MEDITERRANEAN CLIMATE OUTLOOK FORUM
MEDCOF-19 Online Forum

MONITORING SUMMARY MEDCOF-19

for October 2022

First draft

Last update: 17 Nov 2021

Compiled by

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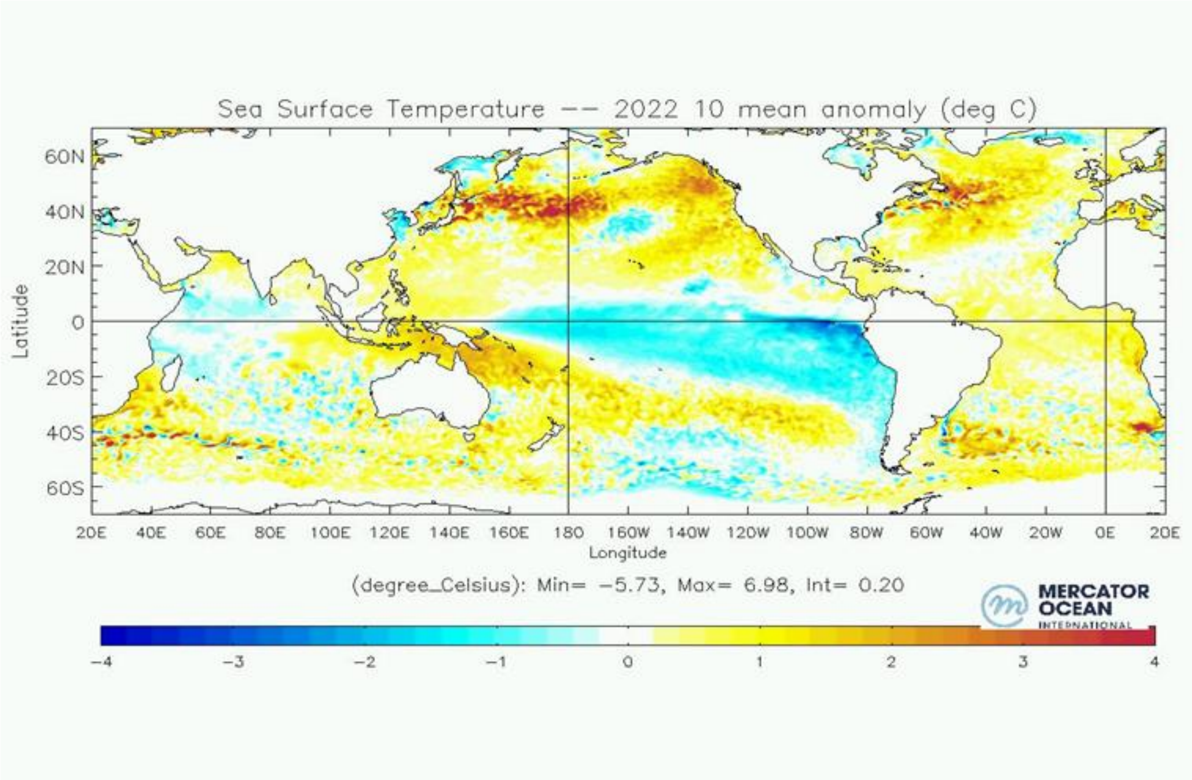
The following MedCOF monitoring summary is based on

- climate monitoring results from RA VI RCC Node-CM at DWD,
- Seasonal forecast bulletins and verification bulletins from RA VI RCC Node-LRF at Météo France,
- SEECOF monitoring report
- Assessments from NOAA CPC and BOM Australia

1 Oceanic Analysis

1.1 Sea Surface Temperature (SST) anomalies

- **Equatorial Pacific**: The characteristic pattern of La Niña continues unchanged compared to the previous month. Negative anomalies over a large area along the central and eastern equatorial Pacific and west of South America point to a continuation of a well-developed La Niña. The shape of the area of negative anomalies is very similar to that what we had last year in October (2021). SST anomaly of Niño 3.4 region was −1.0 °C, which can be classified as a moderate La Niña, see https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php. Nino3.4 monthly index from Mercator Ocean analysis was – 0.9 °C. The western equatorial Pacific including the sea areas around Indonesia is warmer than normal. Since last month, negative equatorial SST anomalies became stronger in the eastern Pacific Ocean, but remained constant in the central Pacific Ocean.
- The **northern Pacific** was mostly warmer than normal with highest anomalies in central parts. The warm anomaly over the northern Pacific has decreased in places. However, the PDO remains in the negative phase: https://stateoftheocean.osmc.noaa.gov/atm/pdo.php (see section 1.4 below).
- **Atlantic**: Weak positive anomalies in the tropical Atlantic, close to neutrality. In the North Atlantic, a strong warm anomaly is present in the west. Positive anomalies are similarly strong like in the North Pacific and extended to the subtropics, but with cooling tendency. Slightly negative anomalies between central America and Iberia.
- **Indian Ocean:** A west-east gradient is still persistent. Negative value of DMI (negative phase of IOD), see section 1.5 below.
- The **western Mediterranean Sea** is still warmer than normal, which means that warm subtropical air coming from North Africa is further warmed when it crosses the Mediterranean Sea. On the other hand, there is a higher potential for convective events. However, anomalies are not so high anymore like in September
- The **eastern Mediterranean Sea** had an SST close to normal with slight cooling tendency.



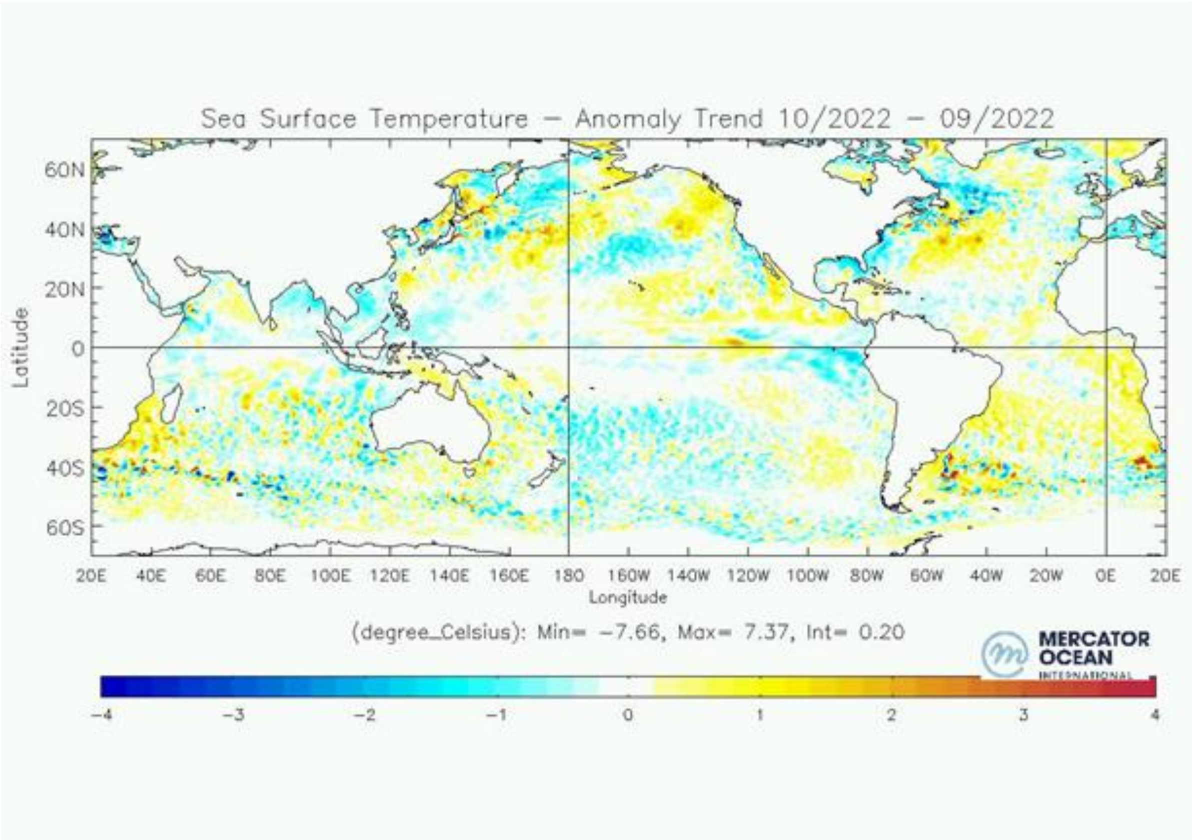


Figure 1.1: Upper map: sea surface temperature anomalies for October 2022. Lower map: anomaly differences October minus September 2022 (anomaly trend). Source: Météo France, Mercator Ocean data.

