GLOBAL CLIMATE BULLETIN

n°217 – July 2017

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I. DESCRIPTION OF THE CLIMATE SYSTEM (May 2017)

I.1.Oceanic analysis

Over the Pacific ocean :

- SST overall cooling trend, particularly over the north and south subtropicals parts (except off Japan).
- Fairly marked cooling of the eastern part of the equatorial rail. Very slight drop of the Nino 3.4 index at + 0.5 ° C.
- In subsurface, a cold Kelvin wave landed on the east of the basin, resulting in surface cooling. No large warm pool on the west.

Over the Maritime Continent :

- Cooling trend in the vicinity of Java, and warming trend over China Sea and Philippines.

Over the Indian Ocean :

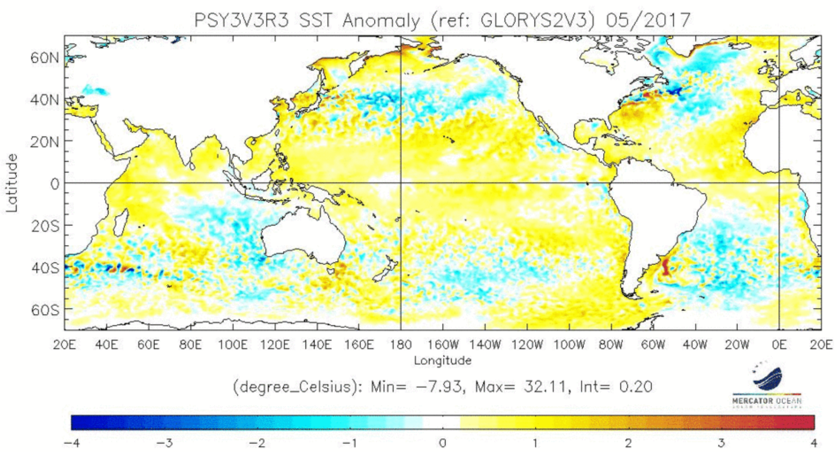
- In the Southern Hemisphere, there is always a strong contrast between East (cold) and West (warm), but trend tend rather towards a weakening of this structure. In the north, warming over Gulf of Bengal.
- DMI index has decreased ; ~ 0 ° C at the end of May. The heat content (trend not shown here) has also decreased strongly in the west (off the coast of Somalia to the Maldives) and strongly increased in the east (from southern Sri Lanka to Sumatra).

Over the Atlantic:

- Weak and rather positive SST anomalies around the equator and on the eastern part of the North tropical ocean, but there is a small cooling trend on the equatorial rail. Negative heat content anomalies just south of the equator show that the cold water tongue is present (see impact on African monsoon activity) ; And the trend between May and April shows that it has strengthened (not shown here). Positive SST anomalies from Bermuda to the Sargasso Sea, which have been strengthened. Significant negative SST anomaly from southern Greenland to around 30 ° N, which has increased in the southern part.

Over the Mediterranean:

- SST uniformly higher than normal. Cooling trend on both sides of Italy.



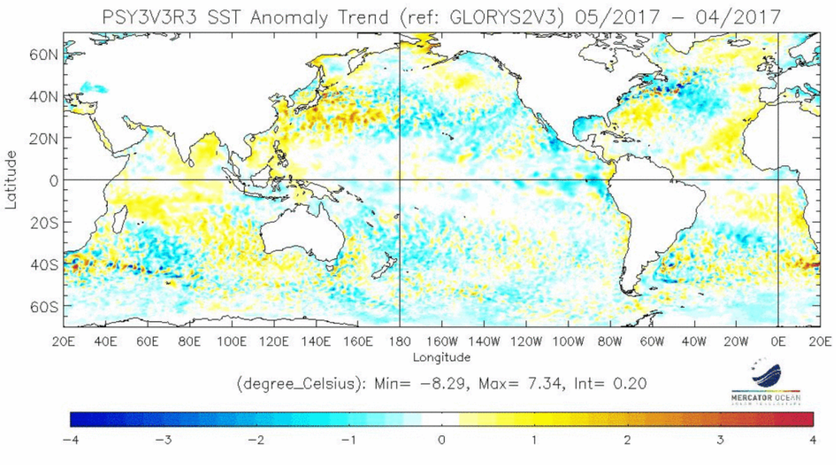


fig.I.1.1: top : SST Anomalies (°C) . Bottom : SST tendency (current – previous month), (reference Glorys 1992-2013).

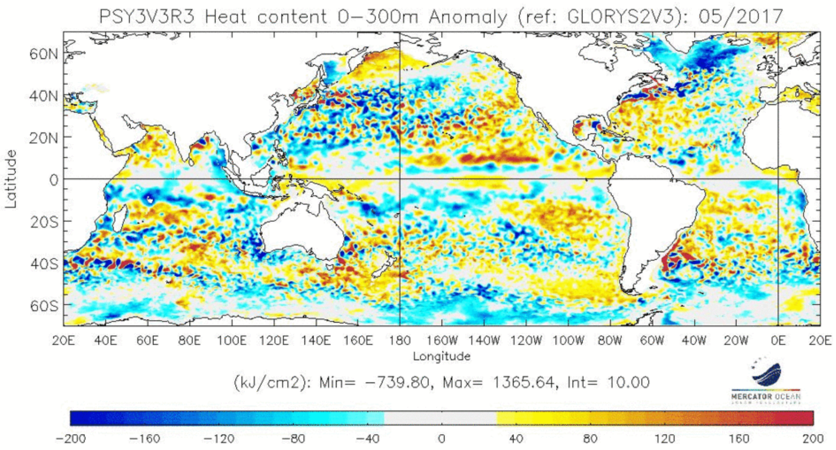


fig.I.1.2: map of Heat Content Anomalies (first 300m, kJ/cm2, reference Glorys 1992-2013)

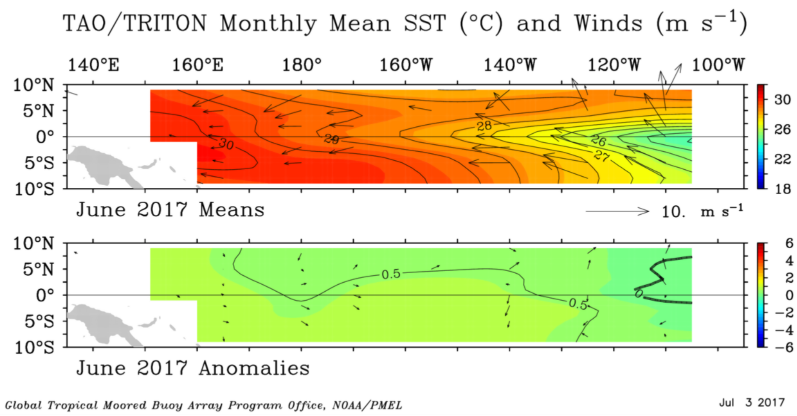


fig.I.1.3: SST Anomalies and Wind anomalies over the Equatorial Pacific from TAO/TRITON.http: //www.pmel.noaa.gov/tao/drupal/assorted_plots/images/sst_wind_mon.png

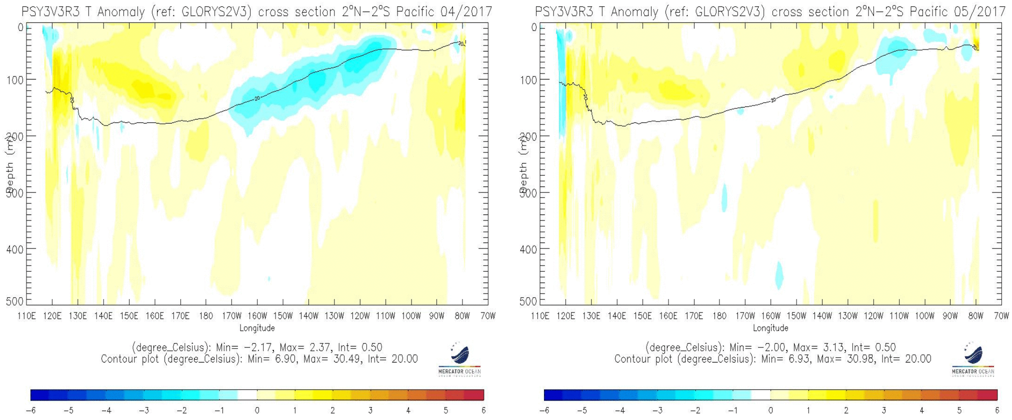


fig.I.1.4: Oceanic temperature anomaly in the first 500 meters in the Equatorial Pacific (previous and current month)

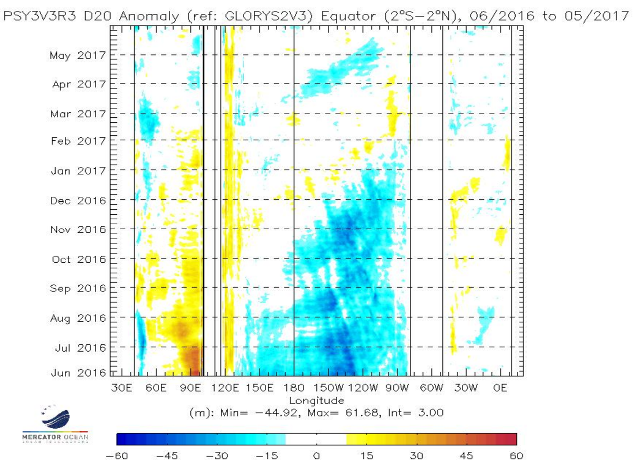


fig.I.1.5: Hovmüller diagram of Thermocline Depth Anomalies (m) (depth of the 20°C isotherm) along the equator for all oceanic basins over a 6 month period

<u>Sea surface temperature near Europe :</u>

European Arctic Sea: Most parts north of Iceland still warmer than normal except some partly frozen areas close to Svalbard and eastern Greenland, and near the northern Scandinavian subcontinent, where SST was close to normal or slightly below. Compared to April, anomalies mostly have a slight negative trend.

Close to Scandinavia: less seasonal warming than normal, SST mostly reached normal values, the Baltic Sea even slightly colder than normal.

Cold blob south of Greenland/Iceland has not changed position and intensity significantly, but a second cold anomaly of similar size emerged south of it in the subtropics, almost no seasonal warming in that area. However, this new subtropical anomaly was not significant in the subsurface.

On the East Atlantic, no significant change to April, mostly slightly warmer than normal.

Mediterranean still warmer than normal, but negative anomaly trend (weaker seasonal warming) especially in northern parts of the western basin including the Adriatic Sea, the latter now even colder than normal.

Black Sea, too, was colder than normal with weaker seasonal warming.

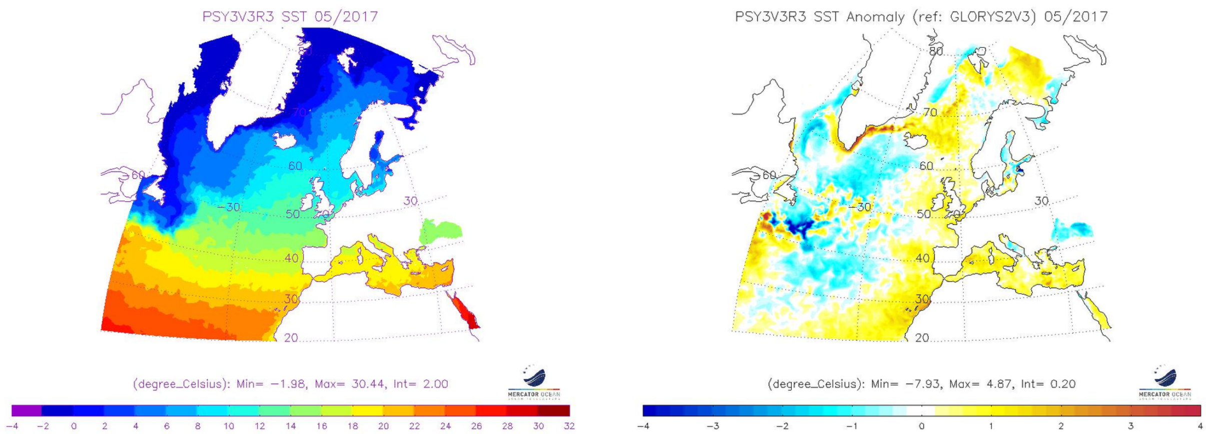


fig.I.1.6 : Mean sea surface temperature in the RA VI Region (Europe) and anomaly (reference Glorys 1992-2013).

<u>**I.2. ATMOSPHERE**</u>

<u>I.2.a General Circulation</u>

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

- Over the Pacific, divergent circulation anomalies are not (a priori) attributable to SST anomalies.
- Conversely, over the other two large ocean basins, coherence is good with SST anomalies.

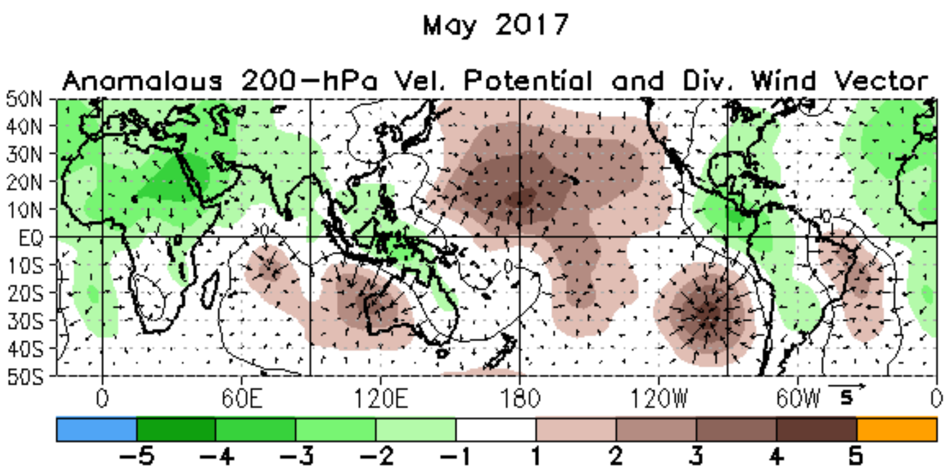


fig.I.2.1.a: Velocity Potential Anomalies at 200 hPa and associated divergent circulation anomaly. Green (brown) indicates a divergence-upward anomaly (convergence-downward anomaly).
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

<u>SOI :</u>

- In neutral ENSO phase, SOI index continues to oscillate from one month to the next. It recorded a positive value of +0.3 in May, whereas it was negative in April -0.2 (see NOAA standardized SOI : https://www.ncdc.noaa.gov/teleconnections/enso/indicators/soi/).
<u>MJO (fig. I.2.1.b)</u>

- Temporary activity in the first part of May (phase 8 and 1), then again at the end of May over Indian Ocean (phases 2 and 3). But the trace of this activity is difficult to detect in large-scale fields (perhaps for the anomaly of divergent circulation over Central America ?).

