MEDITERRANEAN CLIMATE OUTLOOK FORUM
MEDCOF-8 Online Forum

MONITORING SUMMARY MEDCOF-8

for April 2017

Final Version

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Compiled by

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The following MedCOF monitoring summary is based on

- climate monitoring working reports from RA I NA RCC-CM, RA VI RCC-CM and RA VI RCC-LRF

1. Oceanic Analysis

The **Pacific Ocean** was uniformly warmer than normal except over 2 zones of cold anomalies: the first one between 30°N and 40°N (weak positive PDO index of +0.52) and the second one around 40°S (Fig. 1). No significant East-West contrast along the equator. "El Niño costero" along the coast of Peru and further north near the equator ended due to a strong cooling during April. In the subsurface, a cold Kelvin wave had strengthened during April entering the eastern part of the basin (Fig. 2-5).

It was warmer than normal around the **Maritime Continent** in the eastern part, neutral in the western part.

Over the **Indian Ocean**, there was a strong contrast in the southern hemisphere between east (cold) and west (warm). Further to the north the DMI was close to 0.

The **Atlantic** had weak warm anomalies around the equator and up to 40°N. Warming of the eastern North Atlantic also affected areas near Western Europe, which were slightly warmer than normal (Fig. 6). Cold anomalies dominated further north from Labrador to Newfoundland and south of Iceland (Cold-Blob), but also in the South Atlantic especially around 40°S. The Cold Blob did not change its position and intensity during the recent months.

The **European Arctic Sea** (north of Iceland), **North Sea** and **Baltic Sea** were mostly warmer than normal, except frozen parts east of Greenland and around Svalbard. The northernmost part of the Baltic Sea was still frozen.

SSTs over the **Mediterranean** were up to +2°C warmer than normal.

The **Black Sea** had a cooling compared to previous months like most of Eastern Europe, but SST was around normal except the east, which was slightly colder.

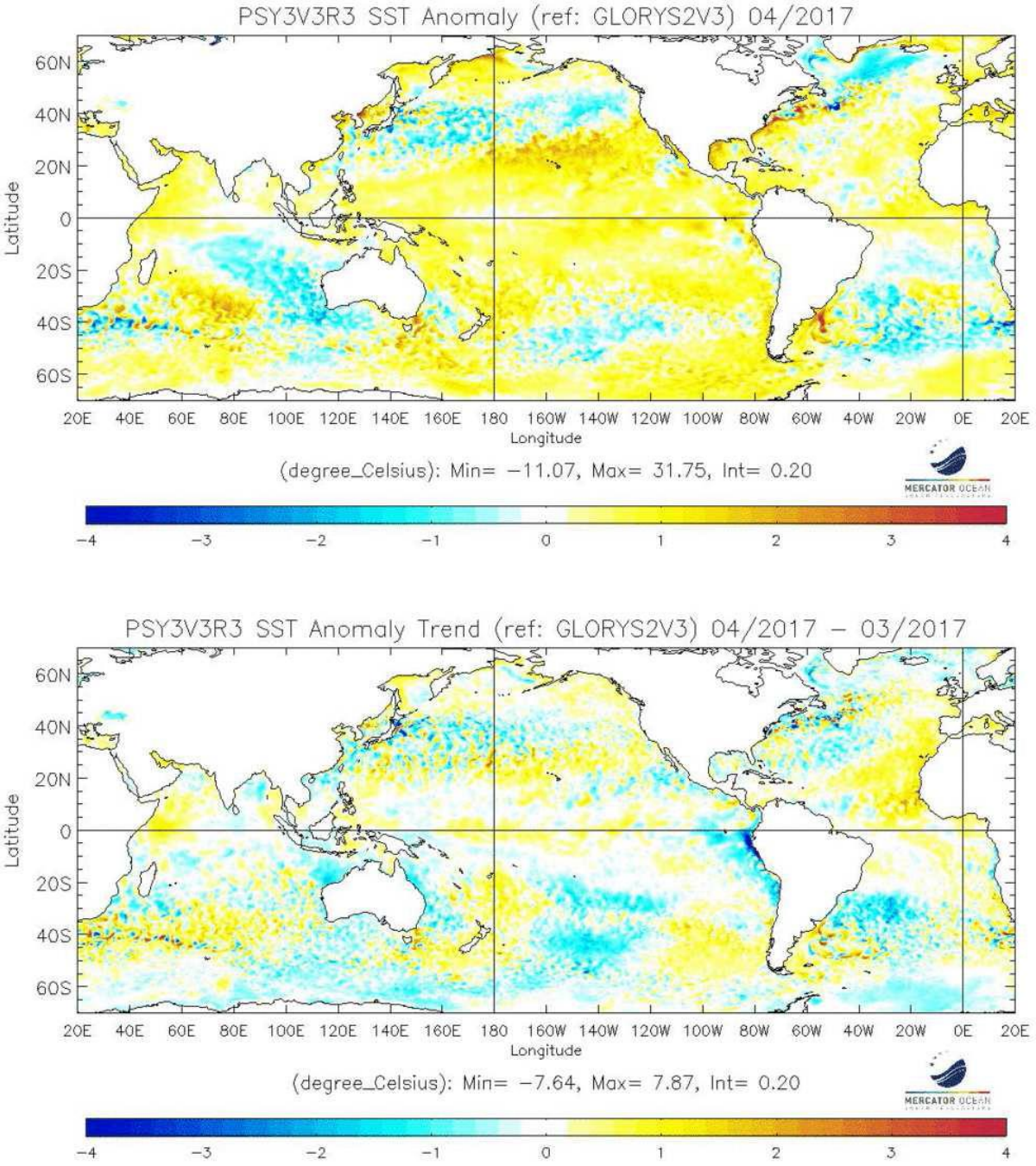

Figure 1: top: SST Anomalies (°C). Bottom: SST tendency (current – previous month), (reference Glorys 1992-2013).

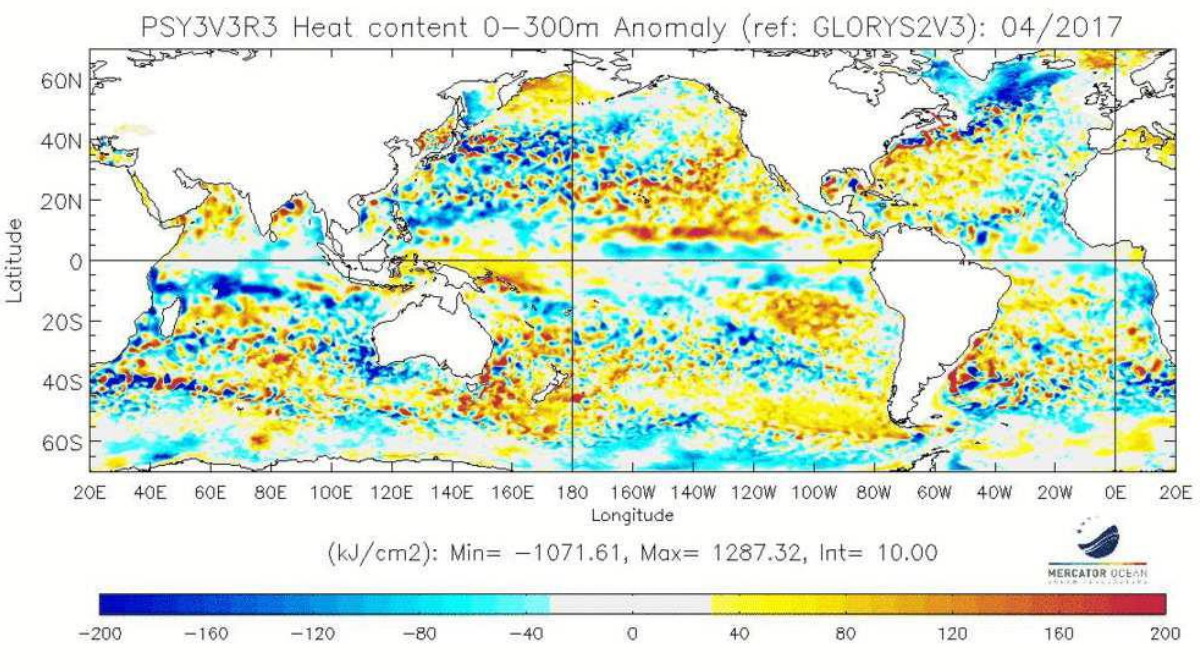

Figure 2: map of Heat Content Anomalies (first 300m, kJ/cm2, reference Glorys 1992-2013)

