MEDITERRANEAN CLIMATE OUTLOOK FORUM
MEDCOF-9 Meeting

MONITORING SUMMARY MEDCOF-9

for October 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
- information about climate drivers from NMA Romania (R. Bojariu)

1. Climate drivers

Several large-scale drivers can be identified, which are relevant for the winter season. They are summarized in Table 1.

Phenomenon/Mechanism/ factor in October 2017	Atmospheric blocking events in Atlantic/European area	Zonal circulations	Stratospheric warmings	NAO phase	Shifts in the jet stream position/intensity over Atlantic/European area
Weak/moderate La Nina (Polvani, 2017)		slightly enhanced		slightly positive	Northward over Europe?
Slightly positive NAT SST index (e.g. Bojariu, 1997; Chang, Ji, and Li, 1997)		slightly less frequent, (reduced trade winds)		slightly negative	yes
Positive AMO					
Slightly positive PDO					yes
May SST (Rodwell and Folland, 2002)		slightly enhanced		slightly positive	Northward over Europe?
More snow cover extent in Eurasia (e.g. Bojariu and Gimeno, 2003)	enhanced	less frequent		negative	Southward over Europe?
Reduced Arctic sea ice concentration (e.g. Deser and Teng, 2008)	enhanced	less frequent		negative	yes
Strong polar vortex? (Baldwin and Dunkerton, 1999)	less frequent (in the first part of the winter)	enhanced (in the first part of the winter)		positive (in the first part of the winter)	Northward over Europe?
Easterly QBO (e.g. Marshall and Scaife, 2009)		less frequent	yes	negative	Southward over Europe?

Table 1: Brief synthesis of predictability drivers in Mediterranean regions. The left column describes the situation of the phenomena/mechanisms for the monitoring month October 2017, the other columns the expected impact for the following winter according to the cited publications in the first column. Source: NMA Romania (R. Bojariu)

2. Oceanic Analysis

For the month October 2017, the following oceanic features have been noticed:

Over the Pacific ocean:

- Since September, no significant SST evolution in the tropical Pacific. Niño 3.4 index: -0.4°C (-0.5°C in Sept.). Still a strong West-East gradient, consistent with a La Niña phase of ENSO.
- In the subsurface, the only significant evolution concerns the western part of the basin, with an intensification of the warm reservoir (west of 150°W).
- Noisy PDO+ pattern, the main element is the persistence of a warm anomaly all along the Northern tropics.

Over the Maritime Continent:

- No significant evolution : slightly above normal SSTs

Over the Indian Ocean :

- In the northern hemisphere, generally warm anomalies. The IOD is still slightly positive, due to a weak gradient.
- In the southern hemisphere, persisting SST gradient (enhanced in October) between a still cold eastern basin and a warm western basin.

Over the Atlantic:

- Little evolution in the tropics. Still warm anomalies in the Gulf of Guinea up to the coasts of Senegal; and in the Caribbean Sea and Gulf of Mexico.
- over Northern Atlantic, persisting North-South gradient, the cold blub is still present (confirmed by the subsurface)

Over the Mediterranean:

- Anomaly gradient between the West (warmer than normal) and the East (cooler than normal).

Over the Black Sea

- strong cooling compared to September, negative anomalies

Over the European Arctic Sea

- very warm for the season, high positive anomalies

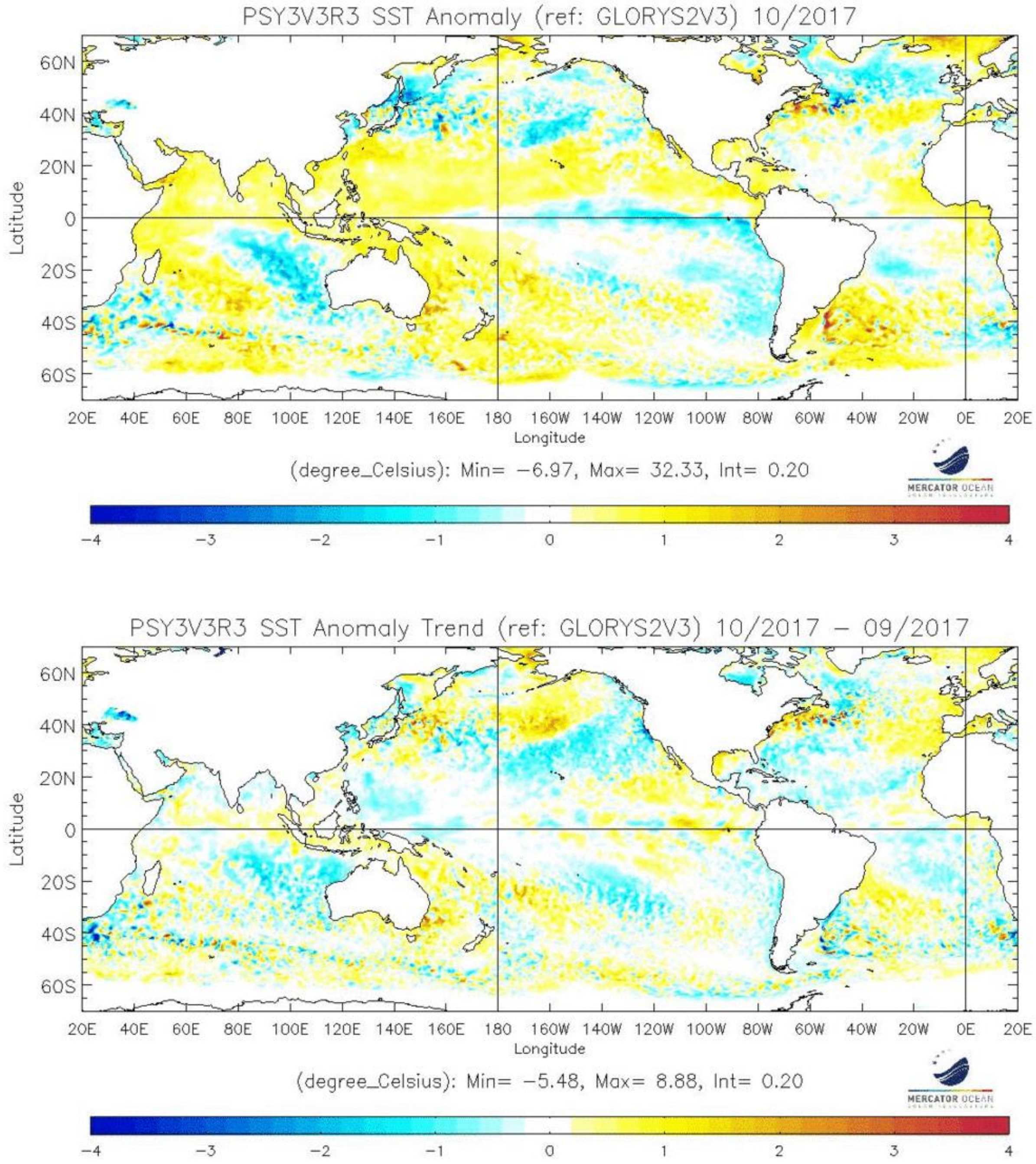


Figure 1: top: SST Anomalies (°C). Bottom: SST tendency (current – previous month), (reference Glorys 1992-2013).

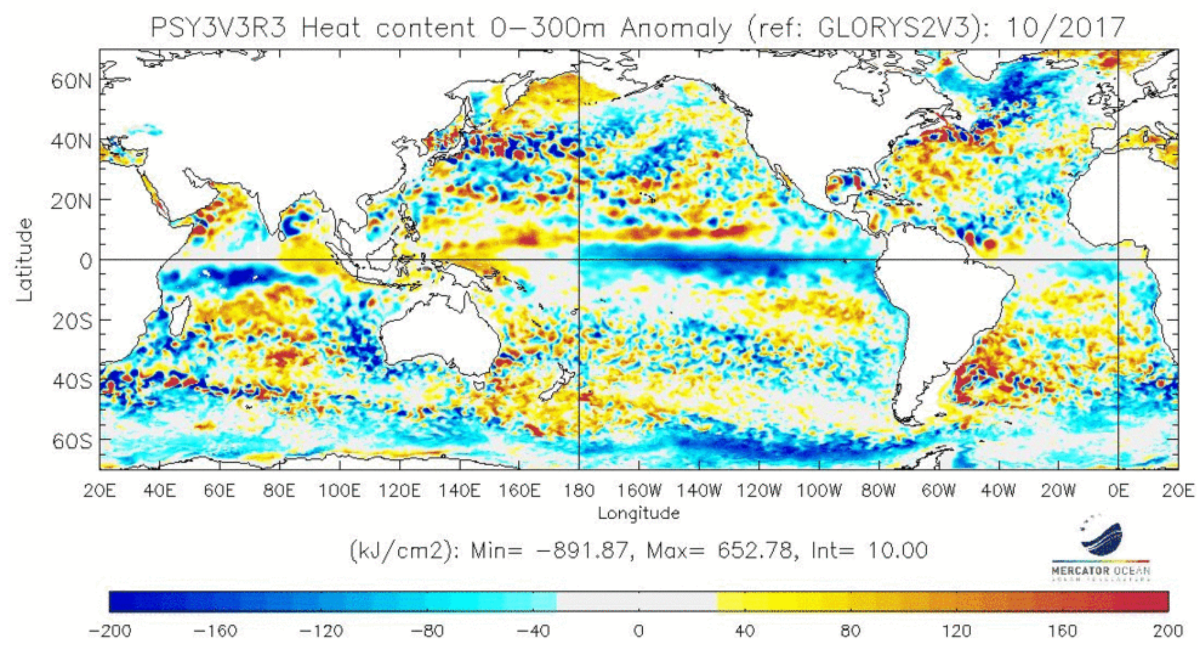


Figure 2: map of Heat Content Anomalies (first 300m, kJ/cm2, reference Glorys 1992-2013)

