GLOBAL CLIMATE BULLETIN
n°209 – November 2016

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I. DESCRIPTION OF THE CLIMATE SYSTEM (SEPTEMBER 2016)

I.1. OCEANIC ANALYSIS

I.1.a Global analysis

Pacific ocean :

- Along the Equator: surface SST cooling continued during September over the western basin, reaching the date line. To the east however slight warming occurred, so that the Niño 3.4 anomaly has remained close to la Niña threshold (-0.5°C). Subsurface slight warming but still widespread negative anomalies.
- Persistent positive anomalies of SST both sides of the equatorial waveguide in the tropical area, despite slight cooling.
- Over the North Pacific: PDO index falling down to –1.06 (-0.66 in August) ; cooling trend over the tropics, warming between 30 ° N and 40 ° N, and alternate warming and cooling areas more to the north, leading to meridional SST gradients.

Maritime continent :

- Cooling trend over the northern area, between Indonesia and China, and warming to the south, but overall still positive SST anomalies.

Indian Ocean :

- After rising in August, the IOD index dropped again in September, consistent with an active MJO over the eastern Indian Ocean and the Maritime Continent. Negative SST anomalies returned along the eastern coast of Africa.
- Positive SST anomaly remaining in the Gulf of Bengal.
- Persisting negative anomalies west and south of Australia and negative anomalies developing over the Mayotte – Madagascar – Réunion area.

Atlantic Ocean :

- Widespread cooling, excepted west of Portugal and Senegal, and locally to the south of Newfoundland (which now induces a strong SST gradient favourable to baroclinic cyclogenisis).
- As a result : the persistent central-Atlantic “cold blob” has extended, mainly toward the south and the west of the basin. Strong positive anomalies have persisted however over the western tropical basin (Caribbean, Bahamas, Bermuda).

- SST structure at the end of September is a mix of EA+ and SCAND+ canonical patterns. It has been proved that such patterns favour the Scandinavian blocking regime during the following winter.
- (http://www.cnrm-game-meteo.fr/gmgec-old/page_perso/guemas/Seminaire_LMD_10_08.pdf)

In the Mediterranean :

- Cooling to the east, warming to the west, mainly due to atmospheric circulation over the basin in September. Positive anomalies still largely dominate.

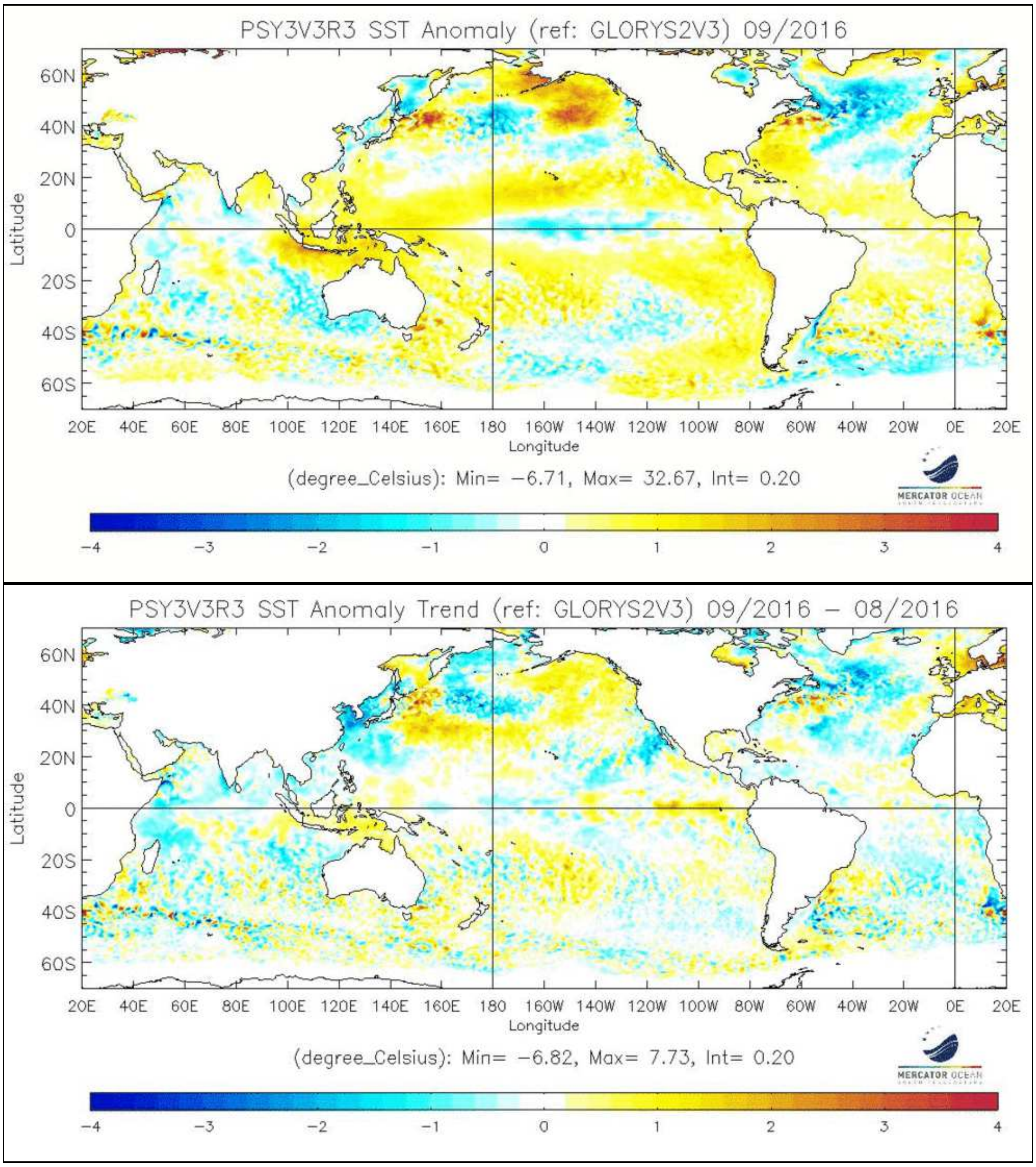


fig.I.1.1: top : SSTs Anomalies (℃) . Bottom : SST tendency (current – previous month), (reference Glorys 1992-2009). http://bcg.mercator-ocean.fr/

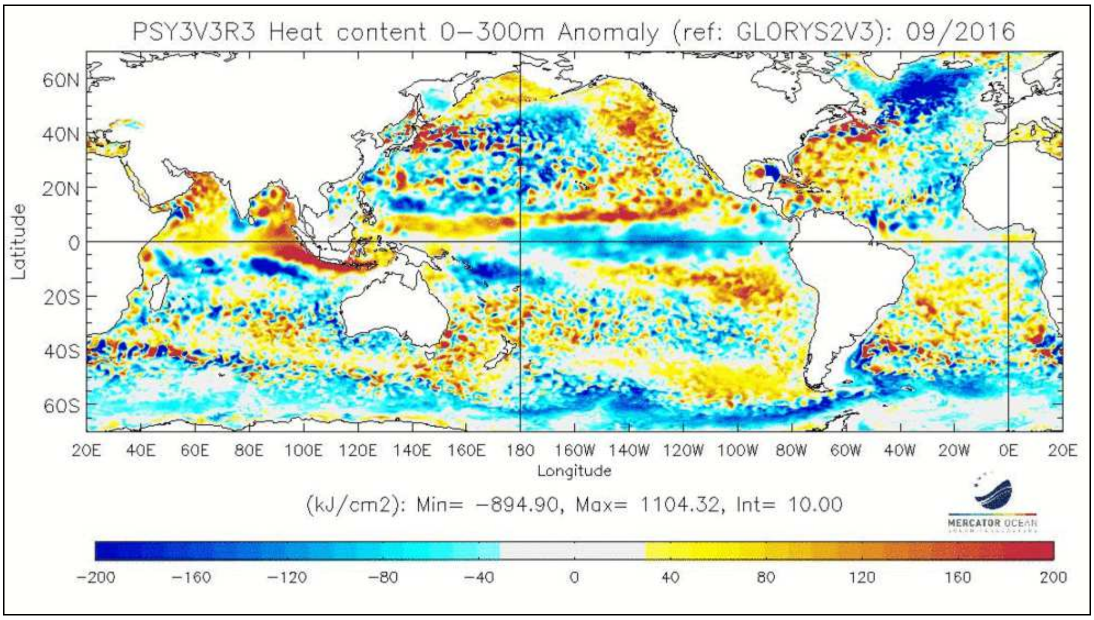


fig.I.1.2: map of Heat Content Anomalies (first 300m, kJ/cm2, reference Glorys 1992-2009)
http://bcg.mercator-ocean.fr/

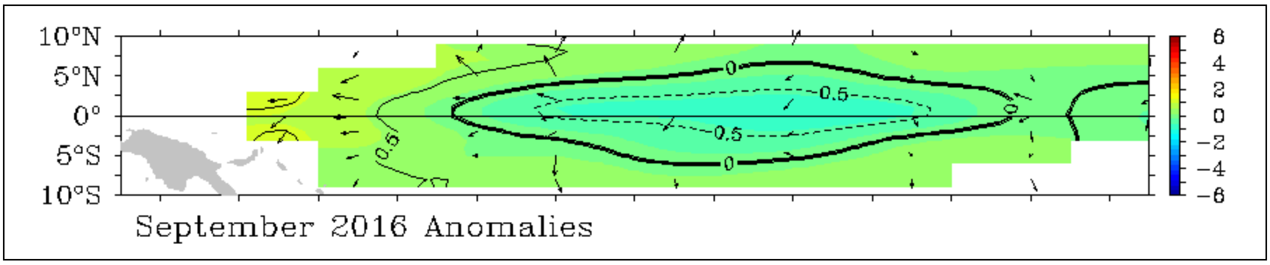


fig.I.1.3: SST Anomalies and Wind anomalies over the Equatorial Pacific from TAO/TRITON.
http://www.pmel.noaa.gov/tao/jsdisplay/monthly-summary/monthly-summary.html

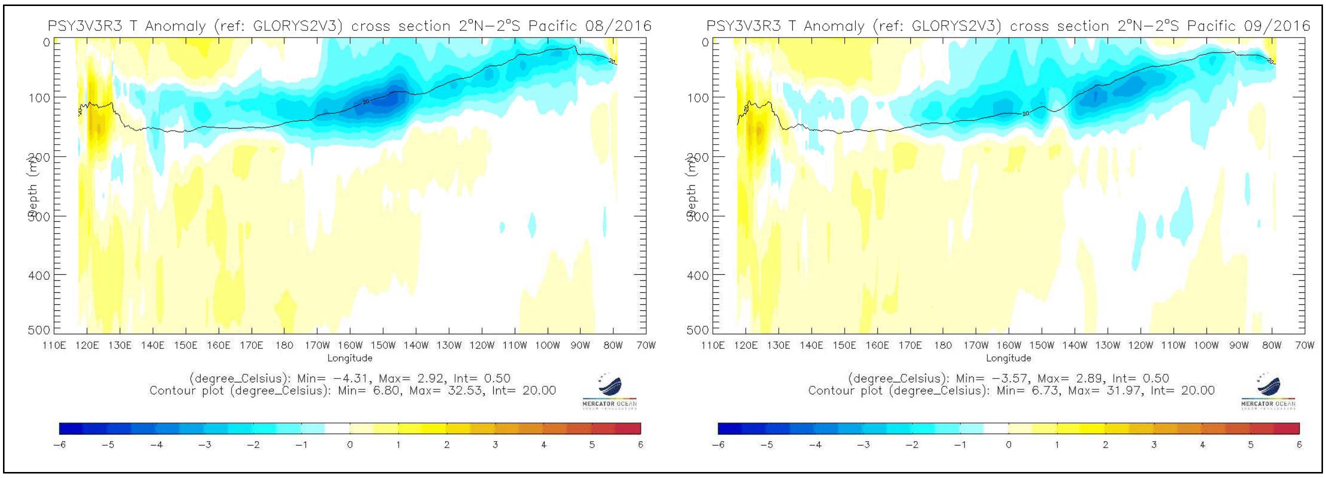


fig.I.1.4: Oceanic temperature anomaly in the first 500 meters in the Equatorial Pacific (previous and current month), http://bcg.mercator-ocean.fr

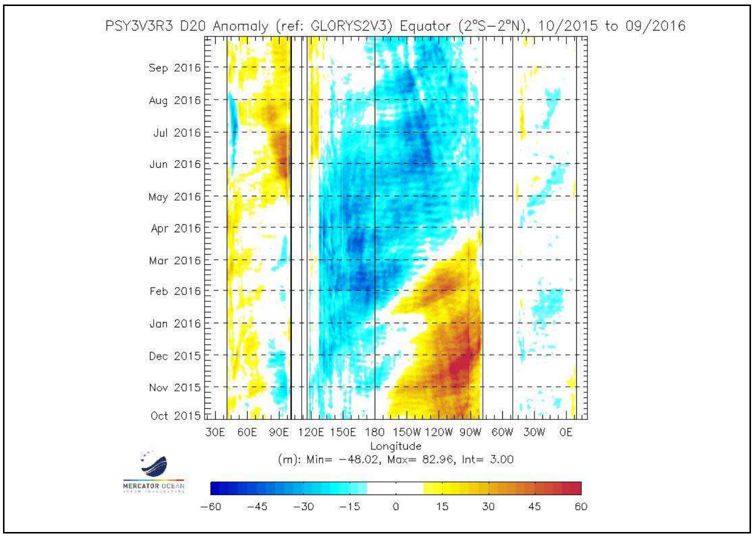


fig.I.1.5: Hovmüller diagram of Thermocline Depth Anomalies (m) (depth of the 20℃ isotherm) along the equator for all oceanic basins over a 6 month period http://bcg.mercator-ocean.fr/

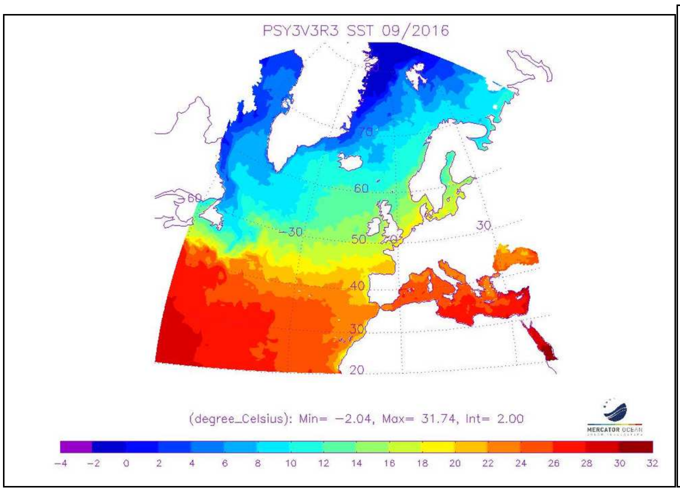
I.1.b Sea surface temperature Near Europe

Arctic region and along eastern coast of Greenland: Anomalies decreased compared to August, but still warmer than normal.

West of Scandinavia still partly colder than normal, but less than in August because warm air was advected northwards to this area. Colder-than-normal SST mainly trapped to an area south of 60°N and west of Ireland. In contrast, warmer-than-normal SST near most of European west coast, also North Sea and Baltic Sea became warmer than normal.

Mediterranean Sea also warmer than normal now in almost the whole basin except a few places, e.g. near Greece / western Turkey or Tunisia, where partly heavy convective events with downbursts took place.

Still colder than normal at the west coast of Portugal.



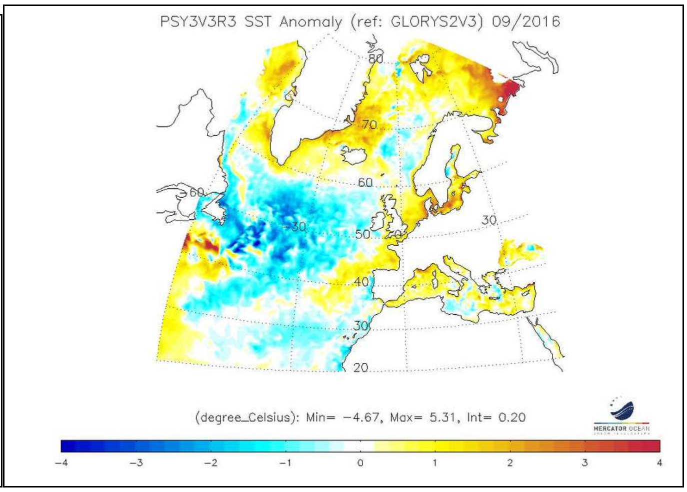


fig.I.1.6 : Mean sea surface temperature in the RA VI Region (Europe) and anomaly (reference Glorys 1992-2009). http://bcg.mercator-ocean.fr/

I.2.ATMOSPHERE

I.2.a General Circulation

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

Negative anomaly (upward motion) along Taiwan, Philippines, Indonesia, Australia (consistent with an active MJO, phase 4 and 5), extending toward tropical south-eastern Indian Ocean, south-east Asia, and Sahel region. Positive anomaly (downward motion) over the western Indian Ocean (consistent with negative IOD), over most of the Atlantic Ocean (especially over the Caribbean), and over tropical south-eastern Pacific Ocean and south America.

SOI rose form +0.7 in August to +13.5 in September, which is largely above La Niña threshold of +7. (http://www.bom.gov.au/climate/current/soihtm1.shtml). However this index has to remain above the threshold for several weeks for a la Niña event to be declared, which has not been the case yet (it was forecast to decrease in October). Besides, trade winds were weaker than normal over the tropical Pacific in September (see fig I.1.3.), which shows that the atmosphere has not responded to oceanic forcing yet.