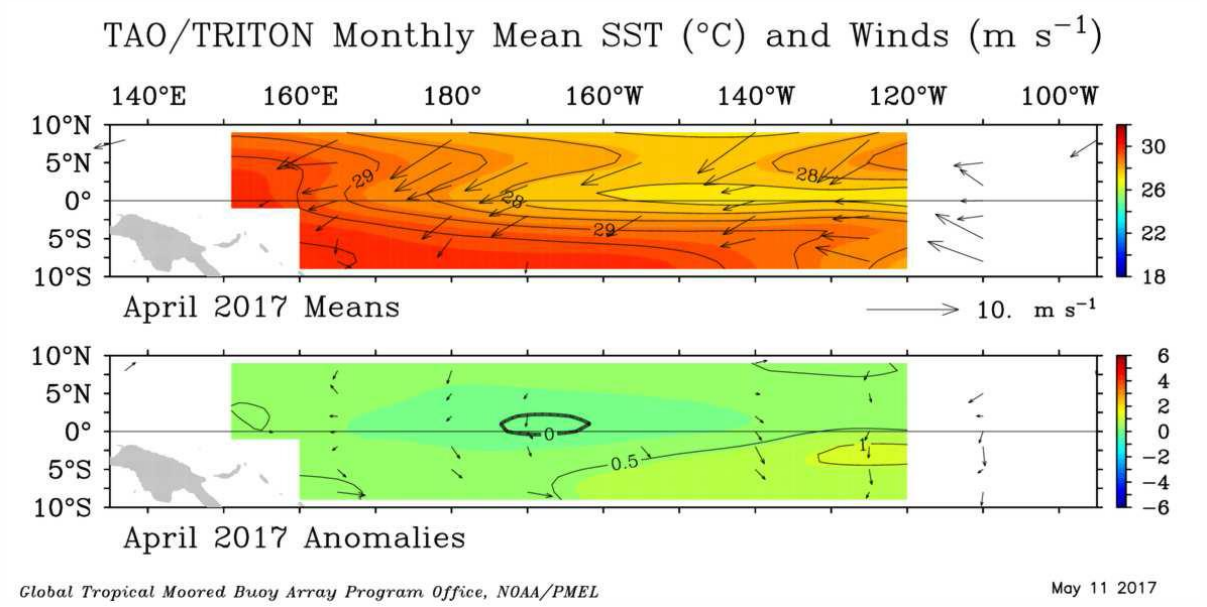

Figure 3: SST Anomalies and Wind anomalies over the Equatorial Pacific from TAO/TRITON.
http://www.pmel.noaa.gov/tao/drupal/assorted_plots/images/sst_wind_mon.png

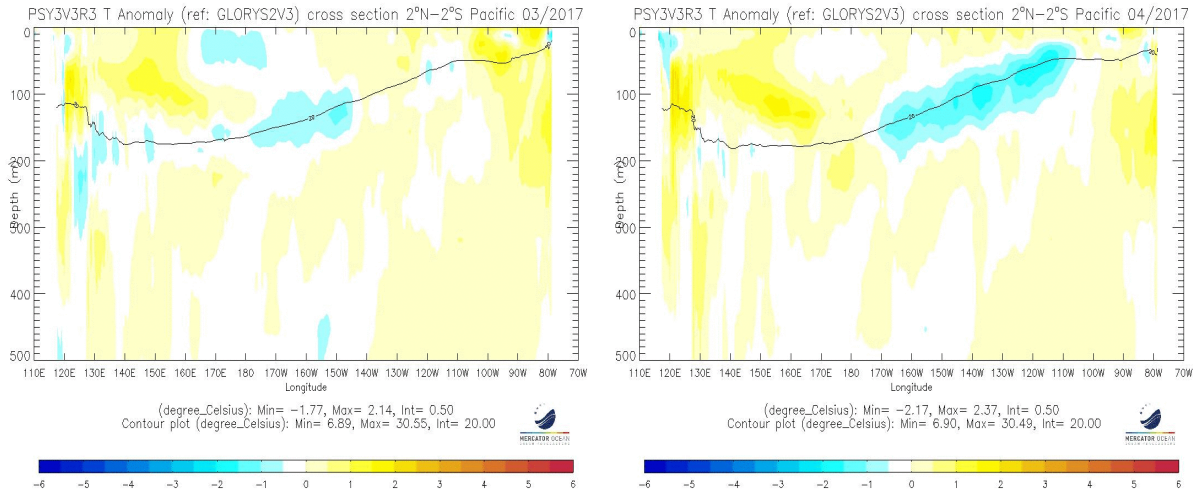

Figure 4: Oceanic temperature anomaly in the first 500 meters in the Equatorial Pacific (previous and current month).

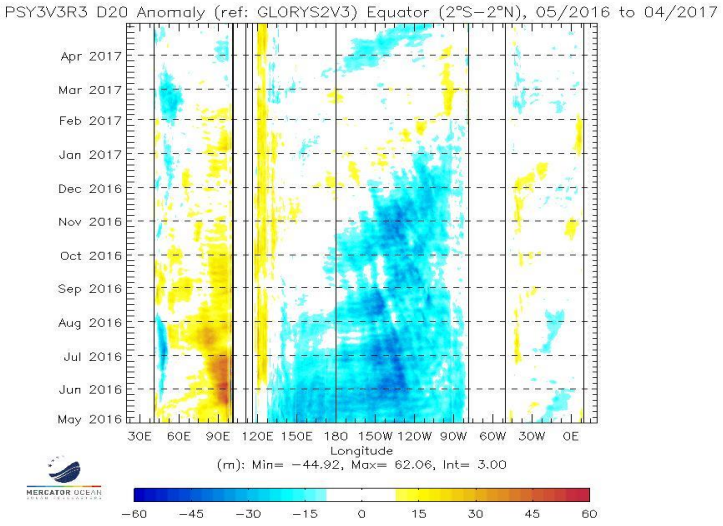

Figure 5: Hovmöller diagram of Thermocline Depth Anomalies (m) (depth of the 20°C isotherm) along the equator for all oceanic basins over a 6 month period.

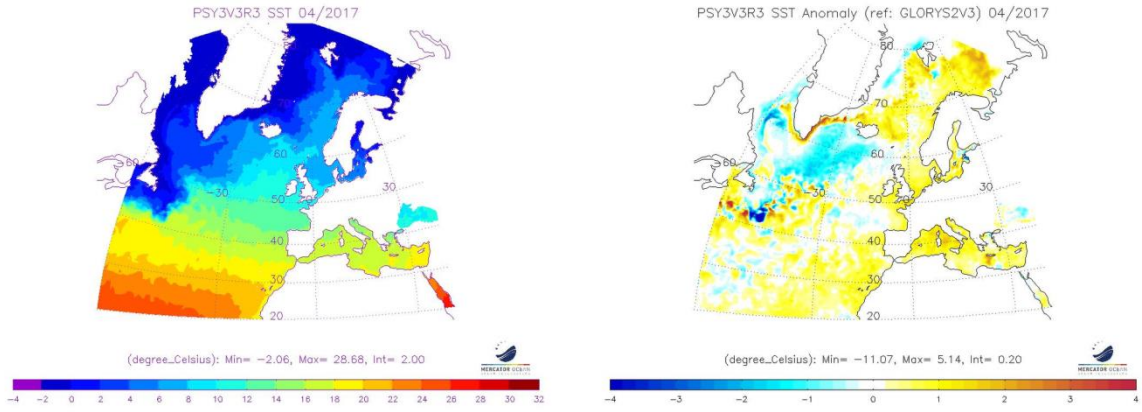

Figure 6: Mean sea surface temperature near Europe and North Africa and anomaly (reference Glorys 1992-2013).