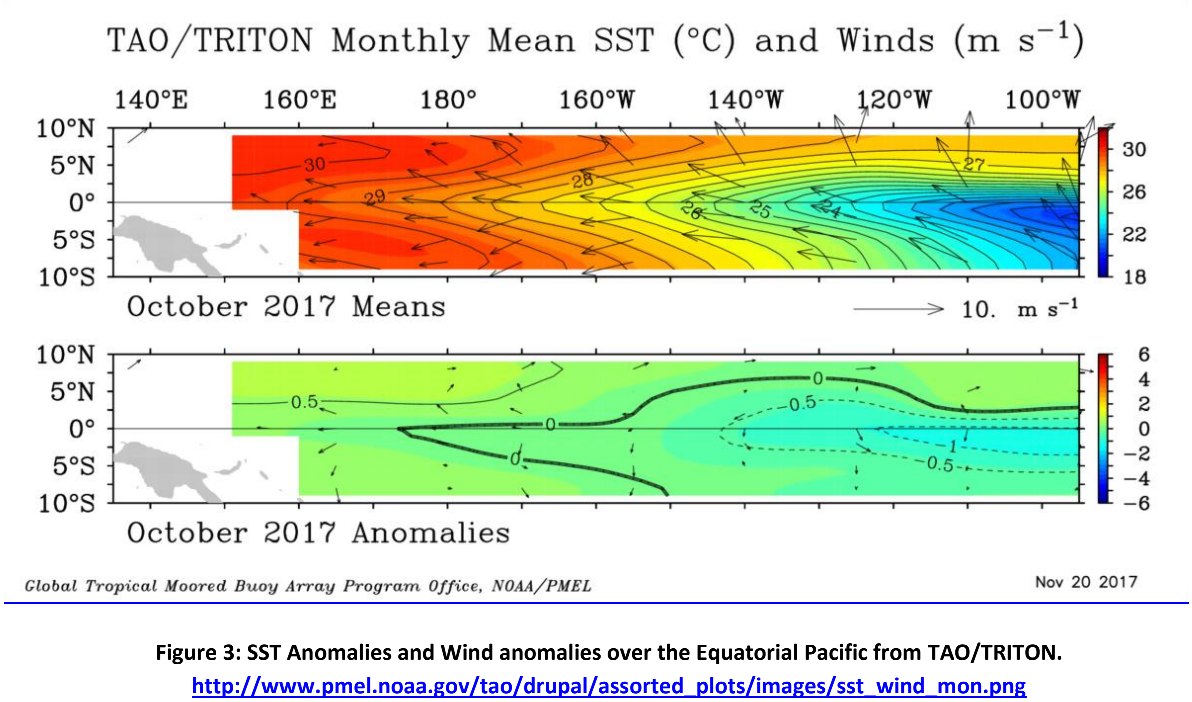


Figure 3: SST Anomalies and Wind anomalies over the Equatorial Pacific from TAO/TRITON.
http://www.pmel.noaa.gov/tao/drupal/assorted_plots/images/sst_wind_mon.png

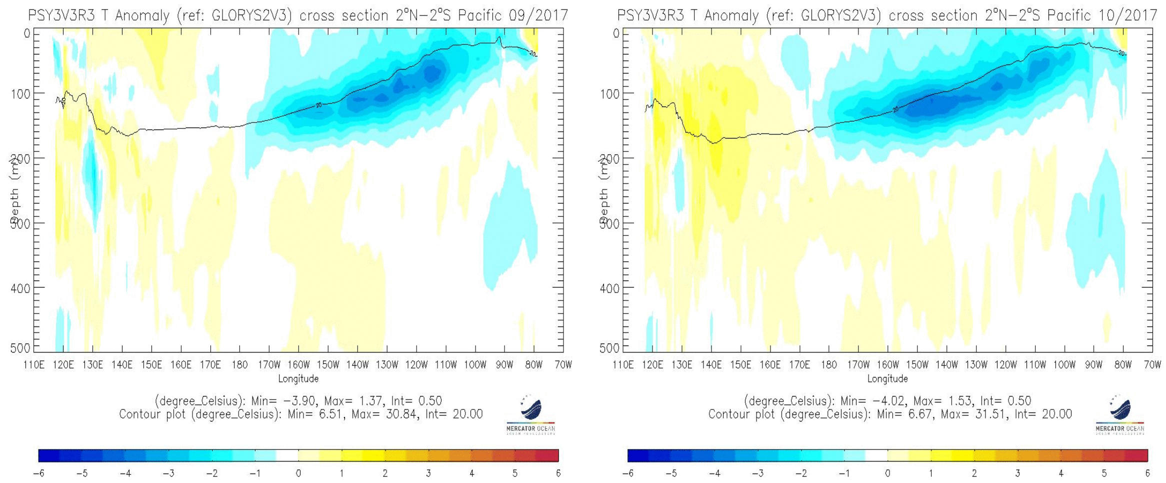


Figure 4: Oceanic temperature anomaly in the first 500 meters in the Equatorial Pacific (previous and current month).

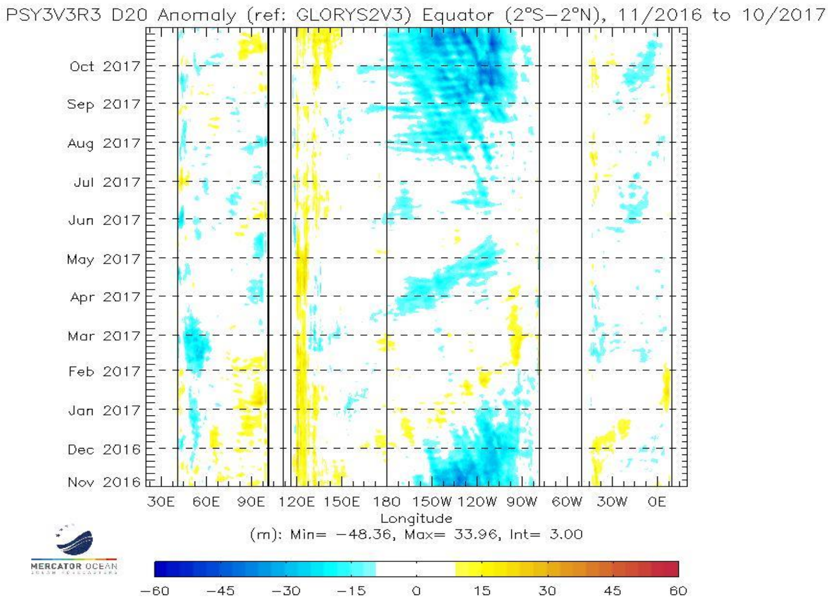


Figure 5: Hovmöller diagram of Thermocline Depth Anomalies (m) (depth of the 20°C isotherm) along the equator for all oceanic basins over a 6 month period.