1.2 ENSO analysis of recent months and years:

Since the second half of 2020, there are more or less La Niña conditions, sometimes with only short interruptions. In summer 2022, SST anomalies in the Niño 3.4 region were not weaker than -0.5 °C, which means that La Niña did not vanish this year. We are coming into the third successive La Niña season now.

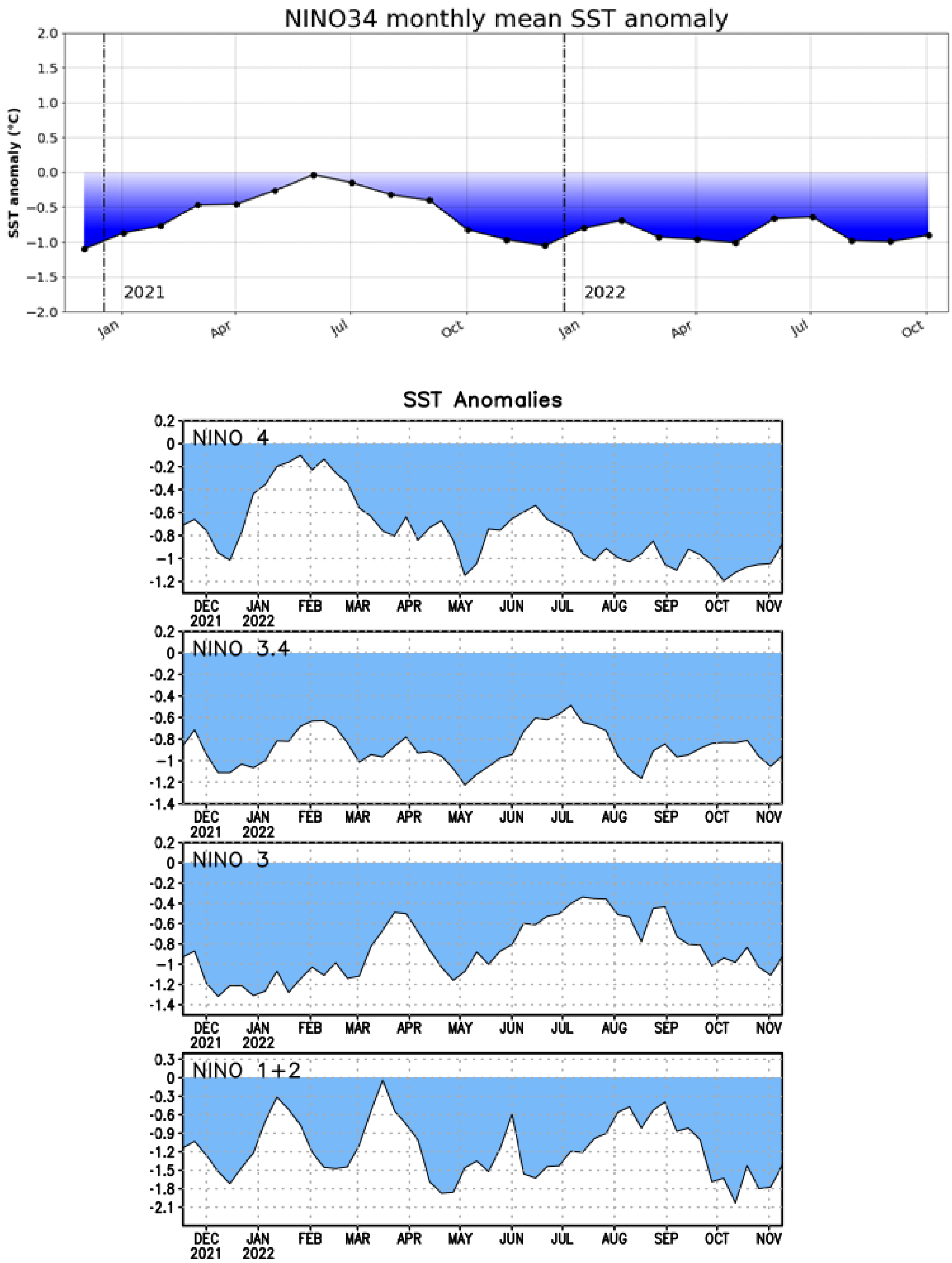


Figure 1.2: Evolution of sea surface temperature anomalies in several Niño boxes. Source: Upper map: Météo France, Mercator Ocean data. Lower map: NOAA CPC, https://origin.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml#history

1.3 ENSO Forecasts

Recent multi-model forecasts of Niño3.4 SST show that La Niña will likely persist during the coming boreal winter (DJF) 2022/23 and will probably not end before boreal spring 2023.

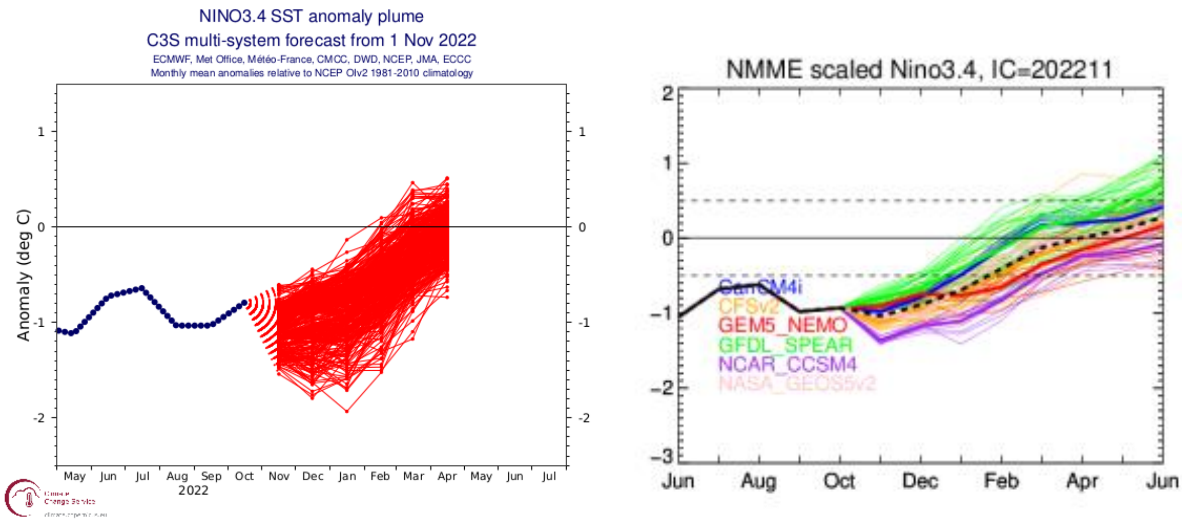


Figure 1.3: Evolution of El Niño3.4 expected temperature from C3S (left) and NMME (right) until April-June 2022. Source: C3S: https://climate.copernicus.eu/charts/c3s_seasonal/c3s_seasonal_plume_mm ; NMME: https://www.cpc.ncep.noaa.gov/products/NMME/current/plume.html

1.4 Pacific Decadal Oscillation (PDO) analysis:

Since January 2020, PDO was negative without interruption. It developed until its peak in July 2022, then it became weaker. October 2022 value of PDO Index after NOAA NCEI was -1.79, https://www.ncei.noaa.gov/access/monitoring/pdo/). A negative PDO phase in relation with a central Pacific La Niña favours a positive phase of NAO (Ding et al. 2017).

