MEDITERRANEAN CLIMATE OUTLOOK FORUM
MEDCOF-22 Online Forum

MONITORING SUMMARY MEDCOF-22

for April 2024

Final version

Last update: 29 May 2023

Compiled by

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The following MedCOF monitoring summary is based on

- Monitoring information from RA I NA RCC and RA VI RCC Node-CM
- Contribution from Météo France (draft of LRF bulletin)
- Further information from various sources (BOM, NOAA-CPC)
- SEECOF-31 Monitoring document

1. Oceanic Analysis

Significant change in the ocean state is found across all basins since last winter.

Over the Pacific Ocean: La Niña:

- El Niño has faded in recent months and La Niña will probably set up next autumn (note the strong cooling next month in the extreme east of equatorial Pacific). Current Nino3.4 monthly index issued from Mercator Ocean analysis : 0.8°C
- The PDO remains in a strong negative phase.
- For more details see:
    - http://seasonal.meteo.fr/slides/BulTech (password protected)
    - https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml
    - http://www.bom.gov.au/climate/enso/index.shtml#tabs=Pacific-Ocean
    - PDO:
        - https://www.ncdc.noaa.gov/teleconnections/pdo/
        - https://stateoftheocean.osmc.noaa.gov/atm/pdo.php

Over the Maritime Continent and the Indian Ocean:

- The tropical Indian Ocean was warmer than normal in April 2024, most in the west (more than +1 °C).
- Indian Ocean Dipole (IOD): No significant East/West gradient, slightly in the southern tropic parts. Value of DMI is close to zero (neutral phase of IOD).

Over the North Atlantic:

- SST close to normal conditions in the northwestern part of the basin.
- A strong warm SST anomaly is present in the southeastern and equatorial part of the North Atlantic, from South America to the northern African coasts and the Gulf of Guinea.

Over the Mediterranean and Black Sea:

- The Mediterranean Sea was warmer than normal in April 2024, around 0.5-1 °C in the western basin and 1-2 °C in the central and eastern basin.
- SST in the Black Sea was well above normal (>2 °C anomaly).

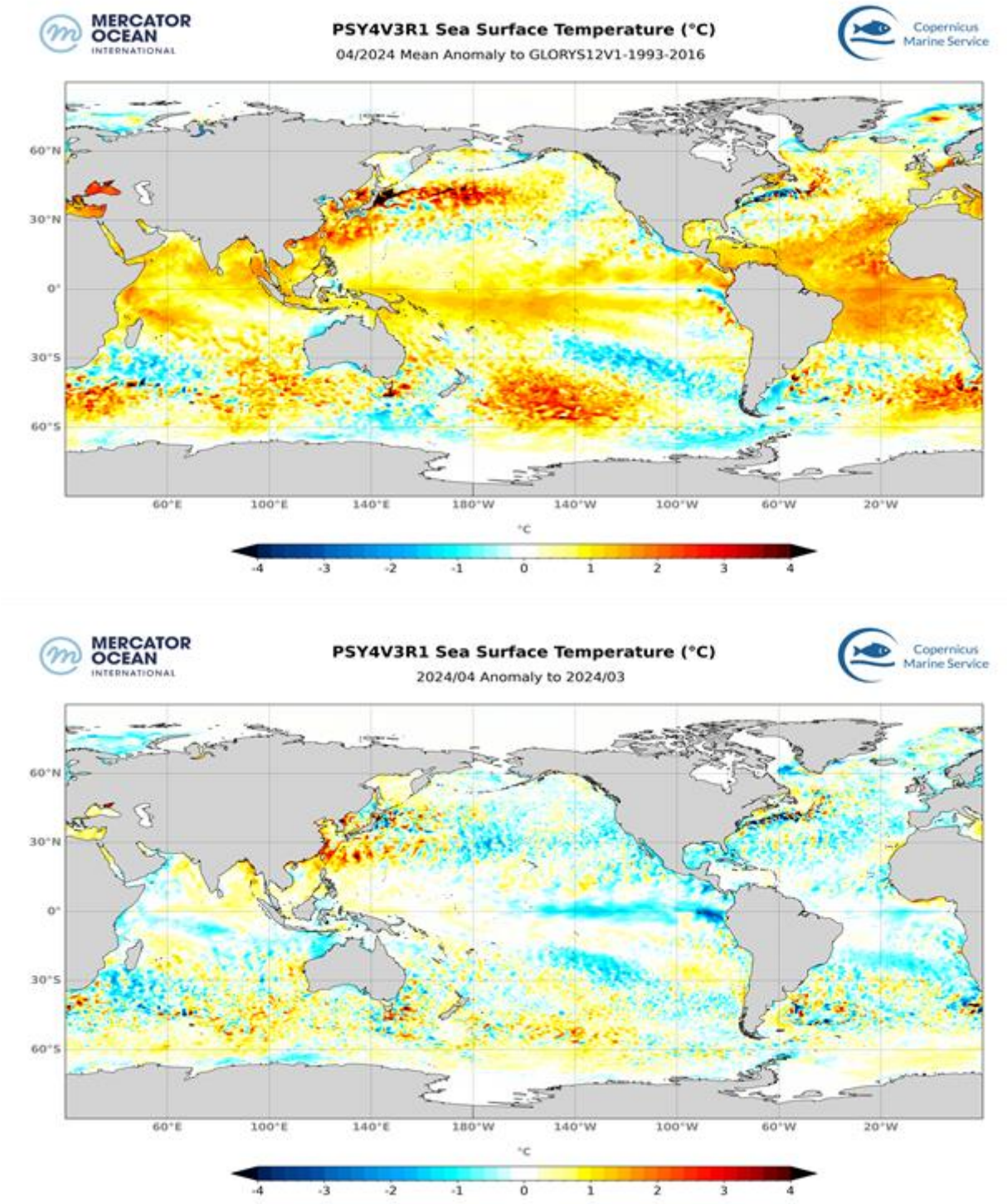


Figure 1.1: Sea surface temperature anomalies for April 2024, 1993-2016 reference (upper map) and anomaly differences April minus March 2024 (anomaly trend). Source: Météo France

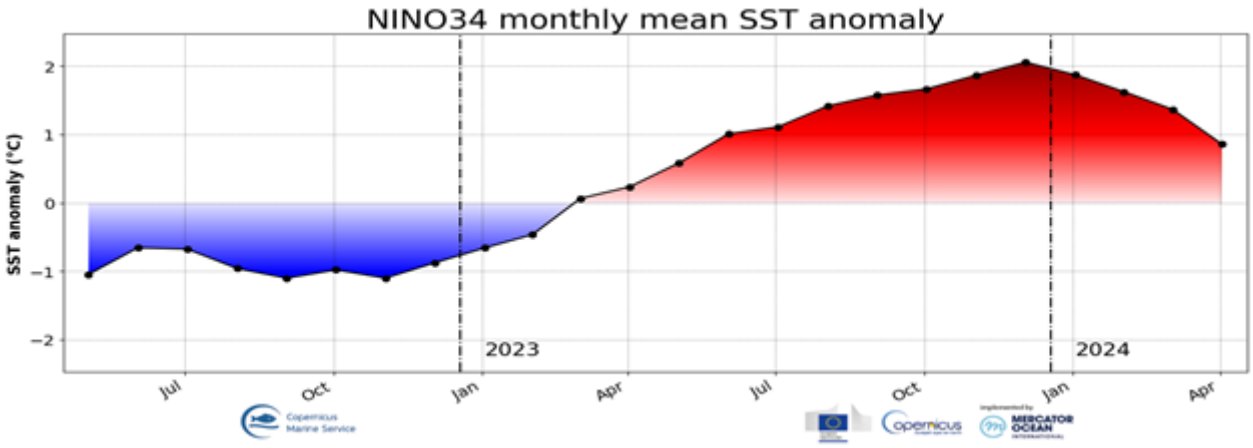


Figure 1.2: Evolution of sea surface temperature anomalies in the Niño3.4 box, 1993-2016 reference. Data from Mercator Ocean, source: Météo France.