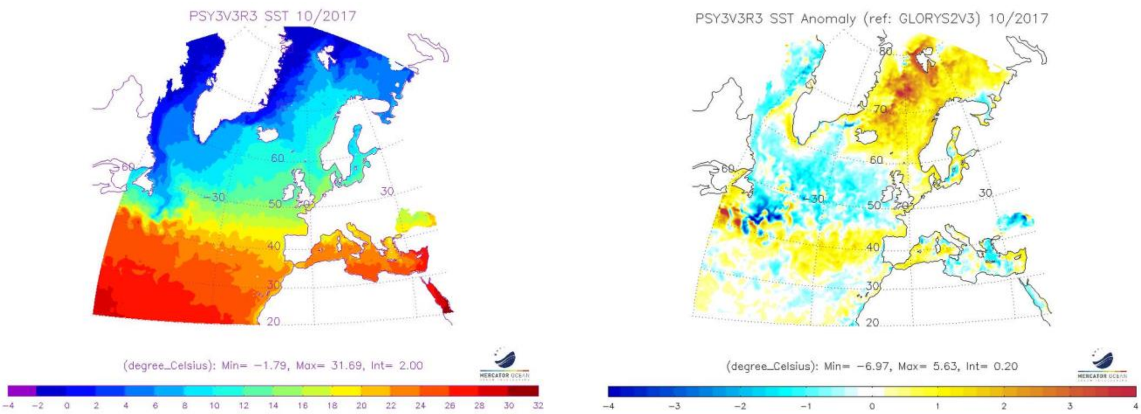


Figure 6: Mean sea surface temperature near Europe and North Africa and anomaly (reference Glorys 1992-2013).

3. Atmospheric Circulation Analysis

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

- since August downward motion anomalies over the eastern part of the tropical Pacific, consistent with the SST anomalies (a hint of some ocean-atmosphere coupling) and upward motion anomalies over the Maritime Continent, especially to the east. This is consistent with La Niña impact.
- Over the Indian Basin, West-East anomaly dipole, despite a quite neutral DMI. So this dipole is probably due to the La Niña influence.
- Over the Atlantic, large downward anomaly.

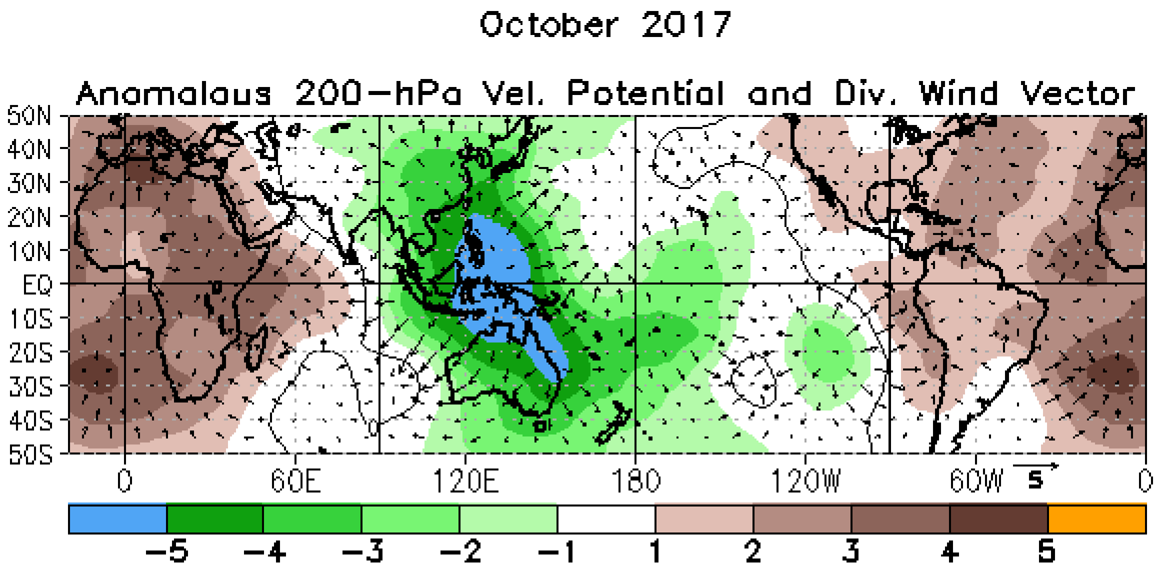


Figure 7: Velocity Potential Anomalies at 200 hPa and associated divergent circulation anomaly. Green (brown) indicates a divergence-upward anomaly (convergence-downward anomaly).
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

SOI:

- Still a positive SOI in October (+0.9), stronger than in September (+0.6). See NOAA Standardized SOI: https://www.ncdc.noaa.gov/teleconnections/enso/indicators/soi/ .

MJO (Fig. 8)

- Strong MJO activity in October. This explains the strong contrasts observed on the Velocity Potential anomaly map. But disappearing in November.

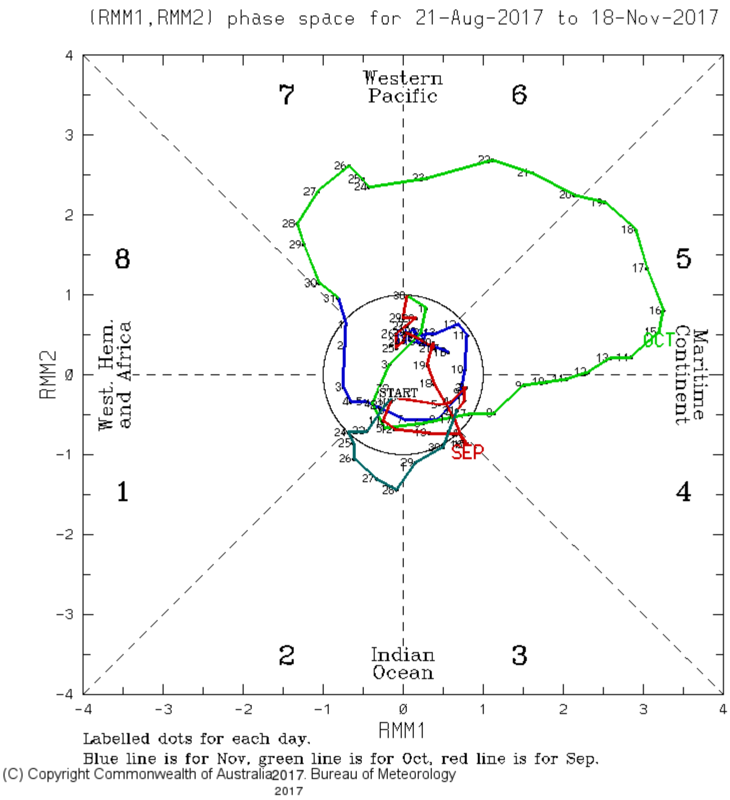


Figure 8: MJO indices. **http://www.bom.gov.au/climate/mjo/**

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

- Contrary to the previous months, significant anomalies in the inter-tropical band.
- On the Eastern Pacific, cyclonic anomalies on both sides of the equator (cyclonic means negative stream function anomalies in the northern hemisphere, but positive in the southern hemisphere).
- Close to the Indian basin, anticyclonic anomalies around 20°N and S.
- No clear teleconnection toward mid-latitudes: the PNA- pattern could potentially be associated with La Nina pattern.

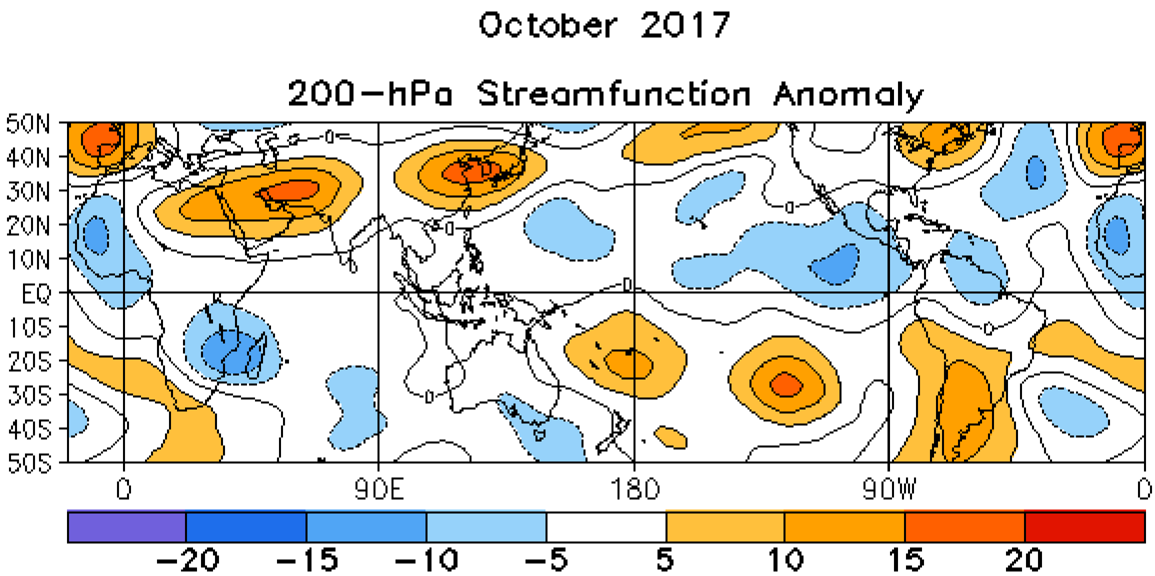


Figure 9: Stream Function Anomalies at 200 hPa. http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt22.shtml

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

- Northern Atlantic and Europe: strong anomaly dipole between western and eastern Europe. No strong teleconnection patterns (Table 2).
- Pacific-America: further strong positive anomalies over SE Canada and Gulf of Alaska. Quite intense wave pattern. Further amplification in the first half of November.