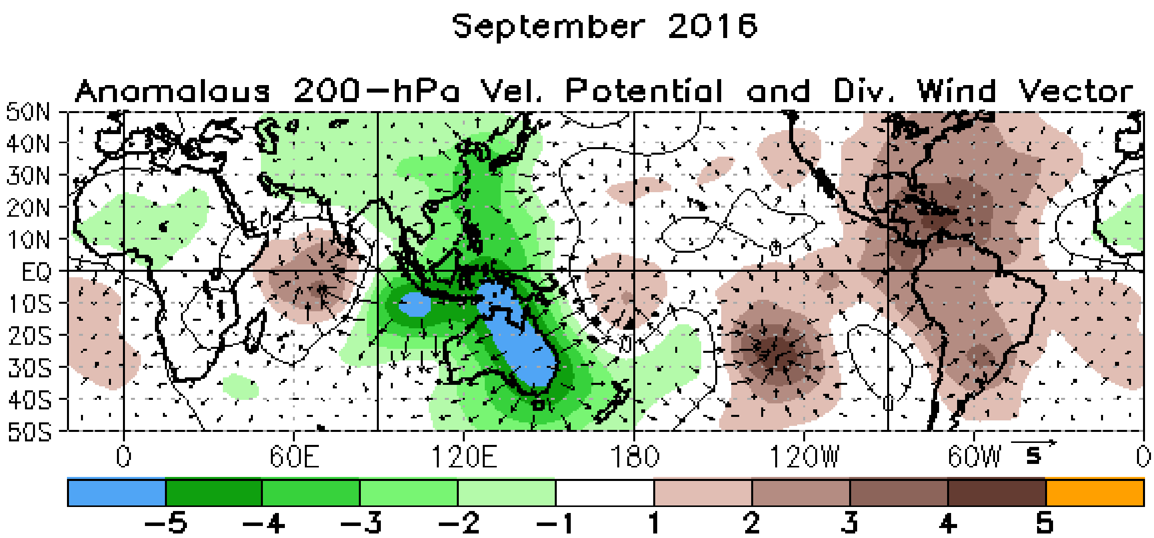


fig.I.2.1: Velocity Potential Anomalies at 200 hPa and associated divergent circulation anomaly. Green (brown) indicates a divergence-upward anomaly (convergence-downward anomaly).
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

MJO (fig. I.2.1.b)

- significant activity during the second half of the month over the eastern Indian Ocean and over the Maritime Continent, which is consistent with the observed negative velocity potential anomaly at 200 hPa.

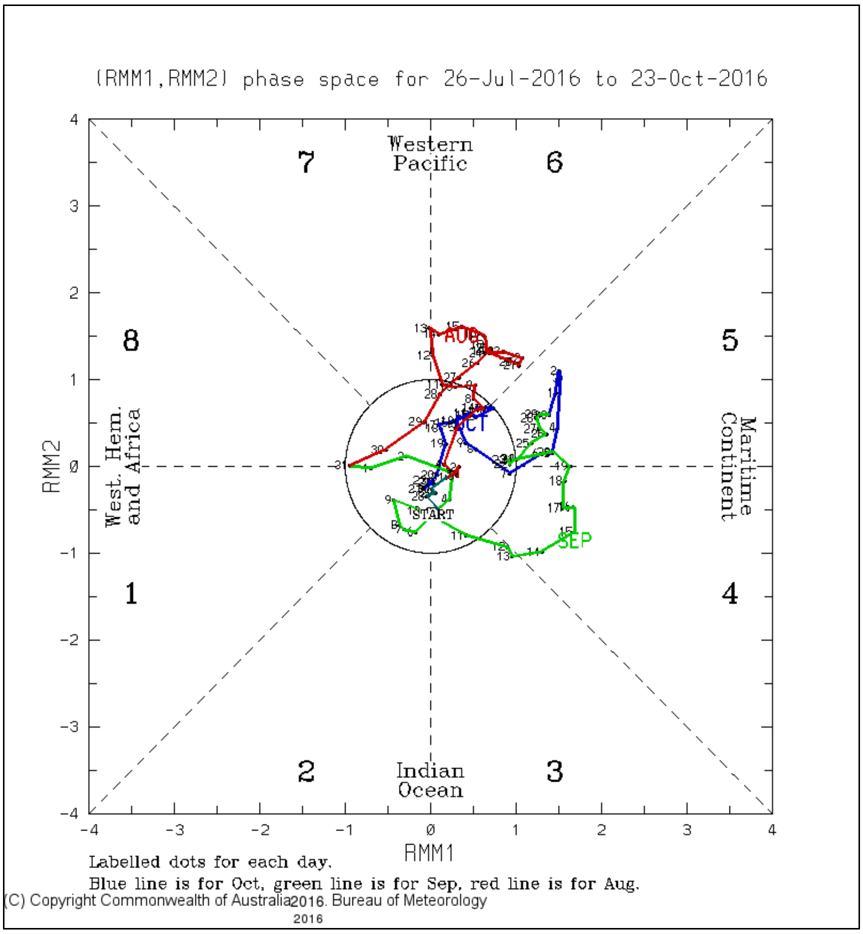


fig.I.2.b: MJO index http://cawcr.gov.au/staff/mwheeler/maproom/RMM/phase.Last90days.gif

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

No teleconnection visible to the mid latitudes in the northern hemisphere.

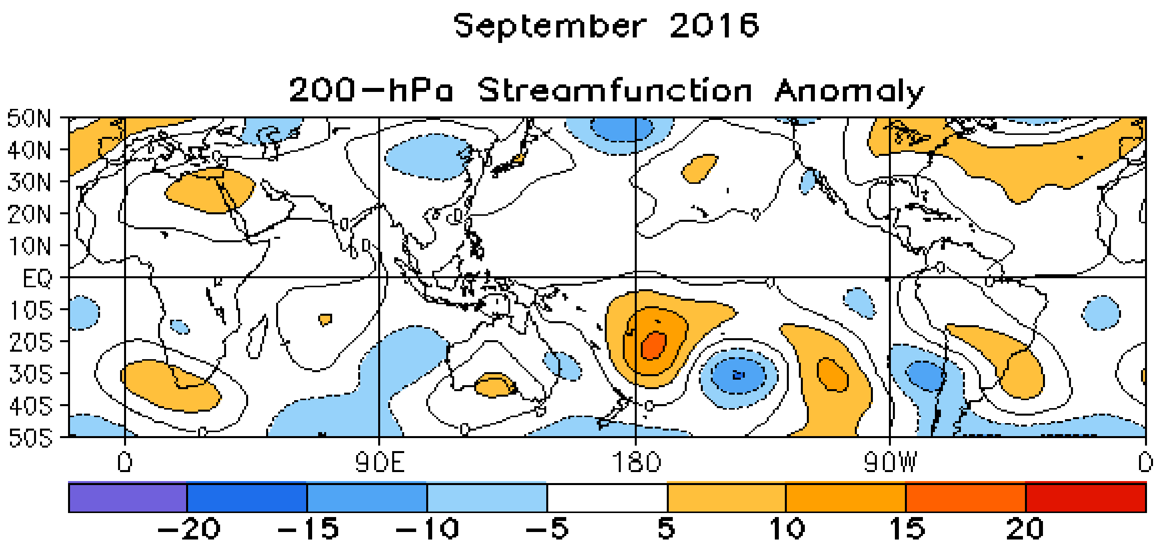


fig.I.2.2: Stream Function Anomalies at 200 hPa.
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt22.shtml

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

- Over the Northern Hemisphere, strong positive anomaly over northern Siberia, extending toward western Europe. Persisting negative anomaly over central Atlantic ocean, which produced a strongly positive EA index anomaly of +3.48 (highest value for September since 1950). Negative anomaly for central Asia and the eastern Mediterranean.
- Over the Southern Hemisphere, alternate positive and negative anomalies over mid-latitudes, but with positive anomalies extent dominating. Negative anomalies prevailing over the Antarctic continent, with a stronger than usual zonal flow. This is maybe the explanation of the dramatic sea ice loss observed in mid-September (see fig I.2.11.).

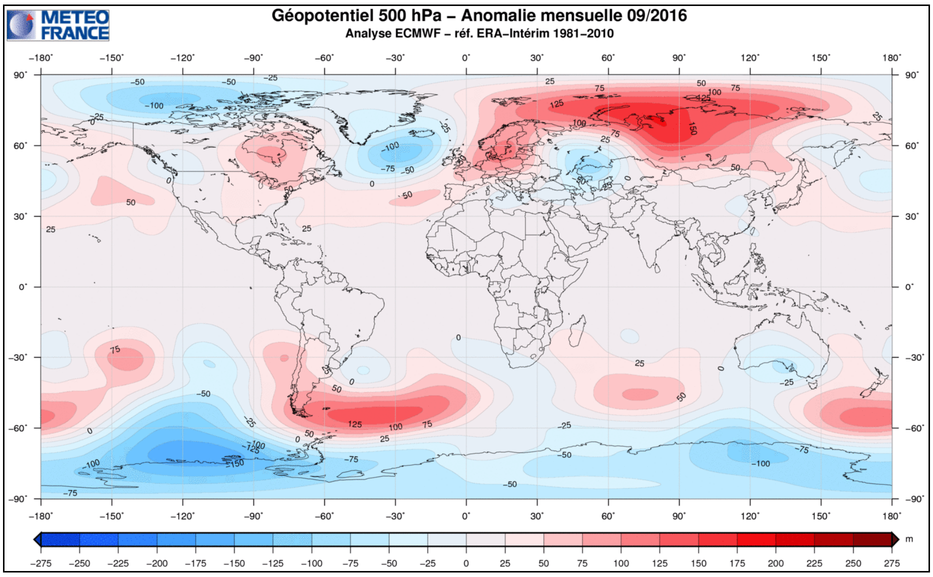


fig.I.2.3: Anomalies of Geopotential height at 500hPa (Meteo-France)

MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
SEP 16	**0.7**	**3.5**	**-1.8**	**-1.4**	**0.1**	**---**	**0.1**	**-1.0**	**-1.3**
AUG 16	-2.2	2.1	-0.4	-0.4	-0.9	---	-3.3	-0.4	2.4
JUL 16	-1.7	1.8	-1.4	-0.4	0.5	---	-1.0	-0.7	-0.2
JUN 16	-0.1	0.4	-0.6	1.3	-0.6	---	-1.9	-1.0	-1.1
MAY 16	-0.7	0.2	0.6	0.1	-0.9	---	-2.0	1.1	-0.4
APR 16	0.3	1.0	-0.3	1.5	0.6	---	-0.5	-0.1	-1.6

Evolution of the main atmospheric indices for the Northern Hemisphere for the last 6 months :
http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/table3.shtml

<u>Sea level pressure and circulation types over Europe</u>

Both Icelandic Low and Azores High were more intense than normal. SLP anomalies were especially high in the eastern North Atlantic, but also extended to the western part. This pattern is also visible in 500 hPa geopotential, resulting in a very high positive index value of EA (+3.5, even higher than last month), but also a shift to a slight positive phase of NAO.

The Azores High extended quite far into Europe, forming a blocking high. Thus, the strong westward flow over the North Atlantic was redirected to northern Europe, causing a warm air flow into this region. MF weather type classification shows 17 days of blocking type, which is more than half of all days in September. Hess/Brezowsky Grosswetterlagen classification also shows many anticyclonic types, but including some westerly types at the beginning and the end of the month, and also southerly and southwesterly types, showing that subtropical air advection also occurred during some days of the month.

Much of Europe was under high pressure influence, except eastern parts, which were rather cyclonic in September. The EA/WR pattern plays no more role.

High pressure influence also dominated over much of the European Arctic region, revealed by a new negative phase of the POLEUR pattern.

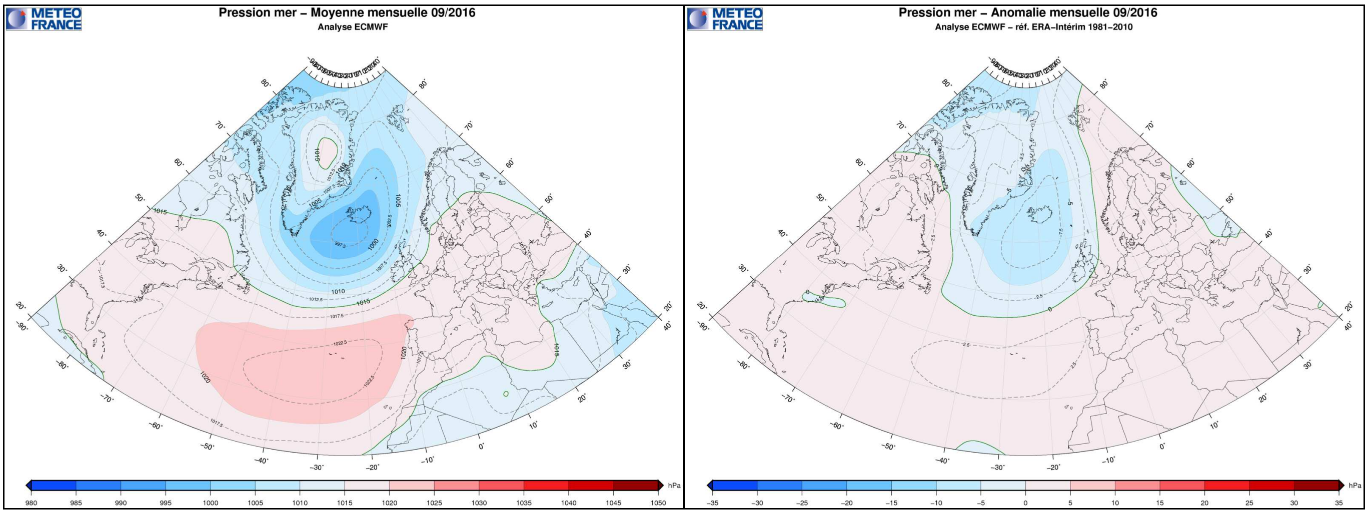


fig.I.2.4: Mean sea level pressure in the RA VI Region (Europe) (left) and 1981-2010 anomalies (right).

Circulation indices: NAO and AO

NAO shifted from negative to positive phase just at the beginning of September. This slight positive phase remained during most of the month, followed by another short, but intense negative phase around 25 September. This phase also was connected with formation of a steep high pressure ridge over Europe.

AO, too, was mainly in a slight positive phase in September, in continuation of the previous month. Air mass exchange between polar and middle latitudes therefore was again relatively low, although quite a warm air mass prevailed over the Arctic region hemispherically.

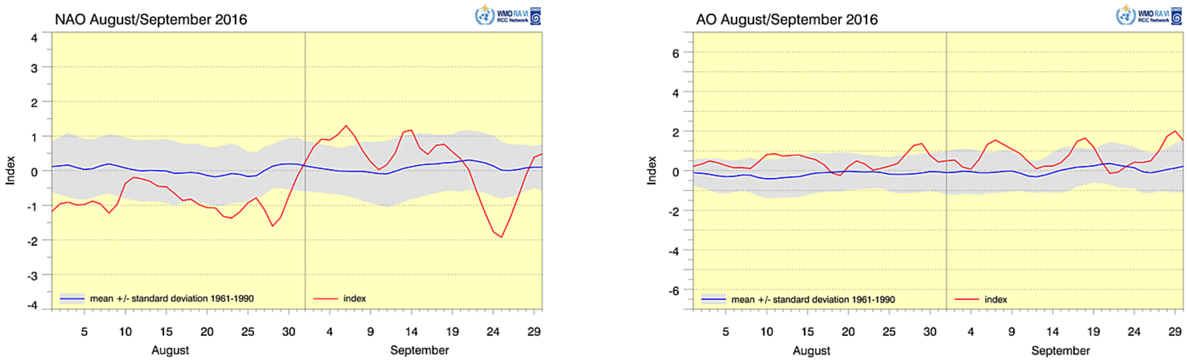


fig.I.2.5: North Atlantic Oscillation (NAO, left) and Arctic Oscillation (AO, right) indices with 1961-1990 mean standard deviation (shading). http://www.dwd.de/rcc-cm , data from NOAA CPC: http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml

I.2.b Precipitation

- Consistent with velocity potential anomalies, much wetter than normal conditions prevailed over Indonesia extending toward south-eastern China and Australia (2nd wettest September for the country as a whole). Drier than normal conditions over the Caribbean and south America. African monsoon still quite active (wetter than normal over most of the Sahel region).
- Over Europe: mostly dry except for the western British Isles (cf EA++ index) and from south Italia to Greece and Turquey where rainfall amounts locally reached record high values (see below for more details).