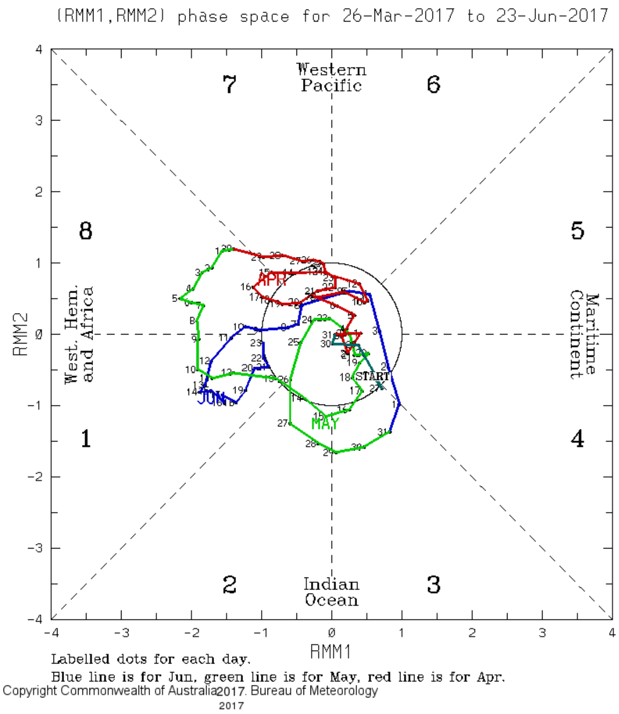


fig.I.2.1.b: indices MJO http://www.bom.gov.au/climate/mjo/

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

- No plainly organized structures. Weak anomalies generally, especially in the tropical atmosphere. This is a sign that ocean / atmosphere forcings are weak. The most marked nuclei are in the vicinity of South America, potentially linked to the influence of mid-latitude circulation (winter in the southern hemisphere). The Easter Island anticyclone extends abnormally southward (not shown here, looking at sea pressure fields), which explains this strong core off South America.

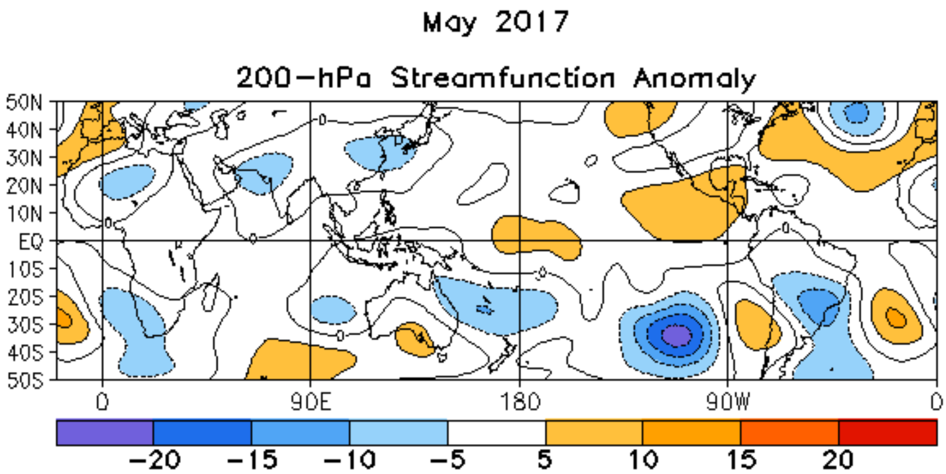


fig.I.2.2: Stream Function Anomalies at 200 hPa. http://www.cpc.ncep.noaa.gov/products/CDB/Tropics /figt22.shtml

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

- Consistent with previous rotational anomalies.
- An abnormally southern extension of the dynamic anticyclone of the Easter Island.
- On the North Atlantic, structure of anomalies is projected fairly well over the EA + and NAO - modes : minimum in the North Atlantic and high in Greenland / Iceland. This has generated SW flows on the Atlantic coast of Europe (see further temperature impact on the SW of Europe : positive temperature anomalies).
- On the western side of Russia, a rather marked negative GP anomaly (consistent with a very positive value of the EA / WR mode) : significant impact on temperatures (negative anomalies, see further).

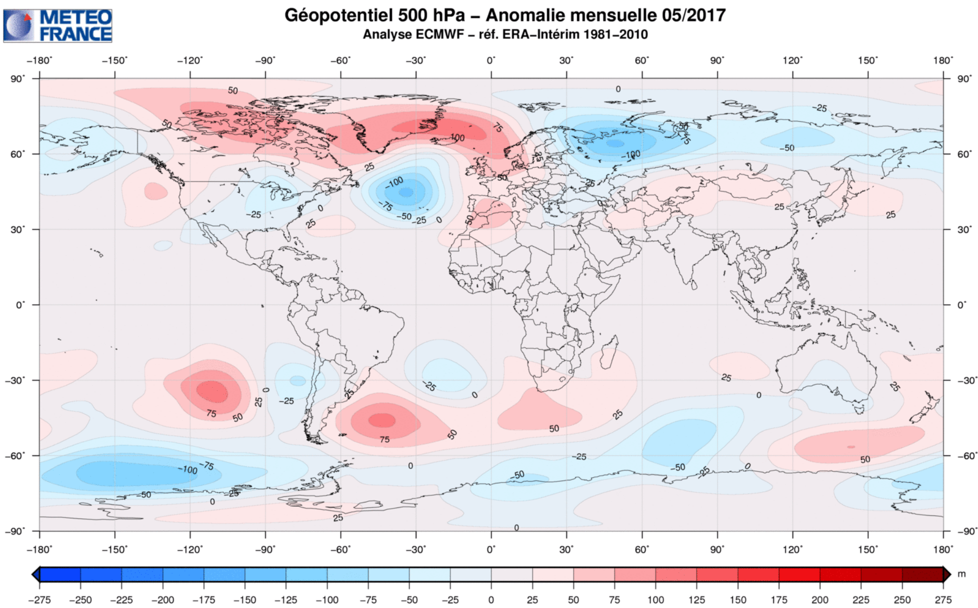


fig.I.2.3: Anomalies of Geopotential height at 500hPa (Meteo-France)

MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
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
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

Evolution of the main atmospheric indices for the Northern Hemisphere for the last 12 months :
http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/table3.shtml

Sea level pressure and circulation types over Europe

The Icelandic Low was stronger than normal and significantly extended to the south at the expense of the Azores High, which had a smaller extension than normal. This extension caused a negative NAO pattern (due to Greenland High) but likewise a weak positive EA pattern, both just converse to the month of April. The westerly flow over the North Atlantic was relocated far to the south causing subtropical airflow to western parts of Europe, but with occasional cyclonic influence.

Since the Greenland High also extended further east to Scandinavia, a weak positive SCAND pattern was established. Anticyclonic influence dominated from Scandinavia southward over Central Europe to the western Mediterranean. This anticyclonic blocking was very frequent that month (on 19 days according to MF weather type classification). Hess/Brezowsky weather types showed 18 days with high pressure either over northern or central Europe.

Low pressure over northeastern and eastern Europe formed a positive EATL/WRUS pattern, causing inflow of cold polar air into this area, near surface as well as in the upper atmosphere. Occasionally, this pattern extended far to the south down to the eastern Mediterranean with cold and wet air. Scandinavia, too, was under this cold airflow but under more anticyclonic conditions.

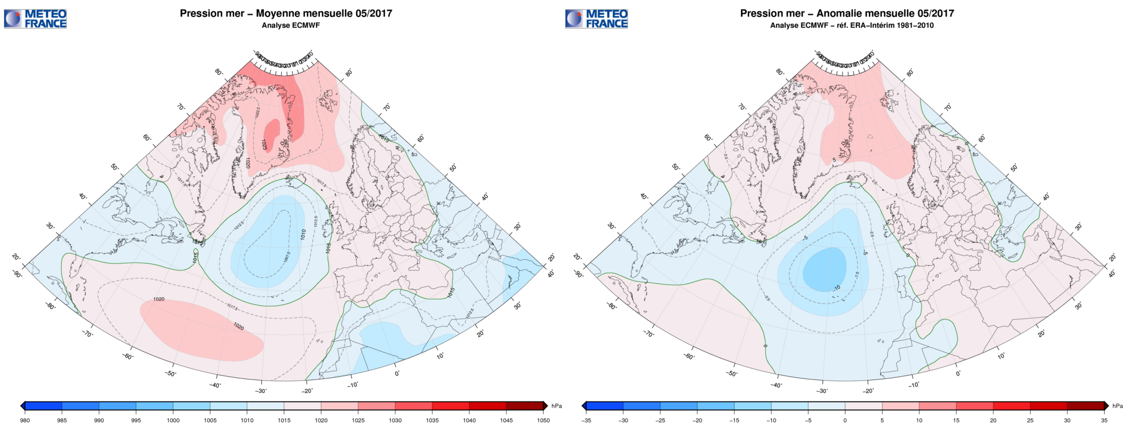


fig.I.2.4: Mean sea level pressure in the RA VI Region (Europe) (top) and 1981-2010 anomalies (bottom).

Circulation indices: NAO and AO

NAO was in a negative phase during the entire month, just converse to April. The change of phase occurred just at the end of April, then the negative phase developed rapidly in the first decade of May, then it weakened to close to zero until the end of the month.

AO showed a very similar development like NAO, suggesting that this is part of a hemispheric circulation change.

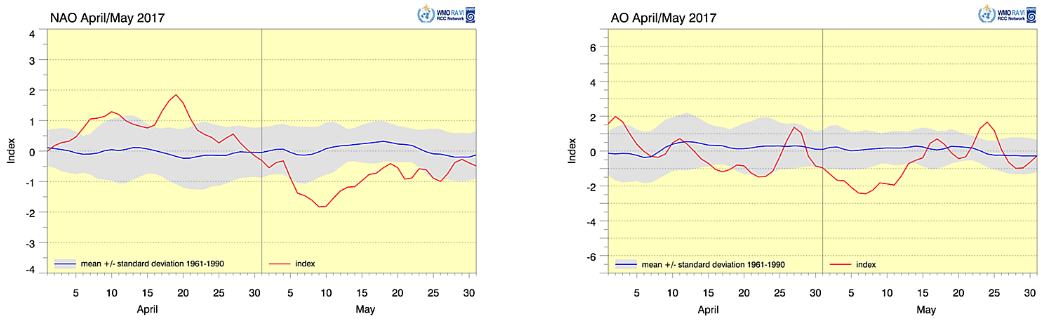


fig.I.2.5: North Atlantic Oscillation (NAO, left) and Arctic Oscillation (AO, right) indices with 1961-1990 mean standard deviation (shading). http://www.dwd.de/rcc-cm , data from NOAA CPC: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml

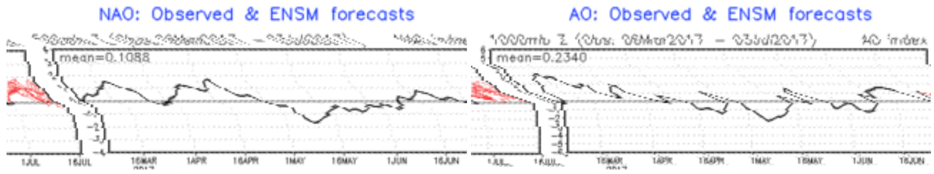


fig. I.2.5a: North Atlantic Oscillation (NAO, left) and Arctic Oscillation (AO, right) indices for the last 4 months and forecasts for the following weeks. Source: NOAA CPC, http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml

I.2.b Precipitation

- In relation to the above-mentioned potential velocity anomalies, precipitation deficit in western Australia, most of the Pacific, and excess precipitation over the Maritime Continent, off Central America, Mali and Nigeria. On the other hand, some structures of precipitation anomalies are not consistent with large-scale circulation : northern South America, over Indian Ocean, northern Africa and over Mediterranean sea, south-western Europe.
- Precipitation deficit over Gulf of Guinea

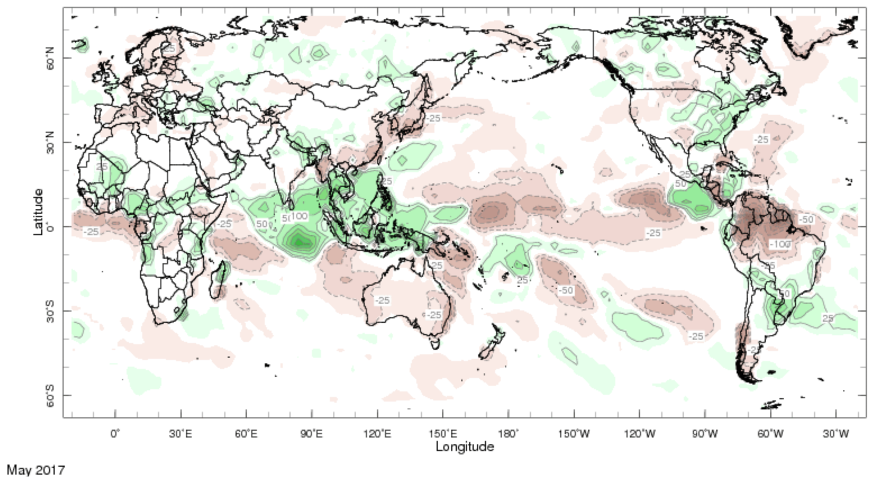


fig.I.2.6: Rainfall Anomalies (mm) (departure to the 1979-2000 normal) – Green corresponds to above normal rainfall while brown indicates below normal rainfall. http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/Anomaly.html

Precipitation anomalies in Europe:

Most parts of Europe were relatively dry, reflecting anticyclonic blocking over Scandinavia and/or Central Europe. Partly drought conditions in northern Europe and western Mediterranean. Western Europe was occasionally touched by cyclonic influence and some above-normal rain, but only locally heavy. Eastern Europe, Caucasus region and Turkey mostly had above-normal precipitation due to EATL/WRUS impact, partly heavy with large hail and strongly triggered by orographic influence especially in the North Caucasus. Due to strong cold air inflow, precipitation in Eastern Europe partly fell as late snow in higher latitudes and higher elevations even in Turkey.