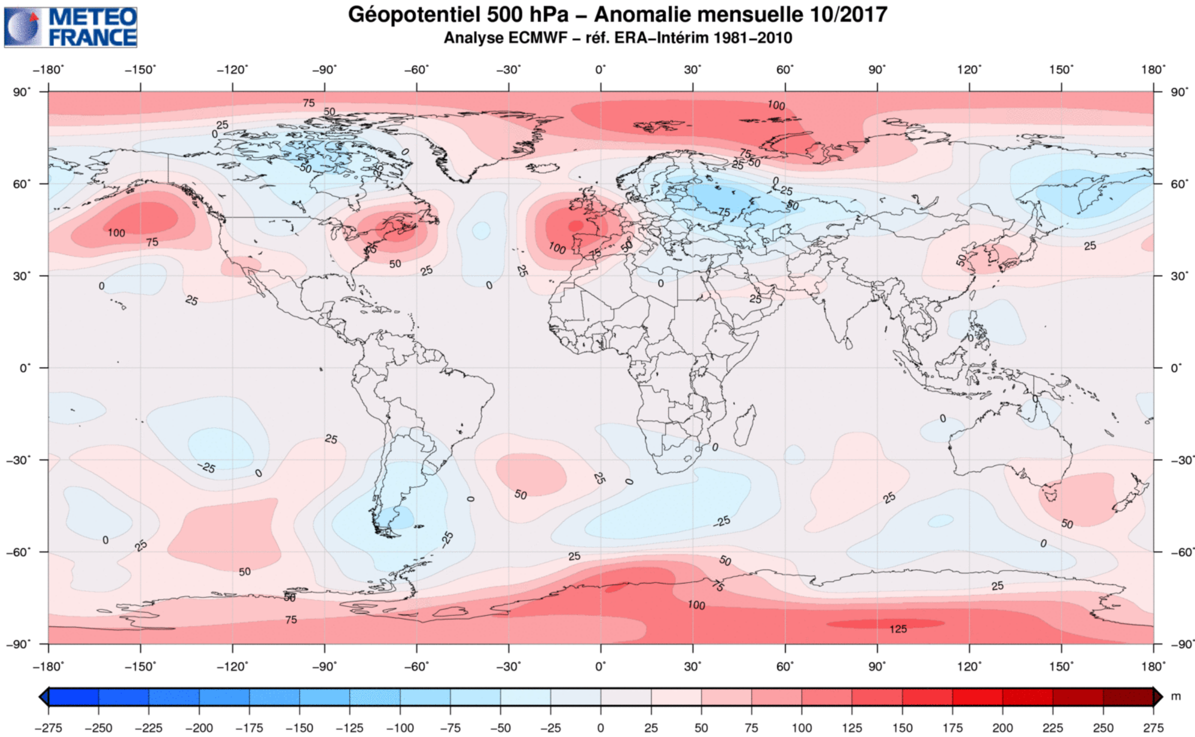


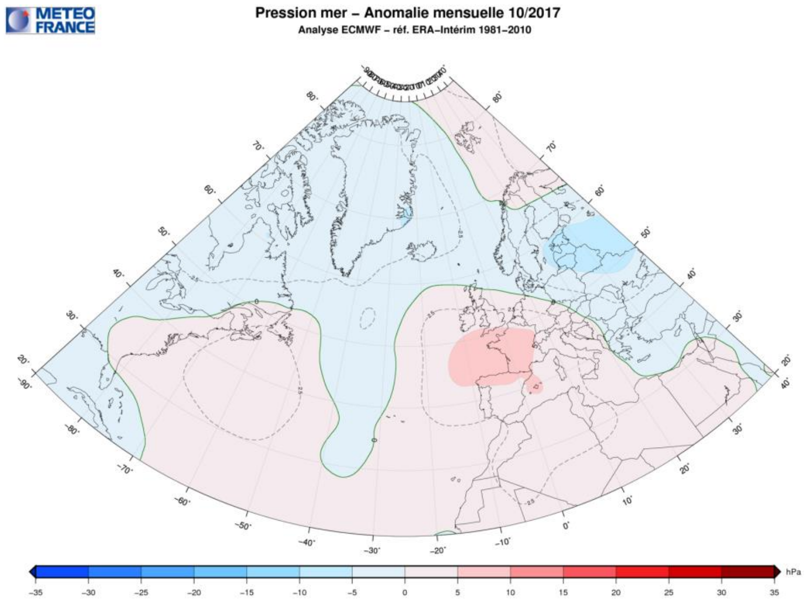
Figure 10: Anomalies of Geopotential height at 500hPa (Météo-France)

MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
OCT 17	0.7	0.6	0.7	-0.6	-0.3	---	-0.0	0.3	-1.2
SEP 17	-0.5	1.6	-1.2	-0.5	-0.3	---	-2.5	0.5	-1.7
AUG 17	-1.5	2.0	-1.4	-1.6	0.2	---	-2.9	-1.6	1.8
JUL 17	1.3	1.8	0.5	0.0	1.3	---	-0.6	0.0	-0.1
JUN 17	0.4	2.0	-0.8	0.5	1.2	---	0.3	-1.4	-0.1
MAY 17	-1.7	0.5	0.7	-0.7	-0.2	---	1.5	0.9	0.5
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

Table 2: 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

Sea level pressure and circulation types over Europe

High pressure dominated over much of Europe, the Mediterranean and North Africa, particularly in western parts. Less anticyclonic / cyclonic in the east.



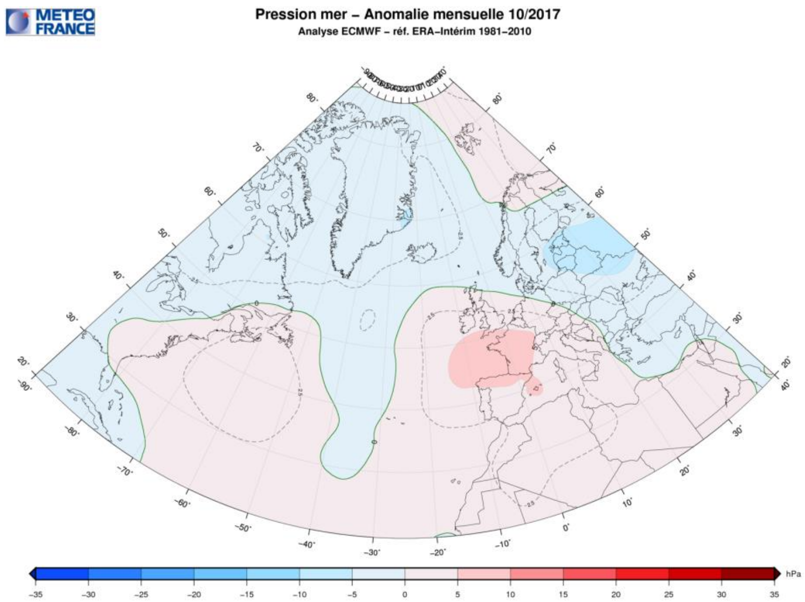


Figure 11: Mean sea level pressure over the North Atlantic, Europe and North Africa (top) and 1981-2010 anomalies (bottom) (Météo France)

Circulation indices: NAO and AO

NAO was in a positive phase during the first half of the month (Fig. 12), but switched to a negative phase in the second half, but mainly with little intensity. The AO phase was also positive in the first half, but became neutral in the second half.