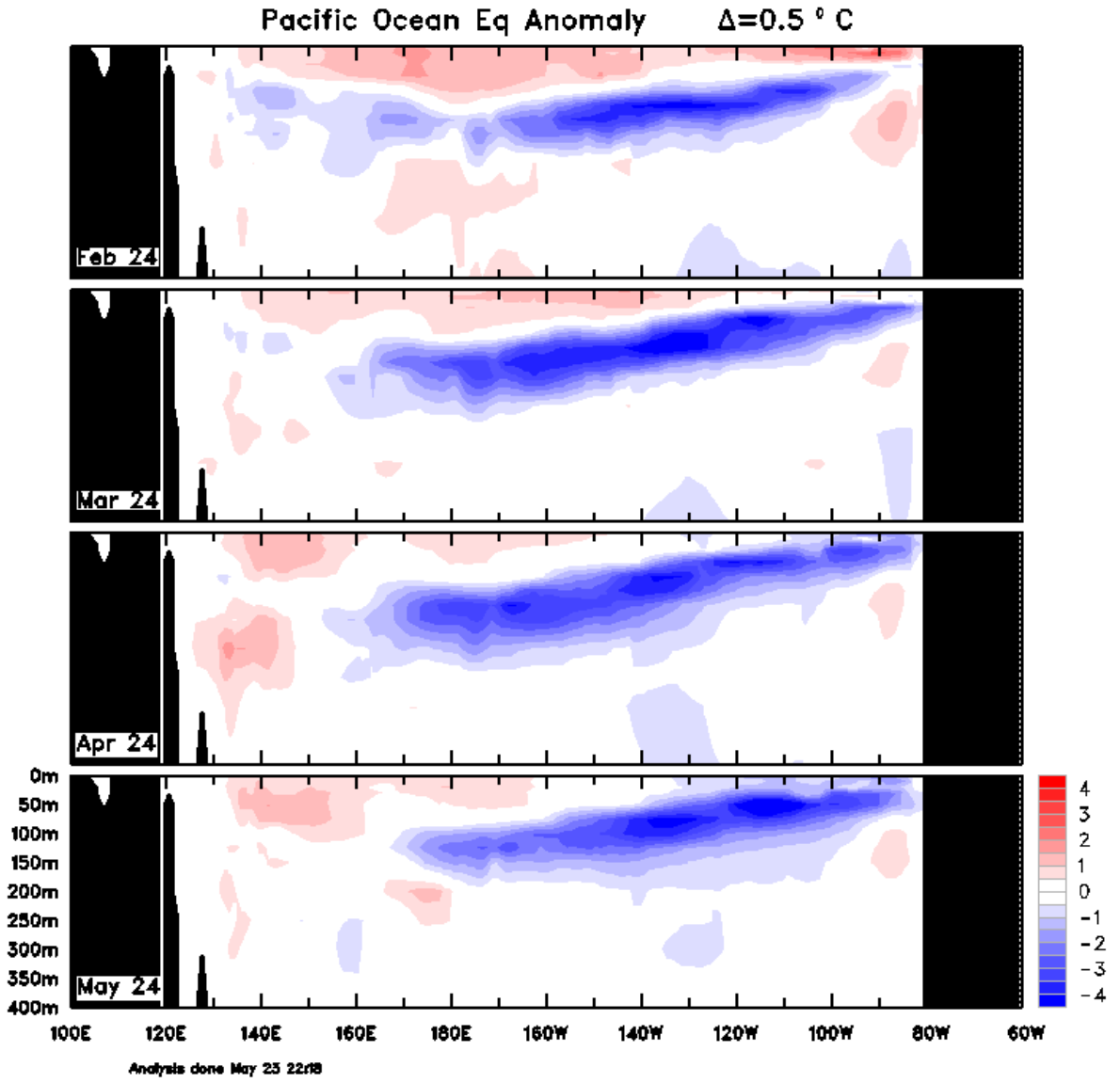


Figure 1.3: Monthly Pacific Ocean temperature anomalies in the sub-surface February-May 2024, 1900-1992 reference (Climatology after Levitus World Ocean Atlas). Source: BOM, http://www.bom.gov.au/climate/enso/index.shtml#tabs=Sea-sub%E2%80%93surface

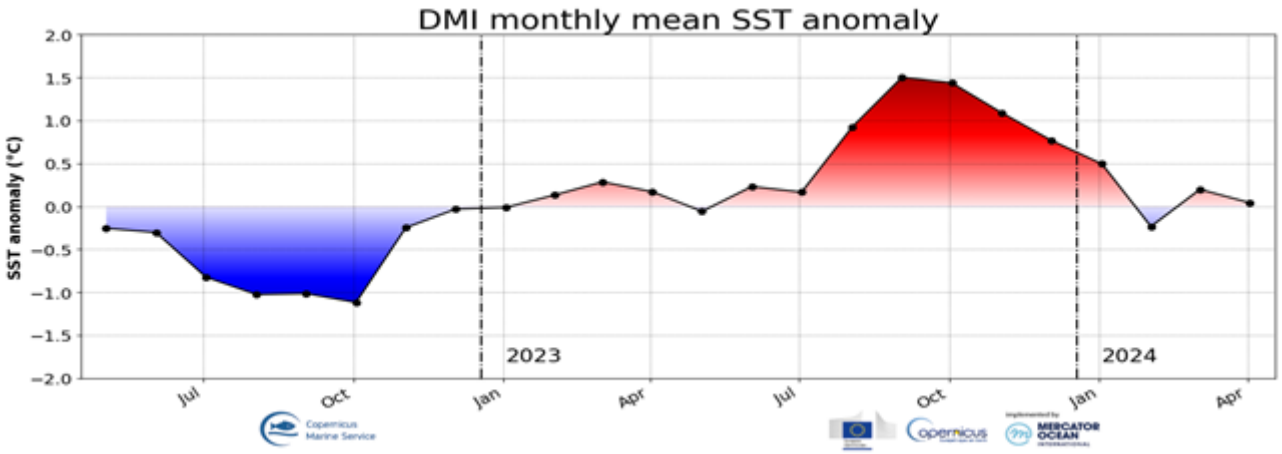


Figure 1.4: Evolution of the DMI monthly index (Indian Ocean Dipole), 1993-2016 reference. Data from Mercator Ocean, source: Météo France.

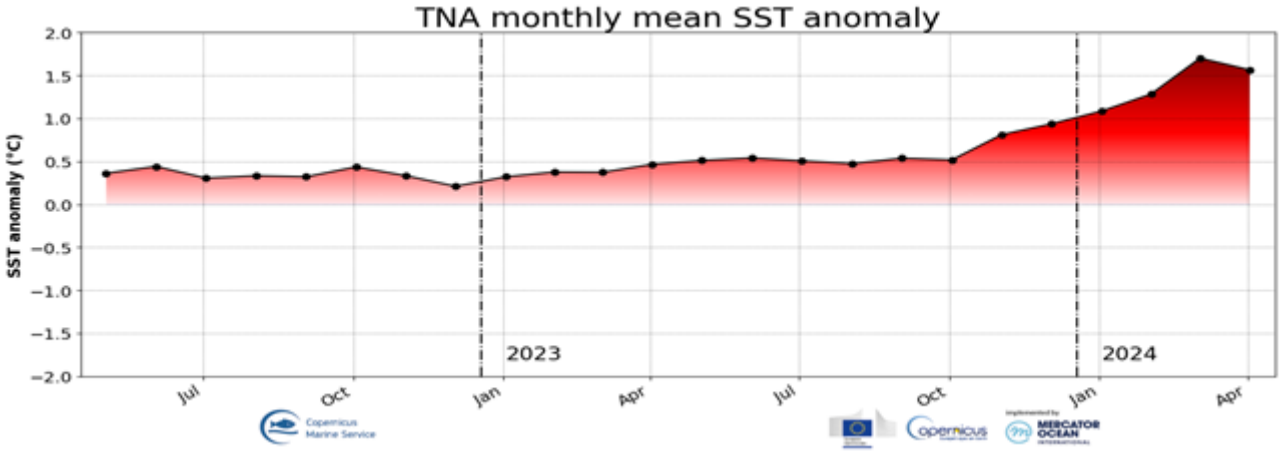


Figure 1.5: Evolution of the NAT monthly index (North Atlantic temperature), 1993-2016 reference. Data from Mercator Ocean, source: Météo France.

2. Atmospheric Circulation Analysis

Velocity potential and stream function anomaly field in the high troposphere (fig. 2.1a – insight into Hadley-Walker circulation anomalies), Southern Oscillation Index (SOI) and Madden-Julian Oscillation (MJO) (fig. 2.1.b)

- Velocity Potential at 200 hPa: No upward anomaly motion over the equatorial Pacific in FMA 2024, despite the positive SST anomaly linked to El Niño. (The MJO probably played a role by contradicting what was expected during an El Niño episode). Over the Indian Ocean we note a dipole with a downward anomaly over the eastern part of the basin and an upward anomaly motion over the western part of the basin and over Africa, while the IOD is in neutral phase.
- Streamfunction at 200 hPa: small dipole around the equator over the Central Pacific, no clear teleconnection pattern is visible.
- SOI values were close to zero for both March and April 2024 (+0.4 for March, -0.2 for April according to NOAA CPC)
  - https://www.ncdc.noaa.gov/teleconnections/enso/soi
  - http://www.bom.gov.au/climate/enso/index.shtml#tabs=Pacific-Ocean&pacific=SOI

