GLOBAL CLIMATE BULLETIN

n°229 – July 2018

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I. DESCRIPTION OF THE CLIMATE SYSTEM (May 2018)

I.1.Oceanic analysis

Over the Pacific Ocean :

Neutral pattern :

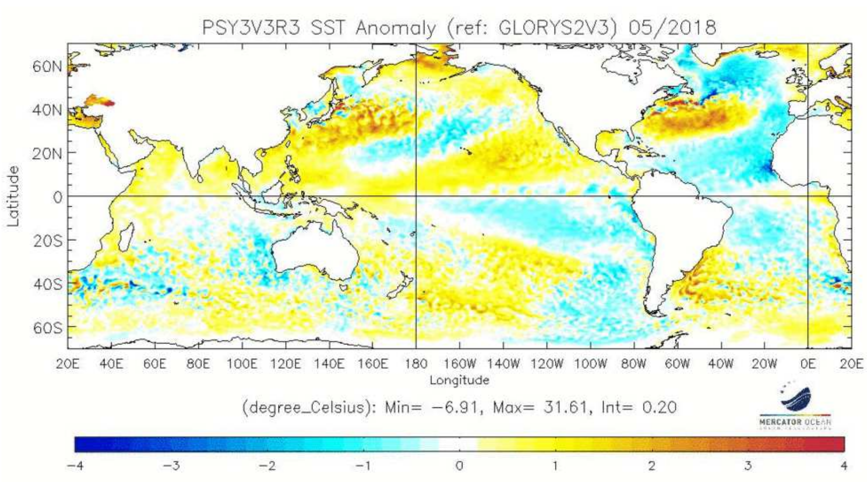
- Along the Equator, return to a neutral pattern after several months of La Niña configuration (see fig. I.I.4). In subsurface, substantial warming (Kelvin wave) spreading eastward.
- In the northern hemisphere, mainly positive anomalies in the tropics. No clear PDO pattern visible, the index remains weakly negative (-0.6 for this month, see https://www.ncdc.noaa.gov/teleconnections/pdo/)
- In the southern hemisphere, warm anomalies decreasing in the Western part of the basin, especially around New Zealand. And a large negative anomaly in the Eastern sub-tropics.

Over the Indian Ocean :

- warm anomalies (<1℃) in the Northern hemisphere. To the South (up to 20℃), the contrast between western and eastern parts has eased down.
- DMI slightly above zero (source : MERCATOR-Ocean)

Over the Atlantic:

- In the North Atlantic, a horseshoe-like pattern has formed in May, with record-cold tropical SSTs.
- along the equator, weak warm conditions. Combined with cold northern SSTs, the TASI index has been strongly negative during the month, and the TNA index was close to -1℃.
- the southern basin has cooled down.



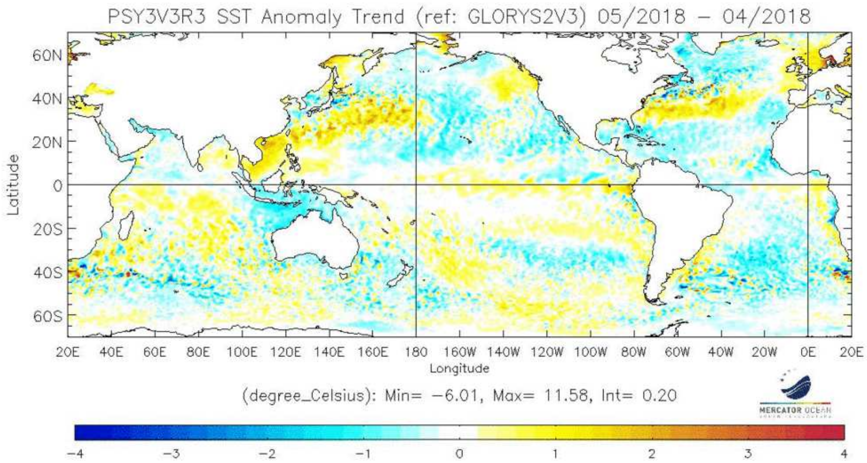


fig.I.1.1: top : SST Anomalies (℃) . Bottom : SST tendency (cur rent – previous month), (reference Glorys 1992-2013).

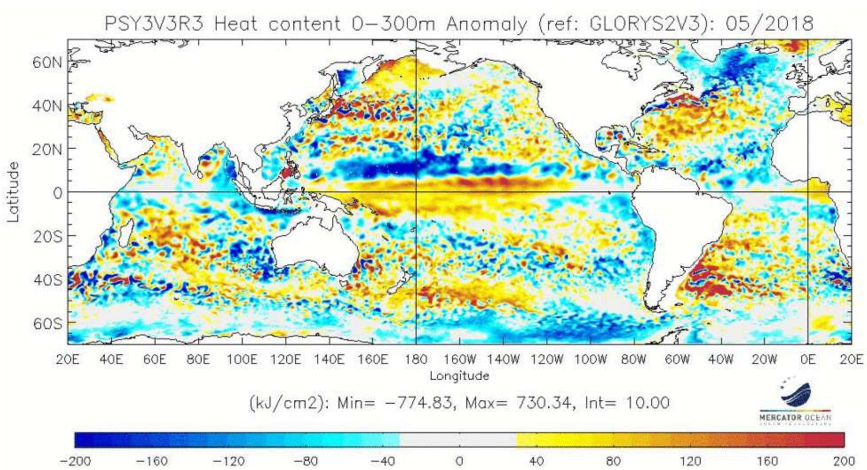


fig.I.1.2: map of Heat Content Anomalies (first 300m, kJ/cm2, reference Glorys 1992-2013)

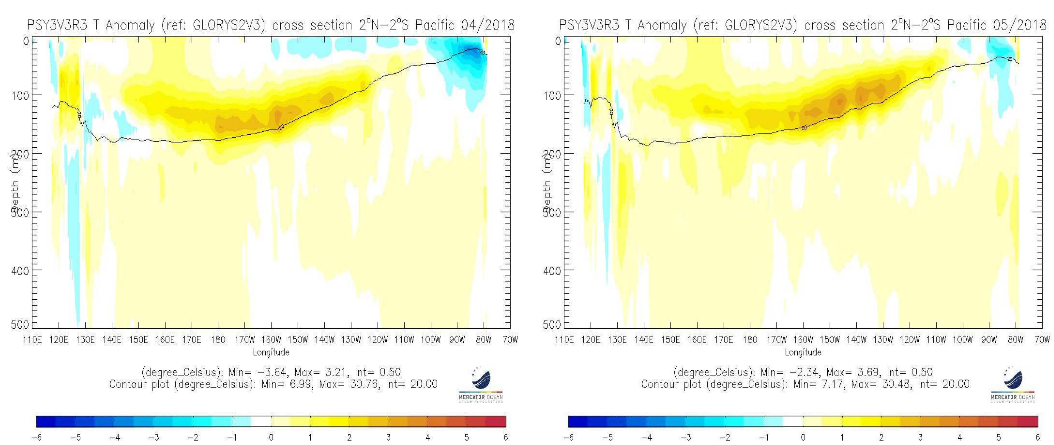


fig.I.1.4: Oceanic temperature anomaly in the first 500 meters in the Equatorial Pacific (previous and current month)

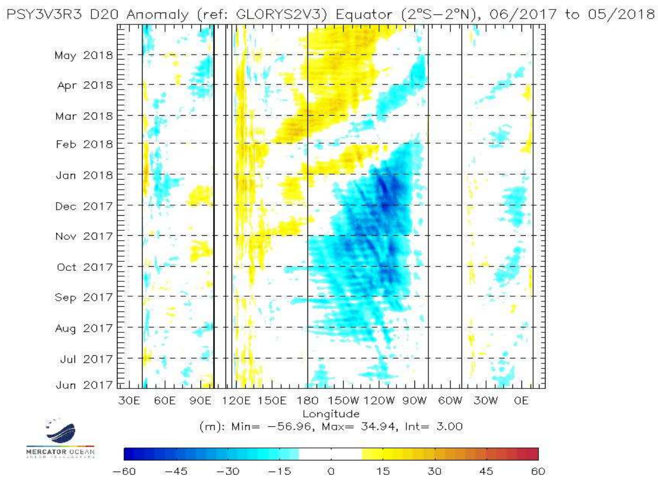


fig.I.1.5: Hovmüller diagram of Thermocline Depth Anomalies (m) (depth of the 20℃ isotherm) along the equator for all oceanic basins over a 6 month period

Sea surface temperature near Europe :

Arctic Sea: not much change compared to April. Mainly warmer than normal, only south of Svalbard slightly colder than normal (could be a small-scale circulation effect due to sea ice further north)

North Atlantic, south of Iceland: The horse-shoe pattern (see above) has more developed in intensity, that means the cold anomalies and also the warm anomalies in between of that pattern have become stronger. The main reason is that both the Azores High and the Icelandic Low have shifted to the north. The Azores High has the same position as the warm SST anomaly which was triggered by subsidence. The cold SST anomalies are mainly caused by the cold flow north of and around the Azores High. In Europe, mainly Spain was affected by this pattern, but anomalies did not change much in that area.

North Sea: Anomalies have changed from cold to warm since April. The warming has come from extension of the Azores High to Europe.

Baltic Sea: Again a substantial change from cold to warm, particularly in the southern part. Anomalies were much lower in the north of the basin because this part was still frozen in April, so some of the thermal energy was needed to remove the sea ice first.

Biscay: warming from normal to warmer SST anomalies. Same effect like for North and Baltic Sea. This area was not affected significantly by the horse-shoe pattern.

Mediterranean: Western Mediterranean slightly colder than normal, more or less like in April. Might be due to the horse-shoe pattern circulation, but only temporarily. Eastern basin warmer than normal with high anomalies especially on the Adriatic Sea and near Turkey due to ongoing subtropical warming. Adriatic Sea temperatures were higher than 20℃ on monthly average, which is not usual in May.

Black Sea: Also much warmer than normal due to subtropical air masses. Anomalies are quite different within that sea surface area due to local circulation effects, but warming was everywhere.

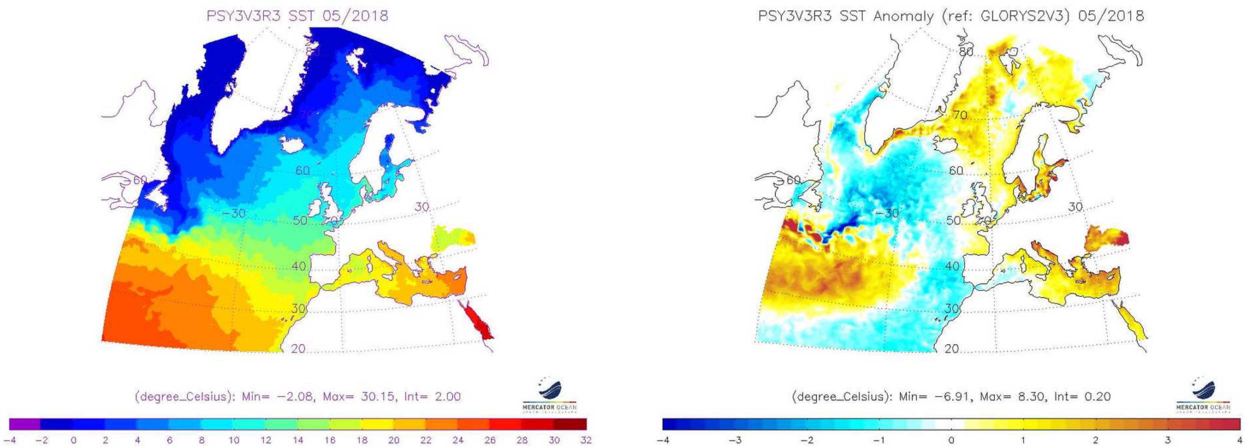


fig.I.1.6 : Mean sea surface temperature in the RA VI Region (Europe) and anomaly (reference Glorys 1992-2013).

I.2. ATMOSPHERE

I.2.a General Circulation

Velocity Potential Anomaly field in the high troposphere (fig. 1.2.1. a – insight into Hadley-Walker circulation anomalies) :

- strong negative anomalies over Africa and western Indian Ocean, in agreement with the active phases of the MJO in May. Strong negative anomalies over the Pacific basin, especially in the southern hemisphere.

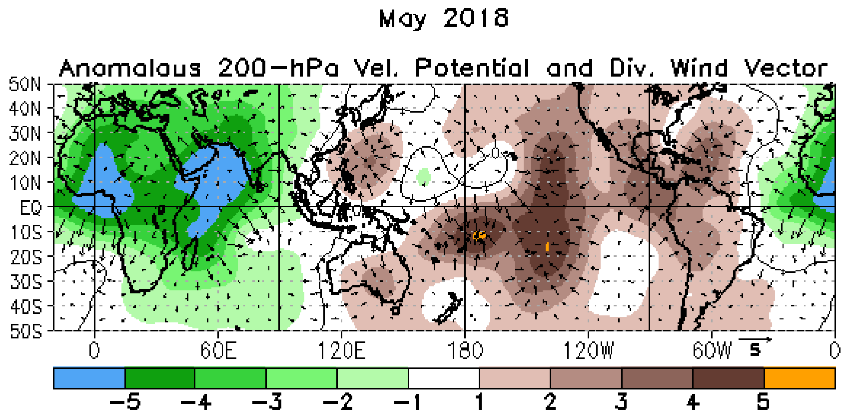


fig.I.2.1.a: Velocity Potential Anomalies at 200 hPa and associated divergent circulation anomaly. Green (brown) indicates a divergence-upward anomaly (convergence-downward anomaly). http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

SOI :

- SOI remains neutral at +0.4 (NOAA Standardized SOI: https://www.ncdc.noaa.gov/teleconnections/enso/indicators/soi/).

MJO (fig. I.2.1.b)

- Active MJO in phases 1, 2 and 3 (green curve).

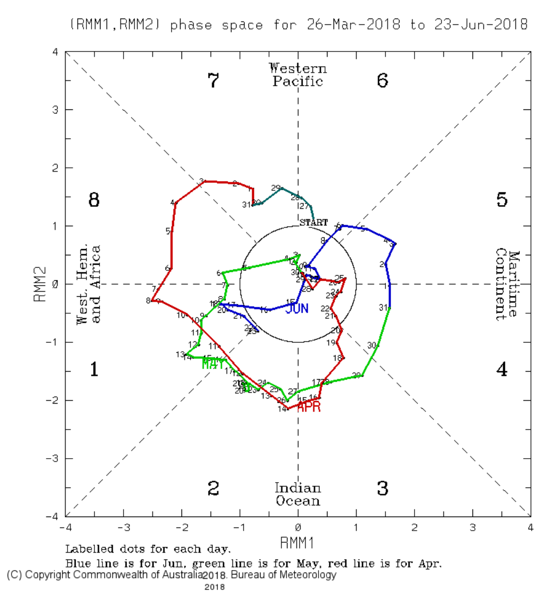


fig.I.2.1.b: indices MJO http://www.bom.gov.au/climate/mjo/

Stream Function anomalies in the high troposphere (fig. 1.2.2 – insight into teleconnection patterns tropically forced):

- the La-Niña-like signal still visible in April has disappeared in May. There is now no clear signal emanating from the tropics.
- the strong anticyclonic anomalies in the northern hemisphere seem to originate from mid or high latitudes.

