GLOBAL CLIMATE BULLETIN
n°180 - JUNE 2014

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I. DESCRIPTION OF THE CLIMATE SYSTEM (APRIL 2014)

I.1.OCEANIC ANALYSIS

I.1.a Global Analysis

At the Surface (fig. 1) :

Some evolutions in the equatorial waveguide ; especially a warming East to the dateline in the Pacific and cooling on the Eastern part of the Indian Ocean. To be quoted the maximum of the positive anomaly on the dateline. In the tropics, some warming in Tropical North Atlantic (especially in the vicinity of West Africa) and Northern Indian Ocean.

In the sub-tropics and mid latitudes some evolution across the Pacific, Indian Ocean and the Atlantic.

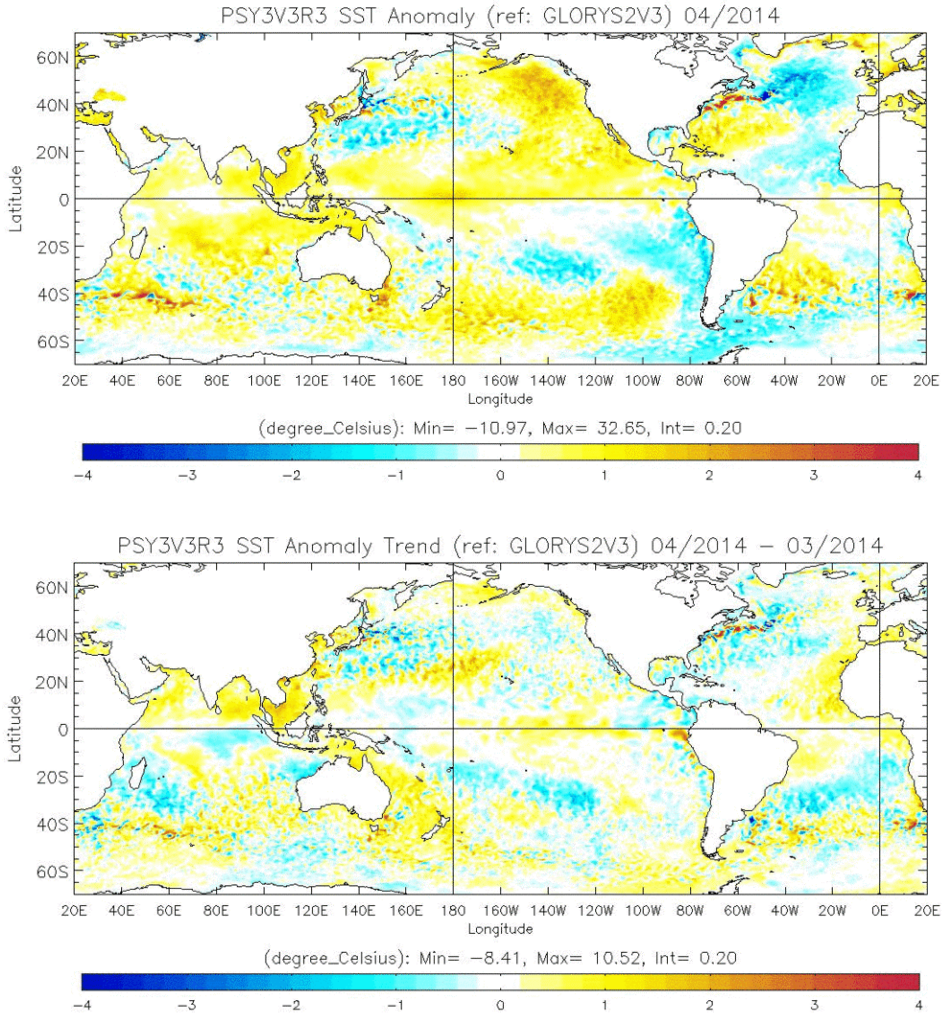


fig.1: top : SSTs Anomalies (°C) (reference Glorys 1993-2009); bottom : SST tendency (current – previous month) http://bcg.mercator-ocean.fr/

In subsurface (fig.2) :

In the Pacific : in the equatorial band (10°N-10°S), strong positive heat content anomalies in the Central Pacific along the Equator and negative anomaly in the most western part. Little traces of the persistent positive anomalies in the Western part off equator (in the Northern hemisphere between 10°N and 20°N). In the SPCZ region a negative anomaly extends South-East in the Tropics.

In the Atlantic : in the equatorial waveguide some negative anomalies and a weak positive anomaly in the Guinean Gulf. In the Topical North Atlantic, negative anomalies from West Africa to the Northern coast of South America (North Hemisphere) and from Angola to the Equator South Hemisphere).

In the Indian Ocean : development of negative anomalies in the Tropical most Eastern part and positive anomalies off equator (especially in the Southern hemisphere). In the Tropical Southern part of the basin mostly warmer than normal conditions consistently with SSTs.

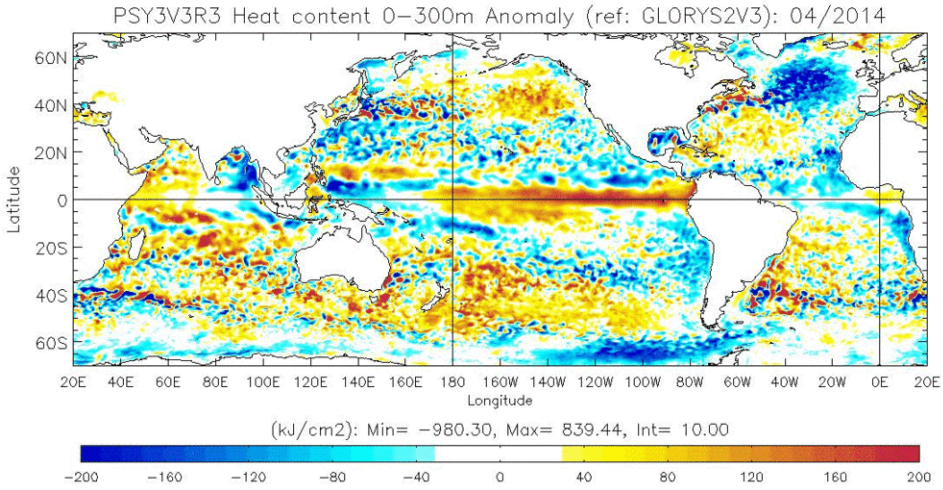


fig.2: map of Heat Content Anomalies (first 300m) (in kJ/cm²). (reference Glorys 1992-2009)
http://bcg.mercator-ocean.fr/

I.1.b Pacific Basin (fig. 3, 4 and 5)

Most of the Northern Hemisphere shows a positive anomaly ; a negative one is visible in the Eastern Southern part. The trade wind anomalies in the western part of the basin seems to be consistent with a Large Scale convection displacement beyond the dateline and a weakening of the trade wind over the western regions. The positive SOI (0.8) is not consistent with the development of an El Niño but is consistent regarding the location of negative SST anomaly close to Tahiti and positive SST anomaly in the vicinity of Northern Australia.

In the Niño boxes (4, 3.4, 3 et 1+2 ; see definition in Annex) the monthly averages are respectively 0.6°C, 0.2°C, 0.2°C to -0.4°C from West to East.

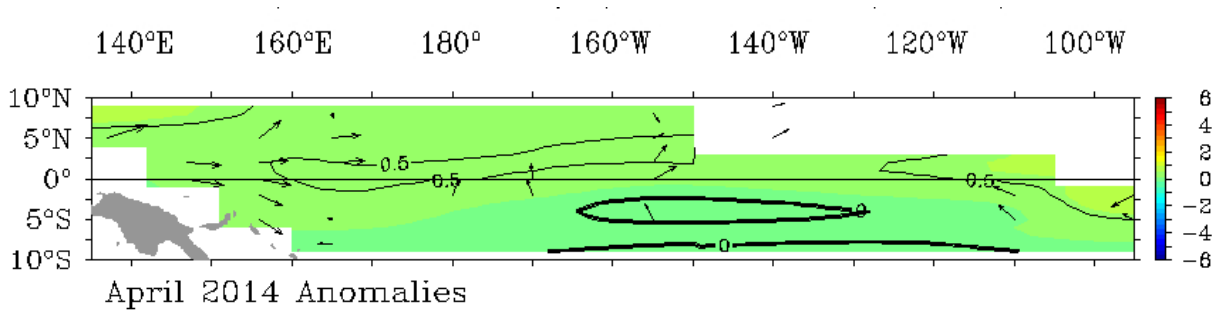


fig.3: SST and Wind anomalies over the Equatorial Pacific from TAO/TRITON.
http://www.pmel.noaa.gov/tao/jsdisplay/monthly-summary/monthly-summary.html

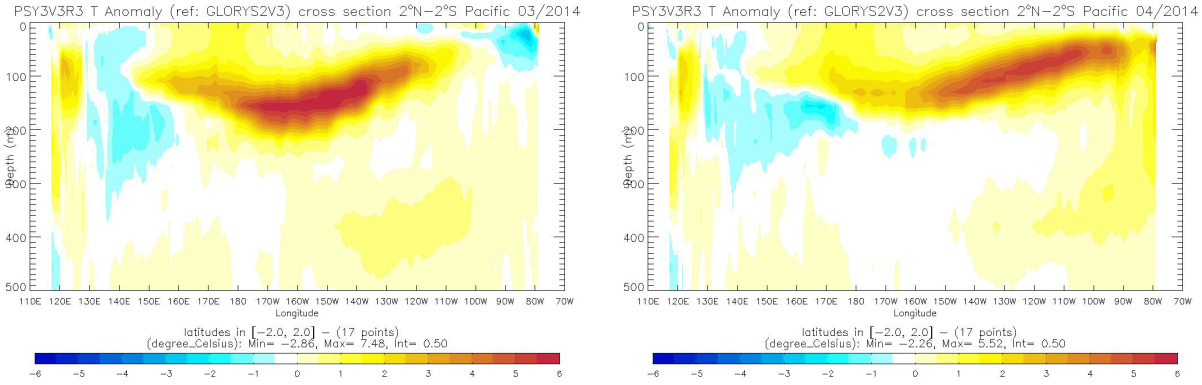


fig.4: Oceanic temperature anomaly in the first *500 meters* in the Equatorial Pacific, in previous month (left) and current month (right) http://bcg.mercator-ocean.fr/

In the equatorial waveguide (fig. 4) : A very clear propagation of a Kelvin wave (positive anomaly) under the surface (close to immersion 150m) ; the positive anomaly is landing on the Eastern side. The negative anomaly disappeared in the Eastern part in relation with the eastward propagation of the warm sub-surface signal. Conversely, a negative anomaly appeared in the Western part with some propagation (could be the trace of the delayed oscillator influence).

The thermocline structure (fig. 5) : Consistently with the previous comment, traces of the (strong) deepening of the thermocline in the Eastern part and of the Kelvin wave propagation (positive anomaly) east to the dateline.

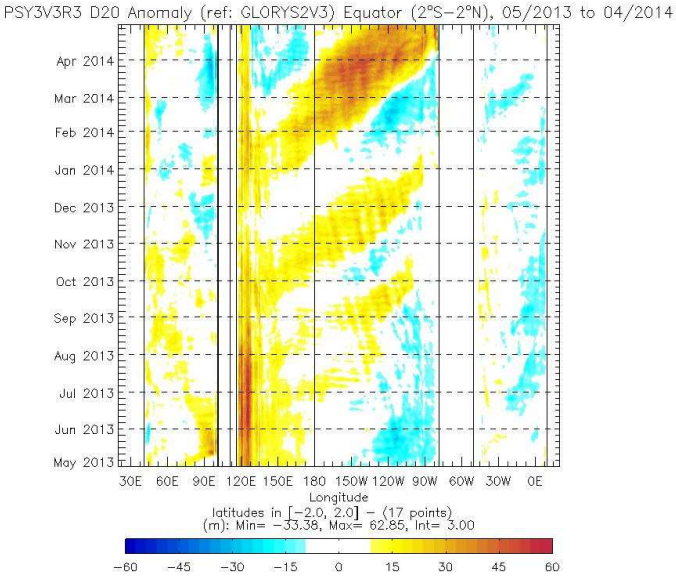


fig.5: Hovmöller diagram of Thermocline Depth Anomalies (m) (depth of the 20°C isotherm) along the equator for all oceanic basins over a 24 month period. http://bcg.mercator-ocean.fr/

I.1.c Atlantic Basin

Northern Tropical Atlantic : cooler than normal but with a change in the tendency (mostly warming).
Equatorial waveguide : Close to neutral to the exception of a weak positive anomaly in the Guinean Gulf (associated to a warming) ; the SAT index is positive.
The Southern Tropical Atlantic : Close to normal to the exception of the regions close to the African continent (close to Namibia/Angola ; negative anomaly).
The TASI index is now in a negative phase.

Sea Surface Temperature near Europe (fig.5a):
Still warmer than normal in the Arctic Sea and the North Sea with anomalies up to more than +1°C. Above-normal warming extending from the subtropics along the Atlantic west coasts of North Africa and western Europe. The warming extended also into the Mediterranean, resulting in positive anomalies between +0.5 and +1°C in the whole Mediterranean basin and the Black Sea.

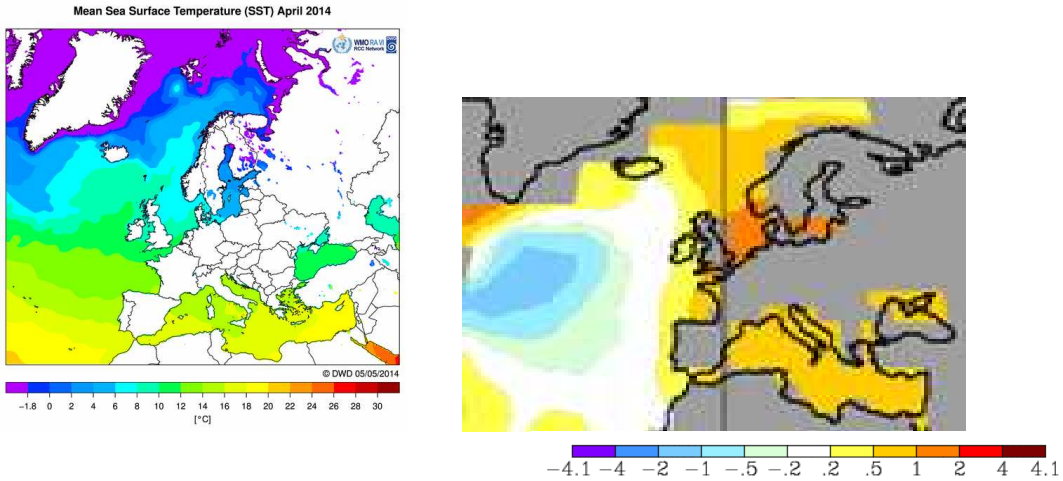


fig.5a: left : Monthly mean SST near Europe and the Mediterranean. http://www.dwd.de/rcc-cm ; right : Corresponding monthly mean SST anomalies (1981-2010 reference). http://data.giss.nasa.gov/gistemp/maps/

I.1.d Indian Basin

Southern Tropical Indian Ocean : warmer than normal conditions over most of the basin with a cooling close to North-West Australia.
Equatorial waveguide : close to normal conditions in the central part, the DMI is close to neutral in relationship with the WTIO and SETIO boxes (both warmer than normal). To be quoted a cooling tendency on the Eastern side.
Northern Tropical Indian Ocean : mostly positive anomaly and warming tendency.

I.2. ATMOSPHERE

I.2.a Atmosphere : General Circulation

Velocity Potential Anomaly field in the high troposphere (fig. 6 – insight into Hadley-Walker circulation anomalies) : The MJO Index was significant during the first half of the month and the phase was between the Indian Ocean and the western Pacific. Then the MJO was with little activity up to the end. This could explain the relative fragmented patterns. Then, the anomalies pattern in the Tropics look like the climatology so they appear as a strengthened climatology.

On the Pacific : Strong Divergent circulation anomaly (upward anomaly motion) close to the dateline (in relationship with the SST anomaly pattern in the equatorial waveguide). This pattern extends far in both hemispheres and along the equatorial region (consistently with the SSTs anomalies). Over the Eastern Pacific some weak but discernable Convergent/Divergent cells likely linked with the sub-tropics (South/North).
On the Atlantic : Convergent circulation anomaly (downward anomaly motion) close to the Equator with some extension along the Northern coast of South-America and the Caribbean and toward mid-latitudes of South Atlantic. A weak Divergent circulation anomaly over the North-Eastern Tropical Atlantic. Also to be quoted the dipole over the Northern part of Africa ; these cells being connected with the tropical part.
On the Indian Ocean : Strong convergent circulation anomalies (downward anomaly motion) over most of the South-Western part of the basin (in the vicinity of Madagascar).

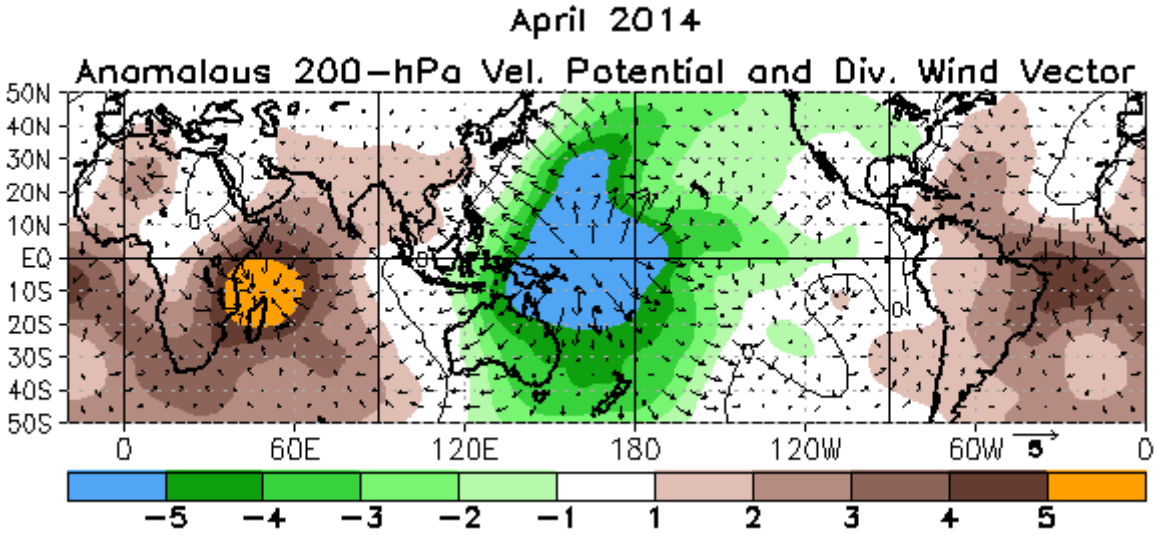


fig.6: Velocity Potential Anomalies at 200 hPa and associated divergent circulation. Green (brown) indicates a divergence-upward anomaly (convergence-downward anomaly).
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

Stream Function anomalies in the high troposphere (fig. 7 – insight into teleconnection patterns tropically forced) : Some signal in the inter-tropical band especially in the Central and Eastern Pacific. The cells are difficult to interpret as "canonical" teleconnection patterns and seem to be related to the local/regional signal. Nevertheless, they could have some influence and linkage with the mid-high latitude activity.