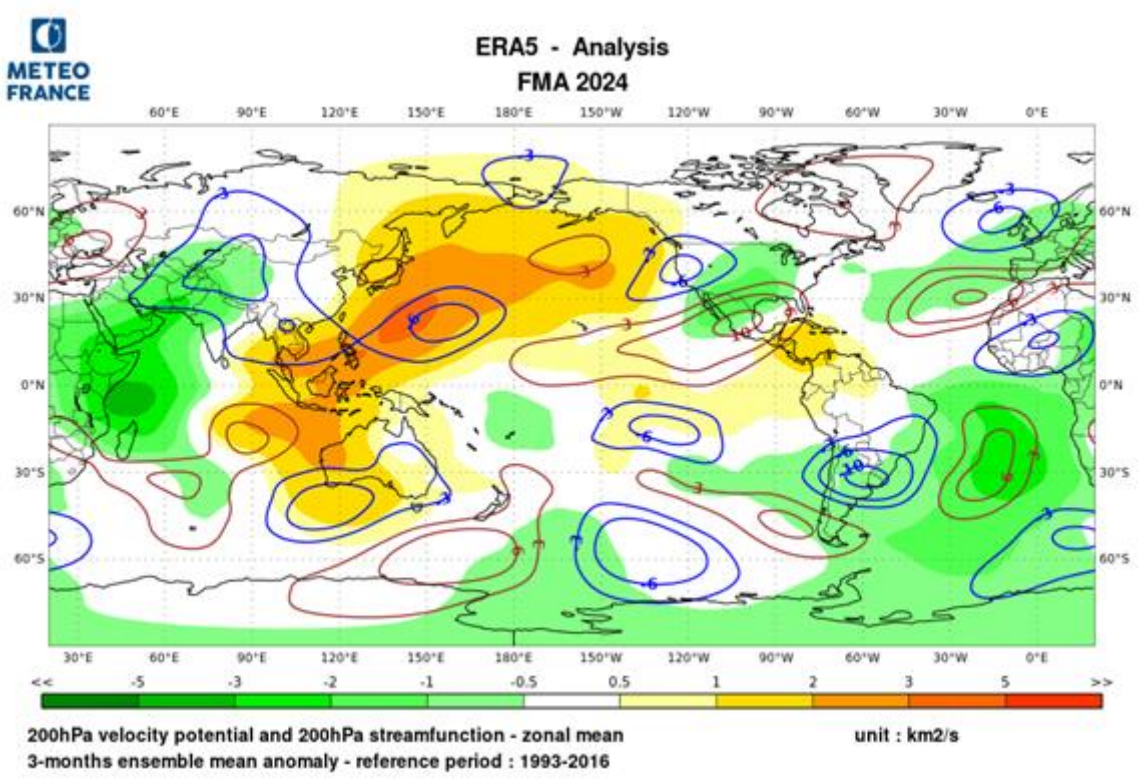


Figure 2.1.a: Velocity potential and stream function anomalies at 200 hPa for February-April 2024. Green (yellow/brown) indicates a divergence-upward motion anomaly (convergence-downward motion anomaly). Source: Meteo France

- MJO was strongly active in March 2024, but rather weak or inactive in April and May 2024.

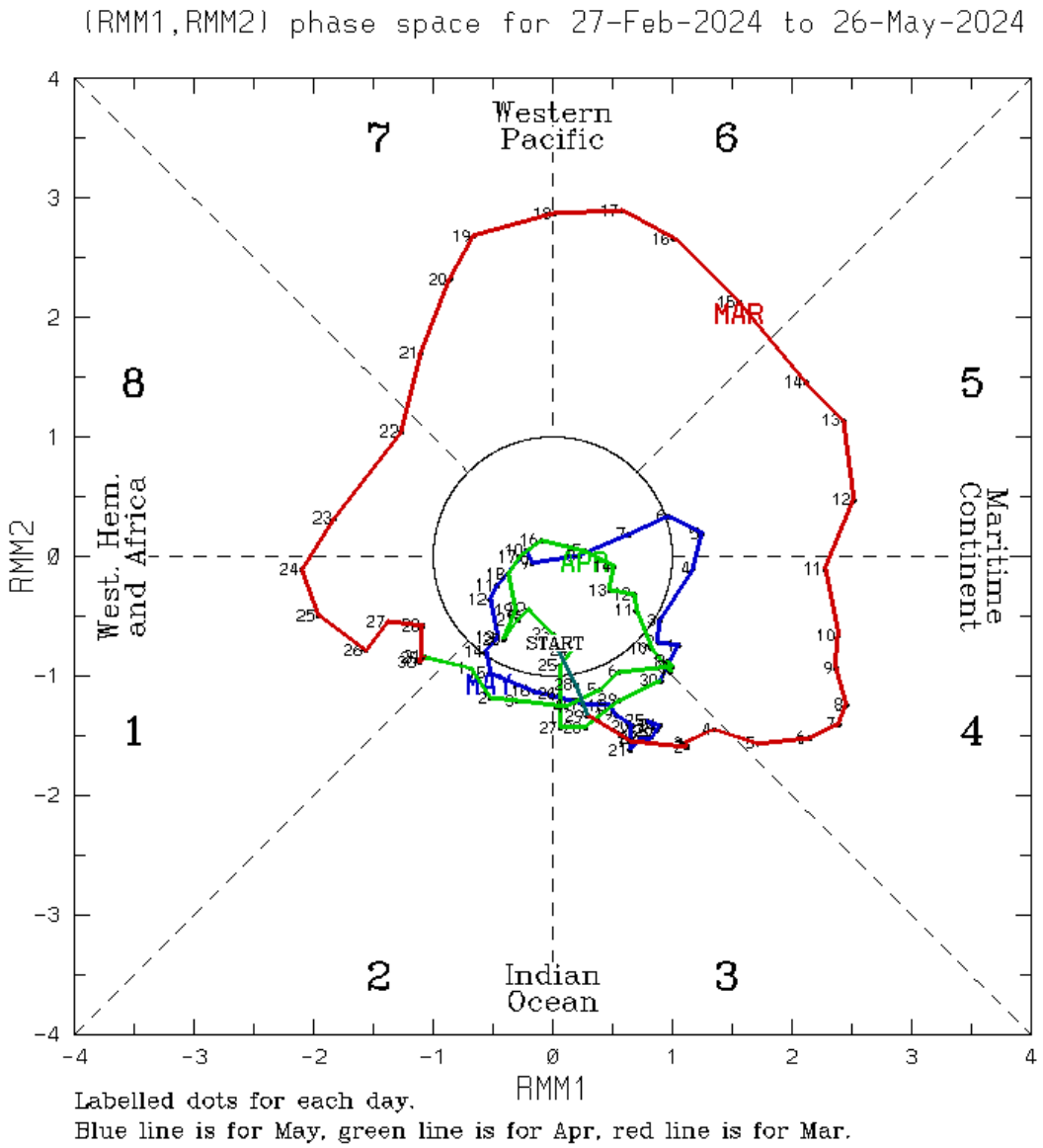


Figure 2.1.b: indices MJO

http://www.bom.gov.au/climate/mjo/

Geopotential height at 500 hPa (fig. 2.3 – insight into mid-latitude general circulation):

- Weak negative PNA pattern in April 2024 (PNA index -0.65 according to NOAA, https://www.ncdc.noaa.gov/teleconnections/pna/), after a long period of a positive pattern from June 2023 to March 2024.
- A much more notable quadrupole pattern can be seen over the mid-latitude North Atlantic.
- A broad and intense ridge was located with its axis over southern European Russia. Large positive anomalies over the entire MedCOF domain.
- Polar vortex was weak over the European Arctic.