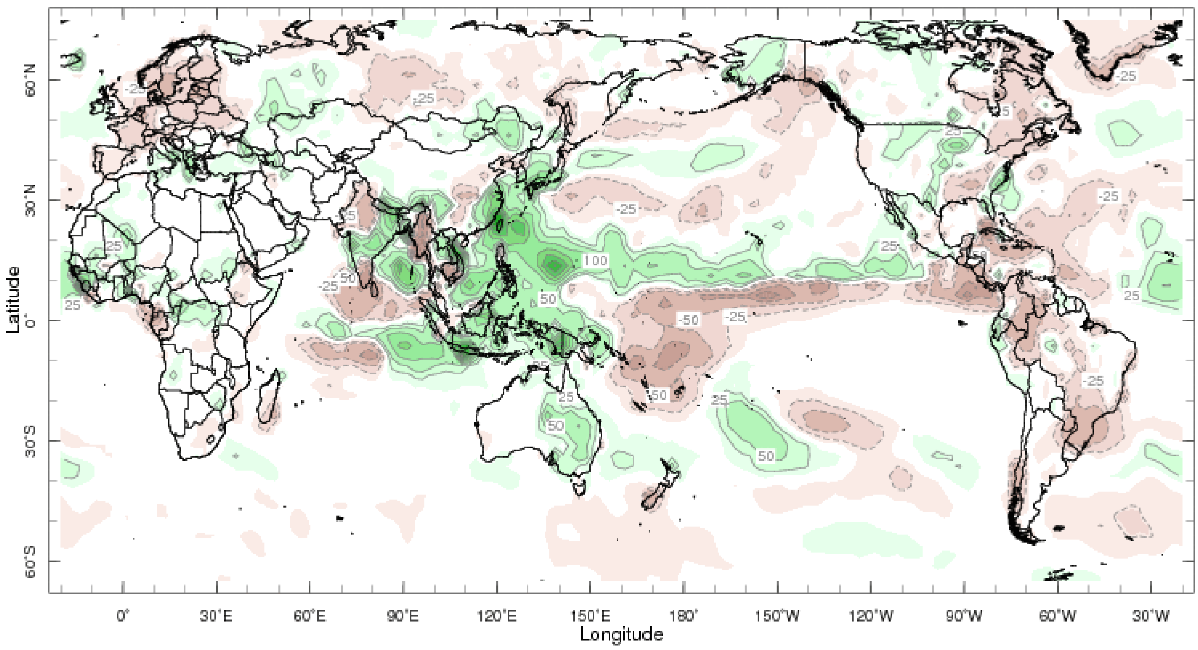


fig.I.2.6: Rainfall Anomalies (mm) (departure to the 1979-2000 normal) – Green corresponds to above normal rainfall while brown indicates below normal rainfall.
http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/Anomaly.html

<u>Precipitation anomalies in Europe:</u>

Very little precipitation over much of Europe due to extended high pressure influence. Some areas were particularly affected by extreme drought conditions, e.g. in parts of northwestern Germany, where also a very low soil moisture was found. Parts of central Ukraine did not receive any rain at all that month, causing very negative impact on crop germination.

On the other hand, some extreme convective heavy rains occurred especially over the central Mediterranean (particularly Greece / southern Italy), at the eastern Black Sea coast (particularly in Turkey), and also near the Caspian Sea (Azerbaijan), all influenced by relatively high SST and quasi-stationary low pressure systems.

Cyclonic influence over Russia resulted in above-normal rainfall there. This was related to cold air flow moving quite far to the south and causing snowfall in mountains of Turkey and North Caucasus down to 1500m elevation.

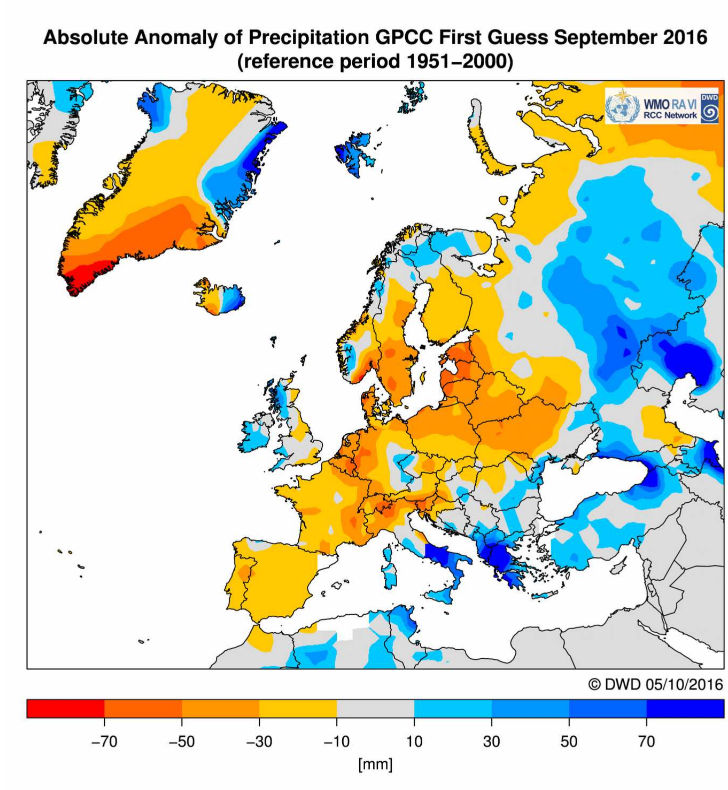


fig.I.2.7: Absolute anomaly (1951-2000 reference) of precipitation in the RA VI Region (Europe), data from GPCC (Global Precipitation Climatology Centre), http://www.dwd.de/rcc-cm.

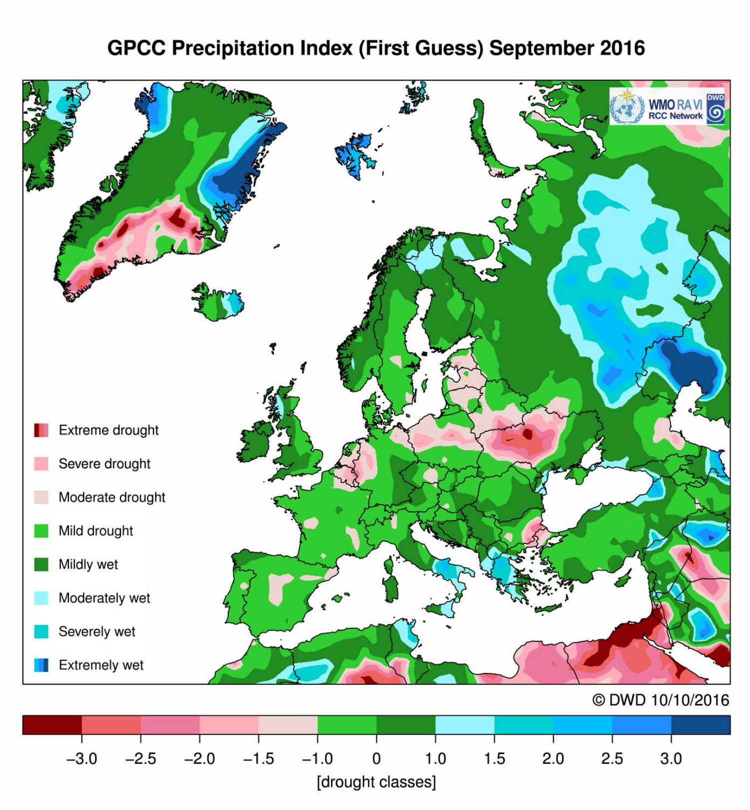


fig. I.2.8: GPCP Precipitation Index http://www.dwd.de/rcc-cm .

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	-24.8 mm	-0.408
Southern Europe	-6.3 mm	-0.112

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

Positive anomalies still dominated worldwide. According to NOAA September 2016 was the 2nd warmest September month on record, just below September 2015. For Europe, it was the warmest on record, with a strong positive anomaly extending from Siberia (up to +6°C !) to Scandinavia and France / British Isles.

The only noticeable exception for continental areas is Australia, with a widespread negative anomaly, which may be due both to the negative SST anomalies and to the very wet conditions observed during the month.

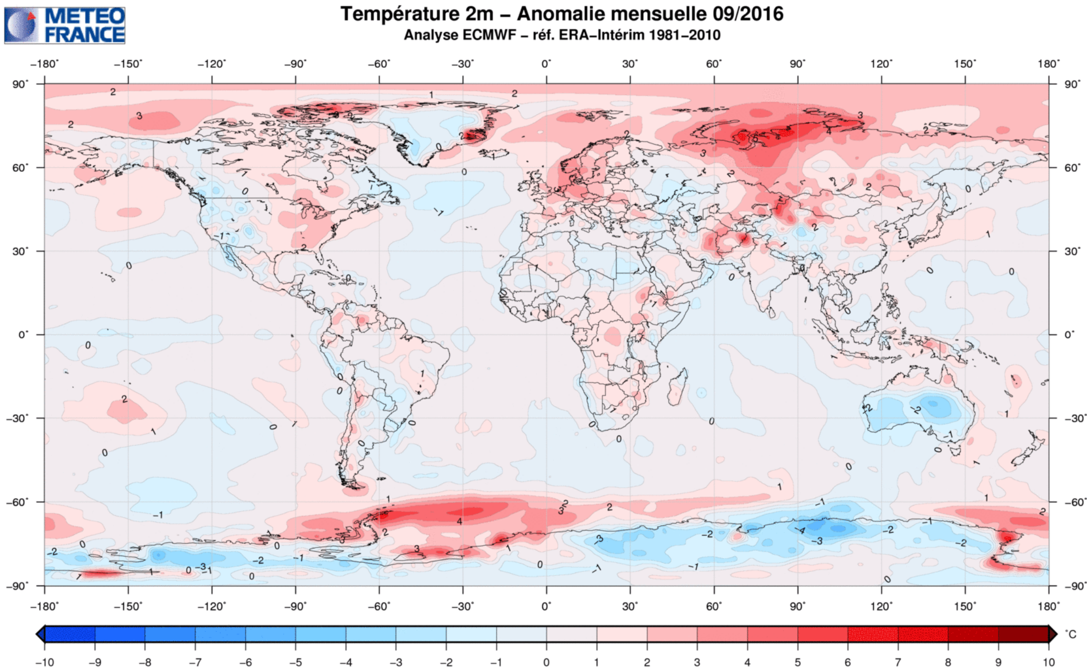


fig.I.2.9: Temperature Anomalies (°C) (Meteo-France)

<u>Temperature anomalies in Europe:</u>

September again was a very warm month in Europe except in some eastern parts and a few places in the south. Highest anomalies over Germany, Netherlands and southern Scandinavia. Germany had an anomaly of +3.4K compared to 1981-2010 average, the warmest September since 1881 together with September 2006. According to NOAA data, September 2016 also was the warmest September on European average since 1910. This high anomaly (at least in Germany) was caused by a combination of high pressure subsidence, subtropical air advection, and high totals of solar radiation and sunshine duration. In southern UK, more than 34°C was measured, highest September maximum on record there. Other record high temperatures were registred in Spain and in France (45°C in Cordoba on the 6th, and nearly 39°C in Biarritz on the 7th).

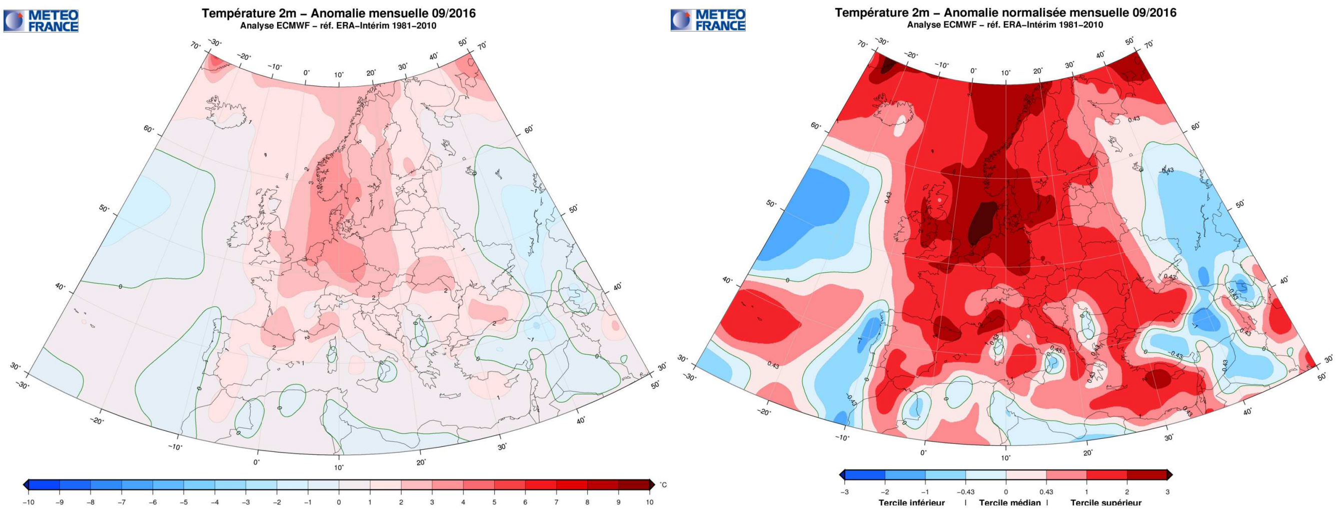


fig.I.2.10: Left graph: Absolute anomaly of temperature in the RA VI Region (Europe). Right graph: Standardized temperature anomalies

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	+2.5 °C
Southern Europe	+1.4 °C

I.2.d Sea ice

In the Arctic (fig. 1.2.11 and 1.2.12 - left) : still a strong extension deficit, despite a rapid growth rate during the month. The minimum extent "only" was the 5th lowest on record since 1979 (http://nsidc.org/arcticseaicenews/)

In the Antarctic (fig. 1.2.11 and 1.2.12 - right) : brutal drop in extension around mid-month, bringing the extent close to –2 std at the end of the month (see the Geopotential at 500 hPa paragraph above for a possible explanation).

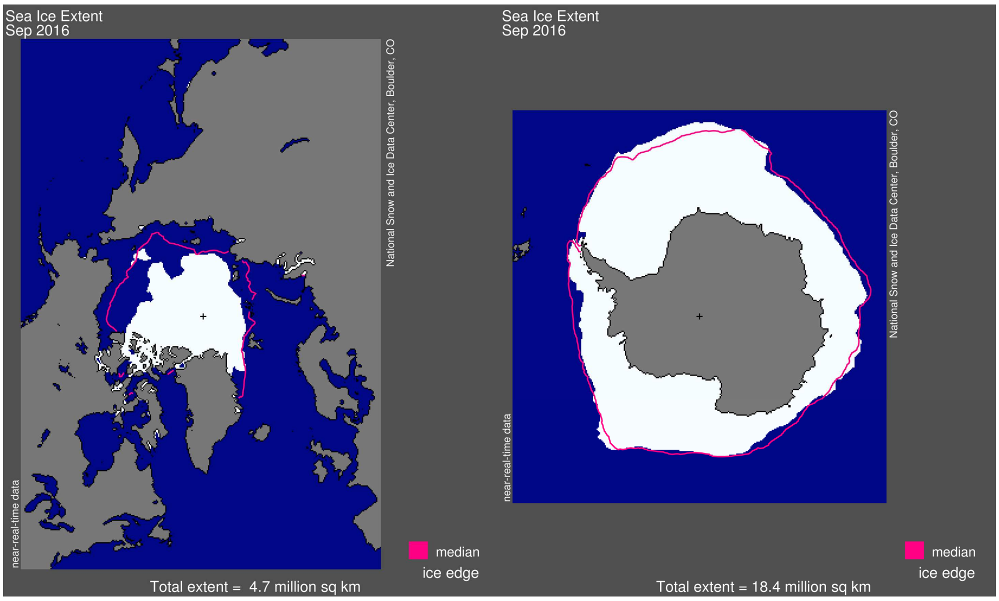


fig.I.2.11: Sea-Ice extension in Arctic (left), and in Antarctic (right). The pink line indicates the averaged extension (for the 1979-2000 period). http://nsidc.org/data/seaice_index/

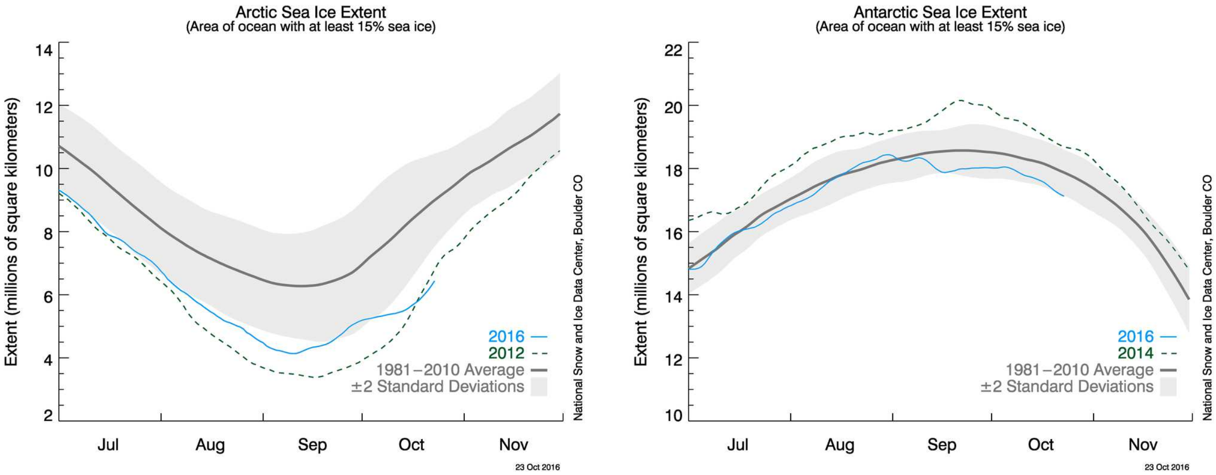


fig. I.2.12 : Sea-Ice extension evolution from NSIDC.
http://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png

II. SEASONAL FORECAST FROM DYNAMICAL MODELS

Note : the new ARPEGE System 5 model contributes now to the EUROSIP consensus.

II.1. OCEANIC FORECASTS

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

- Pacific Ocean: Models in good agreement with persisting negative SST anomalies east of the dateline over the Equatorial Pacific. Models also suggesting a return to positive PDO values. Positive anomalies should persist over tropical areas on both sides of the equator, and also over the whole western basin.
- Indian Ocean: Strongly negative up until October, the IOD index is forecast to return to neutral value by late November (see fig II.1.7.). Significant cooling should occur over the eastern basin, while warming should be observed over the western basin, east of Africa. The negative anomalies surrounding south and west Australia should persist.
- Atlantic Ocean: for the northern part : persistence of the central cold blob is forecast by all the models, along with strong positive anomalies over the western basin, from the Caribbean to Newfoundland. This should induce a strong zonal SST gradient which might be favourable to enhanced baroclinic cyclogenesis over the area. For the southern part : widespread positive anomalies, except ashore from Namibia / Angola.

