MEDITERRANEAN CLIMATE OUTLOOK FORUM
MEDCOF-14 ONLINE MEETING

ANALYSIS AND VERIFICATION
OF THE MEDCOF-13 CLIMATE OUTLOOK
FOR THE 2019-20 WINTER SEASON
FOR THE MEDITERRANEAN REGION (MED)

Second Draft

Last update: 15 May 2020

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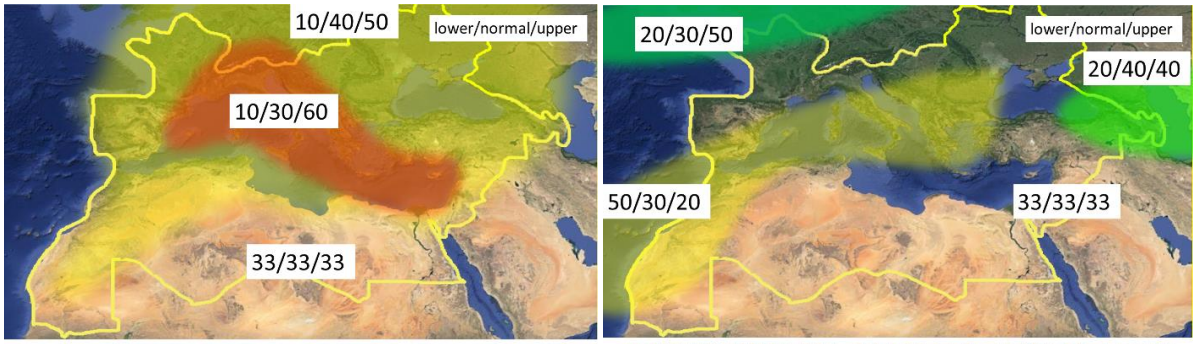
The following MedCOF verification report is based on

- the outcome of the consensus forecast of MedCOF 13,
- climate monitoring results of RA I NA RCC and RA VI RCC networks,
- national verification reports received from NMHSs or posted in RCOF forums of MedCOF, SEECOF or PRESANORD,
- SEECOF-23 verification report

1 MedCOF-13 Climate outlook for the 2019-20 winter season



(a) (b)

Figure 1: Graphical presentation of the climate outlook for the 2019-20 winter season for the Mediterranean region (a) Temperature Outlook, (b) Precipitation Outlook

1.1 General circulation

Observed sea surface temperatures and forecast for the next three months showed neutral ENSO conditions with most models showing high agreement for ocean evolution. The Indian Ocean Dipole (IOD) was the main driver showing a clear signal with strong positive phase (warm anomalies over western tropical Indian Ocean and cold anomalies over the East), influencing the atmospheric circulation. Consequently, this positive phase translated to a drier- than-normal signal over the Maritime Continent and Australia and wetter than normal conditions over eastern Africa. Most models tended to show teleconnections with IOD foreseen towards Middle East and Central Asia. As continuation of previous forecasts, models showed good agreement on favor of positive phases of East Atlantic (EA) and North Atlantic Oscillation NAO (which are two main modes of variability over the Atlantic), possibly linked with the strong IOD positive signal.

1.2 Temperature

As stated in the MedCOF-13 consensus statement for the seasonal climate outlook for the 2019/2020 winter season for the Mediterranean region, there was a tendency for the upper tercile range with temperatures warmer than normal for most of the European continent and over the Mediterranean (Fig. 1a). The highest probability for above-average temperatures was expected over the western and central Mediterranean.

Over North Africa, the warm tercile range was more probable over the extreme north of Egypt with probability of 60%. Over all of Tunisia, almost all of Morocco, the North and the SW of Algeria the upper tercile was expected with probability of 50%. Elsewhere no clear signal was expected.

1.3 Precipitation

Regarding precipitation, the consensual forecast has shown a clear latitudinal gradient with wetter-than-normal conditions over North-Western Europe and a dry tongue protruding towards the Southern Mediterranean region (Fig. 1b). Elsewhere there was no large-scale precipitation signal present in the forecast.

Over the North African domain, there were below-normal conditions over most parts of Morocco, the coastal zone of Algeria and the extreme north of Tunisia with probability of 50%. Elsewhere no clear signal, therefore the climatological forecast (33%, 33%, 33%).

2 Analysis of the 2019-20 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 2019/20:
  - WMO RA I RCC Node on Climate Monitoring: https://www.meteo.tn/en/climate-monitoring-watch
  - WMO RA VI RCC Offenbach Node on Climate Monitoring: http://www.dwd.de/rcc-cm),
- contributions from Météo France (http://seasonal.meteo.fr/),
- the Regional Climate Outlook Forum
  - for Southeastern Europe (SEECOF, http://www.seevccc.rs),
  - for North Africa (PRESANORD, http://acmad.net/rcc/presanord.php),
- national verification reports from MedCOF participants.

2.1 General circulation

2.1.1 Ocean

While the western tropical Pacific was up to above +1 K warmer than normal (1981-2010 reference) in winter 201920 at the ocean surface, sea surface temperatures (SST) in the eastern tropical Pacific mostly were close to normal on winter average (Fig. 2). The tropical Indian Ocean was warmer than normal with slight differences in SST anomalies between west and east. The Mediterranean, too, was warmer than normal with anomalies from +0.5 K in the west and above +1 K in the east. The Black Sea also was above +1 K warmer than normal.

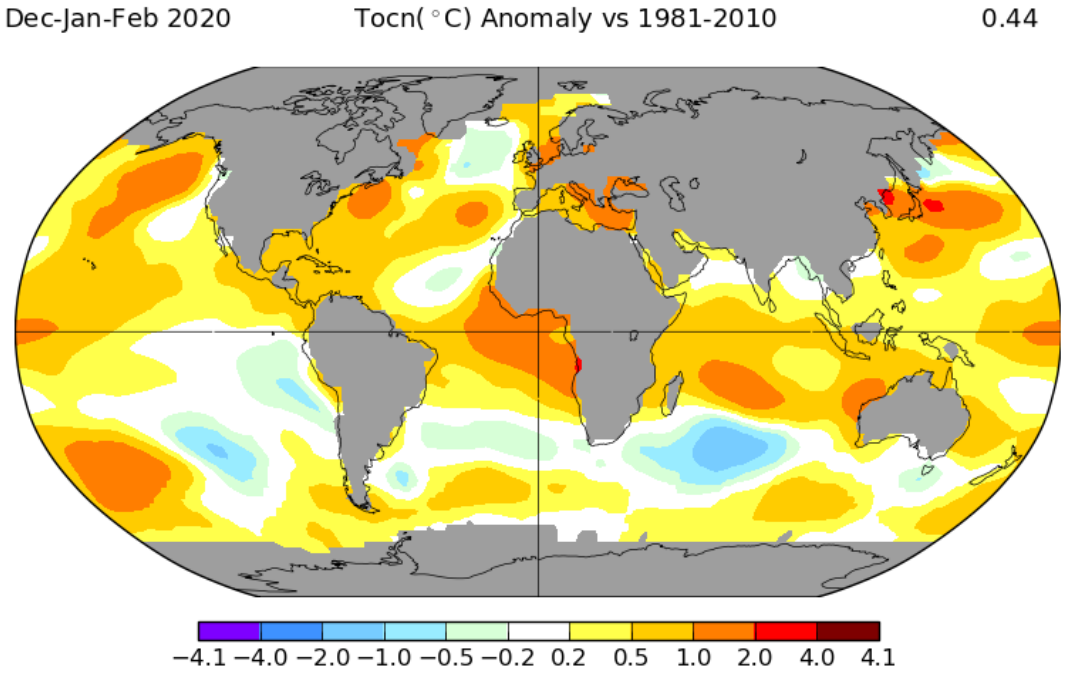


Figure 2: Sea surface temperature anomalies for boreal winter 2019-20 (December-February), 1981-2010 reference. Data from ERSSTv5 Ocean model analysis with 250km smoothing, source: NASA GISS, https://data.giss.nasa.gov/gistemp/maps/

ENSO

Looking at the standard Niño regions (Tab. 1), anomalies were very close to +1 K (1981-2010 reference) in region 4 (western equatorial Pacific) and between +0.2 and +0.3 K in region 3 (eastern equatorial Pacific). Region 3.4, which includes parts of regions 3 and 4 and is mostly used for definition of Niño events, had anomalies between +0.4 and +0.5 K for December 2019 to February 2020. This was just around the El Niño threshold of +0.5. However, since there was no long persistence of this anomaly and also other indicators showed only small deviations from normal, ENSO (El Niño – Southern Oscillation) conditions were still classified as neutral, see e.g. assessments from NOAA (https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst/) or BOM Australia (http://www.bom.gov.au/climate/enso/wrap-up/archive/20200303.archive.shtml#tabs=Sea-surface), which was in line with MedCOF-13 expectations.

MONTH	NIÑO 1+2		NIÑO 3		NIÑO 4		NIÑO 3.4	
	TEMP	ANO	TEMP	ANO	TEMP	ANO	TEMP	ANO
December 2019	23.16°C	0.34°C	25.47°C	0.33°C	29.50°C	1.01°C	27.07°C	0.50°C
January 2020	24.55°C	0.03°C	25.81°C	0.18°C	29.28°C	0.98°C	27.09°C	0.53°C
February 2020	26.56°C	0.42°C	26.61°C	0.24°C	29.17°C	1.08°C	27.14°C	0.42°C

Table 1: Sea surface temperature and anomalies for various Niño regions in boreal winter months 2019-20 (December-February), 1981-2010 reference. Data from OISST ocean model analysis, source: NOAA, https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst.php with definitions of Niño regions.

Indian Ocean Dipole (IOD)

The IOD was in a strong positive phase in boreal autumn 2019 by the time when MedCOF-13 was issued, but this anomaly weakened quickly to neutral conditions until late winter 2019/20 (Fig. 3). Thus, this driver weakened during winter season, but was still active at least in December 2019.

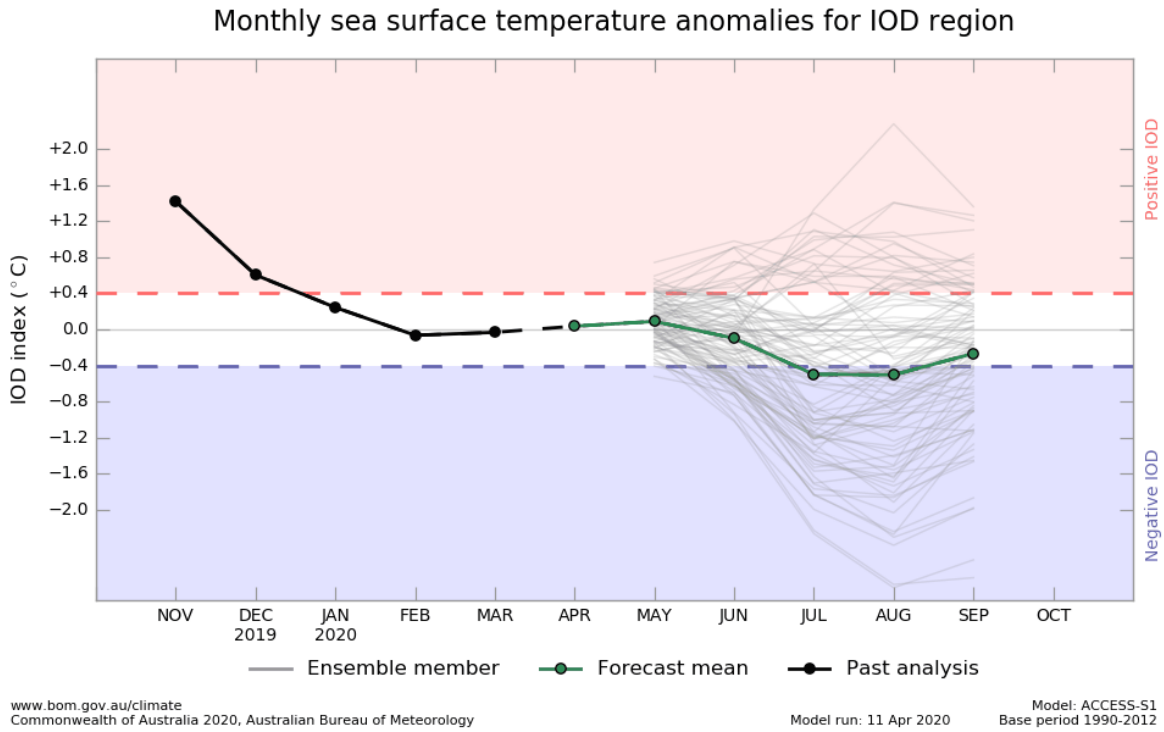


Figure 3: Indian Ocean Dipole (IOD) index (monthly values). Source: Australian Bureau of Meteorology (BOM), http://www.bom.gov.au/climate/enso/#tabs=Indian-Ocean

2.1.2 Atmosphere

Seasonal averages of 500-hPa geopotential in winter 2019/20 show a rather zonal circulation over the North Atlantic, but a noticeable trough over the eastern Mediterranean. Positive (anticyclonic) anomalies extended over the western and central Mediterranean up to the Balkans and Ukraine, while South Caucasus, Turkey, Cyprus and Middle East had negative anomalies (Fig. 4).

