe (RA VI)

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Albania *	Above normal	Above normal (20/30/50)	Above normal	Below normal (40/35/25)	No events
Armenia (1)	Above normal	Near or above normal (20,40,40)	Normal	No predictive signal (33,34,33)	2017/18 winter was characterized by very high temperature and lack of snow cover in lowland areas, as no snow cover was formed. Foggy weather was observed in December and January in Shirak Region, Ararat valley with very low visibility, below 50 m. Strong wind 25-29 m/s was observed on 23rd of December, and 19th, 20th of January in Shirak region.
Azerbaijan *	Above normal	Near or above normal (20,40,40)	Normal	No predictive signal (33,34,33)	No events

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Federation of Bosnia and Herzegovina (1)	Above normal in almost entire Bosnia and Herzegovina (except in mountainous areas)	Above normal (20,30,50)	Above normal in almost Bosnia and Herzegovina (except in central Herzegovina)	No predictive signal (33, 34, 33)	-December Wettest and warmest -January Extremely warm 3rd Warmest for Bihac and 14th warmest for Bjelasnica -February Very wet and extremely wet Record wet for Bihac
The Republika Srpska - Bosnia and Herzegovina (5)	Above normal	Above normal (20,30,50)	Above normal	No predictive signal (33, 34, 33)	At the end of February extremely cold / lowest daily Tmax record
Bulgaria (1)	Above normal	Near or above normal (20,40,40)	Above normal	No predictive signal (33,34,33)	Winter 2017/18 was marked by one significantly strong winter storm observed in the very last days of February. The northeastern part of the country was affected by blizzard accompanied by strong winds and snowdrifts on the roads.

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Croatia (1)	Normal Southern Adriatic and part of the Northern and Middle Adriatic Above normal the rest of Croatia	Above normal (20,30,50)	Normal Dalmatia and hinterland Above normal in the remaining part of Croatia	No predictive signal (33/34/33)	December 2017 was warmer than normal. The amount of precipitation in most part of the country was above normal. The high impact weather was not recorded. January 2018 was warmer than normal. According to percentile ranks and classification ratings, thermal conditions in Croatia for January 2018 fall under the category warm, very warm and extremely warm. The high impact weather was not recorded. February 2018 was colder than normal in the whole country. The absolute minimum temperature (-6,4°C) was measured in Zadar (measurement from 1961) on 28th February. The cold spell was recorded in the last few days of the mounth (from 25th). As from the 26th, the minimum temperature in most part of the interior was below -10°C, and on 27th and 28th below 0°C, at the coast . The absolute maximum snow cover was recorded (on 27th) in Delnice, Gorski kotar (measurement from 1981) – 182 cm, Plitvička Jezera (measurement from 1999) – 147 cm and Ogulin (measurement from 1949) – 118 cm. In the mountain part of Croatia traffic was disrupted due to snow cover and some parts were completely cut off from rest of the country for several days.

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Cyprus (5)	Above normal	Near or above normal (20,40,40)	Below normal	Below normal (40,35,25)	Hail was recorded on the 5th and 24th of December. January - Extremely high temperatures were recorded, as an example, Prodromos recorded a highest daily maximum of 15.5°C (compared to the normal of 6.3°C) and Athalassa recorded a highest daily maximum of 21.5°C (compared to the normal of 15.5°C). Extremely low temperatures were also recorded, as an example, note that the lowest daily minimum temperature of Achna was 1.6°C (compared to the normal of 6.6°C). On 4th and 22nd of January hail was reported. February - Extremely high temperatures were recorded, over Athalassa with an extreme maximum of 25.2°C (compared to the normal of 16.0°C) or over Prodromos with an extreme maximum of 18.2°C (compared to the normal of 6.7°C). Extremely low temperatures were also recorded at Achna with a recorded low of 3.9°C (compared to the normal of 8.6°C). Record-breaking precipitation total of 91.6mm was recorded on the dawn of the 16th over the area of Limassol (southern part). During this rain event flash floods were recorded.

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
France (5)	Normal, in the northwest above normal	Above normal (20/30/50), in the south (10/30/60)	Above normal, with small regional differences	Above normal (10/40/50) in the north and northwest, no predictive signal in the remaining part (33/34/33)	Wettest winter since 1959. Floods in January in northeastern Normandy and Limousin, very severe damage in urban area. Many storms in December and January, most stormy month of January for 20 years, several victims and very severe damage to buildings in many regions. Two cold spells in February. Many stations with Tmin below -10°C and daily mean over France of -3.2°C, new record. Some victims, high energy consumption. Several snow events in the plain, numerous perturbations on transport. Snow pack on the mountains near record in the northern Alps, strong avalanche activity.
Georgia **(1)**	Above normal	Near or above normal (20,40,40)	Near the normal and above normal in most of the territory of west Georgia Above normal in other parts	No predictive signal (33, 34, 33)	No high impact events.