2. Atmospheric Circulation Analysis

Velocity Potential Anomaly field in the high troposphere (Figure 7 – insight into Hadley-Walker circulation anomalies):

The following main anomalies can be seen:

- Vast kernel of strong downward anomaly over the Indian Ocean in step with the cold SST anomaly.
- Upward anomaly over the east of the Maritime Continent.
- Elsewhere over the Pacific Ocean, moderate downward anomaly in the northern tropical part, moderate upward anomaly in the southern tropical part to South America.
- Over the North Atlantic, weak East-West dipole.

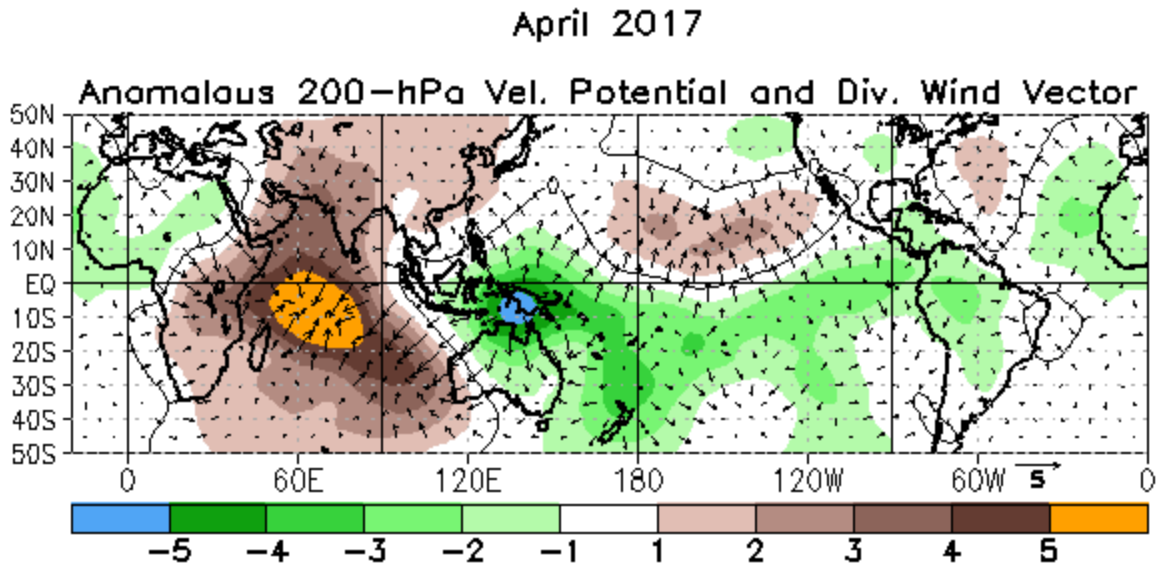

Figure 7: Velocity Potential Anomalies at 200 hPa and associated divergent circulation anomaly. Green (brown) indicates a divergence-upward anomaly (convergence-downward anomaly).
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

SOI:

Since ENSO phase is neutral, the SOI index continues to swing around 0 from one month to another. It was negative in April (-6.3) while it had been slightly positive (+5.1) in March (see the Bureau of Meteorology bulletin).

MJO (Fig. 8)

Weak MJO activity in April. Temporarily weak activity over the Western and Central Pacific.

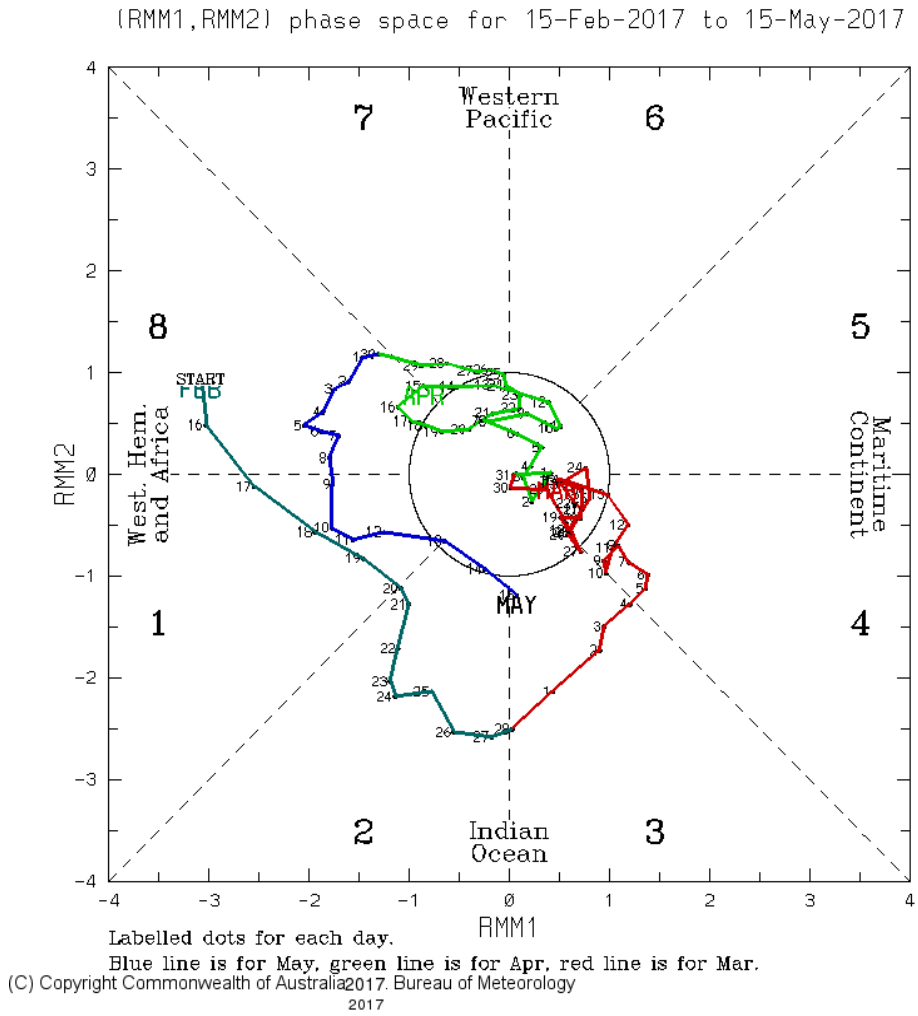

Figure 8: MJO indices. http://www.bom.gov.au/climate/mjo/

Stream Function anomalies in the high troposphere (Fig. 9 – insight into teleconnection patterns tropically forced):

Since there is no forcing in the equatorial zone, there is no organized structure near the equator in April. The stronger kernels near the tropics are due to mid-latitude circulation influence.

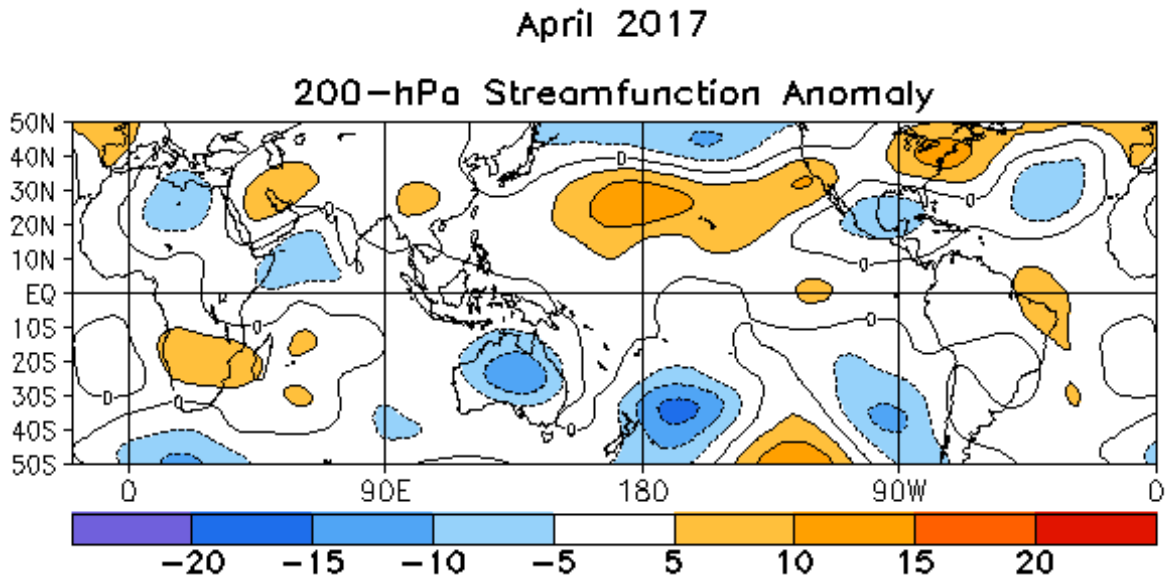

Figure 9: Stream Function Anomalies at 200 hPa. http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt22.shtml

Geopotential height at 500 hPa (Fig. 10 – insight into mid-latitude general circulation):

Unusual conditions over Europe in April. A strong positive anomaly area with centre off the coast of Ireland extended from the North Atlantic to Western Europe. Conversely, a negative anomaly area is to be seen south-west of the Azores and from Scandinavia to Russia. In this constellation, an Atlantic Ridge weather regime was very favored in April at the expense of NAO weather regimes (NAO- and NAO+).