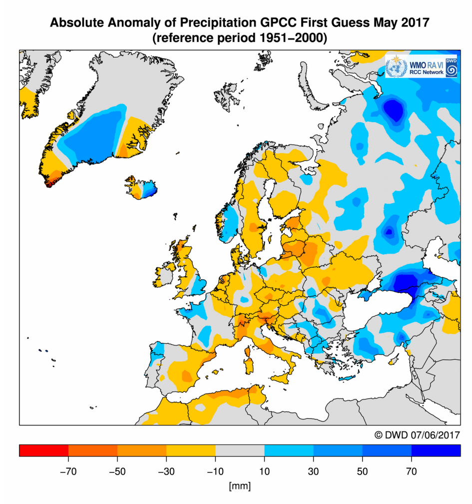


fig.I.2.7.a : Absolute anomaly (1951-2000 reference) of precipitation in the RA VI Region (Europe), data from GPCC (Global Precipitation Climatology Centre), http://www.dwd.de/rcc-cm.

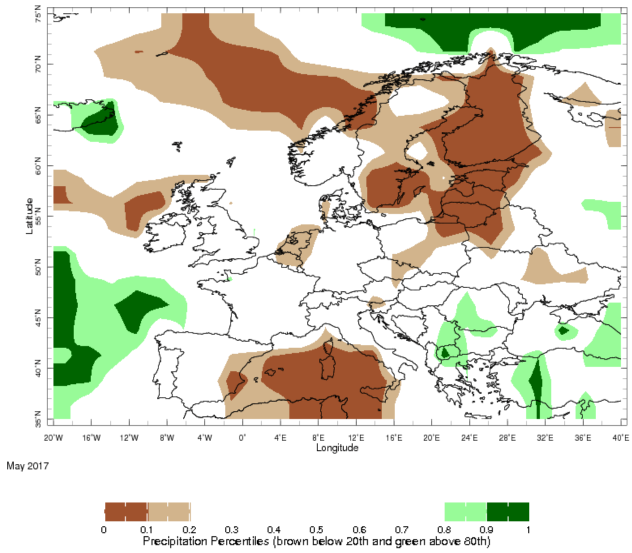


fig.I.2.7.b : Percentiles of precipitation, 1981-2010 reference. Data from NOAA Climate Prediction Center, http://iridl.ldeo.columbia.edu/maproom/Global/Precipitation/Percentiles.html

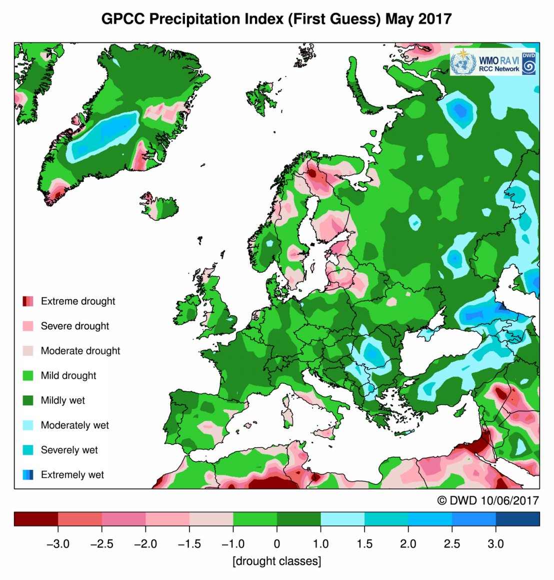


fig. I.2.8: GPCC Precipitation Index, http://www.dwd.de/rcc-cm .

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	- 14.2 mm	- 0.673
Southern Europe	- 9.0 mm	- 0.022

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

- Overall May 2017 was warmer than normal (1981-2010) by 0.56 ° C, making it the second hottest May after 2016, according to Copernicus (https: //climate.copernicus. eu / resources / data-analysis / average surface-air-temperature-analysis / monthly-maps / May-2017).
- Negative temperature anomalies were observed in western Russia and the southern United States, as well as in the north Atlantic south-east of Newfoundland (southern extension of the Labrador Current, see http: //bulletin.mercator-ocean.fr/en/PSY4#4/78.72/-42.98).
- Significant positive anomalies on Maghreb and western Europe (impact mode EA +).

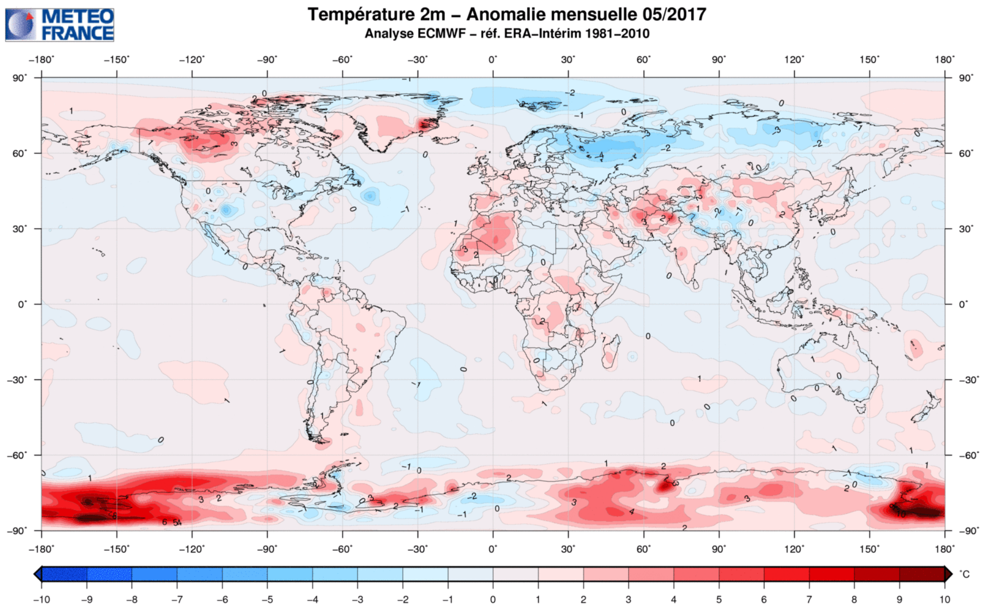


fig.I.2.9: Temperature Anomalies (°C) (Meteo-France)

Temperature anomalies in Europe:

Warming in western and much of central Europe, particularly south-western Europe due to EA+ influence, anticyclonic subsidence and below-normal cloud cover.

Strong cold anomaly over northeastern Europe mainly due to EATL/WRUS+. Colder than normal even far in the south in Turkey and parts of the Mediterranean due to occasionally extended cyclonic influence from the north.

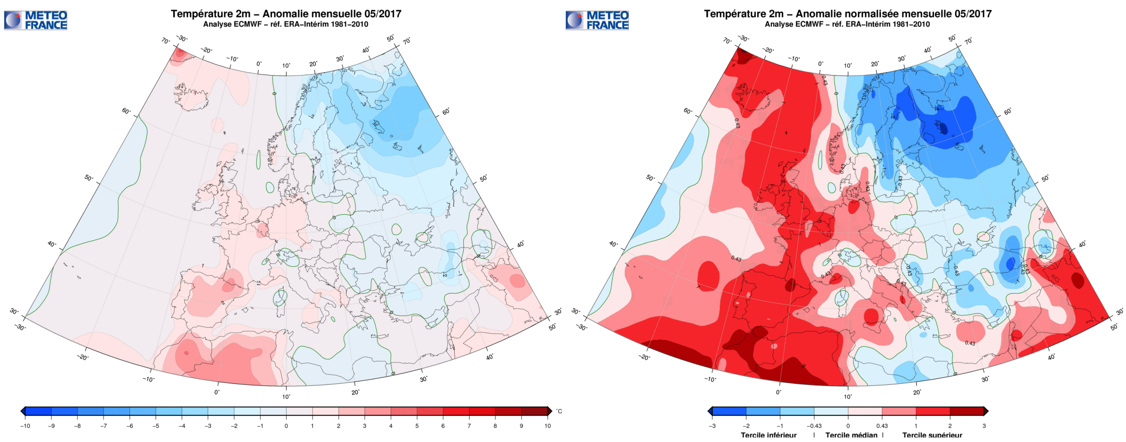


fig.I.2.10: Left graph: Absolute anomaly of temperature in the RA VI Region (Europe). Right graph: Standardized temperature anomalies

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	+ 1.0 °C
Southern Europe	+ 1.9 °C

I.2.d Sea ice

- In Arctic, sea ice extensions in May are still well below normal 1981-2010 (and even below the first decile of the distribution over this period). Only the extensions of May 2015, and especially May 2016 (the lowest ever measured) remain below those of May 2017. The most severe deficits are for the Bering Sea and the Barents Sea,
- In Antarctica, the deficit is still very important in a context that changed dramatically during the boreal summer / fall 2015. The sea-ice extent in Antarctica is the second lowest for this month since start of measurement in 1979 (smaller extent for May 1980, see graph below).

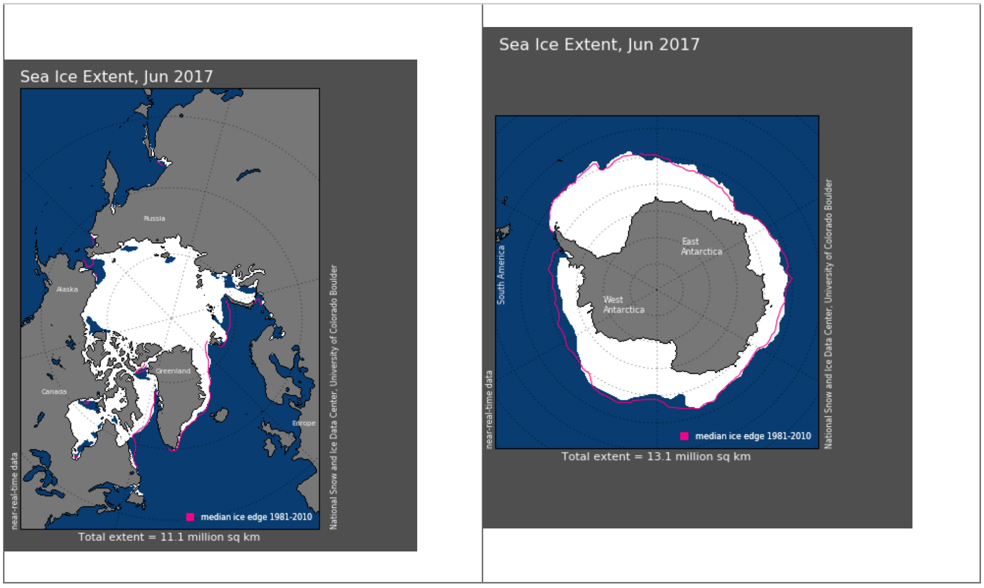


fig.I.2.11: Sea-Ice extension in Arctic (left), and in Antarctic (right). The pink line indicates the averaged extension (for the 1979-2000 period). http://nsidc.org/data/seaice_index/

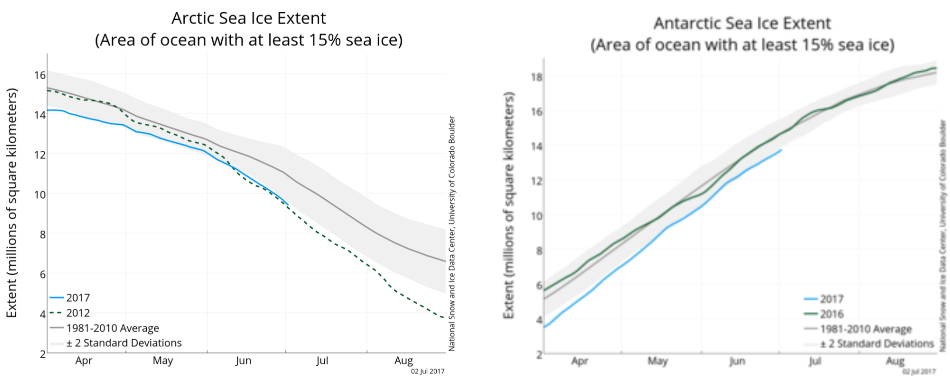


fig. I.2.12 : Sea-Ice extension evolution from NSIDC. https://nsidc.org/data/seaice_index/images /daily_images/N_stddev_timeseries.png

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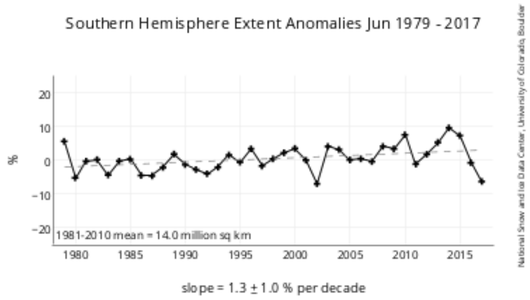


fig 1.2.13 : Monthly Sea Ice Extent Anomaly Graph in Antarctic for the month of analysis (http://nsidc.org /data/seaice_index/)

II. SEASONAL FORECAST FROM DYNAMICAL MODELS

II.1. OCEANIC FORECASTS

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

- Pacific Ocean: Models examined are consistent : they maintain the warm anomaly in the inter-tropical zone, with a weakness along the equator over an eastern part of the basin. This area with low (or even slightly negative) anomalies starts at around 150 ° W longitude to stretch to the Colombian / Ecuadorian / Peruvian coasts. MF and JMA models are somewhat colder than the other models in this region.
  In the north Pacific , there is a cold anomaly from off Japan to the Gulf of Alaska (or south of the Aleutians, depending on the model).
- Indian Ocean: Likely diminushing of the cold anomaly over southeastern basin (but not all models agree on this scenario) and reinforcement of the warm anomaly in the southwest. Over equator, the east-west contrast should remain stable, and the IOD should be in a neutral phase. DMI is expected to remain positive for the next quarter but not to reach the positive phase threshold of IOD.
- Atlantic Ocean:
  - In the equatorial zone, the cold water tongue is not forecasted with the same intensity according to the models : MF is the coldest. But the general oceanic context seems to favor a more active African monsoon than normal.
  - Over North Atlantic, the general structure is expected to persist with an area of positive anomaly from the Moroccan coasts to the northern coast of Brazil, which is a rather favorable context for the development of tropical storms. The evolution of negative anomalies areas ("cold blob" + southern extension of the current of Labrador) is quite differently appreciated by the different models : not really consensus.
- Mediterranean Sea : Positive SST anomalies, especially over the western part of the basin (there is consensus of the models).