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Greece (2)	Above normal	Above normal (20,30,50)	Above normal in most parts of the country (except regions of south - southeastern Greece: below normal)	Below normal (40,35,25) Except northeast with no signal (33/34/33)	During winter 2017/18, very warm and extremely warm conditions prevailed in eastern Greece and in the Aegean islands, while warm or normal conditions prevailed in western Greece and Ionian islands. During the first days of December 2017 heavy rainfall affected west Greece leading to extensive floods and landslides. The area of eastern Pelion, in particular the region of Zagora was affected by heavy precipitation during February 2018 causing many landslides, road destructions and transportation disruptions.
Hungary*	Above normal	Above normal (20,30,50)	Above normal Normal in places in the north	No predictive signal (33/34/33)	No events
Israel (5)	Above normal	Above normal (20,30,50)	Above normal	Below normal (40,35,25)	No high impact events.
Italy*	Above normal in most parts, Below normal in the north and in Sardinia	Above normal (10/30/60)	Near normal, locally above or below normal	No predictive signal (33/34/33) in the north, Below normal (40/35/25) in the south	No events
Jordan*	Above normal	Above normal (20,30,50)	Around normal, locally above normal	Below normal (40/35/25)	No events

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Lebanon *	Above normal	Above normal (20,30,50)	Normal to above normal	Below normal (40/35/25)	No events
FYR of Macedonia (5)	Above normal	Above normal (20,30,50)	Above normal	No predictive signal (33, 34, 33)	December Significant monthly amounts of precipitations; Record-breaking daily sum of 130.0 mm was measured on 1st in Mavrovo January Absolute maximum temperature in Gevgelija 20.3°C on 30th exceeded the historical values for this month February Significant monthly amounts of precipitation; Record-breaking monthly sums in Lazaropole 274.1mm, Mavrovo 293.4mm and Skopje 113.3 mm; Record-breaking daily precipitation sums: 92.5mm in Lazaropole, 71.2mm in Mavrovo and 47.5mm in Skopje on 4th; Heavy rains caused the overflow of water from river beds and flooding
Moldova (5)	Above normal	Near or above normal (20,40,40)	Above normal or Near normal	No predictive signal (33, 34, 33)	Recorded meteorological phenomena in the form of sleet deposits up to 35 mm in diameter (December 18, MS Bravicea) and heavy snowfall with the precipitation sums up to 22-30 mm in 12 hours (January 17-18, MS Camenca, Râbniţa, HP Hruşca, Camenca, Beloci). Maximum snow depth 37cm (January, MS Bravicea). Mist, deposits of hard rime and glaze, wind gusts up to 20 m/s (January, MS Comrat, Ceadâr-Lunga), blizzard, ice on roads.

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Montenegro (1,5)	Normal to above normal	Above normal (20,30,50)	Normal to above normal (December and February) Below normal to normal (January)	Below normal (40,35,25) in central to coastal area No predictive signal (33,34,33) in the rest of the country	**No high impact events.**
Portugal *	Normal in the west, below normal in the east	Above normal (10/30/60)	Normal	No predictive signal (33,34,33)	No events
Romania *	Above normal	Above normal (20,30,50)	Above normal, locally near normal	No predictive signal (33,34,33)	No events

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Serbia (1)	Above normal in almost entire Serbia	Above normal (20,30,50)	Above normal in most of Serbia, except in northeastern part (normal)	No predictive signal (33, 34, 33)	Winter of 2017/2018 was the 4th wettest and 12th warmest for Serbia December was wettest in Leskovac (southern Serbia), record breaking daily precipitation sum in Kursumlija and Dimitrovgrad; 4th warmest in Loznica, two heat waves; January was the 5th warmest for Serbia, 2nd warmest in Sombor and Banatski Karlovac; February was 9th wettest in Serbia, at Palic 3rd, at Sjenica and Zlatibor 4th wettest
Slovenia (5)	Above normal in the most of the country normal to below normal in the north-west	Above normal (20,30,50)	Above normal	No predictive signal (33, 34, 33)	Among the 20 warmest winters since 1961/62 Fourth wettest since1961/62, second only to winters 1976/77, 2013/14 and 2008/09 December temperature above average, January very warm, third warmest since 1961, second only to January 2014 and 2007 February very cold, 11th coldest since 1961, due to distinctive cold wave in the last decade. Average daily temperature in the last three to four days of the month dropped 10 °C and more below 1981–2010 average in some areas Very wet December and February. December 4th wettest since 1961, February 5th wettest since 1961