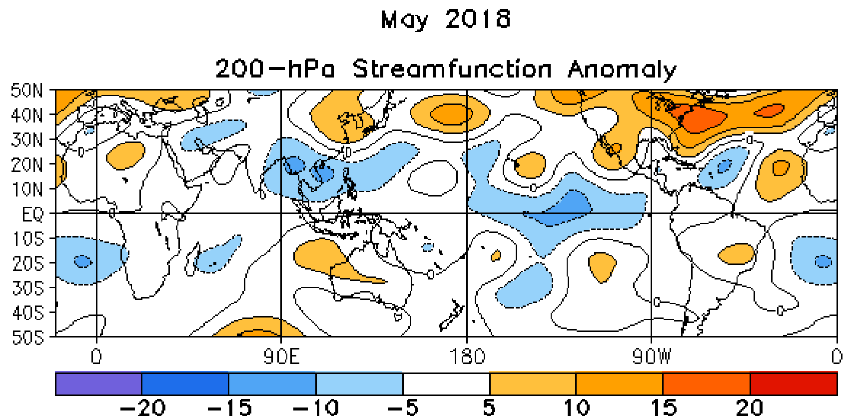


fig.I.2.2: Stream Function Anomalies at 200 hPa.
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt22.shtml

Geopotential height at 500 hPa (fig.1.2.3 – insight into mid-latitude general circulation):

- strong anomalies in the Northern Hemisphere, with a strong blocking pattern over western Europe (see table below) combined with a positive NAO over the Atlantic.
- on the North-American continent, negative PNA configuration.

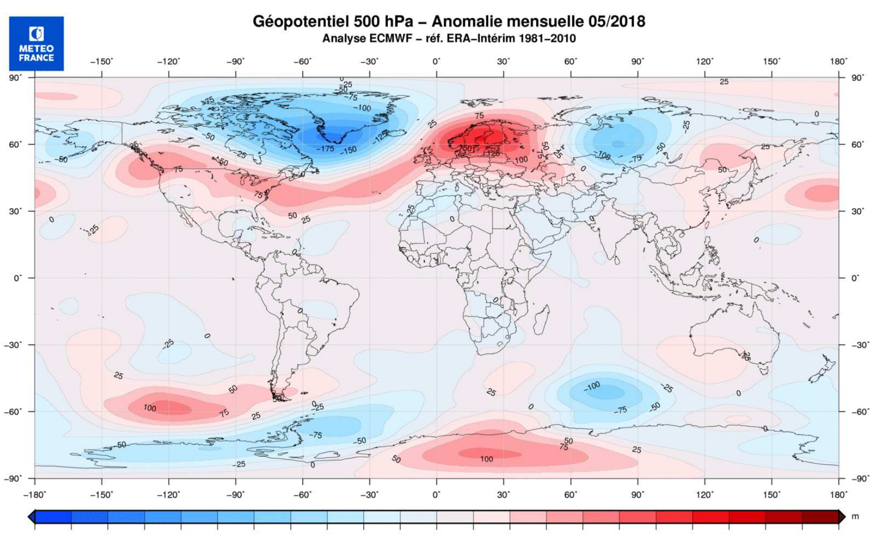


fig.I.2.3: Anomalies of Geopotential height at 500hPa (Meteo-France)

MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
MAY18	2.0	-0.1	-0.2	-1.0	-1.1	---	-1.4	1.7	-0.3
APR 18	1.2	1.1	-0.7	-0.2	-1.1	---	0.5	0.3	-1.3
MAR 18	-1.4	-0.6	0.8	0.3	-1.2	---	4.0	-0.8	0.1
FEB 18	1.3	-1.4	0.4	0.2	-1.7	2.2	-1.4	0.4	-2.2
JAN 18	1.2	0.6	0.4	0.7	-0.1	-0.3	-1.6	0.4	-1.5
DEC 17	0.7	-0.5	0.3	---	0.6	1.0	-1.6	-0.5	-2.0
NOV 17	-0.1	0.1	0.7	0.4	-2.0	---	-1.2	-0.1	-2.2
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

Evolution of the main atmospheric indices for the Northern Hemisphere for the last 9 months. (see http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/table3.shtml for the most recent 13 months).

Sea level pressure and circulation types over Europe

Both Icelandic Low and Azores High intensified since April, though the latter one only slightly. This resulted in an increase of NAO index from 1.2 to 2.0. EA+ phase is no longer active due to a shift of these patterns to the north. The other circulation feature important for Europe is the blocking ridge extending far to the north over Scandinavia and western Russia, contributing to both quite intense SCAND+ (1.7) and EATL/WRUS- (-1.4) patterns.

Correspondingly, MF weather type classification shows only 2 circulation types for May: Scandinavian Blocking (17 days) and NAO+ (14 days), while there were no Atlantic Ridge and NAO- types that month (referring to the winter regime classification; although May is part of the warm season, it seems to be better to use the winter than the summer regime because NAO+ is better represented in the winter regime classification).

Analog to the trough-ridge pattern (strong meridional component) in 500hPa, there is a high pressure bridge near surface extending from the subtropical North Atlantic to northern Europe, but with a separate high pressure core over Scandinavia. This means the Scandinavian High does not only have a blocking function of the North Atlantic flow, it also separates a dry warm air mass in northern Europe from an also warm, but instable air mass in southern Europe, which was more under cyclonic influence.

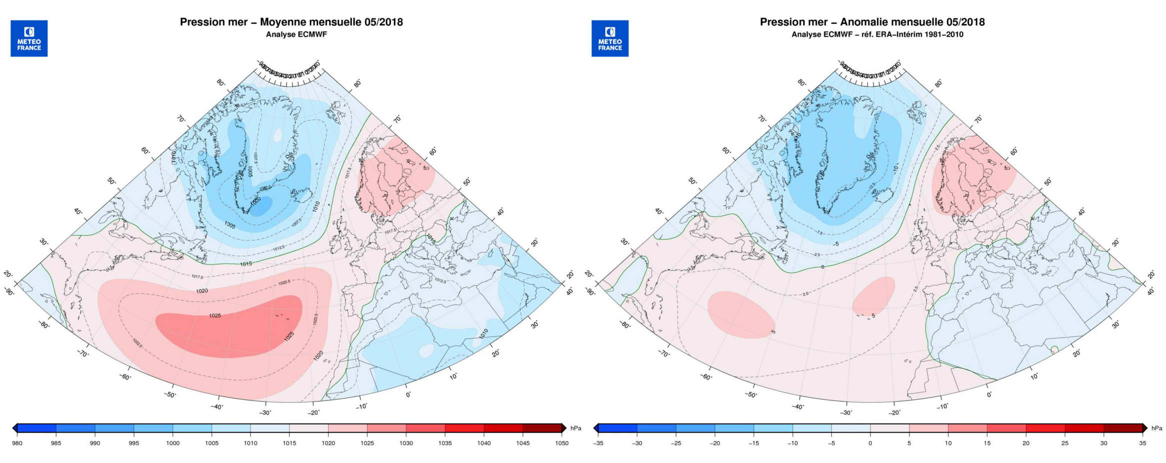


fig.I.2.4: Mean sea level pressure in the RA VI Region (Europe) (top) and 1981-2010 anomalies (bottom).

Circulation indices: NAO and AO

NAO index was positive during the whole month of May. The highest index values (highest intensity) were at the beginning of the month (close to +3 which is extraordinary), weakening to values around +1 (around 1 standard deviation).

AO shows a rather similar development, also a positive phase throughout the month, strongest at the beginning of the month. This means more zonal than normal. Meridional circulation is quite usual for May, so this deviation means a mix of zonal (NAO+) and meridional components (like the ridge over northern Europe and the trough over Greenland). Generally, AO+ patterns mean a higher separation of air masses than usual, like between northern and southern Europe.

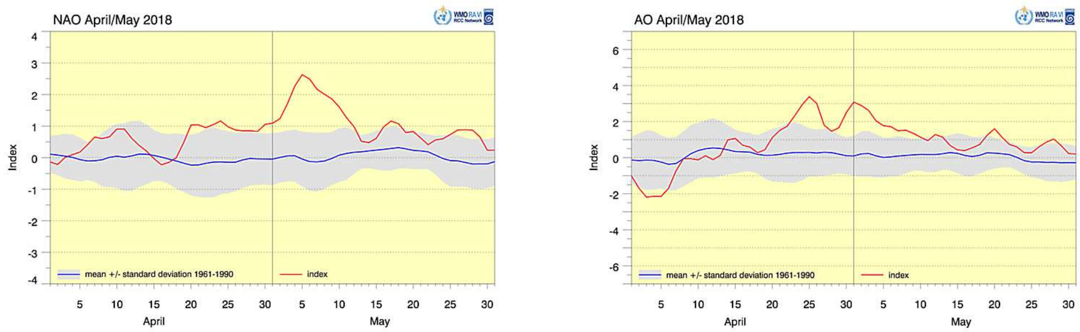


fig.I.2.5: North Atlantic Oscillation (NAO, left) and Arctic Oscillation (AO, right) indices with 1961-1990 mean standard deviation (shading). http://www.dwd.de/rcc-cm , data from NOAA CPC: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml

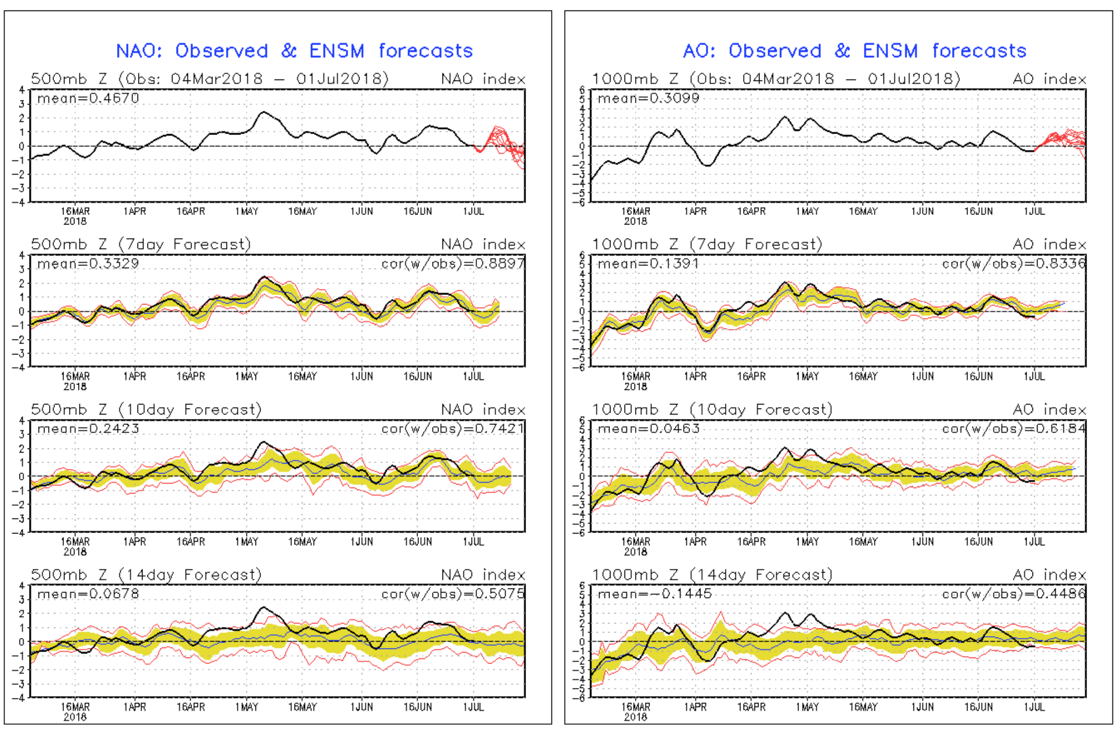


fig. I.2.5a: North Atlantic Oscillation (NAO, left) and Arctic Oscillation (AO, right) indices for the last 4 months and forecasts for the following weeks. Source: NOAA CPC, http://www.cpc.ncep.noaa.gov/products/precip/CWlink

/daily_ao_index/teleconnections.shtml

I.2.b Precipitation

- In agreement with velocity potential anomalies, wet conditions prevailed over eastern Africa, Oman, Yemen, south India and western Indian Ocean.
- no clear signal for the Maritime Continent, lacking any organized pattern of SST or VP200 anomalies.
- still dry over Brazil and dry conditions beginning over the eastern Carribean. Over Europe, dry to the north, wet to the south (in agreement with the blocking pattern).

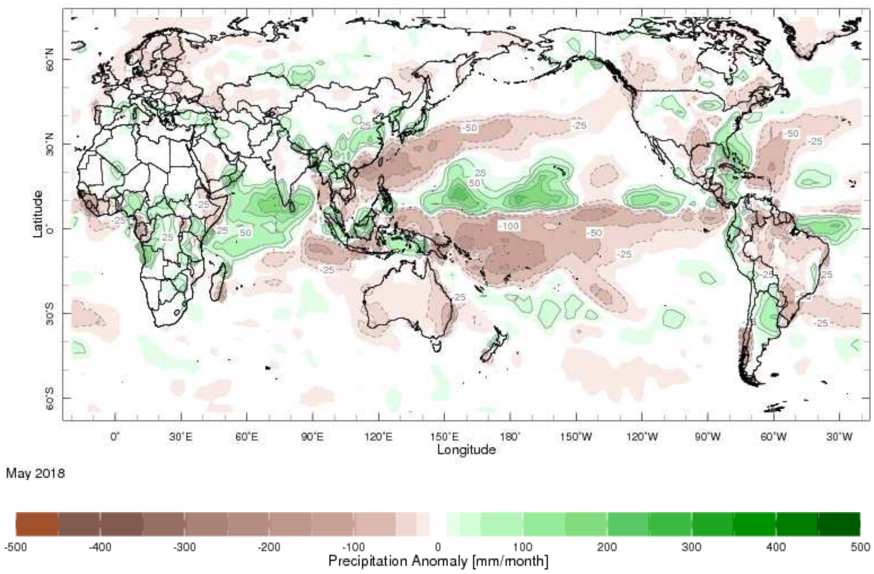


fig.I.2.6: Rainfall Anomalies (mm) (departure to the 1979-2000 normal).
Green corresponds to above normal rainfall while brown indicates below normal rainfall.
http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/Anomaly.html

Precipitation anomalies in Europe:

As explained above, clear separation between dry areas in the north from wet areas in the south of Europe due to surface pressure. There were also local effects, also in the dry area, especially in southern Scandinavia, northeastern Germany and Baltic countries with anomalies of -20mm or below, which was essential for the north, causing severe drought with large crop losses and early harvest in June. Nevertheless, precipitation totals were below the 10th percentile over almost entire northern Europe.

In the south, precipitation was mostly convective in the instable air mass, so the 90th percentile was exceeded locally due to heavy precipitation, especially over the warm water in the Mediterranean and the Adriatic Sea. This precipitation also caused much flooding in this region combined with strong convective gusts and damage including fatalities.