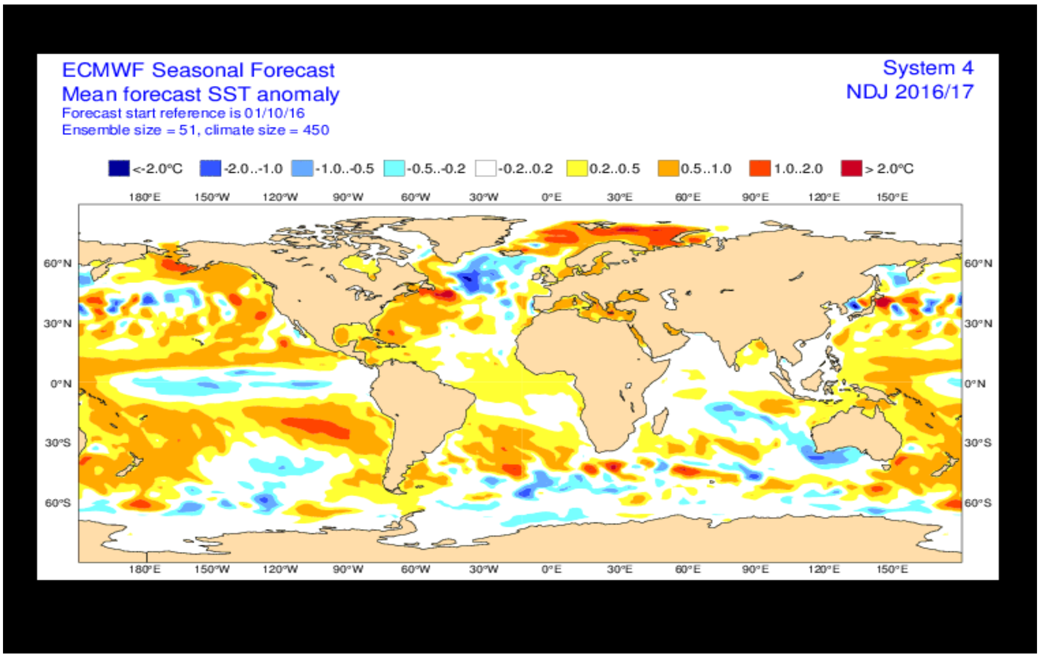


fig.II.1.1: SST anomaly forecast from ECMWF
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/group/

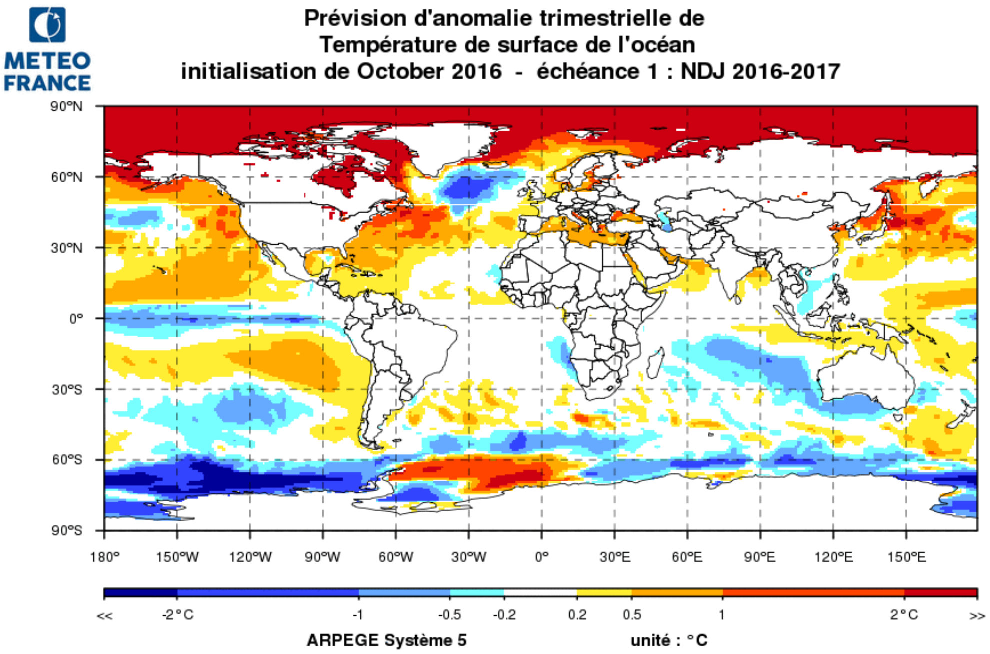


fig.II.1.2: SST Anomaly forecast from Meteo-France (recalibrated with respect of observation).
http://elaboration.seasonal.meteo.fr

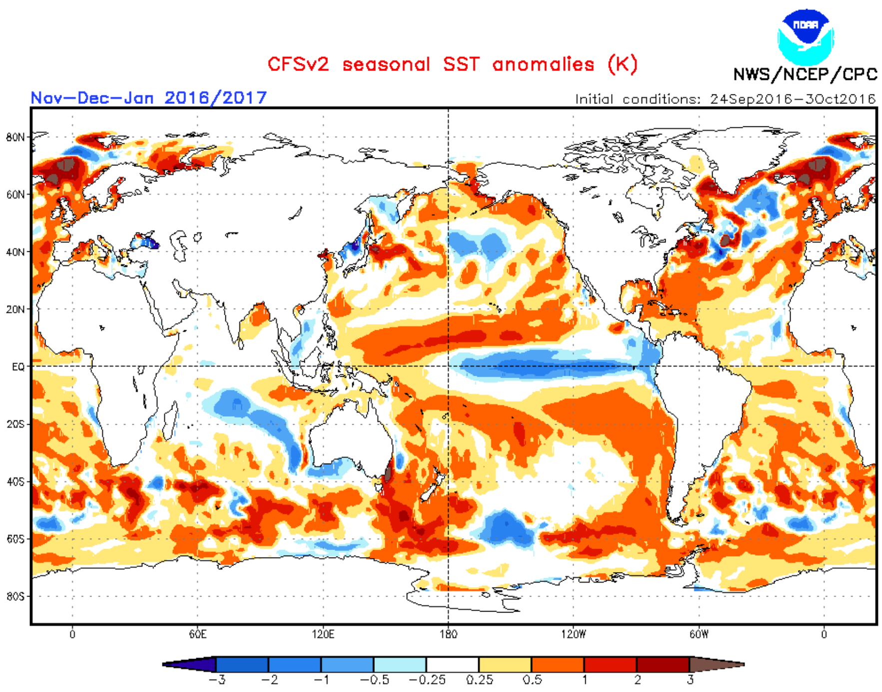


fig.II.1.3: SST anomaly forecast from NCEP.
http://www.cpc.ncep.noaa.gov/products/people/wwang/cfsv2fcst/imagesInd1/glbSSTSeaInd1.gif

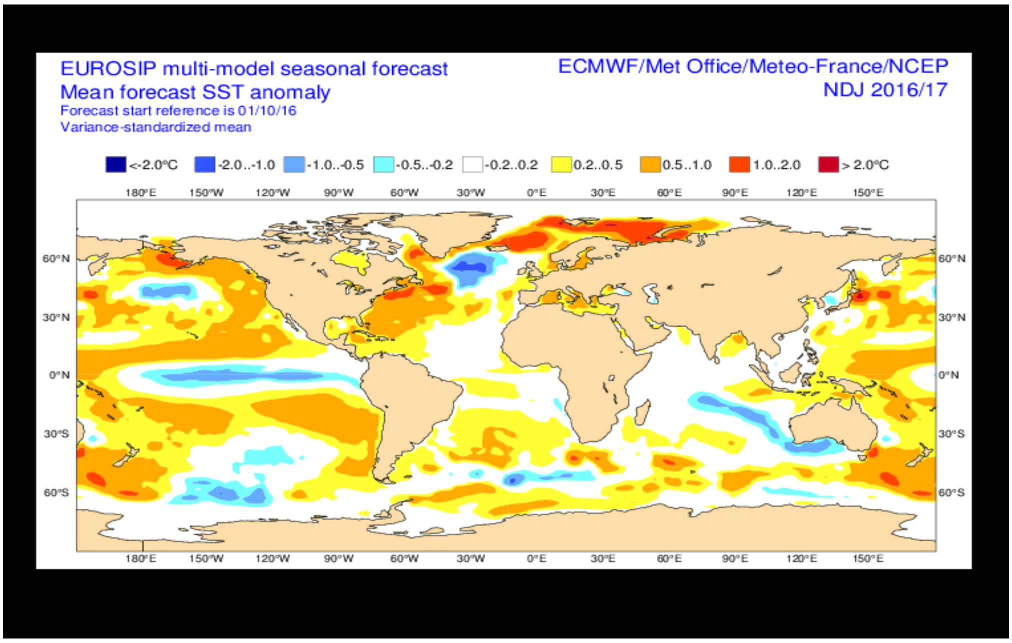


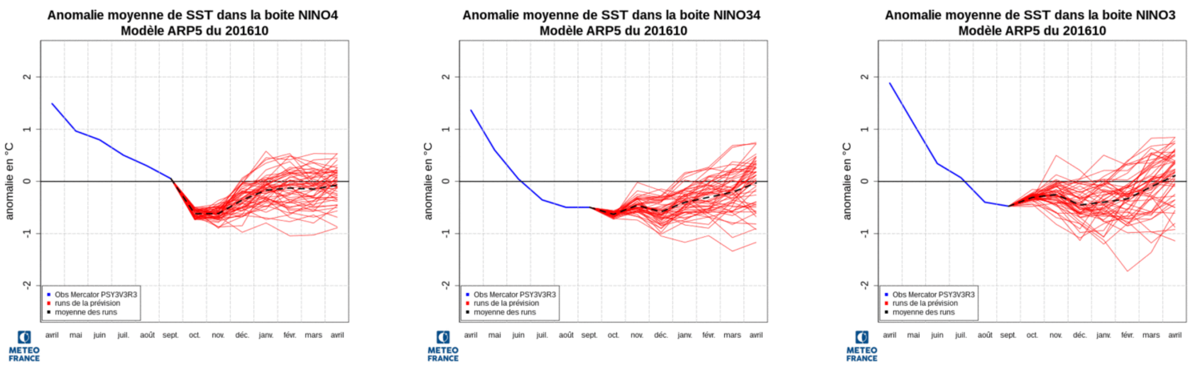
fig.II.1.4: SST Forecasted anomaly from Euro-SIP

II.1.b ENSO forecast :

Forecast Phase: *weak La Niña likely starting late fall / early winter2016*

Although oceanic SST thresholds have somehow been reached in September, the atmosphere has not fully responded yet to this weak oceanic forcing. A trade-wind surge has however been observed in the first half of October but values have returned to normal since then.

The EUROSIP models are suggesting a possibility of weak la Niña conditions for the NDJ period. This is also supported by the IRI bulletin analysis (probability close to 60 %, see http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/). Should a " la Niña" occur, its intensity would be low and the subsequent atmospheric response rather weak and mostly confined to the tropical Pacific/Eastern Indian ocean areas.



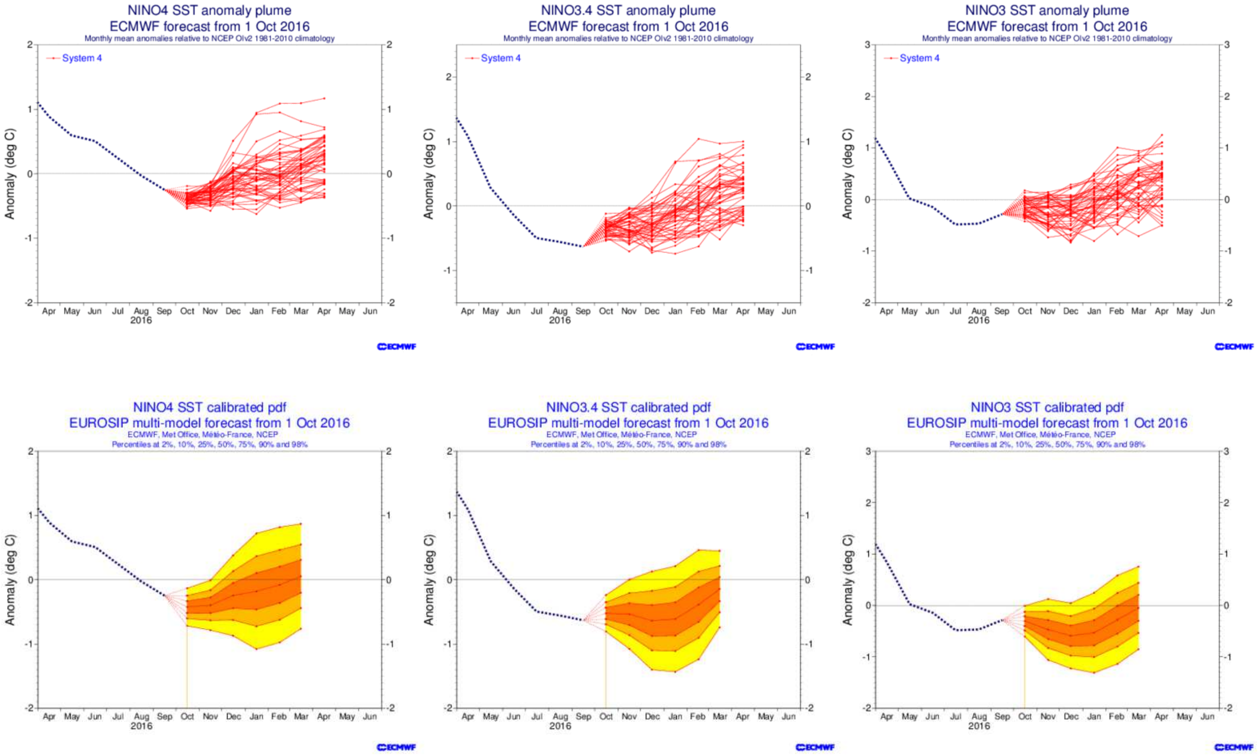
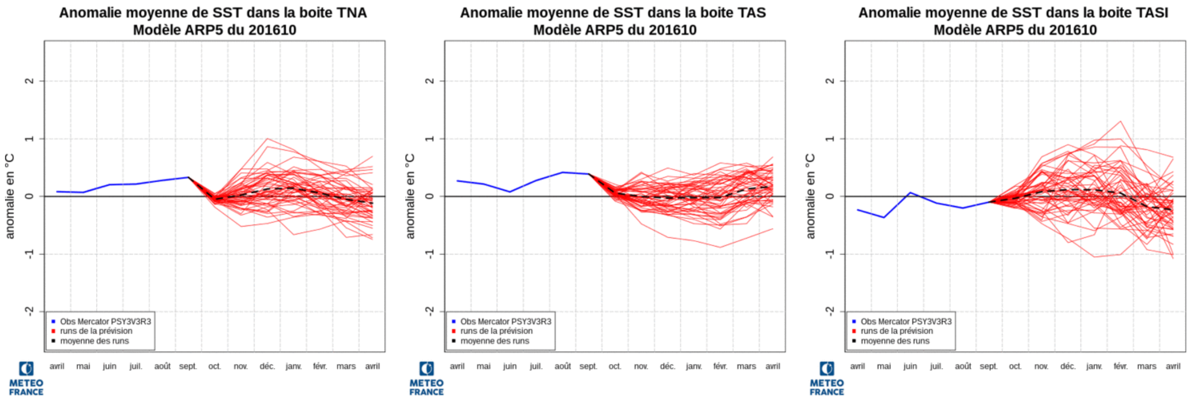


fig.II.1.5: SST anomaly forecasts in the Niño boxes from Météo-France (top) and ECMWF (middle) - monthly mean for individual members - and EuroSIP (bottom) – recalibrated distributions - (http://elaboration.seasonal.meteo.fr , http://www.ecmwf.int/)

II.1.c Atlantic ocean forecasts



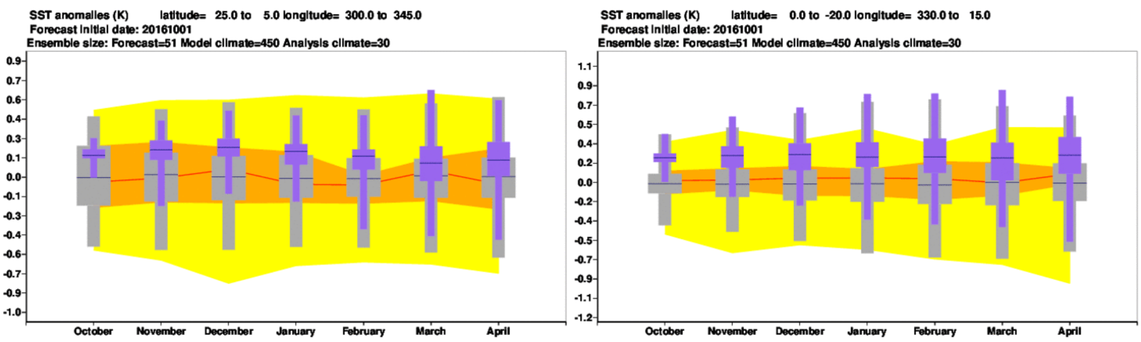


fig.II.1.6: SSTs anomaly forecasts in the Atlantic Ocean boxes from Météo-France and ECMWF, plumes / climagrams correspond to ensemble members and monthly means.