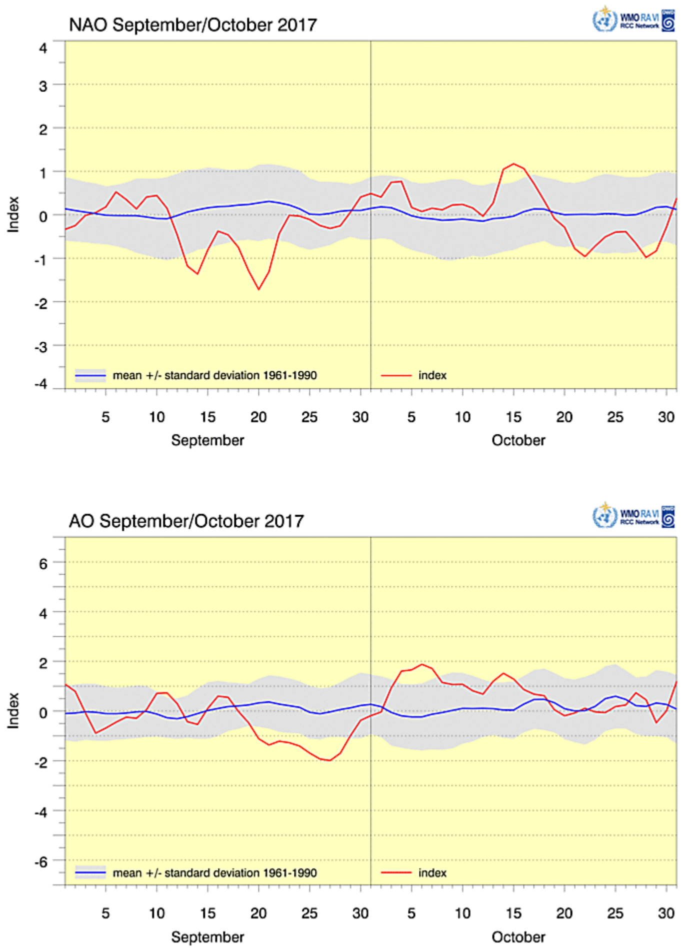


Figure 12: North Atlantic Oscillation (NAO, left) and Arctic Oscillation (AO, right) indices with 1961-1990 mean standard deviation (shading). http://www.dwd.de/rcc-cm , data from NOAA CPC: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml

Weather types

The most frequent weather type in October 2017 according to Météo France classification was Atlantic ridge. Also the Blocking type had a relatively high frequency but with decreasing tendency (Fig. 13).

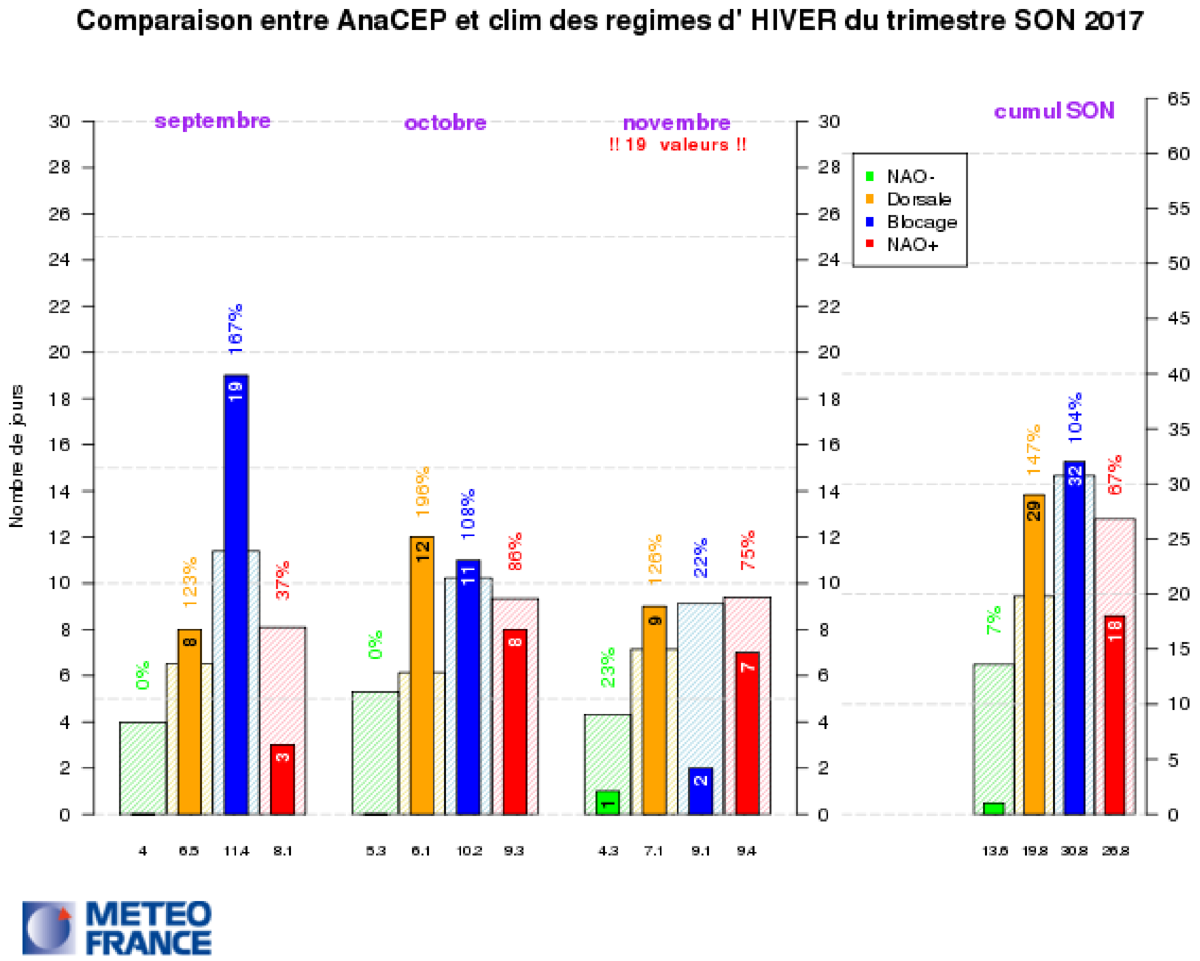


Figure 13: Distribution of weather types of Météo France classification: NAO-, Atlantic ridge (Dorsale), Blocking (Blocage), NAO+. Source: Météo France, http://seasonal.meteo.fr/fr/content/suivi-clim-regimes-trim

Summary of Circulation Analysis for the MedCOF domain:

There is a clear tendency for La Nina development since late summer 2017. A teleconnection to Europe/Mediterranean is possible, but not clear to detect. An intense wave structure can be found in the northern middle latitudes, propagating from the North Pacific to Western Europe. An anticyclonic pattern dominated particularly over the western parts of the domain with decreasing influence in eastern parts.

4. Temperature anomalies

Global

October 2017 was one of the warmest October months on record globally. A significant contribution came from the polar regions, but also several areas on all continents had high positive anomalies, though there were also some negative ones (Fig. 14). The following are especially remarkable:

- over western Europe, large positive anomaly, close to classical impact of EA mode (cf http://seasonal.meteo.fr/fr/content/suivi-clim-modes-impacts)
- over the rest of the Eurasian continent, large negative anomaly, probably related (at least partly) to the early snow cover over Siberia.
- over North America, strong positive anomalies in Alaska and Eastern Canada. At the contrary, negative anomaly (significant) over the western part of US.

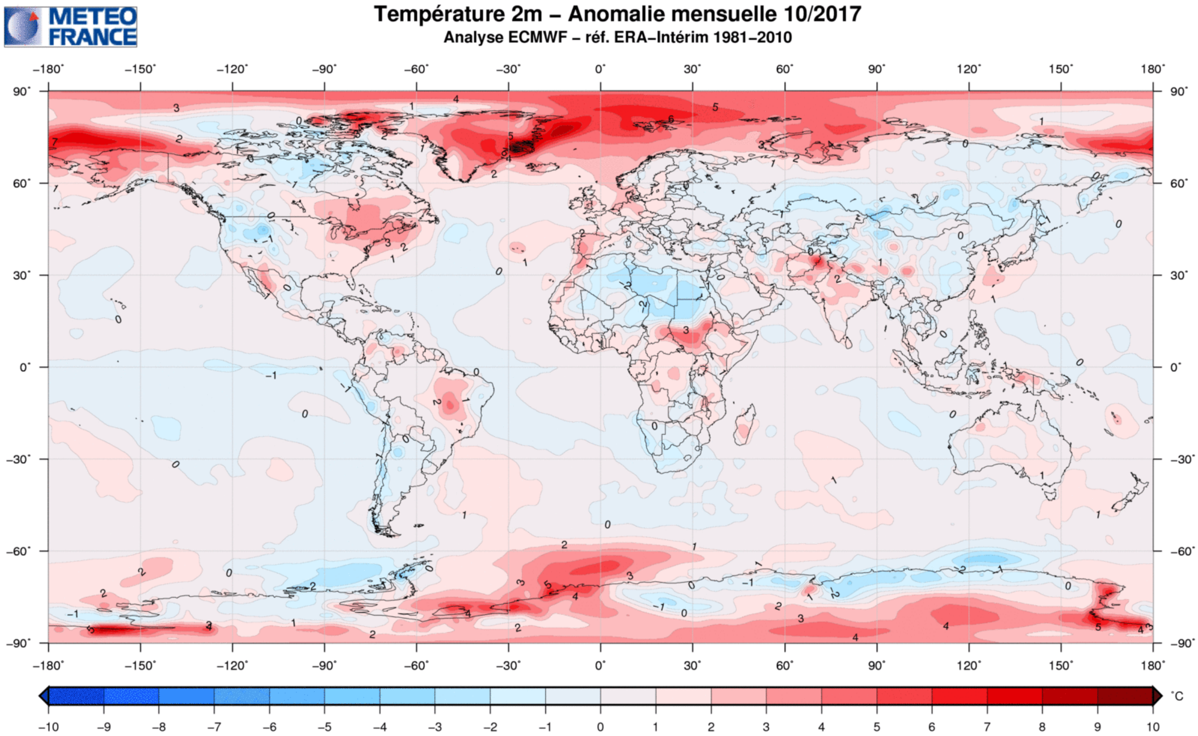


Figure 14: Temperature Anomalies (°C) (Meteo-France)

Europe / RA VI

Monthly mean temperature in the lowlands in October 2017 ranged from around 7°C in the northern Ukraine to around 23°C in the Middle East (Fig. 15).