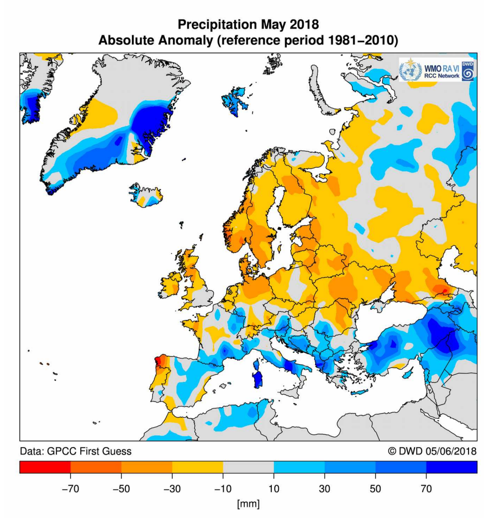


fig.I.2.7.a : Absolute anomaly (1951-2000 reference) of precipitation in the RA VI Region (Europe), data from GPCC (Global Precipitation Climatology Centre), http://www.dwd.de/rcc-cm.

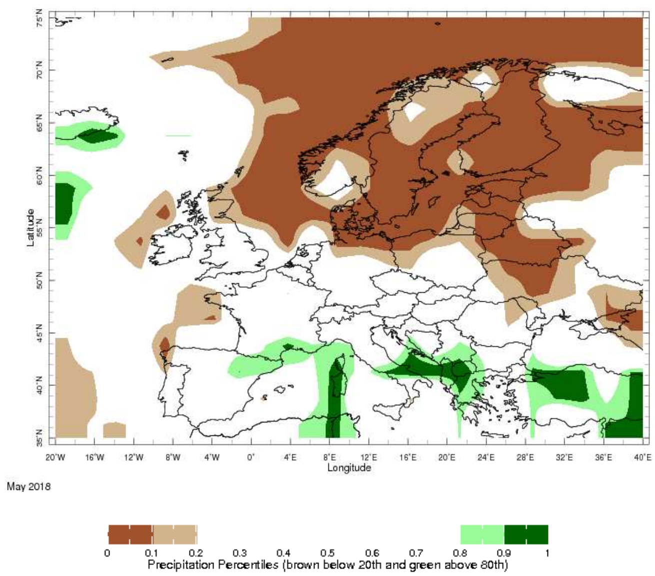


fig.I.2.7.b : Percentiles of precipitation, 1981-2010 reference. Data from NOAA Climate Prediction Center, http://iridl.ldeo.columbia.edu/maproom/Global/Precipitation/Percentiles.html

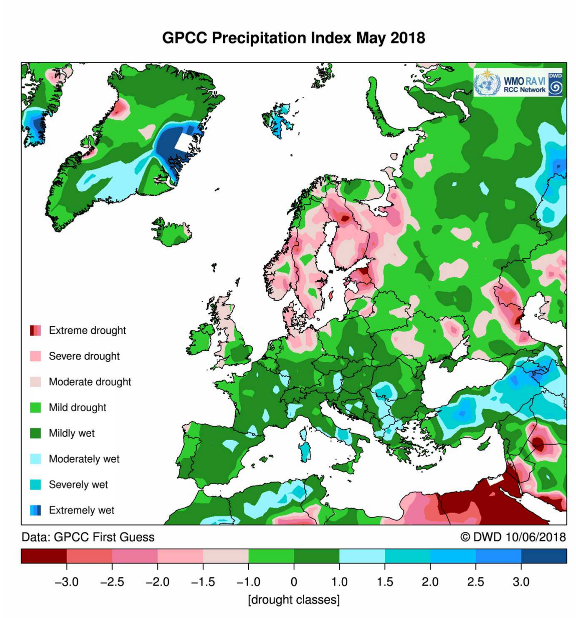


fig. I.2.8: GPCC Precipitation Index, http://www.dwd.de/rcc-cm .

Monthly mean precipitation anomalies in European subregions. Subregions refer to ECMWF land boxes defined in Annex III.3. Anomalies are based on gridded data from GPCC First Guess Product, ftp://ftp-anon.dwd.de/pub/data /gpcc/PDF/GPCC_intro_products_2008.pdf, 1951-2000 reference.

Subregion	**Absolute anomaly**	**GPCC Drought Index**
Northern Europe	- 23.4 mm	- 1.144
Southern Europe	+ 3.5 mm	+ 0.409

Please note: new drought index since January 2016. The GPCC drought index, which also considers evaporation in addition to precipitation replaces the former SPI-DWD.

I.2.c Temperature

- Record warmth over Europe (see below), especially over Scandinavia.
- Also a large positive anomaly over the USA, leading to the warmest May on record for the country.
- Cold anomalies for Quebec, Greenland, Central Siberia, and western Africa from Marocco to Senegal.

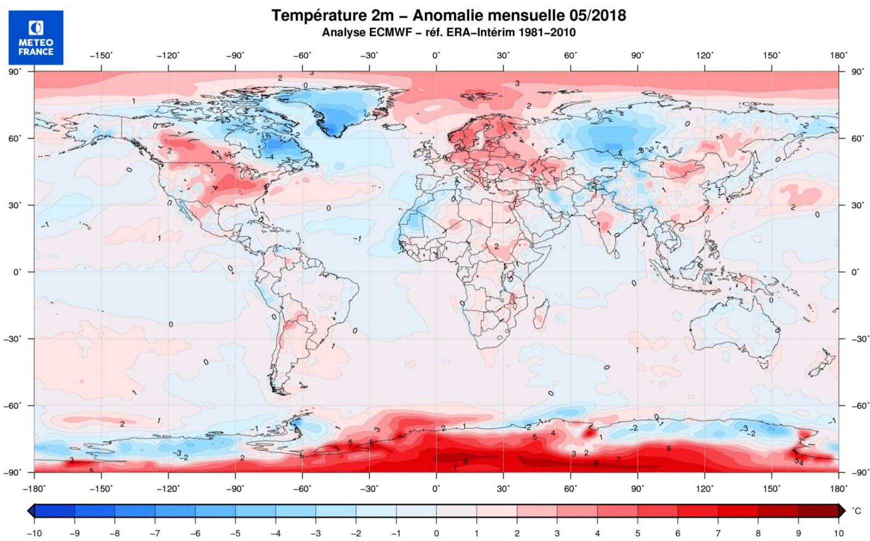


fig.I.2.9: Temperature Anomalies (℃) (Meteo-France)

Temperature anomalies in Europe:

Mostly warm over Europe. Highest anomalies in Scandinavia due to most intense high pressure influence and subsidence. Further south, influence of subtropical air masses.

It was record warmth in many places, especially in the north. Even countries in Central Europe (e.g. Germany) noted their warmest May on record since 1881. Snow in the mountains melted quickly.

Over the North Atlantic, the hose-shoe pattern can be identified like for SST (see above). This explains that a few places in Europe were cooler than normal (Iberia and Western Mediterranean). Greenland and Iceland were also cooler in May; they were within a trough area (see fig.I.2.4).

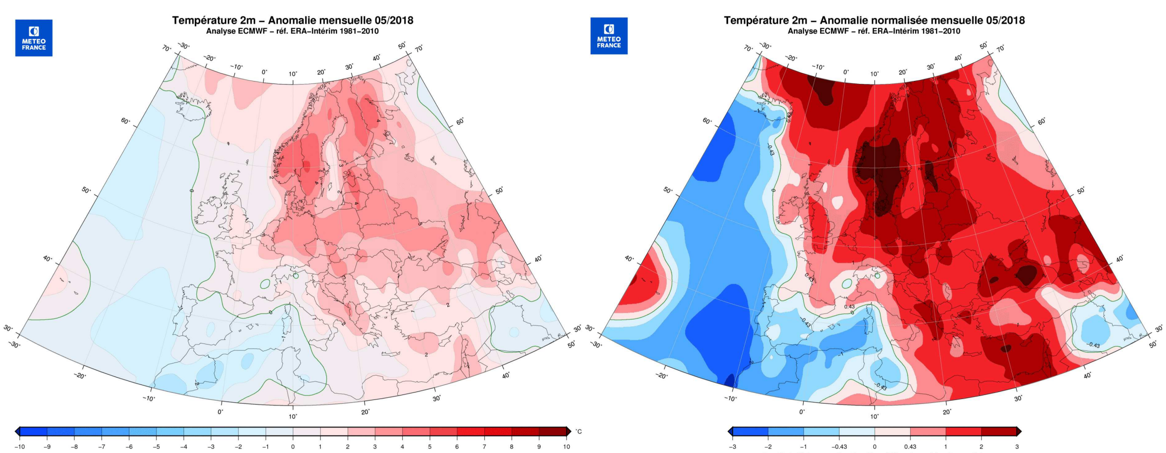


fig.I.2.10: Left graph: Absolute anomaly of temperature in the RA VI Region (Europe). Right graph: Standardized temperature anomalies

Monthly mean temperature anomalies in European subregions: Subregions refer to ECMWF land boxes defined in Annex III.3. Anomalies are based on gridded CLIMAT data from DWD, http://www.dwd.de/rcc-cm, 1961-1990 reference.

Subregion	Anomaly
Northern Europe	+ 3.4 ℃
Southern Europe	+ 1.7 ℃

I.2.d Sea ice

- In the Arctic : remaining close to record-low extent (2nd lowest, behind 2016). Record low for the Bering Sea.
- In Antarctica the deficit is still important, but smaller than in 2017.

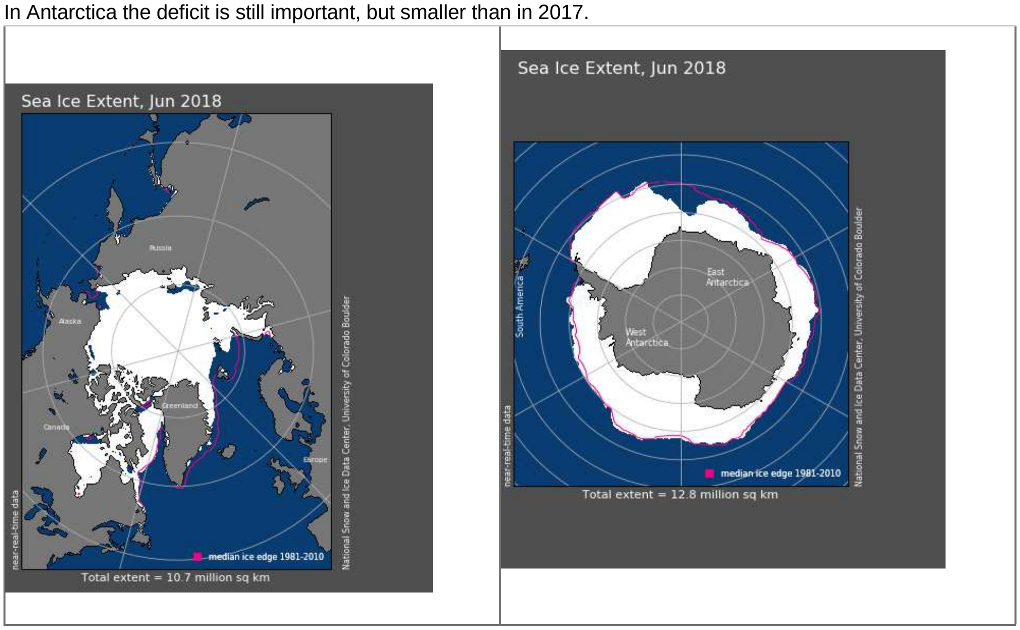


fig.I.2.11: Sea-Ice extension in Arctic (left), and in Antarctic (right). The pink line indicates the averaged extension (for the 1979-2000 period). http://nsidc.org/data/seaice_index/

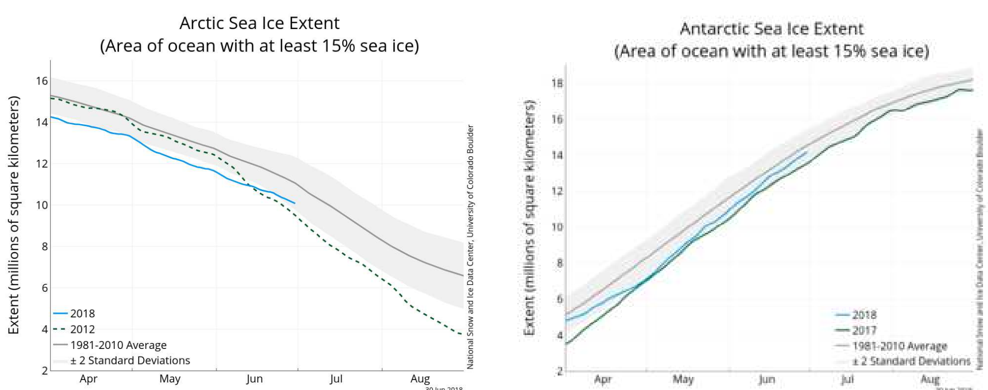
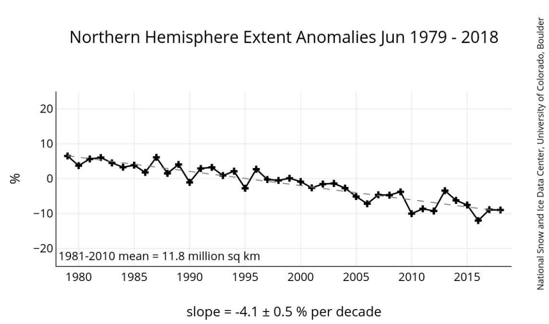


fig. I.2.12 : Sea-Ice extension evolution from NSIDC. https://nsidc.org/data/seaice_index/images/daily_images /N_stddev_timeseries.png



Monthly Sea Ice Extent Anomaly Graph in Arctic for the month of analysis.
http://nsidc.org/data/seaice_index/images/n_plot_hires.png

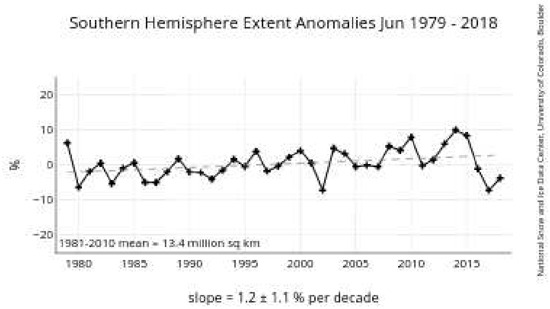


fig 1.2.13 : Monthly Sea Ice Extent Anomaly Graph in Antarctic for the month of analysis (http://nsidc.org/data/seaice_index/)

II. SEASONAL FORECAST FROM DYNAMICAL MODELS

Neutral conditions expected over the tropical Pacific for the next three months, but with a warming tendency. A shift toward El Niño conditions is likely for this autumn, which will be closely monitored in the next bulletins.

In this bulletin, the new MF-S6 model is used for illustrations (instead of MF-S5). But please note that the Eurosip system shown in this bulletin still uses the MF-S5 outputs, which may differ from the MF-S6 forecasts (see http://seasonal.meteo.fr/fr/content/ARP5 for more details).

II.1. OCEANIC FORECASTS

II.1.a Sea surface temperature (SST, figure II.1.1 to II.1.4)

- Pacific Ocean: Models in rather good agreement for JAS. Warming along the Equator, leading to widespread warmer than normal conditions. To the south, the cool anomalies should decrease in strength. Warm anomalies persisting to the north.
- Indian Ocean: Most models suggest ongoing neutral conditions in the northern basin along with a weakly positive DMI. (see BOM summary here : http://www.bom.gov.au/climate/model-summary/#tabs=Indian-Ocean). In the southern tropical basin, warmer to the West, cooler to the East, off the Australian coast.
- Atlantic Ocean:
  - northern Atlantic : models in good agreement with a persisting horseshoe pattern, more intense with ECMF-S5. A cool anomaly should therfore extend from the western coast of Africa to the Carribean.
  - equatorial Atlantic : warm signal
  - southern tropical Atlantic : no significant signal
- Mediterranean Sea : Warmer than normal to the east; no signal to the west.