II.1.d Indian ocean forecasts

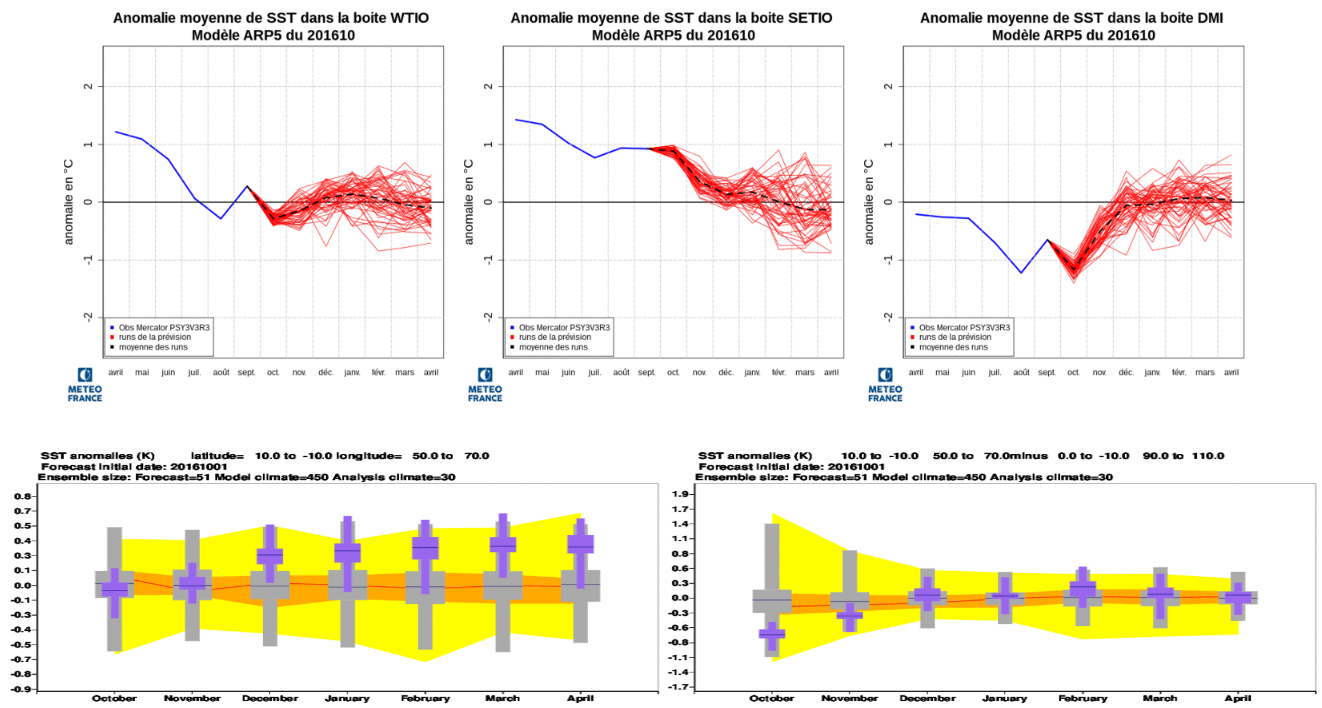


fig.II.1.7: SSTs anomaly forecasts in the Indian Ocean boxes from Météo-France and ECMWF, plumes / climagrams correspond to ensemble members and monthly means.

II.2. GENERAL CIRCULATION FORECAST

II.2.a Global forecast

Velocity potential anomaly field (cf. fig. II.2.1 – insight into Hadley-Walker circulation anomalies) and **Stream Function anomaly field** (cf. fig. II.2.1 – insight into teleconnection patterns tropically forced):

Velocity potential : good agreement between models : widespread ascending anomaly zone over the Atlantic and southern America, and large convergence (subsidence) anomaly zone over the Indian Ocean (the ARPEGE model being more extreme than the ECMWF). Besides, all models show a dipole between the Maritime Continent under ascending anomalies and the Central Pacific under subsidence anomalies. This could be consistent with a weak atmospheric response to a weak Modoki-like (restricted to the Central and western Pacific) la Niña.

Stream Function anomaly : anticyclonic anomaly in both hemispheres from Australia to Indonesia and Japan which seems to induce a weak teleconnection up until the western USA (PNA+ like pattern).

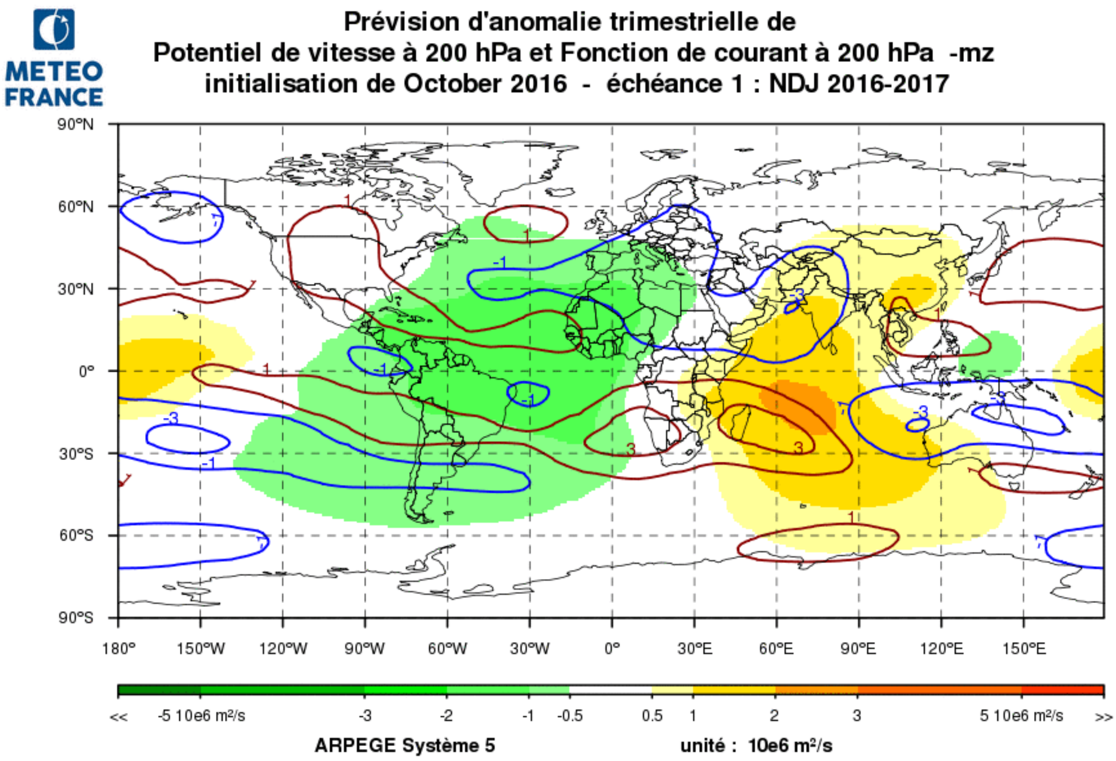


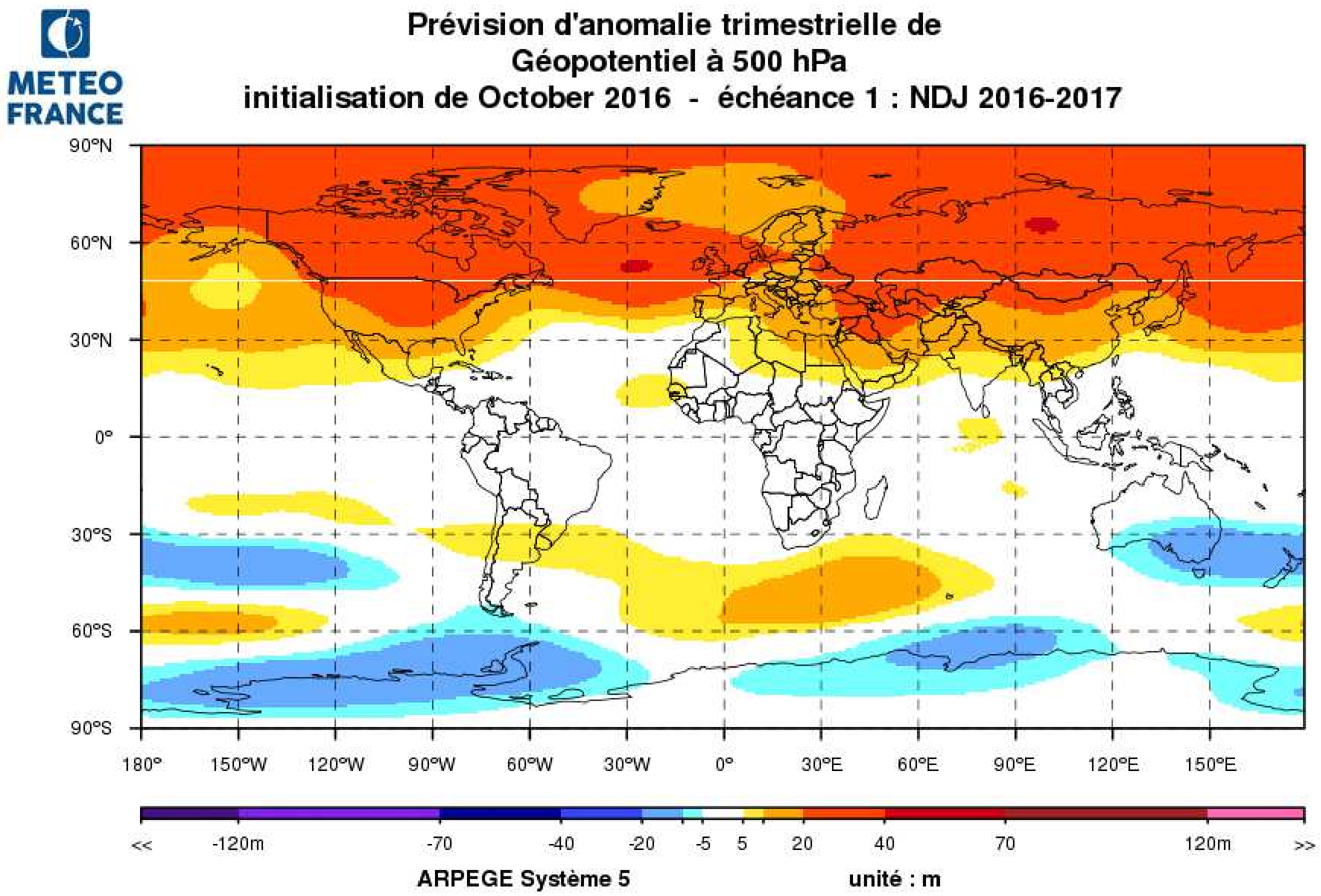
fig.II.2.1: Velocity Potential anomaly field χ (shaded area – green negative anomaly and yellow positive anomaly) and Stream Function anomaly ψ (isolines – red positive and blue negative in NH) at 200 hPa by Météo-France ARPEGE-S5.

II.2.b Northern hemisphere and Europe forecast

<u>Geopotential height anomalies</u> (fig. II.2.2 and II.2.3 – insight into mid-latitude general circulation anomalies) :

Models are in good agreement in predicting positive 500 hPa height anomalies over the arctic basin, meaning a weaker than usual polar vortex, which would clearly not act in favour of the NAO+ regime. But when it comes to north Atlantic / western Europe the agreement is not so good : some models would go for a dominating Atlantic Ridge (AR) pattern (e.g. ARPEGE, see fig II.2.3.), while others would rather suggest a Scandinavian Blocking circulation or even a negative NAO (ECMWF). Regarding the identified October predictors of winter European regimes :

- below normal arctic sea ice is supposed to favour the negative NAO type
- Siberian snow-cover is close to normal, so no weather regime supposed to be favoured
- SST configuration is a mix of Atlantic Low and Scandinavian blocking types (which have dominated since mid-august). These regimes drive SST anomaly patterns that in turn tend to favour the blocking regime during the following winter (http://www.cnrm-game-meteo.fr/gmgec-old/page_perso/guemas/Seminaire_LMD_10_08.pdf)
- Monthly ECMWF forecast (up to 6 weeks) clearly rejects the NAO+ type, until early December and indicates that AR or blocking should be prevailing.
- Weak la Niña : http://ds.data.jma.go.jp/tcc/tcc/products/clisys/enso_statistics/ seems to favour the AR regime, but given the weak intensity of the event, if it occurs at all, we won't take it into account.
- To sum up for NDJ (including models outputs): NAO+ unlikely, AR, NAO- and Scandinavian blocking favoured.



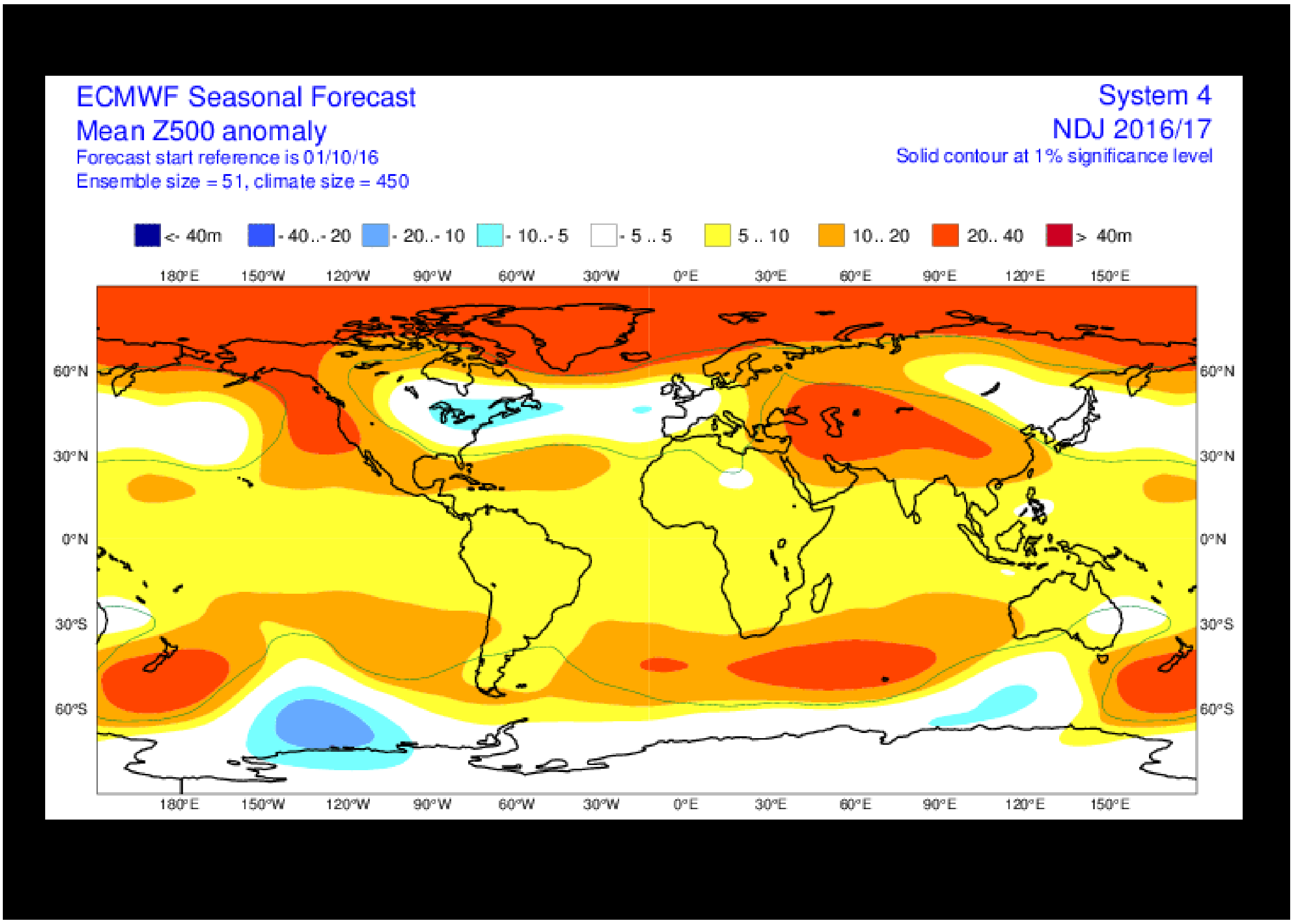
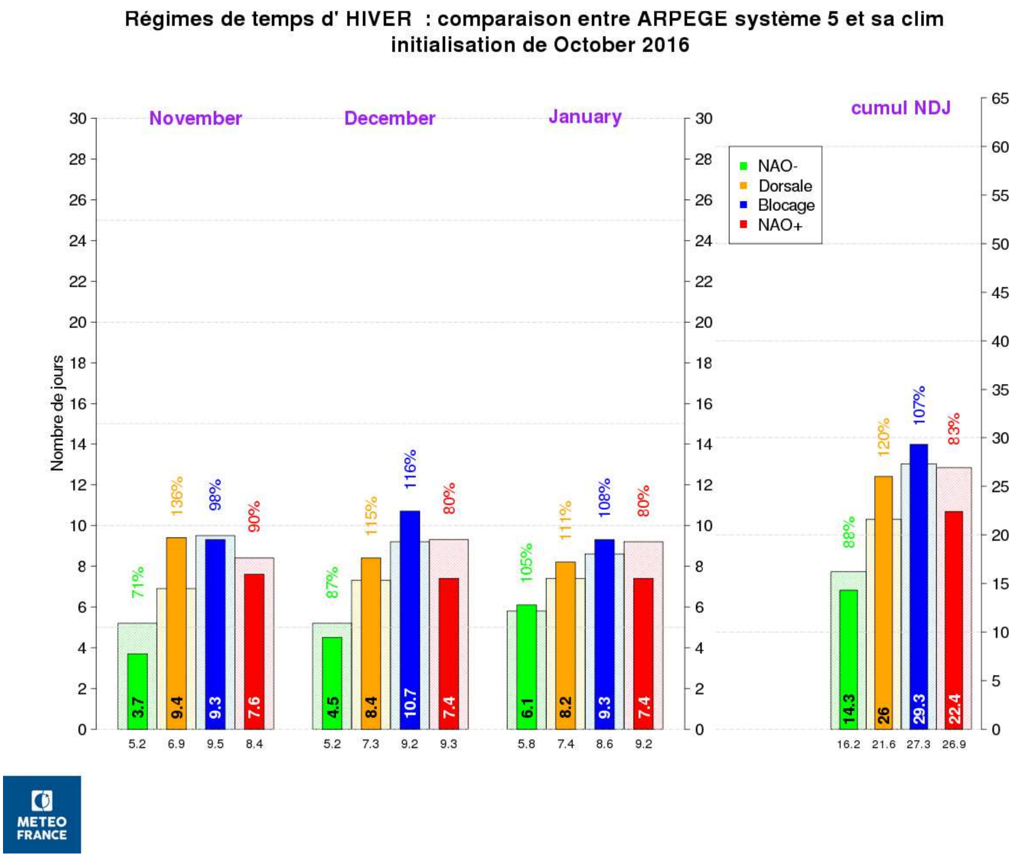


fig.II.2.2: Anomalies of Geopotential Height at 500 hPa from Météo-France (top) and ECMWF (bottom).