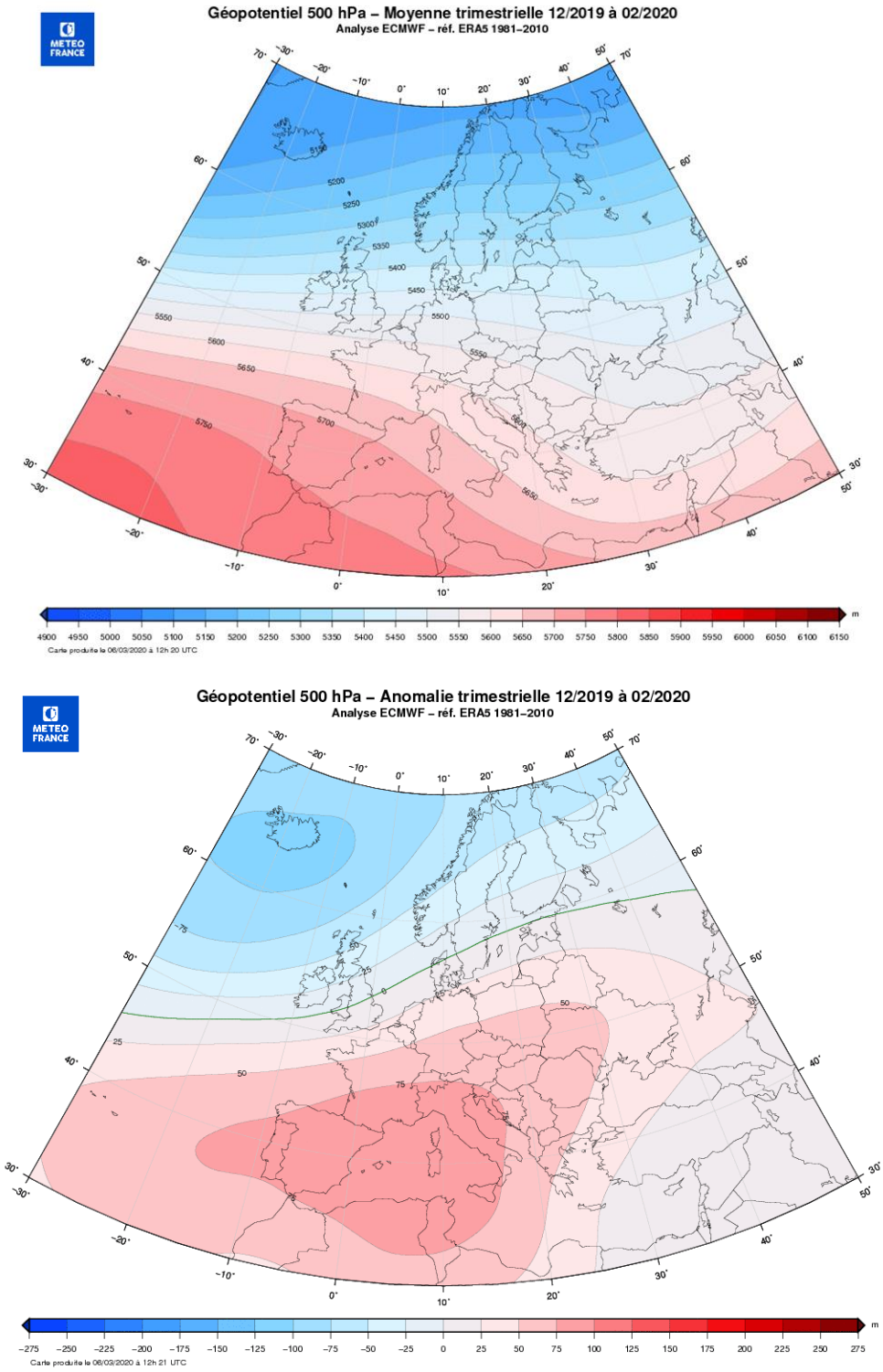


Figure 4: Seasonal mean and anomalies of 500-hPa geopotential for winter 2019/20 (1981-2010 reference). Source: Météo France, data source: ECMWF ERA5 reanalysis, http://seasonal.meteo.fr/content/suivi-clim-cartes-ERA5 (login required)

This seasonal pattern was visible more or less in all three months, though with different intensity and extension (Fig. 5).

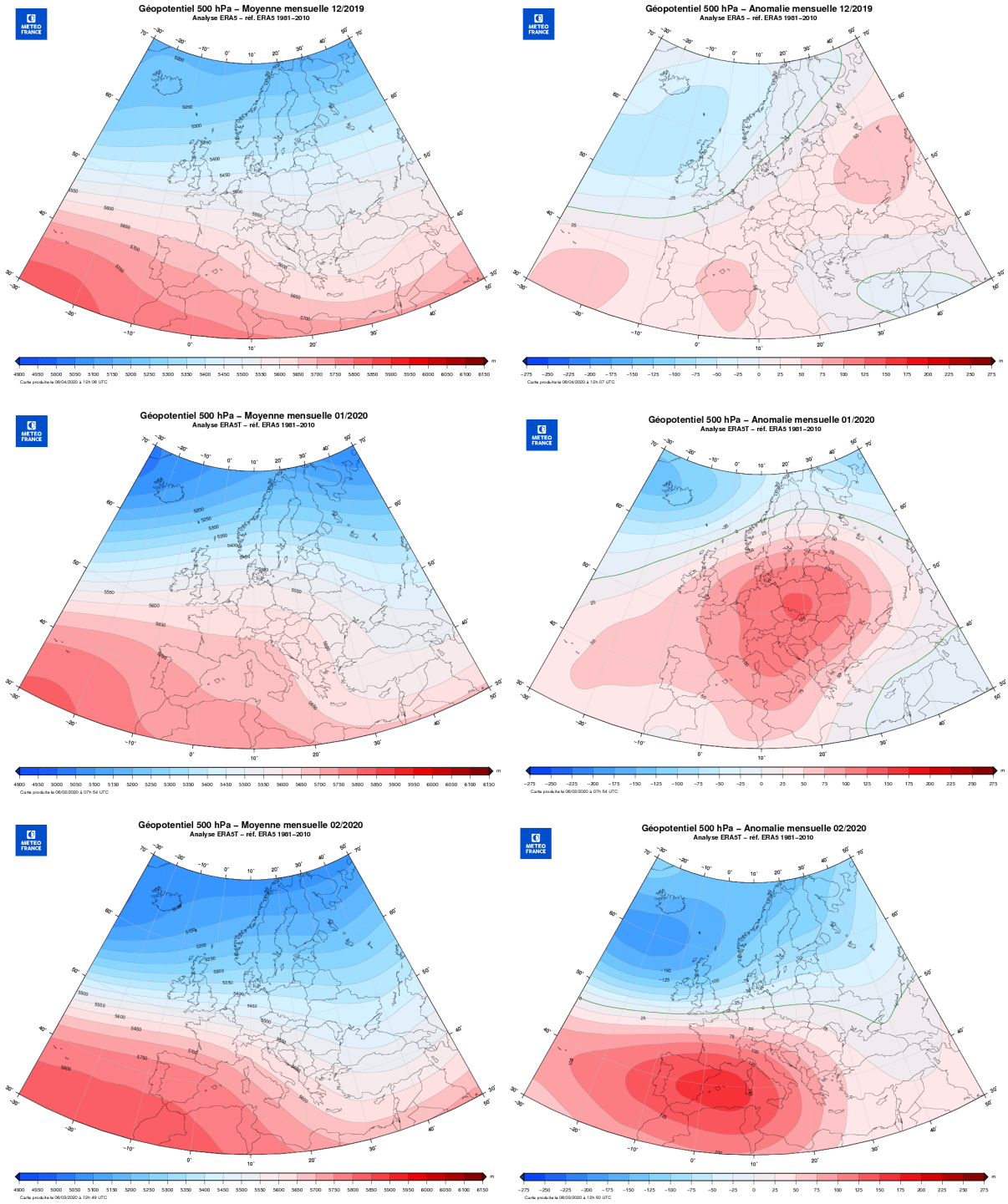
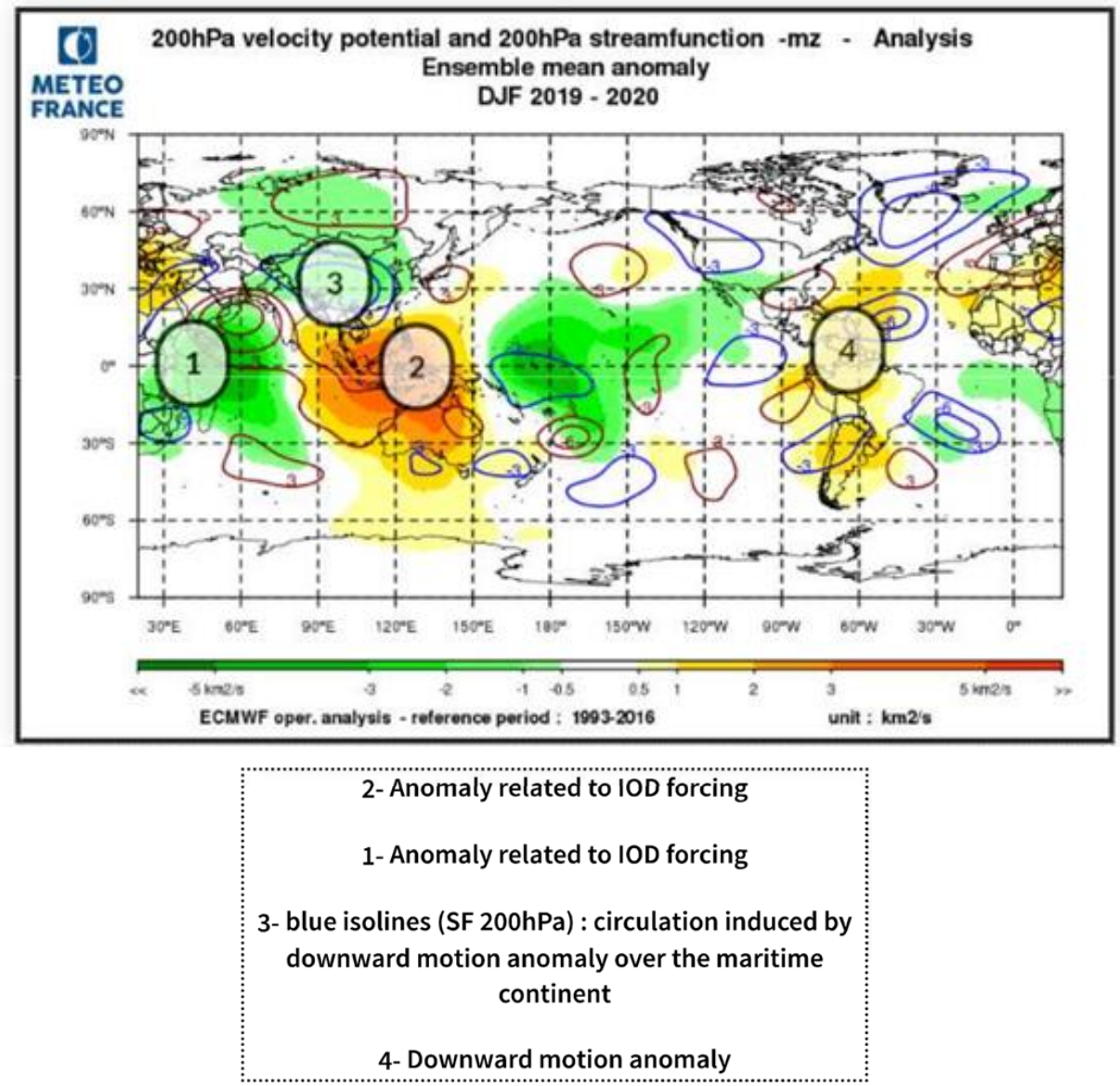