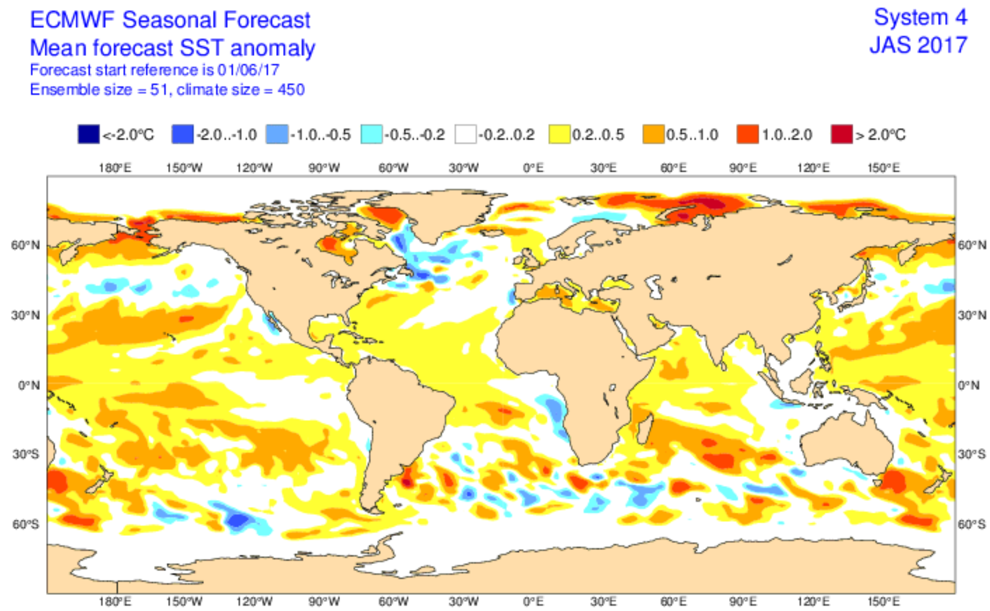


fig.II.1.1: SST anomaly forecast from ECMWF http://www.ecmwf.int/products/forecasts/d/charts/seasonal /forecast/seasonal_range_forecast/group/

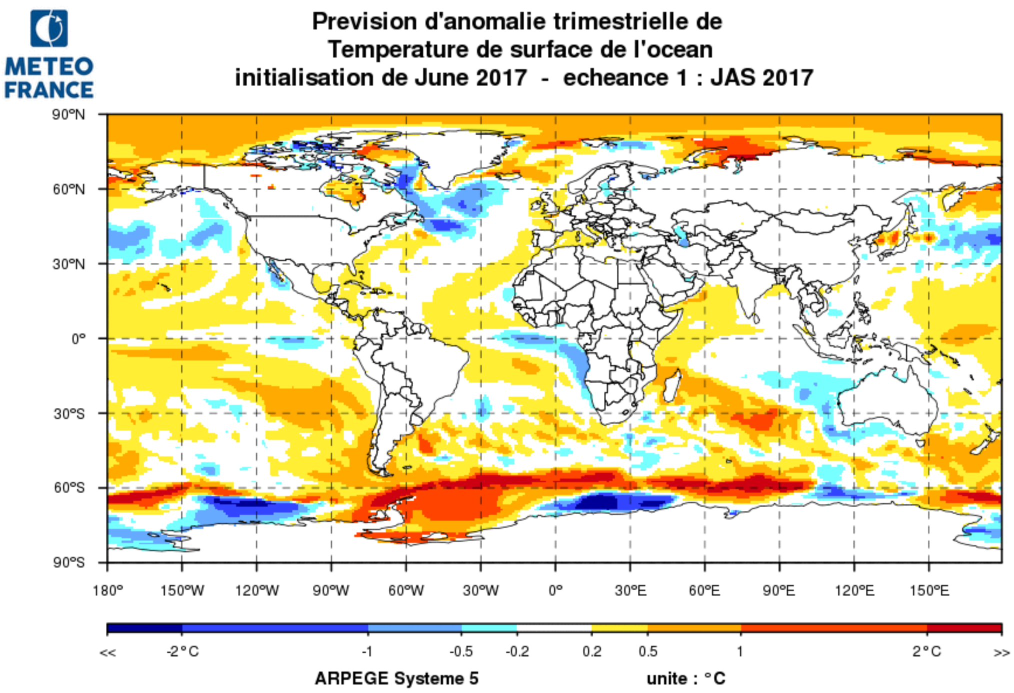


fig.II.1.2: SST Anomaly forecast from Meteo-France (recalibrated with respect of observation). http://seasonal.meteo.fr

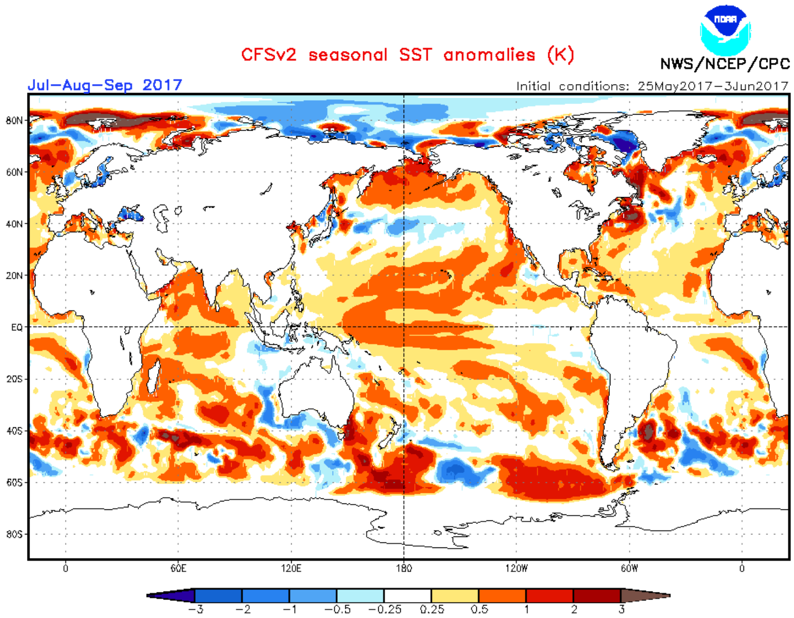


fig.II.1.3: SST Anomaly forecast from NCEP. http://www.cpc.ncep.noaa.gov/products/people/wwang/cfsv2fcst/imagesInd1/glbSSTSeaInd1.gif

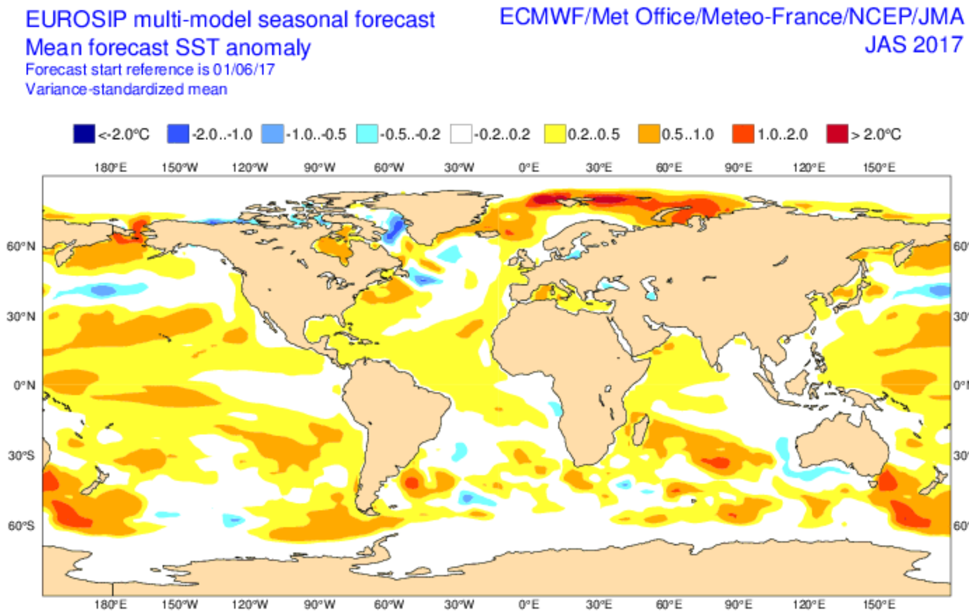


fig.II.1.4: SST Forecasted anomaly from Euro-SIP

II.1.b ENSO forecast :

***Forecast Phase*: likely neutral during the next three months.**

Most simulations predict anomalies between 0 and +1 ° C, with no real trend (a slight decline is even observed during the summer before a stabilization phase in autumn). In the IRI synthesis http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/ in mid-June, the neutral and El Niño phase probabilities exceed about 10 % climatological probabilities for the JAS quarter. The emergence of La Niña is however unlikely.

In the longer term, it is the neutral phase that seems to prevail (for the boreal winter) without being able to rule out a positive ENSO phase (of low intensity, however, if it were to take place).

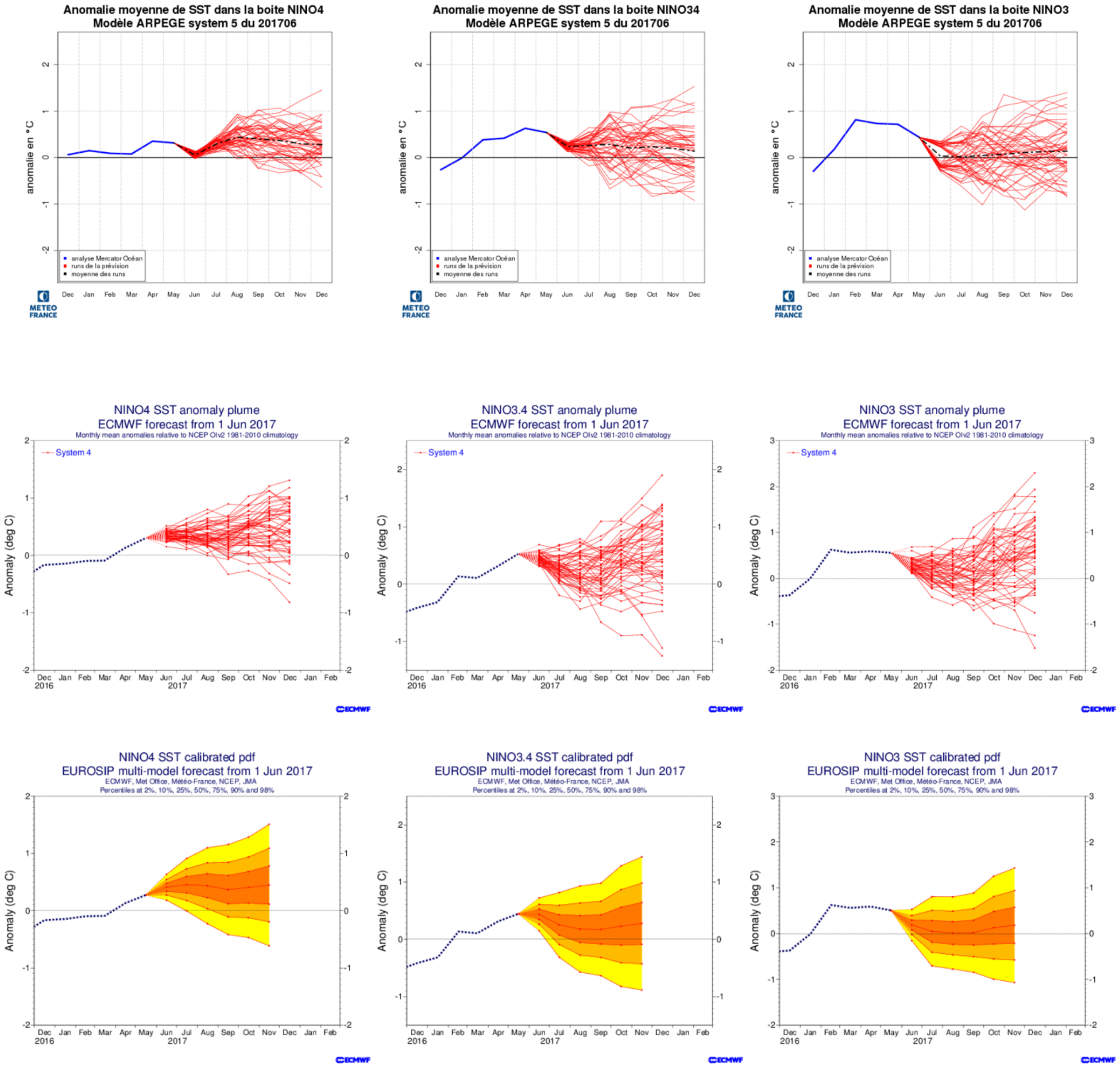


fig.II.1.5: SST anomaly forecasts in the Niño boxes from Météo-France (top) and ECMWF (middle) - monthly mean for individual members - and EUROSIP (bottom) – recalibrated distributions - (http://seasonal.meteo.fr , http://www.ecmwf.int/)