Other patterns outside Europe:

- Negative anomaly in the Northern Pacific and a positive one in the north of the Strait of Bering.
- Positive anomaly in North-eastern USA and south of Quebec, and negative in Northern Canada.

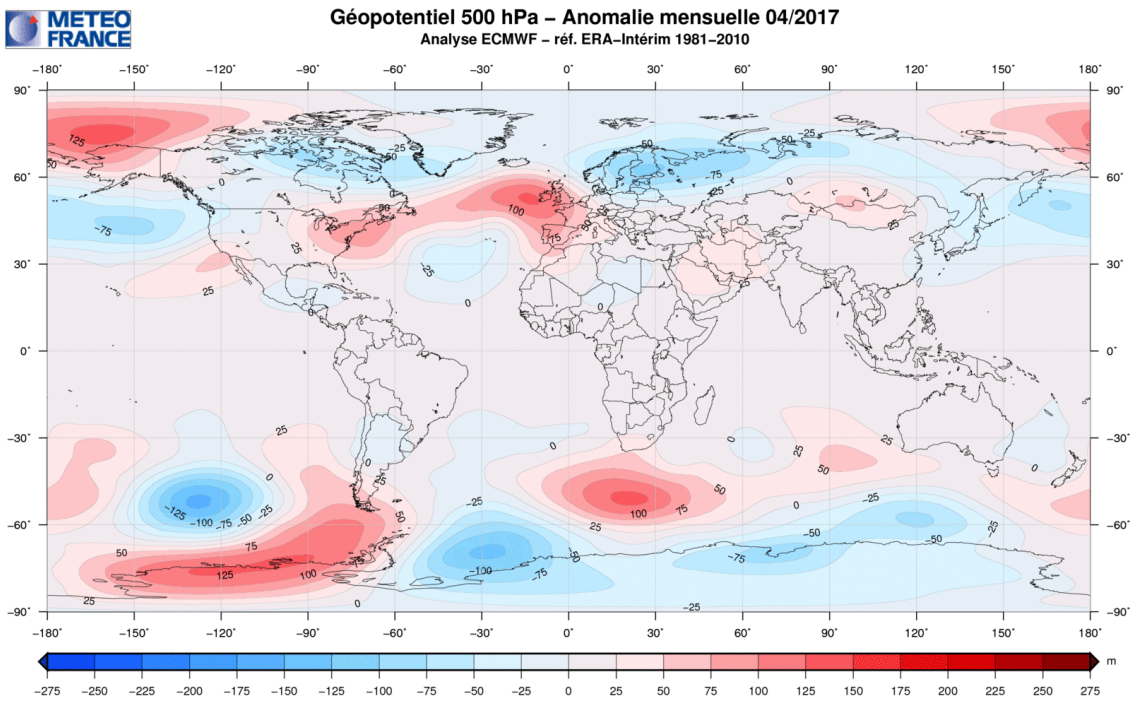

Figure 10: Anomalies of Geopotential height at 500hPa (Meteo-France)

MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
APR 17	1.7	-0.6	-0.4	1.0	0.1	---	0.7	-1.5	-1.4
MAR 17	0.4	1.0	-2.1	-1.0	-0.0	---	-1.0	-1.0	0.7
FEB 17	0.7	0.6	-0.1	0.2	-0.1	-0.1	1.1	0.7	-0.4
JAN 17	0.1	-1.2	0.6	0.4	-0.3	-0.3	0.6	0.2	1.0
DEC 16	0.4	0.9	1.0	---	-0.7	0.9	1.5	-1.2	-1.1
NOV 16	-0.3	-0.4	1.0	-1.4	1.4	---	-0.9	-0.1	-2.8
OCT 16	1.0	0.4	0.5	-0.8	1.5	---	-1.3	1.1	-2.9
SEP 16	0.7	3.5	-1.8	-1.4	0.1	---	0.1	-1.0	-1.3
AUG 16	-2.2	2.1	-0.4	-0.4	-0.9	---	-3.3	-0.4	2.4
JUL 16	-1.7	1.8	-1.4	-0.4	0.5	---	-1.0	-0.7	-0.2
JUN 16	-0.1	0.4	-0.6	1.3	-0.6	---	-1.9	-1.0	-1.1
MAY 16	-0.7	0.2	0.6	0.1	-0.9	---	-2.0	1.1	-0.4

Table 1: Evolution of the main atmospheric indices for the Northern Hemisphere for the last 10 months: http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/table3.shtml

Sea level pressure and circulation types over Europe

The Icelandic Low had its usual position and was slightly more intense than normal, but the Azores High was shifted far to the north with its core close to Ireland (Fig. 11). This caused a switch to a negative EA pattern (Table 1), whereas NAO was still in a positive phase, but only by contribution of the western North Atlantic. Furthermore, the Arctic polar vortex extended to northern Europe, strengthening also the negative SCAND phase. The resulting high-reaching low pressure area extended from Scandinavia far into northern Russia (with positive EATL/WRUS phase). This constellation fostered cold polar outbreaks reaching particularly

northeastern Europe, but temporarily also other parts in northern, central, eastern and even southeastern Europe. Moisture uptake over relatively warm water surfaces partly caused heavy snowfall. On the other hand, large parts of Western Europe were influenced by warm and dry high pressure conditions.

This weather type situation dominated most of the month. According to Météo France weather type classification, 20 days of the month had the weather type "Atlantic ridge".