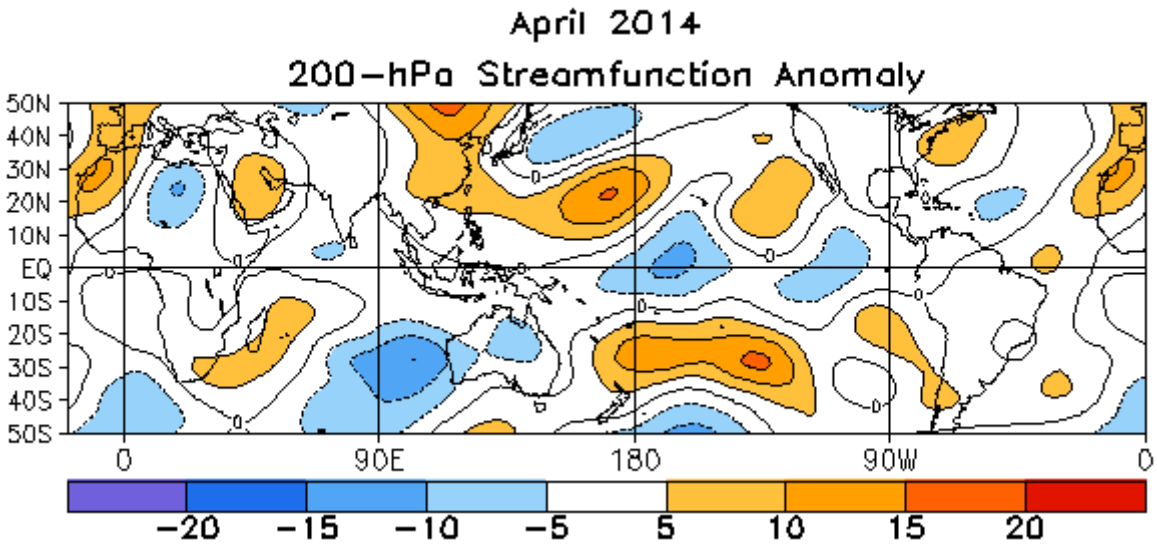


fig.7: Stream Function Anomalies at 200 hPa.
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt22.shtml

Geopotential height at 500 hPa (fig. 8 – insight into mid-latitude general circulation) : Consistently with the previous analysis, anomalies coming from the Tropics only from the Pacific. A strong positive anomaly over Eastern Siberia. To be quoted an active negative phase over the West Pacific (WP pattern -1.4). The strongest anomalies in the Northern Hemisphere are in the high latitudes.

Relevant for Europe and Eurasia, the East Atlantic/West Russia (EATL/WRUS) and the Polar Eurasia (POLEUR) patterns switched to relatively high positive values (+1.2 and +1.0, respectively). Both patterns result in a meridional circulation favored across the Atlantic and Western Europe, and for the POLEUR even stronger over Asia, but also a relatively strong polar vortex.

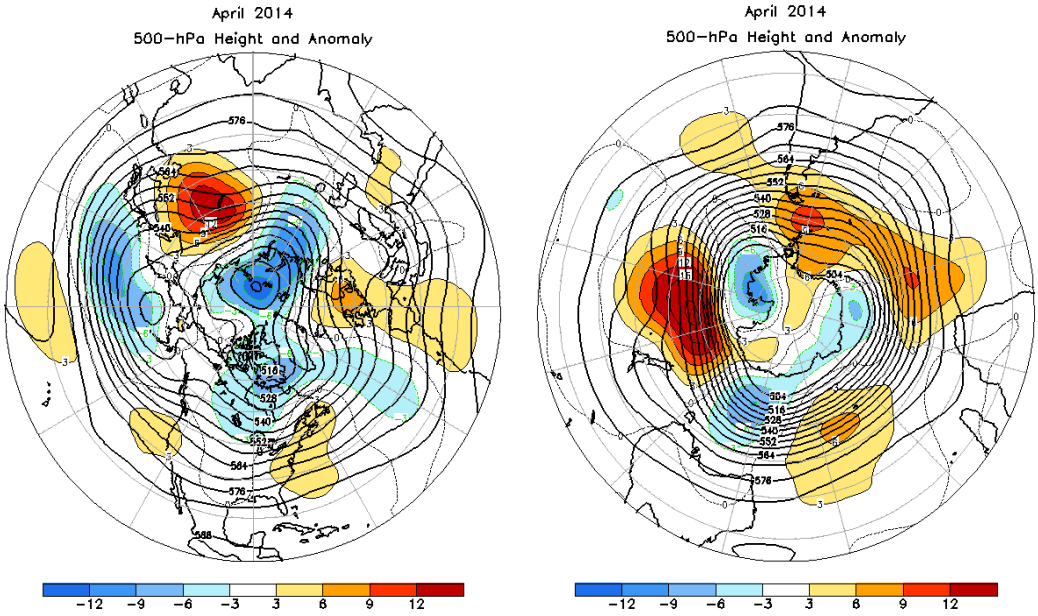


fig.8: Anomalies of Geopotential height at 500hPa (left North Hemisphere http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/fige9.shtml, and right South Hemisphere http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/fige15.shtml)

Evolution of the main atmospheric indices for the Northern Hemisphere for the last 6 months :

MONTH	NAO	EA	WP	EP-NP	PNA	TNH	EATL/WRUS	SCAND	POLEUR
APR 14	0.2	0.5	-1.4	0.1	0.0	---	1.2	-0.7	1.0
MAR 14	0.4	0.9	-0.4	1.2	0.5	---	-0.1	-0.5	0.0
FEB 14	1.1	2.2	-1.4	0.3	-1.6	0.3	-1.9	1.1	-1.9
JAN 14	-0.2	1.4	0.5	1.1	0.6	1.6	-1.3	1.7	-0.8
DEC 13	0.8	1.2	-2.0	---	-1.2	1.8	-0.4	-0.7	-0.8
NOV 13	0.8	0.1	0.0	1.2	-1.1	---	-0.9	-0.7	2.6

http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/table3.shtml

Sea level pressure and circulation over Europe and the Mediterranean regions (fig. 8a)

There is little anomalies over Europe and North Africa to the exception of weak anomalies over South-East Europe. So the surface pressure field is close to normal over the continents.

Regarding the mean circulation : Low-pressure centers in the North (Icelandic Low and polar vortex) more intense than normal, but weaker Azores High. The zonal circulation over the North Atlantic (consistent with the Z500 analysis) was blocked over western Europe while much of central and northeastern Europe was under high pressure or an easterly airflow with dry and warm air. Southeastern Europe, in contrast, was influenced by Mediterranean cyclones over a longer time.

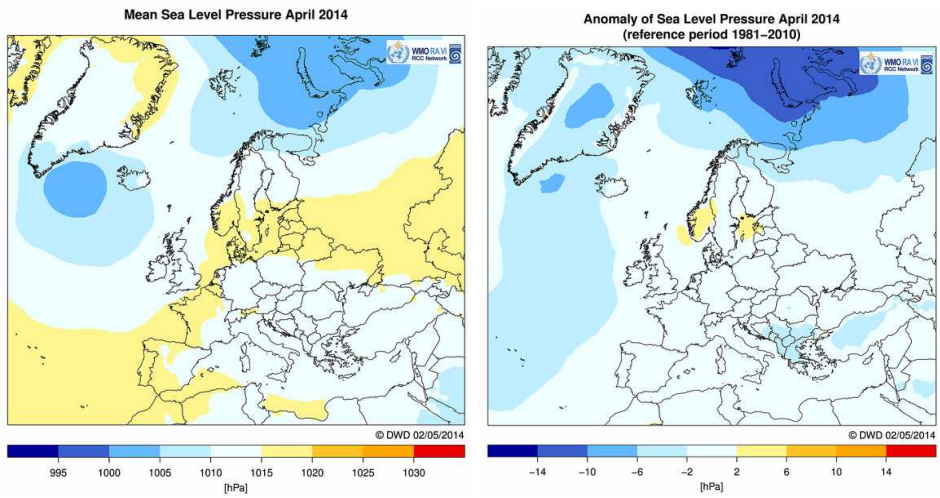


fig.8a: Monthly mean SLP over Europe (left) and corresponding anomalies (right). http://www.dwd.de/rcc-cm

I.2.b Precipitation

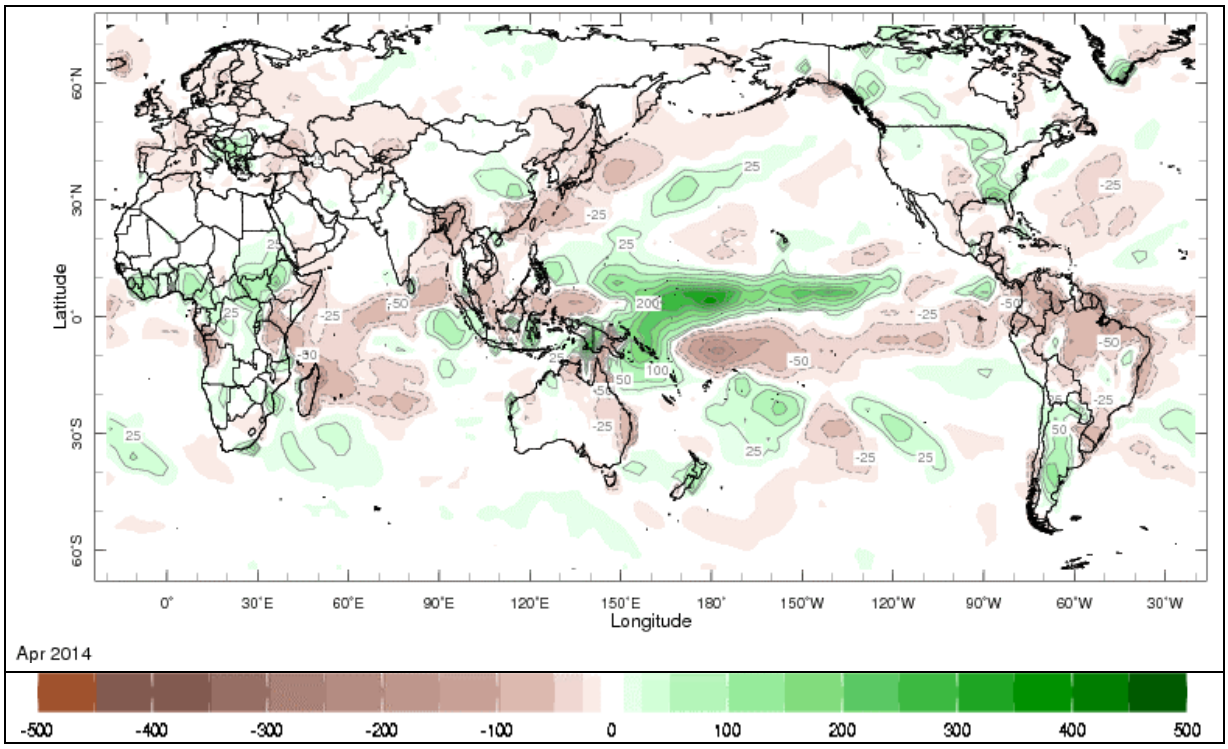


fig.9: Rainfall Anomalies (in mm) (departure to the 1979-2000 normal) – Green corresponds to above normal rainfall while brown indicates below normal rainfall.
http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/

Intertropical zones (including sub-tropics) : good consistency with the Velocity Potential anomalies, over the Indian Ocean (globally – in the vicinity of Madagascar and Eastern coast of Africa), close to the dateline and along the equatorial waveguide (+) in the Pacific. Good consistency on Northern South America (-). Less consistency over West Africa to the exception of the most Eastern side of the Gulf of Guinea.
Mid-latitudes : mostly drier than normal over the Eastern part of the Asian continent including the region in the vicinity of the Bay of Bengal.

Rainfall anomalies in Europe:

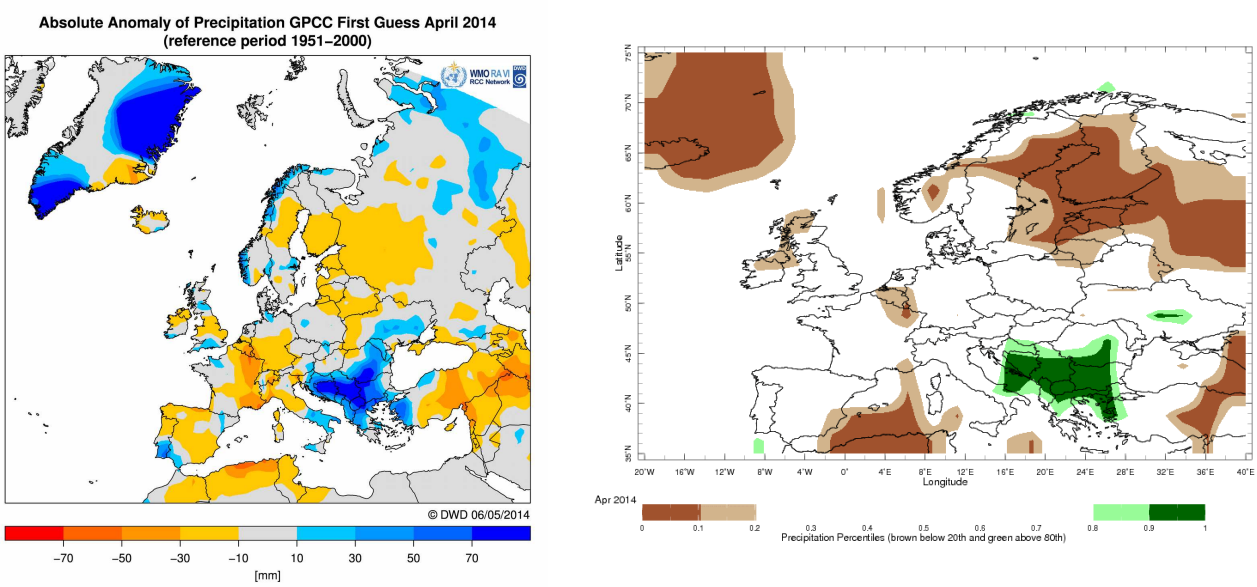


fig.10: Left: Absolute anomaly of precipitation in the RA VI Region (Europe), data from GPCC (Global Precipitation Climatology Centre – reference 1951-2000), http://www.dwd.de/rcc-cm.
Right: Percentiles of precipitation. Data from NOAA Climate Prediction Center, http://iridl.ldeo.columbia.edu/maproom/Global/Precipitation/Percentiles.html

Large parts of Europe and the Middle East were drier than normal in April. In some areas monthly totals were below the 10th percentile (especially southern parts of the western Mediterranean, parts of Turkey and the eastern Black Sea region and particularly northeastern Europe. Outstanding was the extreme precipitation over the Balkan Peninsula and western Turkey, which was clearly above the 90th percentile.

I.2.cTemperature

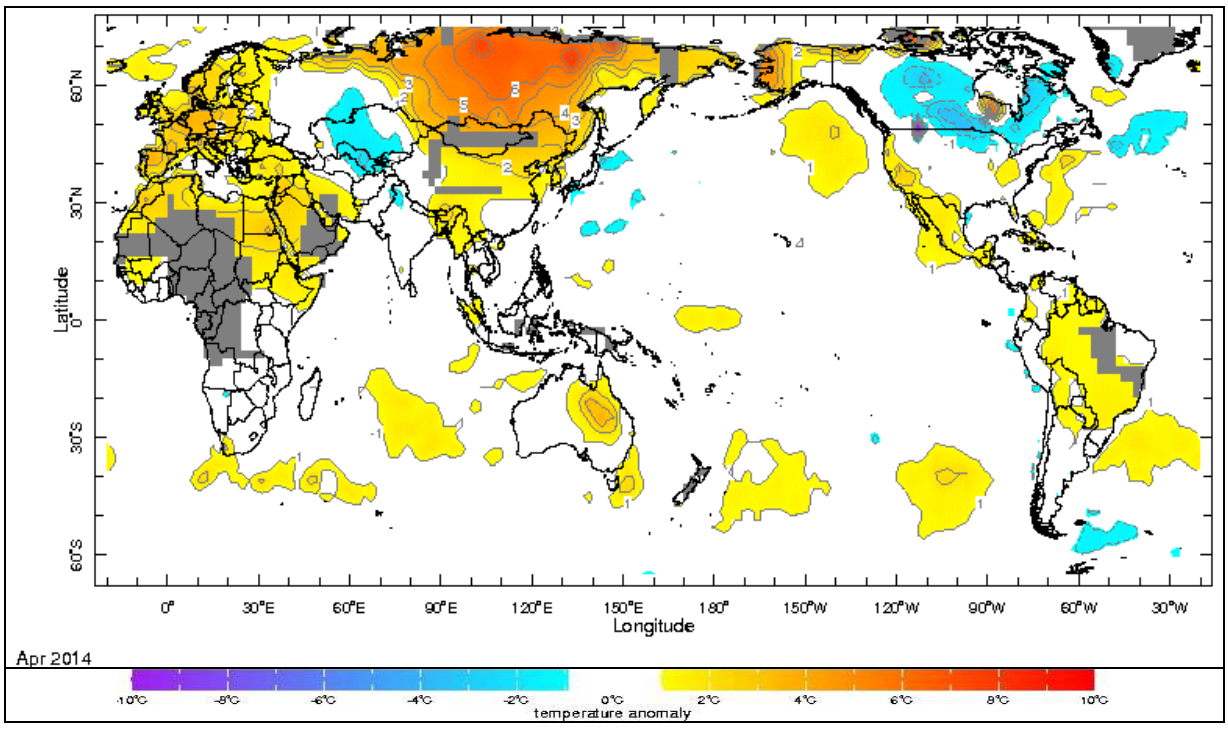


fig.11: Temperature Anomalies (in °C) (departure to the 1979-2000 normal)
http://iridl.ldeo.columbia.edu/maproom/.Global/.Atm_Temp/Anomaly.html

Strong warm anomalies over Siberia (consistent with Z500 anomaly) extending southward up to South-East Asia. Positive anomalies from Western and Central Europe up to most of the African continent North to the Equator and the Arabic Peninsula. A large portion of Brazil (and neighboring countries) face above normal conditions. Negative anomaly covering most of the Canada and over Kazakhstan .