PDO- means warm SST anomalies in the interior North Pacific and cool SST anomalies along the North American coast, or above average sea level pressures over the North Pacific, see https://www.ncei.noaa.gov/access/monitoring/pdo/

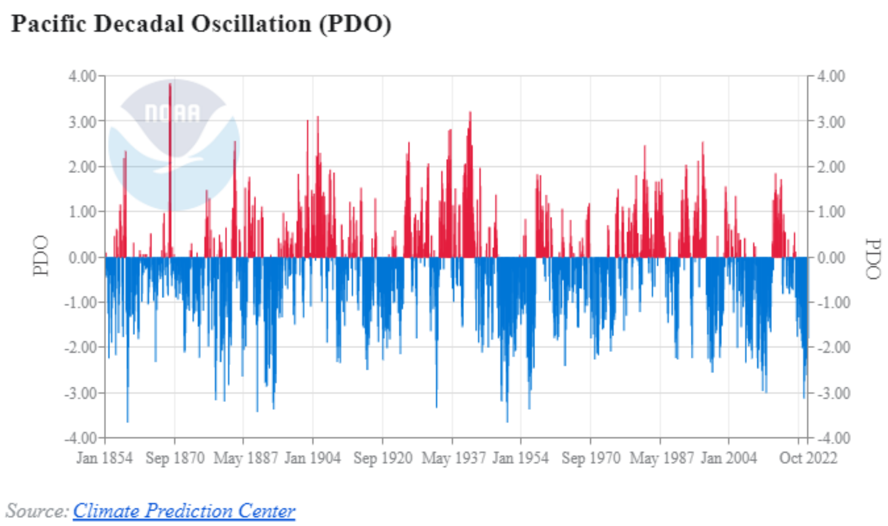


Figure 1.4: Evolution of PDO index, source: https://www.ncdc.noaa.gov/teleconnections/pdo/

1.5 Indian Ocean Dipole (IOD):

A significant negative IOD (west-east gradient of SST anomalies) persists since July 2022. For DJF 2022/23, neutral IOD conditions are forecasted. IOD events typically break down in November or December with the arrival of the Asian monsoon. DMI (Dipole mode index) from Mercator Ocean analysis was – 0.9 °C for October 2022.

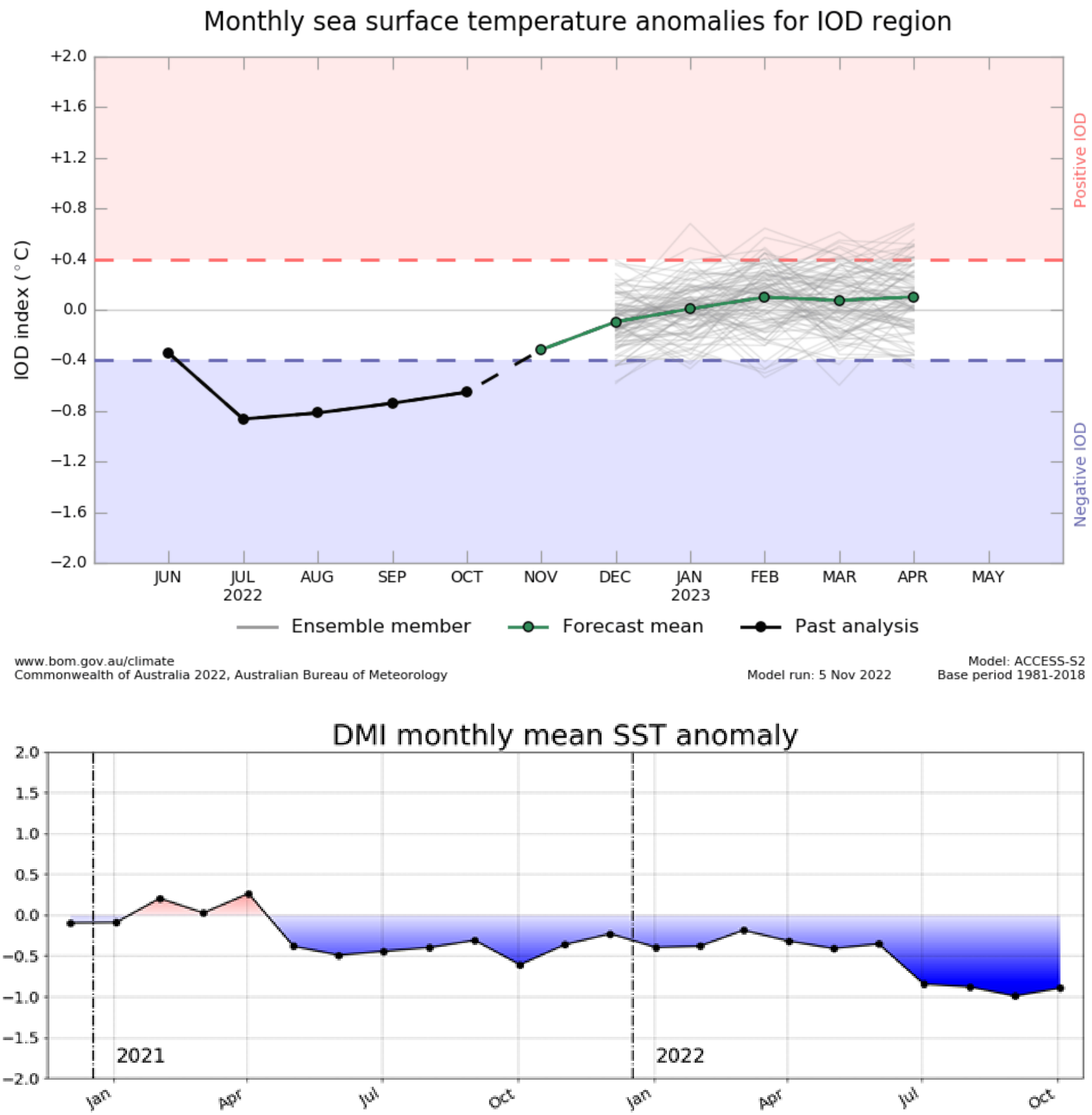


Figure 1.6 Observed and expected evolution of Indian Ocean Dipole. Source: upper map: BOM, http://www.bom.gov.au/climate/enso/index.shtml#tabs=Indian-Ocean, lower map: Météo France, Mercator Ocean data

2 Atmospheric Circulation Analysis

2.1 Velocity potential and stream function anomalies in the high troposphere

Velocity Potential 200 hPa: Dipole with downward anomaly motion over the Central Pacific and upward anomaly motion over the maritime continent (link to La Niña), with an extension up to Africa.

Stream function in 200 hPa: strong dipole around the equator over the western central Pacific, teleconnection visible both in the North Pacific and South Pacific.

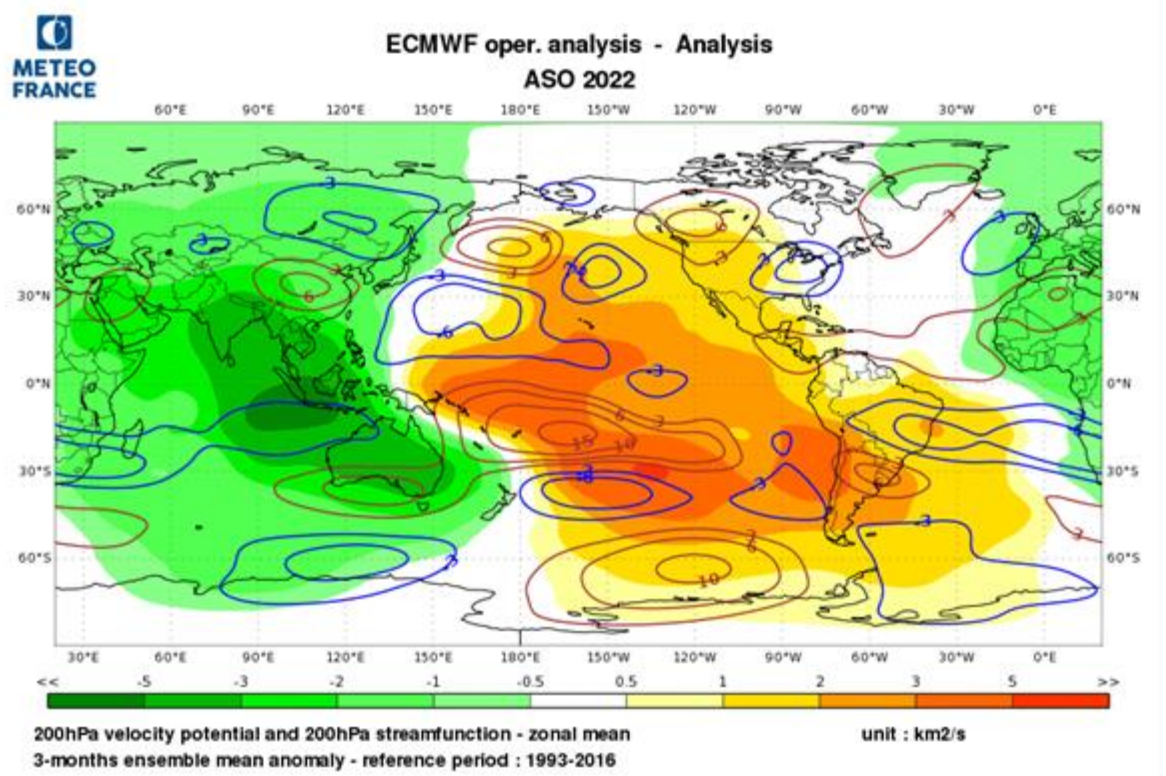


Figure 2.1: Averaged anomalies of stream function (contours) and velocity potential (shaded) average during August-October 2022. Positive shaded values (yellow/orange): convergence (downward motions). Negative ones (green): divergence (upward motions). Positive contours (red): anticyclonic circulation in the northern hemisphere, negative contours (blue): cyclonic circulation in the northern hemisphere.