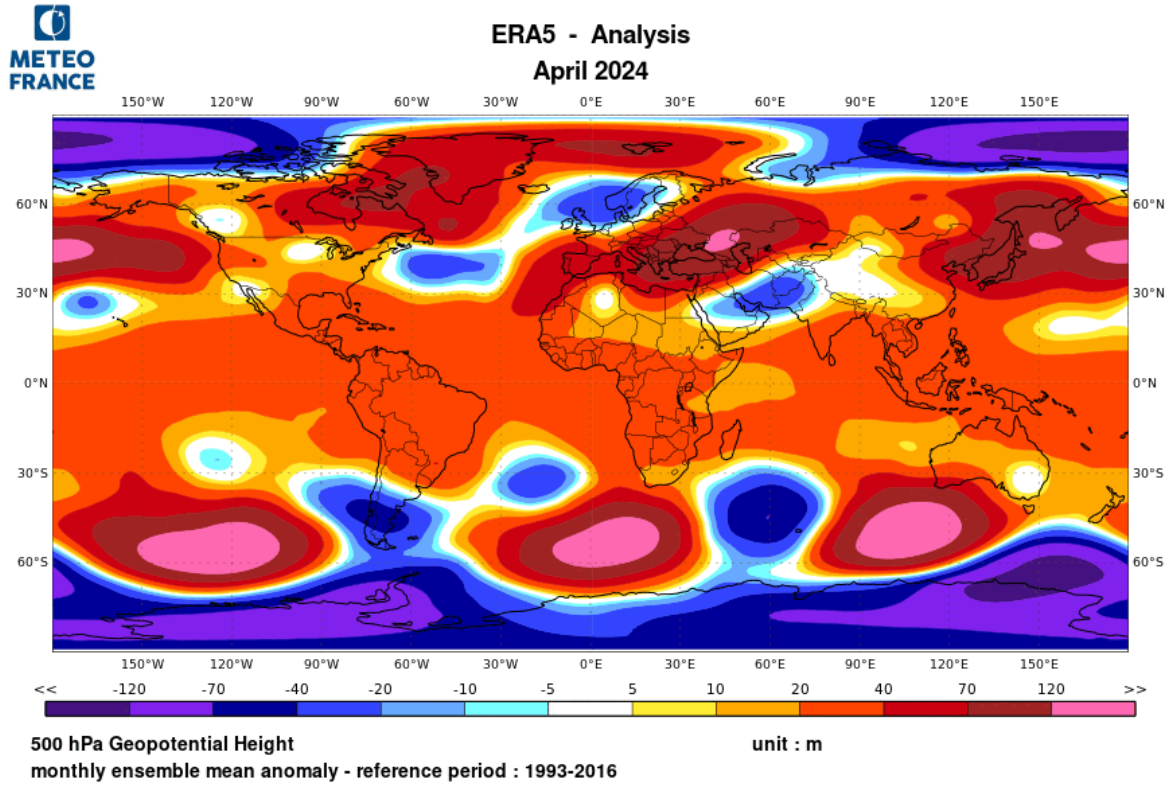


Figure 2.3: Anomalies of Geopotential height at 500hPa (ERA5 data),

Source: Météo-France, http://seasonal.meteo.fr/content/suivi-clim-cartes-ref93-16

Sea level pressure and circulation types relevant for the domain

- Above-normal high pressure over Greenland and near Svalbard.
- The Icelandic Low was relocated southeastwards close to Scotland. A low-pressure zone expanded further east, up to eastern Europe.
- The Russian High was more intense than normal, but less expanded to the west.
- The Azores High was more expanded to the east, over the western and central Mediterranean.
- Low-pressure anomalies over the eastern Mediterranean.

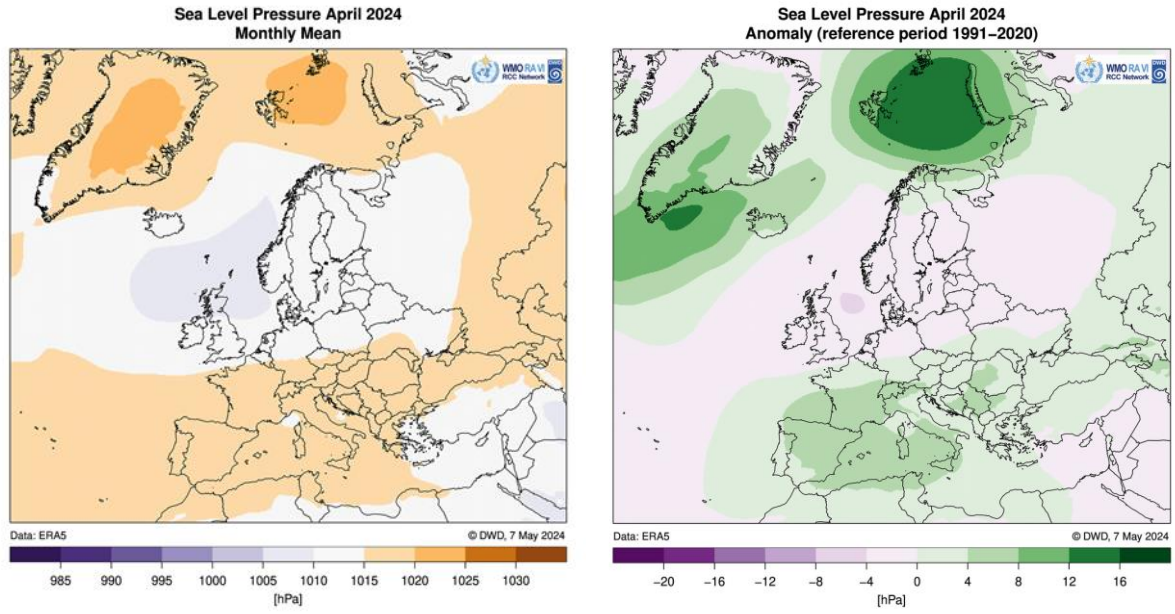


Figure 2.4: Mean sea level pressure over the North Atlantic, Europe and North Africa and 1991-2020 anomalies for April 2024. Source: DWD, https://www.dwd.de/DE/leistungen/rcccm/int/rcccm_int_ppp.html?nn=490674

Circulation patterns

- The most outstanding circulation pattern in April 2024 was EA+ (East Atlantic pattern), characterized by a low-pressure area close to Ireland/UK and high pressure in the subtropics. The EA+ pattern was stable during the last months and persisted since July 2023. The other patterns were much weaker and showed a higher variability.
- The NAO (North Atlantic Oscillation) started with a significant negative phase in April, but was mostly neutral during the rest of the month and in May. Forecasts for the next two weeks show a tendency to NAO-.
- The AO (Arctic Oscillation) differed much from NAO in April. An intense AO+ pattern developed in the first half of the month, but broke down in the second half and came to mostly neutral conditions.
- Over the North Atlantic and Europe, weather regime frequencies show intra-seasonal variability during the FMA season. The predominance of the NAO- regime can't be explained by the MJO, which was in phase 7/8 only during the first half of February and one week in March, nor by SSWs which occurred this winter, but did not propagate to the troposphere.

MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
APR 24	-1.0	3.0	0.7	-0.3	-0.9	---	-0.7	-0.7	0.4
MAR 24	-0.6	1.5	1.0	0.5	0.1	---	1.1	0.8	0.2
FEB 24	0.8	1.7	1.6	-0.5	-0.2	-0.3	-0.2	-0.5	-1.8
JAN 24	-0.3	2.6	0.7	0.1	-0.1	-0.3	0.5	-1.2	-0.9
DEC 23	1.7	1.5	1.2	---	0.9	-1.1	0.1	0.7	-0.5
NOV 23	-0.5	1.2	0.6	0.4	0.5	---	0.1	-0.1	0.3
OCT 23	-1.7	1.2	-0.8	0.3	1.5	---	0.6	-0.6	-0.1
SEP 23	-0.3	2.7	1.3	-2.6	0.8	---	-2.1	-0.3	0.8
AUG 23	-1.6	2.1	-0.4	-1.2	0.4	---	-2.4	-1.1	-1.1
JUL 23	-2.1	1.8	1.3	0.8	0.7	---	-1.8	-0.6	0.0
JUN 23	-0.3	-1.1	0.3	-1.9	0.8	---	0.4	0.8	0.2
MAY 23	0.4	-0.1	1.0	-0.8	-0.7	---	-2.2	-1.1	1.9
APR 23	-0.8	-0.2	-0.2	-0.7	-0.7	---	-0.2	1.3	-0.7

Table 1: Evolution of the main atmospheric indices for the Northern Hemisphere for the last months:
http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/table3.shtml