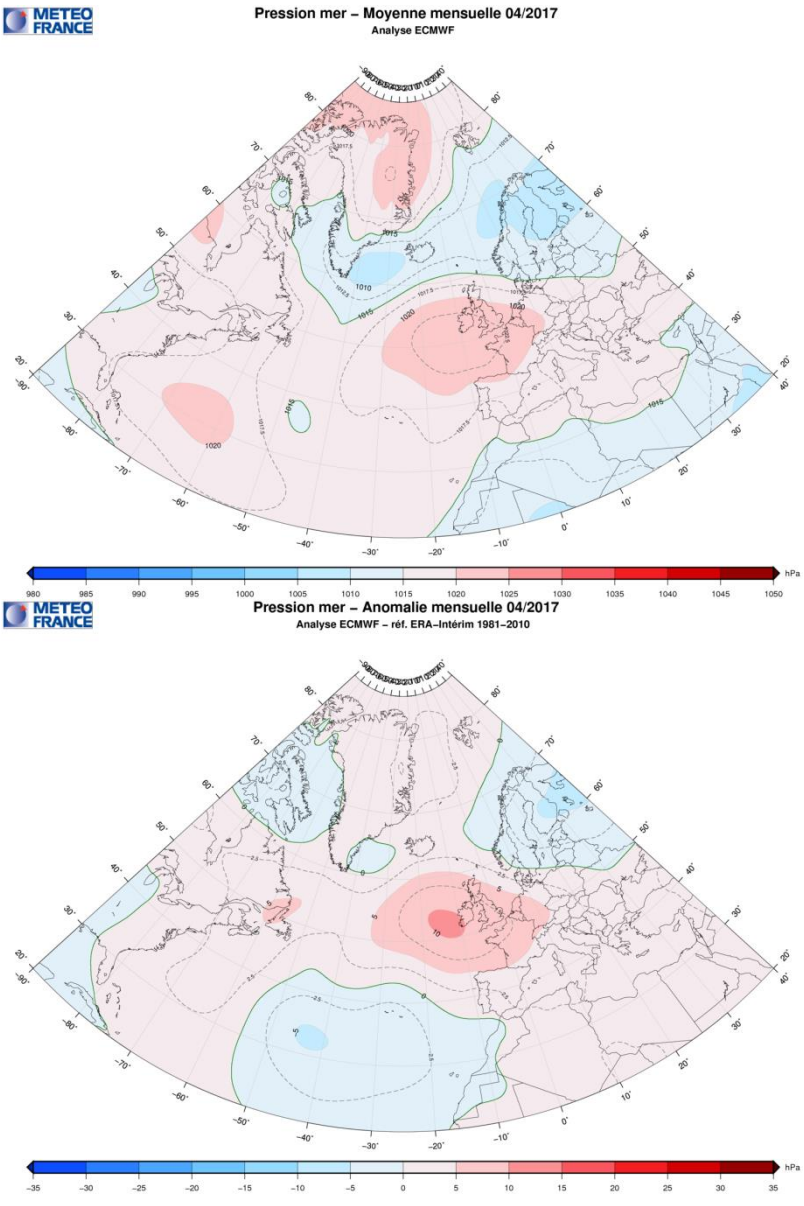

Figure 11: Mean sea level pressure over the North Atlantic, Europe and North Africa (top) and 1981-2010 anomalies (bottom) (Météo France)

Circulation indices: NAO and AO

NAO was in a positive phase during the whole month (Fig. 12), but without much impact in Europe due to the East Atlantic High. The AO did not follow the NAO fluctuations and had relatively low variability, but a slight negative phase in the second half of the month. That period was particularly favored for stronger cold polar air outbreaks.

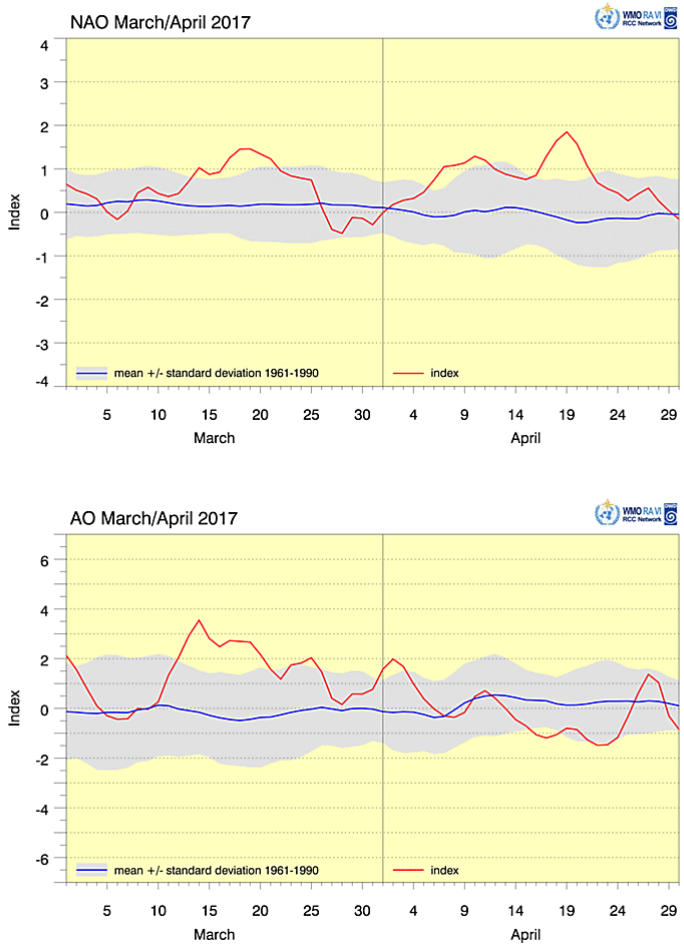

Figure 12: North Atlantic Oscillation (NAO, left) and Arctic Oscillation (AO, right) indices with 1961-1990 mean standard deviation (shading). http://www.dwd.de/rcc-cm , data from NOAA CPC: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml

Summary of Circulation Analysis for the MedCOF domain:

Especially western parts of the MedCOF domain were influenced by an Atlantic Ridge pattern, which dominated in the month of April 2017. This pattern caused high pressure influence, subsidence, and inflow of warm subtropical air over western parts of Europe and North Africa and over the western Mediterranean basin, and hence warm and dry conditions.

In contrast, cold cyclonic polar outbreaks affected temporally the eastern parts of the domain from the Balkans to eastern North Africa, mainly due to a negative SCAND pattern and were particularly efficient during a short period of negative AO. Over the Mediterranean basin, the cooling was partly counteracted by a relatively high Mediterranean SST.

Neither any tropical forcing nor any significant impact from North Atlantic Oscillation can be detected for that month.

3. Temperature anomalies

Global

Globally, April 2017 was +0.51°C warmer than the 1981-2010 normal. That is the second highest value behind 2016. (https://climate.copernicus.eu/resources/data-analysis/average-surface-air-temperature-analysis/monthly-maps/april-2017)

Warm anomalies occurred at the North Pole, in Siberia, Mongolia and a part of China, from India to Iran and Eastern Africa, Northwest Africa and Southwest Europe, and in the east of the USA (Fig. 13).

Cold anomalies can be found over Greenland, Canada and western USA, southern South-America, much of Europe, central and eastern North Africa, parts of southern Africa and Australia.

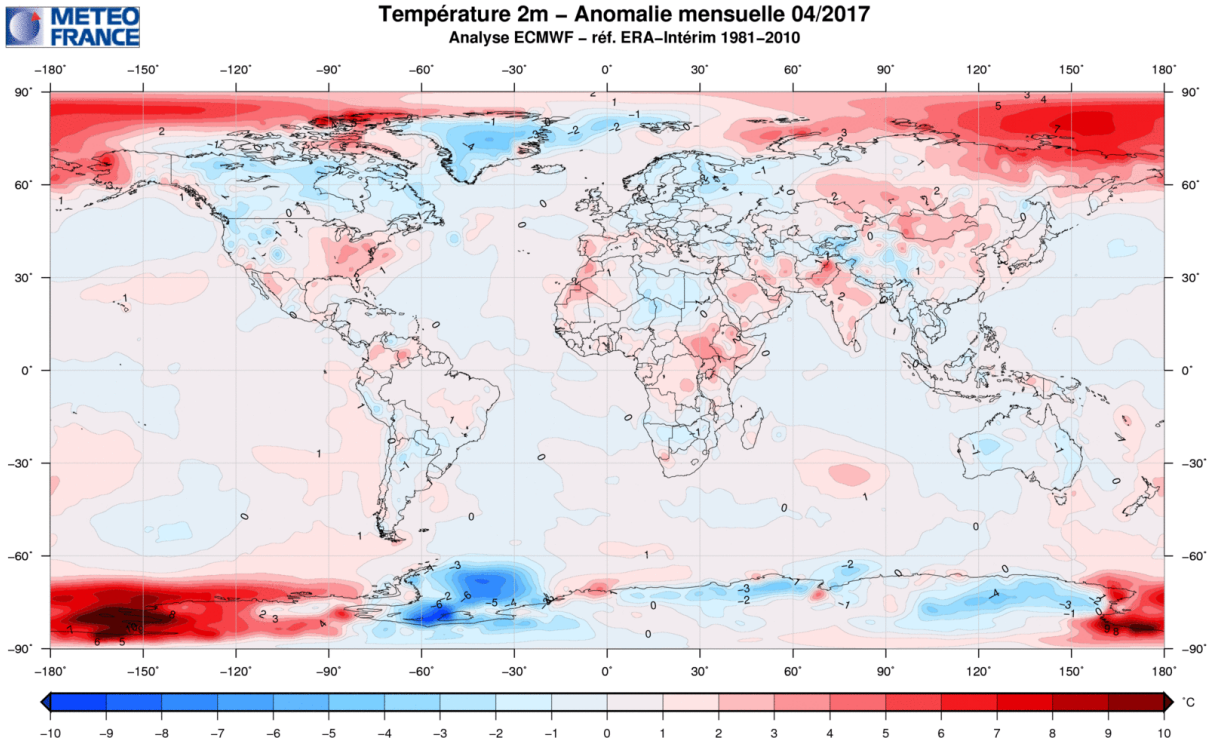

Figure 13: Temperature Anomalies (°C) (Meteo-France)

Europe / RA VI

Monthly mean temperature in the lowlands in April 2017 ranged from around 9°C in the north to around 21°C in southern Israel and Jordan.