Temperature anomalies in Europe:
April 2014 was again a very warm month in most of Europe. Anomalies were above +2°C and the 90th percentile over a large area and one of the warmest April months on record for several countries. Other areas over the North Atlantic and Russia / West Kazakhstan were colder than normal, reflecting the meridional circulation patterns mentioned above.

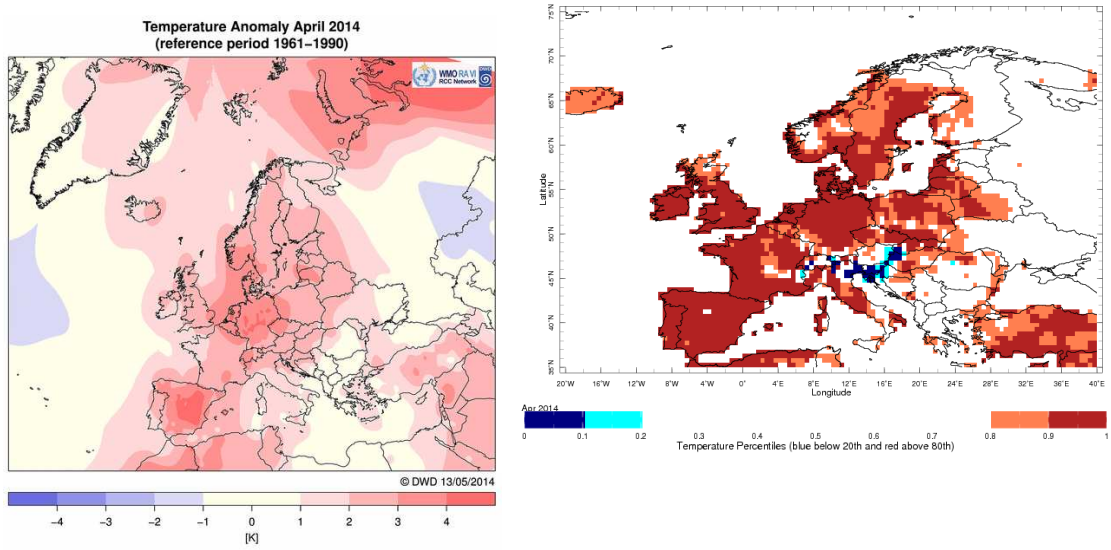


fig.12: left : Absolute anomaly of temperature in the RA VI Region (Europe), data from Deutscher Wetterdienst (DWD); http://www.dwd.de/rcc-cm . Right : Percentiles of temperature. Data from NOAA Climate Prediction Center, http://iridl.ldeo.columbia.edu/maproom/Global/Atm_Temp/Percentiles.html .

I.2.d Sea Ice

In Arctic (fig. 15&15bis- left) : below normal sea-ice extension (negative anomaly not so far from 2 standard deviations).
In Antarctic (fig. 15&15bis - right) : well above normal sea-ice extension anomaly (on record) with some large regional modulation.

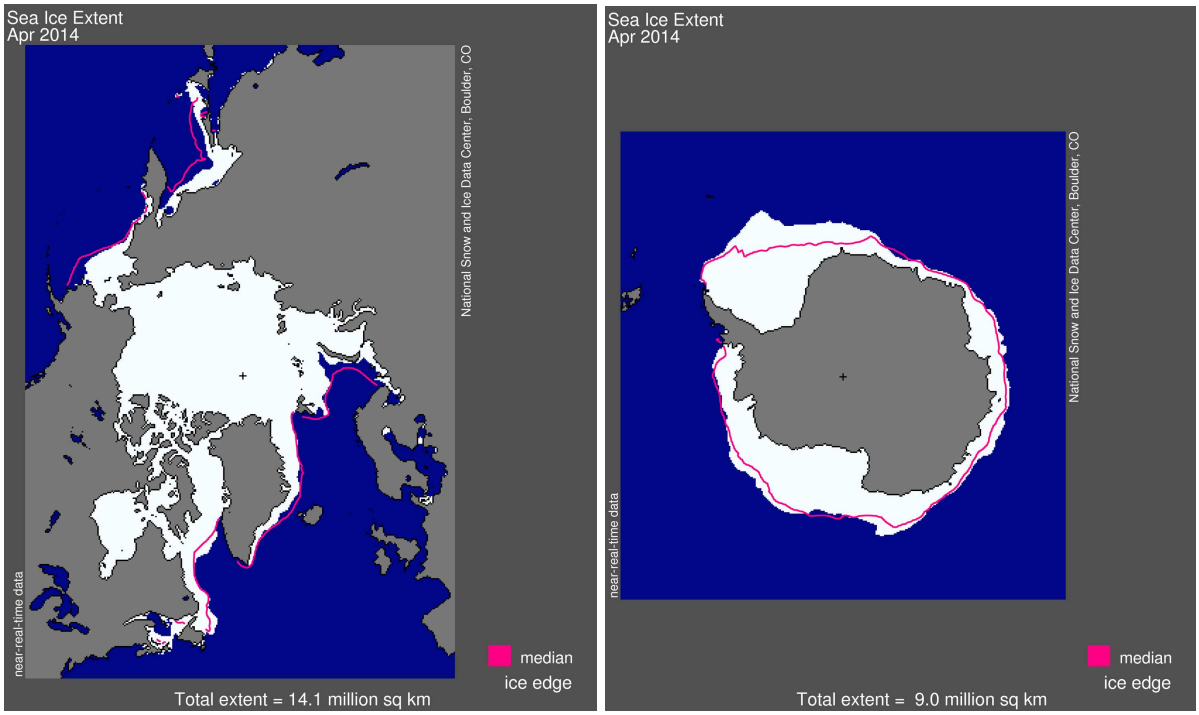


fig.13: Sea-Ice extension in Arctic (left), and in Antarctic (right). The pink line indicates the averaged extension (for the 1979-2000 period). http://nsidc.org/data/seaice_index/

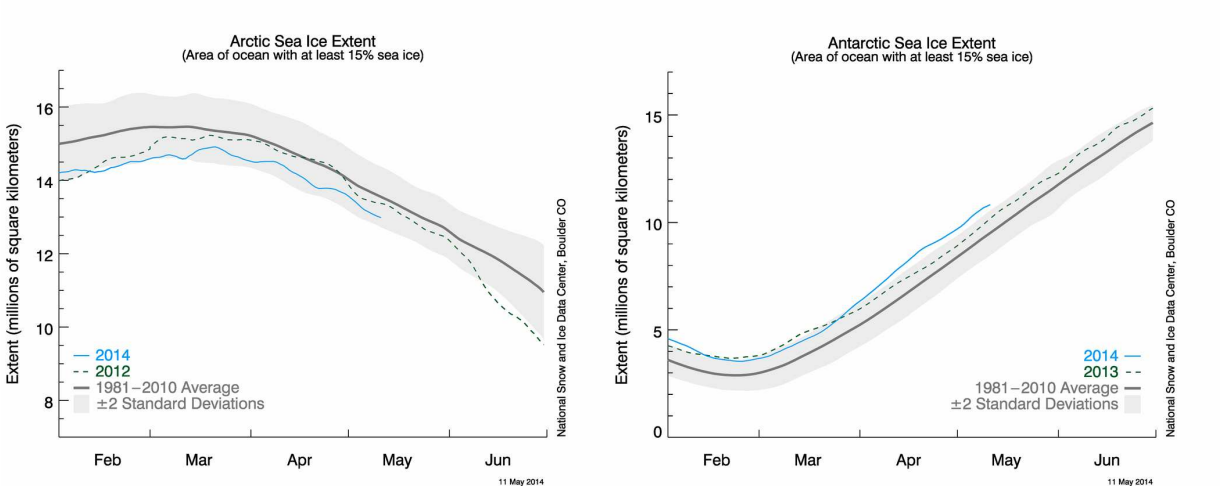


fig. 15bis : Sea-Ice extension evolution from NSIDC
http://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png

II. SEASONAL FORECASTS FOR JJA FROM DYNAMICAL MODELS

II.1.OCEANIC FORECASTS

II.1.a Sea Surface Temperature (SST)

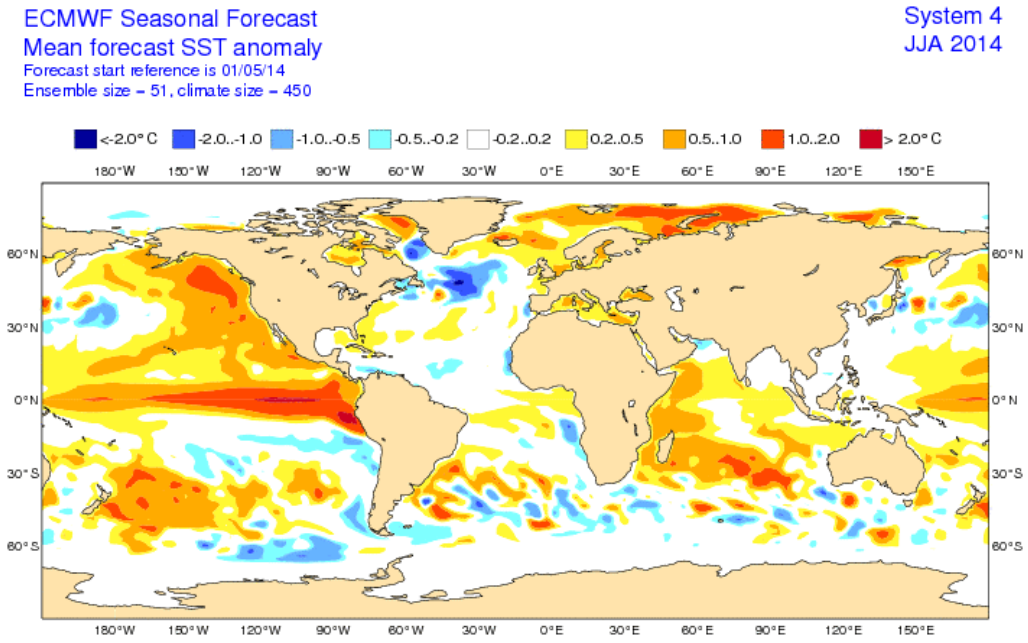


fig.14: SST anomaly forecast (in °C) from ECMWF.
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/group/

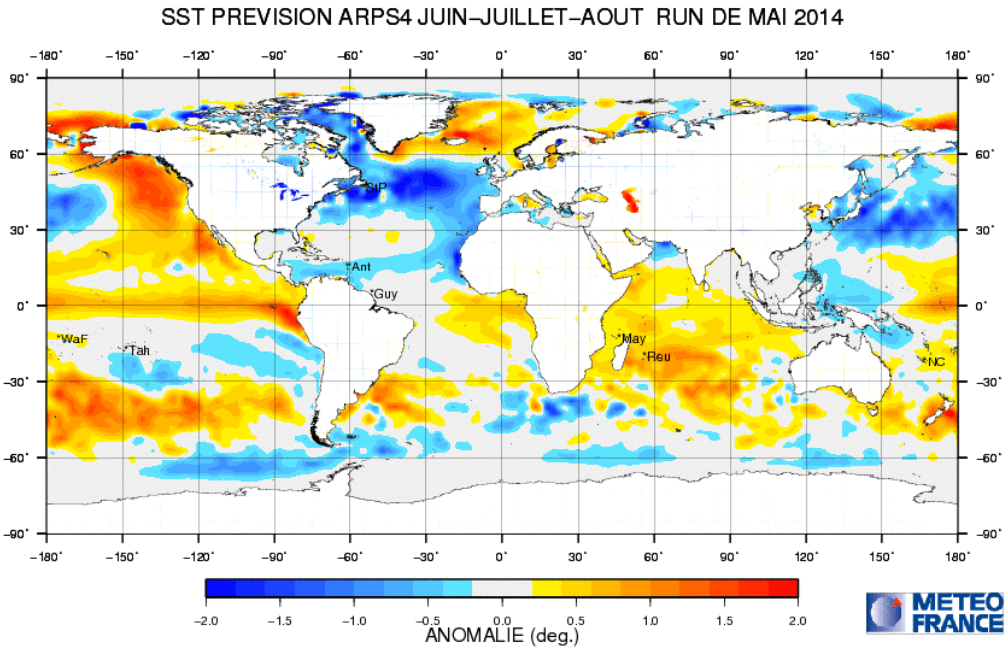


fig.15: SST Anomaly forecast (in°C - recalibrated with respect of observation) from Météo-France.
http://elaboration.seasonal.meteo.fr/

For the 2 individual models :
Whatever the differences in the post-processing of the anomalies (including reference period for the hindcast ; 81-2010 for ECMWF and 91-2010 for MF system 4), fairly consistent SST forecasts (taking into account the hindcast period differences), over both Hemispheres.
Pacific : Clear warmer than normal conditions in the equatorial waveguide. ECMWF is warmer than MF East to the dateline. The positive anomaly extends up to the dateline in both models. Negative anomalies in the Western Tropics in MF. The differences between MF and ECMWF can be at least partly related to hindcast issues. Positive anomalies over the Half Eastern North Pacific in both models and negative in MF in the North Western Pacific.
Atlantic : equatorial waveguide warmer than normal in the Guinean Gulf (close to neutral outside) in both models. Some consistency for negative anomalies in the Northern hemisphere on the eastern side extending to East (up to Caribbean region in MF). Colder than normal conditions in the Northern mid-latitudes.
Indian Ocean : Warmer than normal conditions more or less everywhere. IOD mostly on the positive side.

In Euro-SIP :
Some robust patterns appear in the tropics everywhere to the exception of the Atlantic. More or less the same comments than for the individual models.
Pacific : The positive anomaly in the equatorial waveguide region from the most Eastern part up to the dateline. Quite consistent patterns in the subtropics and the mid-latitudes of both hemispheres.
Atlantic : close to neutral over the Equatorial waveguide. Colder than normal conditions Close to West Africa. The Southern Tropics are close to neutral to the exception of the coastal African regions.
Indian Ocean : Warmer than normal conditions over a large portion of the basin.

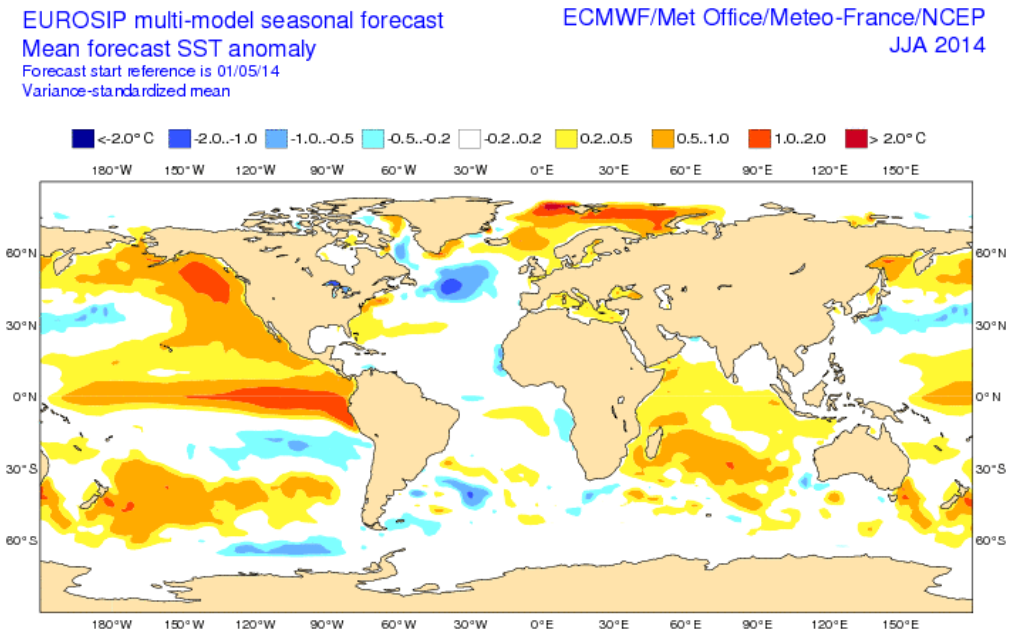


fig.16: SST Forecasted anomaly (in °C) from Euro-SIP. http://www.ecmwf.int/

II.1.b ENSO Forecast :

Forecasted Phase : Close to El Niño threshold conditions

For JJA : the majority of the dynamical models stay in the range of neutral conditions at the beginning of the targeted period. However, they are indicating a warming on time in the Niño 3.4 area. Most of them are reaching the Niño threshold at the end of the period and go beyond after.

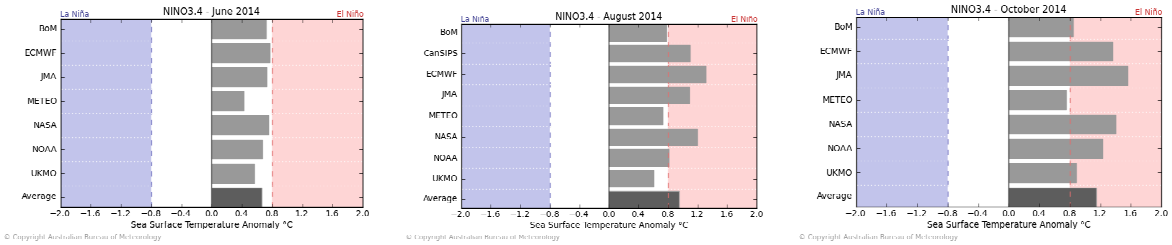
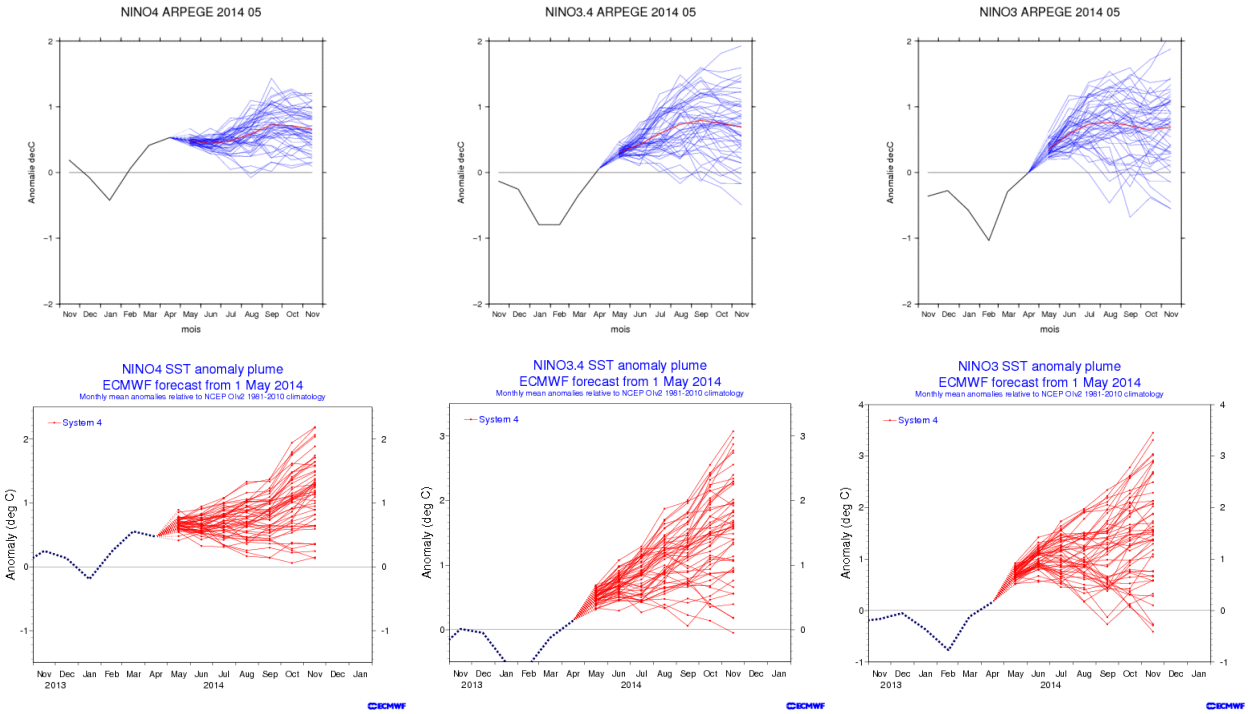


fig.17: Synthesis of Niño 3.4 forecasts from several GPC by BoM :
http://www.bom.gov.au/climate/ahead/model-summary.shtml#tabs=Pacific-Ocean

Plumes from Météo-France and ECMWF for the 3 Niño boxes (see definition in Annex – fig. II.1.5) : In both models and on average, prevailing conditions close to Niño threshold for JJA. In both models the warming trend is less than the previous month and the uncertainty is larger (especially in MF). In EuroSIP Plumes, close to Niño threshold on average. The spread indicates a larger uncertainty with respect of the previous month.