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

2.2 SOI index:

SOI index is positive (La Niña) since the second half of 2020, in line with SST anomalies. From July to October 2022, (standardized) SOI increased from 0.8 to 1.7, pointing to an increasing intensity. However, September 2022 value (1.6) was already very close to October. Nevertheless, SOI was much higher than in the previous two La Niña years in October (2020: 0.5, 2021: 0.7), so it might be a strong one this winter.

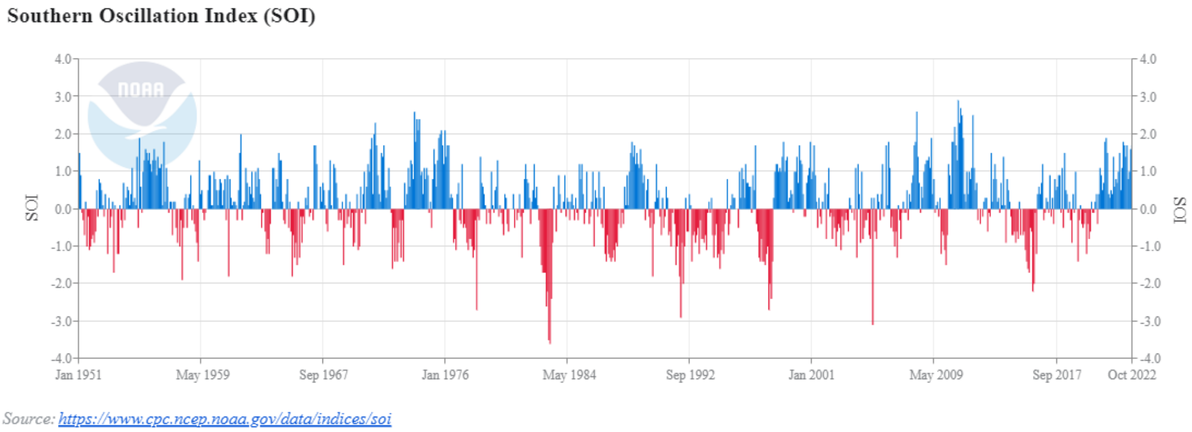


Figure 2.2: Southern Oscillation Index (SOI). Positive values mean La Niña response, negative values El Niño response. Source: https://www.ncdc.noaa.gov/teleconnections/enso/indicators/soi/

2.3 Geopotential height at 500 hPa:

A clear PNA+ pattern is visible (positive Pacific/North American pattern, positive geopotential anomalies over the western USA/Canada, negative anomalies over the eastern USA. This is not very typical for La Niña because PNA+ tends to be associated with El Niño and PNA- with La Niña, see https://legacy.climate.ncsu.edu/climate/patterns/pna

A notable wave structure in the geopotential anomaly field can be seen from North America over the North Atlantic to Europe. Positive anomalies over much of Europe, the Mediterranean and western parts of North Africa, negative anomalies over the eastern North Atlantic. In spite of this meridional pattern, cold Artic air was not touched in the European part, no weakening of the polar vortex visible there.

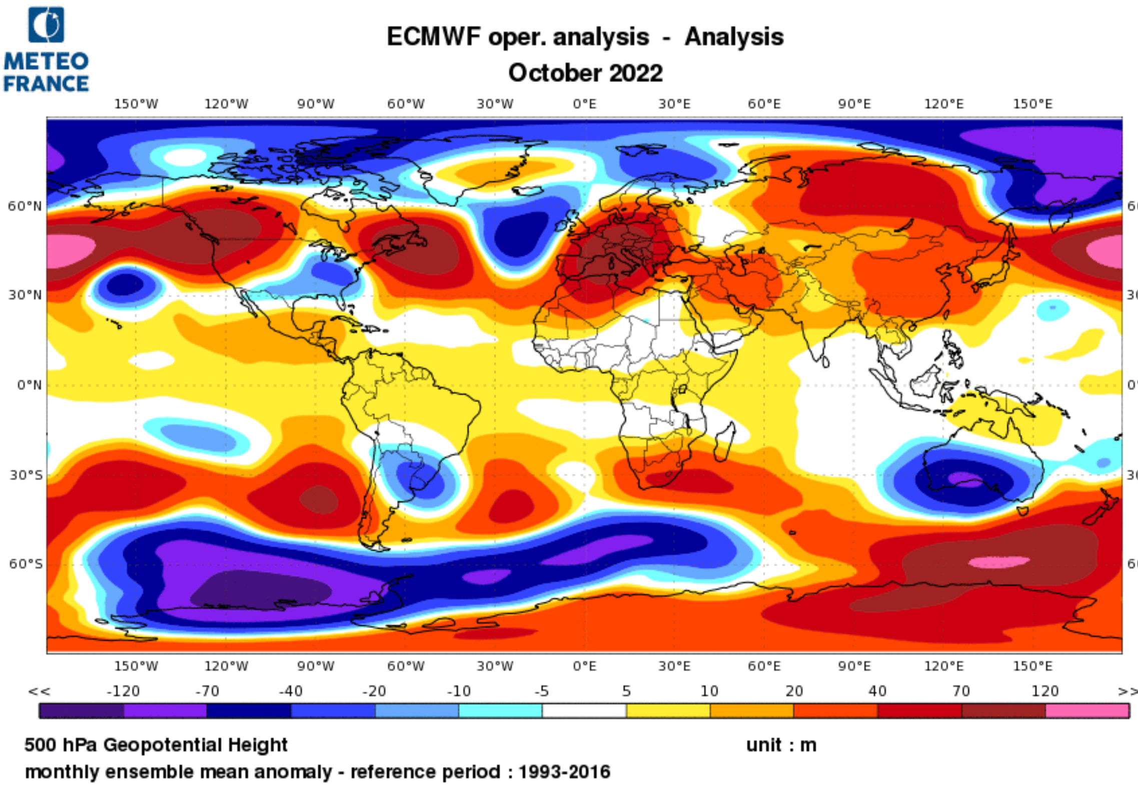


Figure 2.3: Anomalies of Geopotential height at 500hPa (Source: Météo-France, http://seasonal.meteo.fr/content/suivi-clim-cartes-ref93-16 , data from ECMWF)

2.4 Sea level pressure (SLP)

A low-pressure zone including the Icelandic Low and the Arctic Sea Low was quite intense in October 2022, and also a large high-pressure area extending from Africa over the western and central Mediterranean to the Balkan Peninsula and the Ukraine. Between these two SLP centres, a warm air flow occurred during much of the month from the subtropics over Southwestern Europe to Central and even Northeastern Europe. East of the high-pressure area, cold air moved to western Türkiye and the Aegean Sea region, while warm air flowed to the South Caucasus west of the Russian High, which was retreated more to the east than usual.