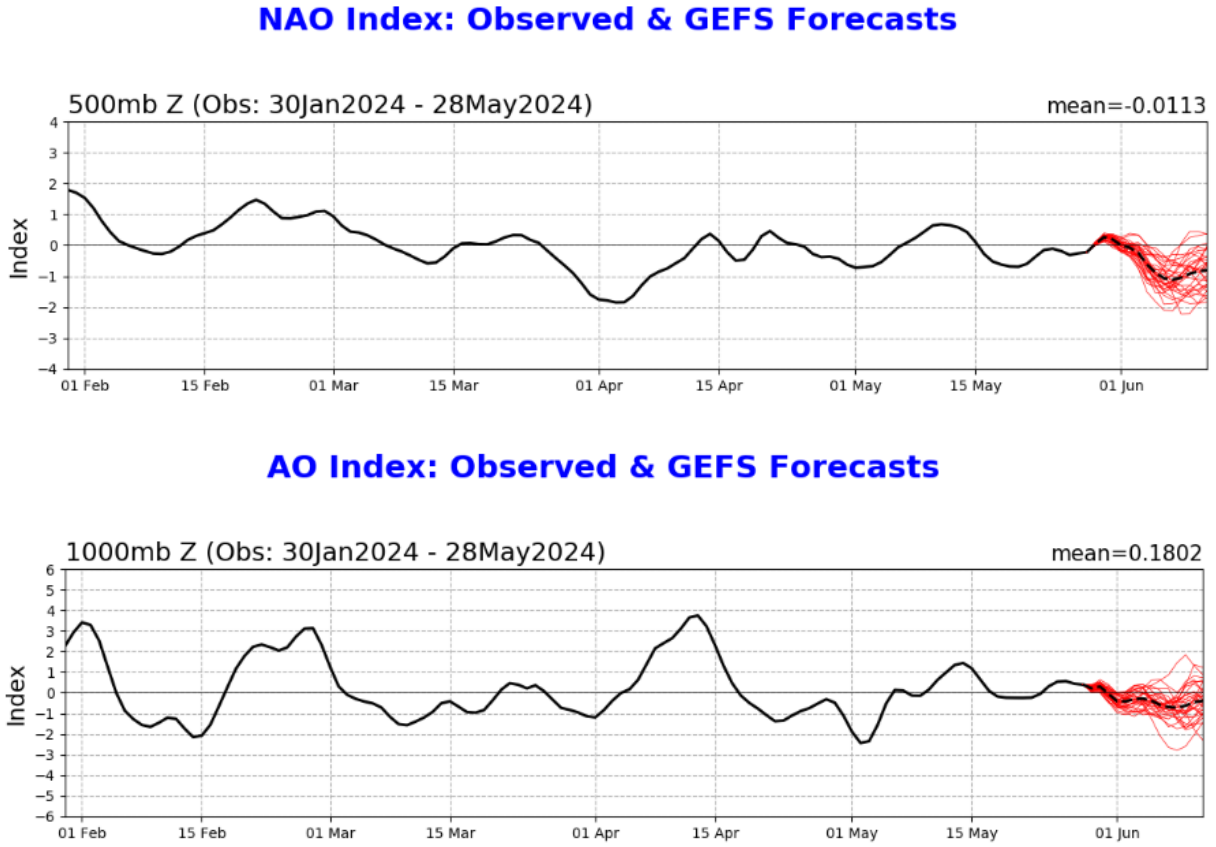


Figure 2.5: North Atlantic Oscillation (NAO) and Arctic Oscillation (AO) indices. Source: NOAA CPC, https://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml

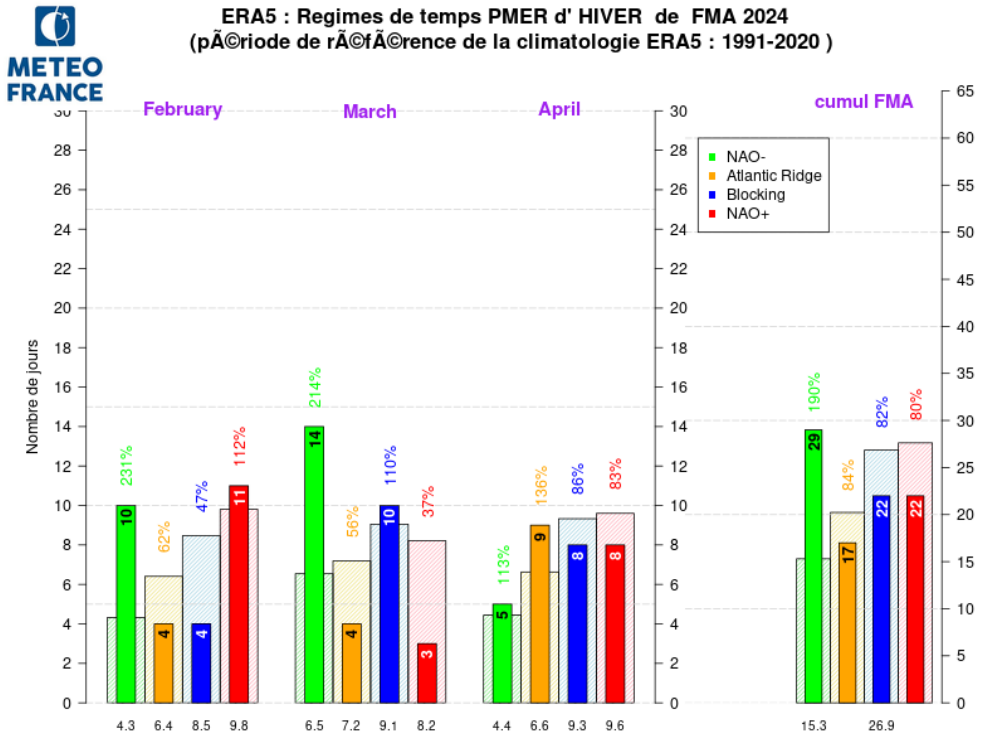


Figure 2.6: Frequency distribution of SLP weather regimes of Météo France classification (winter regime) for February–April 2024 compared to climatology, and aggregation over the entire quarter, for ERA5 reanalysis data. Source: Météo France, http://seasonal.meteo.fr/content/suivi-clim-regimes-trim

3. Precipitation

Europe/RA VI domain

Monthly precipitation in April 2024 was below normal (1991-2020 reference) in most parts of the MedCOF domain due to prevailing high-pressure influence. Some areas received less than 40% of the normal, being below the 10th percentile, especially in Türkiye, Georgia, southern Greece, eastern Hungary, and eastern Ukraine, and further west also in Spain and southern Italy (especially Sicily), partly below 25%. Areas with well above-normal monthly precipitation (>150% of normal and >90th percentile) were located in the central Ukraine and the Black Sea coastal regions of Romania and Bulgaria.

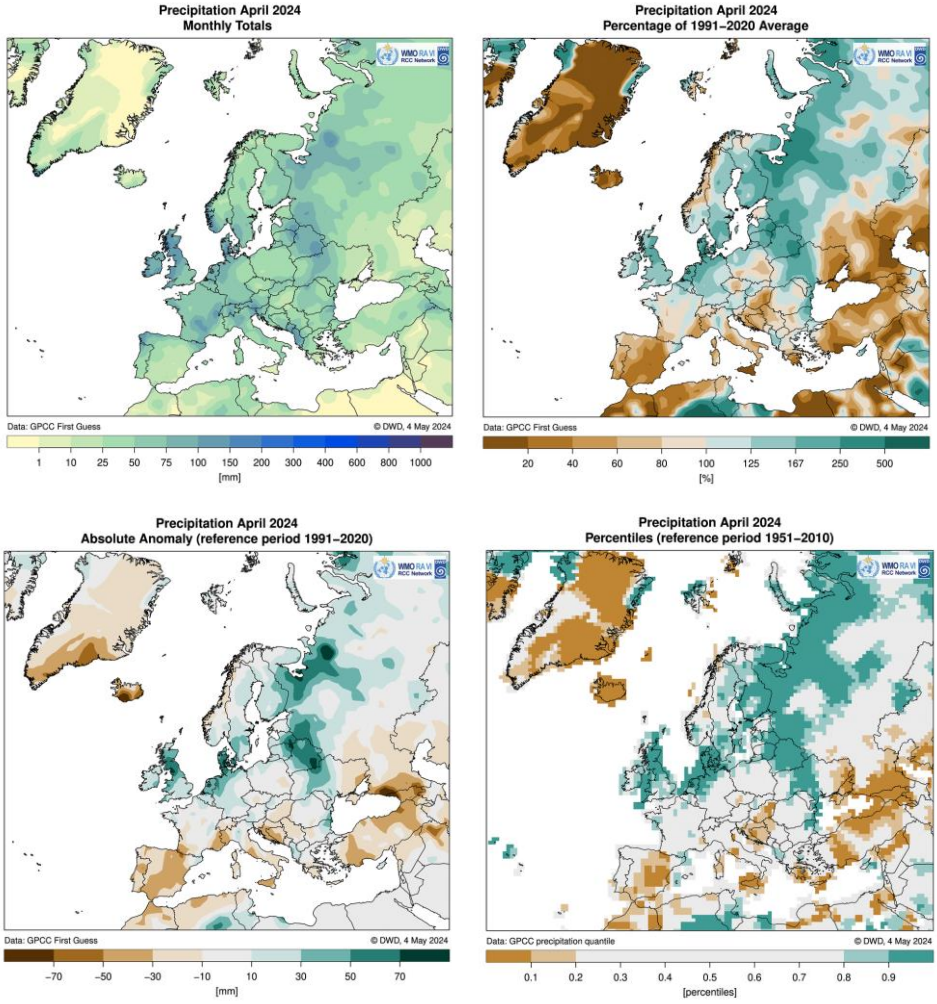


Figure 3.1: Monthly precipitation sum (upper left), percentage of normal (upper right), absolute anomalies (lower left), and percentiles (lower right) for April 2024 (1991-2020 reference for percentages and anomalies, 1951-2010 for percentiles) in Europe/RAVI. Data from GPCC (First Guess version). Source: DWD, https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_month_rrr.html

Precipitation in North Africa

The majority of the North African domain was very dry in April 2024. Precipitation was less than 20 mm, except some parts of the northern regions of Tunisia, the northwest of Algeria and north of Morocco, which received nearly 50 mm (Fig. 3.2, upper map).

Regarding the tercile map (Fig. 3.2, lower map), precipitation was mostly below normal across the North African regions, except in the southern parts of Egypt and Libya, where it was above normal.