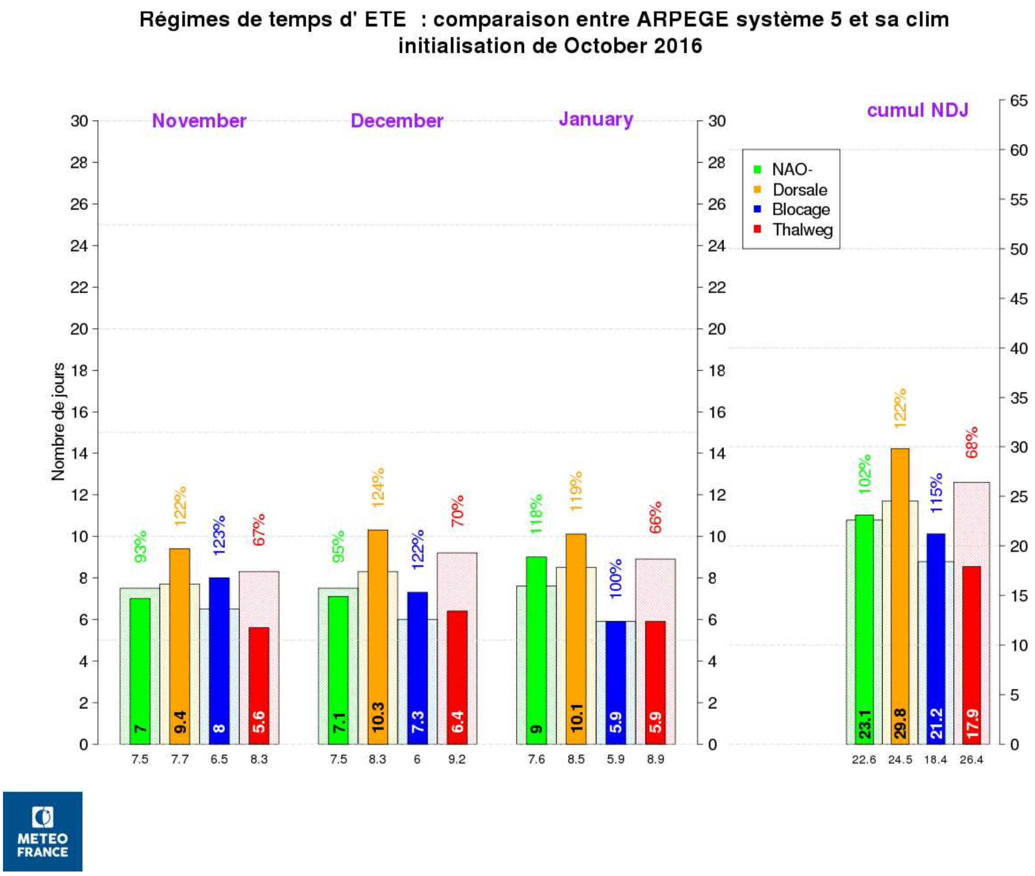


fig.II.2.3: North Atlantic Regime occurrence anomalies from Meteo-France ARPEGE-S5 : vertical bars represent the excitation frequency anomaly (in %) for each of the 4 regimes (winter regimes at the top, summer regimes at the bottom).

II.3. IMPACT: TEMPERATURE FORECASTS (FIGURE II.3.1 TO II.3.4)

Positive anomalies still dominate worldwide. For continental areas, the southern half of Australia should undergo cooler than normal conditions. Worth of notice is also the “white” (absence of warm signal) area covering most of south America (mainly Brazil and Amazonia), probably linked with expected wetter than normal conditions (see below, and also potential velocity forecast paragraph).

For Europe, the low probability of positive NAO should lead to a three-month period not as mild as the one from 2015/2016. The enhanced probability of the 3 other regimes can have different impacts depending on the region. For the Mediterranean areas, NAO- favours warmer than normal conditions, whereas this regime is associated with cold conditions over northern Europe. AR favours widespread colder than normal conditions, and blocking generates warmer than normal conditions over northern Scandinavia, and colder conditions over central and eastern Europe. Therefore, it is difficult to identify the most likely scenario for most of Europe. However, according to the models, the Mediterranean region should be warmer than normal, and the 3 supposed dominating regimes could favour colder than normal conditions over central Europe (even though the signal in not very clear on the probability maps, but the ongoing global warming makes it difficult to clearly distinguish -currently speaking- cold periods). For the British Isles, which stand close to the Atlantic cold blob, and considering the low probability of NAO+, we can forecast close to normal temperatures (or even slightly colder than normal).

II.3.a ECMWF

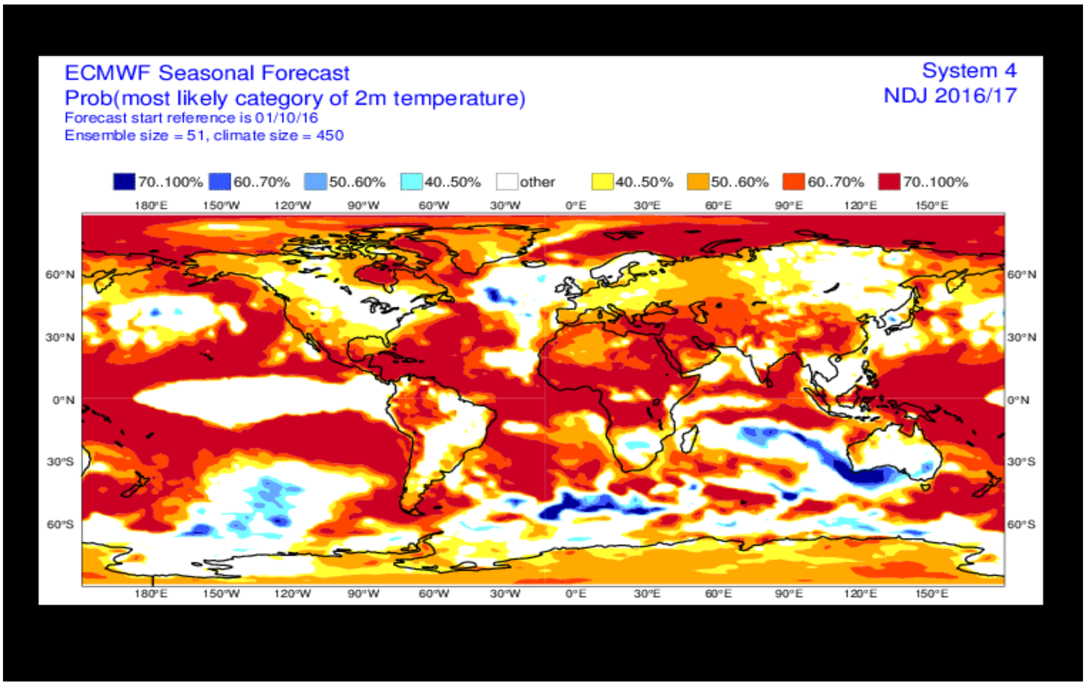


fig.II.3.1: Most likely category probability of T2m from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal). http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/

II.3.b Météo-France

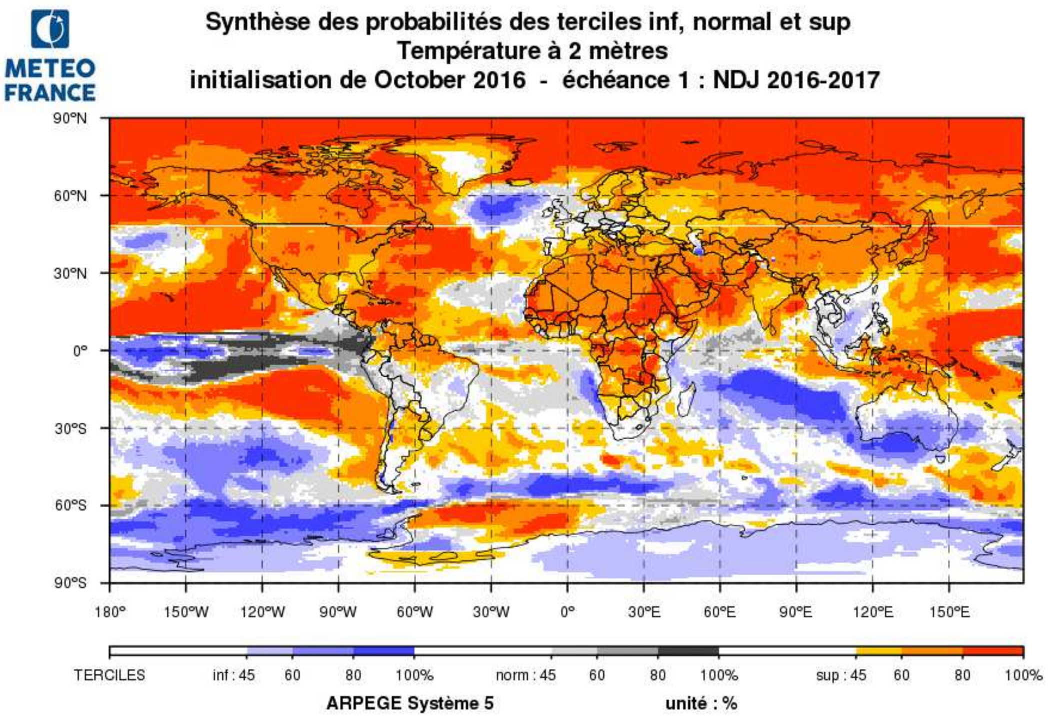


fig.II.3.2: Most likely category of T2m. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://elaboration.seasonal.meteo.fr/

II.3.c Japan Meteorological Agency (JMA)

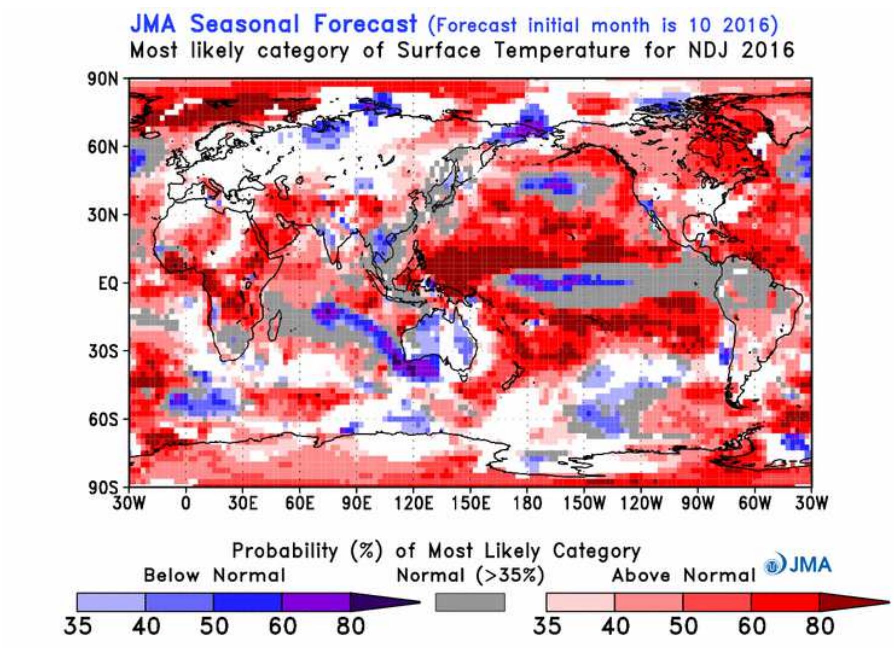


fig.II.3.3: Most likely category of T2m. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/4mE/fcst/fcst_gl.php

II.3.d EUROSIP

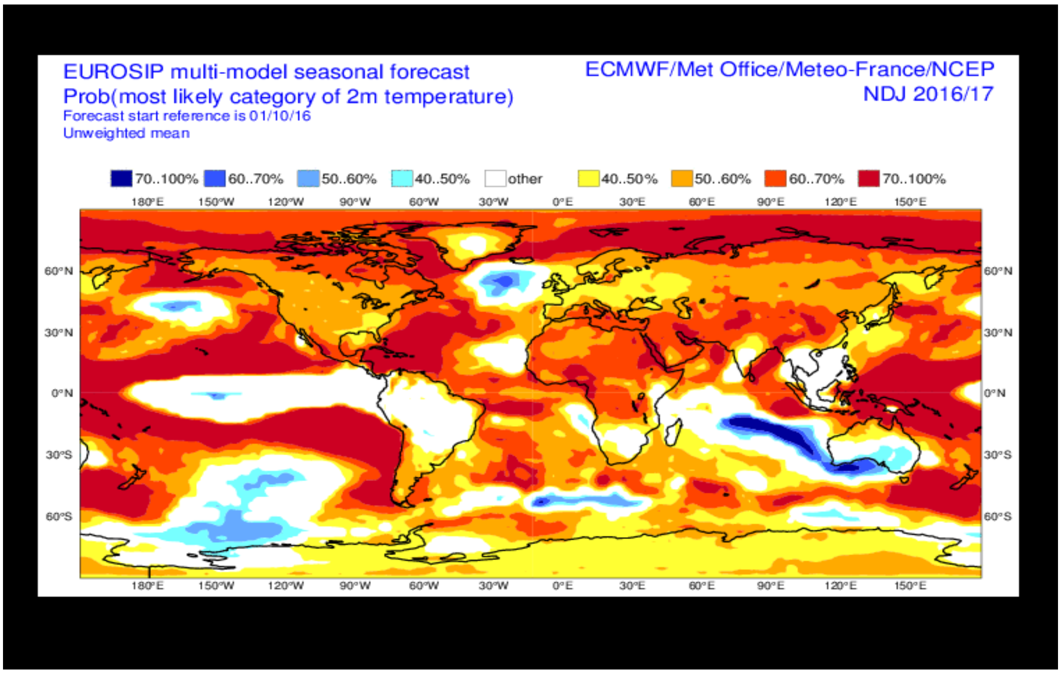


fig.II.3.4: Multi-Model Probabilistic forecasts for T2m from EUROSIP (2 Categories, Below and Above normal – White zones correspond to No signal and Normal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/

II.4. IMPACT : PRECIPITATION FORECAST

Consistent with a weak la Niña event, dry anomaly is forecast along the Equatorial Pacific ocean. Wet anomaly is forecast on both sides, as well as over the Maritime Continent and the eastern half of Australia. Dry anomaly very likely over western Indian ocean and eastern Africa (Great Lakes area included) consistent with the large subsidence anomaly (see fig II.2.1.). Wet conditions expected over Amazonia and Brazil.

Diminished NAO+ probability would favour drier than normal conditions for northern Europe, but the enhanced AR regime probability would mean wetter than normal conditions for eastern Europe and Scandinavia. Therefore, we can barely forecast drier than normal conditions only for the north-western half of the British Isles. For southern Europe, antagonists effects of the 3 most probable regimes leave us without a most likely scenario for precipitation.