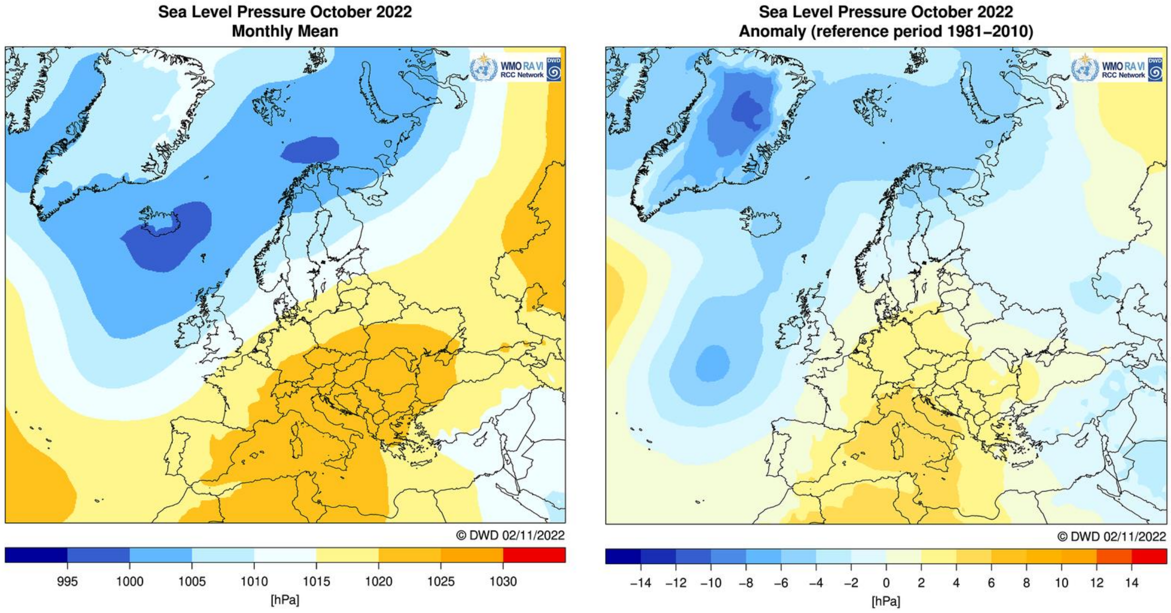


Figure 2.4: Mean sea level pressure and anomalies (1981-2010 reference) over the North Atlantic, Europe and North Africa for October 2022. Source: DWD, https://www.dwd.de/DE/leistungen/rcccm/int/rcccm_int_ppp.html?nn=490674

2.5 Circulation patterns

The major circulation patterns relevant for Europe and the MedCOF region were quite weak or close to neutral in October. The most outstanding one was a negative East Atlantic - Western Russia pattern (lower-than-normal geopotential over the East Atlantic, higher over Western Russia), which persisted since summer 2022, but has a weakening tendency.

Table of Teleconnection Indices

OCTOBER 2022

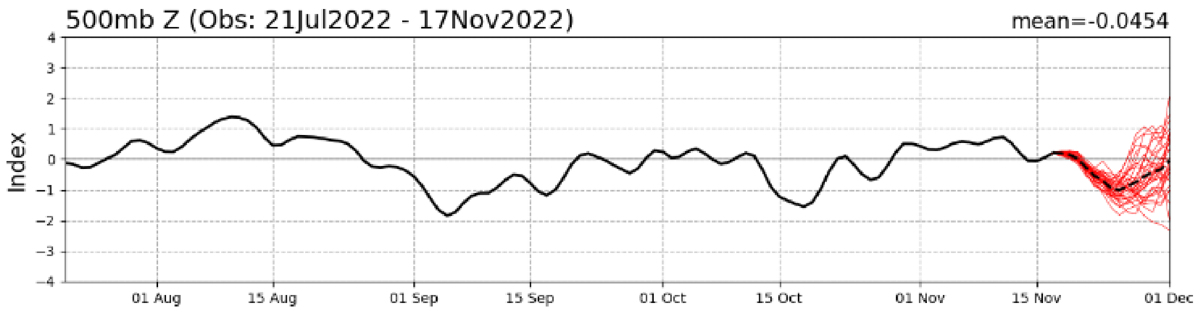
MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
OCT 22	-0.3	0.2	1.0	-0.1	0.3	---	-0.7	-0.2	1.1
SEP 22	-1.4	-1.2	1.8	-0.8	0.1	---	-1.1	0.5	-0.6
AUG 22	1.8	1.4	-0.4	-1.1	0.8	---	-3.4	1.0	-0.3
JUL 22	-0.1	1.4	-0.5	-1.6	2.0	---	-1.2	-0.5	0.0
JUN 22	0.2	0.5	-1.7	0.0	-0.2	---	-0.5	0.0	-1.3
MAY 22	0.7	0.2	-1.4	-0.3	-0.6	---	0.9	-1.5	-0.3
APR 22	-0.5	-0.9	0.3	-0.7	-1.0	---	-0.1	-0.7	-1.2
MAR 22	0.4	1.5	0.6	0.3	-0.2	---	1.4	1.0	-0.5
FEB 22	1.5	0.2	-0.4	-0.9	0.6	1.8	-0.9	-2.1	-1.6
JAN 22	0.7	-1.4	-1.4	0.5	0.6	0.7	1.1	-0.9	-0.3
DEC 21	0.2	-0.1	0.5	---	-2.9	-0.3	0.0	0.3	-0.5
NOV 21	-0.3	-0.9	-0.1	0.3	0.7	---	0.0	-0.8	0.5
OCT 21	-2.0	0.9	1.7	-2.4	1.4	---	-0.6	-0.2	-0.5

Table 2.1: 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

2.6 North Atlantic Oscillation (NAO) and Artic Oscillation (AO:

NAO was close to neutral since late September 2022, with an exception of a short negative (meridional) phase in mid-October. The AO was mainly in a positive (zonal) mode, pointing to a stable and strong polar vortex without much airmass exchange with the middle latitudes. Presently (mid-November 2022), AO is close to neutral.

NAO Index: Observed & GEFS Forecasts



AO Index: Observed & GEFS Forecasts

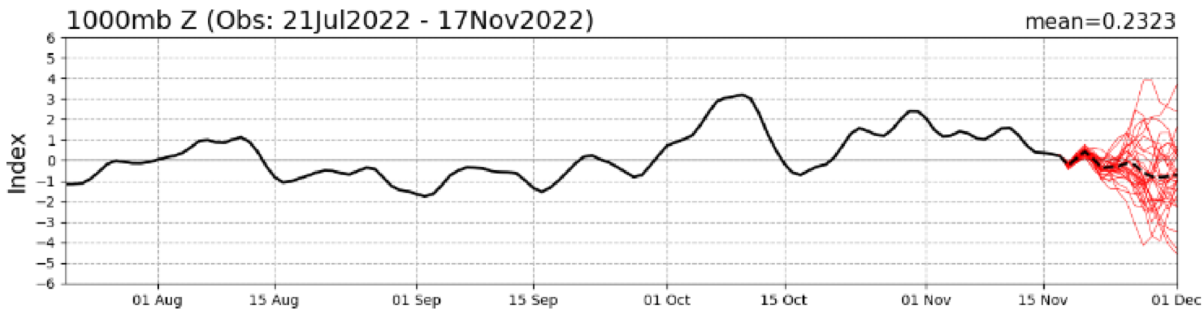


Figure 2.6: North Atlantic Oscillation (NAO) and Arctic Oscillation (AO) indices. Source: NOAA CPC, https://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/ao.shtml

2.7 Weather regimes

Over North Atlantic and Europe, weather regime frequencies show an important intra-seasonal variability during the ASO season. The most frequent type in October 2022 was “Atlantic ridge”, but the ridge was mainly over the western North Atlantic that month. No blocking patterns at all occurred during October, in contrary to late summer 2022.