Anomalies (1981-2010 reference) were above normal and/or mostly in the upper tercile in Iberia, southern France, nearly whole Italy, the Mediterranean basin, most of the Middle East and parts of the central Ukraine. Highest anomalies (above +2°C to around +3°C) were recorded all in western parts of the domain in central Iberia, in the Pyrenees region, and near the French/Italian border, due to high pressure influence and subtropical air advection. It was the third warmest April in Spain in this century, behind 2011 and 2014. Below-normal anomalies in the lower tercile can be seen especially in eastern France, parts of Hungary and Romania, eastern parts of the Balkans and parts of Turkey due to temporal cold polar outbreaks. Negative anomalies were mostly between 0 and -1°C, in places below -1°C, in northeastern Turkey below -2°C. The rest of the region had temperatures mainly around normal.

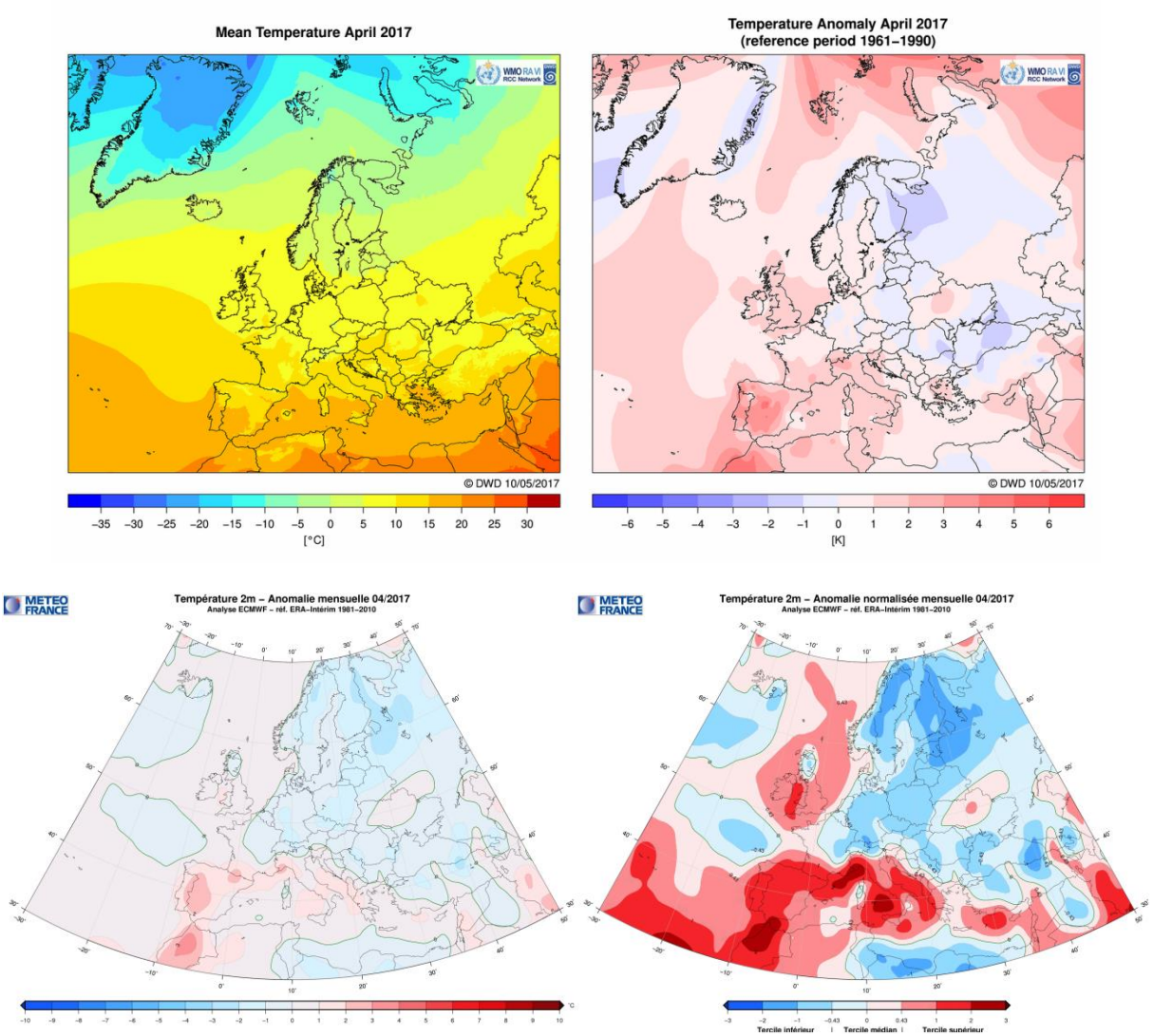

Figure 14: Mean temperature (upper left) and anomalies (1961-1990 reference, upper right) in °C in the RA VI Region (Europe) interpolated from CLIMAT station data, for April 2017. Source: DWD, http://www.dwd.de/DE/leistungen/rcccm/int/rcccm_int_ttt.html?nn=490674.

Lower left: Absolute anomaly of temperature (1981-2010 reference), lower right: Standardized temperature anomalies, from ERA-Interim Reanalysis (Source: Meteo France)

North Africa

During the month of April 2017, registered temperatures were above normal over the central and western region of the North African Domain. Monthly mean temperature in April 2017 ranged from less than 13°C in the north of Morocco and Algeria to above 30°C in southern Algeria. Mean temperature of the region was the 11th highest since 1980 with +0.6 °C above the normal of 1981-2010. Temperature anomaly has reached more than +3°C especially in the western regions of Algeria and north of Morocco. Some records have been noticed at several stations. Eastern and southern regions of the North African domain have registered near normal temperature with a tendency to below normal over the south of Algeria, major part of Libya, the southern and the western parts of Egypt.

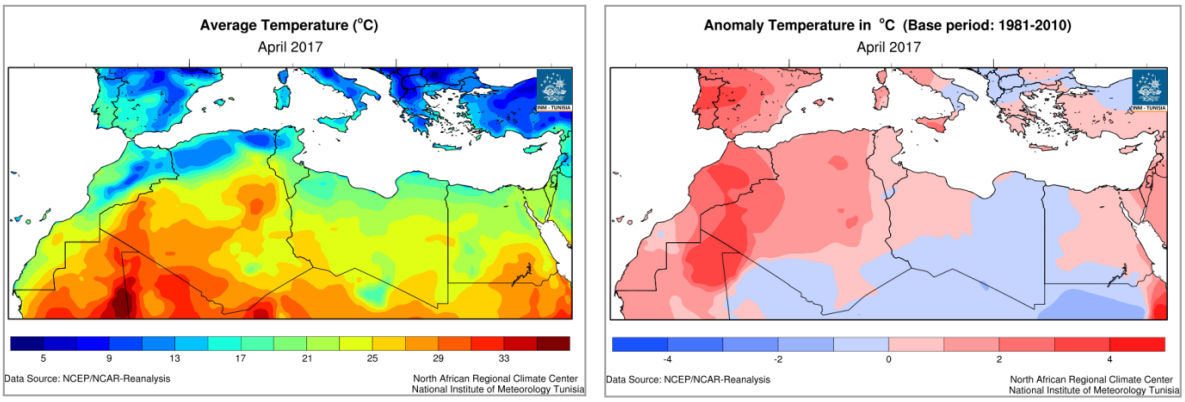

Figure 15: Left: Mean temperature; Right: Absolute anomalies of temperature in the RAI-NA Region (North Africa) Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010), http://www.meteo.tn/htmlen/donnees/climatemonitoring.php.

4. Precipitation anomalies

Global

In connection with the velocity potential anomalies mentioned above, there was a deficit of precipitation over the Indian Ocean and an excess over the Maritime Continent (Fig. 16). Over the Pacific a deficit of precipitation can be found north of the equator and an excess south of it.

Brazil saw another dry month and also northern South America, except locally at the west coast near to the Equator and in Peru. In contrast, it was wetter than normal in the USA.

In Europe, it was dry in the West, but wetter than normal in Eastern Europe and Russia.