Figure 5: Same as Figure 4, but for the months December 2019, January and February 2020.

It is likely that this pattern was related to the positive IOD phase as expected from MedCOF-13. Velocity potential patterns in 200hPa showed clearly an upward motion anomaly over the western Indian Ocean and a downward motion anomaly over the maritime continent (Fig. 6). This means, in spite of the weakening of the IOD in winter 2019/20, there was still a well-established atmospheric circulation pattern over the Indian Ocean. Stream function anomalies in 200 hPa showed furthermore a propagating wave from the Indian Ocean to Central Asia, but also to the Middle East, Europe and the North Atlantic. This stands for a teleconnection inducing a cyclonic anomaly over the eastern Mediterranean and an anticyclonic anomaly over Southwestern Europe and the Balkans.



2- Anomaly related to IOD forcing

1- Anomaly related to IOD forcing

3- blue isolines (SF 200hPa) : circulation induced by downward motion anomaly over the maritime continent

4- Downward motion anomaly

Figure 6: Velocity potential anomalies (color shading: green: upward motion, orange: downward motion) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere, vice versa in the southern hemisphere). Data basis: ECMWF analysis. Source: Météo France, http://seasonal.meteo.fr/sites/data/Bulletins/Verification/VERIFICATION_202003_DJF2019-2020.pdf , login required.

Monthly NOAA CPC teleconnection patterns showed a positive phase for both the North Atlantic Oscillation (NAO) and the East Atlantic pattern (EA) in all three winter months, most intense in January (Tab. 2). This is also in line with the MedCOF-13 outlook. Both patterns can explain the anticyclonic geopotential anomaly over the western Mediterranean and the Balkans.

yyyy	mm	NAO	EA	WP	EP/NP	PNA	EA/WR	SCA	TNH	POL	PT	Expl.Var
2019	12	1.02	0.81	0.74	-99.90	-0.12	0.15	0.84	-0.22	-0.43	-99.90	63.0
2020	1	1.05	1.74	0.69	-0.60	-0.95	0.66	-0.55	-0.87	0.16	-99.90	84.9
2020	2	0.98	1.38	1.46	-1.79	-0.07	-0.06	-2.69	1.69	-0.39	-99.90	81.3

Table 2: Circulation indices of NOAA CPC patterns for the winter months 2019/20. Source: ftp://ftp.cpc.ncep.noaa.gov/wd52dg/data/indices/tele_index.nh

The circulation type classification of Météo France, too, showed a clear preference for NAO+ types in all three winter months (Fig. 7). They occurred almost twice as frequently as normal.

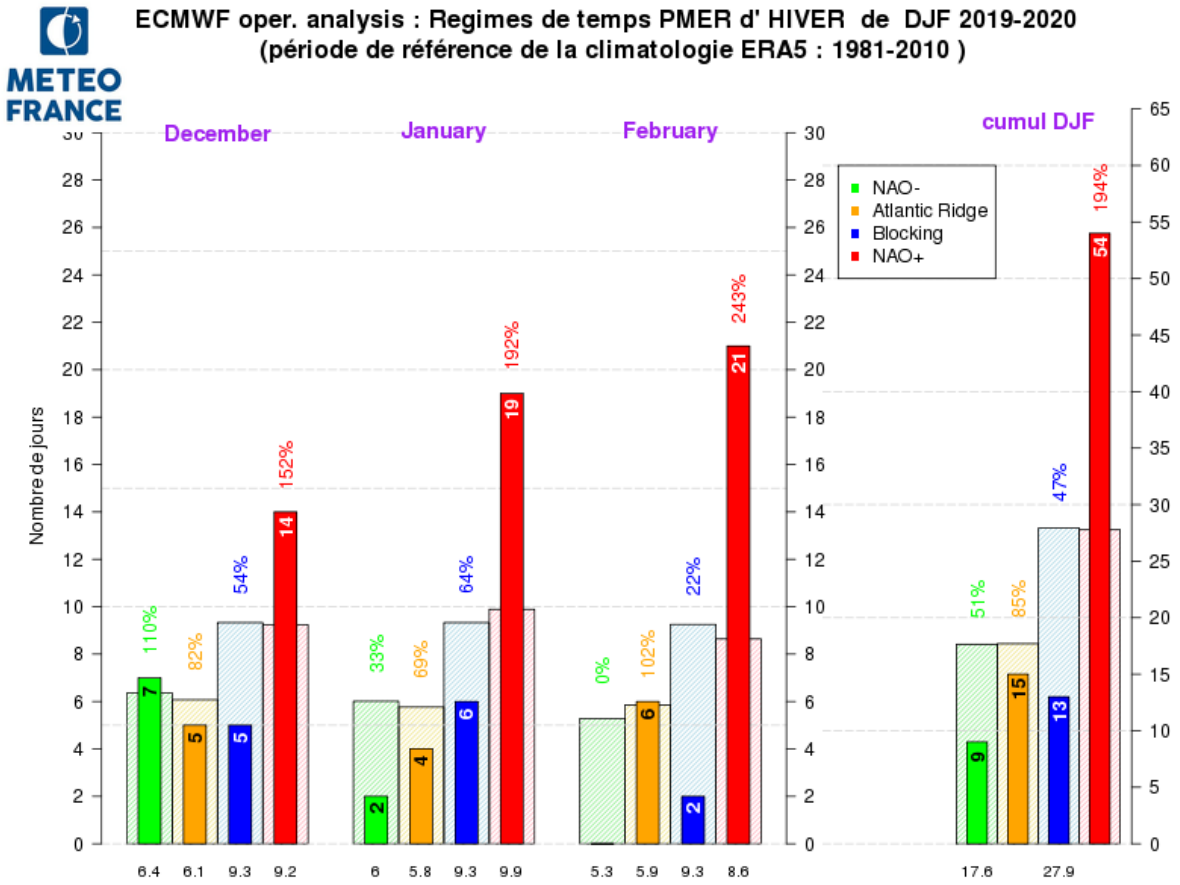


Figure 7: Number of days with circulation types of the Météo France classification for each month of the winter 2019/20 season and for the whole season (right), and in percent of the climatological frequency distribution 1981-2010. Source: Météo France, http://seasonal.meteo.fr/en/content/suivi-clim-regimes-trim

Seasonal mean sea level pressure in winter 2019/20 was characterized by a zonal flow over the North Atlantic extending far into Eastern Europe, also affecting the Ukraine (Fig. 8). Southwestern Europe, western and central Mediterranean and much of the Balkan Peninsula were under high-pressure influence on seasonal average. However, anomalies were slightly below normal (more cyclonic) in the east of the MedCOF domain.

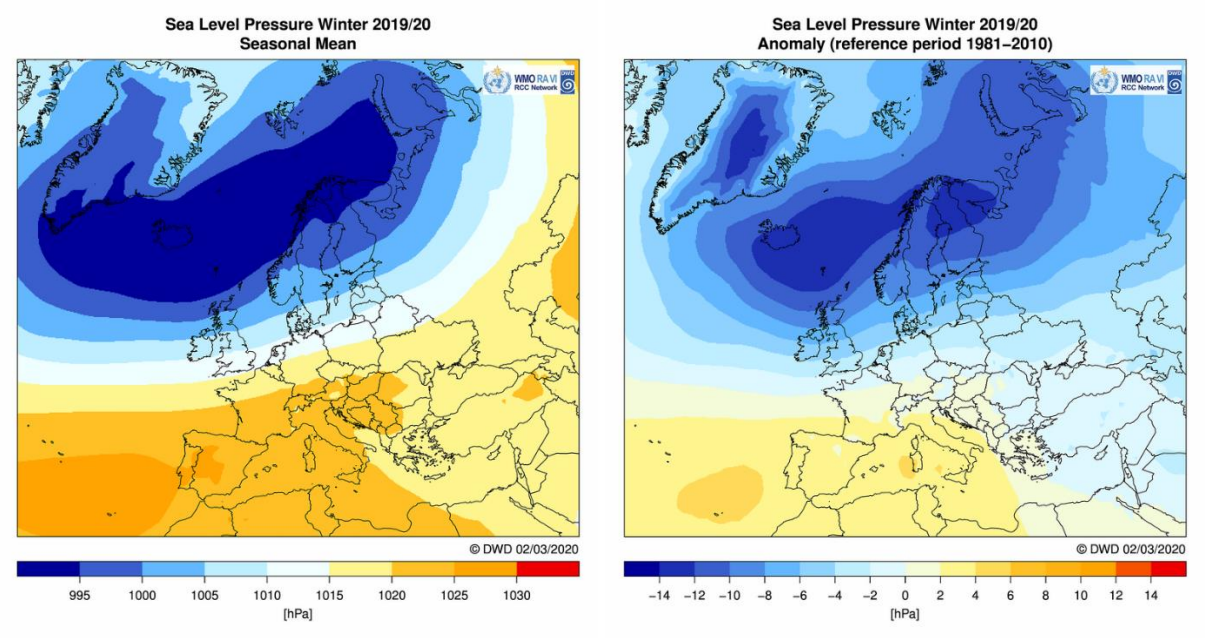


Figure 8: Seasonal mean sea level pressure and its anomalies for winter 2019/20 (1981-2010 reference). Source: Deutscher Wetterdienst (DWD), data source: DWD numerical ICON model analysis, http://www.dwd.de/EN/research/weatherforecasting/num_modelling/01_num_weather_prediction_modells/icon_description.html?nn=484268

For single months, mean sea level distribution was quite similar to the seasonal mean, but intensity was different (Fig. 9). Anticyclonic conditions within the MedCOF domain were strongest and most extended in January 2020 and least in December 2019.