Anomalies (1981-2010 reference) were above normal and mostly in the upper tercile particularly in Iberia and much of France. In the rest of the domain mean temperatures were mainly around normal, but locally well above or below. Highest anomalies were recorded in Spain (above +3°C for 1981-2010 reference, above +4°C for 1961-1990), due to most intense high pressure influence.

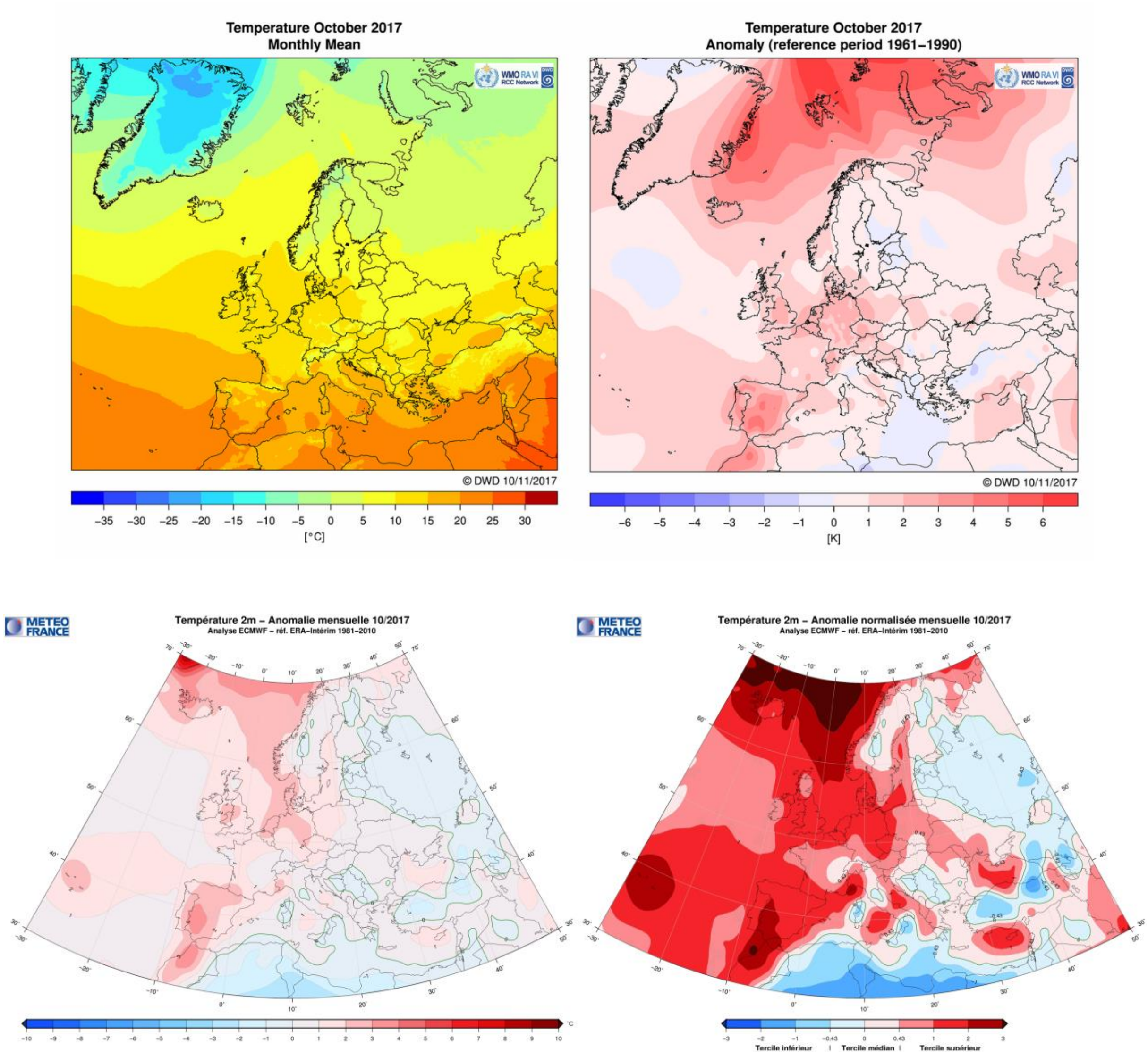


Figure 15: Mean temperature (upper left) and anomalies (1961-1990 reference, upper right) in °C in the RA VI Region (Europe) interpolated from CLIMAT station data, for October 2017. Source: DWD, http://www.dwd.de/DE/leistungen/rcccm/int/rcccm_int_ttt.html?nn=490674.

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

North Africa

During the month of October 2017, registered temperatures were above normal over the north-central and western region of the North African Domain. Monthly mean temperature in October 2017 ranged from less than 12°C in the North and central-east of Morocco and north of Algeria to above 30°C in southern Morocco and 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 north-western regions and south of Morocco. Some records have been noticed at several stations. Central and eastern regions of the North African domain have registered near normal temperature with a tendency to below normal. All of Tunisia, north and east of Libya have registered a negative temperature anomaly especially in the north-west of Libya where it reached -3°C.

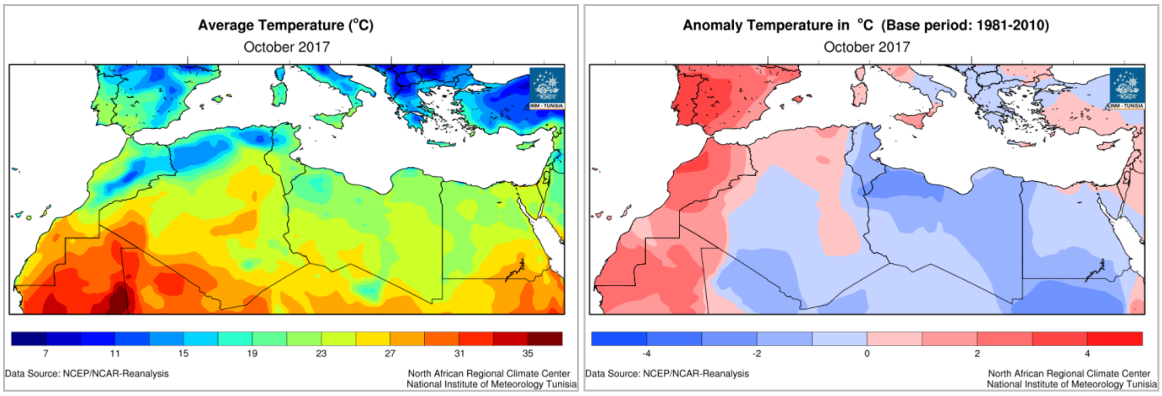


Figure 16: Left: Mean temperature; Right: Absolute anomalies of temperature in the RAI-NA Region (North Africa) Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010), http://www.meteo.tn/htmlen/donnees/climatemonitoring.php.

5. Precipitation anomalies

Global

- In agreement with SST anomalies and velocity potential anomalies, above normal rainfall for the Maritime Continent (particularly over the east) and India, and below normal over the Equatorial Pacific.
- Drier than normal over West-Africa and for Amazonia where rainfall deficits have been persisting since April.
- Drier than normal for the Caribbean, wetter than normal over Central America.
- Over Europe, strong contrast between West/South-West (very dry) and East (very wet), consistent with Z500 anomalies.