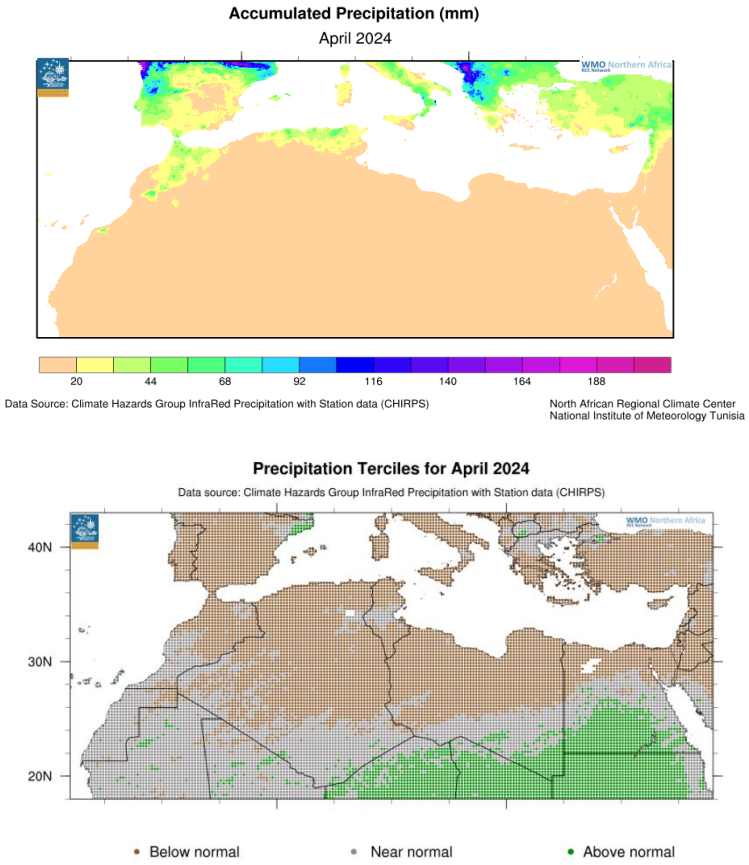


Fig.3.2: Upper map: Total precipitation; lower map: Precipitation terciles for April 2024 in the RAI-NA Region (North Africa). Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010). Source: INM Tunisia, https://www.meteo.tn/en/climate-monitoring-watch

4. Temperature

Europe/RA VI domain

Averaged over all RA VI land areas, April 2024 was the warmest April on record since at least 1981 (Fig. 4.1). The anomaly was +2.1 °C (1991-2020 reference). The warming rate of RA VI was +2.5 °C over the period 1981-2024 (44 years); this is equivalent to +0.57 °C per decade.

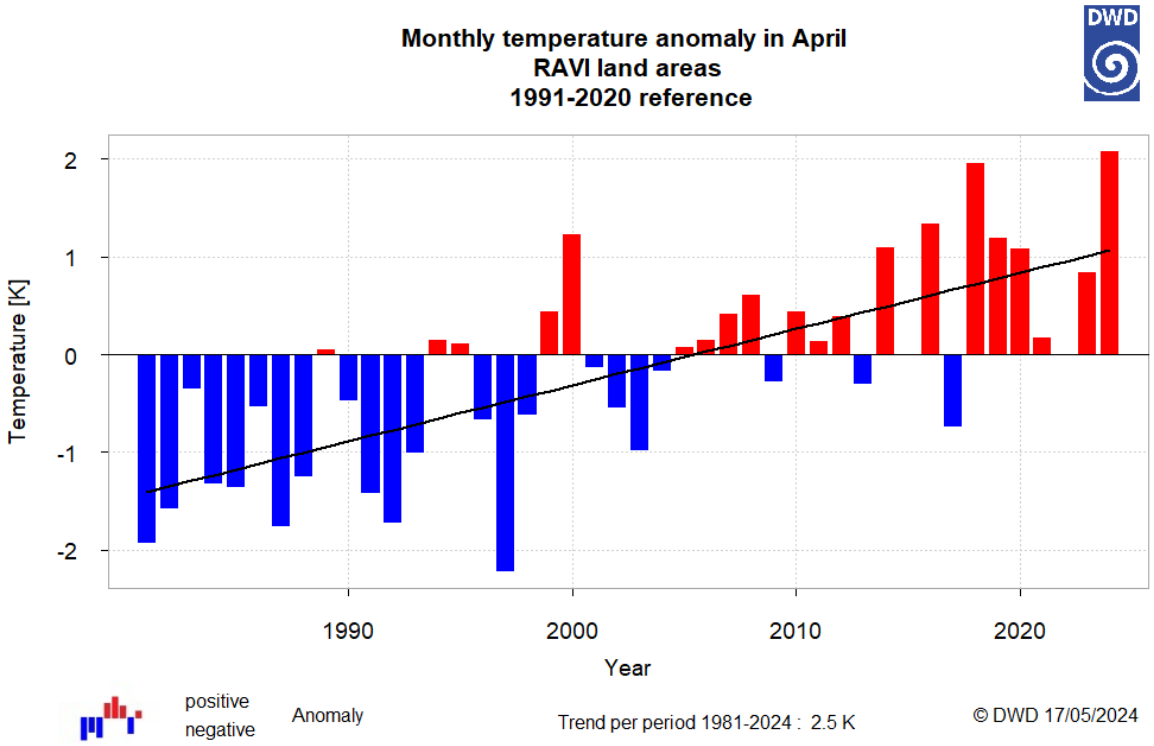


Fig. 4.1: Monthly mean temperature anomaly time series for the years 1981-2024 with trend line, averaged over all RA VI land areas. Source: DWD

Monthly mean temperatures in the MedCOF RA VI domain in April 2024 ranged from close to 0 °C in the Alps to above 20 °C in the Middle East (Fig. 4.2). Most lowland areas had monthly averages of 10–15 °C, only some parts in higher altitudes had lower values. Over the southern Iberian Peninsula, parts of the Balkan Peninsula, eastern Ukraine, Türkiye, and over the Mediterranean sea surface, the air was warmer (mainly 15–20 °C, in the eastern Mediterranean region above).

Monthly mean temperature in April 2024 was at least 1 °C above normal in most of the domain, with highest anomalies in the northeast (more than +5 °C in the eastern Ukraine and northern Georgia, but also locally in Türkiye for 1991-2020 reference). In France and over the western Mediterranean, including the islands, April 2024 temperature was only slightly above normal (< +1 °C anomaly).

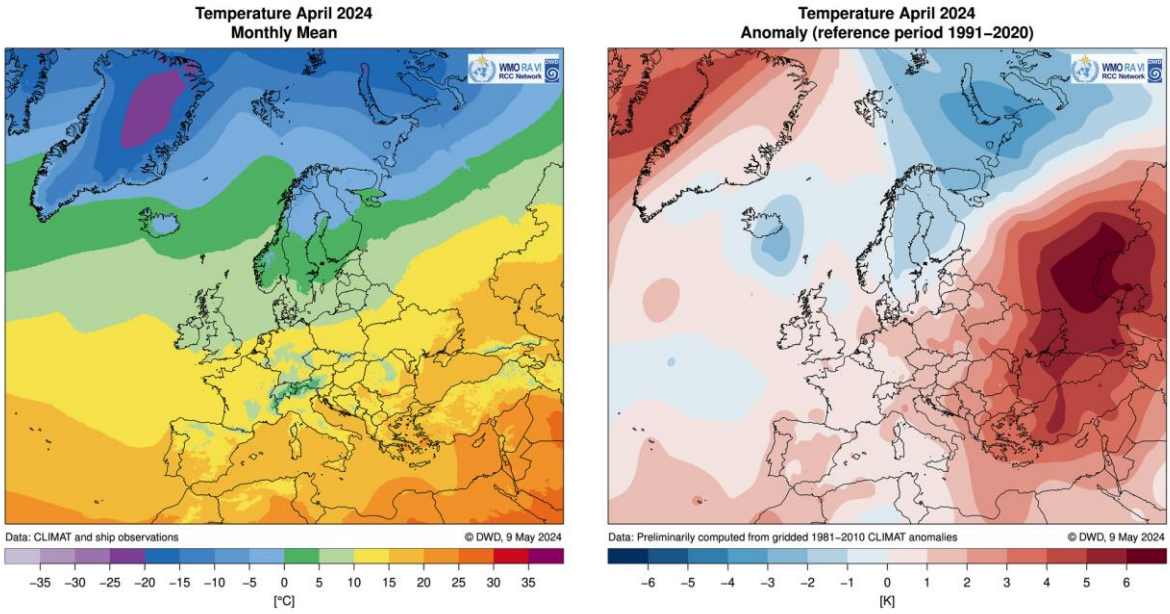


Figure 4.2: Mean temperature (left) and anomalies (1991-2020 reference, right) in °C in the RA VI Region (Europe) interpolated from CLIMAT station and ship data, for April 2024. Source: DWD, https://www.dwd.de/EN/ourservices/rcccm/int/rcccm_month_ttt.html

Temperature in North Africa

The graph in Fig. 4.3 shows the monthly trend of air temperature anomaly of April in degrees Celsius since 1979 through 2024. For each year, the positive anomaly is indicated by the red vertical bars and the negative anomaly is indicated by the blue vertical bars. The black line tracks the changes in the trend over time.