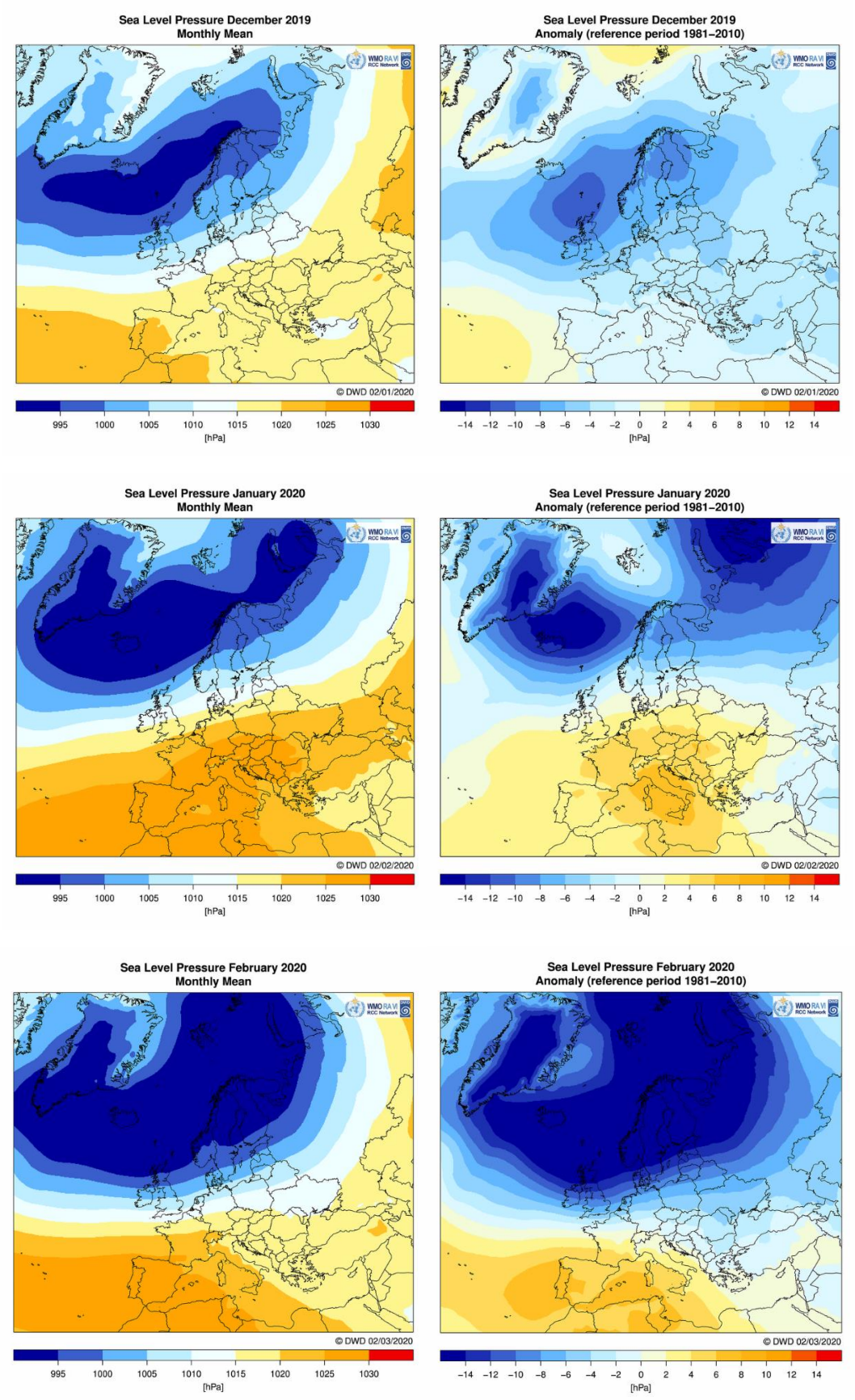


Figure 9: Same as Figure 8, but for the months December 2019 – February 2020.

2.2 Temperature

Europe and Middle East (RA VI)

Seasonal means and anomalies

Seasonal mean temperature in winter 2019/20 ranged from below -10°C in high mountain areas to around 15°C in southern Portugal and southern Israel (Fig. 10). Mostly the seasonal means ranged between 0 and 5°C in the Ukraine, on the Balkan Peninsula and in Turkey, between 5 and 10°C in Southwestern Europe, the Middle East and in eastern coastal regions, and between 10 and 15°C on Mediterranean islands and in western coastal regions.

Temperature was above the 1981-2010 normal in the whole RA VI MedCOF region. Anomalies ranged from around +0.5 K in the eastern Mediterranean to above +5°C in the northern Ukraine.

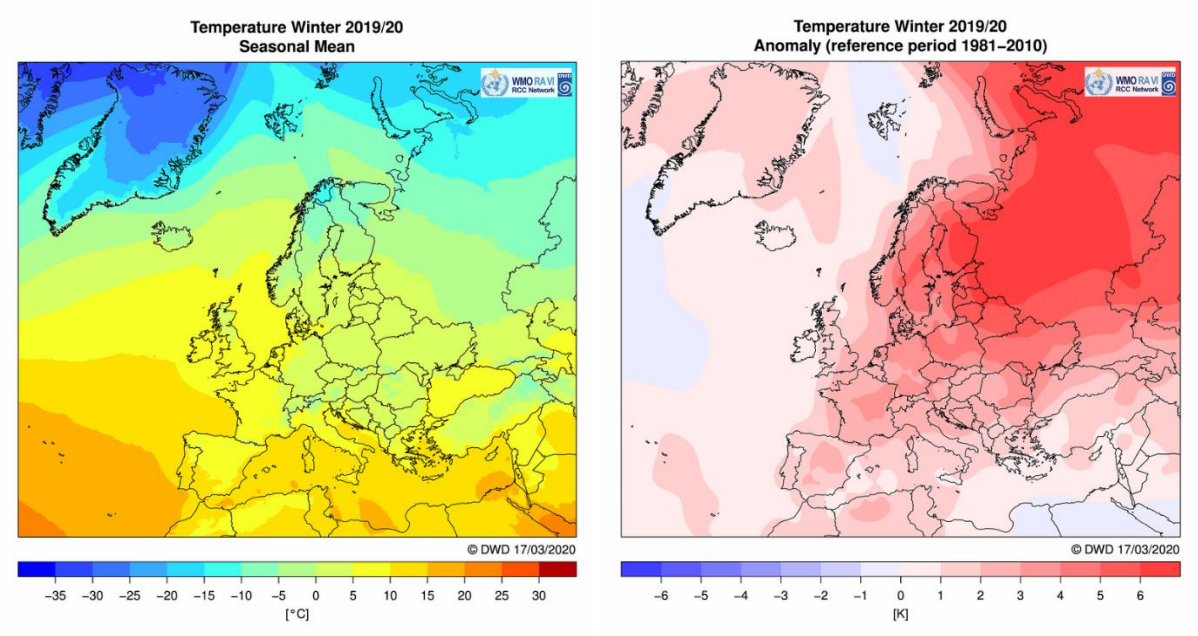


Figure 10: Surface air temperature for winter 2019/20. Left: seasonal mean, right: anomalies, 1981-2010 reference, source of both maps: WMO RAVI RCC, based on interpolated CLIMAT data, www.dwd.de/rcc-cm

Terciles

In terms of terciles, almost the whole MedCOF domain had temperatures in the upper tercile (Fig. 11 and 12). Only some places in the east (Greece, Turkey, South Caucasus, Middle East) had seasonal means in the middle tercile (1981-2020 reference, ECMWF-ERA 5 reanalysis data).

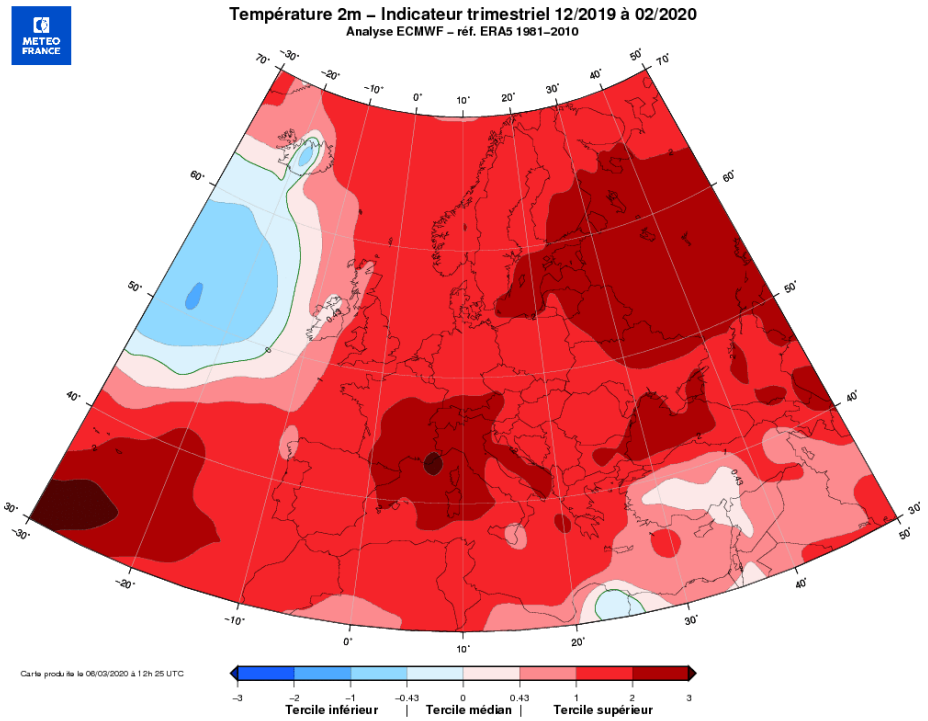


Figure 11: Seasonal normalized anomalies of winter 2019/20 surface air temperature based on ECMWF-ERA5 grid data, 1981-2010 reference. The data range between -0.43 and +0.43 represents the middle tercile, below -0.43 the lower tercile and above +0.43 the upper tercile. Source: Météo France, http://seasonal.meteo.fr/content/suivi-clim-cartes-ERA5

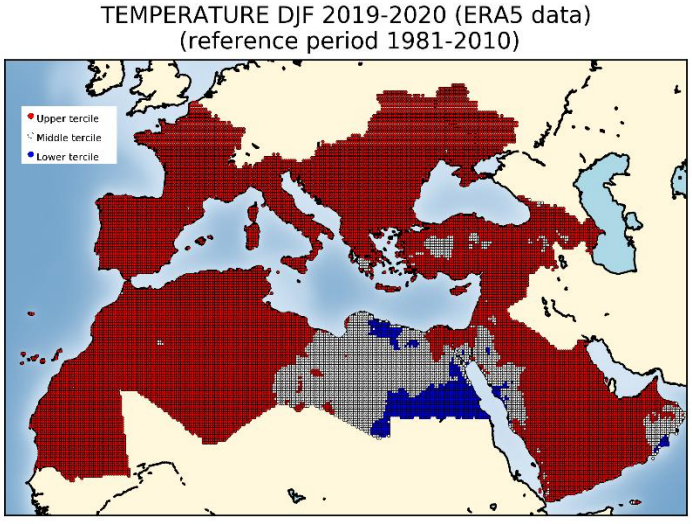


Figure 12: Terciles of winter 2019/20 surface air temperature based on ERA5 Reanalysis, 1981-2010 reference. Source: AEMET, data source https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5

E-OBS data show places in the Middle East even in the lower tercile (Fig. 13). This is verified by at least one ECA&D station in Israel. ECA&D also shows one station on Ibiza (Baleares) being in the middle tercile. Apart from these very local differences, the results are very similar.