<table>
<tr><th rowspan="2">Country</th><th colspan="2">Seasonal temperature (DJF)</th><th colspan="2">Seasonal precipitation (DJF)</th><th rowspan="2">High Impact Events</th></tr>
<tr><th>Observed</th><th>MedCOF-9 climate outlook for temperature</th><th>Observed</th><th>MedCOF-9 climate outlook for precipitation</th></tr>
<tr><td>Spain
(5)</td><td>Normal, though prone to cold conditions</td><td>Above normal (10/30/60)</td><td>Normal to above normal</td><td>No predictive signal
(33, 34, 33)</td><td>Frequent cold events with frost.
Warm events in January, Tmax up to above 26°C.
Heavy precipitation with storms in all 3 months, wind gusts above 100km/h, daily precipitation totals above 100mm, over 25cm of snow, high waves up to 8m, seasonal precipitation of 821mm in San Sébastian/Igueldo, highest since 1928, up to 41 snow days (Puerto de Navacerrada).</td></tr>
<tr><td>Syria *</td><td>Above normal</td><td>Above normal (20,30,50)</td><td>Normal,
Above normal in the northwest</td><td>Below normal (40,35,25)</td><td>No events</td></tr>
<tr><td>Turkey
(5)</td><td>Above normal</td><td>Near or above normal
(20,40,40)
in north-eastern regions

Above normal
(20,30,50)
in the whole country except northeastern part</td><td>Mostly normal to below normal

Above normal only in small regions in the north</td><td>No predictive signal (30,34,33)
in the whole country except the south part

below normal
(40, 35, 25) in southern regions of the country</td><td>In December 2017, frost damaged yields in greenhouses in Balıkesir. Heavy rain caused flood in Ordu and Çanakkale which damaged some buildings and roads.
In January 2018, avalanche occurred in Bitlis. Landslide occurred in Silifke and caused damages to infrastructure.
In February 2018, heavy rain and flood caused damages in buildings in Çanakkale. In Sanliurfa, two people lost their lives because of the flood.</td></tr>
</table>

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-9 climate outlook for temperature	Observed	MedCOF-9 climate outlook for precipitation	
Ukraine (1,5)	Above normal (83% stations) Normal (17% stations)	Normal and above normal (20,40,40)	Above normal (74,5% stations) Normal (25,5% stations)	No predictive signal (33, 34, 33)	On December 15-16th, very heavy snowfall (20-36 mm precipitation in 6-12 hours) and rain (32-42 mm in 12 hours) in Zakarpattya and Ivano-Frankivsk regions; on 18-19th very heavy snowfall (21-36 mm/12 hours) in the regions of Kyiv, Zhytomyr, Cherkasy. December was record warm month since the records began in the eastern part of country. On January 17-18th very heavy snowfall (20-45 mm/6-12 hours) in Kyiv, Chernihiv, Symy, Kirovograd, Chercasy, Odesa regions; very heavy rain (51 mm/12 hours) and strong wind (gust 25-29 m/s) in Odesa region. On February 26-28th very heavy snowfall (20-27 mm/12 hours) in Odesa region; strong wind (gust 25-28 m/s) in Donetsk, Zaporizzhya, Kherson, Odesa regions and strong blizzard (for 14-23 hours with wind gust 15-27 m/s) in Mykolaiv and Odesa regions. Unfavorable weather caused power outage, telecommunications, utilities, transport disruptions. Winter was wet, but in some regions (Lviv, Kyiv, Chernihiv regions) stations observed wettest winter conditions since 1961, with 214-306 mm of precipitation (176-223% of the norm).

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)

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 South-East. Below normal to near normal elsewhere.	Above normal in the north Slightly above normal elsewhere	Below normal to normal in the north. Near normal to above normal in the south.	Below normal in the north. No forecast in the south.	No comment
Egypt *	Above normal	Above normal	Below normal to normal in the north. Near normal to above normal in the south.	Below normal in the north. No forecast in the south.	No comment
Libya *	Above normal	Above normal	Near normal to above normal in the western parts. Below normal to near normal over the eastern parts.	Below normal in the north. No forecast in the south.	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)	Below normal over almost all of Morocco Near normal over NE part	Above normal (10/30/60) in the northern half (20/30/50) in the southern half	Normal to above normal	Below normal (40/35/25)	January 2018 - New records of absolute maximum rainfall in 24h February 2018 - Heavy rainfall - Significant snowfall over snow-free regions for decades (Ouarzazate, Taroudant, Errachidia, Zagora) - Exceptional cold waves - Strong winds
Tunisia (1)	Near normal to above normal	Above normal	Above normal in some parts of the south. Below normal to near normal elsewhere	Below normal	No comment

Note:
(1) Basic climatological period (1981-2010)
* Data source: Temperature: NCEP/NCAR reanalysis data, precipitation: GPCC first guess product

References:

MedCOF9 Outlook: http://medcof.aemet.es/Medcof/events/medcof3/docMedcof3/Consensus%20Statement%20MedCOF-3.pdf

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

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

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

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

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

NOAA ESRL composite maps: http://www.esrl.noaa.gov/psd/data/composites/day/

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