I.1.c Atlantic ocean forecasts

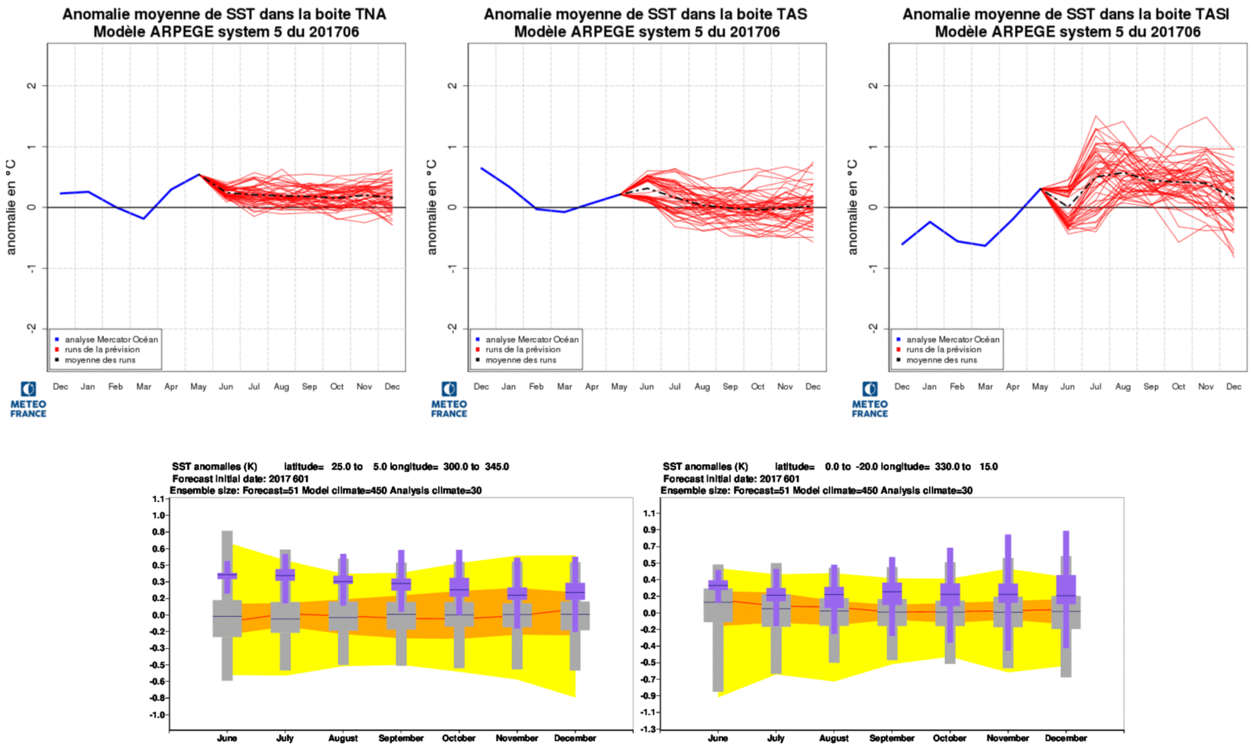
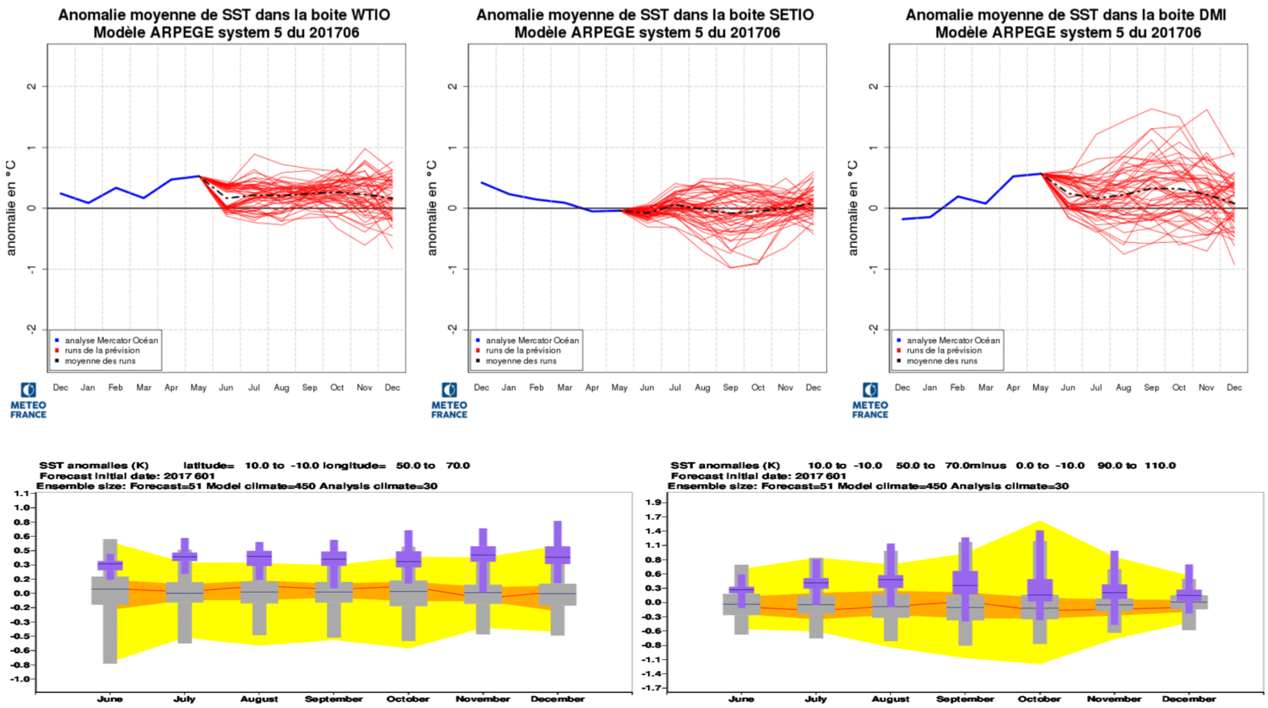
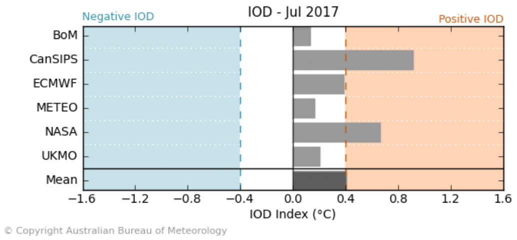


fig.II.1.6: SSTs anomaly forecasts in the Atlantic Ocean boxes from Météo-France and ECMWF, plumes / climagrams correspond to ensemble members and monthly means.

I.1.d Indian ocean forecasts





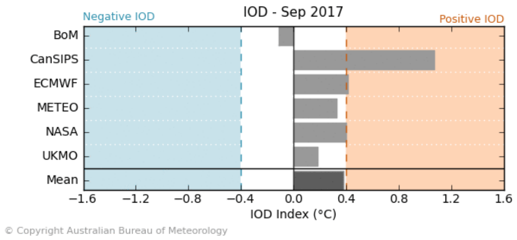
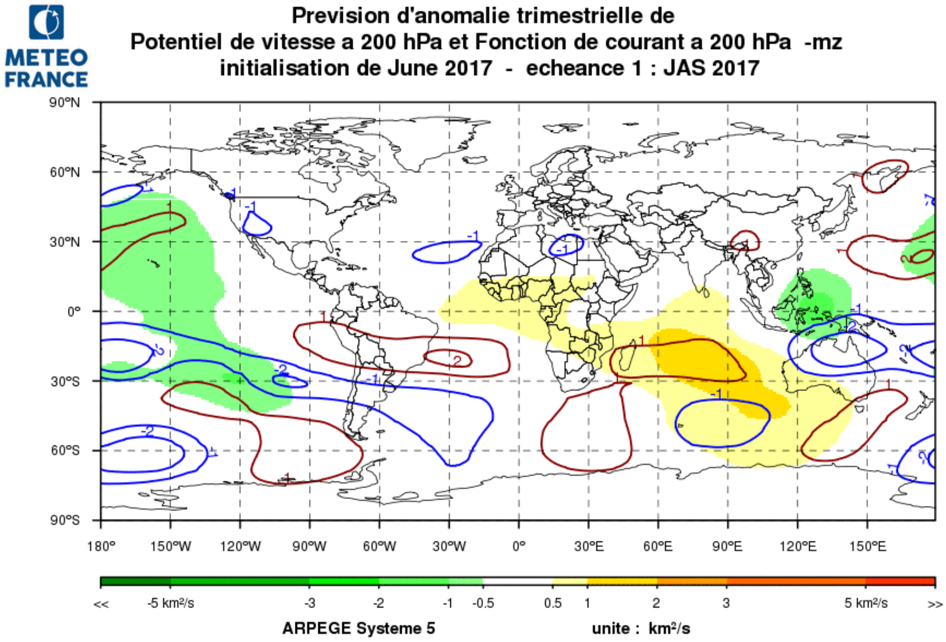


fig.II.1.7: SST anomaly forecasts in the Indian Ocean boxes from Météo-France and ECMWF, plumes / climagrams correspond to ensemble members and monthly means.

II.2. GENERAL CIRCULATION FORECAST

II.2.a Velocity potential anomaly field and Stream Function anomaly field

- Velocity potential : models disagree, and anomalies are weak, particularly for the ECMWF model. The only consensus is for Indonesia with a small negative anomaly (strengthening upward movements).
- Stream Function : The disagreement of the models persists. No consistent overall scheme. No teleconnections toward mid latitudes. Weak and disorganized anomalies. The atmosphere seems completely "inert" without any particular large-scale forcing.



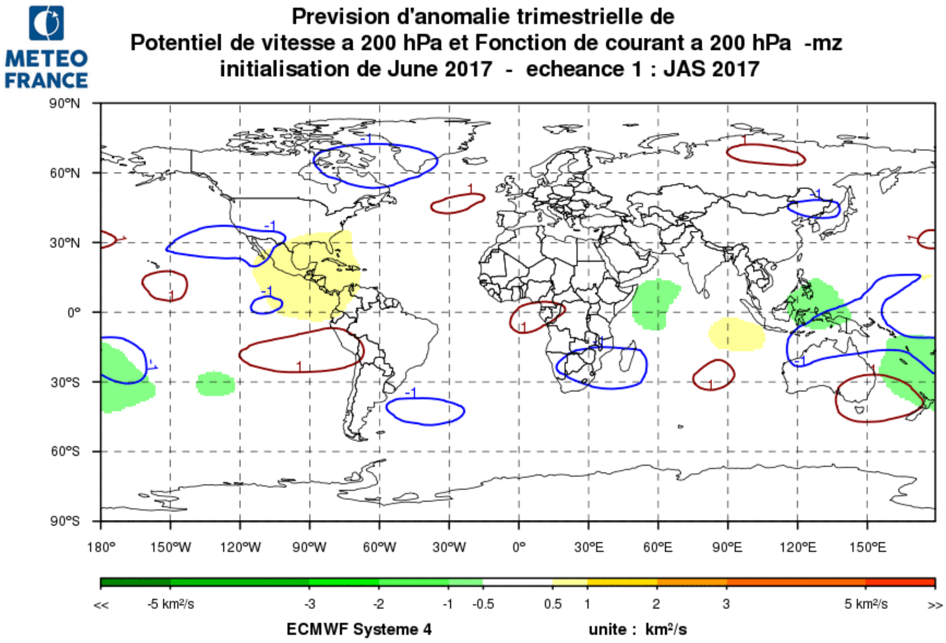


fig.II.2.1: Velocity Potential anomaly field χ (shaded area – green negative anomaly and pink positive anomaly), associated Divergent Circulation anomaly (arrows) and Stream Function anomaly ψ (isolines – red positive and blue negative) at 200 hPa by Météo-France (top) and ECMWF (bottom).

II.2.b Geopotential height anomalies

Models suggest a context of positive geopotential anomalies at 500 hPa, but in a very broad and very soft way on almost the whole planet (except over mid-lat south hemisphere). Europe does not escape this trend. Models available at the time of writing (11 out of the 12 GPCs) offer a fairly consensual wide positive anomaly of geopotentials from the Azores to the Black Sea, although, depending on the model, this anomaly is either rather south, or rather north. But for Europe, this constitutes each time a positive anomaly of geopotential.

Without any identified forcings and teleconnections, this is likely to reflect the expansion of the atmosphere as a result of global warming. We will opt for this scenario, but remaining very careful about its reliability (especially considering the season).

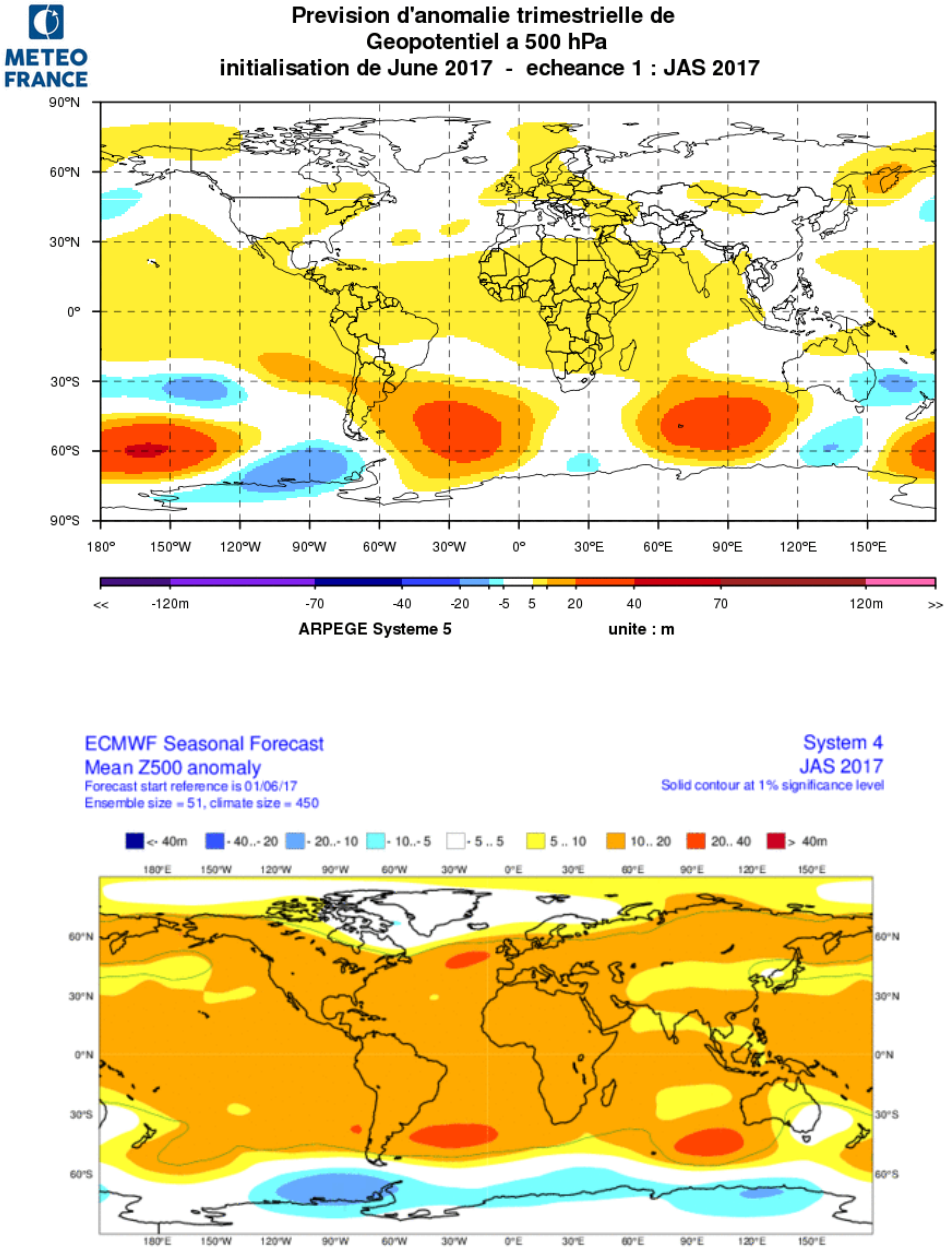


fig.II.2.2: Anomalies of Geopotential Height at 500 hPa from Météo-France and ECMWF.
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast

II.2.c. weather regimes

MF model forecasts only. Confirmation of the proximity of the atmosphere of a state close to climatology, with almost no signal on the summer regimes (neither in Pmer nor in Z500).