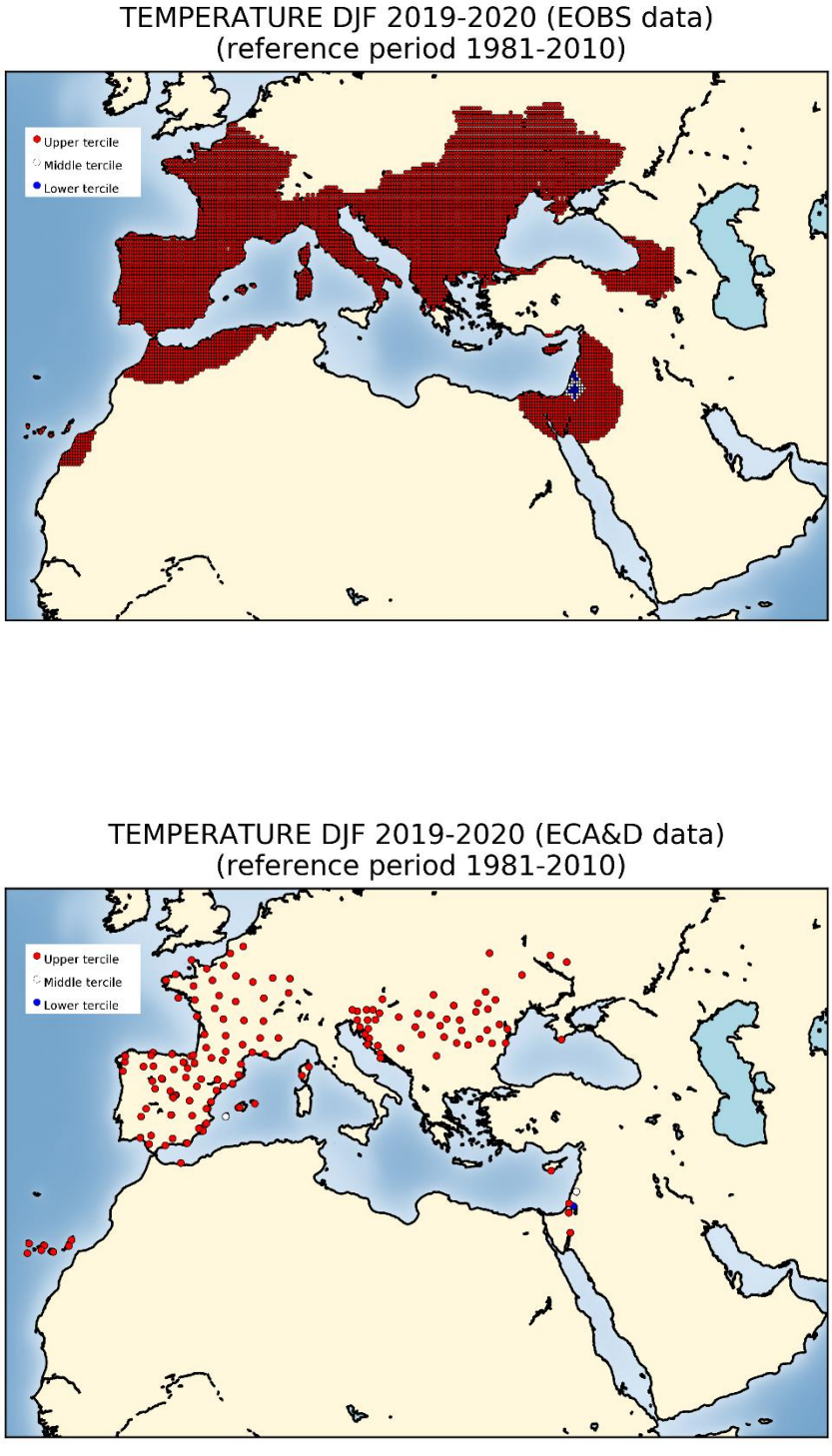


Figure 13: Terciles of winter 2019/20 surface air temperature based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Source: AEMET, data source: http://www.ecad.eu/

North Africa (RA I)

Winter 2019-20 temperature was above normal throughout the North Africa region with the exception of the extreme southeast, the southwest of Algeria, and the southern region of Libya, which was normal. Over the south of Egypt the temperature was below normal.

Mean temperatures were ranging between 0°C and 22°C. Winter season mean temperature is at its minimum over the north of Tunisia, Algeria and Morocco.

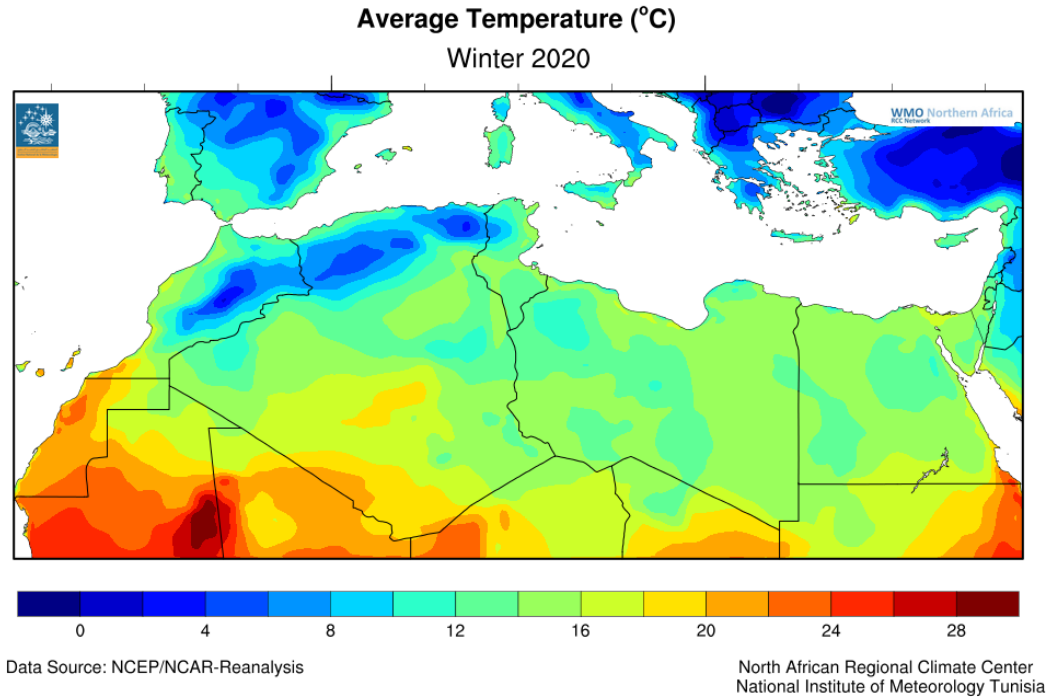


Figure 14: Mean temperature for winter season 2019/20 in North Africa (in °C). Source: INM Tunisia, Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov

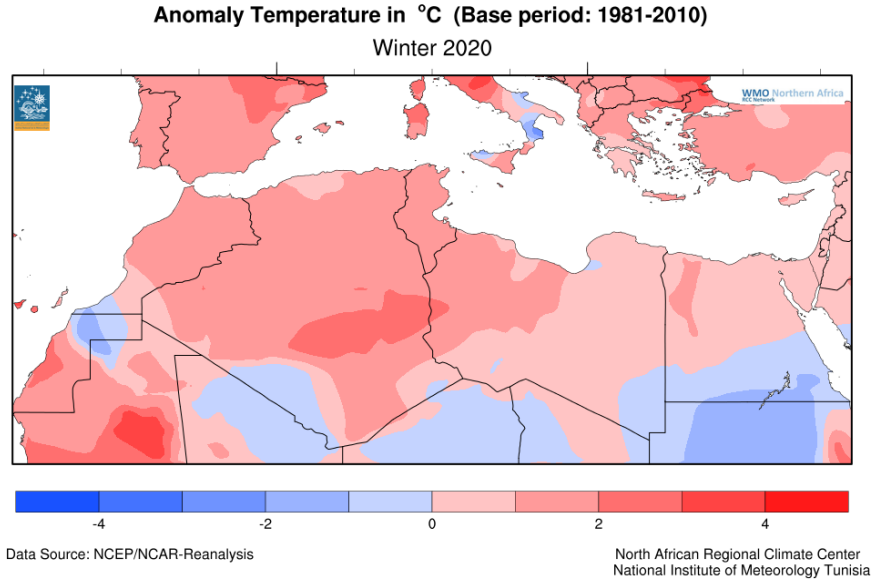


Figure 15: Temperature anomaly for winter season 2019/20 in North Africa (in °C), reference period 1981-2010. Source: INM Tunisia, Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov

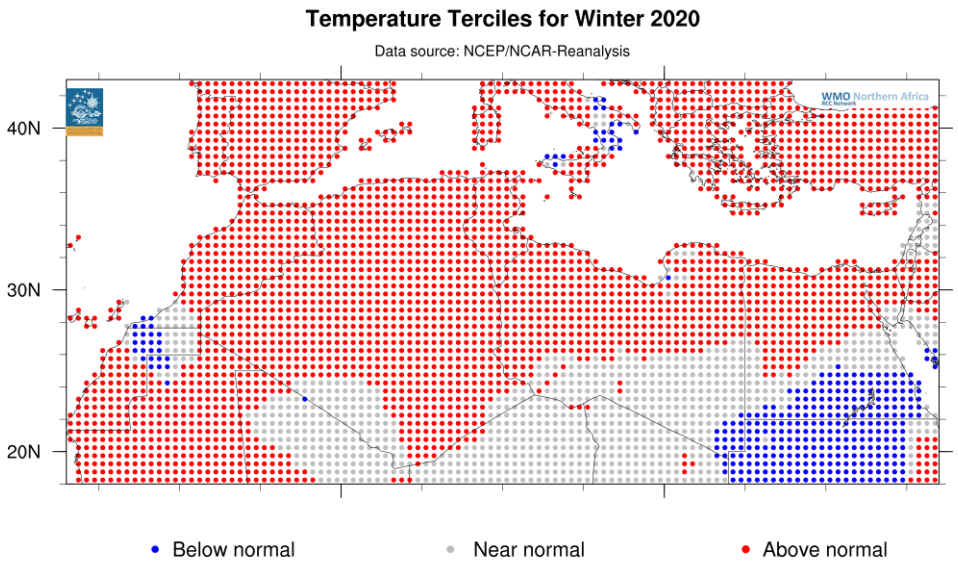


Figure 16: Temperature terciles for 2019-20 winter season in North Africa (Reference period 1981-2010). Source: INM Tunisia, Data from NCEP/NCAR reanalysis, http://www.esrl.noaa.gov

In Tunisia, the winter season 2019/20 was hotter than normal. The seasonal mean temperature during the winter was at its minimum over the north-western regions. The lowest value of seasonal mean temperature was +8.3°C measured in Thala in the western center of Tunisia. The eastern part of the country was mainly the warmest region this winter season. The highest value of absolute maximum temperature was registered during February 2020, it was 29.9°C measured in Kairouan in the center of Tunisia. Mean temperature registered was above normal over all of the country, with anomalies reaching up to +1.86°C locally in the south-west and at the eastern coast.

Over Algeria, positive anomalies for temperature were observed in most parts of the country reaching +1.9°C in the north-central regions and the Sahara. The temperatures were normal in the extreme north-western region and the south-western zone.

Over Morocco, above-normal conditions were observed over almost all the country (1981-2010 reference period). Three stations (Rabat and Kenitra from the NW region and Houceima from the NE region) were characterized by normal temperatures, but with values very close to the upper terciles.

In Egypt, the winter temperature was above normal over the north, below normal to normal over the south of the country.

Over Libya, temperature anomalies were above normal over the north of the country and normal over the south.