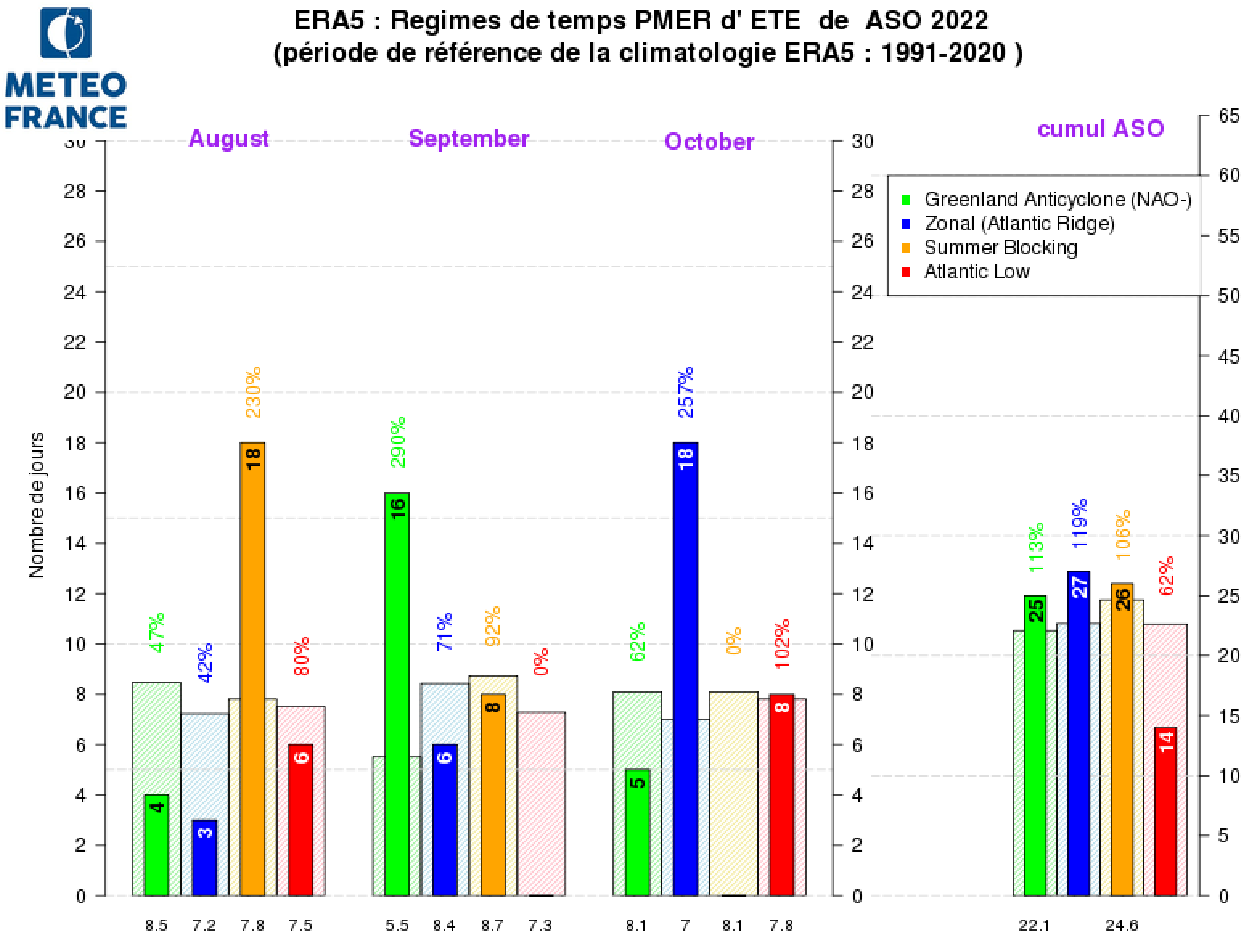


Figure 2.7: Weather regimes frequencies during ASO 2022 compared to 1991-2020 climatology and aggregation over the entire quarter, source: Météo France, data from ERA5.

3 Drivers

- La Niña combined with PDO : Effect depends on the type of La Niña (https://journals.ametsoc.org/view/journals/clim/30/9/jcli-d-16-0376.1.xml#bib26). La Niña currently seems to be the Central Pacific type. If it persists the next month it will promote the positive phase of the NAO.

- West QBO since this summer ==> it tends to strengthen the polar vortex, so higher probability of NAO+ circulation than normal.

- Presently no sudden stratospheric warmings (SSW) observed, but cannot be excluded for the coming winter. A strong SSW could cause a weakening or breakdown of the polar vortex with cold air flowing into Europe.

4 Temperature

Europe/RA VI domain

According to Copernicus data, October 2022 was 1.92 °C warmer than the 1991-2020 average in Europe and the warmest October since start of the series in 1979, particularly in Southwestern Europe and in the western Mediterranean region.

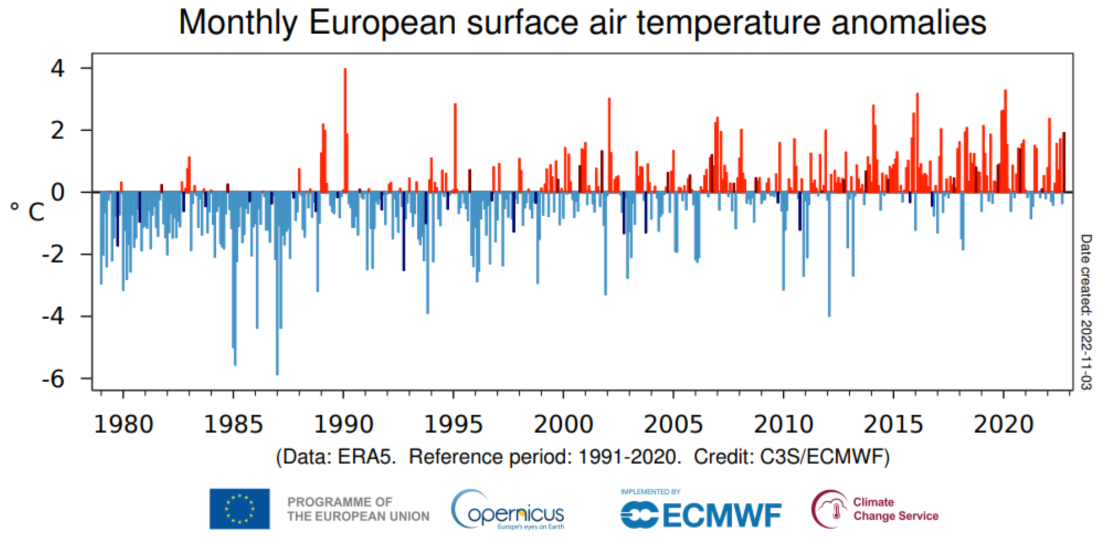


Fig. 4.1: Monthly European-mean surface air temperature anomalies relative to 1991-2020, from January 1979 to October 2022. The darker coloured bars denote the October values. Data source: ERA5. Credit: Copernicus Climate Change Service/ECMWF, https://climate.copernicus.eu/surface-air-temperature-maps

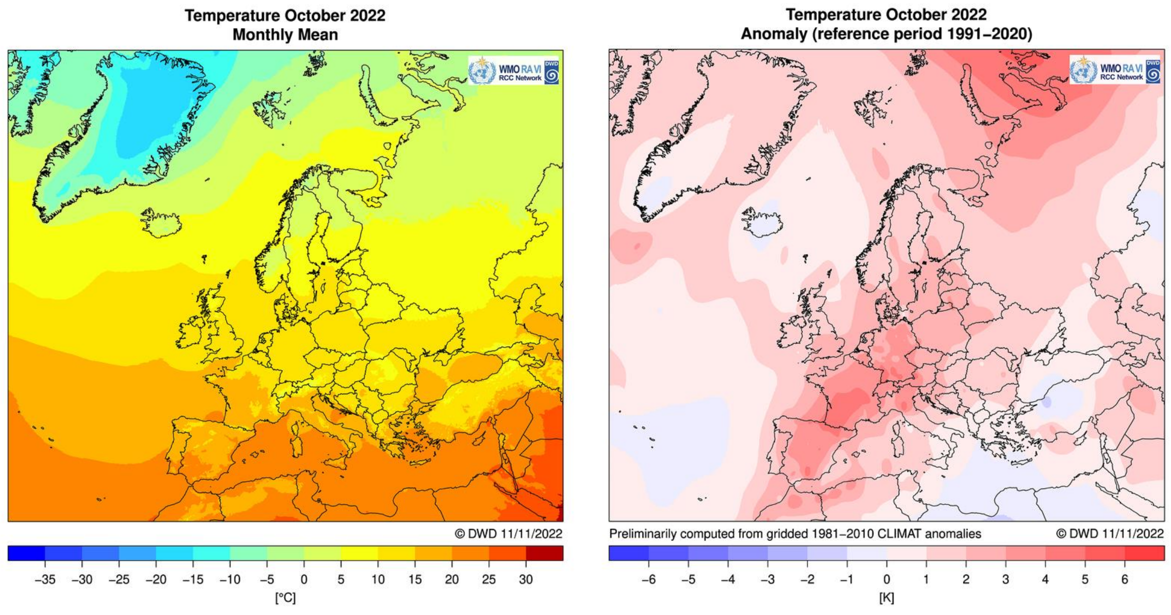


Fig. 4.2: Mean temperature (left) and anomalies (1991-2020 reference, right) in °C in the RA VI Region (Europe) interpolated from CLIMAT station data, for October 2022. Source: DWD, http://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_ttt.html

Within the RAVI MedCOF domain, it was warmer than the 1991-2020 in most parts, particularly in the west. Highest anomalies up to above +4 °C could be found especially in large parts of southern France, but also locally in southern Spain and northern Italy. Other western parts of the domain were 1-4 °C warmer than normal. Anomalies in eastern parts of the domain were mainly in the range of 0-2 °C, some areas in western Türkiye were slightly colder than normal (not more than 1 °C).