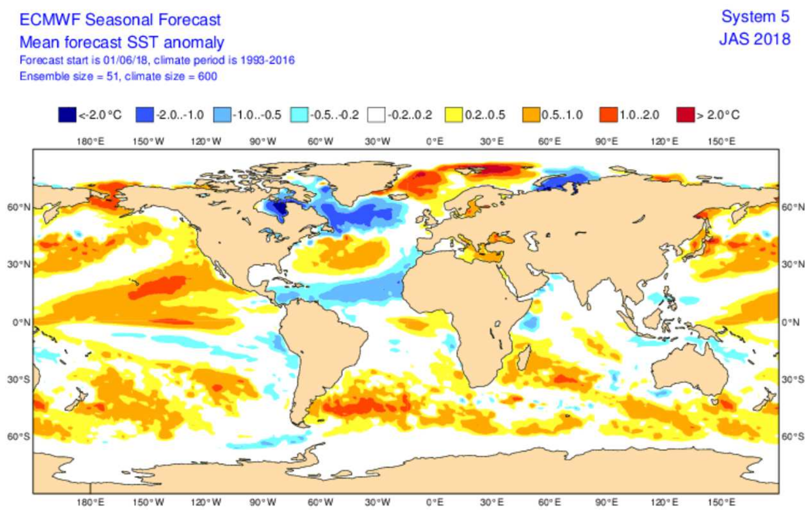


fig.II.1.1: SST anomaly forecast from ECMWF
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/group/

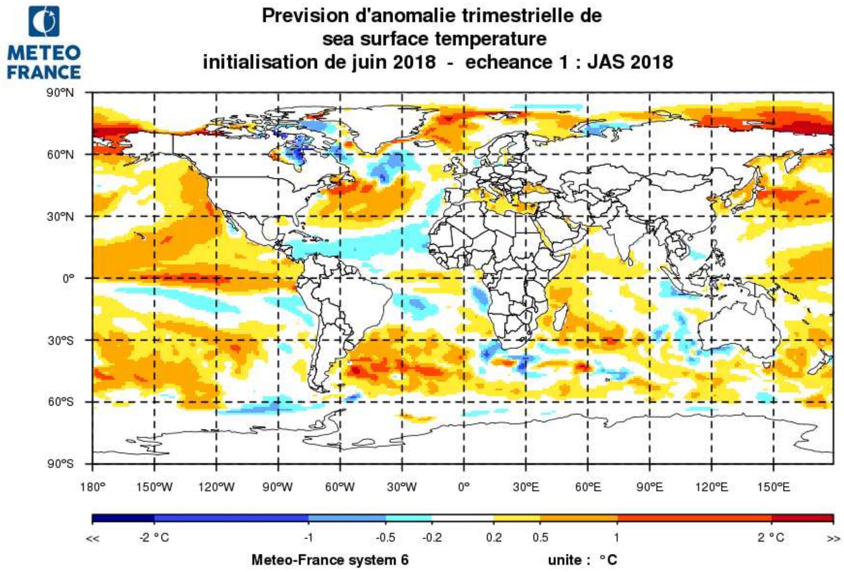


fig.II.1.2: SST Anomaly forecast from Meteo-France (recalibrated with respect of observation).
http://seasonal.meteo.fr

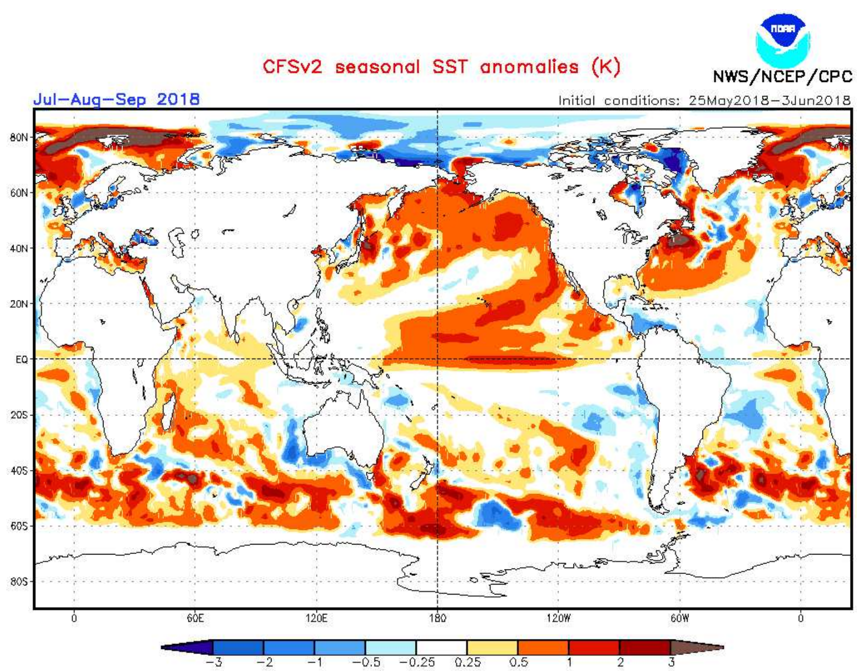


fig.II.1.3: SST Anomaly forecast from NCEP.
http://www.cpc.ncep.noaa.gov/products/people/wwang/cfsv2fcst/imagesInd1/glbSSTSeaInd1.gif

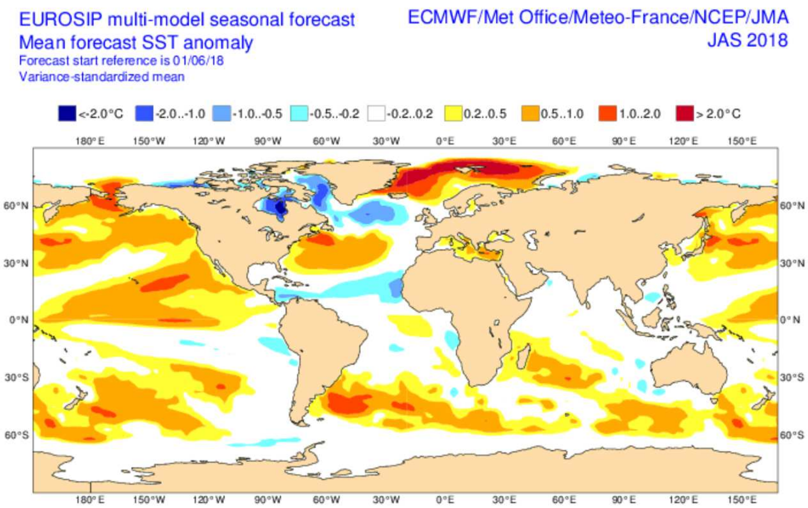
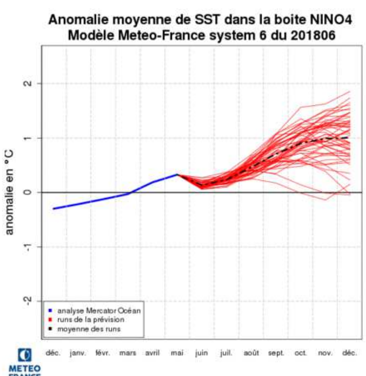
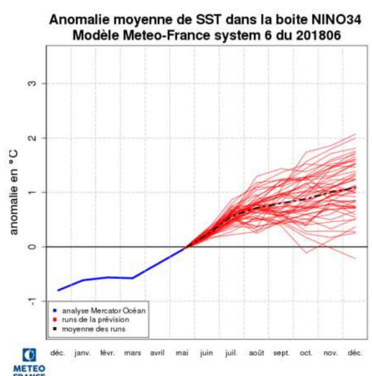


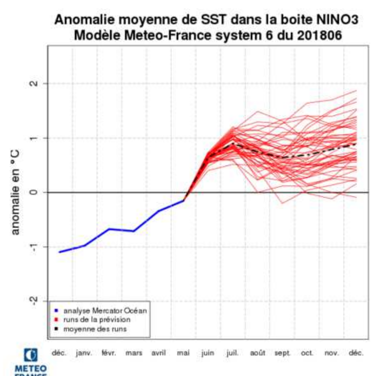
fig.II.1.4: SST Forecasted anomaly from Euro-SIP

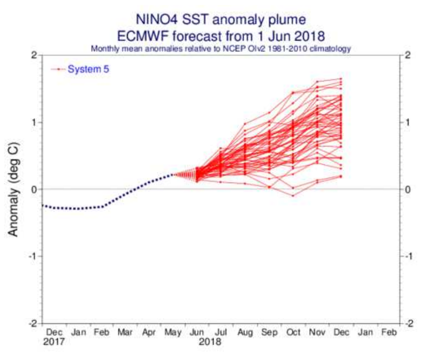
II.1.b ENSO forecast :

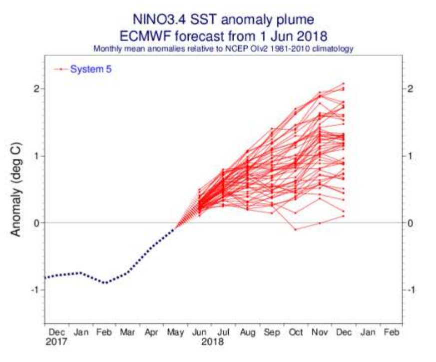
***Forecast Phase*: neutral phase for JAS.** WMO calls for a 75% chance of neutral conditions for the next three months. However, evolution towards warmer than normal conditions in the Equatorial Pacific is now very likely, and the odds of an El Niño are increasing for this autumn. The IRI probabilistic forecast is now in favour of an El Niño event starting in September : https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/ . The Australian BOM is also under "Niño watch" status.

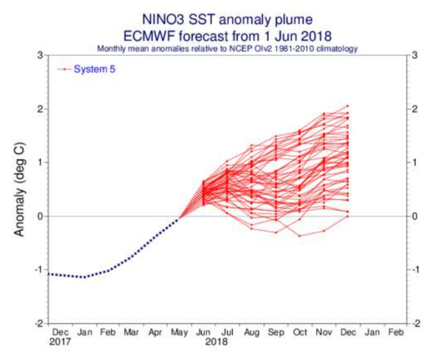












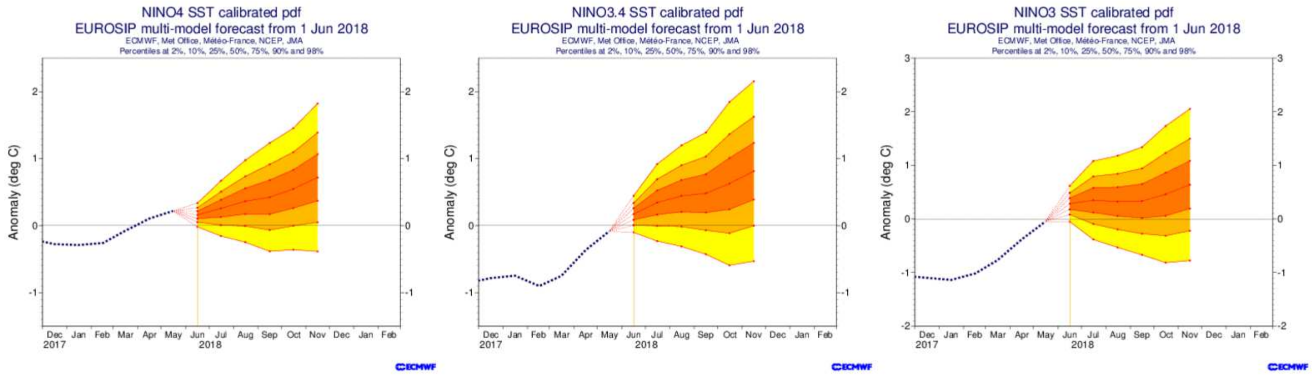


fig.II.1.5: SST anomaly forecasts in the Niño boxes from Météo-France (top) and ECMWF (middle) - monthly mean for individual members -
and EUROSIP (bottom) – recalibrated distributions -
(http://seasonal.meteo.fr , http://www.ecmwf.int/)

<u>I.1.c Atlantic ocean forecasts</u>

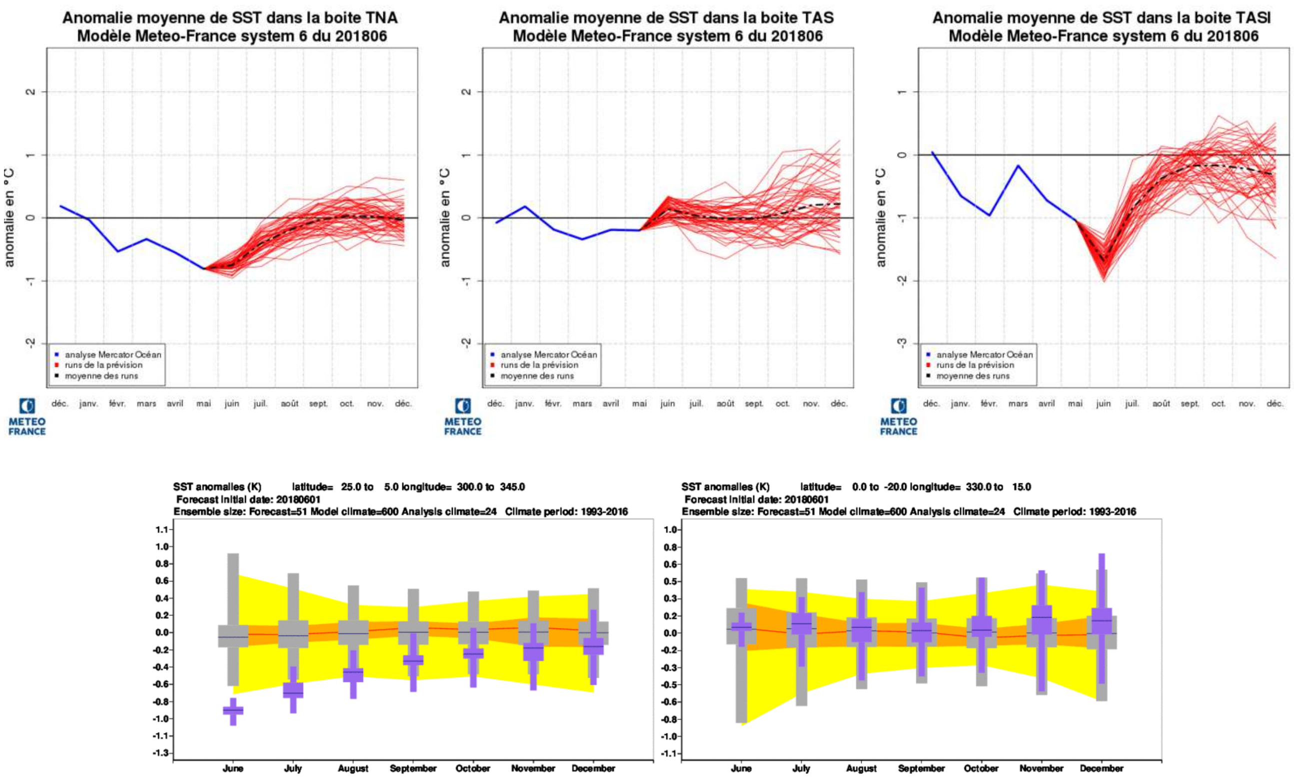


fig.II.1.6: SSTs anomaly forecasts in the Atlantic Ocean boxes from Météo-France and ECMWF, plumes / climagrams correspond to ensemble members and monthly means.