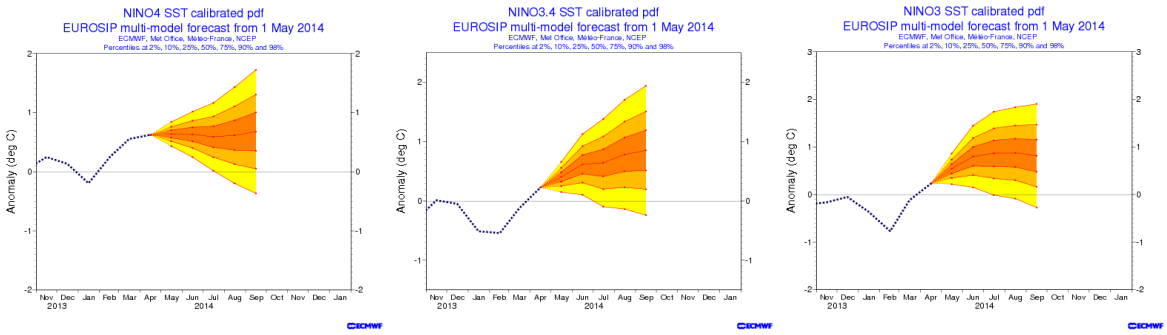


fig.18: SST anomaly forecasts in the Niño boxes from Météo-France (top) and ECMWF (middle) - monthly mean for individual members - and EuroSIP (bottom) – recalibrated distributions.
(http://www.ecmwf.int/)

II.1.c Atlantic Ocean forecasts :

Forecasted Phase: Below Normal in the Northern and Above normal in the Southern Tropics - TASI on the negative side returning to neutral

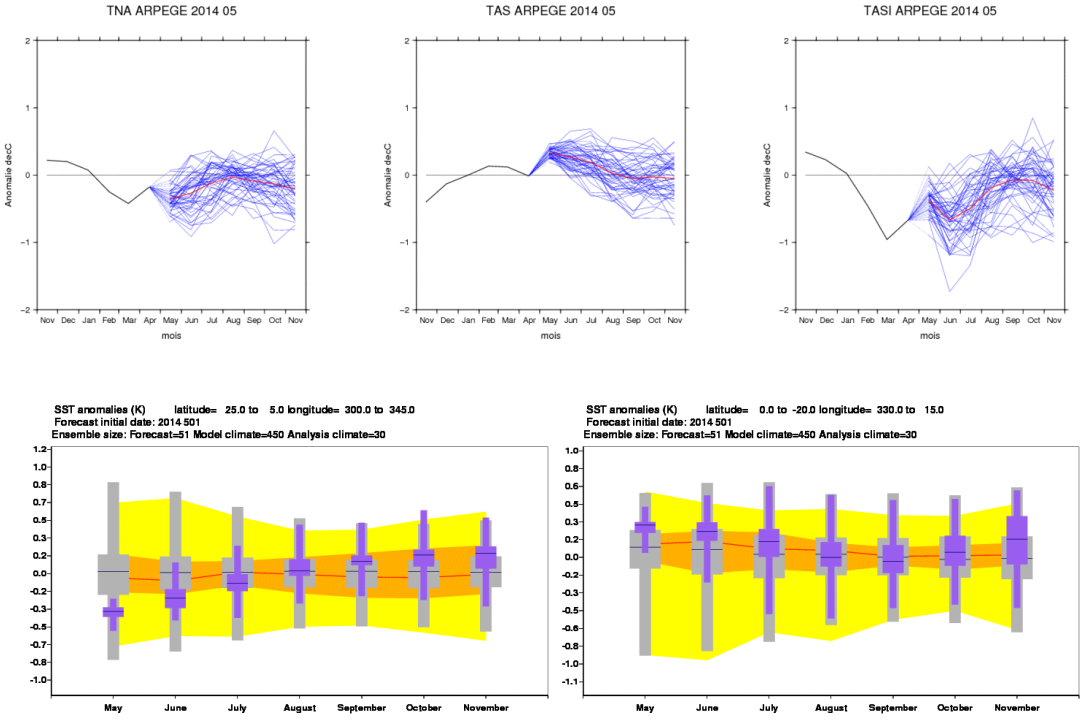


fig.19: SSTs anomaly forecasts in the Atlantic Ocean boxes from Météo-France (top) and ECMWF (bottom), plumes / climagrams correspond to 51 members and monthly means.

Consistent behaviour between the 2 models over the targeted period.
North Tropical Atlantic : Colder than normal conditions in both models with a progressive warming.
South Tropical Atlantic : Above Normal conditions in both models with some cooling up to August.
TASI : in MF, the TASI index is negative for JJA with a tendency to return to neutral conditions at the end of Summer/beginning of Fall. However the spread is large.
Guinean Gulf : Above Normal in MF with a return to Neutral conditions at Fall.

II.1.d Indian Ocean forecasts :

Forecasted Phase: West and East warmer than normal conditions
IOD on the positive side

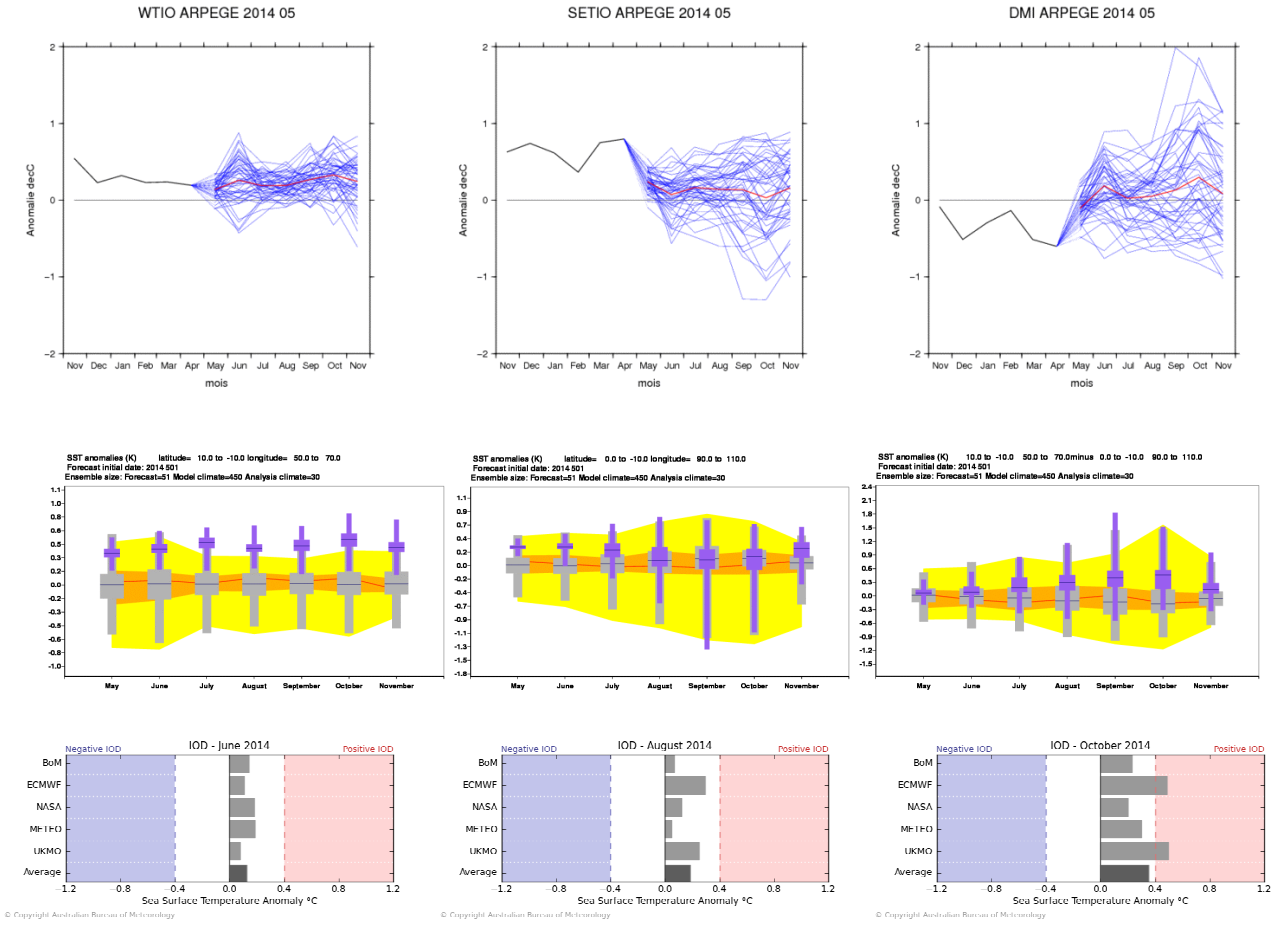


fig.20: SSTs anomaly forecasts in the Indian Ocean boxes from Météo-France (top), ECMWF (middle), plumes / climagrams correspond to 51 members and monthly means. Synthesis for IOD (bottom) for several GPCs from BoM http://www.bom.gov.au/climate/ahead/model-summary.shtml#tabs=Indian-Ocean

Quite consistent behaviour between the 2 models.
In WTIO : warmer than normal with a slight warming on time. Not too much uncertainty.
In SETIO : Above normal conditions. Quite large spread at Fall.
DMI (IOD) : on the positive side in both models ; the spread becomes large at Fall with bias toward positive value.

II.2. GENERAL CIRCULATION FORECAST

II.2.a Global Forecast

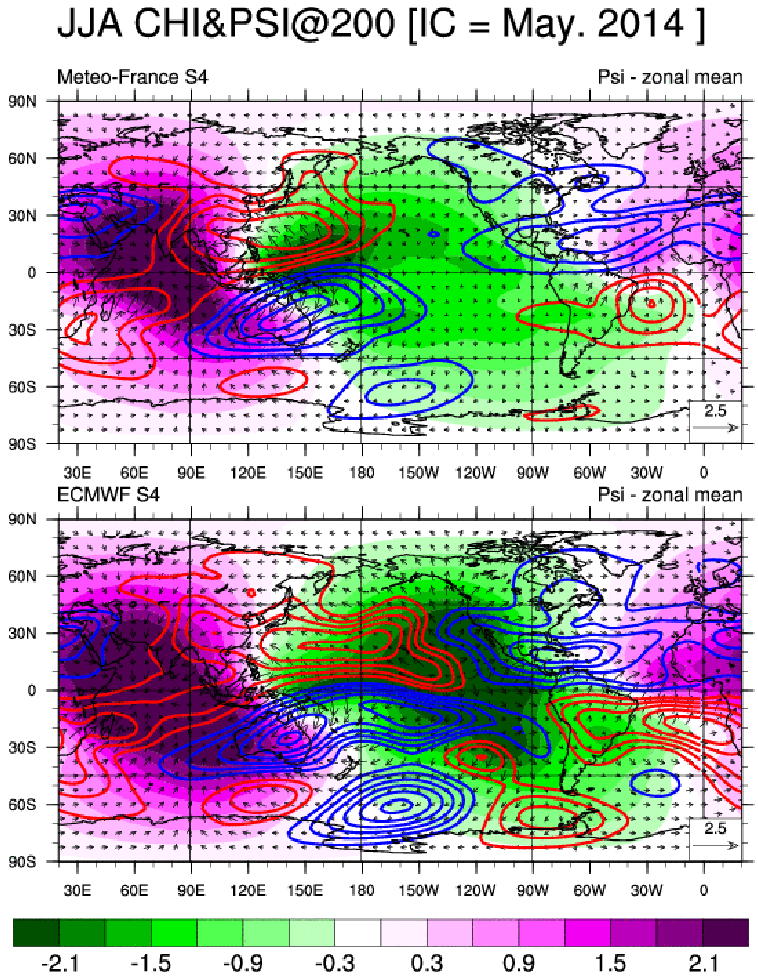


fig.21: Velocity Potential anomaly field χ (shaded area – green negative anomaly and pink positive anomaly), associated Divergent Circulation anomaly (arrows) and Stream Function anomaly ψ (isolines – red positive and blue negative) at 200 hPa by Météo-France (top) and ECMWF (bottom).

Velocity potential anomaly field (cf. fig. 21 – insight into Hadley-Walker circulation anomalies) : some consistency between the 2 models in the Tropical Indian Ocean and Atlantic, but also some large differences in the Central Pacific.

Over the Pacific, The divergent circulation anomaly is not very consistent between the two models. The strongest Large Scale Convection response stays close to the dateline in MF while it is moving far on the Eastern side in ECMWF. ECMWF response seems to be more consistent with the development of the Pacific warm event from the eastern part of the basin ; in addition the JMA forecast is more similar to ECMWF ones (but with a negative less extended toward the dateline). The best solution is possibly the one from ECMWF as the warm event is primilarly developing in the Eastern part of the basin. However, there is some evidence in the observation that some convection is still present close to the dateline, the SOI index is not consistent yet with a warm event and there is a pause which is forecasted at summer in the Niño development. So it seems a bit difficult to give more weight to ECMWF solution with respect of

MF forecast.
Over the Atlantic, quite consistent response (Convergent circulation anomaly - downward anomaly motion) over the African continent North to the Equator with some extension over the Atlantic in the vicinity of the Equator. In JMA, the positive anomaly exists but weaker and more over the continent.
Over the Indian Ocean : A quite strong convergent circulation anomaly in both models over the Equatorial region and a large portion of the Tropical basins. To be quoted the positive anomaly encompass the Indian sub-continent (in relationship with a weakened monsoon circulation over the Indian regions). These responses are very consistent with the one from JMA.

Stream Function anomaly field (cf. fig. 21 – insight into teleconnection patterns tropically forced) : good consistency in the Tropical Atlantic and over the Indian Ocean and Western Pacific (between 90°E and the dateline). The interpretation of these patterns in the Northern Hemisphere could not be directly related to teleconnection patterns as most of the anomalies seems to be trapped within the sub-tropical regions. The JMA forecast over the Central Pacific is more similar to ECMWF rather than MF in relationship with the differences into the atmospheric response over the Pacific (see Velocity Potential field discussion). Nevertheless, there is some consistency in the anomaly field developed across the Tropical Atlantic up to the Mediterranean Basin.

As a conclusion **the predictability** likely exists in the vicinity of the Pacific basin, over the Indian Ocean (especially within the sub-tropical and tropical regions) and in the Tropics in the vicinity of the Atlantic sector. Over mid-latitudes regions of the Northern Hemisphere, one could consider that the signal is poorly influenced by the Tropics to the possible exception of the Eastern façade of USA. For the Western façade of Europe and North Africa, one can infer some (little) predictability in the vicinity of the Mediterranean basin but not too much over the Northern regions likely more influenced by the internal dynamics of the atmosphere.

II.2.b North hemisphere forecast and Europe

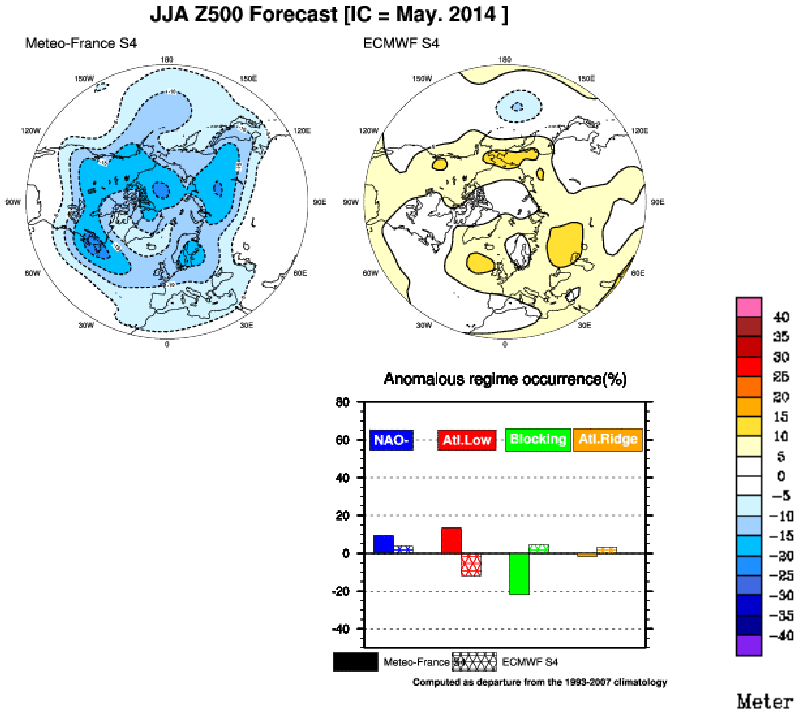


fig.22: Anomalies of Geopotential Height (top) at 500 hPa from Meteo-France (left) and ECMWF (right). http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip and North Atlantic Regime occurrence anomalies (bottom) from Météo-France and ECMWF : vertical bars represent the excitation frequency anomaly (in %) for each of the 4 regimes.