Africa had some drier-than-normal areas especially in the east, but also at the Gulf of Guinea and in the northwest, and some wet areas in Nigeria, central parts of Africa, southern Tanzania / northern Mozambique and in the south in Namibia/Botswana with local flooding.

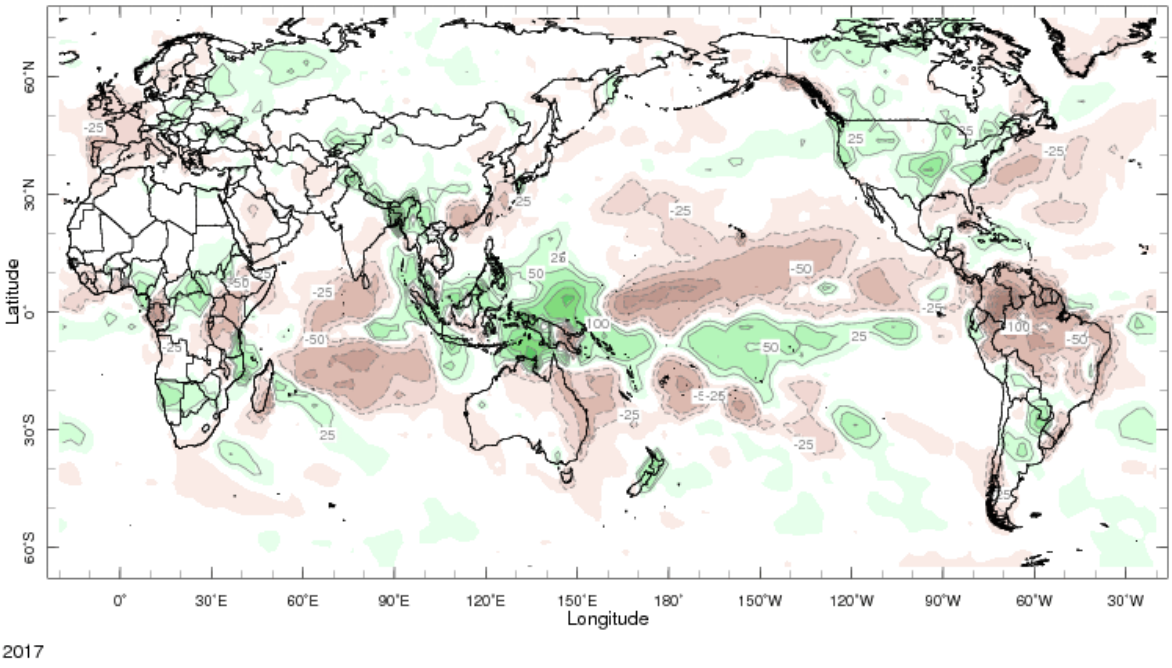

Figure 16: Rainfall Anomalies (mm) (departure to the 1979-2000 normal) – Green corresponds to above normal rainfall while brown indicates below normal rainfall.
http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/Anomaly.html

Europe / RA VI

Monthly precipitation totals of April 2017 had a large variety within the domain. Some very dry places (<10mm) can be found in Portugal, Spain, northern France, southern Greece and in the Middle East. On the other hand, more than 100mm were recorded especially in northeastern Italy, Slovenia, Bosnia-Herzegovina, Montenegro and in places in eastern Ukraine, western Georgia, and southeastern Turkey.

Western and southwestern parts of Europe had below-normal precipitation, partly drought conditions, reflecting high pressure influence. Parts of Portugal, Spain and northern France received less than 20% of the normal total, but also much of the Mediterranean basin including Italy, Greece, northern Ukraine, South Caucasus, and areas near the eastern Mediterranean had a large precipitation deficit. According to preliminary data, it was the driest April since 1931 in Portugal, and probably the driest April in this century in Spain. In contrast, there was well above-normal precipitation in other parts, especially near the eastern Alps (northeastern Italy, Slovenia), Bosnia-Herzegovina, western Serbia, near northern coasts of the Black Sea, locally in Turkey and eastern parts of the Middle East. Places in Serbia, for example, received up to more than 180% of the 1981-2010 precipitation normal.

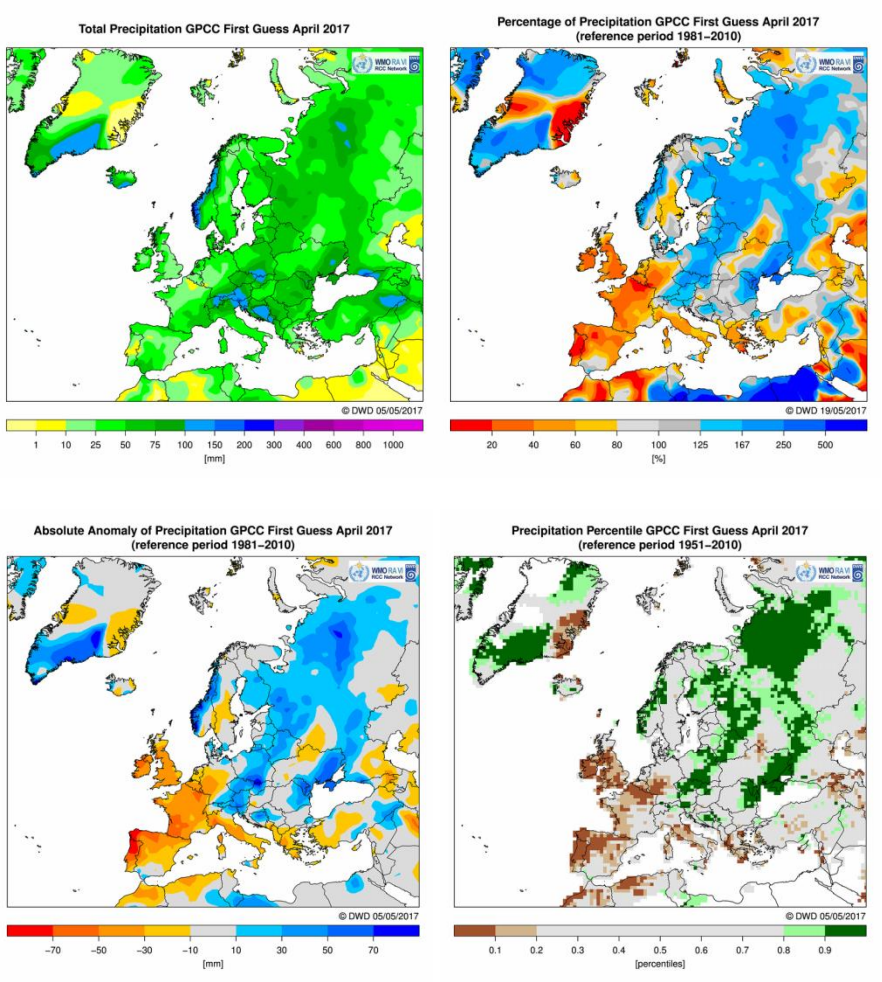

Figure 17: Monthly precipitation sum (upper left), percentage of normal (upper right), absolute anomalies (lower left), and percentiles for April 2017 (1981-2010 reference for means, percentages and anomalies, 1951-2010 for percentiles) in Europe. Data from GPCC (First Guess version). Source: DWD, http://www.dwd.de/DE/leistungen/rcccm/int/rcccm_int_rrr.html?nn=16102

North Africa

Monthly precipitation totals in April 2017 were below 20 mm over almost all of the RA I domain. Rainfall amounts exceeding 40 mm were registered in the extreme north-west and the south-east of Tunisia and in the north-west of Libya. During this month, the south of Tunisia, north and east of Libya and the north of Egypt had known above-normal totals of precipitation. In these regions, rainfall amounts were greater than 500% of normal rainfall amounts. Near-normal conditions occurred over the center and north of Tunisia, eastern and almost all northern parts of Algeria, and the north of Morocco. These regions received between 75% and 125% of the normal. Most parts of the Sahara, which is known as a dry zone, were even drier during this month of the year with less than 20% of the normal.