In terms of terciles, almost the whole domain had temperatures in the upper tercile (1993-2016 reference). Only an area extending from the eastern Black Sea region over western and central Türkiye to the eastern Mediterranean including Crete Island, and southernmost parts of Israel and Jordan had temperatures in the middle tercile, in Türkiye locally in the lower tercile.

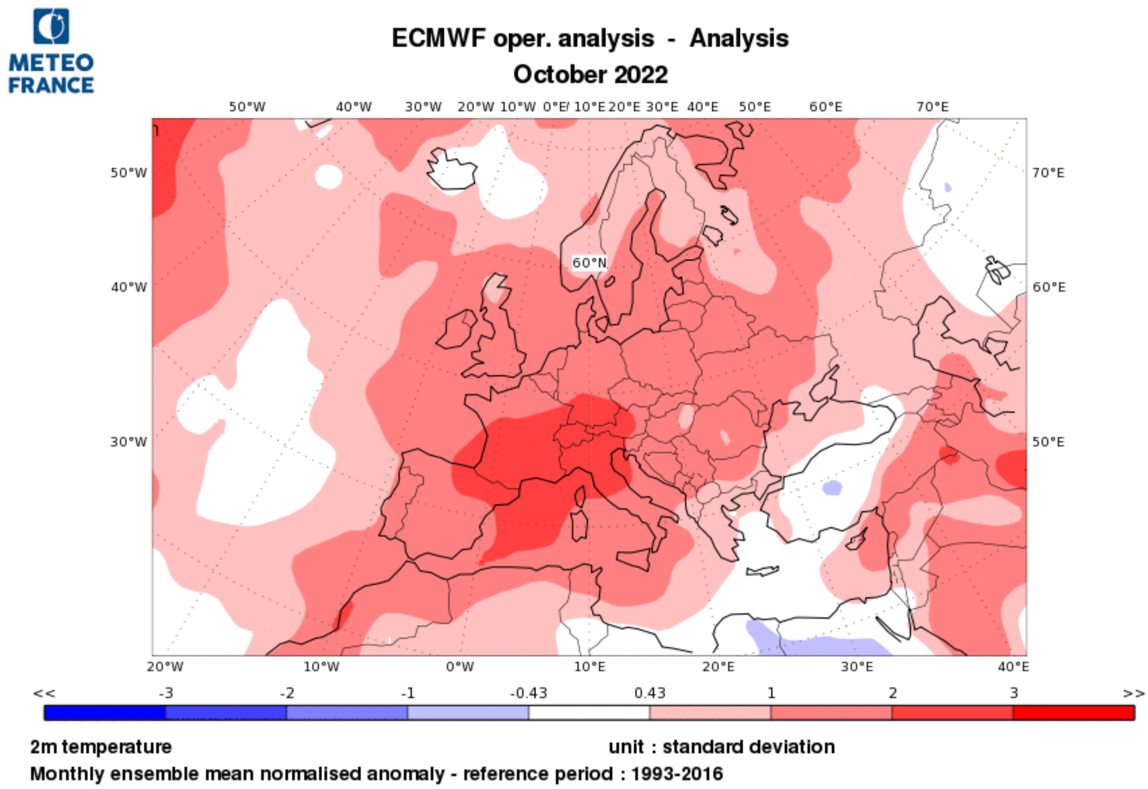


Fig. 4.3: Mean standardized temperature anomalies with terciles for October 2022. Source : Météo France, http://seasonal.meteo.fr/content/suivi-clim-cartes-ref93-16, data source : ECMWF operational analysis

Temperature in North Africa

Figure 4.4: Monthly anomaly mean temperature (October 2022) time series plots with trend line

Figure 4.5: 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),

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

3. Precipitation

Europe/RA VI domain

Much of the RAVI domain was drier than normal. Large parts in the high-pressure zone have received only less than 20% of the normal precipitation, particularly central Italy and much of the Balkan Peninsula and western Türkiye, but also locally in the west (southern Spain, southwestern France). In the Middle East, the wet season has not started in October. On the other hand, it was wetter than normal in much of the western half of Iberia, eastern France, northern Ukraine, locally in the South Caucasus and eastern Türkiye, and over the eastern Mediterranean including Crete and Cyprus islands.

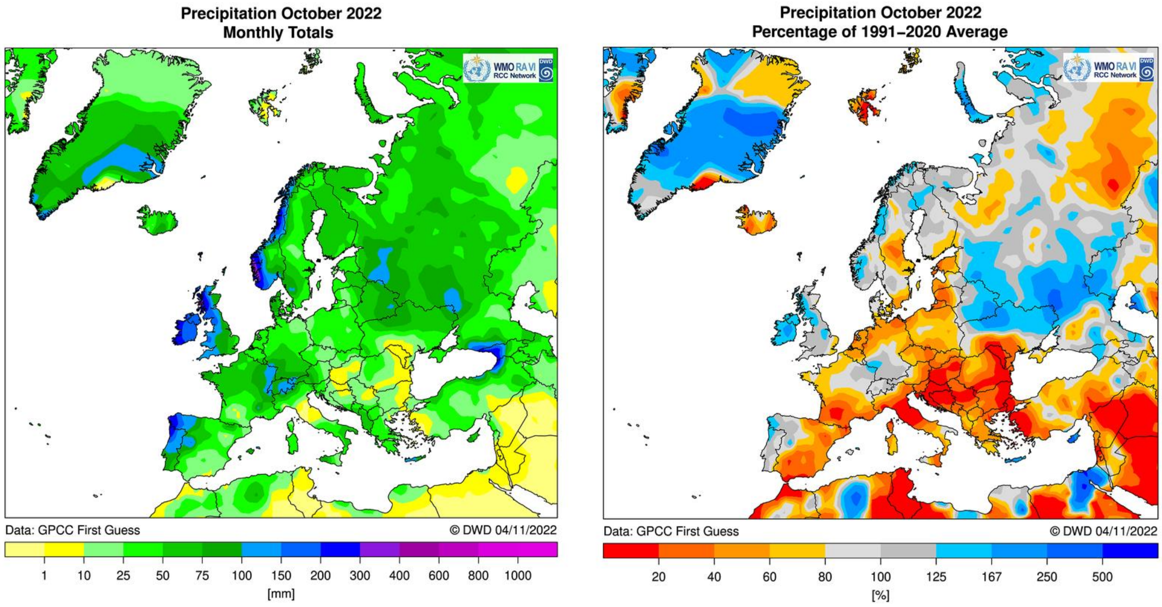


Fig. 5.1: Monthly precipitation totals (left) and percentage of 1981-2010 normal (right) for October 2021 in Europe/RAVI. Data from GPCC (First Guess version). Source: DWD, http://www.dwd.de/EN/ourservices/rcccm/int/rcccm_int_rrr.html

In terms of terciles, a large region from eastern Spain to the Black Sea mostly had precipitation in the lower tercile, only locally in one of the other two terciles. Most places in western Iberia, central France, central and eastern Türkiye and parts of the South Caucasus had precipitation in the middle tercile. Northern Ukraine, western Georgia, Crete and Cyprus Islands and locally several other places received precipitation in the upper tercile in October 2022.