2.3 Precipitation

Europe and Middle East (RA VI)

Seasonal means and anomalies

Seasonal precipitation totals in winter 2019/20 in the European MedCOF domain ranged from around 30mm in eastern Jordan to above 450mm locally at the southern coast of Turkey (Fig. 17). Precipitation was around normal or below normal in much of Iberia, France, Italy, on the Balkan Peninsula, in parts of Turkey and Georgia, and mostly above normal in eastern Spain, northern France, the Ukraine, most of Turkey, Armenia, Azerbaijan, and the Middle East. The precipitation distribution mainly reflects the circulation patterns, especially the westerly flow bringing some rain to middle latitudes (northern France, Ukraine), the cyclonic conditions over the eastern Mediterranean and the main anticyclonic conditions over the western Mediterranean region, though superimposed by some heavy rain events particularly in eastern Spain.

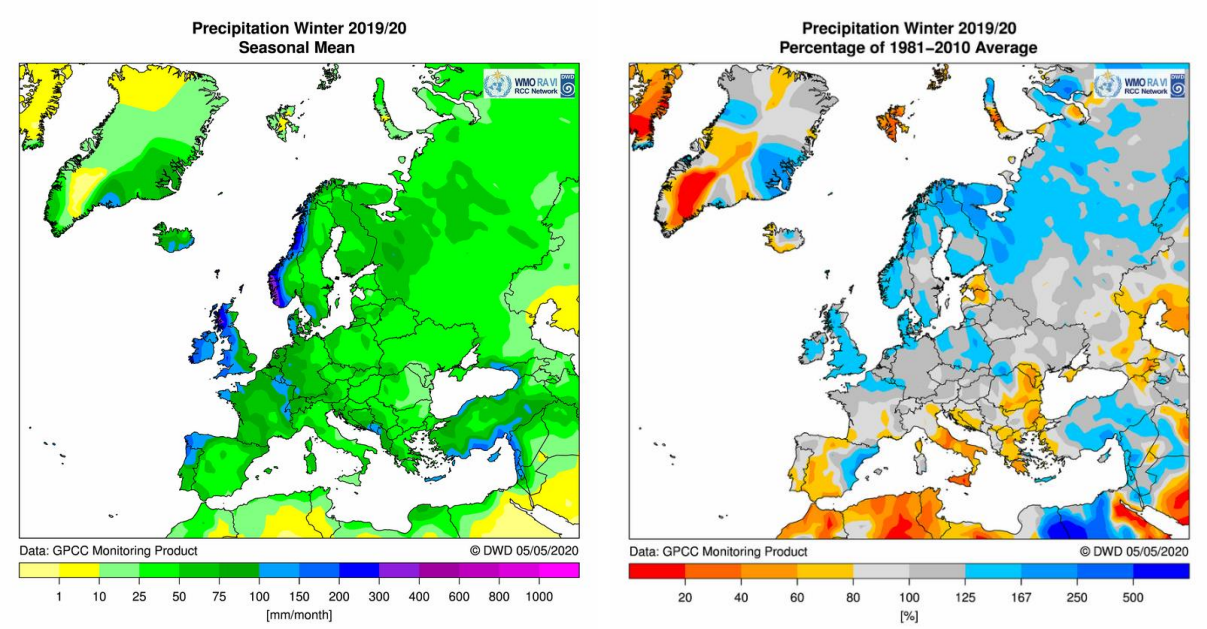


Figure 17: Precipitation for winter 2019/20 in Europe. Left: seasonal total in mm/month, right: percentage of 1981-2010 average, source: WMO RAVI RCC, www.dwd.de/rcc-cm, data source: GPCC, http://gpcc.dwd.de

Terciles

In terms of terciles, precipitation in Italy, on the Balkan Peninsula and in the South Caucasus was mostly in the lower tercile, locally in the middle or rarely in the upper tercile, according to ERA5 reanalysis (Fig. 18). Iberia, southern half of France, Hungary, and Ukraine had precipitation mostly in the middle tercile, partly in the upper or lower tercile. Northern half of France, Turkey, Cyprus, and the Middle East had precipitation mainly in the upper tercile, locally in the middle or (rarely) in the lower tercile. GPCC analysis is very similar.

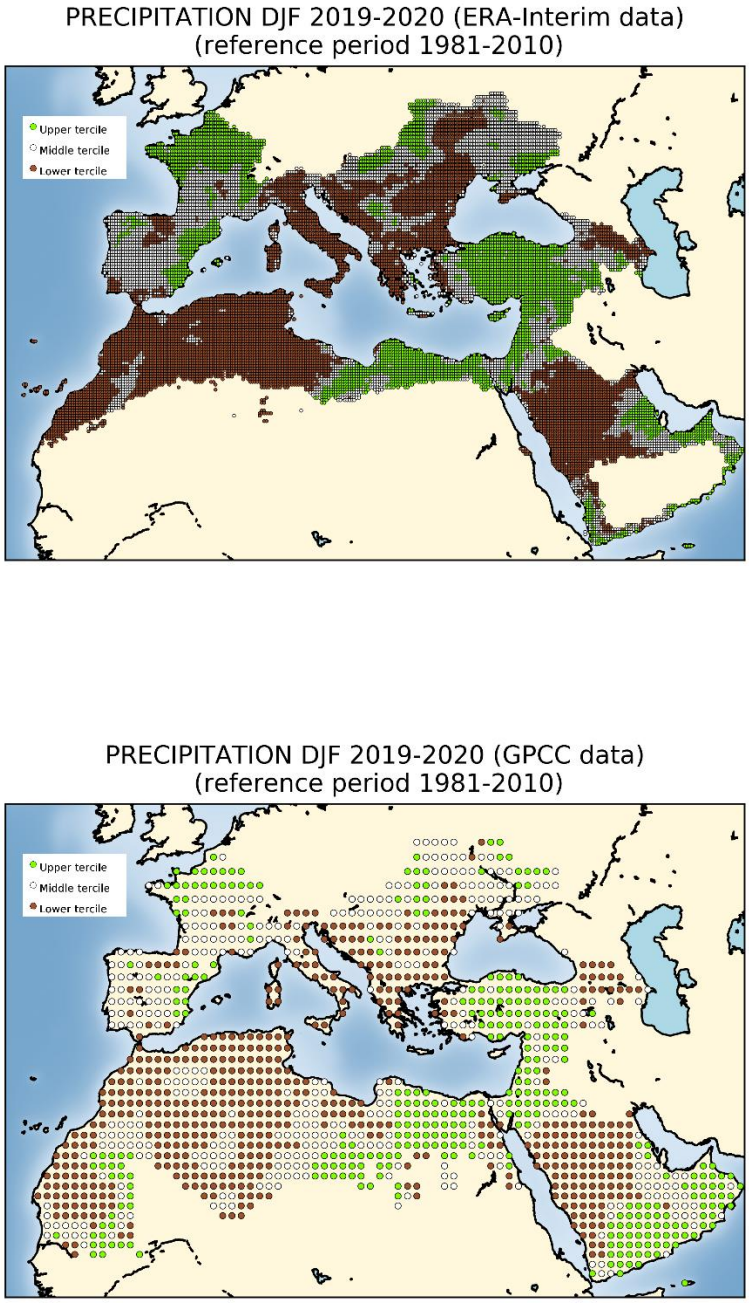
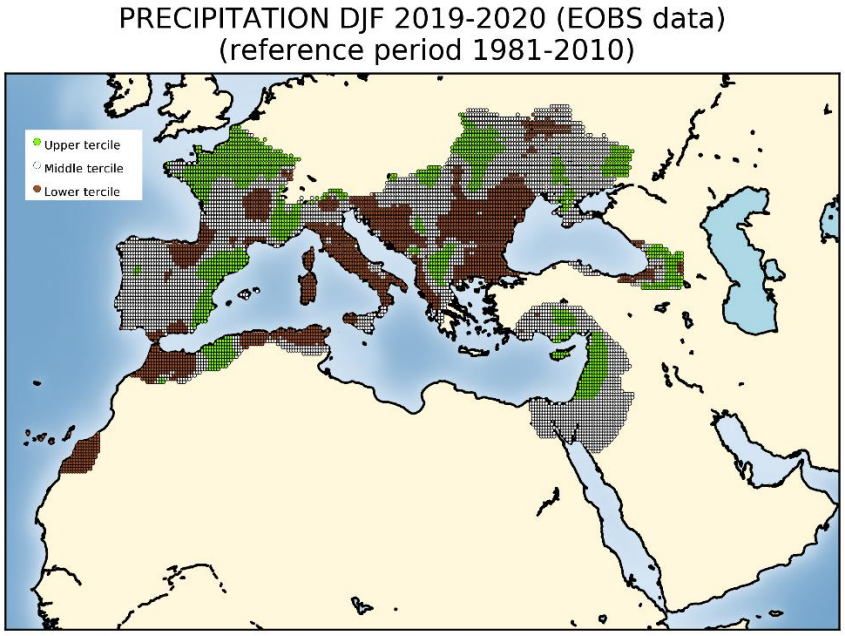


Figure 18: Terciles of winter 2019/20 precipitation based on ERA5 reanalysis (upper graph) and GPCC (lower graph) grid data, 1981-2010 reference. Source: AEMET, data reference: ERA5: https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5 , GPCC: http://gpcc.dwd.de

E-OBS shows some slight differences, especially for Georgia, where above-normal precipitation was indicated in parts of the country, in contrast to ERA5 and GPCC (Fig. 19). No public ECA&D station supports this. The national report looks in better agreement with ERA5 and GPCC.



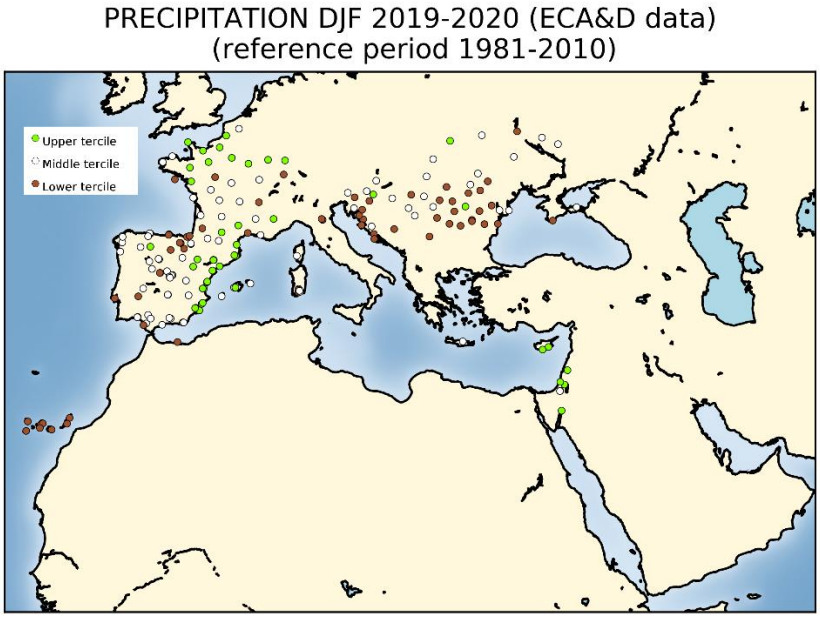


Figure 19: Terciles of winter 2019/20 precipitation based on interpolated E-OBS grid data (upper graph) and individual ECA&D station data (lower graph), 1981-2010 reference. Source: AEMET, data source: http://www.ecad.eu/

North Africa (RA I)

Winter precipitation was very low over North Africa during winter season. Precipitation registered over the Mediterranean coastline of the domain was ranging between 20 mm and 300 mm. Winter 2019-20 precipitation was below normal over most of the region.