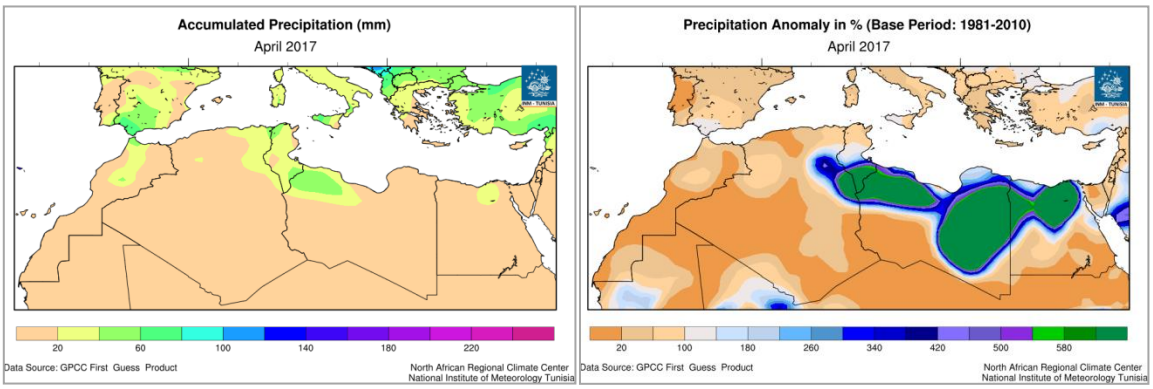

Figure 18: Left: Total precipitation; Right: Absolute anomalies of precipitation in the RAI-NA Region (North Africa)
Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010)
http://www.meteo.tn/htmlen/donnees/climatemonitoring.php.

5. Sea ice

In April 2017, sea ice extent in the Arctic stayed at low record level, while in the Antarctic, there is a downfall in the extent with a very low level in a context which suddenly changed two years ago (Fig. 19-21).

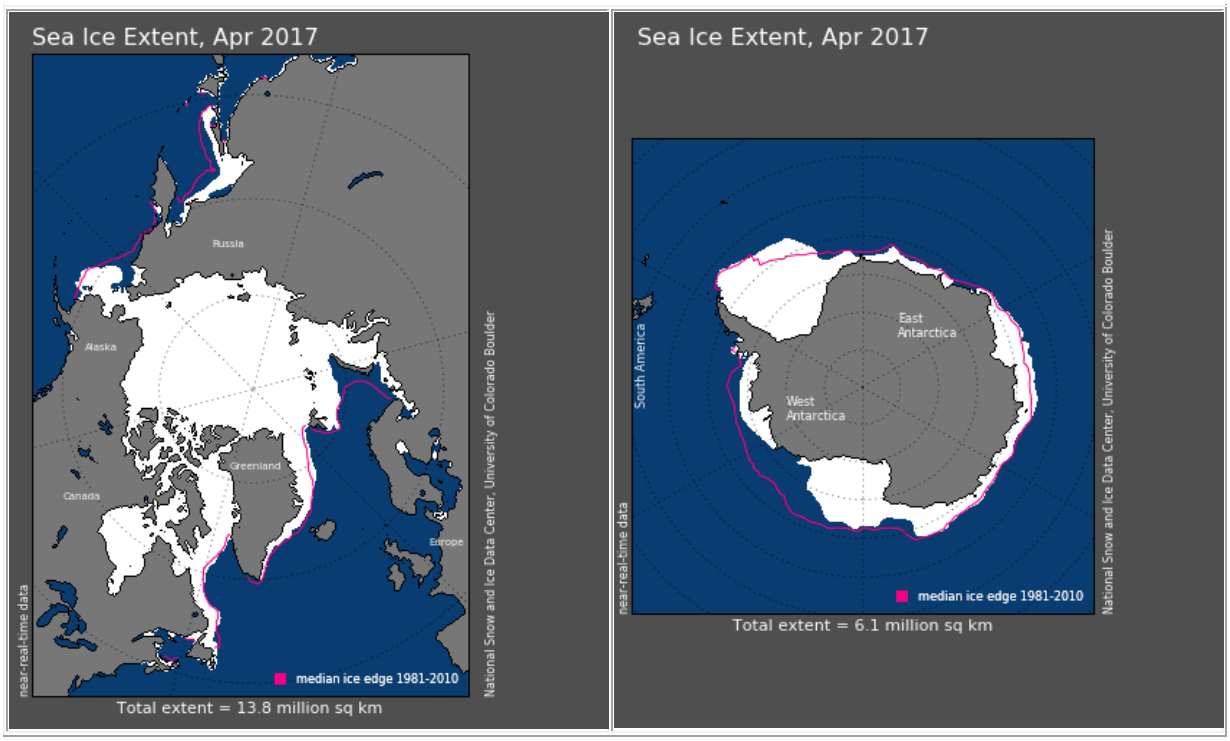

Figure 19: Sea-Ice extension in the Arctic (left) and in the Antarctic (right). The pink line indicates the averaged extension (for the 1979-2000 period). http://nsidc.org/data/seaice_index/

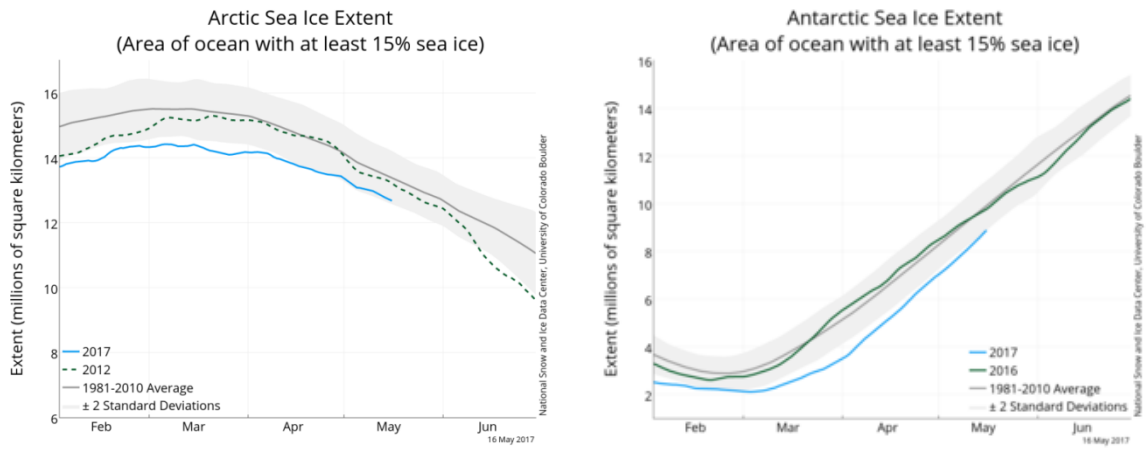

Figure 20: Sea-Ice extension evolution from NSIDC.
https://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png

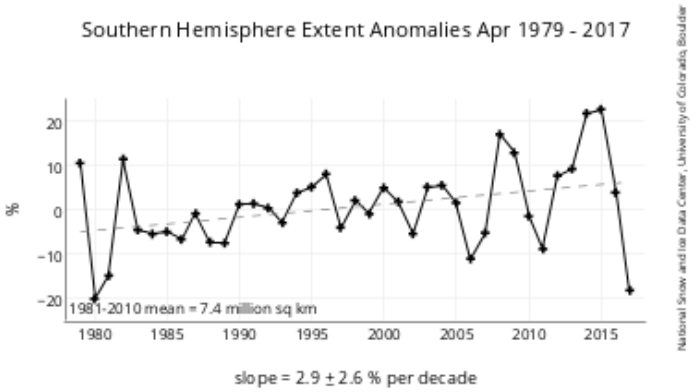

Figure 21: Monthly Sea Ice Extent Anomaly Graph in the Antarctic for the month of analysis (http://nsidc.org/data/seaice_index/)

References:

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

WMO RA I RCC Node on Climate Monitoring Website with monitoring results: http://www.meteo.tn/htmlen/donnees/climatemonitoring.php

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

GPCC: http://gpcc.dwd.de

Monthly climate summary of Spain: http://www.aemet.es/en/serviciosclimaticos/vigilancia_clima/resumenes

Monthly climate summary of Portugal: http://www.ipma.pt/pt/publicacoes/boletins.jsp?cmbDep=cli&idDep=cli&idTema=&curAno=-1

Monthly climate summary of Serbia: http://www.hidmet.gov.rs/eng/meteorologija/klimatologija_produkti.php