Geopotential height anomalies (fig. 22 – insight into mid-latitude general circulation anomalies) : Consistently with the previous discussion, there is only little consistency between the two models in Geopotential Height anomalies. To be quoted that the MF forecast for the Z500 anomaly in the mid/high latitudes seems to be suspicious (likely related to the hindcast – to be investigated).

North Atlantic Circulation Regimes (fig. 22) : As a consequence, no consistency in the regime forecasts.

II.3. IMPACT : TEMPERATURE FORECASTS

II.3.a ECMWF

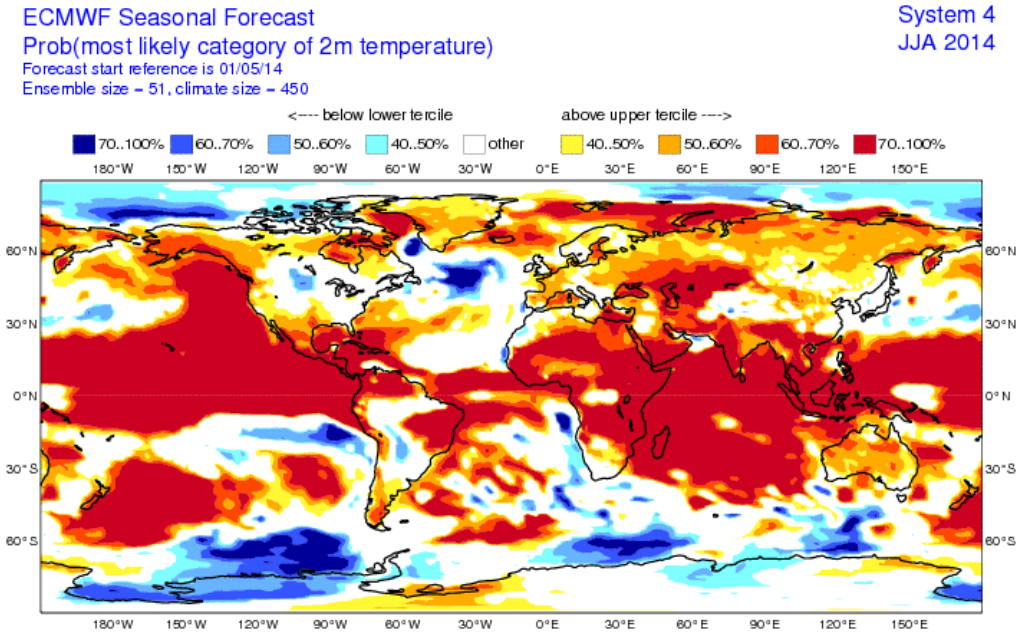


fig.23: Most likely category probability of T2m from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/group/

II.3.b Météo-France

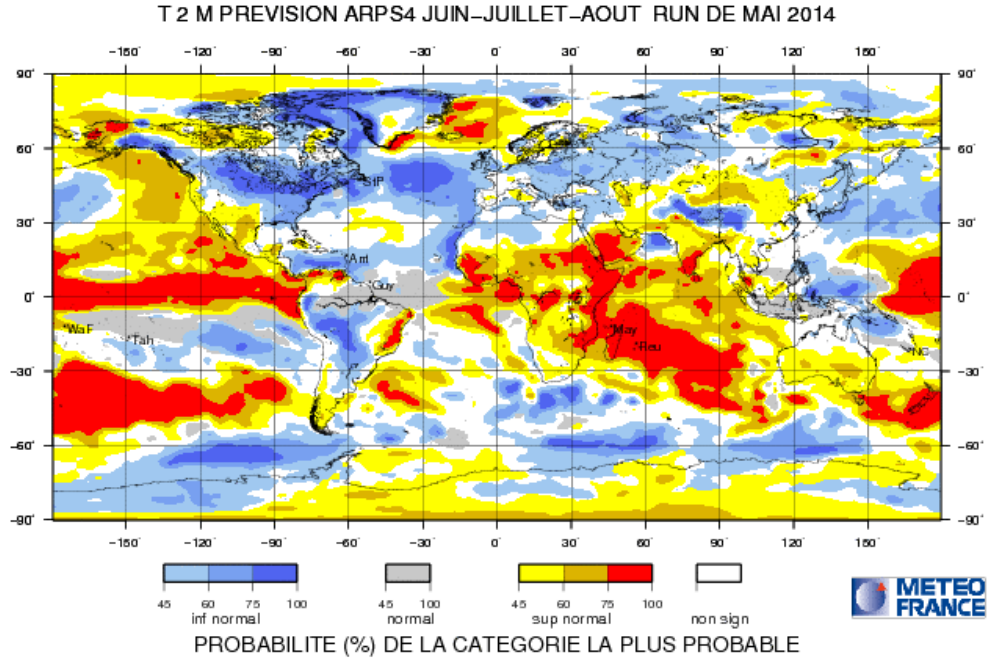


fig.24: Most likely category of T2m from Meteo-France. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://elaboration.seasonal.meteo.fr/

II.3.c Met Office (UKMO)

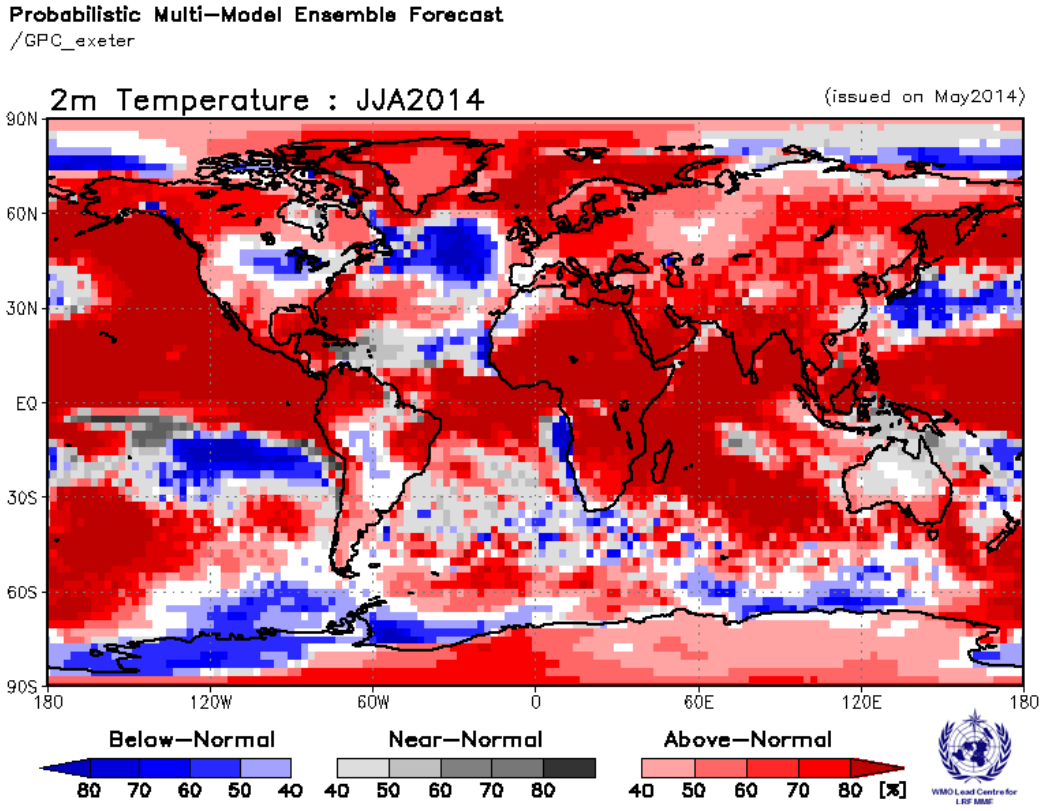


fig.25: Most likely category of T2m Anomaly from UK Met Office. https://www.wmolc.org/

II.3.d Climate Prediction Centre (CPC)

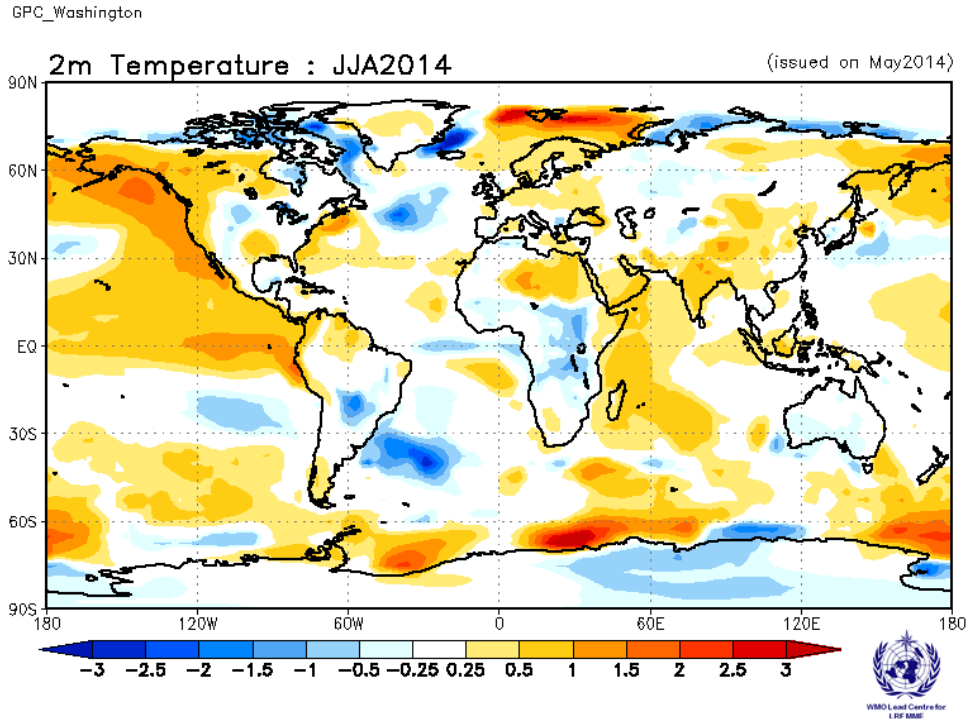


fig.26: **T2m Anomaly ensemble mean from CPC.** https://www.wmolc.org/

II.3.e Japan Meteorological Agency (JMA)

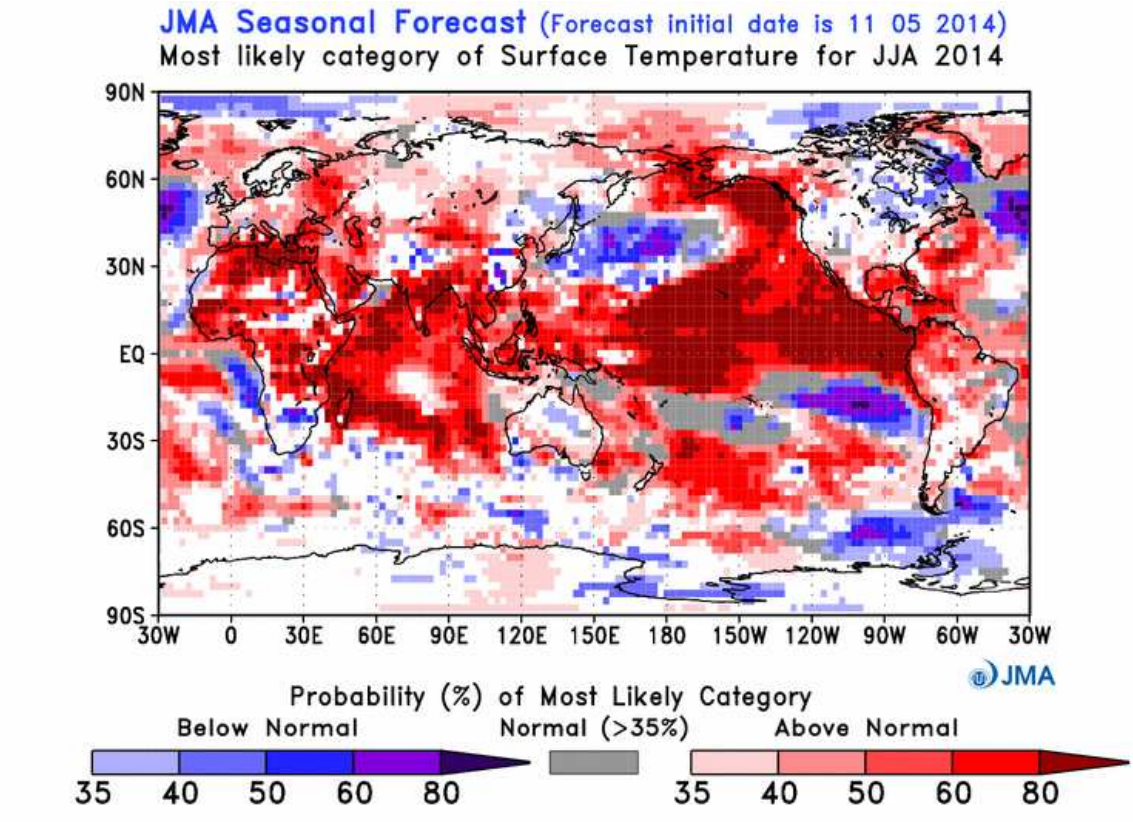


fig.27: **Most likely category of T2m from JMA. Categories are Above, Below and Close to Normal. White zones correspond to No Signal.** http://ds.data.jma.go.jp/tcc/tcc/products/model/

II.3.f Lead Centre on Multi Model Ensemble (LCMME)

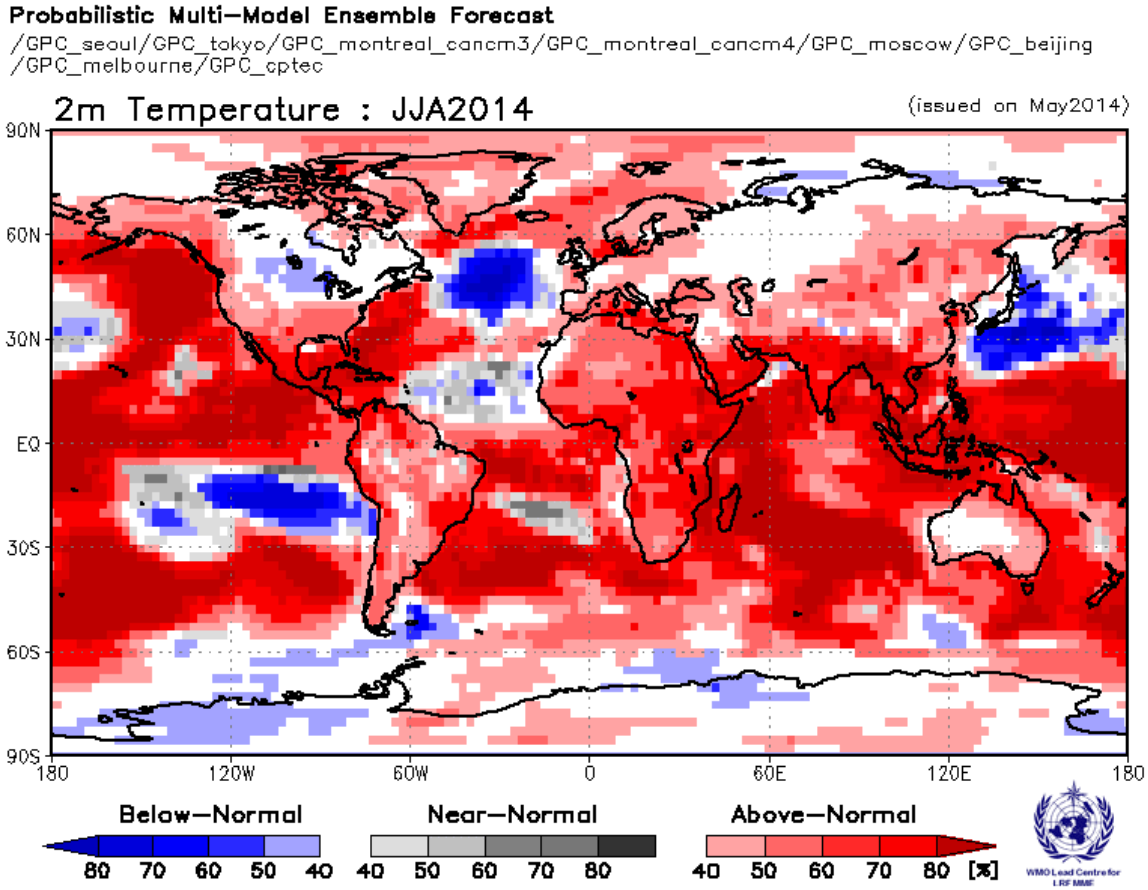


fig.28: MME most likely category of T2m from LC-MME. The MME composition corresponds to the GPCs not used in EuroSIP https://www.wmolc.org/

II.3.g Euro-SIP

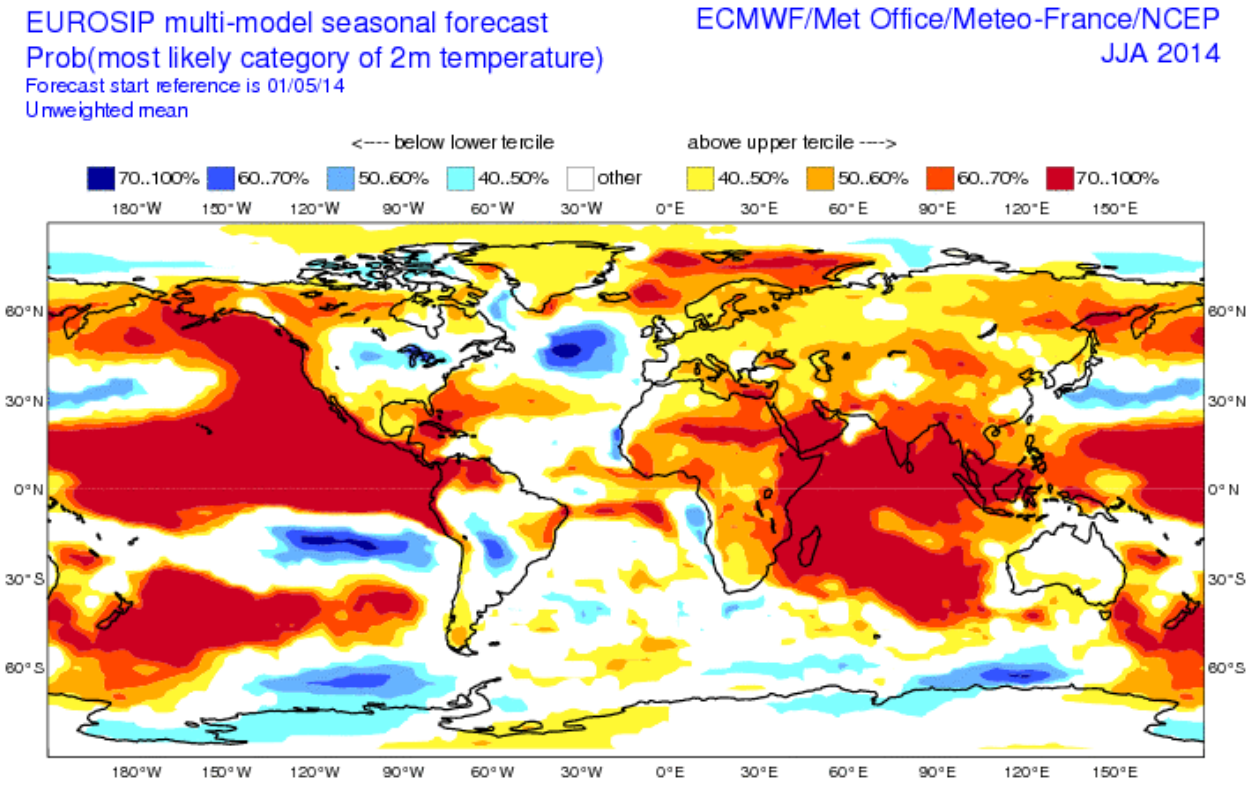


fig.29: Multi-Model Probabilistic forecasts for T2m from EuroSip.
(2 Categories, Below and Above normal – White zones correspond to No signal and Normal).

http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

North-America : enhanced probabilities for warm anomalies over a large portion of Canada and the Western coast of USA.
Central-America : globally warmer than normal extending toward the North Caribbean.
South-America : Some consistent signal over the North-Western coastal part of the continent (warmer than normal) and the Northern regions (on the Atlantic and Nordeste – warmer than normal).
Australia : little signal across the continent.
Asia : Mostly Warmer than normal conditions everywhere. Warmer than normal conditions over most of the Indian sub-continent (likely in relationship with a weak monsoon) and South-East Asia.
Africa : Mostly warmer than normal over most of the continent ; especially the North-Eastern part and along the Eastern coast.
Europe : Warmer than normal conditions over most of the continent to the exception of the Western façade and part of South-East Europe region (No Signal). The probabilities are especially enhanced in the vicinity of the Mediterranean basin and the most Northern part of Scandinavia..