With an excess of +1.1 °C above the land mean temperature over the North African domain, the region has experienced a significant warming trend. This increase corresponds to a substantial warming rate of approximately 0.37 °C per decade.

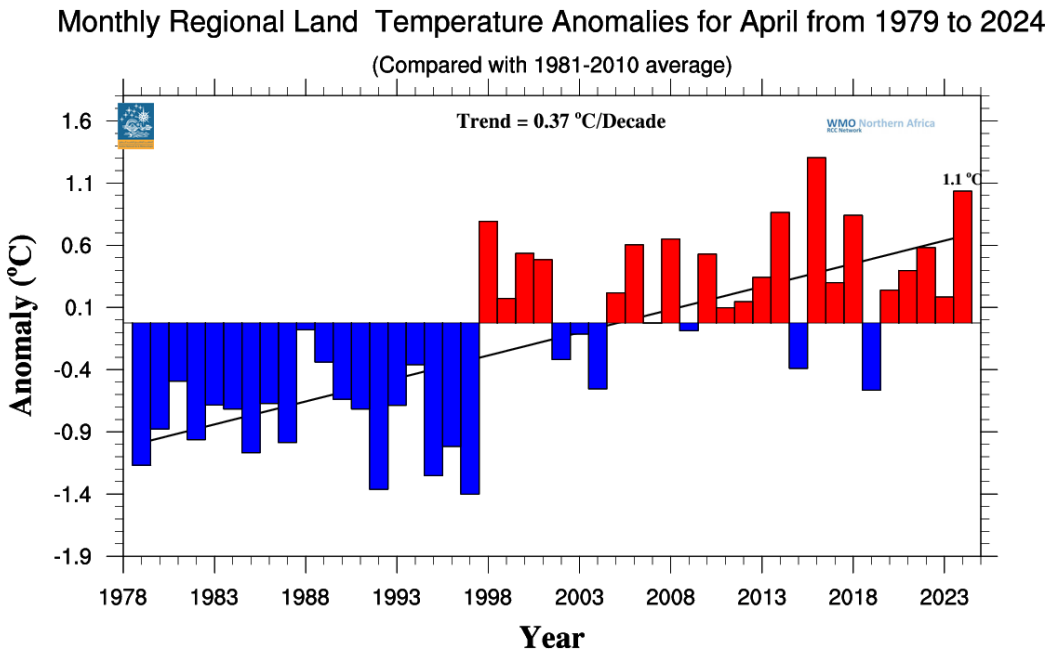


Figure 4.3: Monthly mean temperature anomaly time series 1979-2024 with trend line for land areas over the North African domain. Source: INM

The monthly mean temperature in April 2024 mostly ranged from 8 °C to 28 °C, in small parts reaching 6 °C, especially in the center of Morocco and the north of Algeria. In some parts of southern Algeria and the eastern region of Libya, the mean temperature was above 28 °C and locally in southern Egypt even 30 °C.

Compared to 1981-2010 reference, temperature anomalies were above normal over Tunisia northern Algeria, Libya, mostly in Egypt and north of Morocco. It was mostly in a range between +1 and +2°C. The temperature anomalies were near to below normal over the south of Algeria, the south of Egypt, and over the northeast of Libya, it mostly ranged between −1 °C and −2 °C.

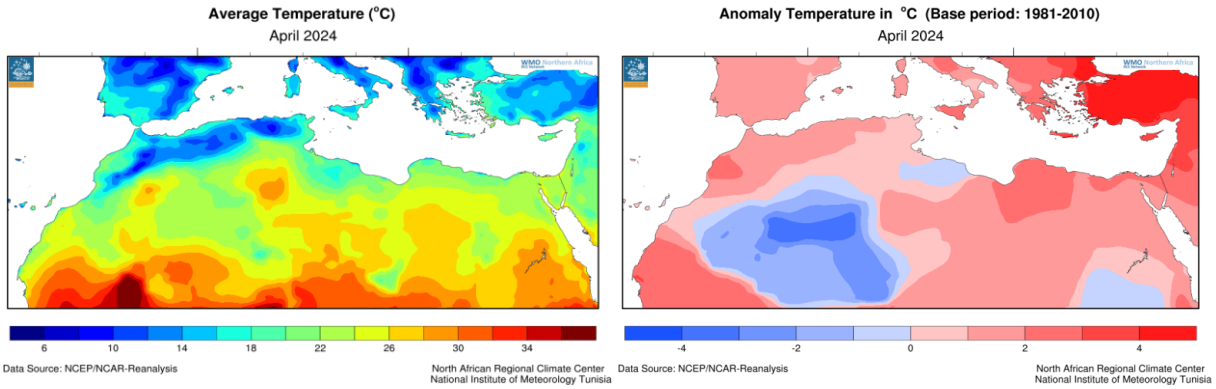


Fig. 4.4: Left: Mean temperature; Right: Absolute anomalies of temperature in the RAI-NA Region (North Africa). Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010), Source: INM,

https://www.meteo.tn/en/climate-monitoring-watch

Regarding to the tercile map, the temperature was below normal over the south of Algeria, near normal over the northwest of Libya and the south of Egypt, over the rest of the region the temperature was above normal.

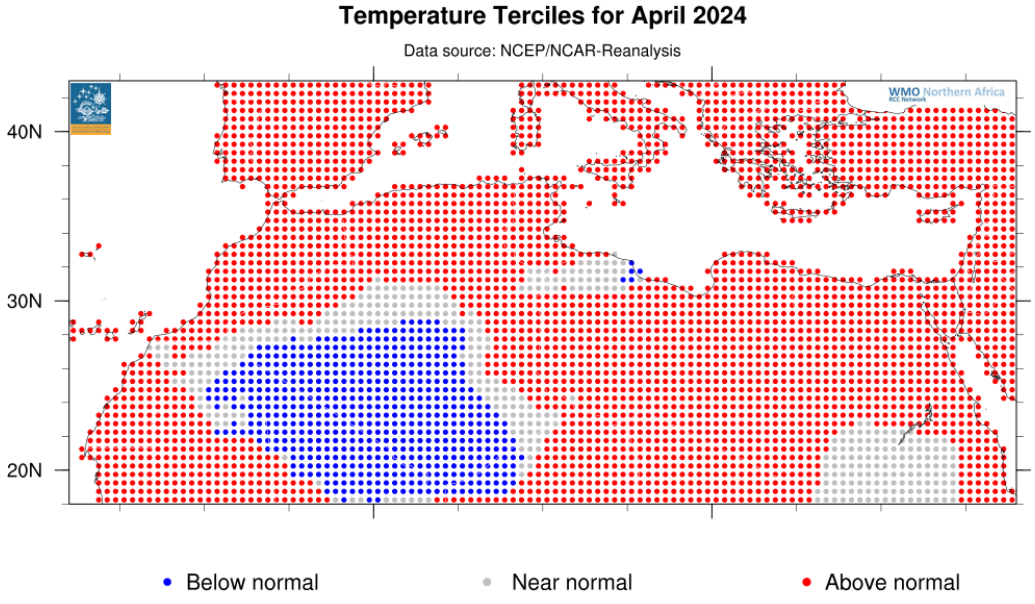


Fig. 4.5: Temperature terciles for April 2024 in the RAI-NA Region (North Africa). Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010). Source: INM

5. Soil moisture

Soil moisture is not only important for agrometeorology, but also for climate diagnostics. In case of long-lasting anticyclonic periods, a dry soil may amplify positive temperature anomalies (and the risk of heat waves) due to missing cooling by less evaporation. It has also impact on precipitation because less evaporation causes a lower water vapour content in the atmosphere and hence less precipitation (which dries out the soils further).

Europe/RA VI domain

In April 2024, soils (near surface) were much drier than normal in most of the domain, but were wetter than normal over the western Iberian Peninsula, France, northern Italy, and western Ukraine, also on some high mountains.