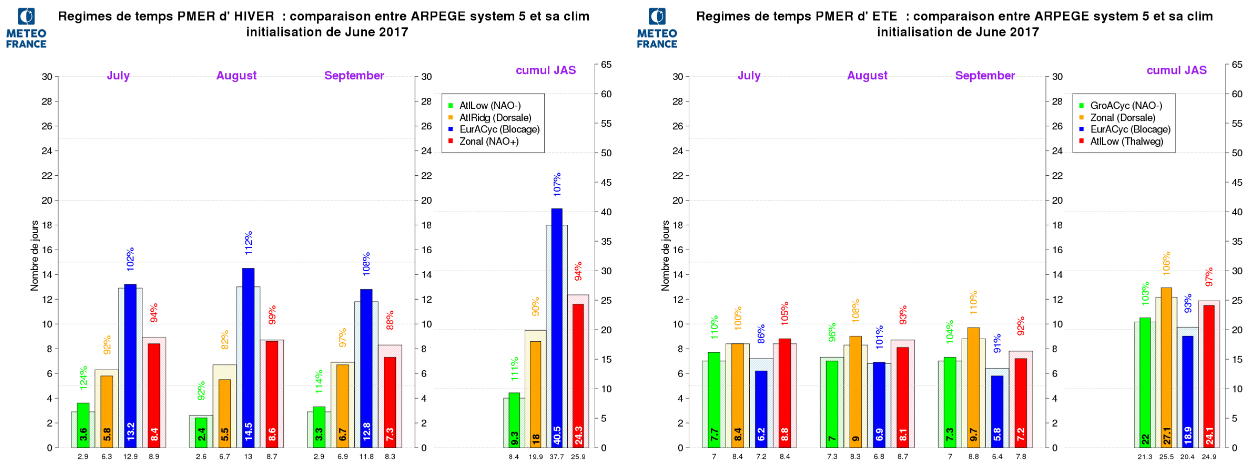


fig.II.2.3bis: North Atlantic Regime occurrence anomalies from Meteo-France ARPEGE-S5 : vertical bars represent the excitation frequency anomaly (in %) for each of the 4 regimes.

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

Globally, the warm signal dominates widely, probably linked to the effects of the global warming. In the tropical belt, the warm signal is generally very likely except for Australia, the southeastern Indian Ocean, the Benguela Current Zone, and the eastern Equatorial Pacific .
Over continents north of 30 ° N, the warm signal also dominates but with a more moderate probability.

Nevertheless, for the western part of Europe, EUROSIP multi-model gives a warm signal with a **relatively** high probability.

It should be noticed that the ARPEGE System 6 model currently being tested at MF also proposes a rather warm scenario (except for western Russia and the southeastern USA, where temperatures are forecasted below normal).

II.3.a ECMWF

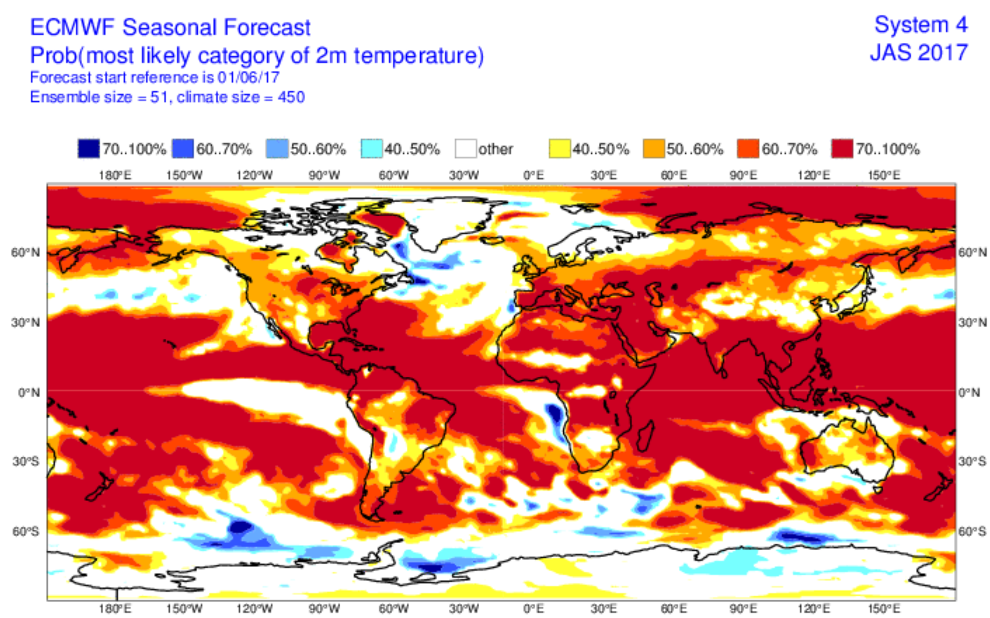


fig.II.3.1: Most likely category probability of T2m from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal). http://www.ecmwf.int/products/forecasts/d/charts/seasonal /forecast/seaso...

II.3.b Météo-France

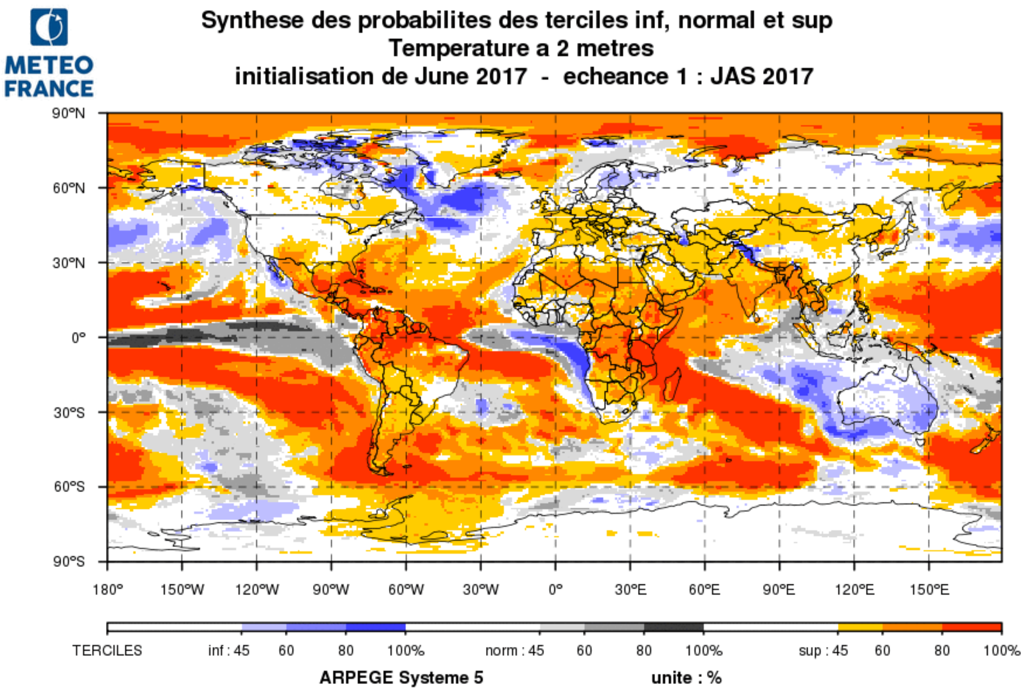


fig.II.3.2: Most likely category of T2m. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://seasonal.meteo.fr/

II.3.e Japan Meteorological Agency (JMA)

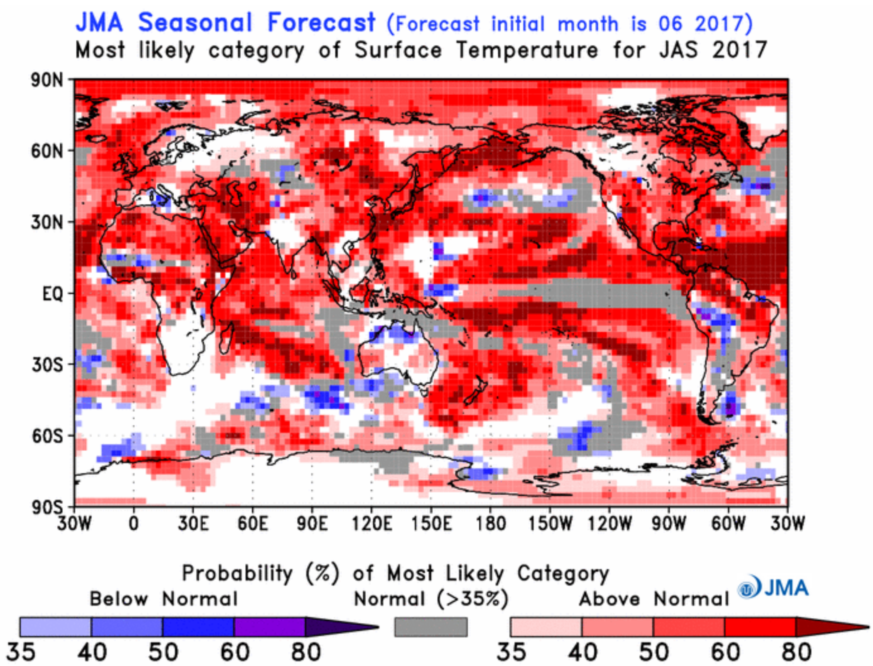


fig.II.3.3: Most likely category of T2m. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/fcst/fcst_gl.php

II.3.g EUROSIP

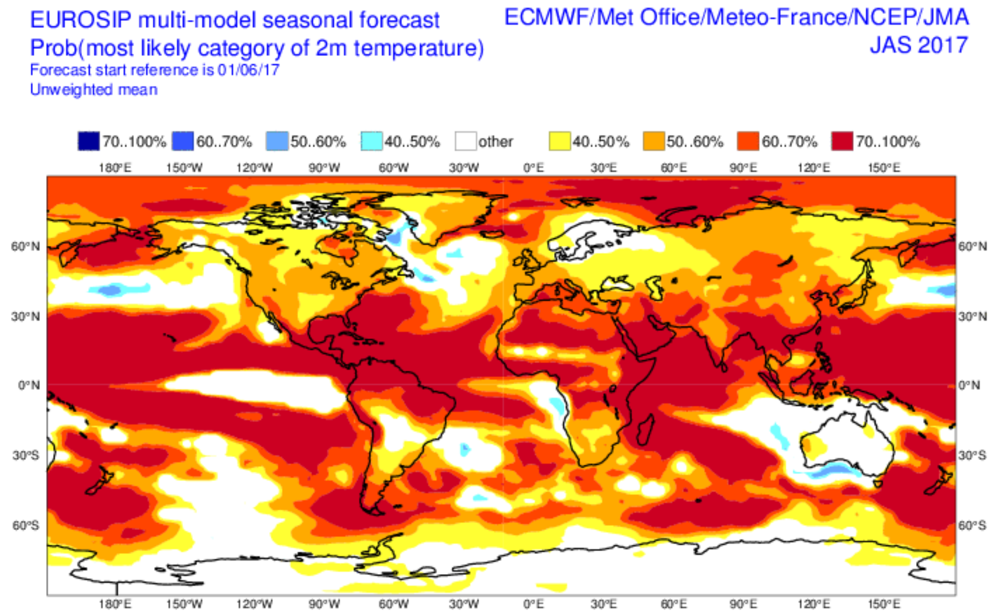


fig.II.3.4: Multi-Model Probabilistic forecasts for T2m from EuroSip (2 Categories, Below and Above normal – White zones correspond to No signal and Normal). http://www.ecmwf.int/products/forecasts/d/charts/seasonal /forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

II.4. IMPACT : PRECIPITATION FORECAST

- Drier conditions than normal on Australia. Conversely, increased probability of wetter conditions between the Philippines and New Guinea. Also, a wet anomaly is expected in northern Mozambique and northern Madagascar (Mayotte and Réunion also concerned).
- The African monsoon should be more active than normal, especially on the western part of the Sahel. It started prematurely and with a high intensity on the western Sahel. ITF was in June very North (see http://www.cpc.ncep.noaa.gov/products/international/itf/itcz.jpg).
- Over Europe, models suggest drier conditions than normal.