<u>I.1.d Indian ocean forecasts</u>

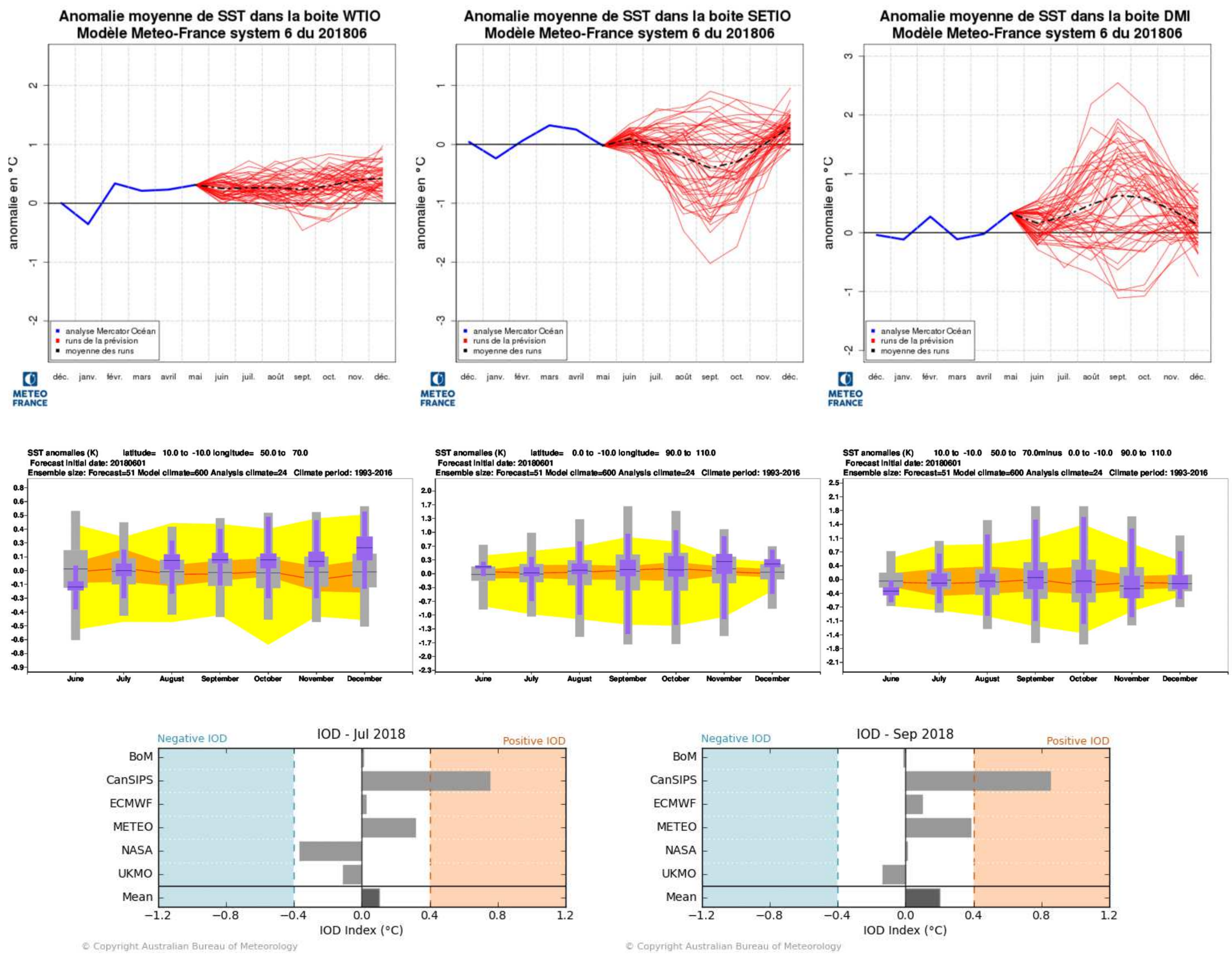
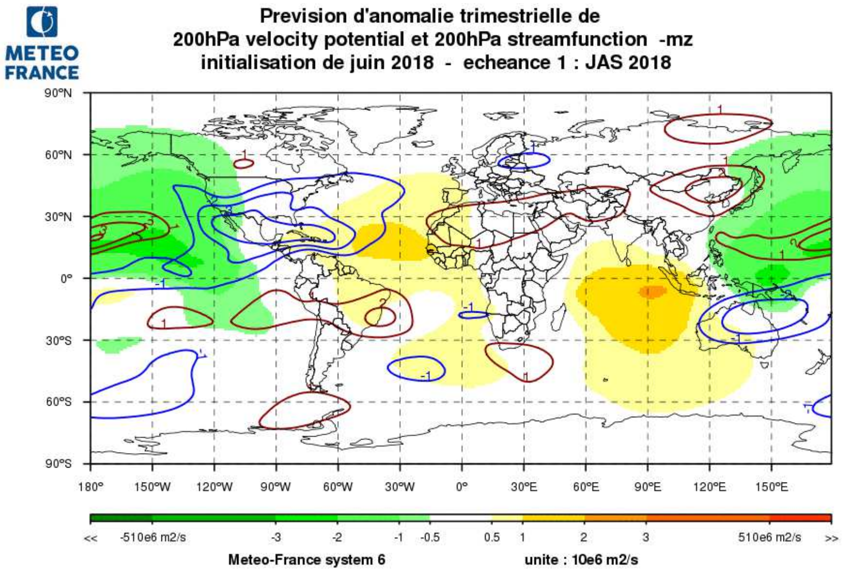


fig.II.1.7: SST anomaly forecasts in the Indian Ocean boxes from Météo-France and ECMWF, plumes / climagrams correspond to ensemble members and monthly means.

II.2. GENERAL CIRCULATION FORECAST

II.2.a Velocity potential anomaly field and Stream Function anomaly field at 200 hPa

- Velocity potential : models in rather good agreement over the Pacific and the Atlantic, with an atmospheric response resembling that of an El Niño situation : negative anomalies over the tropical Pacific (mostly east of the dateline), and positive (subsidence) anomalies over the Atlantic (maybe reinforced by the cold SSTs). For Africa and Tropical Indian Ocean regions, there is no clear consensus between models, except to the south-eastern part where all models forecast subsidence anomalies.
- Stream function : rather strong signal (especially with ECMWF-S5), consistent with VP200 anomalies : cyclonic anomaly from eastern Pacific to southern US, and also from Peru to Brazil, while anticyclonic anomalies are expected over the western part of the Pacific basin.



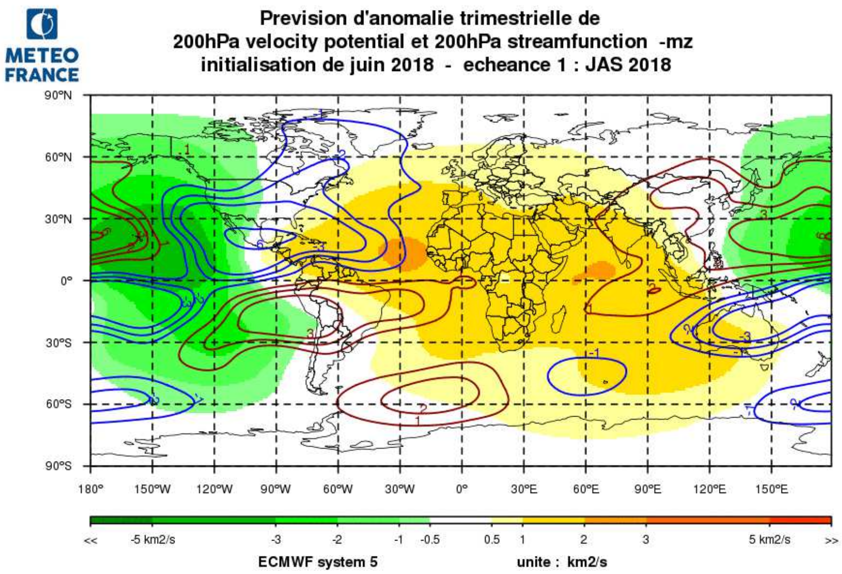


fig.II.2.a: Velocity Potential anomaly field χ (shaded area – green negative anomaly and yellow positive anomaly), associated with Stream Function anomaly ψ (isolines – red positive and blue negative) at 200 hPa by Météo-France (top) and ECMWF (bottom).
http://seasonal.meteo.fr

II.2.b Geopotential height anomalies

Models in rather good agreement which is not that usual especially during summer months : positive geopotential heights anomalies are forecast from Canada to the UK, sometimes extending towards Scandinavia, which is very similar to a "summer" NAO-positive mode, somehow combined with a blocking pattern over Central and Eastern Europe. Lower geopotential heights would then affect southern Europe, especially around the Mediterranean.

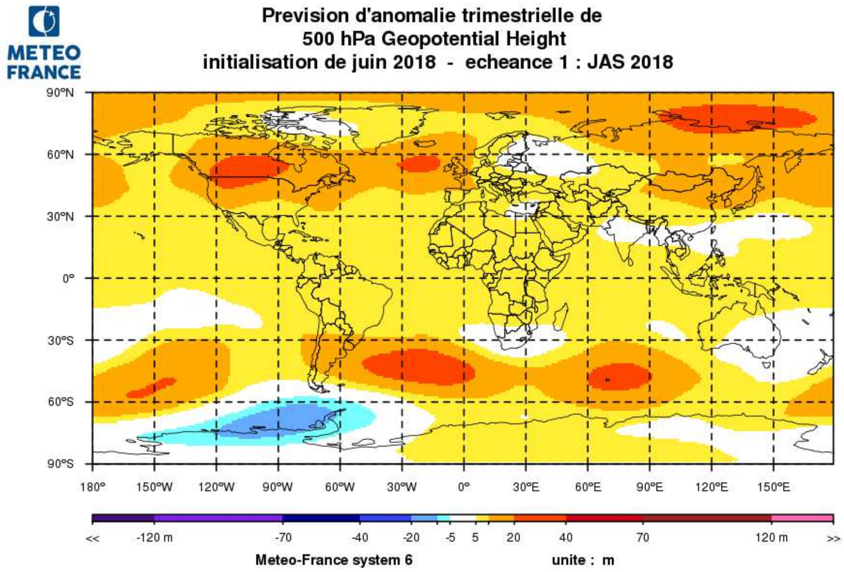


fig.II.2.b.1: Anomalies of Geopotential Height at 500 hPa from Météo-France.
http://seasonal.meteo.fr

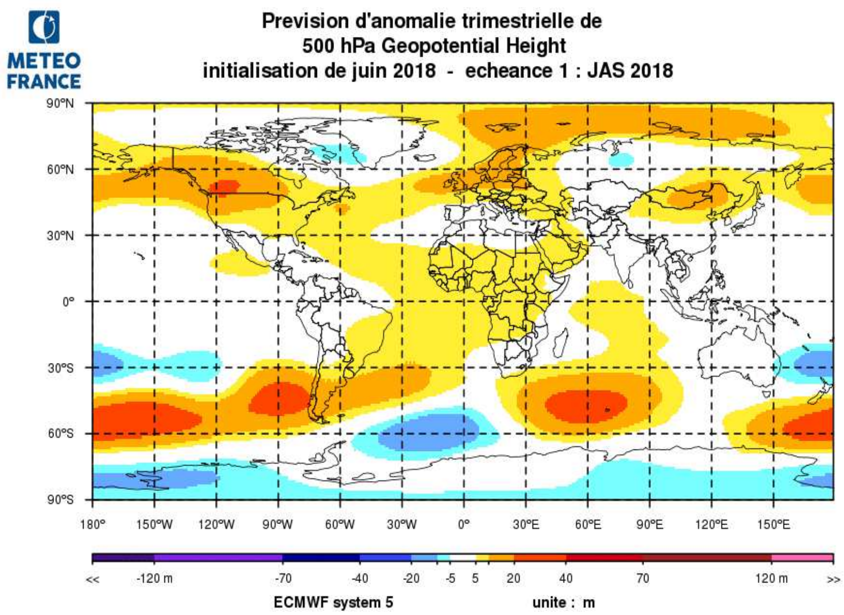


fig.II.2.b.2: Anomalies of Geopotential Height at 500 hPa from ECMWF.
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast

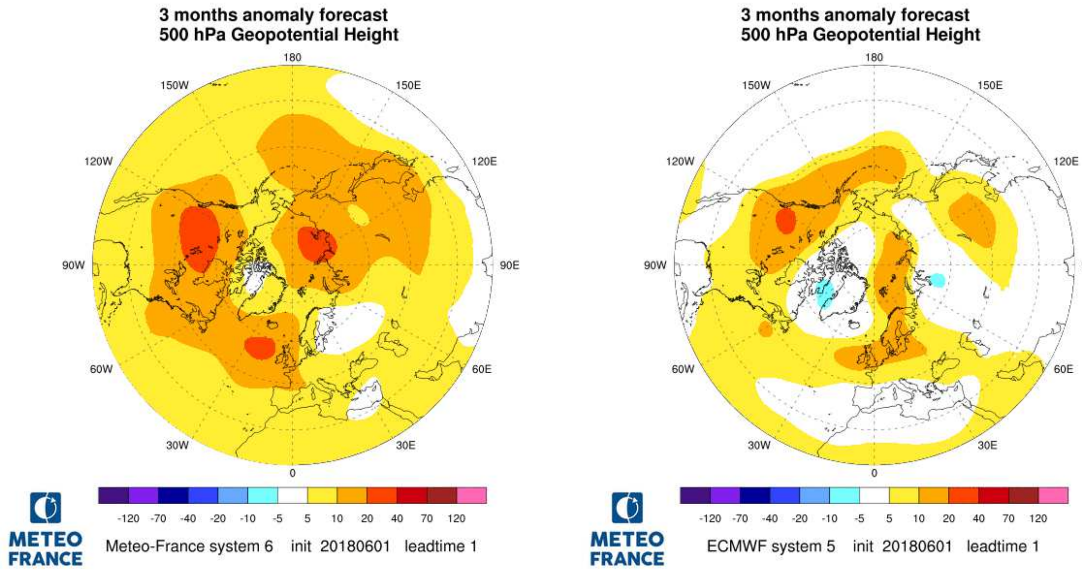


fig.II.2.b.3: Anomalies of Geopotential Height at 500 hPa from Météo-France.
http://seasonal.meteo.fr

II.2.c. modes of variability

MF-S6 and ECMWF-S5 are clearly in favor of positive NAO and EA modes. ECMWF-S5 also favors the Scandinavian blocking pattern. Positive NAO and SCAND mode can be detected when watching the 500 hPa geopotential anomalies. It is much more difficult to detect