II.4.a ECMWF

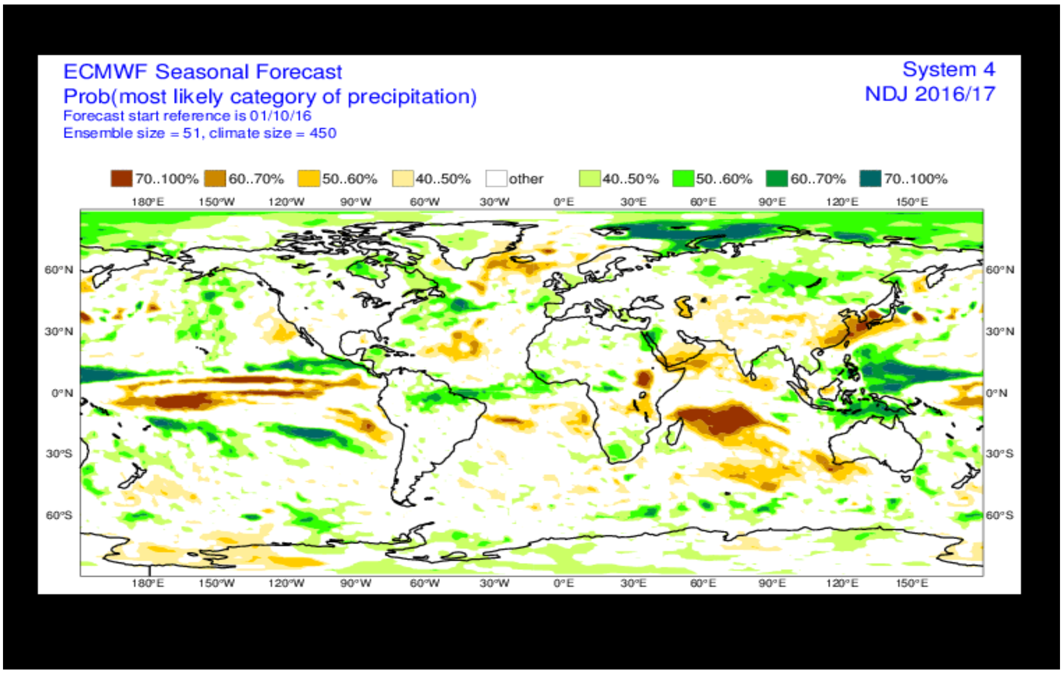


fig.II.4.1: Most likely category probability of rainfall from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal). http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/

II.4.b Météo-France

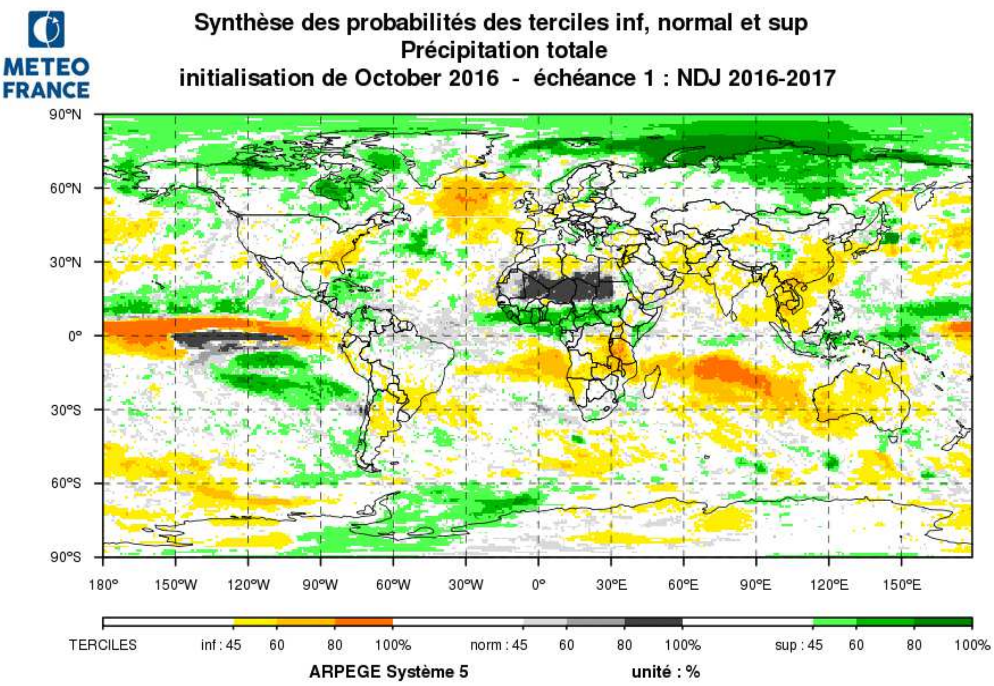


fig.II.4.2: Most likely category of Rainfall. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://elaboration.seasonal.meteo.fr/

II.4.c Japan Meteorological Agency (JMA)

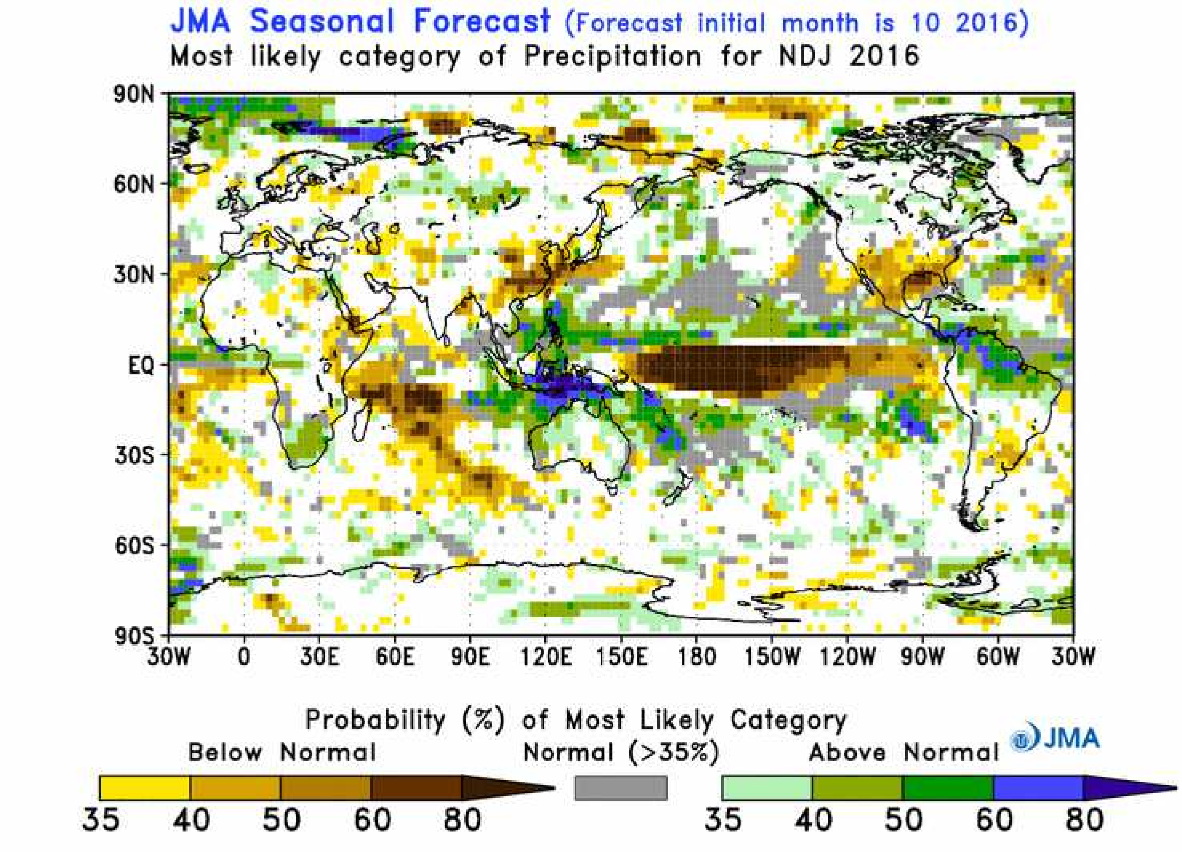


fig.II.4.5: Most likely category of Rainfall from JMA. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://ds.data.jma.go.jp/tcc/tcc/products/model/probfcst/4mE/fcst/fcst_gl.php

II.4.d EUROSIP

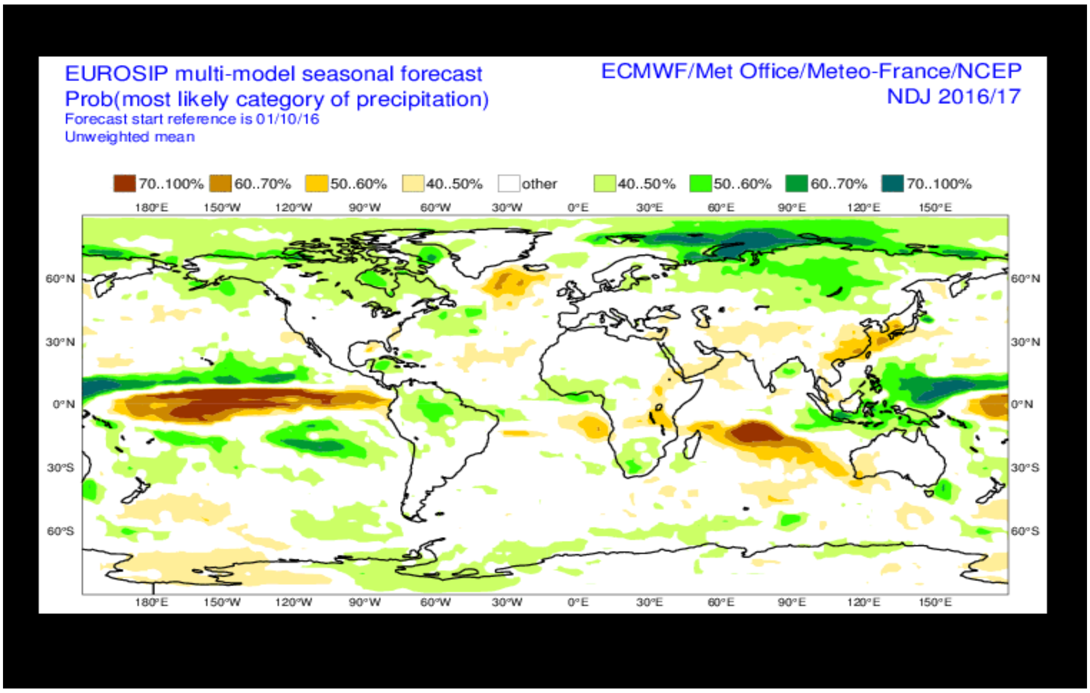


fig.II.4.7: Multi-Model Probabilistic forecasts for precipitation from EUROSIP (2 Categories, Below and Above normal – White zones correspond to No signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/

II.5. REGIONAL TEMPERATURES AND PRECIPITATIONS

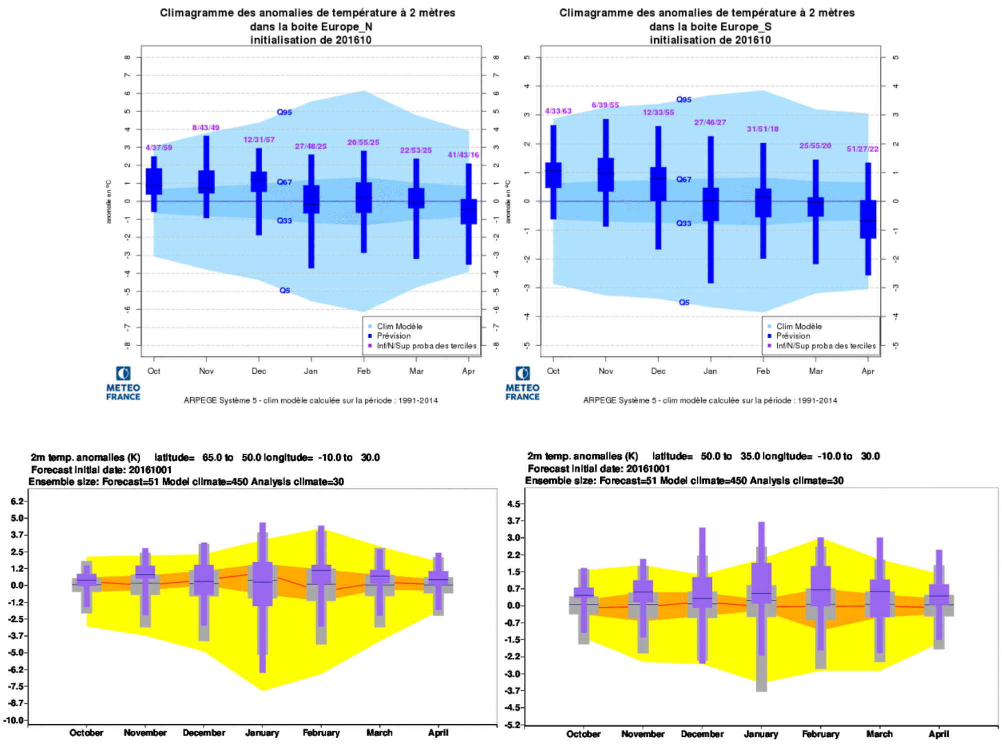


fig.II.5.1 : Climagrams for Temperature in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom).

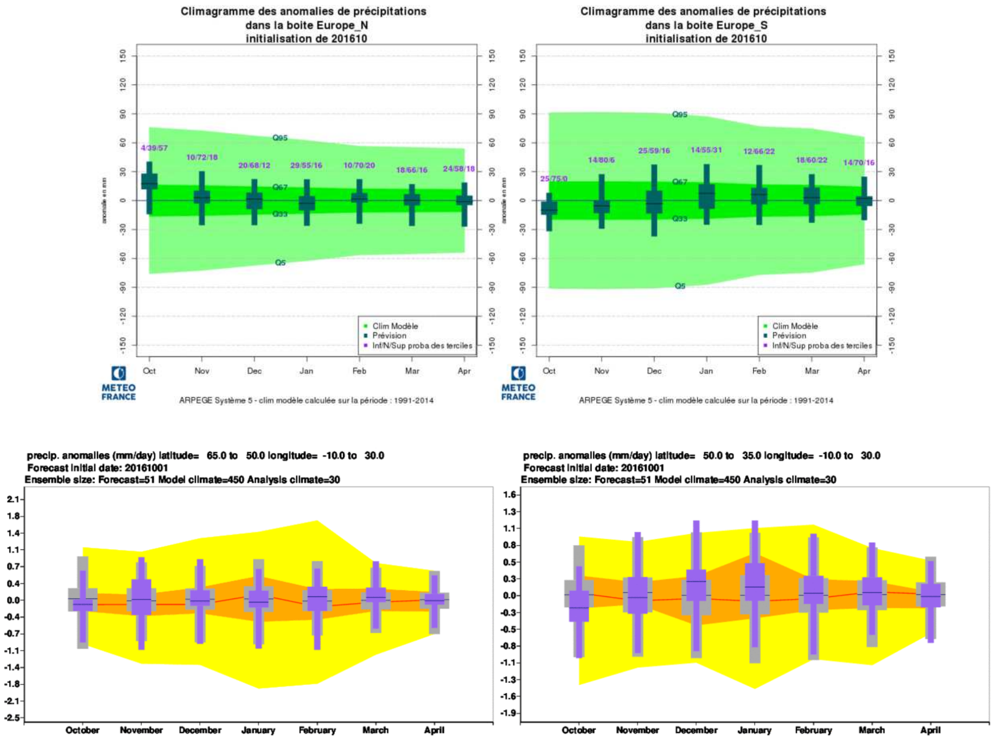
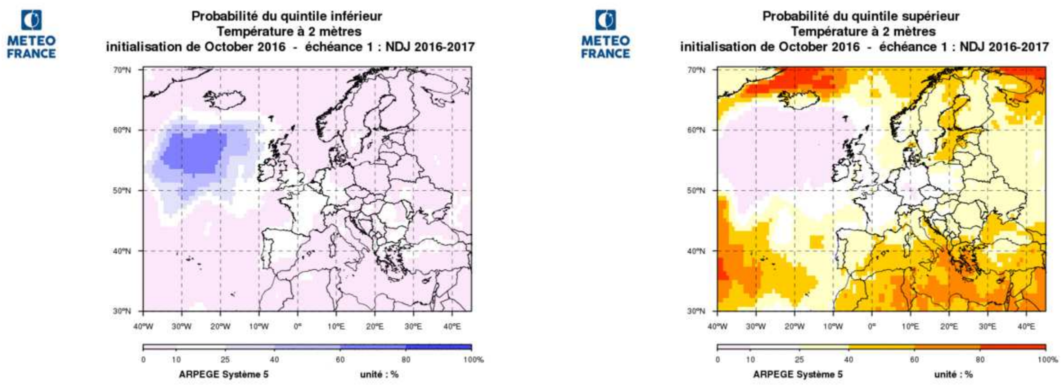


fig.II.5.2 : Climagrams for Rainfall in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom).