II.4.a ECMWF

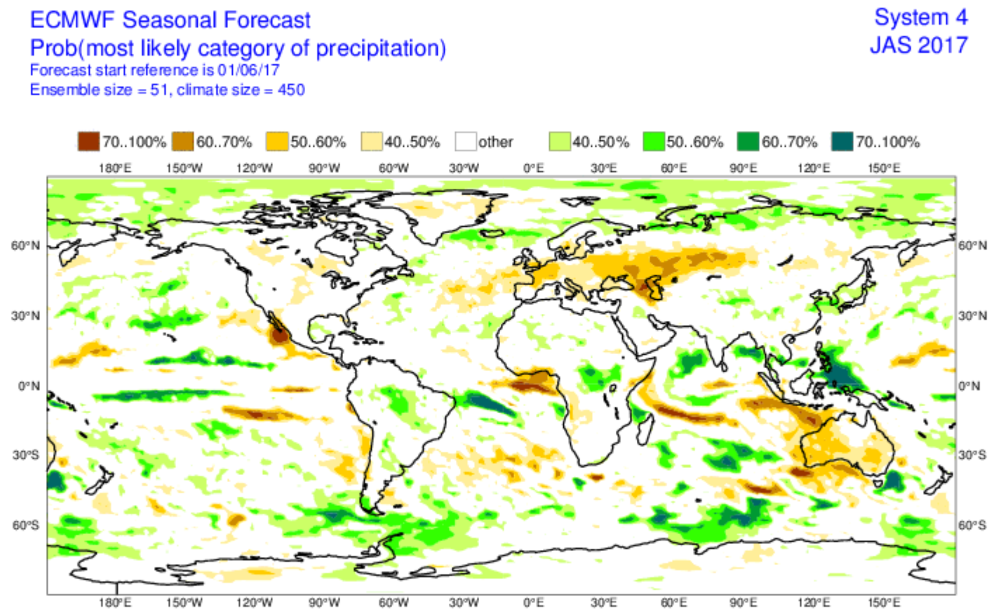


fig.II.4.1: Most likely category probability of rainfall from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal). http://www.ecmwf.int/products/forecasts/d/charts /seasonal/forecast/seasonal_range_forecast/group/

II.4.b Météo-France

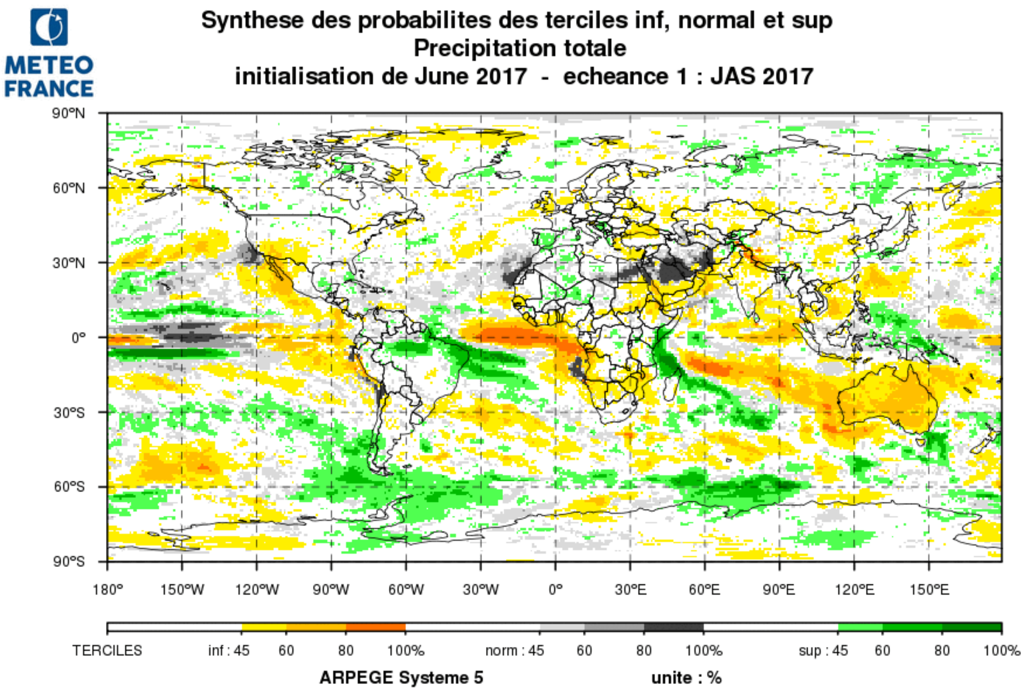


fig.II.4.2: Most likely category of Rainfall. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://seasonal.meteo.fr/

II.4.e Japan Meteorological Agency (JMA)

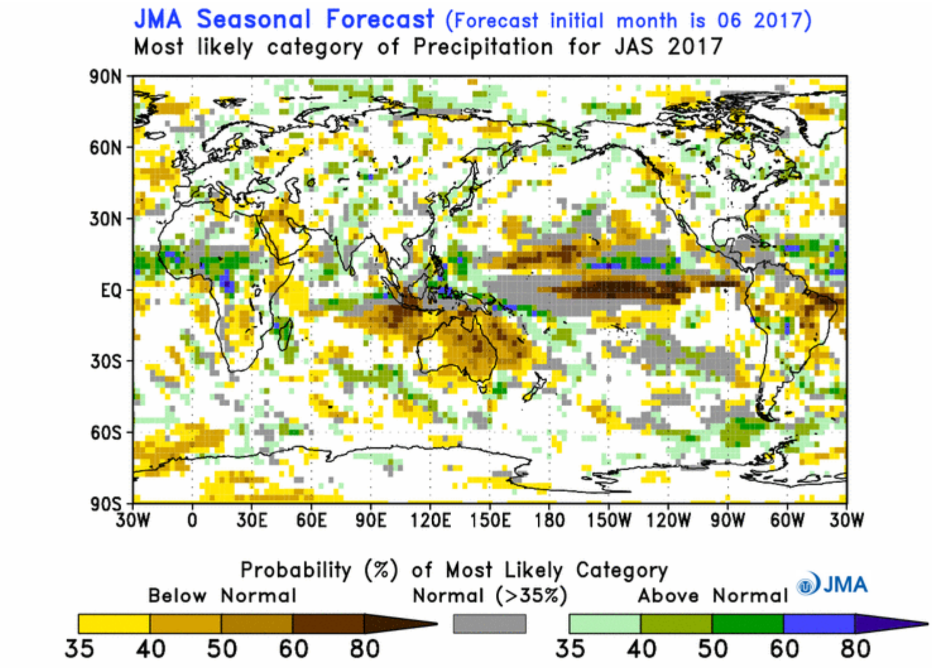


fig.II.4.5: Most likely category of Rainfall from JMA. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/3-mon/fcst/fcst_gl.php

II.4.g EUROSIP

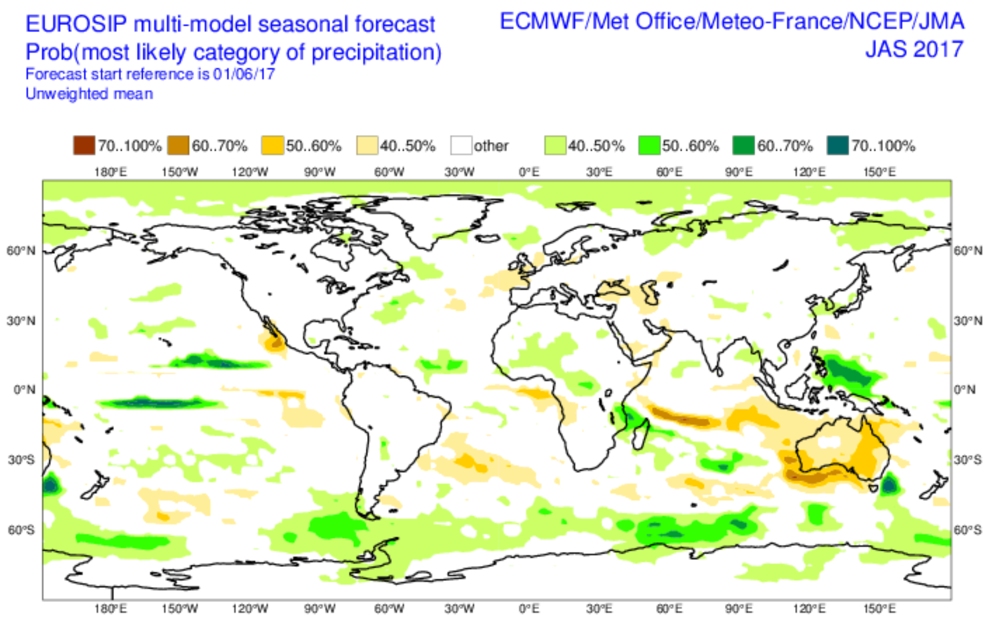


fig.II.4.7: Multi-Model Probabilistic forecasts for precipitation from EuroSip (2 Categories, Below and Above normal – White zones correspond to No signal). http://www.ecmwf.int/products/forecasts/d/charts/seasonal /forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

II.5. REGIONAL TEMPERATURES and PRECIPITATION

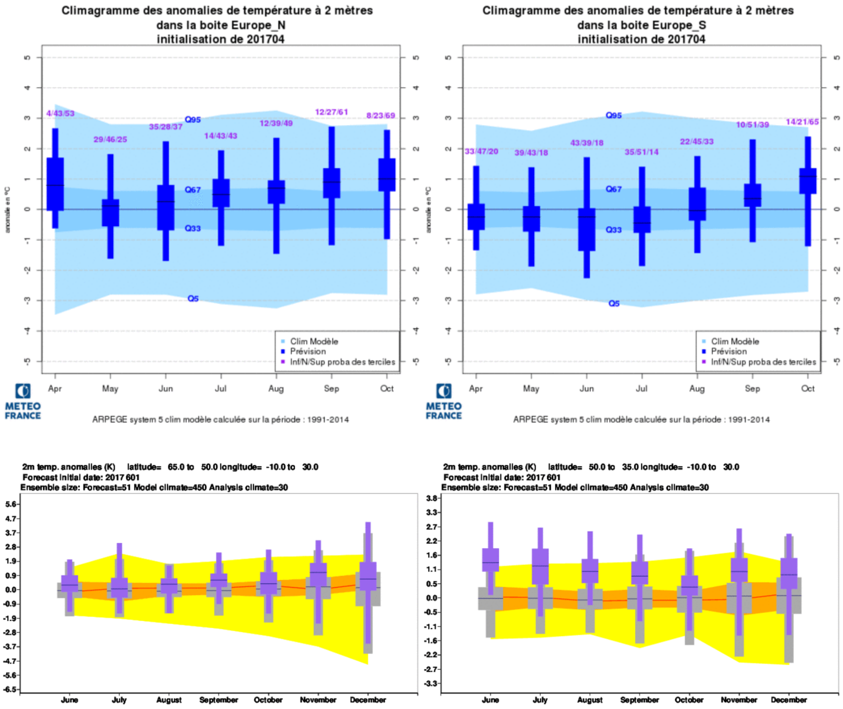


fig.II.5.1 : Climagrams for Temperature in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom).

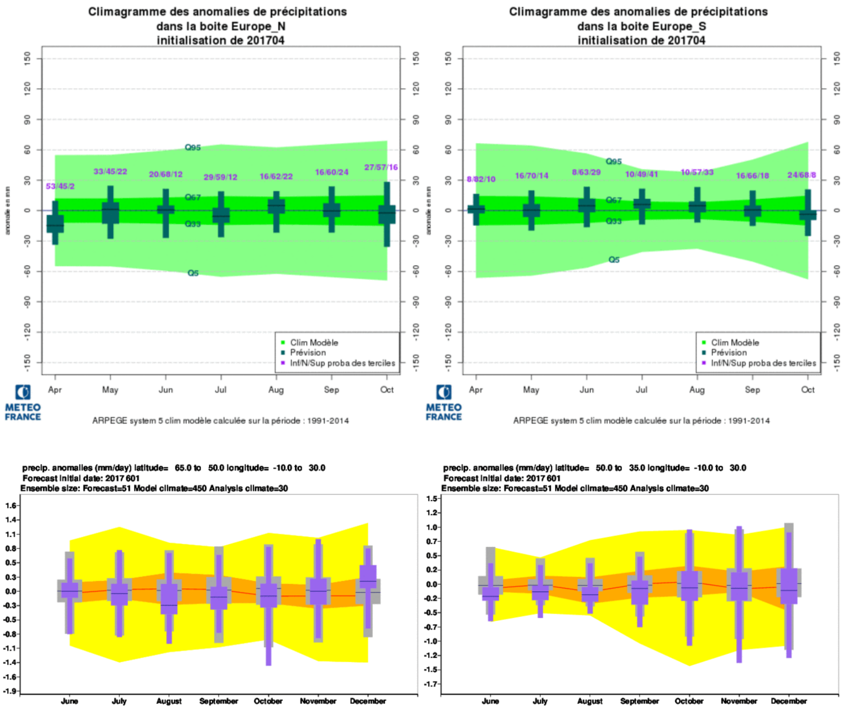


fig.II.5.2 : Climagrams for Rainfall in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom).

II.7. "EXTREME" SCENARIOS

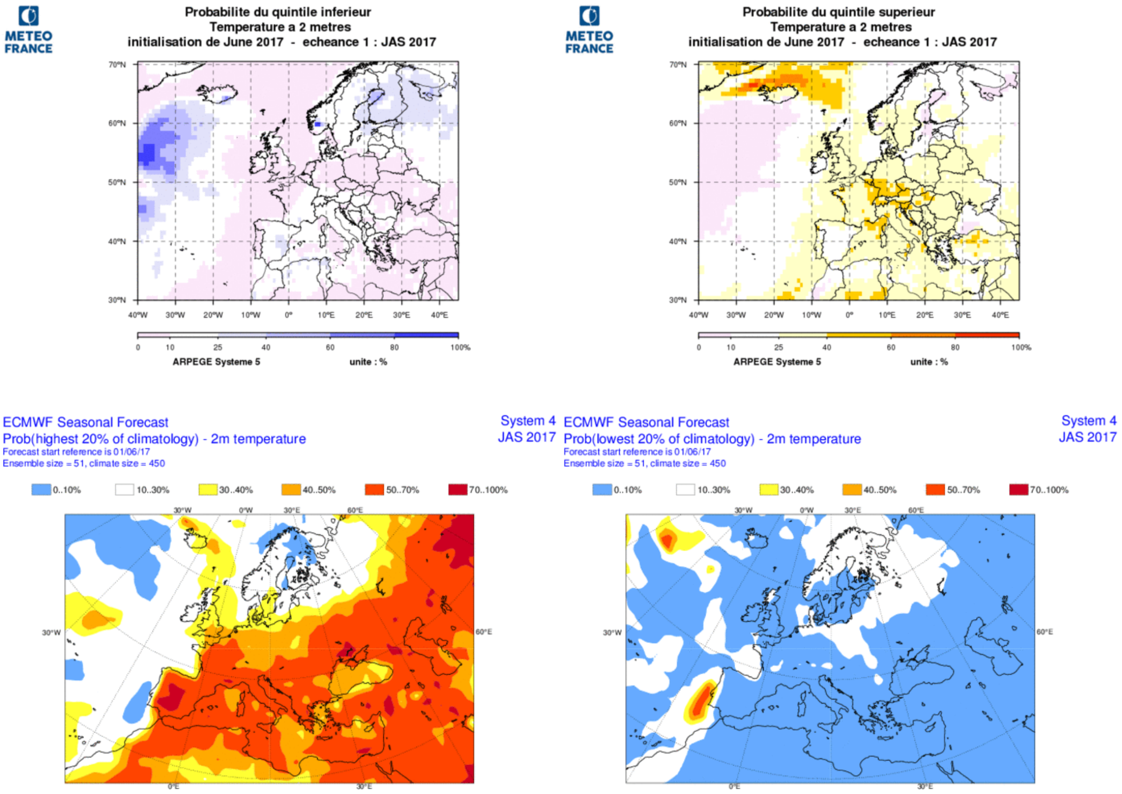


fig.II.7.1 : Top : Meteo-France T2m probability of « extreme » below normal conditions (left - lowest ~15% of the distribution) and "extreme" above normal conditions (right - highest ~15% of the distribution). Bottom : ECMWF T2m probability of « extreme » below normal conditions (left - highest ~20% of the distribution) and "extreme" above normal conditions (right – lowest ~20% of the distribution).