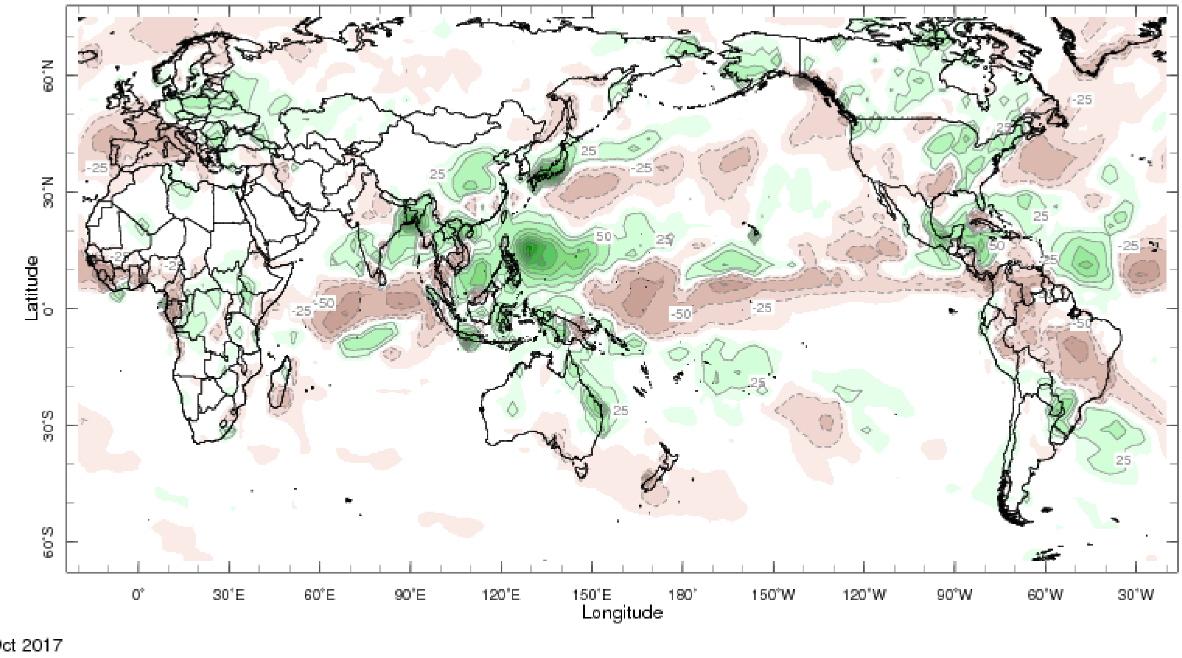


Figure 17: Rainfall Anomalies (mm) (departure to the 1979-2000 normal) – Green corresponds to above normal rainfall while brown indicates below normal rainfall.
http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/Anomaly.html

Europe / RA VI

Some places in Iberia, southern France and Italy received very little precipitation, as well as the typically arid parts in the Middle East (Fig. 18). In the other parts of the domain there is a variety from 10mm in southern parts up to more than 200mm at the eastern Black Sea.

Compared to the 1981-2010 normal the dry places in Iberia, southeastern France, Italy and the Middle East received less than 20% of the normal precipitation. Apart from that the whole western part of the domain from Portugal to the west coast of the Balkans was drier than normal, partly below the 10th percentile, in line with high pressure influence. Eastern parts of the domain from eastern Croatia / Hungary to South Caucasus were wetter than normal, except central Turkey, almost the whole part of the Middle East and places at the Caspian Sea. Partly the totals were above the 90th percentile, especially in places close to the Black Sea and in the northern Ukraine.

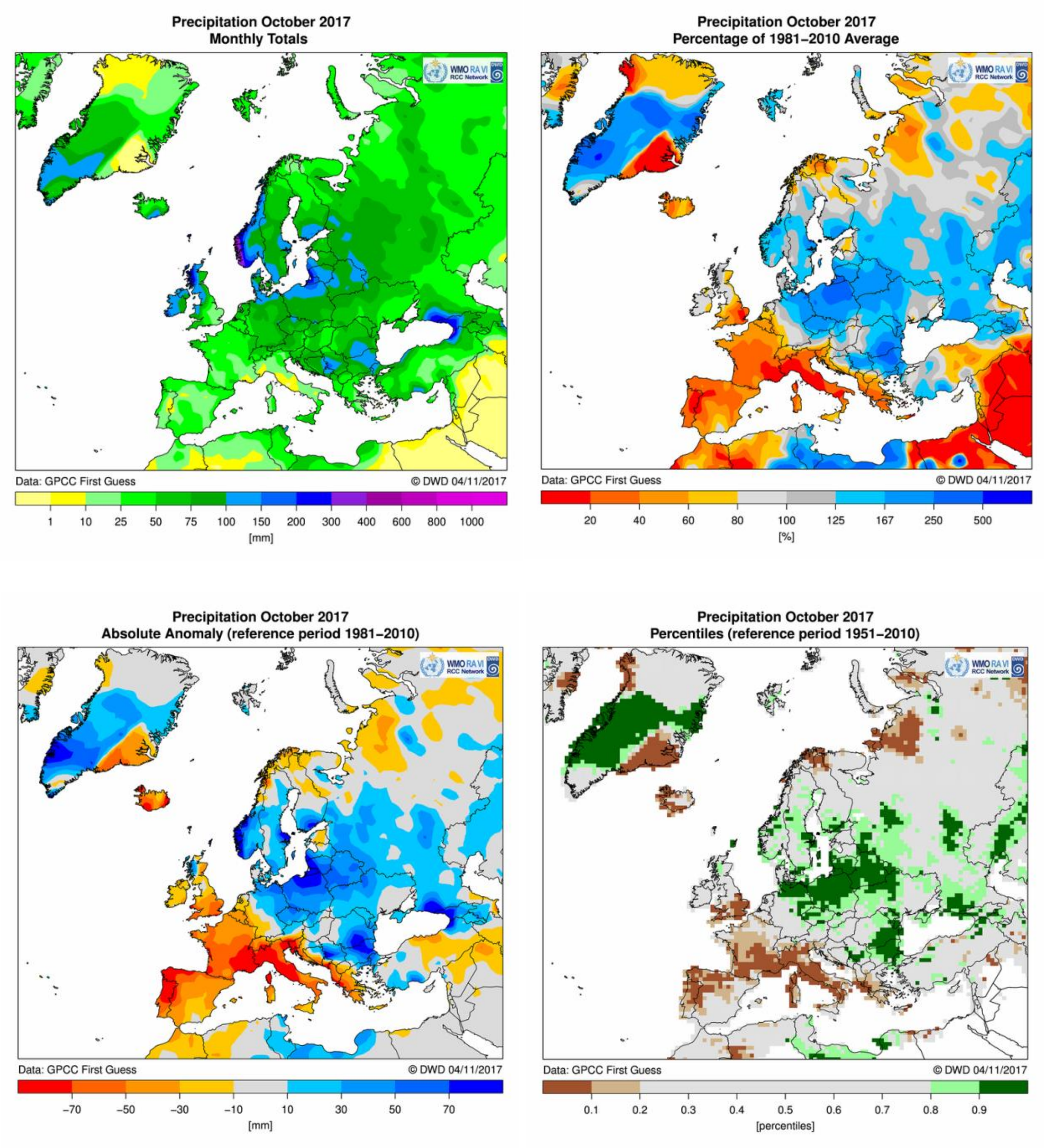


Figure 18: Monthly precipitation sum (upper left), percentage of normal (upper right), absolute anomalies (lower left), and percentiles for October 2017 (1981-2010 reference for means, percentages and anomalies, 1951-2010 for percentiles) in Europe. Data from GPCC (First Guess version). Source: DWD, http://www.dwd.de/DE/leistungen/rcccm/int/rcccm_int_rrr.html?nn=16102

North Africa

Monthly precipitation totals in October 2017 were below 20 mm over almost all of the RA I domain. Rainfall amounts exceeding 20 mm were registered in the extreme north of Morocco and Algeria, all of Tunisia and in the north of Libya. Maximum monthly amounts were registered over the extreme north-east of Tunisia. During this month, the south of Tunisia, north and center-east of Libya and the center-west of Algeria had known above-normal totals of precipitation. In these regions rainfall amounts were greater than 250% of rainfall normal amounts and reached locally 500% of normal.

Near normal conditions occurred over the center and north-west of Tunisia and eastern parts of Algeria. 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.