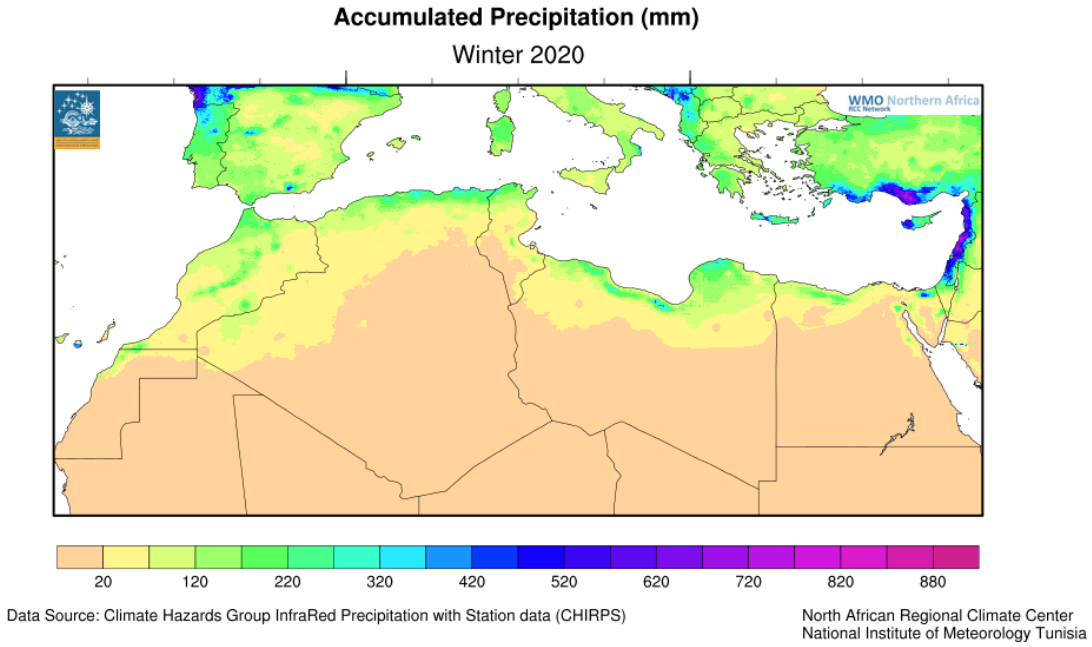


Figure 20: Total precipitation for 2019/20 winter season in North Africa (in mm). Source: INM Tunisia

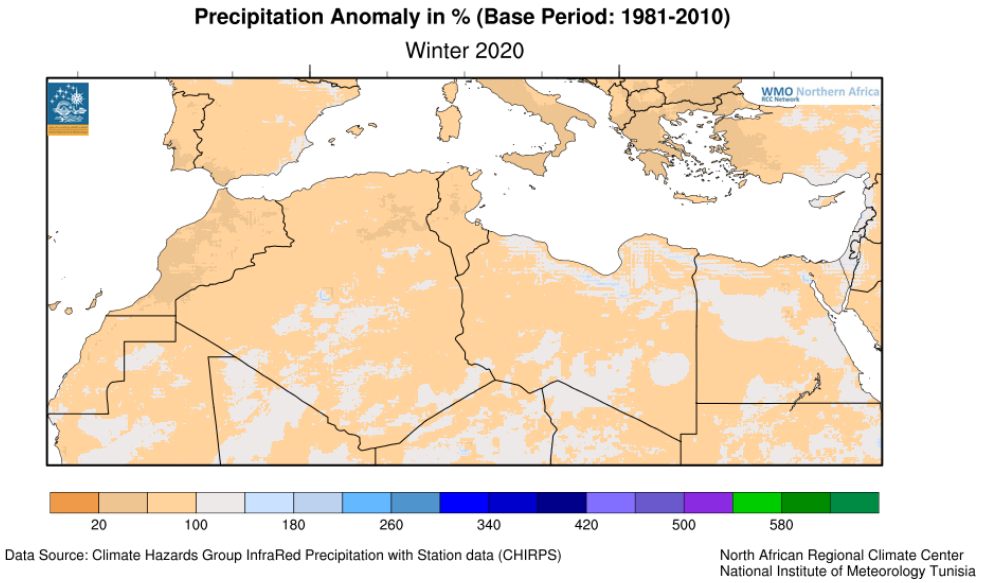


Figure 21: Precipitation anomaly for 2019/20 winter season in North Africa (in %) (Reference period 1981-2010). Source: INM Tunisia

The seasonal precipitation amount in Tunisia was less than 50 mm over most of the country and it had not exceeded 100 mm in a small region in the extreme north.
Compared to 1981-2010 period, total precipitation amount was below normal over all of the country.

The accumulated rainfall totals in most part of Algeria were below normal. However, Algeria recorded a high deficit of rainfall amount where the percentages with respect to the normal conditions (period 1981-2010) were varying between -50 % and -80 % in the north (agricultural zones) and -100% in the north of the Sahara. Therefore, the winter conditions were dry in a large part of Algeria.

Over Morocco, regarding precipitation during winter 2019/20, below-normal conditions were observed over the whole country according to observations from synoptic stations and reanalysis.

Over Egypt, winter precipitation was below normal over the most part of the country except in some northern and northwestern regions, there the precipitation was near to above normal.

Over Libya, during winter 2019/2020, precipitation anomalies were near to above normal in some zones of the north and the south east of the country, elsewhere below normal conditions were showed.

3 Verification of the MedCOF-13 climate outlook (2019-20 winter season)

3.1 Temperature

Europe/RA VI

The MedCOF-13 outlook favored the upper tercile range for the whole domain with 50-60% probability.

The outlook was correct for almost the whole domain with very few exceptions.

North Africa (RAI)

The MedCOF-13 climate outlook for the 2019-20 winter season favored above normal temperature over the extreme north of Egypt with probability of 60%, and 50 % over all of Tunisia, almost all of Morocco, the North and the SW of Algeria. Elsewhere no clear signal was favored.

In fact, in almost all regions of North Africa, temperature was above normal. Over the southern part of Morocco, Algeria and Libya, temperature was near normal conditions. Over the south of Egypt, the temperature was near to below normal.

This indicates that the MedCOF-13 climate outlook for the winter season temperature was excellent for almost all of the North Africa domain.

3.2 Precipitation

Europe/RA VI

The MedCOF-13 outlook favored the wet scenario (upper tercile range) over northern France (50% probability), the normal or wet scenario (middle or upper tercile range) for the South Caucasus (40% each), and the dry scenario (lower tercile range) for southeastern Iberia, the western Mediterranean basin, Italy, Balkan Peninsula (each except the north) and the Aegean Sea region (50%). For the rest of the domain, no privileged scenario was given.

The outlook was correct for northern France, Italy, much of the Balkans and the Aegean Sea region. Not predicted was the above-normal precipitation in eastern Spain and over Turkey / Middle East and the below-normal precipitation in the South Caucasus. For the area with no privileged scenario, climatology was to be assumed, which means the middle tercile. This was correct for some parts, especially much of Iberia, southern France, and the Ukraine.

North Africa

Over the North African region, below-normal conditions were expected over most parts of Morocco, the coastal zone of Algeria and the extreme north of Tunisia. Elsewhere, no preference for any climate defined categories.

In fact, winter 2019-20 precipitation was below normal over Tunisia, Algeria and the most part Morocco. Over the north and northwest of Egypt and some zones in the north and the southeast of Libya, near to above-normal conditions were observed.

The MedCOF-13 climate outlook for the winter season precipitation was able to predict the anomalies of precipitation for most parts of Morocco, the coastal zone of Algeria and the extreme north of Tunisia.

4 Users' perceptions of the MedCOF-13 outlook

Europe/RA VI:

In Spain, AEMET provides seasonal forecasts to the general public on AEMET and MedCOF webpages.

The Croatian Meteorological Service provides seasonal forecasts to Croatian Civil Protection, to Croatian Water Management and in different form (adjusted format) to the general public on its web page.

In Armenia, the State Hydromet Service shares seasonal forecasts with governmental authorities, private companies and the public via mass media. Positive feedback was obtained from the users related to the reliability of forecasts.

In Israel, the seasonal forecast skill is still too low in order to provide it to decision makers in the government or to public services. As there are other professional and unprofessional seasonal forecasts in the air, the Israel Meteorological Service (IMS) provides only the wide public with the seasonal forecast to show its efforts to deal with this tough issue. The most important forecast is for precipitation. The IMS gave no signal for the DJF precipitation; therefore, the end users were not satisfied, as they could not use the forecast.

Other countries do not provide a seasonal outlook to users operationally or no feedback was given.

North Africa

In Morocco, the seasonal outlook is disseminated monthly to 15 departments and ministries.

In the other countries, no feedback was given by users.

Appendix A: Contributors to MEDCOF-14

- 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:

- State Hydrometeorological Service, Republic of Armenia
- Federal Hydrometeorological Institute, 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, Israel
- State Hydrometeorological Service, Republic of Moldova
- Republic Hydrometeorological Service of Serbia, Republic of Serbia
- Agencia Estatal de Meteorología (AEMET), Spain
- Turkish State Meteorological Service, Republic of Turkey

- others via SEECOF-23:

- Hydrometeorological Service, Republic of North Macedonia
- Slovenian Environment Agency, Republic of Slovenia
- Ukrainian Hydrometeorological Centre, Ukraine

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

APPENDIX B: **Analysis and verification of the MedCOF-13 climate outlook for the winter season 2019/2020:**

Verification summary based on the national reports and contributions of the participants of the SEECOF-23 and MedCOF-14 online meetings

In brackets: probabilities in % (lower, middle, upper tercile range) for the country concerned, as stated by the MedCOF outlook.

Europe (RA VI)

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-13 climate outlook for temperature	Observed	MedCOF-13 climate outlook for precipitation	
Albania *	Above normal	Above normal (10/30/60)	Below normal	Below normal (50/30/20)	No events
Armenia (5)	Above normal	Above normal (10/40/50)	Below normal	Normal to above normal (20/40/40)	2019/2020 was the sixth warmest winter for Armenia. Heat waves were observed. Snow cover was not recorded in lowland areas of Armenia at all. 01-09, 11-12, 21, 23, 24-25,27-28 of February strong wind (5-20m/sec, with gusts of 15-28m/sec Dense fog (visibility ≤50m) observed in Ararat and Shirak regions in various periods of the season.
Azerbaijan *	Above normal	Above normal (10/40/50)	Below normal to normal	Normal to above normal (20/40/40)	No events

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	**MedCOF-13 climate outlook for temperature**	**Observed**	**MedCOF-13 climate outlook for precipitation**	
Federation of Bosnia and Herzegovina (1)	Above normal in almost the entire country	Above normal (10/30/60)	Northeast: around normal West, south, southeast, centre: below normal	No predictive signal (33/33/33)	Heavy storms in December and February with material damage to buildings and cars. In the basins of central Bosnia heavily polluted air in December. Unusually low snow cover in the mountains.
Bulgaria (1)	Above normal	Above normal (10/40/50)	Near or below normal	Below normal (50/30/20)	Drought conditions dominated the weather in Bulgaria since the middle of the summer of 2019. They continued in autumn and winter. It was only in February when the weather pattern returned to another weather type. The drought brought water reservoirs in western Bulgaria to critically low levels and special measures had to be taken to tackle the water shortage in cities.
Croatia (5)	Above normal	Above normal (10/30/60)	**Below normal:** Eastern Croatia, the wider areas of the towns of Sisak and Ogulin, Lika region, part of the Northern and Middle Adriatic and their hinterland **Above normal:** the wider areas of the town of Varaždin	**Below normal** (50,30,20) (Majority of Croatia) **No predictive signal** (33,33,33) (the part of the North Adriatic and most western part of Croatia)	A few episodes (in December and February) with hurricane-strong bora wind (NE wind along the Adriatic coast) was recorded. Sea and road traffic between continental part and Adriatic coast was completely interrupted. The measured wind gusts along the coast, on the Pag and Maslenica bridge on February 5th were around 200 km/h. On the same day very windy was it also in the continental part of Croatia. There was a lot of damage in Zagreb, the capital of Croatia - on the roofs and on the cars (the fallen trees).