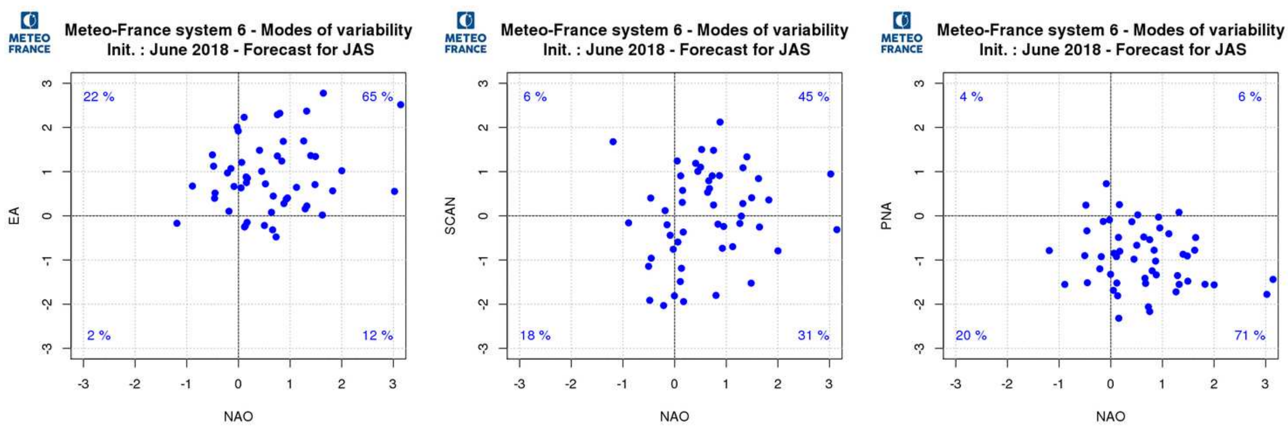


fig.II.2.c.1 : modes of variability forcasts over the Northern hemisphere with Meteo-France MF-S6

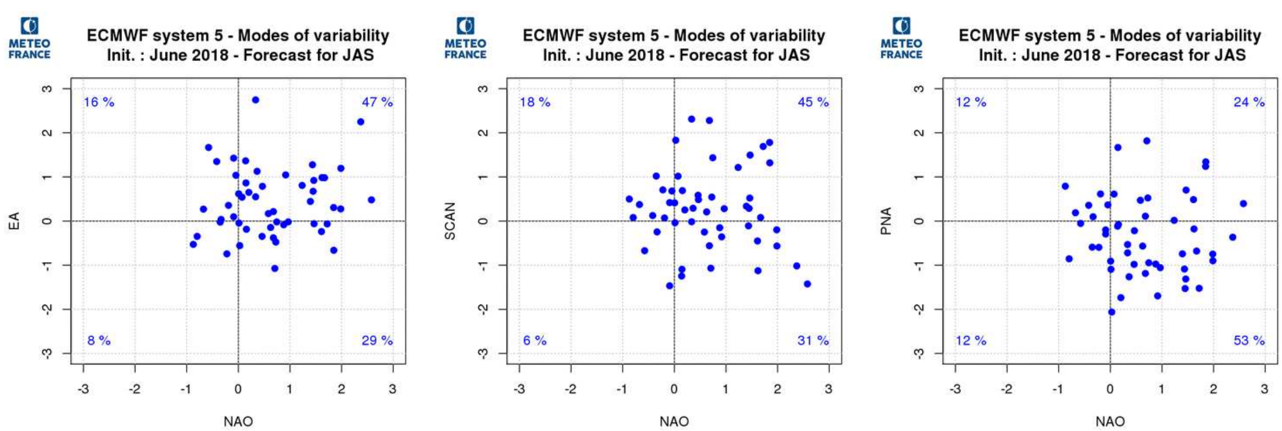


fig.II.2.c.2 : modes of variability forecasts over the Northern hemisphere with ECMWF-S5

II.2.d. weather regimes

MF-S6 and ECMWF-S5 show enhanced chances of summer-type "Atlantic Ridge" regime (which resembles the winter-type blocking regime).

The SST anomalies observed in May-June 2018 in the North Atlantic are very similar to a NOA positive (Atlantic low) pattern. This SST anomalies pattern is known to favor blocking regimes in the following weeks (Guemas et al., 2009).

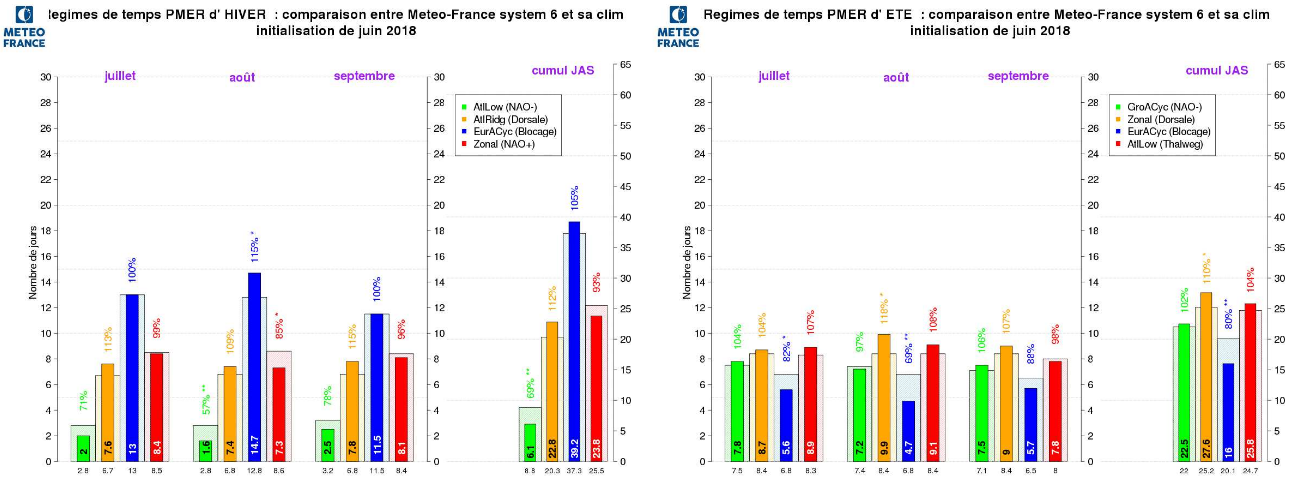


fig.II.2.d.1: North Atlantic Regime occurrence anomalies from Meteo-France MF-S6 : vertical bars represent the excitation frequency anomaly (in %) for each of the 4 regimes.
Left : winter regimes; Right : summer regimes

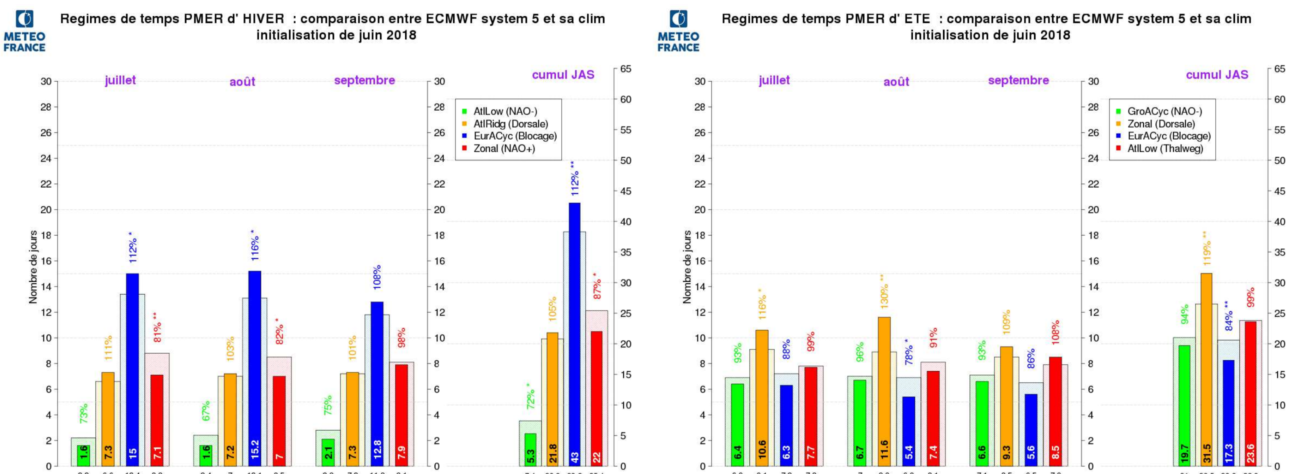


fig.II.2.d.2 : North Atlantic Summer Regime occurrence anomalies from ECMWF-S5 : vertical bars represent the excitation frequency anomaly (in %) for each of the 4 regimes
Left : winter regimes; Right : summer regimes

II.3. IMPACT: TEMPERATURE FORECASTS (figure II.3.1 to II.3.4)

All models suggest the continuation of the horseshoe-like pattern in the Atlantic, which should lead to near-normal (if not cool) temperatures from Ireland to Portugal and western Africa.

Elsewhere, over continents, warm signal is overwhelming, particularly over eastern Europe, Middle East, western Canada and US. No warm signal or cool signal areas restricted to western Australia, Amazon region, Central Siberia, and Quebec.

II.3.a Météo-France

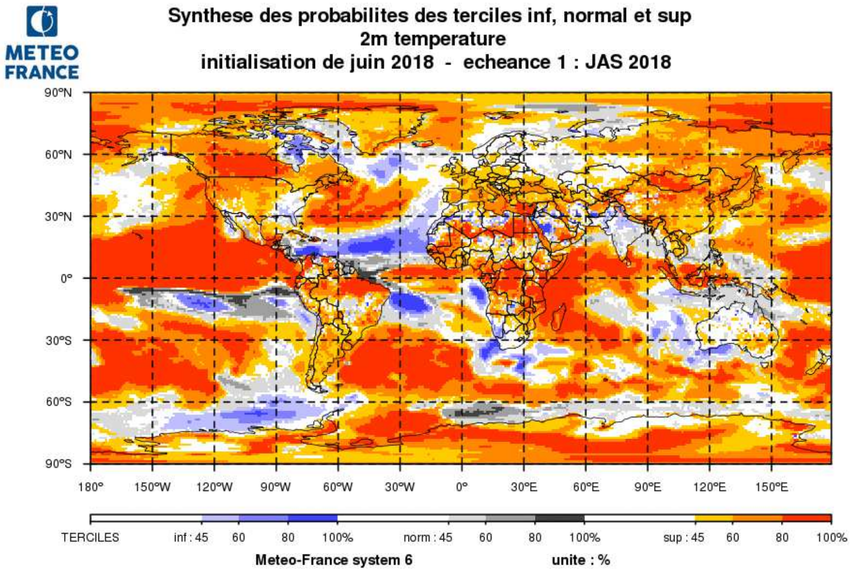


fig.II.3.1: Most likely category of T2m. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://seasonal.meteo.fr/

II.3.b ECMWF

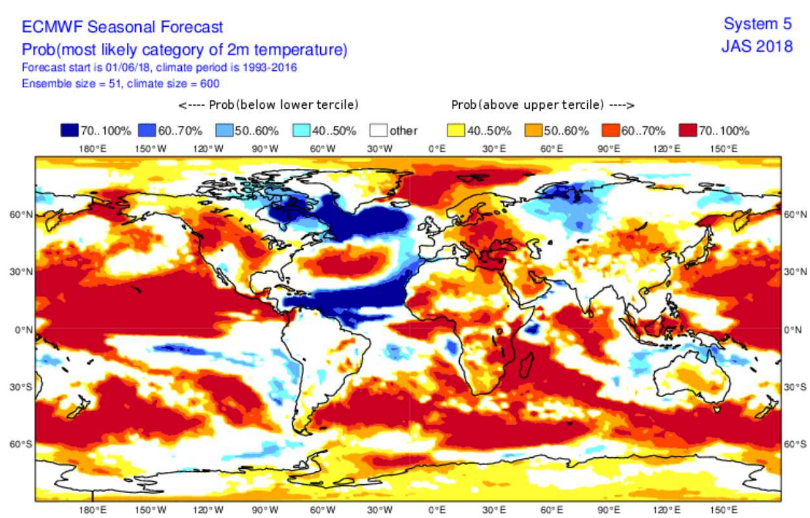


fig.II.3.2: Most likely category probability of T2m from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seaso...

II.3.c Japan Meteorological Agency (JMA)

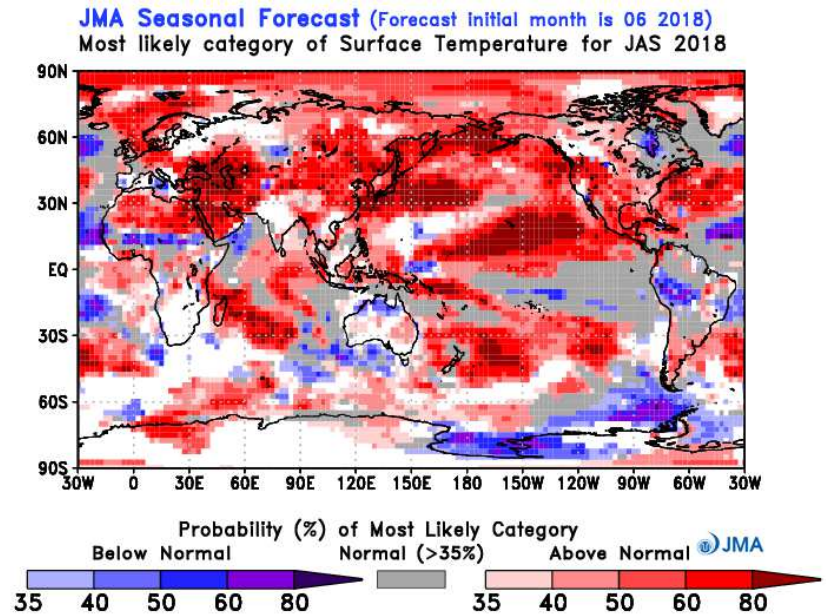


fig.II.3.3: Most likely category of T2m. Categories are Above, Below and Close to Normal. White zones correspond to No Signal.
http://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/fcst/fcst_gl.php

II.3.d EUROSIP

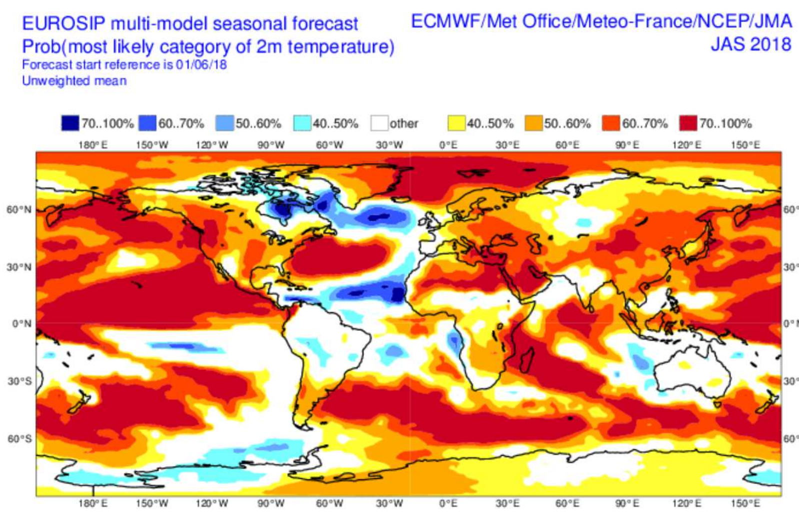


fig.II.3.4: Multi-Model Probabilistic forecasts for T2m from EUROSIP (2 Categories, Below and Above normal – White zones correspond to No signal and Normal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

II.4. IMPACT : PRECIPITATION FORECAST

- inter-tropical regions :
  - For the Pacific basin, wet to the north, east of the dateline (incl. Hawaii), dry to the south, in agreement with SST anomalies.
  - For the Atlantic : enhanced dry signal, from Senegal/Guinea to eastern Caribbean, which is consistent with cooler than normal SSTs and velocity potential anomalies.
  - For the Indian Ocean and Maritime continent, dry signal dominating (except to the South-West of the Indian Ocean) but poor agreement between models does not bring much credit to this scenario.
  - Over Africa, SST conditions should not favor the northward penetration of the monsoon rains. Wet anomalies expected from the gulf of Guinea to Niger and Tchad, and dry anomalies over north-western Sahel (Mali and Senegal).
- Mid-latitudes :
  - dry conditions likely over northern and eastern Europe, up to western Russia, with the combination of blocking and NAO+ patterns (Atlantic fronts rejected more to the north). Somehow wetter than normal over southern Europe, in connection with lower geopotential heights.
  - wet signal for south-western US (see stream function anomalies); dry for north-western US and western Canada.