II.4. IMPACT : PRECIPITATION FORECAST

II.4.a ECMWF

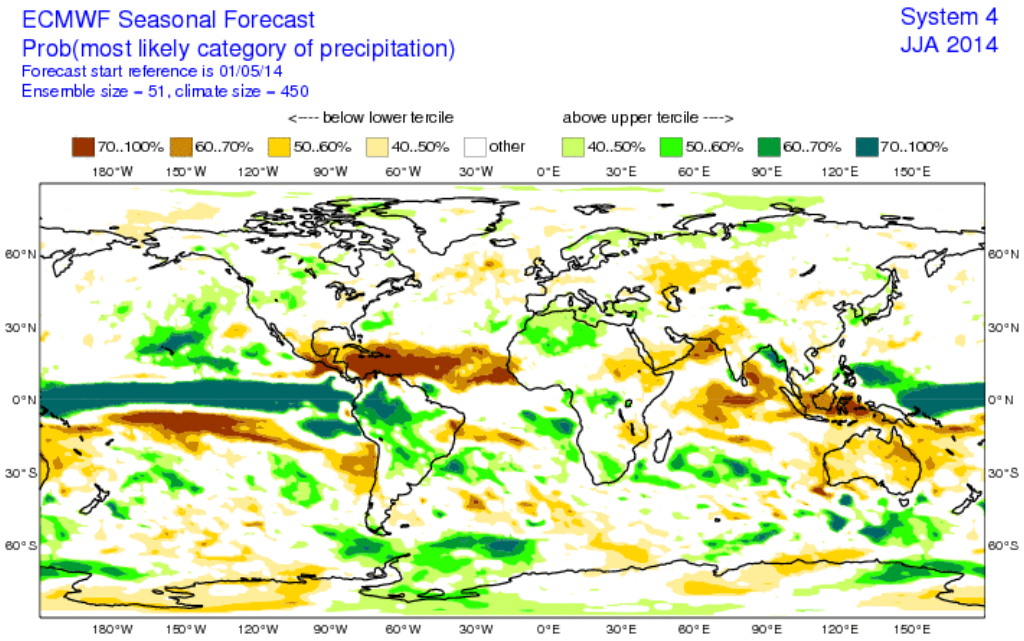


fig.30: Most likely category probability of rainfall from ECMWF. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/charts/seasonal_charts_s2/

II.4.b Météo-France

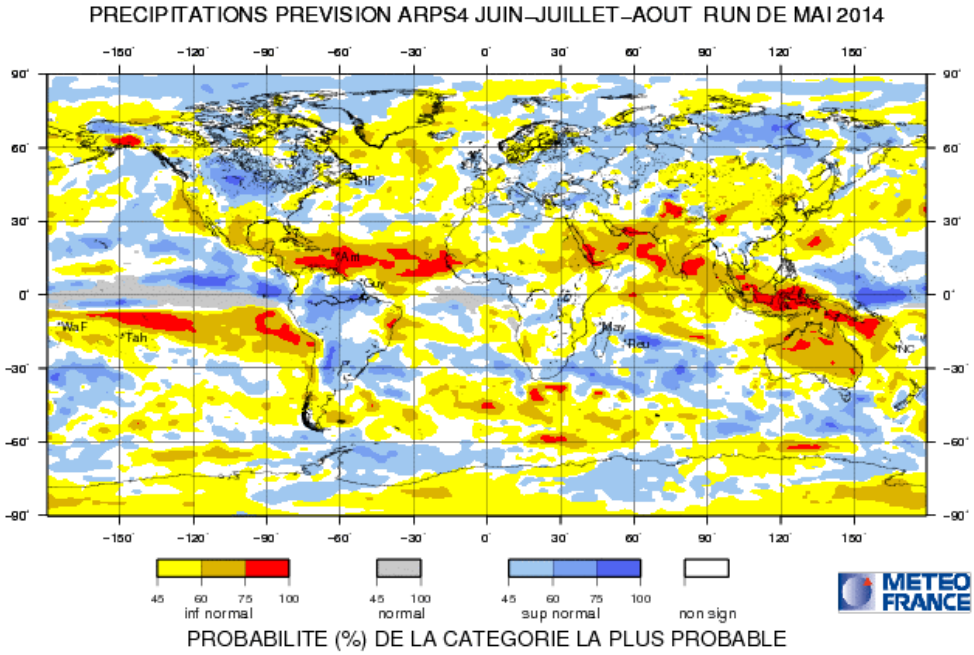


fig.31: Most likely category of Rainfall from Meteo-France. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://elaboration.seasonal.meteo.fr/

II.4.c Met office (UKMO)

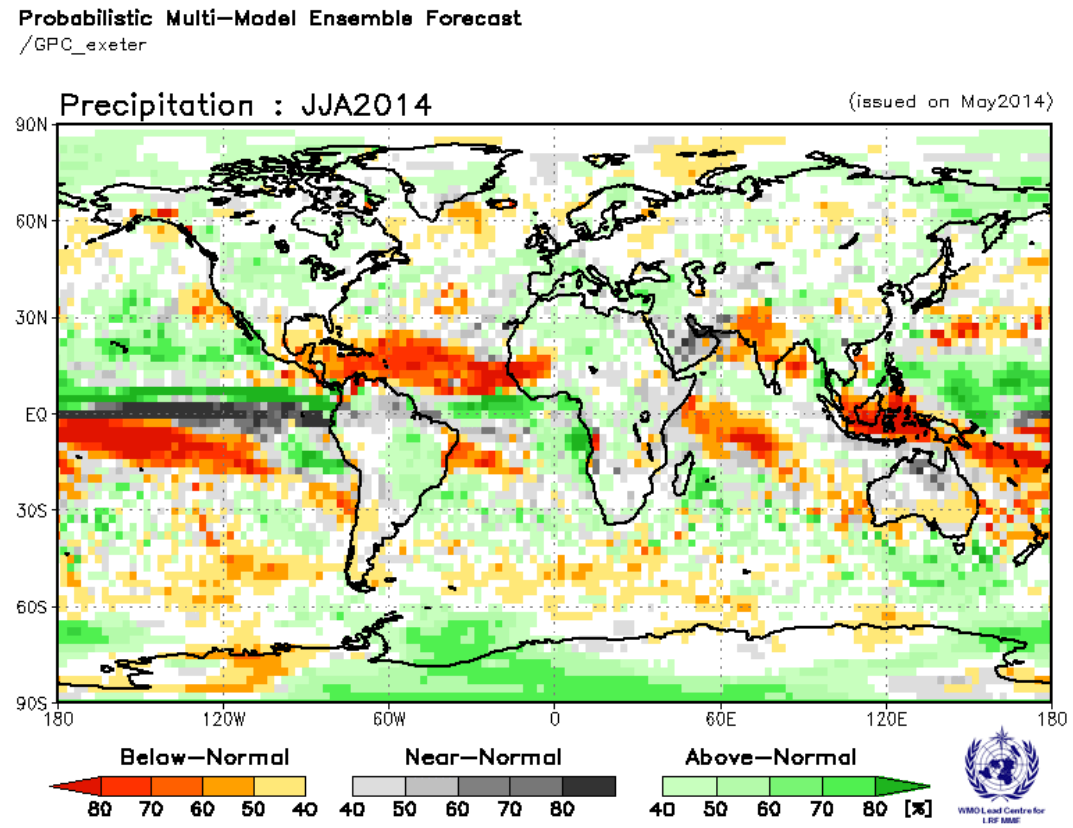


fig.32: Category probabilities of Rainfall from UK Met Office. https://www.wmolc.org/

II.4.d Climate Prediction Centre (CPC)

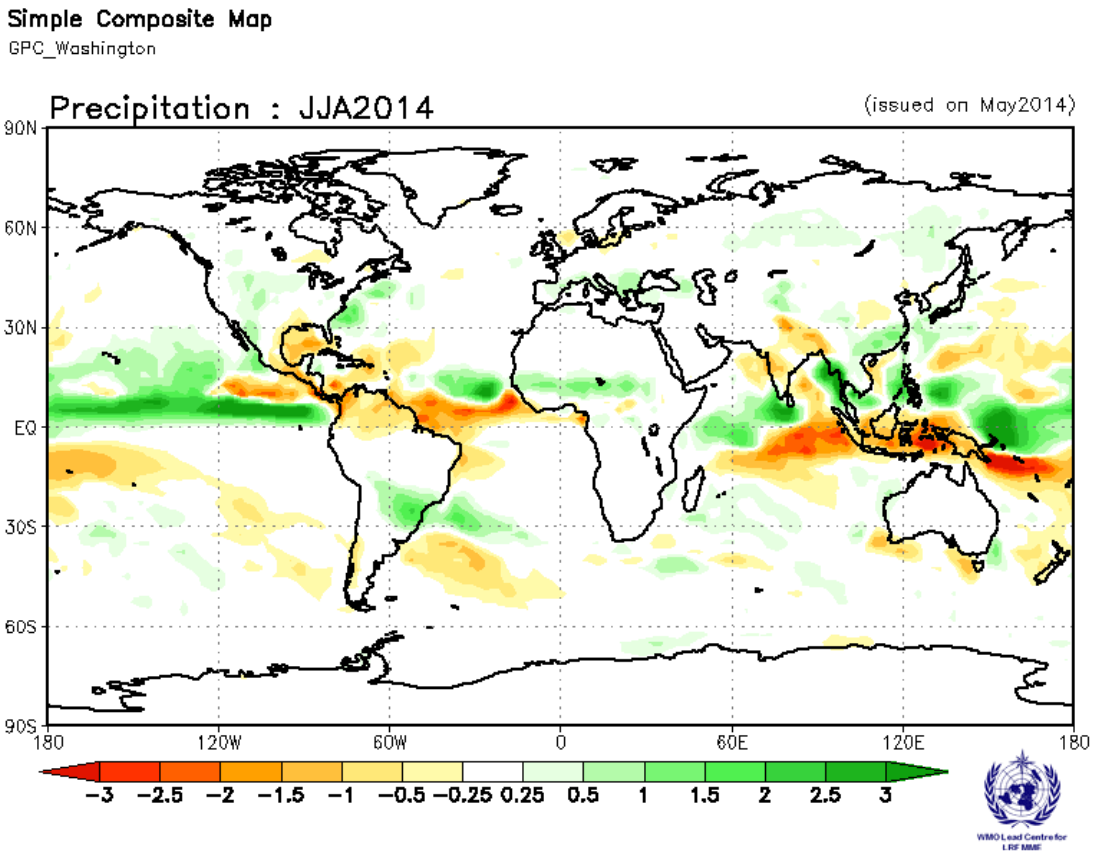


fig.33: Rainfall Anomaly ensemble mean from CPC. https://www.wmolc.org/

II.4.e Japan Meteorological Agency (JMA)

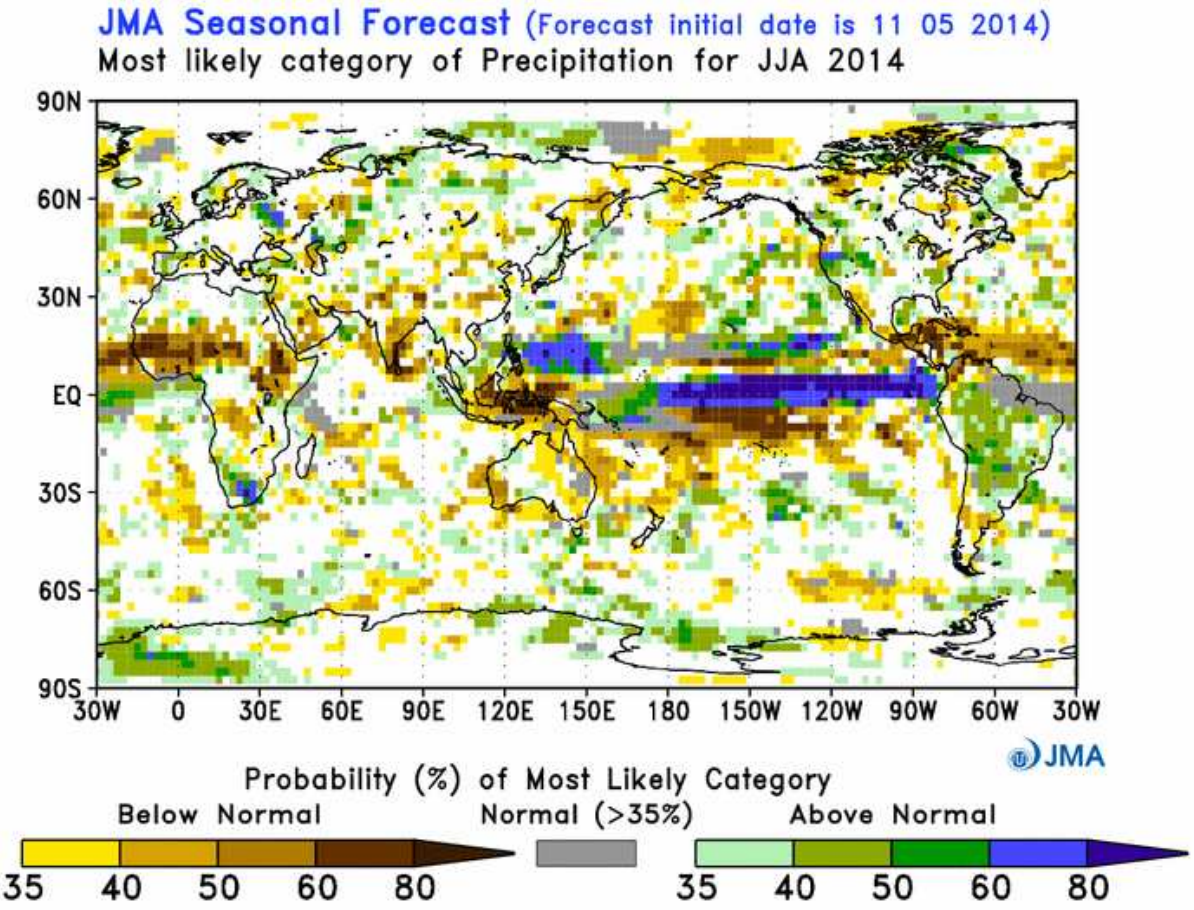


fig.34: Most likely category of Rainfall from JMA. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://ds.data.jma.go.jp/tcc/tcc/products/model/

II.4.f Lead Centre on Multi Model Ensemble (LCMME)

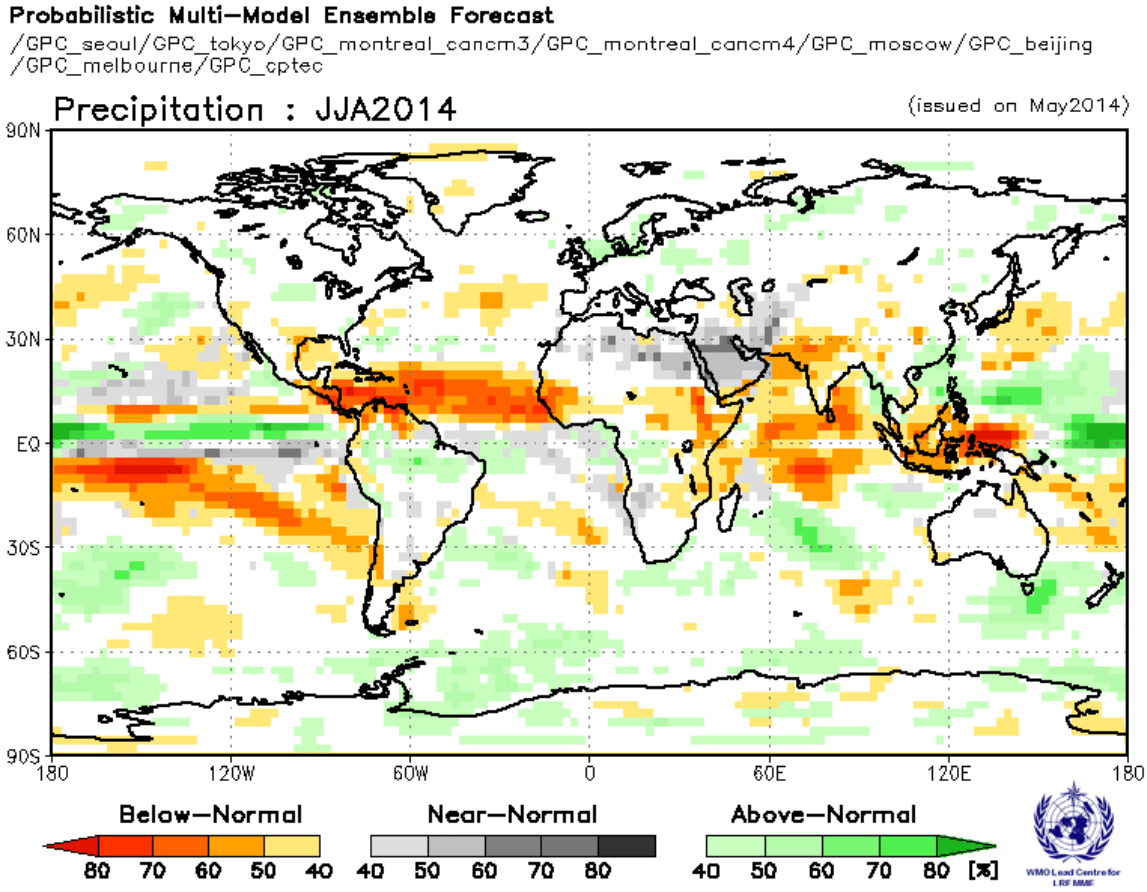


fig.35: **MME most likely category of Rainfall from LC-MME. The MME composition corresponds to the GPCs not used in EuroSIP. https://www.wmolc.org/**