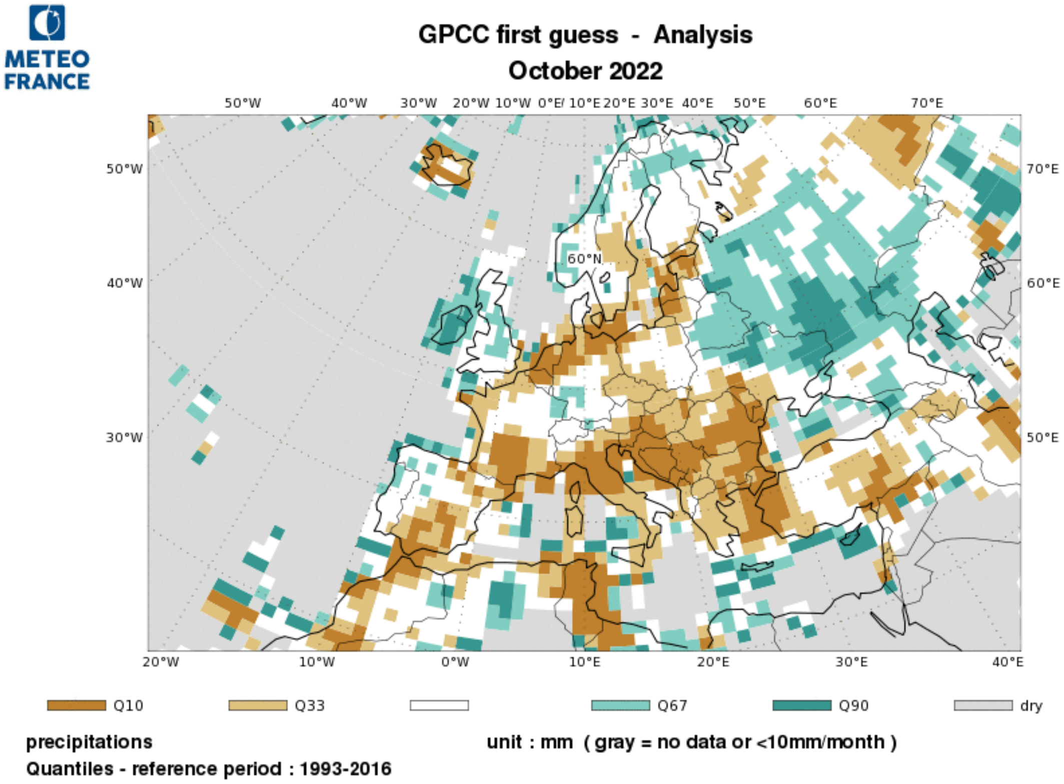


Fig. 5.2: Quantiles of monthly precipitation totals for October 2022. Source : Météo France, http://seasonal.meteo.fr/content/suivi-clim-cartes-ref93-16, data source : GPCC

Precipitation in North Africa

Figure 3.1: Left: Total precipitation; Right: Absolute anomalies of precipitation in the RAI-NA Region (North Africa)
Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010)
https://www.meteo.tn/en/climate-monitoring-watch

4. Soil moisture

<u>Europe/RA VI domain</u>

Soil moisture was below normal in October 2022 in parts of Spain, Italy, west of the Black Sea, in Greece, locally in Türkiye (west and east), Armenia and Azerbaijan. It was above normal locally in northern Spain and northern Portugal, in the northwestern Ukraine, the Black Sea coast of Türkiye, and southern parts of the Middle East. The rest of the domain had mainly close-to-normal soil moisture.

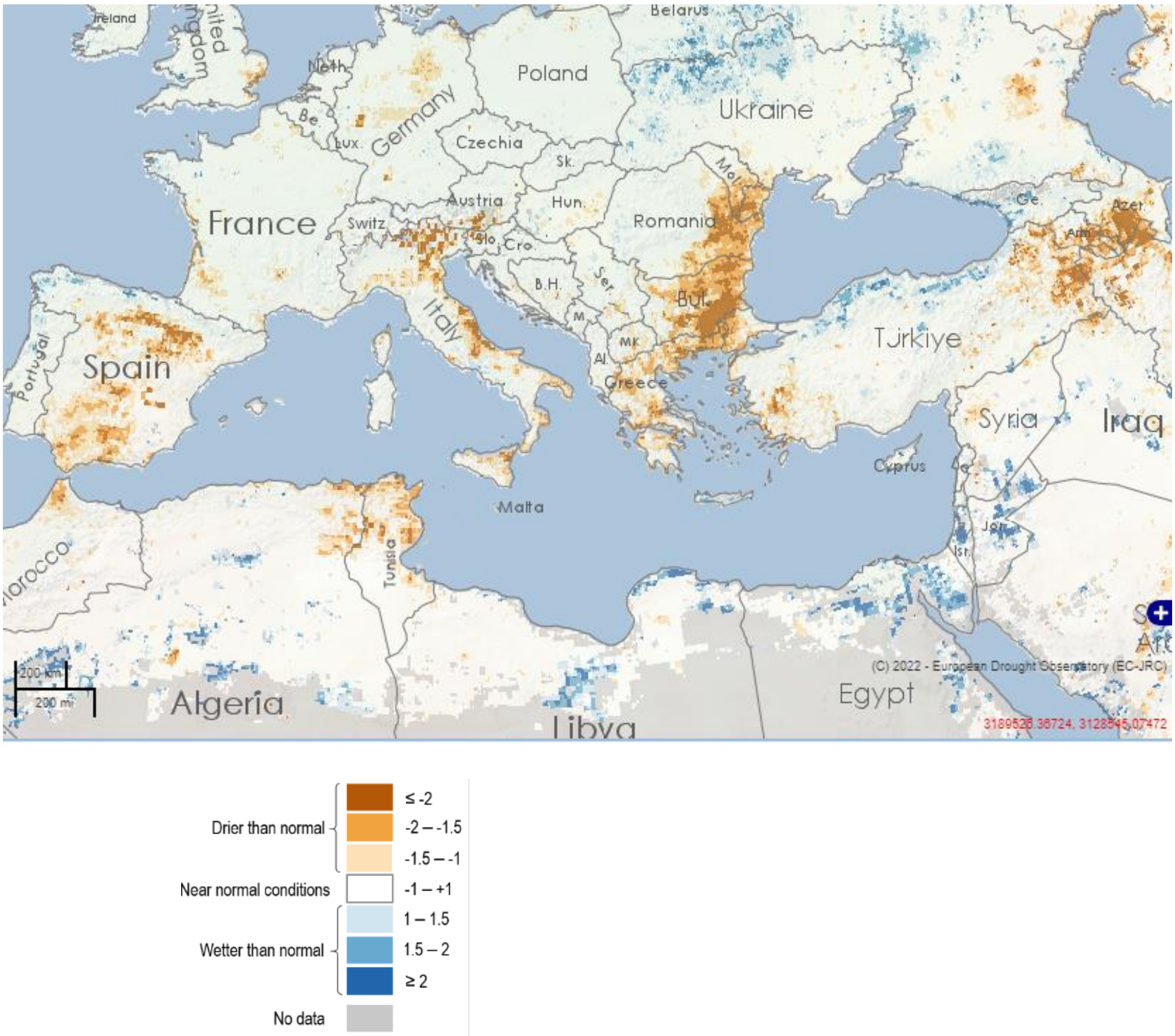


Figure 6.1: Monthly anomalies of soil moisture index (SMI) in October 2022, reference period: 1995-2021. Source: European Drought Observatory (EDO), https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1111

North Africa/RA I domain

Figure 6.2: October 2022 soil moisture, left: monthly total, right: monthly anomalies with reference period: 1981-2010.

References:

Météo France monthly and seasonal 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

Copernicus Climate Change Service: https://climate.copernicus.eu

NOAA National Centers of Environmental Information (NCEI): https://www.ncei.noaa.gov/

NOAA National Centers of Environmental Prediction (NCEP): https://www.ncep.noaa.gov/

Deutscher Wetterdienst (DWD), Germany: https://www.dwd.de

EU Joint Research Centre: http://edo.jrc.ec.europa.eu

Australian Government – Bureau of Meteorology: http://www.bom.gov.au

Ding, S., W. Chen, J. Feng, and H. Graf, 2017: Combined Impacts of PDO and Two Types of La Niña on Climate Anomalies in Europe. *J. Climate*, **30**, 3253–3278, https://doi.org/10.1175/JCLI-D-16-0376.1.