II.4.a Météo-France

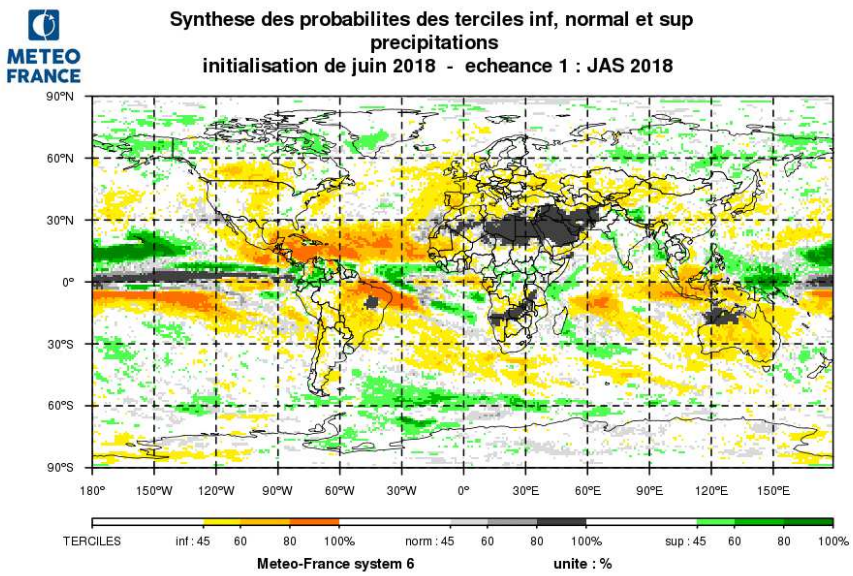


fig.II.4.1: Most likely category of Rainfall. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://seasonal.meteo.fr/

II.4.b ECMWF

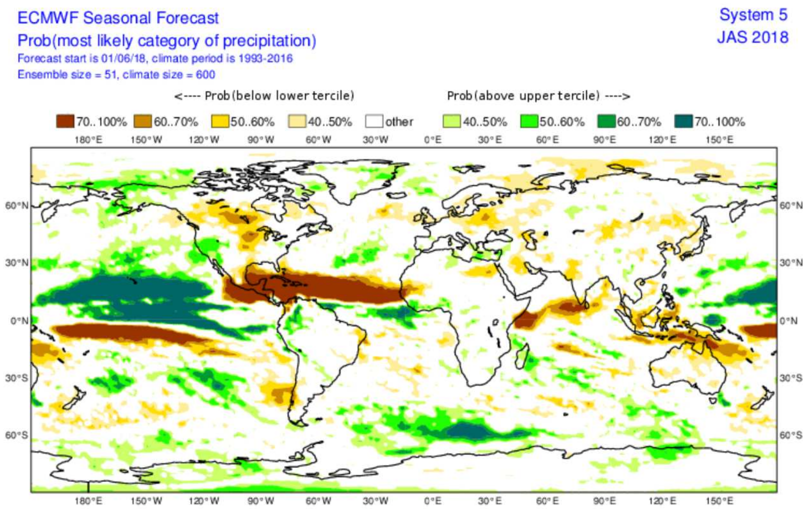


fig.II.4.2: Most likely category probability of rainfall from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/group/

II.4.c Japan Meteorological Agency (JMA)

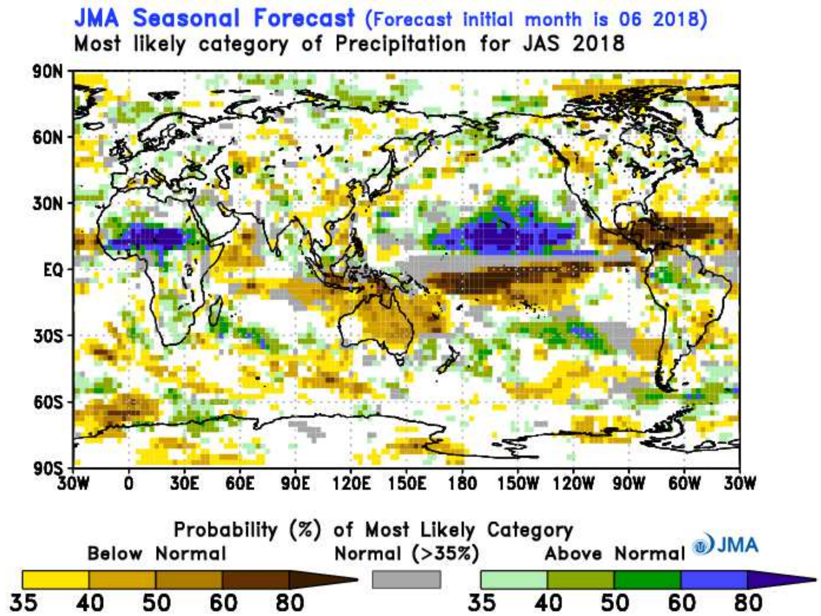


fig.II.4.3: Most likely category of Rainfall from JMA. Categories are Above, Below and Close to Normal. White zones correspond to No Signal.
http://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/fcst/fcst_gl.php

II.4.d EUROSIP

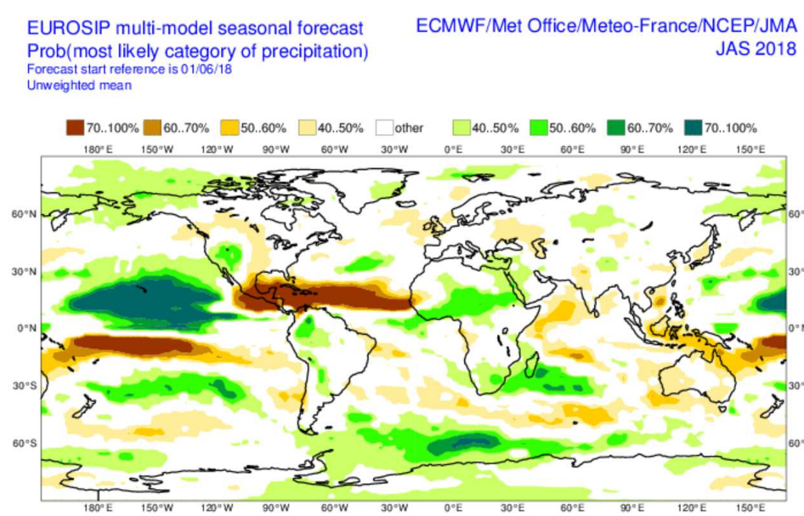


fig.II.4.4: Multi-Model Probabilistic forecasts for precipitation from EUROSIP (2 Categories, Below and Above normal – White zones correspond to No signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

II.5. REGIONAL TEMPERATURES and PRECIPITATION

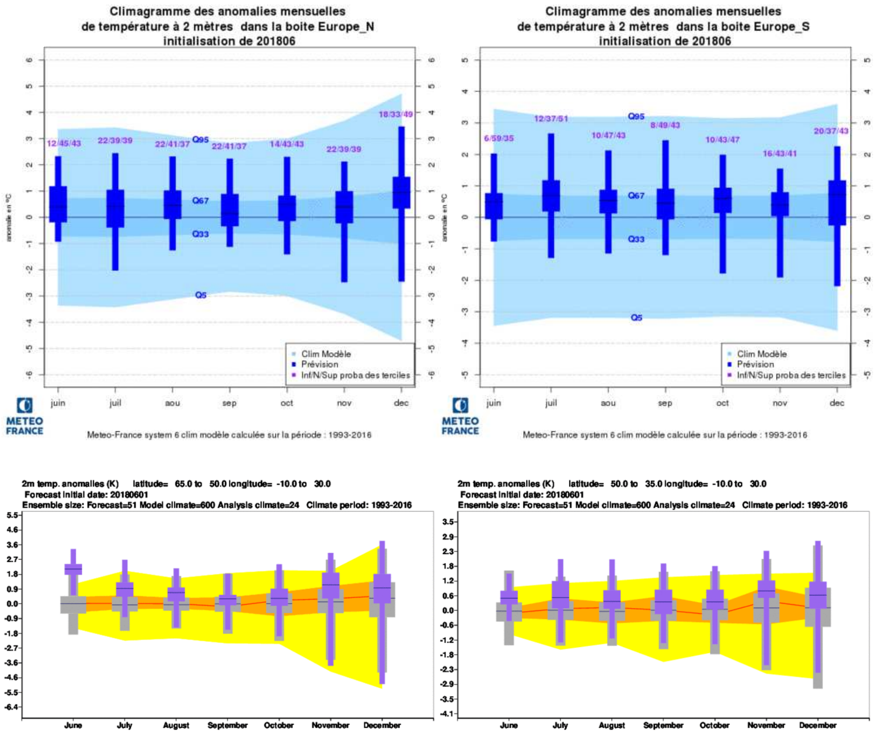


fig.II.5.1 : Climagrams for Temperature in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom).

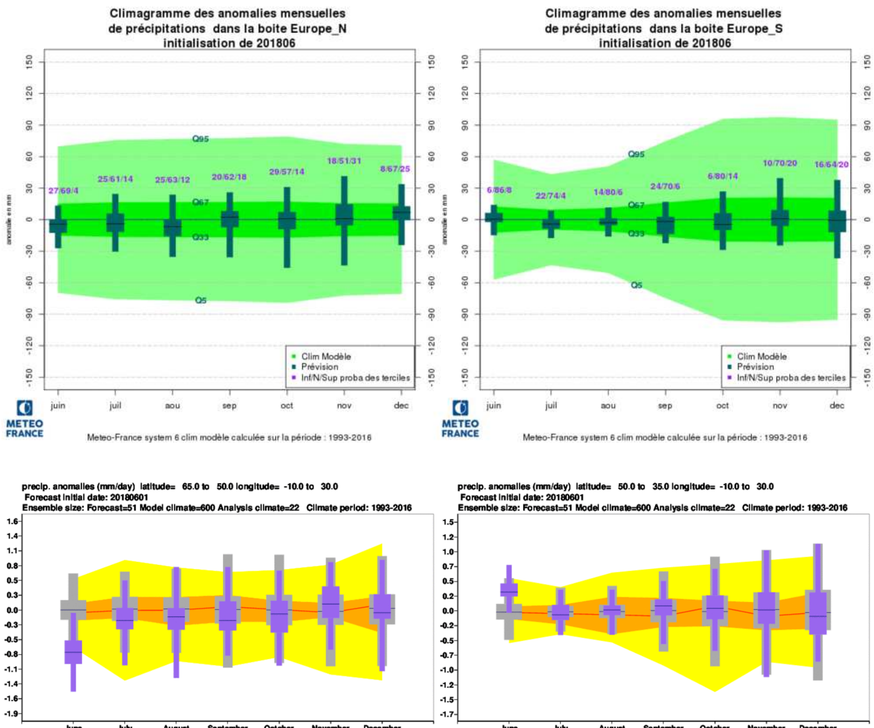


fig.II.5.2 : Climagrams for Rainfall in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom).

II.6. "EXTREME" SCENARIOS

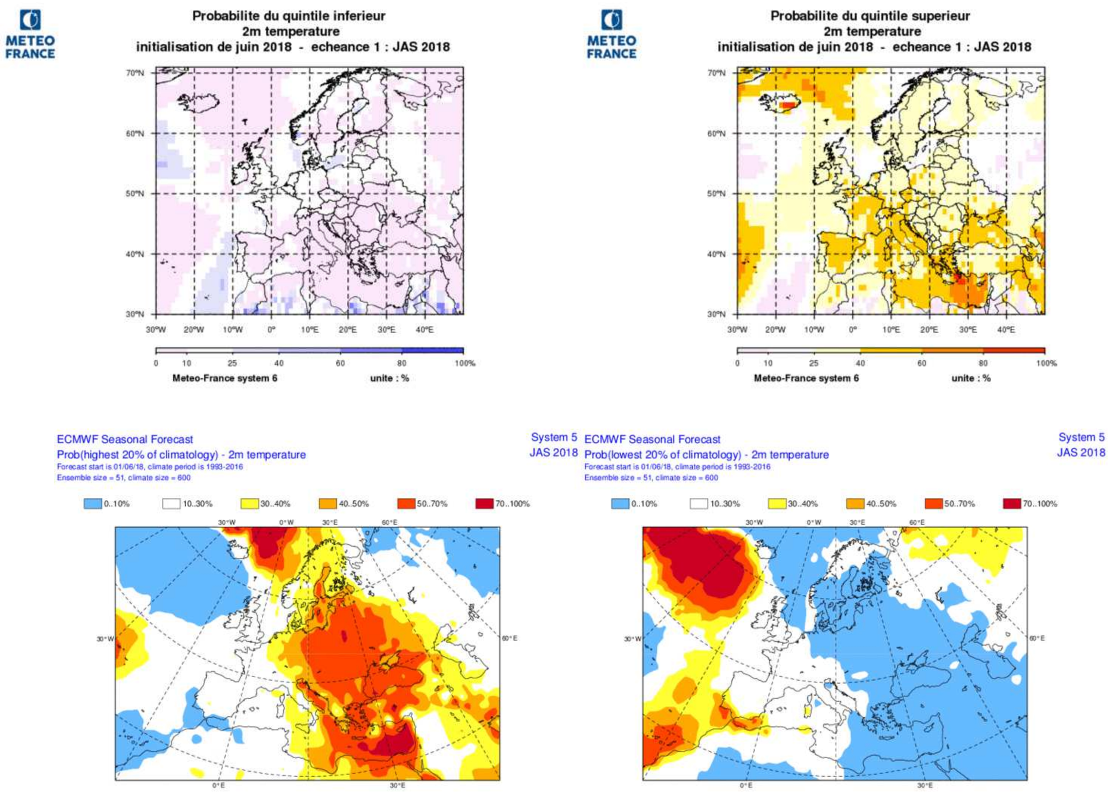


fig.II.6.1 : Top : Meteo-France T2m probability of « extreme » below normal conditions (left - lowest ~15% of the distribution) and "extreme" above normal conditions (right - highest ~15% of the distribution). Bottom : ECMWF T2m probability of « extreme » below normal conditions (left - highest ~20% of the distribution) and "extreme" above normal conditions (right – lowest ~20% of the distribution).