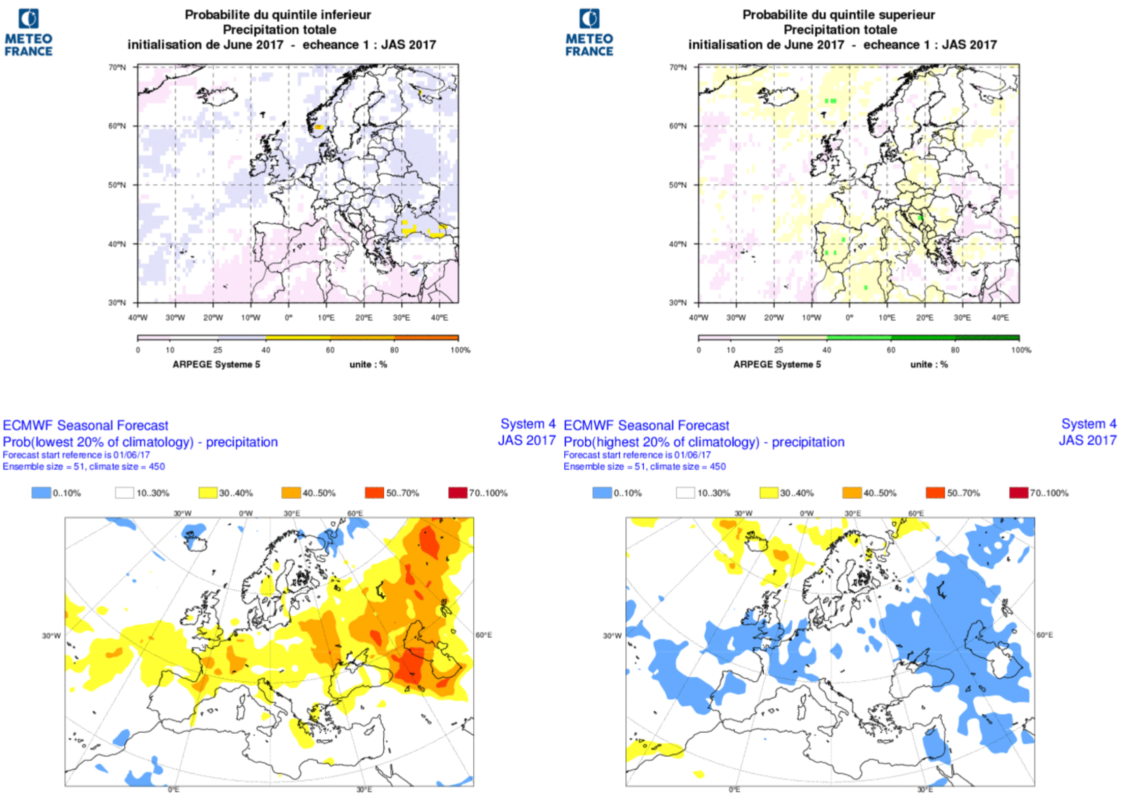


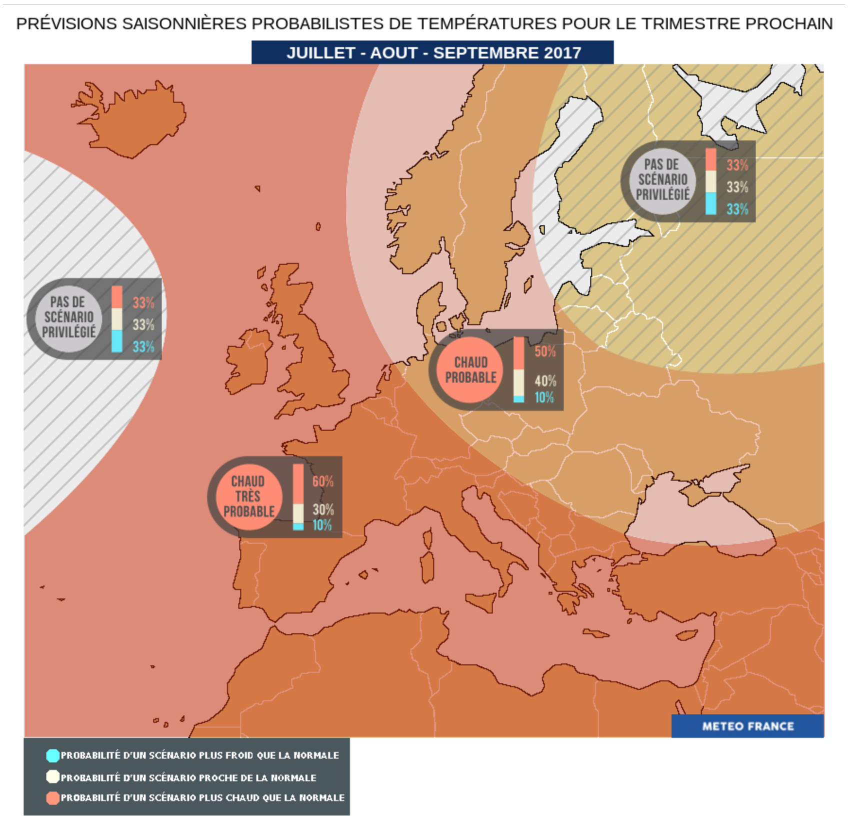
fig.II.7.2 : Top : Meteo-France rainfall probability of « extreme » below normal conditions (left - lowest ~15% of the distribution) and "extreme" above normal conditions (right - highest ~15% of the distribution).

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).

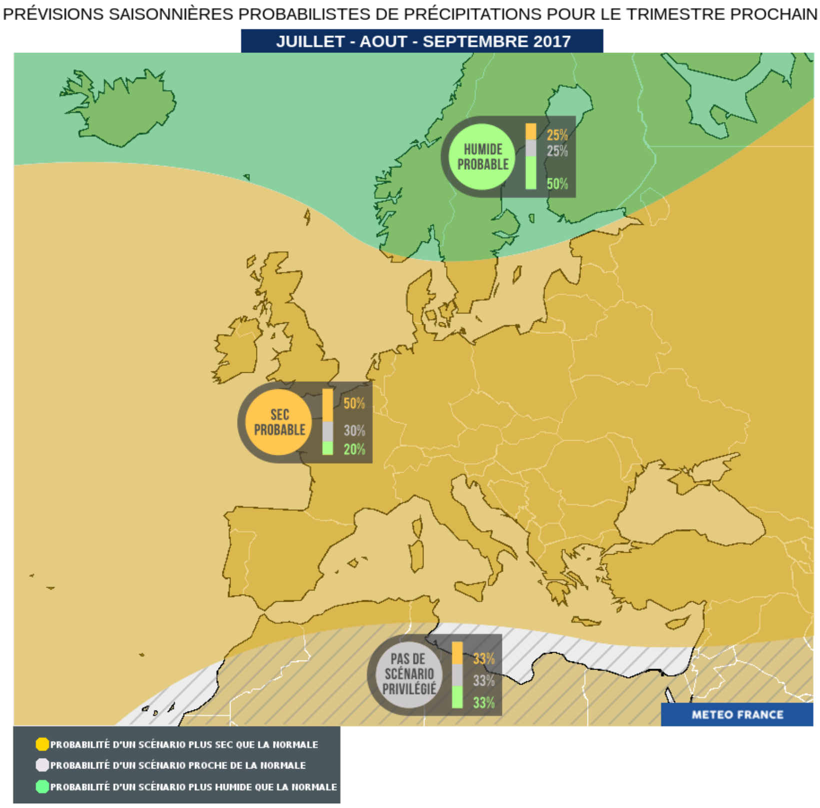
II.8. DISCUSSION AND SUMMARY

II.8.a Forecast over Europe

Temperatures : Warmer than normal over most of Europe. Lower probability of this scenario from Ukraine to Fennoscandia, and no scenario for western Russia.



Precipitation: A drier than normal scenario for most of Europe, except in the extreme north (Iceland, Norway, Finland) where a wetter scenario appears to be slightly probable.



II.8.b Tropical cyclone activity

No significant difference from normal on the whole area of tropical storms for the 2017 season. Nevertheless, the warmer tropical North Atlantic context and the above-normal forecasted activity of the African monsoon (particularly on the Western Sahel) are two elements that could favor the development of tropical storms over the Atlantic basin.

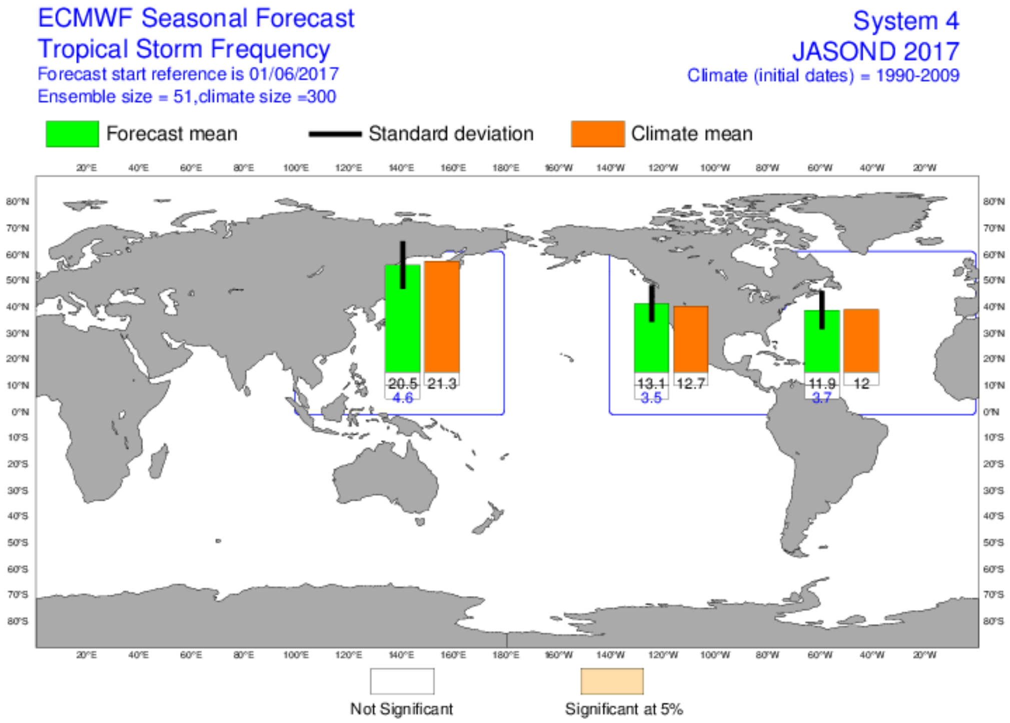


fig.II.8.1 : Seasonal forecast of the frequency of Tropical Cyclones from EUROSIP (Météo-France & ECMWF). http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmtrop/trop_euro /eurosip_tropical_storm_frequency/

III.1. Seasonal Forecasts

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

- BoM, CMA, CPTEC, ECMWF, JMA, KMA, Météo-France, NCEP and UK Met Office have ocean/atmosphere coupled models. The other centres 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 interpretate 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 centres.

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 where the SST warming is developing first at the surface (especially for coastal events).

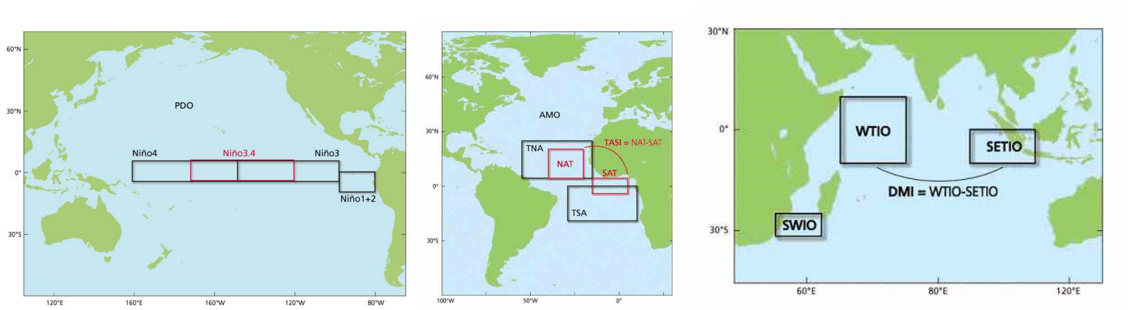
- Niño 3 : 5°S/5°N 90W-150W ; it is the region where the interanual variability of SST is the greatest.

- Niño 4 : 5°S/5°N 160E- 150W ; it is the region where 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 between Niño 3 and Niño 4 boxes (SST variability and Rainfall impact).

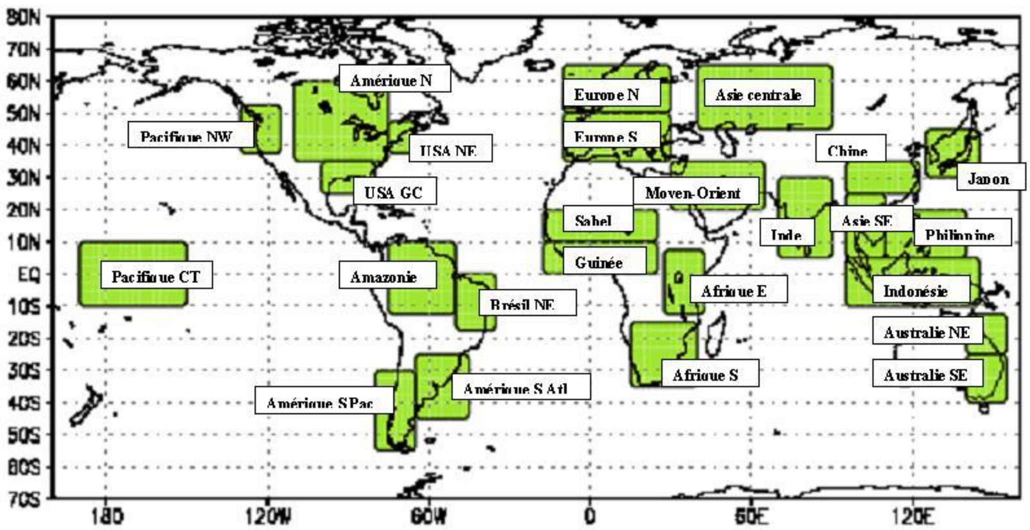
Associated to the oceanic « El Niño / La Niña » events, and taking into account the strong ocean/atmopshere coupling, the atmosphere shows also interanual variability associated to these events. It is monitored using the SOI (Southern Oscillation Index). This indice is calculated using standardized sea 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).