II.6. MODEL'S CONSISTENCY

Not available

II.7. "EXTREME" SCENARIOS



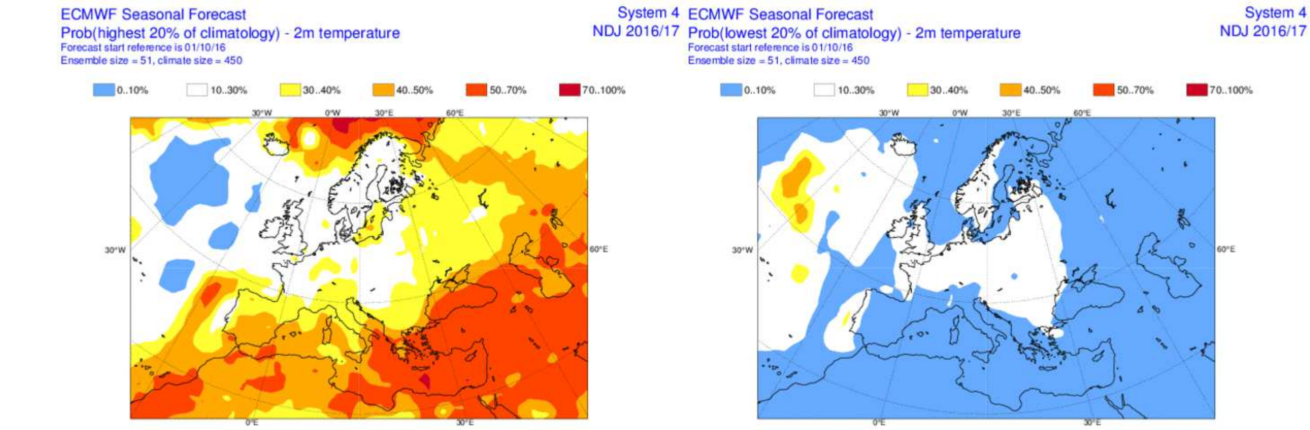


fig.II.7.1 : Top : Meteo-France T2m probability of « extreme » below normal conditions (left - lowest ~15% of the distribution) and "extreme" above normal conditions (right - highest ~15% of the distribution). Bottom : ECMWF T2m probability of « extreme » below normal conditions (left - lowest ~20% of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

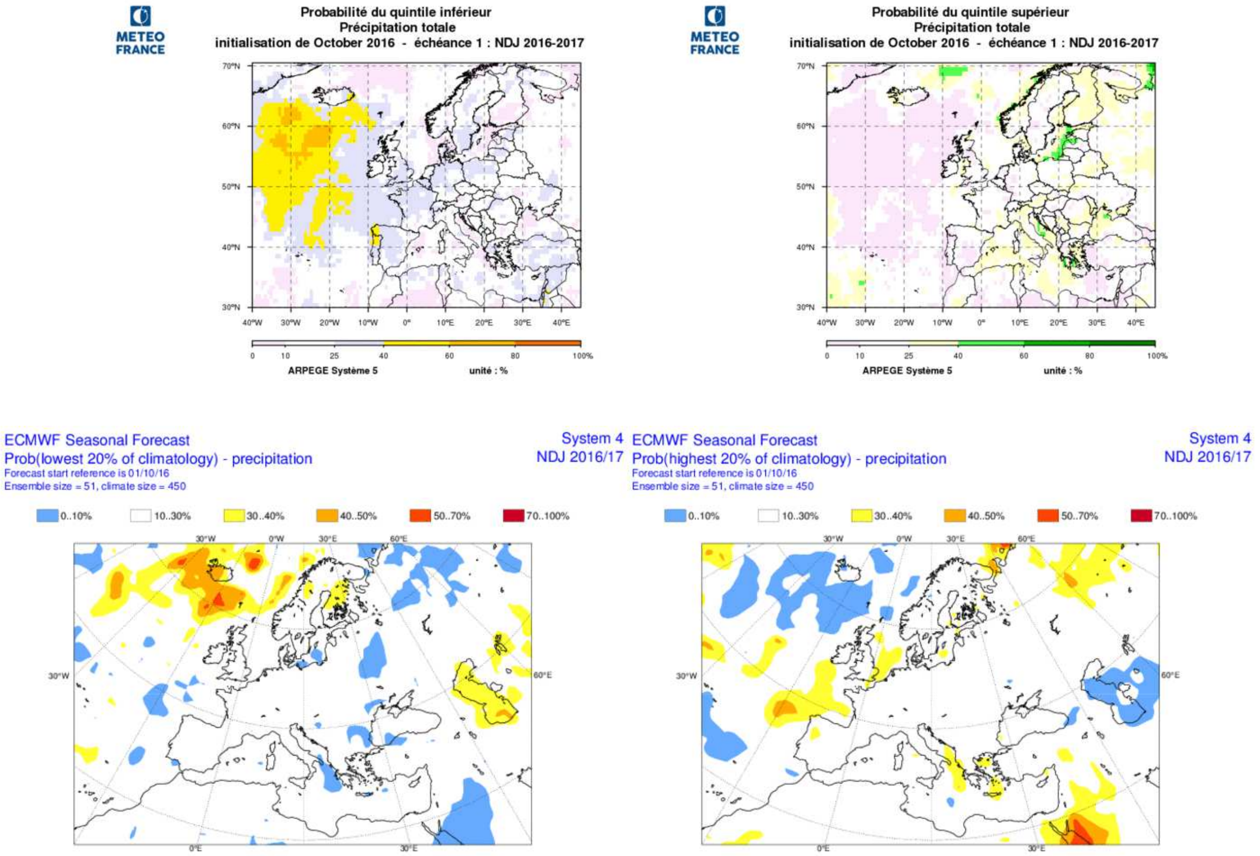
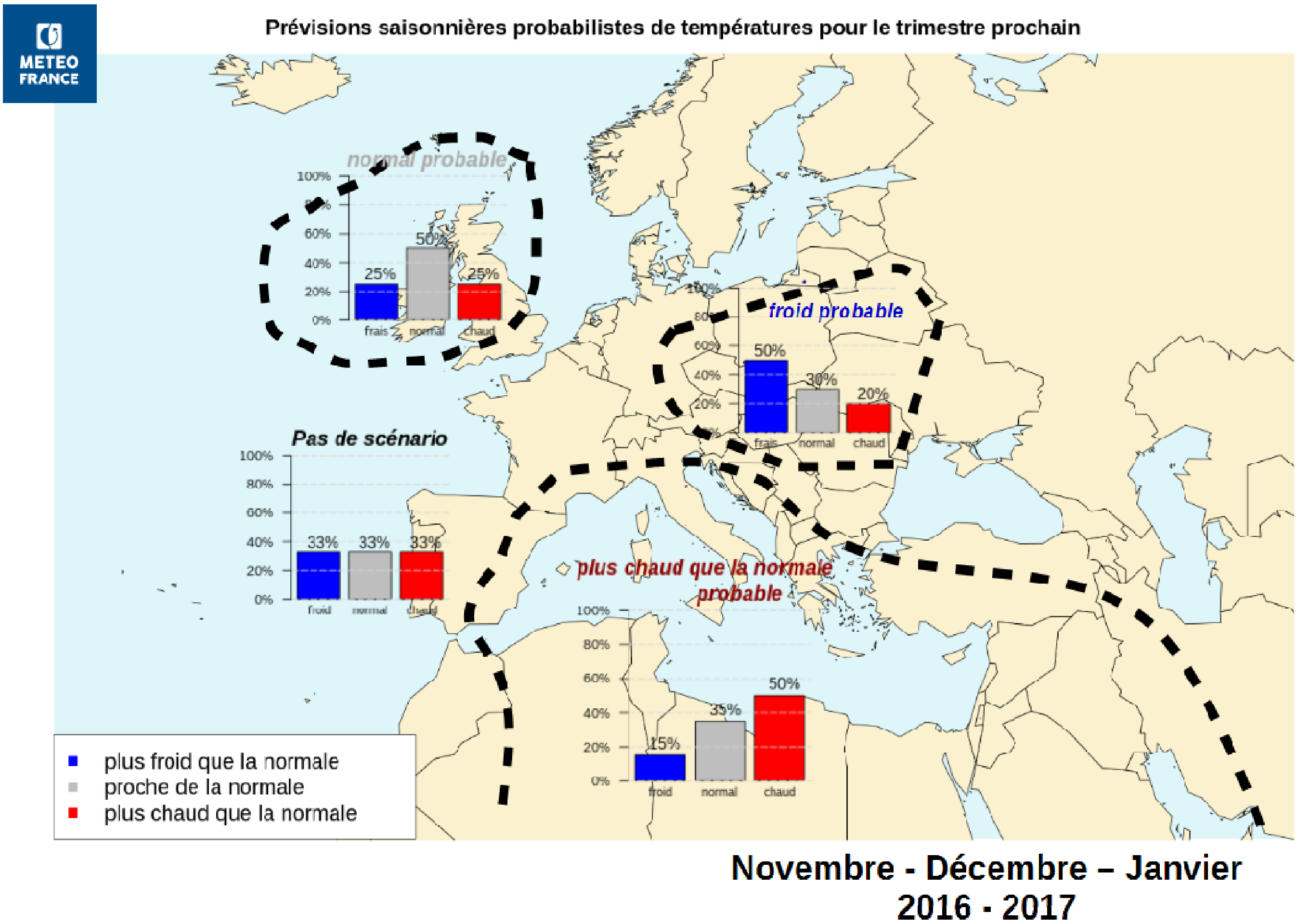


fig.II.7.2 : Top : Meteo-France rainfall probability of « extreme » below normal conditions (left - lowest ~15% of the distribution) and "extreme" above normal conditions (right - highest ~15% of the distribution).
Bottom : ECMWF rainfall probability of « extreme » below normal conditions (left - lowest ~20% of the distribution) and "extreme" above normal conditions (right – highest ~20% of the distribution).

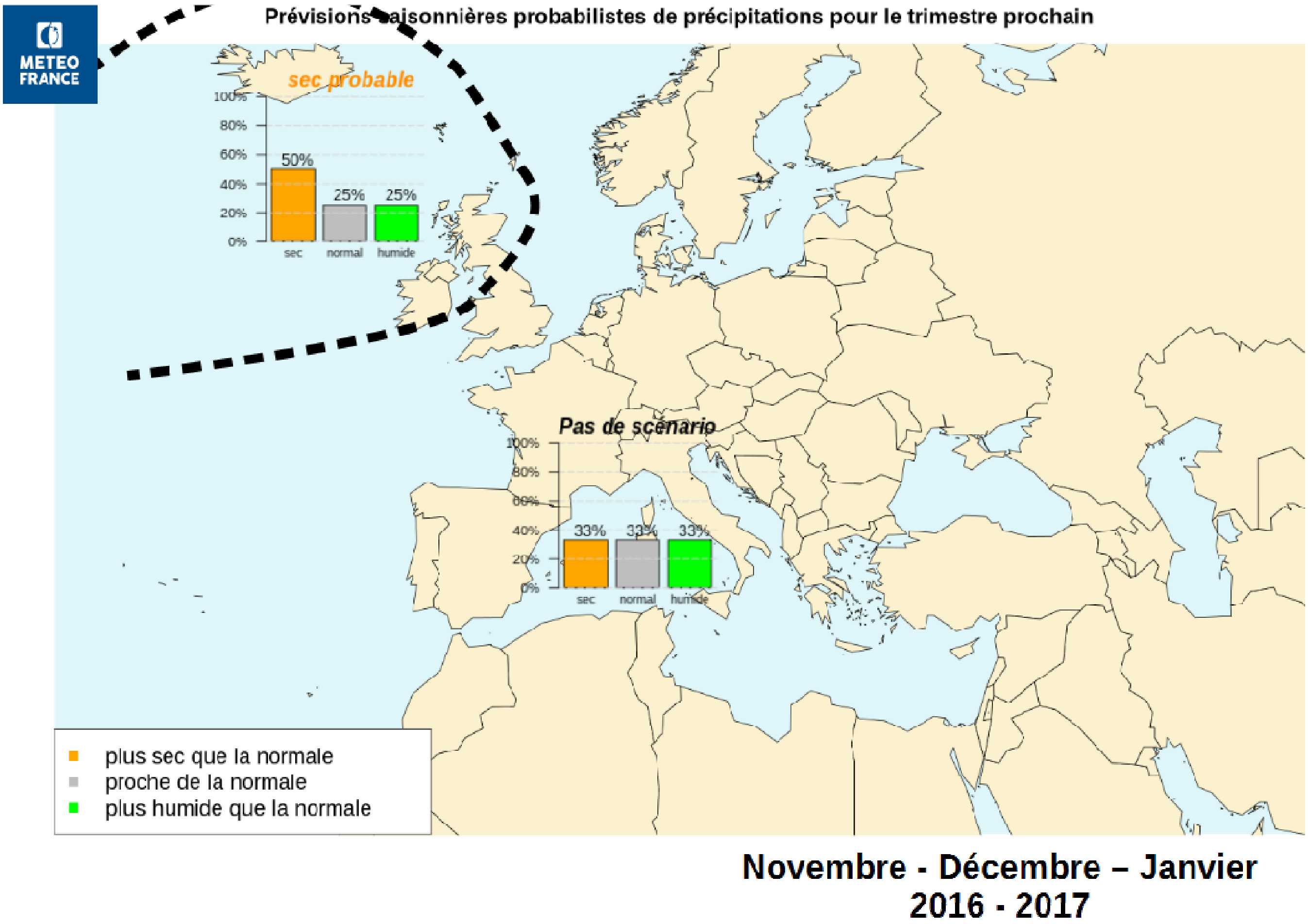
II.8. DISCUSSION AND SUMMARY

II.8.a Forecast over Europe

Temperatures : Warm scenario likely for the Mediterranean. Colder than normal likely for Central Europe (from Austria to Ukraine). Close to normal for the British Isles. Elsewhere no significant tendency is forecast. Caution : "No tendency" does not mean that a cold spell is not possible throughout the NDJ period. Besides, it seems very unlikely that conditions will be as mild as the same period last year (which was record warm in France).



Precipitation: No scenario, except for the north-western half of the British Isles where conditions are likely to be drier than normal. Very wet conditions seem however unlikely for northern Europe since the NAO+ regime should be less frequent than usual.



II.8.b Tropical cyclone activity

Lower than normal activity over southwest Indian Ocean, which is consistent with the forecast subsidence anomaly and the colder than normal SSTs. Activity close to normal elsewhere.

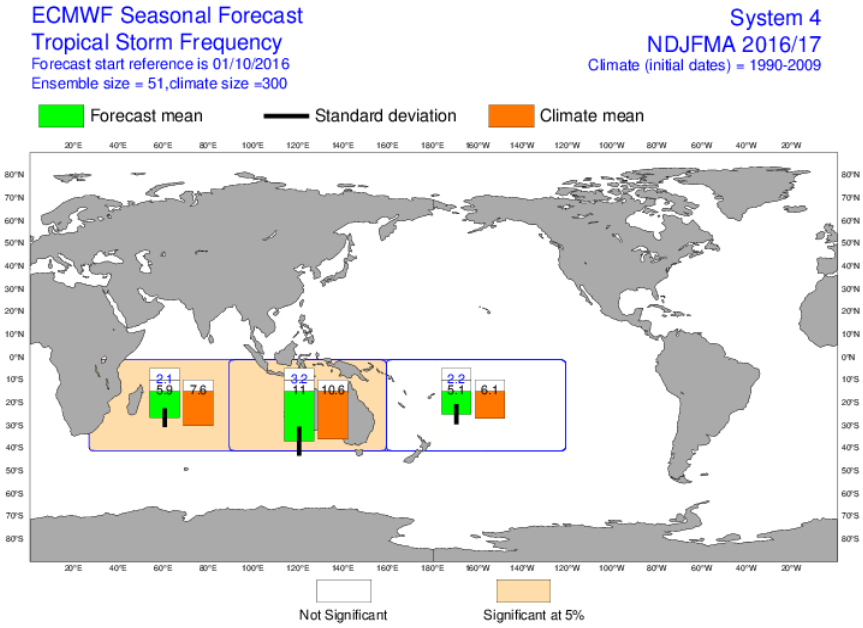


fig.II.8.1: Seasonal forecast of the frequency of Tropical Cyclones from EUROSIP (Météo-France & ECMWF).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/

III. ANNEX

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 4 models (ECMWF, Météo-France, NCEP and UK Met Office). 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.

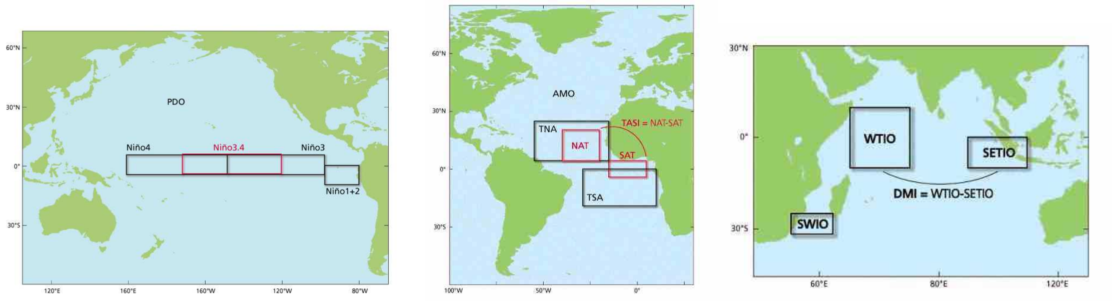
III.2. « NINO », SOI indices and Oceanic boxes

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- 150 W ; 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).

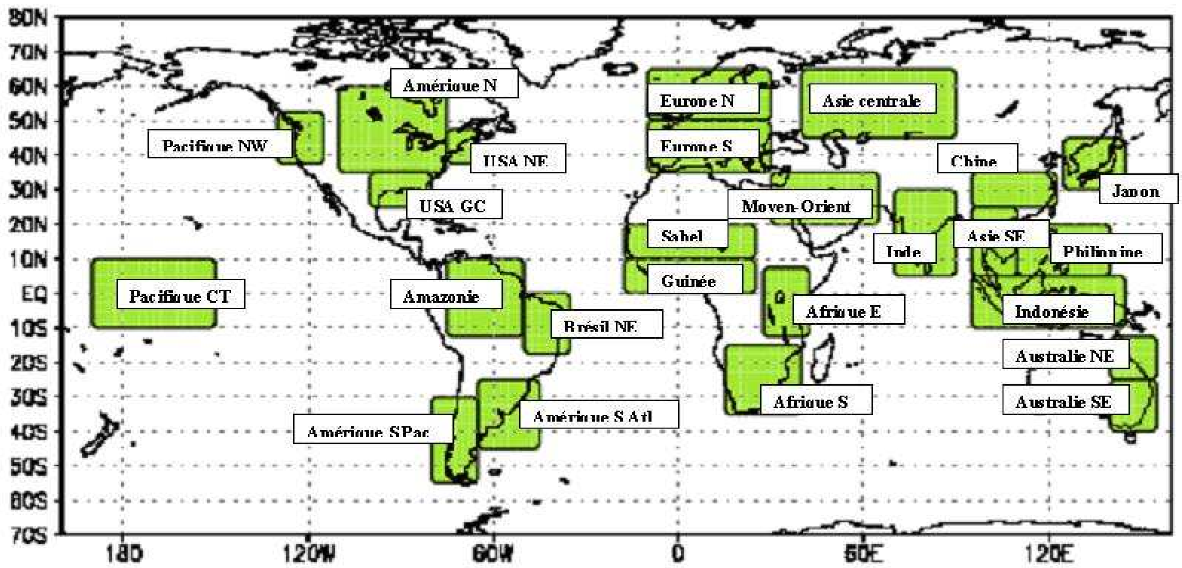
Associated to the oceanic « El Niño / La Niña » events, and taking into account the strong ocean/atmopshere coupling, the atmosphere shows also interanual variability associated to these events. It is monitored using the SOI (Southern Oscillation Index). This indice is calculated using standardized sea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

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