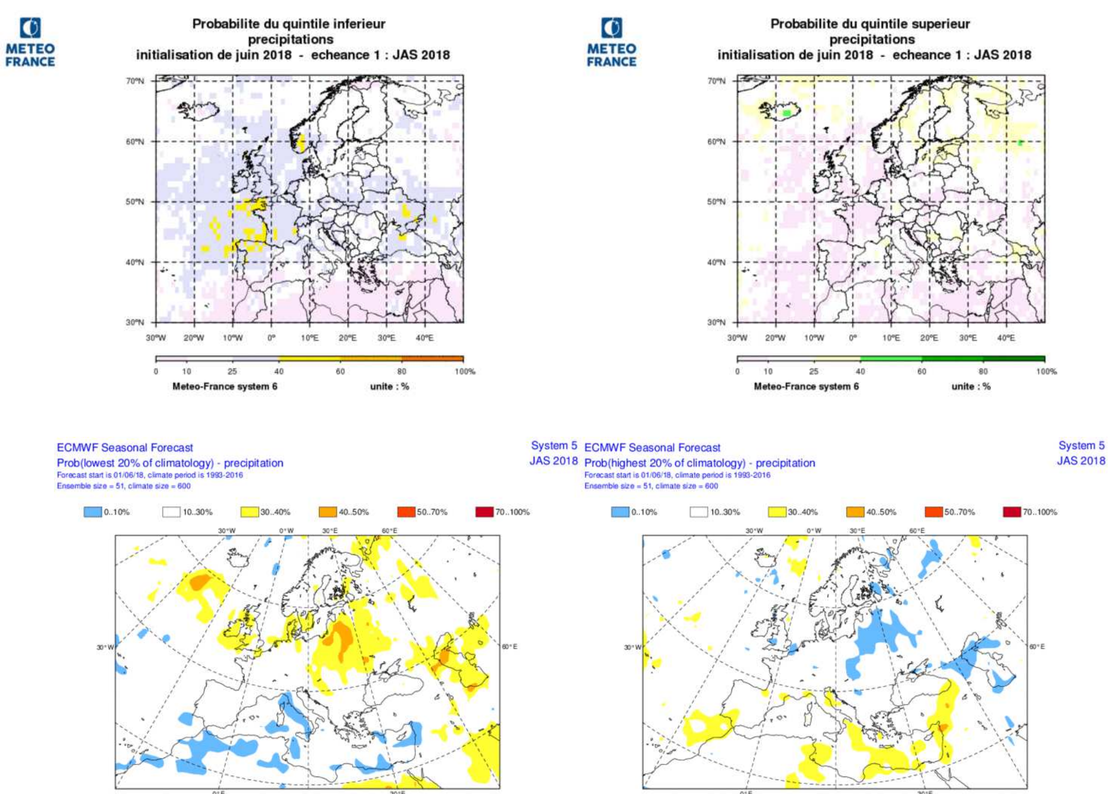


fig.II.6.2 : Top : Meteo-France rainfall probability of « extreme » below normal conditions (left - lowest ~15% of the distribution) and "extreme" above normal conditions (right - highest ~15% of the distribution).
Bottom : ECMWF rainfall probability of « extreme » below normal conditions (left - lowest ~20% of the distribution) and "extreme" above normal conditions (right – highest ~20% of the distribution).

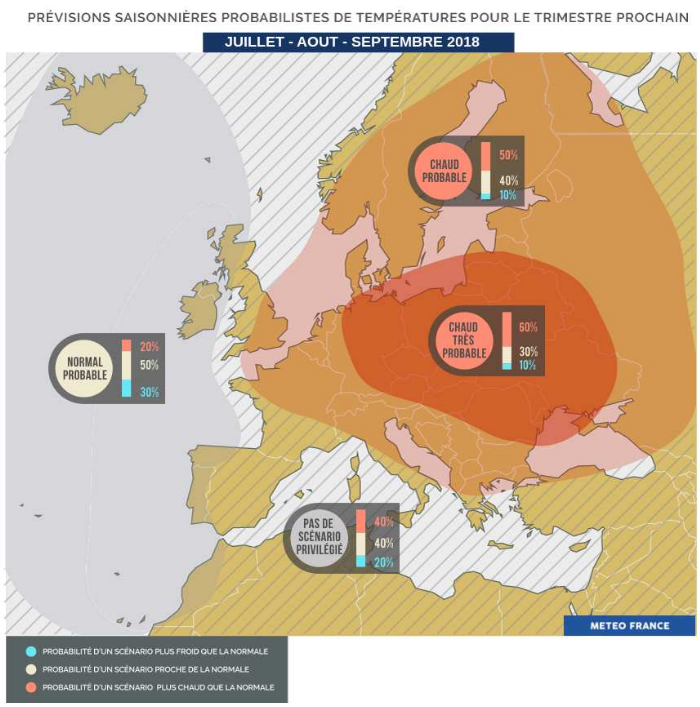
II.7. DISCUSSION AND SUMMARY

II.7.a Forecast over Europe

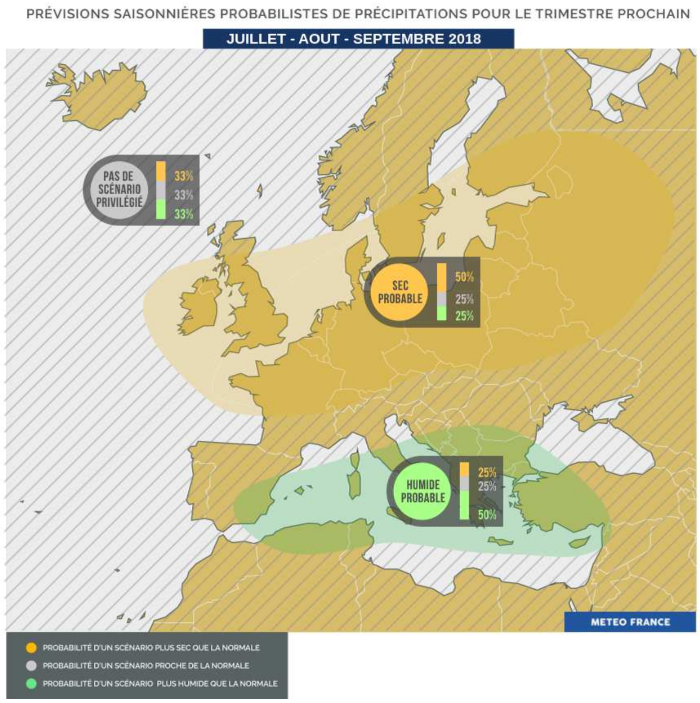
Despite of the lack of tropical teleconnexions, there seems to be a rather good predictability over Europe for the coming months : anticyclonic circulation for northern Europe, more cyclonic for southern Europe.

the negative TASI index should also favor lower than normal geopotential heights over the Mediterranean basin.

Temperature : We rely on summer NAO positive composites, which would bring warmer than normal conditions north of 45N, spreading eastward down to the Black Sea. Elsewhere no prominent signal (but cooler than normal conditions are very unlikely), except for Ireland and Portugal where temperatures could draw near normal (negative SST anomalies).



Precipitations : Drier than normal conditions over northern Europe. Wetter to the south, with enhanced deep convection from Italy to the Balkans and Greece.



II.7.b Tropical cyclone activity

North Atlantic : in connection with lower than normal SSTs (and enhanced subsidence), significantly fewer than normal hurricanes are forecast by most models : especially those evolving from African easterly waves.

North Pacific : slightly higher than normal activity over North-East Pacific.

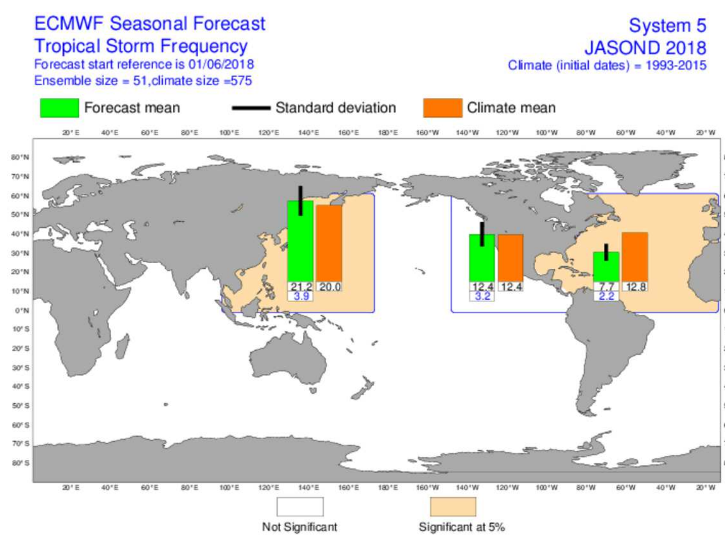


fig.II.7.1 : Seasonal forecast of the frequency of Tropical Cyclones from EUROSIP (Météo-France & ECMWF).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmtrop/trop_euro
/eurosip_tropical_storm_frequency/

III.1. Seasonal Forecasts

Presently several centers provide seasonal forecasts, especially those designated as Global Producing Centers by WMO (see http://www.wmo.int/pages/prog/wcp/wcasp/clips/producers_forecasts.html).

- BoM, CMA, CPTEC, DWD, ECMWF, JMA, KMA, Météo-France, NCEP and UK Met Office have ocean/atmosphere coupled models. The other centers have atmospheric models which are forced by a SST evolution which is prescribed for the entire period of forecast.
- LC-MME and Euro-SIP provide multi-model forecasts. Euro-Sip is presently composed using 5 models (ECMWF, MF, NCEP, UK Met Office and JMA). LC-MME uses information coming from most of the GPCs ; providing deterministic and probabilistic combinations of several coupled and forced models.

Seasonal forecasts use the ensemble technique to sample uncertainty sources inherent to these forecasts. Several Atmospheric and/or oceanic initial states are used to perform several forecasts with slightly different initial state in order to sample the uncertainty related to imperfect knowledge of the initial state of the climate system. When possible, the model uncertainty is sampled using several models or several version of the same model. The horizontal resolution of the Global models is currently between 100 and 300km. This mean that only Large Scale feature make sense in the interpretation of the issued forecasts. Generally speaking, the temperature forecasts show better skills than rainfall forecasts. Then, it exists a natural weakness of the seasonal predictability in Spring (ref to North Hemisphere).

In order to better interpret the results, it is recommended to look to verification maps and graphs which give some insight into the expected level of skill for a specific parameter, region and period. A set of scores is presented on the web-site of the Lead-Centre for Verification (see http://www.bom.gov.au/wmo/lrfvs/) ; scores are also available at the specific web site of each centers.

This bulletin collects all the information available the 21st of the current month preceding the forecasted 3-month period.

III.2. « NINO », SOI indices and Oceanic boxes

El Niño and La Niña events primarily affect tropical regions and are monitored by following the SST evolution in specific area of the equatorial Pacific.

- Niño 1+2 : 0°/10°S 80W-90W ; it is the region wher e the SST warming is developing first at the surface (especially for coastal events).

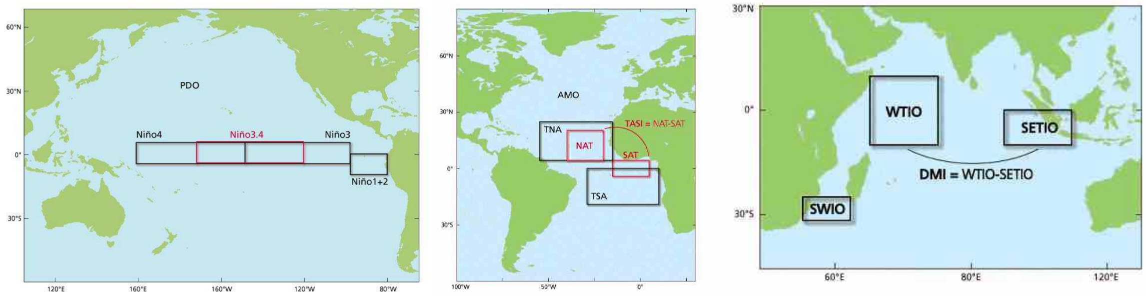
- Niño 3 : 5°S/5°N 90W-150W ; it is the region wher e the interanual variability of SST is the greatest.

- Niño 4 : 5°S/5°N 160E- 150W ; it is the region wh ere SST evolution have the strongest relationship with evolution of convection over the equatorial Pacific.

- Niño 3.4 : 5°S/5°N 120W-170W ; it is a compromise be tween Niño 3 and Niño 4 boxes (SST variability and Rainfall impact).

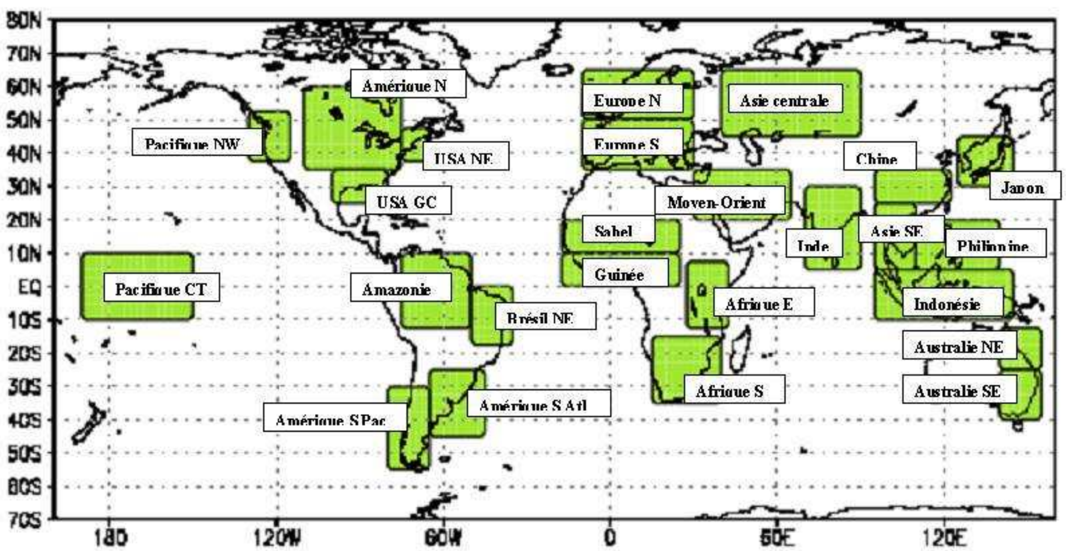
Associated to the oceanic « El Niño / La Niña » events, and taking into account the strong ocean/atmopshere coupling, the atmosphere shows also interanual variability associated to these events. It is monitored using the SOI (Southern Oscillation Index). This indice is calculated using standardized sea level pressure at Tahiti minus standardized sea level pressure at Darwin (see above figure). It represents the Walker (zonal) circulation and its modifications. Its sign is opposite to the SST anomaly meaning that when the SST is warmer (respectively colder) than normal (Niño respectively Niña event), the zonal circulation is weakened (respectively strengthened).

Oceanic boxes used in this bulletin :



III.3. Land Boxes

Some forecasts correspond to box averaged values for some specific area over continental regions. These boxes are described in the following map and are common to ECMWF and Météo-France.



III.4. Acknowledgement

This bulletin is edited by the RCC-LRF Node of the RCC Network in Toulouse for the RA VI. It is a joint effort of the RCC-Climate Monitoring Node (led by DWD) and the RCC-LRF Node (Co-Led by Météo-France).