II.4.g Euro-SIP

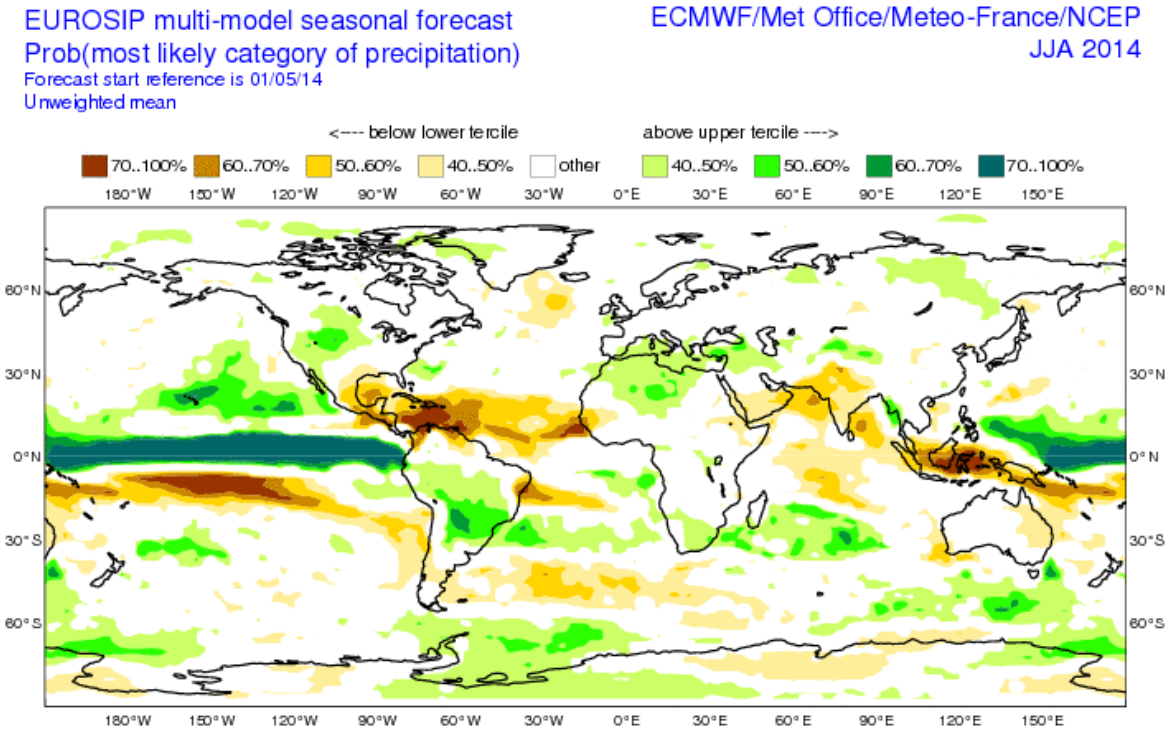


fig.36: Multi-Model Probabilistic forecasts for precipitation from EuroSip. (2 Categories, Below and Above normal – White zones correspond to No signal).

http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

In the Tropics : some consistent signal. Enhanced probabilities for wet scenarios across the Equatorial Pacific extending up to the dateline (see previous discussions), also over a large portion of North Africa, over a large portion of South-America (Brazil, Argentina, Bolivia, …) and part of USA (Western side and the Rocky). Enhanced probabilities for dry scenario over the Northern coastal areas of South America extending across the Caribbean and Central America up to Texas, over most of the Maritime continent and the most Western part of West Africa. Also to be quoted Dry scenarios over part of most the Indian sub-continent consistently with the atmospheric response of the models over the Indian Ocean (weakened monsoon circulation).

For Europe : No signal more or less everywhere to the exception of enhanced probabilities of Wet scenario in the vicinity of the Mediterranean Basin (especially the Southern side).

II.5. REGIONAL TEMPERATURES

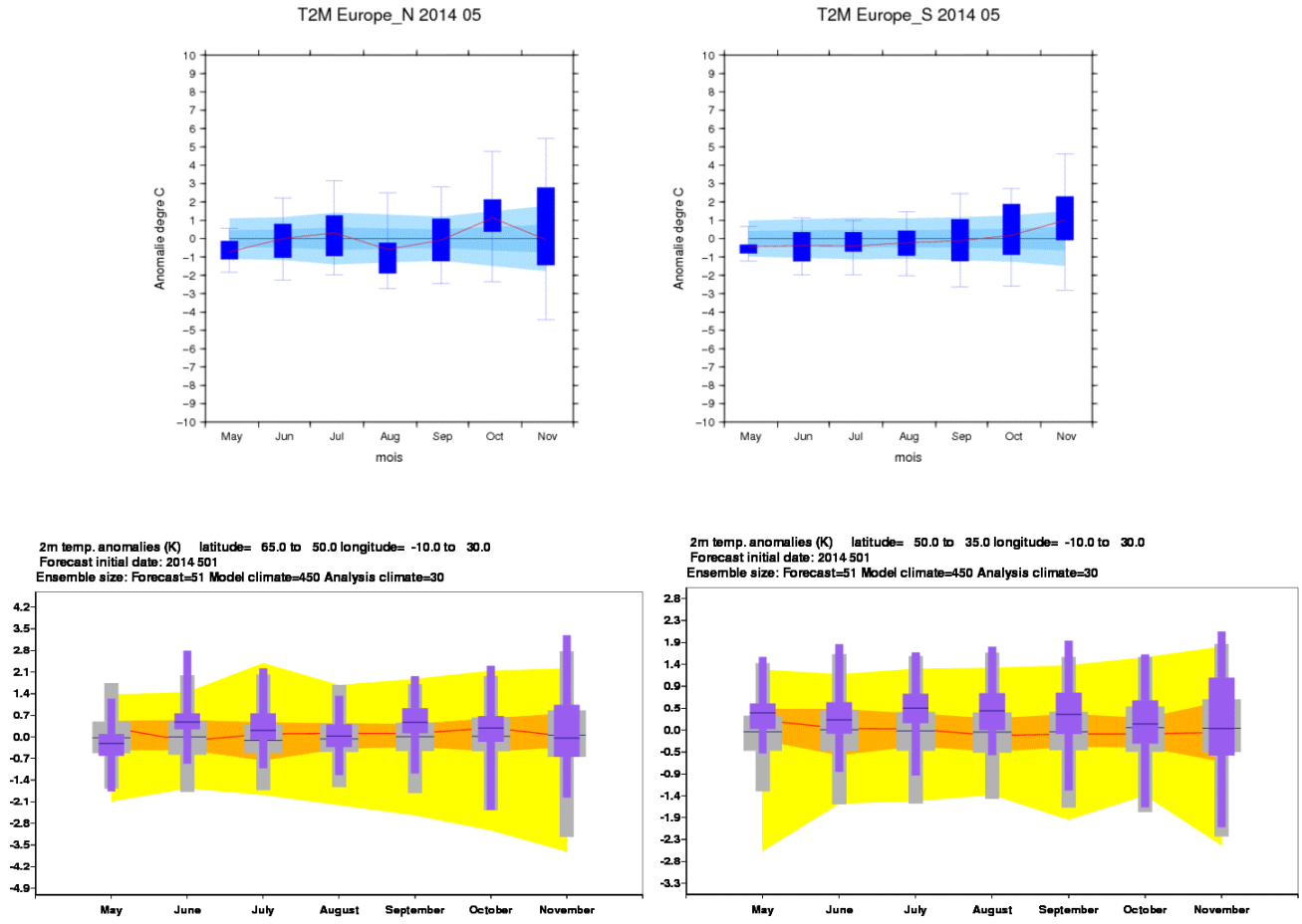


fig.37: Climagrams for T2m in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom - idem).

Only little consistency between the two models (see discussion on Geopotential Height)

For Northern Europe : Close to Normal conditions in MF and large spread in June and beyond. Warmer than normal conditions in ECMWF and return to close to normal conditions at fall. Also quite large spread (with respect of the climate reference).

For Southern Europe : Continuous warming in MF (but mostly Below Normal for JJA) and very large spread at fall. In ECMWF, above normal conditions kept along the entire period. Also very large spread at fall (with respect of the climate reference)..

In Météo-France climagrams, the distributions of area averages are displayed for the seasonal forecast (dark blue boxes and wiskers), and the climate reference on the 29-year hindcast period (blue and light blue bands). The limits of the boxes (ensemble forecast) and blue band (climate reference) correspond to the upper and lower terciles. The limits of the wiskers (ensemble forecast) and light blue band (climate reference) correspond to the mean + 1 standard deviation and the mean – 1 standard deviation. The red line corresponds to the ensemble mean.

REGIONAL PRECIPITATIONS

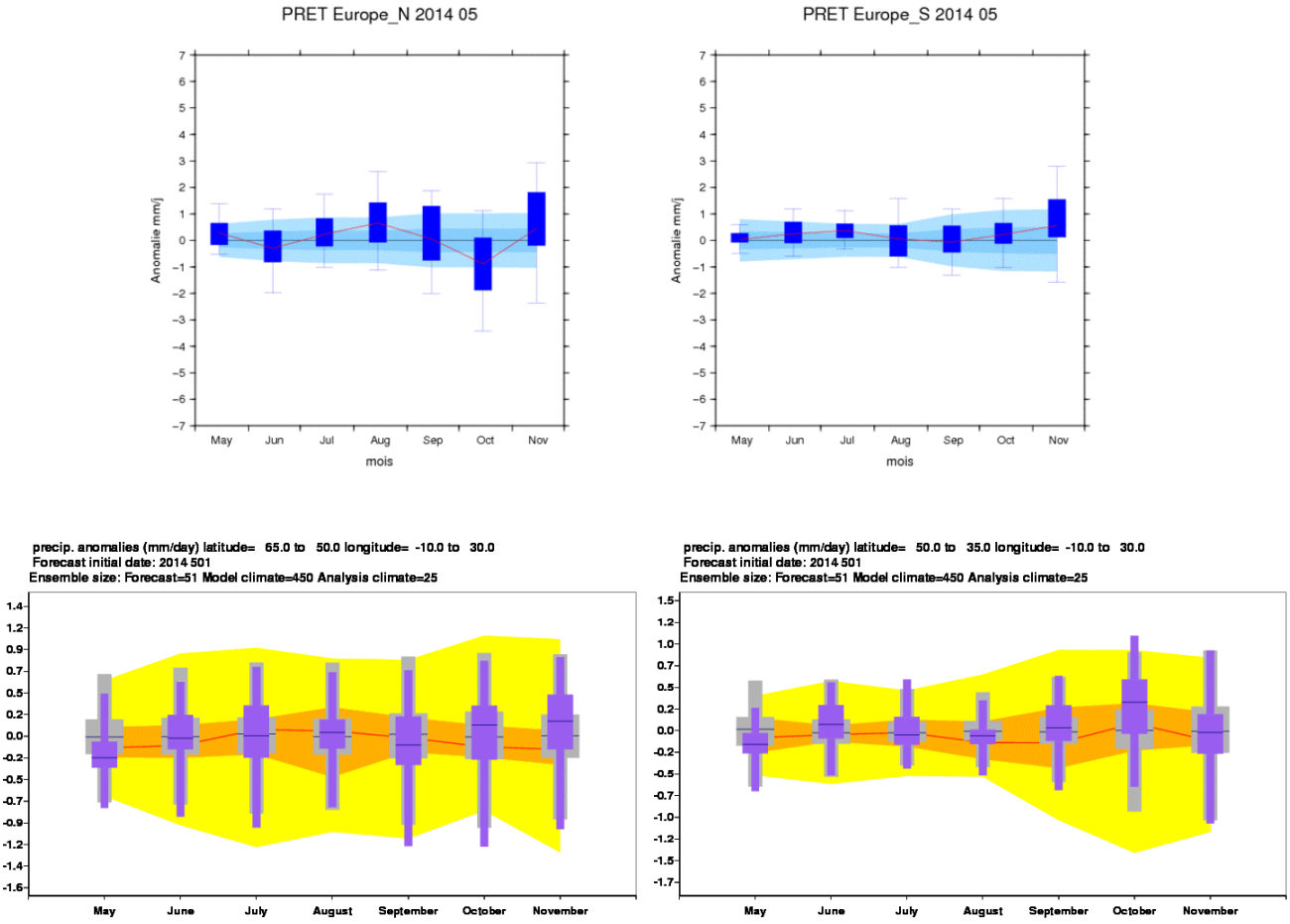


fig.38: Climagrams for Rainfall in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom - idem).

Some consistency between the 2 models over Southern Europe.

For Northern Europe : the signal move in time from Below normal conditions (in June) to Above Normal in MF while it is mostly Above normal in ECMWF in June and then move to Normal and Above normal again. The spread is very large.

For Southern Europe : starting close to Normal in May, then on average Above normal conditions with some differences in the intra-seasonal evolution. Also here the spread is large.

In Météo-France climagrams, the distributions of area averages are displayed for the seasonal forecast (dark blue boxes and wiskers), and the climate reference on the 29-year hindcast period (blue and light blue bands). The limits of the boxes (ensemble forecast) and blue band (climate reference) correspond to the upper and lower terciles. The limits of the wiskers (ensemble forecast) and light blue band (climate reference) correspond to the mean + 1 standard deviation and the mean – 1 standard deviation. The red line corresponds to the ensemble mean.

II.6. MODEL'S CONSISTENCY

II.6.a GPCs consistency maps

GPC_seoul/washington/melbourne/tokyo/ecmwf/montreal/toulouse/moscow/cptec/beijing
SST : GPC_seoul/washington/melbourne/montreal/tokyo/ecmwf/exeter/toulouse/beijing
May2014 + JJA forecast

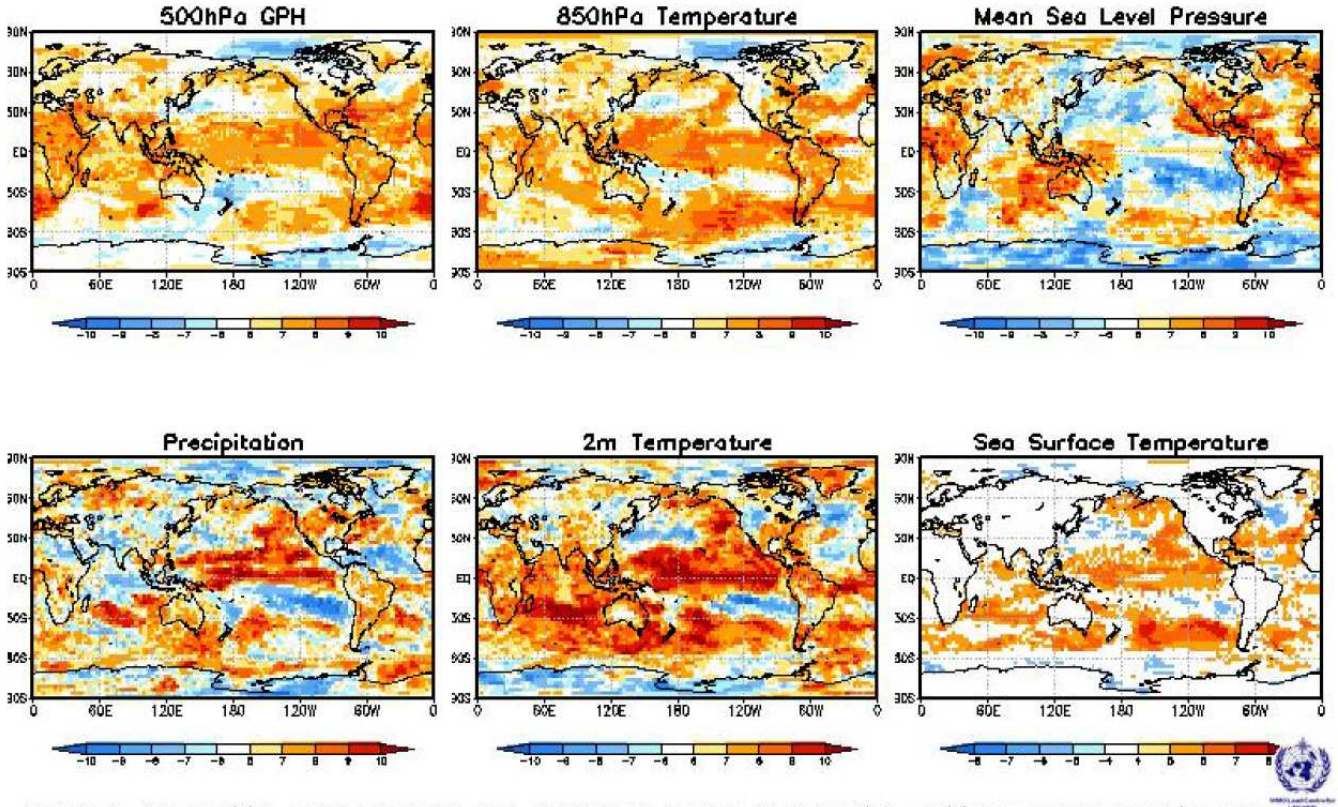


fig.39: ***GPCs Consistency maps from LC-MME*** *http://www.wmolc.org/*

For SST : Surprisingly, less consistency than expected in the SST forecasts and the Tropical regions, especially over the Pacific but also over the Indian Ocean and the Atlantic. The greatest consistency is in the sub-tropics and mid-latitudes of the Southern Hemisphere.
For Z500 : Mostly Above normal consistent signal in the Tropics. In the Northern Hemisphere, consistency for a positive anomaly in the sub-tropics (EA mode positive) and also close to West Africa (see General Circulation discussion – consistent with the velocity potential anomaly already discussed). So some enhanced probabilities for blocked circulation over the Western façades of Europe and North Africa.
For T2m : Some very consistent signal (warmer than normal) over the Equatorial Pacific and Atlantic (see SST above). Some consistency for Above normal conditions over Northern South-America and the Caribbean, the Eastern part of USA, the Maritime Continent with some extension to India and North-Eastern Australia and also over Africa (especially the vicinity of South-Africa and Somalia). Some Below Normal enhanced probabilities over the Western side of USA and Canada. To be noted the little consistency over the European and North African regions.
For Precipitation : Some consistent signal for Above Normal conditions in the Equatorial Pacific, over a large portion of USA (western side) and part of the Canada, over a part of South-America (especially Argentina and Brazil) and also over the Western and Southern façades of Australia. The

Drier than Normal scenarios are possible over the maritime continent, part of the Indian sub-continent, the Caribbean and the Northern coastal regions of South-America. Not too much consistency over the European continent and North Africa. However to be quoted some tendency to Above normal scenario in the vicinity of Mediterranean regions and the most North-Eastern part of Europe and some tendency to Below Normal scenarios over some regions of North-Africa.