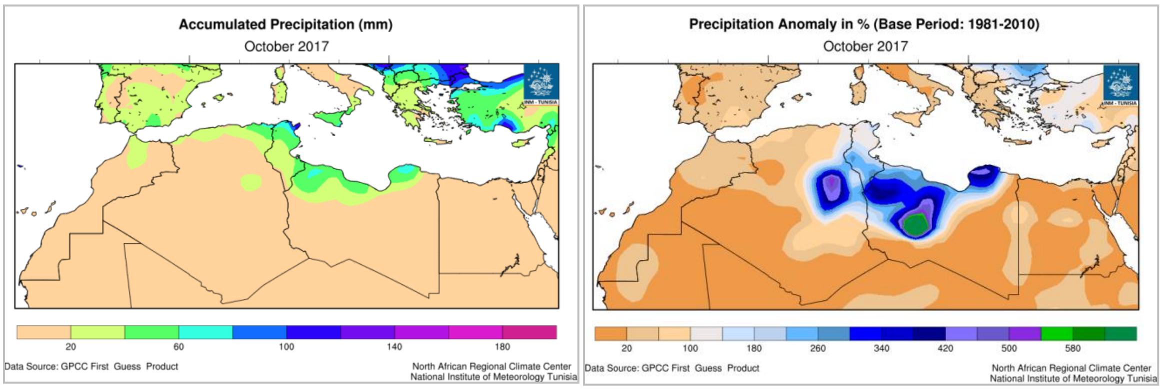


Figure 19: Left: Total precipitation; Right: Precipitation in percent of normal in the RAI-NA Region (North Africa)
Data from NCDC (National Climate Data Centre NOAA – reference 1981-2010)
http://www.meteo.tn/htmlen/donnees/climatemonitoring.php.

6. Sea ice

- In the Arctic, the ice extent remained well below the 1981-2010 normal
- For the Antarctic, the deficit remained also very high, with an annual maximum just above the 2016 record level. (Fig. 20-22).

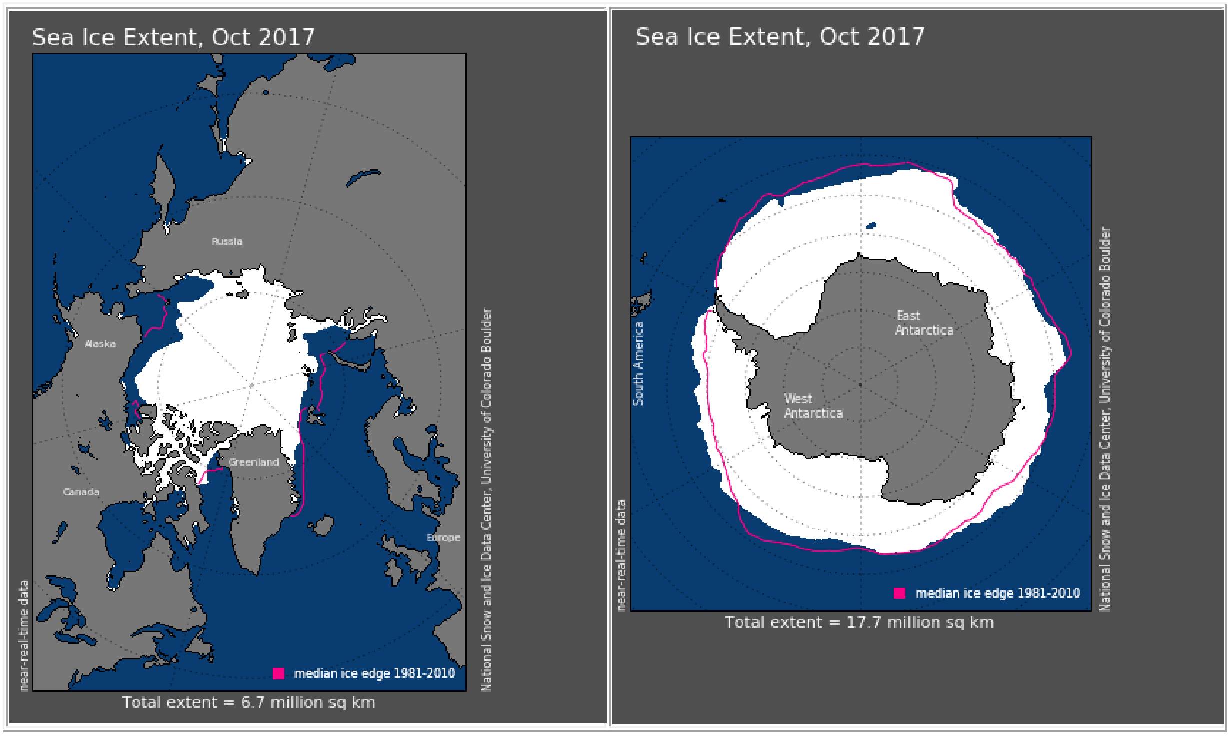


Figure 20: Sea-Ice extension in the Arctic (left) and in the Antarctic (right). The pink line indicates the averaged extension (for the 1979-2000 period). http://nsidc.org/data/seaice_index/

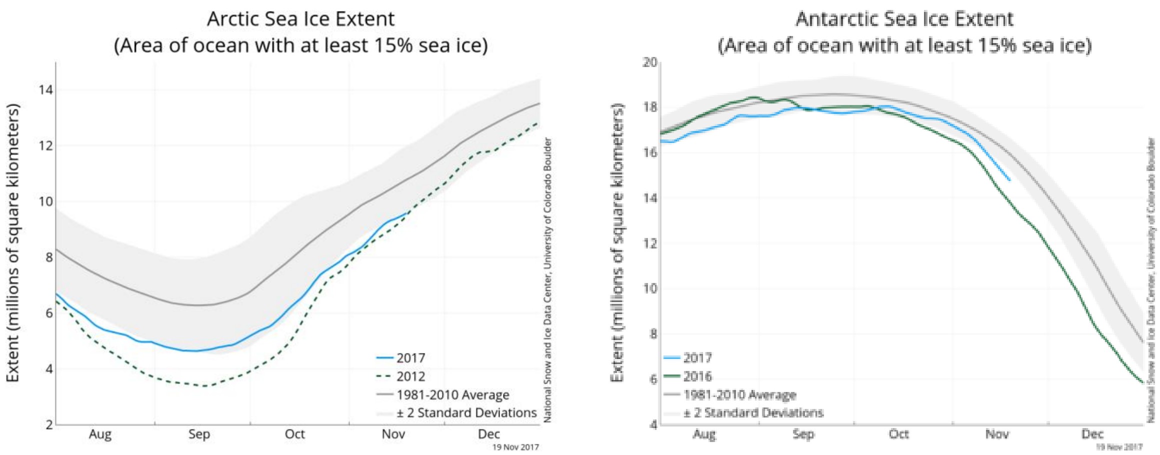
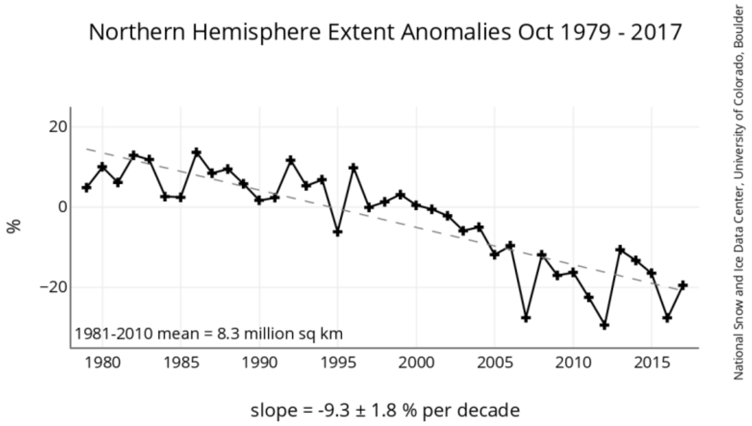


Figure 21: Sea-Ice extension evolution from NSIDC.
https://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png



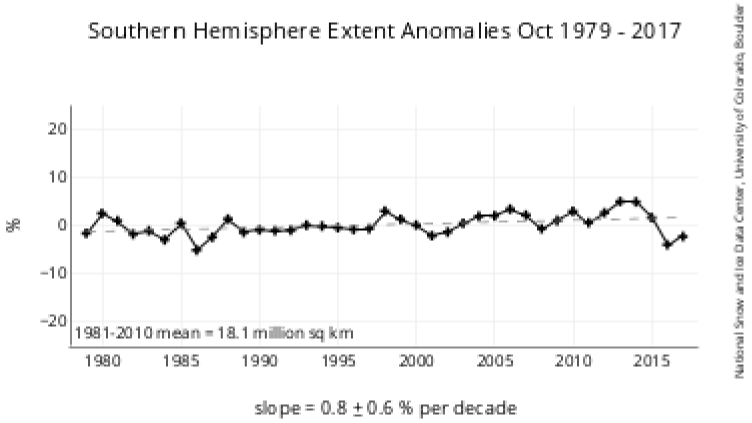


Figure 22: Monthly Sea Ice Extent Anomaly Graph for the northern and southern hemisphere for the month of analysis (http://nsidc.org/data/seaice_index/)

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

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