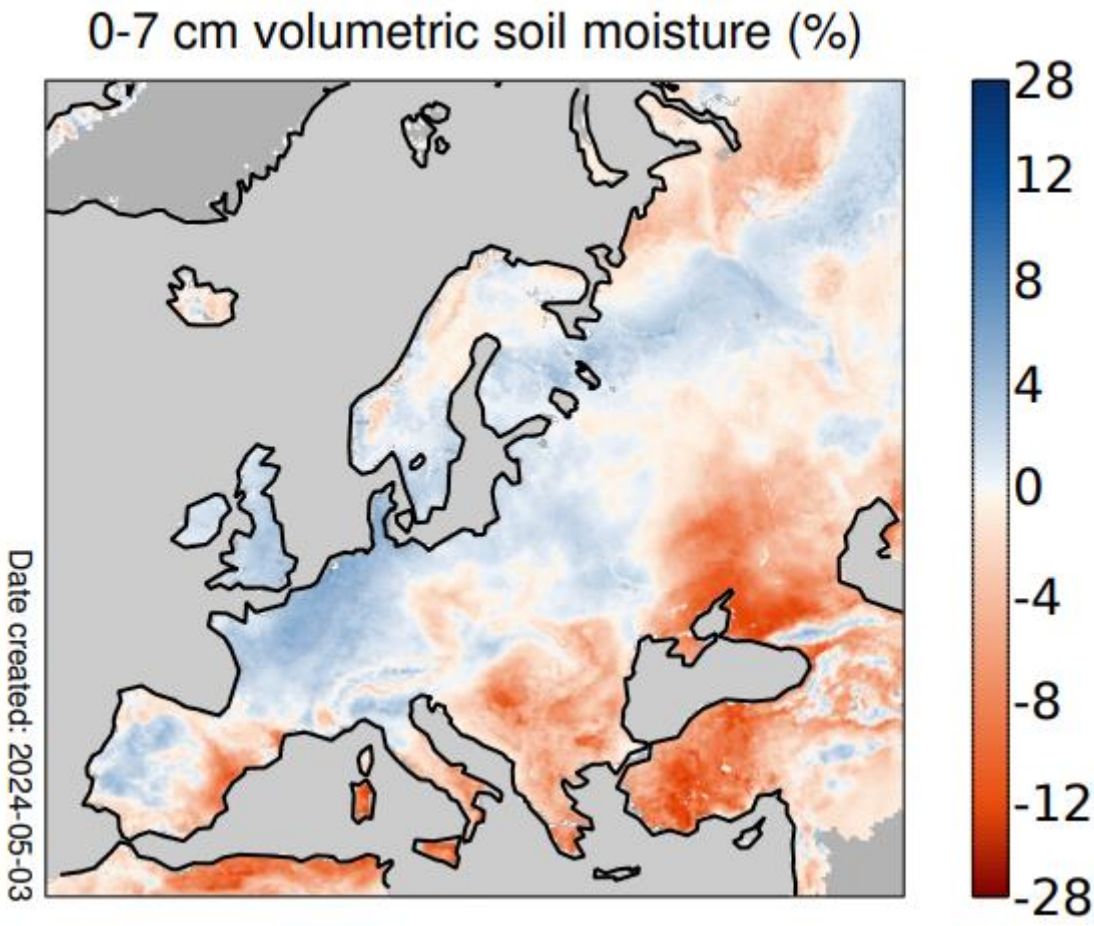


Fig. 5.1: Anomalies of soil moisture in Europe in % of the 1991-2020 normal in a depth layer of 0-7 cm for April 2024. Data from ERA5-Land reanalysis. Source: Copernicus, https://climate.copernicus.eu/precipitation-relative-humidity-and-soil-moisture-april-2024

6. Significant Events in April 2024 in the MedCOF region

High temperatures on the week-end 31 March / 1 April (Easter days):

- Italy: https://www.meteoweb.eu/2024/04/temperature-massime-di-oggi-1-aprile-2/1001397266/
- Hungary: https://www.facebook.com/photo/?fbid=837249871764794&set=pcb.837253228431125
- Montenegro: https://www.facebook.com/photo/?fbid=837249871764794&set=pcb.837253228431125

High temperatures on the week-end 05-07 April with local monthly records:

- Spain: https://twitter.com/AEMET_Esp/status/1777265707387871490
- Italy: https://www.meteoweb.eu/2024/04/temperature-massime-di-oggi-6-aprile-2/1001399869/
- Hungary: https://www.facebook.com/photo/?fbid=840405001449281&set=pcb.840406838115764
- Slovenia: https://meteo.arso.gov.si/uploads/probase/www/climate/text/sl/weather_events/nenavadno-toplo-vreme_6-9apr2024.pdf
- Greece: https://twitter.com/meteogr/status/1776678775280832768

High temperatures mid-April:

- Spain:
  - https://twitter.com/AEMET_Esp/status/1779842591518826496
  - https://twitter.com/AEMET_Esp/status/1780528073827303835
- France: https://meteofrance.com/actualites-et-dossiers-0/chaleur-record-le-week-end-de-mi-avril
-
- Hungary: https://www.met.hu/rolunk/hirek/index.php?id=5721&m=2&hir=Rekordokkal_bucsuzik_a_nyarias_ido_(2024.04.15.)

Cold period 17-22 April:

- Spain: https://twitter.com/AEMET_Esp/status/1781224799454572812
- France: https://www.meteo-paris.com/actualites/nouvelle-annee-de-gel-printanier-dommageable-pour-la-vegetation
- Slovenia: https://meteo.arso.gov.si/uploads/probase/www/climate/text/sl/weather_events/hladna-jutra_17-22apr2024.pdf

Heat 23-25 April:

- Greece: https://www.meteo.gr/article_view.cfm?entryID=3212
- Israel: https://twitter.com/METEOROLOGY_IL/status/1783527415974601120

Heavy rain/flooding France:

- https://www.gdacs.org/report.aspx?eventid=1102550&episodeid=2&eventtype=FL
- https://erccportal.jrc.ec.europa.eu/ECHO-Products/Echo-Flash#/daily-flash-archive/5036
- https://erccportal.jrc.ec.europa.eu/ECHO-Products/Echo-Flash#/daily-flash-archive/5043
- https://www.meteo-paris.com/actualites/pluie-record-a-lyon-et-enfin-de-retour-sur-le-roussillon

Saharan dust:

- https://watchers.news/2024/04/09/exceptionally-intense-saharan-dust-episode-over-europe-degrading-air-quality-suggesting-changes-in-atmospheric-circulation-patterns/

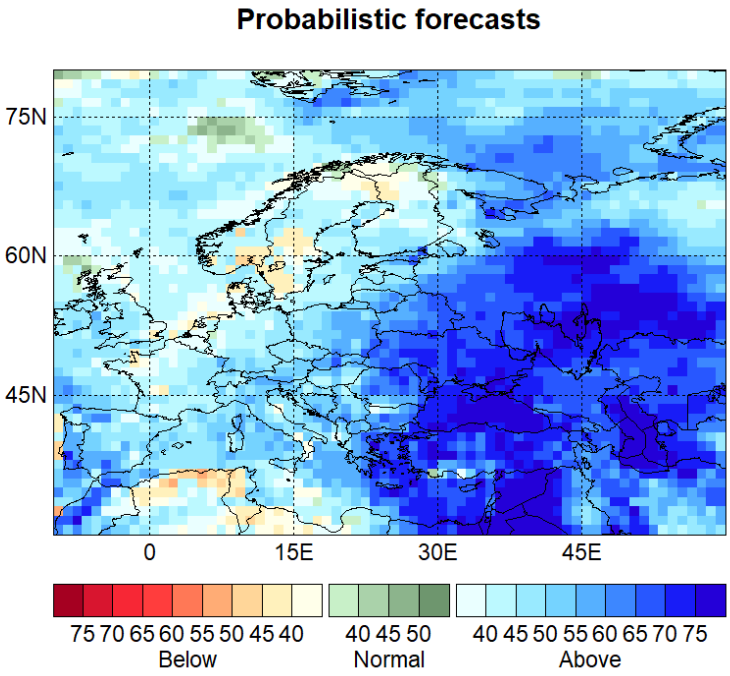
Forest fire eastern Spain (near Valencia):

- https://erccportal.jrc.ec.europa.eu/ECHO-Products/Echo-Flash#/daily-flash-archive/5047
- https://www.gdacs.org/report.aspx?eventid=1019580&episodeid=1&eventtype=WF

7. Likely evolution of large-scale climate patterns in the next months (June–August 2024)

- ENSO will probably stay in neutral conditions during the following months
- IOD : positive phase most likely – effect on Europe in summer undocumented to our knowledge
- SST anomalies over the Atlantic Cold Blob region are slightly positive - http://seasonal.meteo.fr/content/PS-previ-plumes?language=fr >> Atlantique >> boite NACB .

  This is probably linked to the impact of climate change and has no or restricted effects on seasonal to interannual variability of the climate system.
- Warm tropical Atlantic ==> Warm conditions more likely over Eastern Europe based on the Cpt statistical model or analogues



legend: Tercile summary for T2M over the JJA 2024 period from the CPT model using as predictands the SSTs in the North Atlantic, forecast for May by MF8 init May and trained on the Hindcast period (1993-2016) and ERA5 as analysis for T2M on the above domain.

References:

Météo France Monthly Seasonal Forecast Bulletin and climate monitoring maps: http://seasonal.meteo.fr

WMO RA I RCC Node on Climate Monitoring Website with monitoring results: https://www.meteo.tn/en/climate-monitoring-watch

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

GPCC: http://gpcc.dwd.de

EDO (EU European Drought Observatory): https://edo.jrc.ec.europa.eu

SEECOF: http://www.seevccc.rs/?p=22

BOM Climate Driver Update: http://www.bom.gov.au/climate/enso/index.shtml#tabs=Overview

Copernicus monthly report: https://climate.copernicus.eu/surface-air-temperature-april-2024