II.7. "EXTREME" SCENARIOS

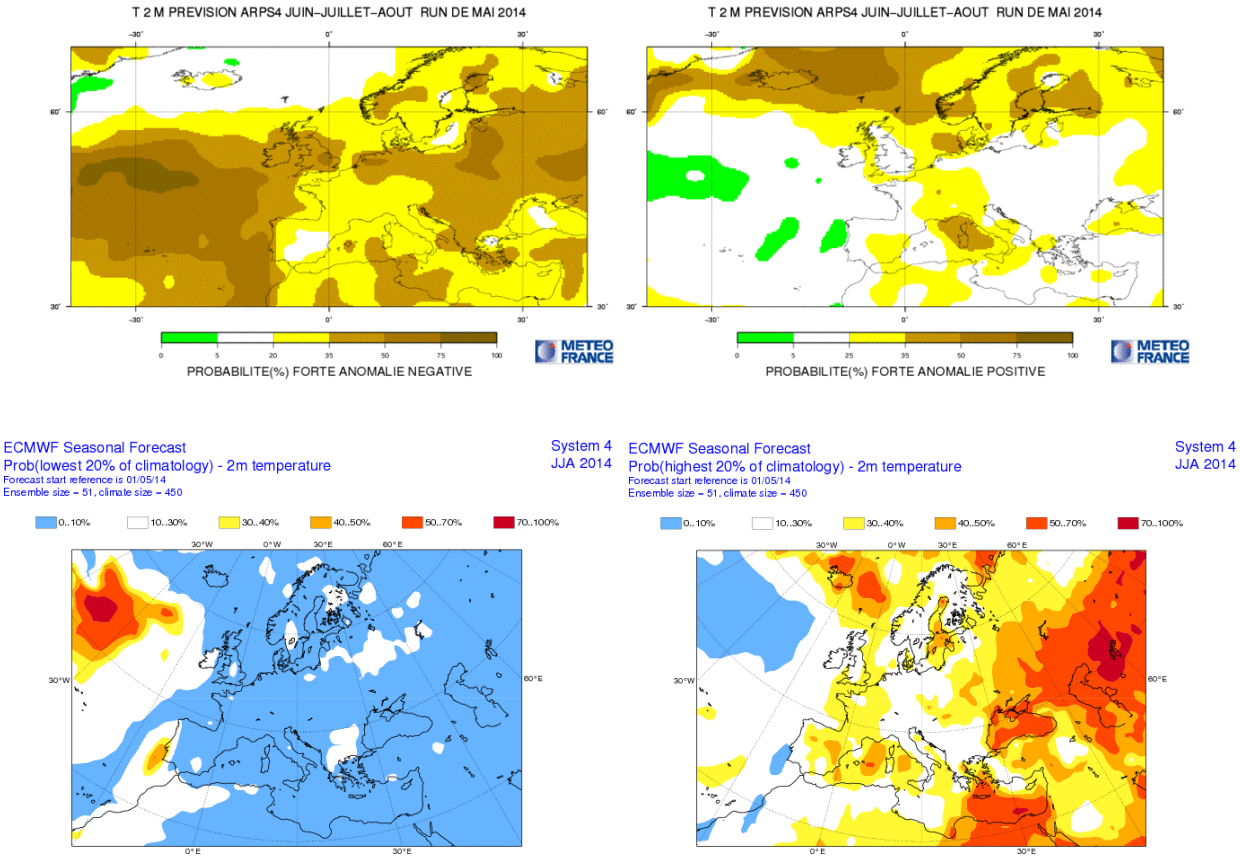


fig.40: Top : Probability of « extreme » above normal conditions from T2m for Meteo-France (left - highest ~15% of the distribution and right lowest ~15% of the distribution)
Bottom : idem from ECMWF (left - highest 20% of the distribution and right lowest 20% of the distribution).

In relationship with the differences in the Z500 forecasts only little consistency between the 2 models.
The **Very below normal scenario** shows enhanced probabilities only in MF. Some consistency for the **Very Above normal** scenario in the vicinity of the Mediterranean region and the most Northern region of Europe.
In MF, for the Very Below normal scenario ROC scores are between 0.55 and 0.8 over a large part of Central Europe. For the Very Above normal scenario, they are fairly good (between 0.6 and 0.85) over Southern Europe and around the Mediterranean basin. So some information could be inferred from these forecasts especially over region Mediterranean region (with a significant score for the Above normal scenario).

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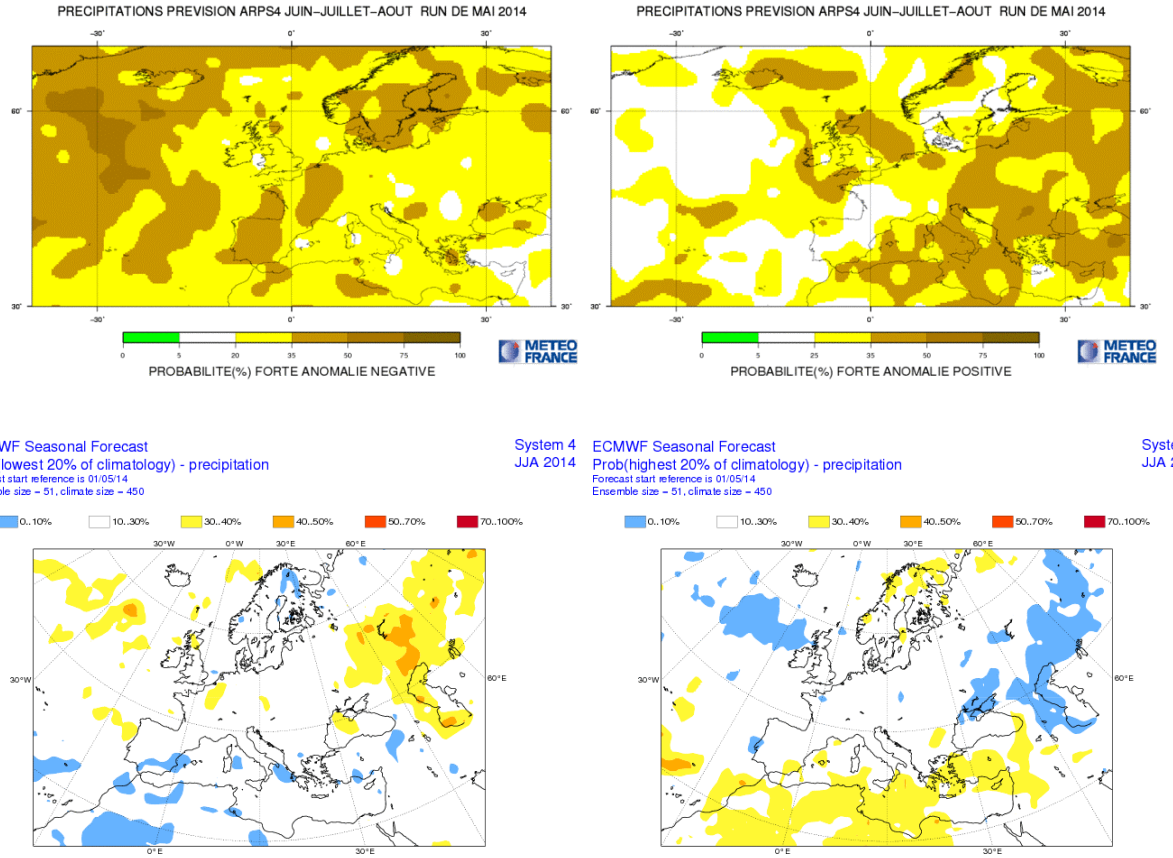


fig.41: Top : Probability of « extreme » above normal conditions for rainfall from Meteo-France (left - highest ~15% of the distribution and right lowest ~15% of the distribution)
Bottom : idem from ECMWF (left - highest 20% of the distribution and right lowest 20% of the distribution).).

For the very Below normal scenario, mostly No signal in ECMWF to the exception of regions close to the Caspian Sea (enhanced probabilities for Well Below scenario). In MF there are divergent signal for extreme scenarios (enhanced probabilities for both extreme categories). To be quoted the divergent scenarios especially around the Mediterranean regions. The ROC scores in MF are worst than climatology over most of Europe to the exception of the most Western side of Mediterranean sea for the Very Above category and part of Central Europe and the Balkan regions for the Very Below category.
So in relationship with the current predictability and the model uncertainties, it seems **difficult to use these extreme precipitation forecasts**.

II.8. DISCUSSION AND SUMMARY

Forecast over Europe and North Africa

For this forecast the major comment is about the **current predictability** in the climate system. The development of a warm event in the Pacific suggest some possible predictability, but mostly located in the Tropics at this stage (Pacific, Indian Ocean and Atlantic). Nevertheless, some predictability could be present over North-Africa and the Mediterranean basin.
The **EuroSIP** forecasts are likely a **good synthesis** of possible scenarios across the planet and more specifically over European regions.
For rainfall, "No Privileged Scenario" covers most of the European continent, to the exception of the regions in the vicinity of the Mediterranean basin of Europe where enhanced probability for Wetter than normal scenario could be considered ; especially a large portion of North-African countries and possibly part of SEE region.
For temperature : the Above normal scenario could be privileged for most of Europe and North-Africa with enhanced probabilities (especially close to the South-Eastern side of the Mediterranean basin). However, there is more uncertainties over the western facades where "No Privileged" scenario should be privileged.
Obviously, some downscaled information could detail these scenarios for specific countries or sub-regions.

Tropical Cyclone activity

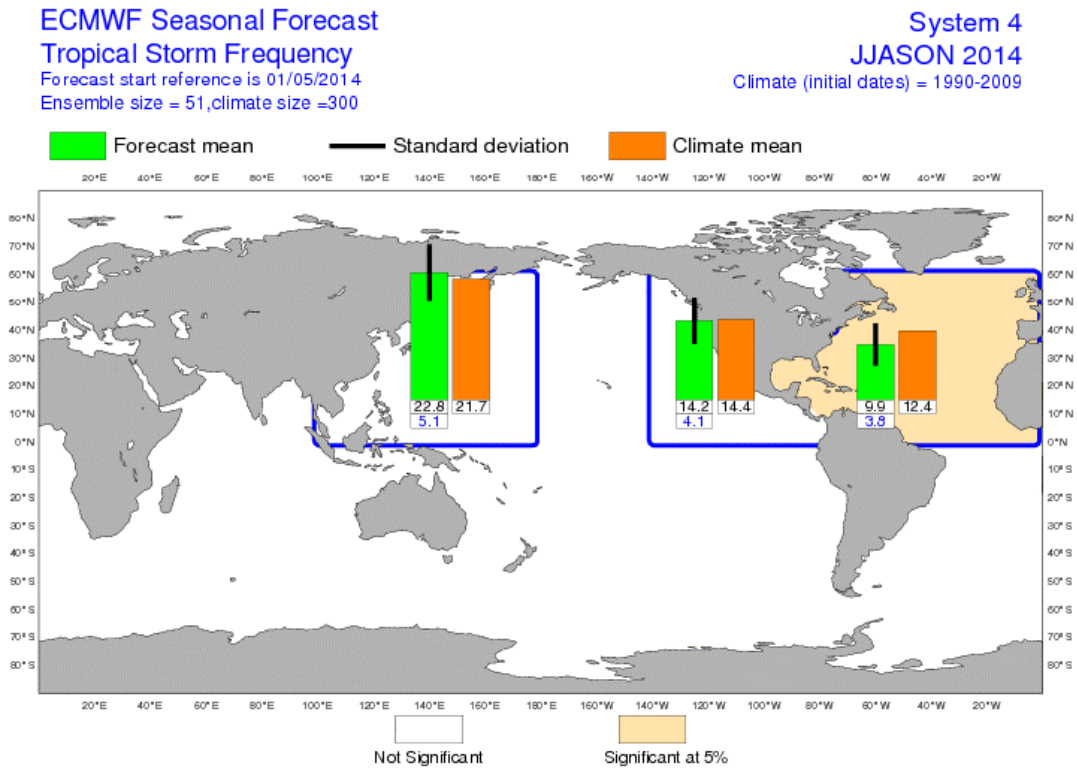


fig.42: Seasonal forecast of the frequency of Tropical Cyclones from EUROSIP (Météo-France & ECMWF).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmtrop/trop_euro/eurosip_tropical_storm_frequency/

For the Tropical Cyclone season and in relationship with the SSTs scenarios, Euro-Sip forecasts indicate Below Normal Topical Cyclone activity over the Tropical North Atlantic (consistently with the development of the Pacific warm event) and close to normal in the Pacific.

WMO RA VI
RCC Network

Synthesis of Temperature forecasts for June-July-August 2014 for European regions

Results are expressed with respect of 3 possible scenarios : « Above normal », « close to normal » and « Below normal ». The limits between each category is given by the corresponding tercile such that each scenario have the same climatological probability of occurrence (33,3%). If the forecast shows no specific signal (because of low predictability and/or divergent scenarios between several models), the cell is filled in grey and "No privileged scenario" is indicated.

MODELS	Northern Europe	Southern Europe	Central Europe	Eastern Europe	SEE Region
CEP					
MF					
Met Office					
CPC					
JMA					
synthesis					
LC-MME					
Eurosip					
privileged scenario by RCC-LRF node	*above normal*	*no privileged scenario*	*above normal*	*above normal*	*above normal*

T Below normal (Cold) | T close to normal | T Above normal (Warm) | No privileged scenario

WMO RA VI
RCC Network

Synthesis of Rainfall forecasts for June-July-August 2014 for European regions

Results are expressed with respect of 3 possible scenarios : « Above normal », « close to normal » and « Below normal ». The limits between each category is given by the corresponding tercile such that each scenario have the same climatological probability of occurrence (33,3%). If the forecast shows no specific signal (because of low predictability and/or divergent scenarios between several models), the cell is filled in grey and “No privileged scenario” is indicated.

MODELS	Northern Europe	Southern Europe	Central Europe	Eastern Europe	SEE Region
CEP					
MF					
Met Office					
CPC					
JMA					
synthesis					
LC-MME					
Eurosip					
privileged scenario by RCC-LRF node	*no privileged scenario*	*no privileged scenario*	*no privileged scenario*	*no privileged scenario*	*Above normal*

RR Below normal (Dry) RR close to normal RR Above normal (Wet) No privileged scenario

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

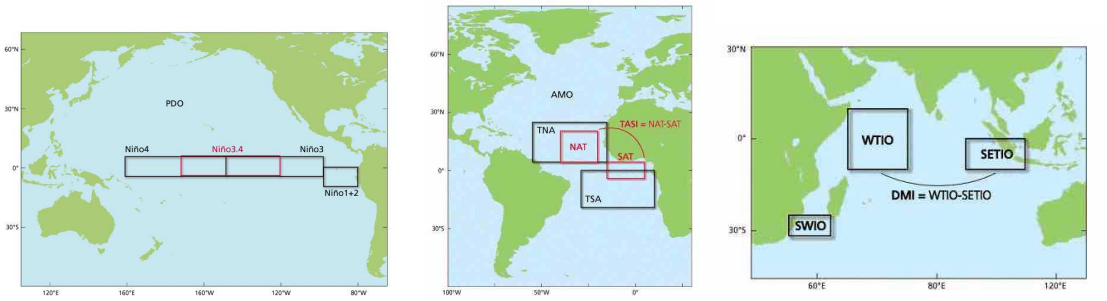
El Niño and La Niña events primarily affect tropical regions and are monitored by following the SST evolution in specific area of the equatorial Pacific.

- 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

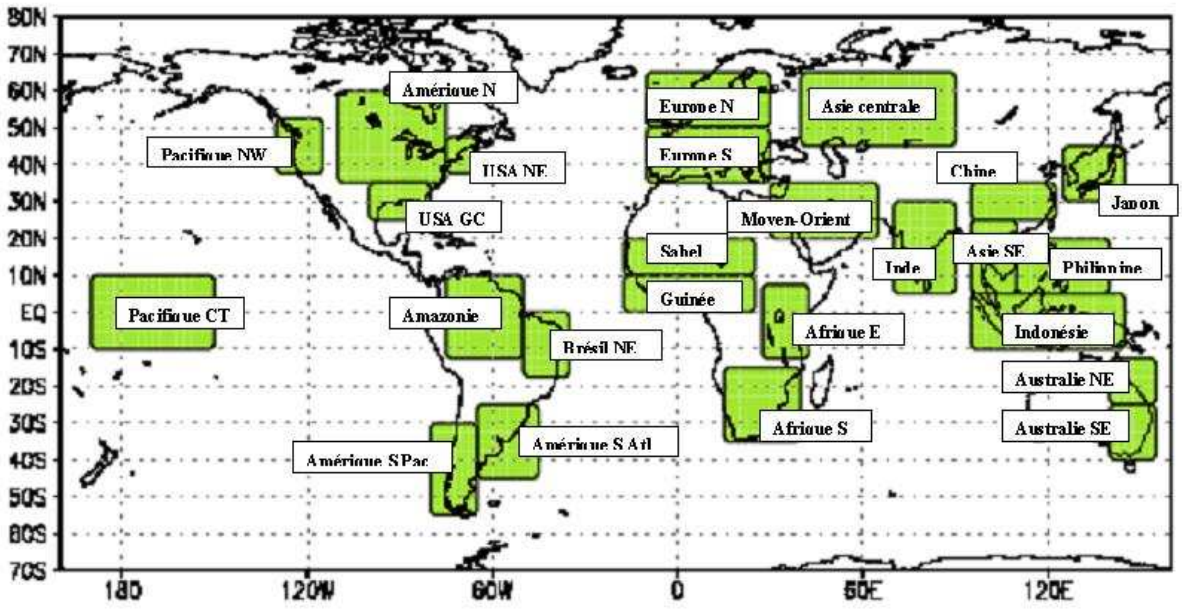
figure). It represents the Walker (zonal) circulation and its modifications. Its sign is opposite to the SST anomaly meaning that when the SST is warmer (respectively colder) than normal (Niño respectively Niña event), the zonal circulation is weakened (respectively strengthened).

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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