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-13 climate outlook for temperature	Observed	MedCOF-13 climate outlook for precipitation	
Cyprus (5)	Normal to above normal	Above normal (10/30/60)	Dec-Jan: Well above normal Feb: slightly below normal	No predictive signal (33/33/33)	Temperature extremes (deviating by 4°C or more from normal) were recorded at numerous of meteorological stations in December and February. Precipitation was well above normal reaching 176,3mm (188% of normal) in December and 147.8mm (178% of normal) in January due to several showers and thunderstorms. Hail on 17 February, snowfall on several days in February.
France (5)	Above normal, especially in the southeast, warmest winter since 1900	Above normal (10/40/50) southeast: (10/30/60)	North: above normal South: below or around normal	North: above normal (20/30/50) Elsewhere: no predictive signal (33/33/33)	1 December: very heavy precipitation in the southeast (Côte d'Azur), 200mm/24h, 7 flood victims, perturbations on transport. 12-23 December: 4 storms, wind gusts >100km/h in 30% of the country. 20 January: absolute record of atmospheric pressure in Abbeville (northern France: 1049.7 hPa. 20-24 January: storm Gloria, heavy precipitation 150-400mm on 3 days, floods, perturbations on transport 3 February: daily mean 13.8°C on average in France, +8.7°C anomaly, second highest on record. 9-11February: storm Ciara, northern half of France, then eastern half and Corsica, gusts >100km/h in 20% of the country. One of the 40 strongest storms in France since 1980.
Georgia (1)	Above normal	Above normal (10/40/50)	West: near normal East: below normal	Normal to above normal (20/40/40)	No events

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-13 climate outlook for temperature	Observed	MedCOF-13 climate outlook for precipitation	
Greece (2)	Above normal	Above normal (10/30/60) Northeast: (10/40/50)	Below normal in most of parts, mainly in the west and north areas, and the east Aegean islands. Above normal in the central and eastern areas, including Thessaly, Sporades islands, Attica, and Evvoia.	Below normal (50/30/20) South-southeast: no predictive signal (33/33/33)	No events
Hungary*	Above normal	Above normal (10/40/50)	Around normal	No predictive signal (33/33/33)	No events
Israel (5)	Around normal	Above normal (10/30/60)	Above normal	No predictive signal (33/33/33)	No events
Italy*	Above normal	Above normal (10/30/60)	Below normal North: around normal	North: no predictive signal (33/33/33) Elsewhere: below normal (50/30/20)	No events
Jordan*	Above normal	Above normal (10/40/50)	Mainly above normal	No predictive signal (33/33/33)	No events

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-13 climate outlook for temperature	Observed	MedCOF-13 climate outlook for precipitation	
Lebanon *	Above normal	Above normal (10/30/60)	Above normal	No predictive signal (33/33/33)	No events
Moldova (5)	Above normal	Above normal (10/40/50)	75% of territory below normal 25% of territory near normal	South: below normal (50/30/20) Elsewhere: no predictive signal	5-6 February: wind gusts up to 15-23 m/s, heavy precipitation (rain, snow, sleet), snow coverage. Electricity wires damaged due to strong wind, difficult conditions for road traffic due to snow, blizzard and black ice. 24 February: wind gusts up to 19-25 m/s, locally 26-27 m/s, isolated dust storm, deterioration of electricity wires, damage on national economy and agricultural lands.
Montenegro *	Above normal	Above normal (10/30/60)	Below normal	Below normal (50/30/20)	No events
North Macedonia (5)	Above normal	Above normal (10/30/60)	Around normal	Below normal (50/30/20)	No events
Portugal *	Above normal	Above normal (10/40/50)	Around normal	No predictive signal (33,33,33) South: below normal (50/30/20)	No events
Romania *	Above normal	Above normal (10/40/50)	Below normal	Below normal (50/30/20)	No events

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-13 climate outlook for temperature	Observed	MedCOF-13 climate outlook for precipitation	
Serbia (1,5)	Above normal	Above normal (10/30/60)	Below normal and normal in most of Serbia	No predictive signal (33,33,33)	Fifth warmest winter 2019/2020 for Serbia since 1951, and fifth warmest for Belgrade since 1888 Second warmest winter for Negotin, third warmest for Loznica, Cuprija, Zajecar and Crni Vrh Second warmest winter for Serbia based on the maximum air temperature Snow cover wasn't recorded in Sombor, Zrenjanin, Banatski Karlovac and Palic, and for the first time snow wasn't registered in Negotin and Kikinda Record late occurrence of snow cover in Belgrade Fifth driest winter in Negotin
Slovenia (5)	Above normal	Above normal (10/30/60)	Southeast: mostly below normal West, north, northeast: mostly normal	No predictive signal (33,33,33)	Temperature above average (among the three warmest since 1961), Precipitation below average, wet December and dry January and February, Very warm February (second warmest since 1961), Very dry January (among the eight driest since 1961).

Spain (5)	Above normal (second warmest winter since 1965 and the warmest winter from 2000	East: above normal (10/40/50) Elsewhere: No predictive signal (33/33/33)	Big spatial and temporal variability. . -Wet or very wet from Aragón and Catalonia to Murcia, west of Castilla y León and on the Balearic Islands. -Extremely wet in some areas near Barcelona, Teruel and Zaragoza provinces, and in the Ebro river delta. -Dry in some zones of mainland Spain. -Extremely dry in Melilla. Overall slightly above normal December and January wet, but February driest since 1965	No predictive signal (33,33,33)	Frequent warm episodes: 13- 28 December, 28 January – 4 February, 21-25 February, maxima close to 30°C in Valencia/Airport, several new records of daily maximum and minimum temperature. 2 cold episodes: 12-14 January, 19-21 January Precipitation: • 2-4 **December,** a cut-off low caused intense precipitation in the Mediterranean fringe and the Balearic Islands. • 12 **December**, intense precipitation was reported in the northern fringe, extending from Galicia to Pyrenees (Lleida). • From 15 to 17 **December**, matching with the pass of Storm Daniel, half- western mainland Spain experienced intense precipitation. • From 18 to 21 **December**, matching with the pass of Storm Elsa passage followed by Storm Fabien, precipitation swept mainland Spain and the Balearic Islands, being very intense in Galicia, Pyrenees, Sistema Central, Sistema Bético and Sierra de Cádiz. • From 18 to 23 January, most outstanding heavy precipitation event, started by the arrival of Storm Gloria (18 to 20 January), which affected eastern Spain and the Balearic Islands with high winds and heavy rainfall, triggering floods with widespread damage to houses. Greater values than 150 mm were recorded in zones of the Balearic Islands and to the south of Valencia and north of Alicante. The following days, precipitation – in some cases thunderstorm and hail - affected mostly Girona and Tarragona provinces, and east of Aragón. Snowfall was reported in some areas of mainland Peninsula, especially in Teruel province and northwest of Castellón province. • 15-16 January, precipitation affected the northwestern quadrant, being heavy to the west of Galicia. • 24-25 January, precipitation was intense in the southwestern quadrant and mainly in Málaga province.

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-13 climate outlook for temperature	Observed	MedCOF-13 climate outlook for precipitation	
Syria *	Above normal	Above normal (10/40/50)	Normal to above normal	No predictive signal (33,33,33)	No events
Turkey (5)	Near and above normal	Near and above normal (10/40/50) Southwest: (10/30/60)	West: below normal Northeast: below normal Elsewhere: near and above normal	West: below normal (50/30/20) Centre: no predictive signal (33,33,33) Northeast: normal to above normal (20/40/40)	December 2019 was the sixth hottest December in the long-term period (1971-2019). Turkey December mean temperature is 4.6°C, December 2019 mean temperature was 6.5°C. 1 station reached new monthly maximum temperature record in December 2019. 1 station reached new monthly maximum temperature record and 1 station reached new monthly minimum temperature record in February 2020. In January 2020, 2 casualties due to flood in Mersin (Eastern Mediterranean Region). In February 2020, 5 casualties due to avalanche and unfortunately 36 casualties due to second avalanche while rescue operation in Van (Eastern Anatolian Region).

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High Impact Events
	Observed	MedCOF-13 climate outlook for temperature	Observed	MedCOF-13 climate outlook for precipitation	
Ukraine (1,5)	Above normal	Above normal (10/40/50)	Above normal (32% stations) Normal (52% stations) Below normal (16% stations)	No predictive signal (33, 33, 33)	Warmest winter since 1961 for most stations in Ukraine. Heavy snowfalls on January 29-30 (26-27 mm precipitation per 12 hours) and strong blizzard (18 hours with wind gust 18 m/s) in Chernihiv and Symy regions. In February 4-6 heavy snowfalls (20-28 mm precipitation per 6-12 hours) in Zakarpattia, Ivano-Frankivsk, Chernivci, Odesa, Zaporizhzhia, Dnipro, Doneck regions, strong wind (25-28 m/s) in Odesa, Kherson regions, in highland of Carpathians 40 m/s. On 10 February strong wind (25-34 m/s) in Lviv, Ivano-Frankivsk and in the highland of Carpathians 40 m/s. On 24 February strong wind (25-32 m/s) in Lviv, Ivano-Frankivsk, Odesa, Mykolaiv, Kherson regions. Unfavorable weather conditions caused loss of power, telecommunications, utilities and transport.

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: ERA5 1981-2010 for temperature, GPCC 1981-2010 for precipitation

North Africa (RA I)

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High impacts events
	Observed	**MedCOF-13 climate outlook for temperature**	**Observed**	**MedCOF-13 climate outlook for precipitation**	
Algeria (1)	Normal to above normal	North and SW: above normal (10/40/50) Elsewhere: no clear signal	Below Normal	Coast regions: Below normal (50/30/20) Elsewhere: no clear signal	Dry winter season.
Egypt *	North: above normal South: near to below normal	Extreme north: above normal (10/30/60) Elsewhere: no clear signal	North/northwest: near to above normal Elsewhere: below normal	No clear signal	No comment ***
Libya *	South: near normal Elsewhere: above normal	No clear signal	Some zones in the north/southeast: near to above normal Elsewhere: below normal	No clear signal	No comment ****

Country	Seasonal temperature (DJF)		Seasonal precipitation (DJF)		High impacts events
	Observed	**MedCOF-13 climate outlook for temperature**	**Observed**	**MedCOF-13 climate outlook for precipitation**	
Morocco (1)	Above normal conditions over almost all the country	Above normal conditions over most of Morocco (10/40/50). No special scenario over SW	Below normal conditions over Morocco	Below normal conditions over Morocco (50/30/20).	-December: -New records of high daily minimum temperature for 2 stations (Taza et Nador) of NE region -7 days of sirocco over Ifrane -February: -Significant rise of daily maximum and minimum temperature over NE region reaching 7°C at some stations -Significant rainfall deficit reaching 100% of NE region -5 days of Chergui or sirocco over Fes.
Tunisia (1)	Above normal	Above normal (10/40/50)	Below normal	Extreme north: below normal (50/30/20) Elsewhere: no clear signal.	- Drought episodes recorded in January and February 2020 causing damages to the agriculture.

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

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