GLOBAL CLIMATE BULLETIN
n°167 - MAY 2013

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I. DESCRIPTION OF THE CLIMATE SYSTEM (MARCH 2013)

I.1. OCEANIC ANALYSIS

I.1.a Global Analysis

At the Surface (fig. 1) :

Generally speaking, little evolutions in the Tropics to the notable exception of the Eastern Pacific equatorial waveguide. More evolutions in the sub-tropics of the Southern Hemisphere.

For the Pacific : In the equatorial wave close to neutral conditions excepted in the most western and eastern part of the basin (positive anomalies) consistently with wave propagations under the surface and the subsequent warming over the Eastern part. Strong cooling close to the South American continent and strong warming in the Eastern mid-latitudes of the Southern hemisphere. In the Northern hemisphere little evolutions.

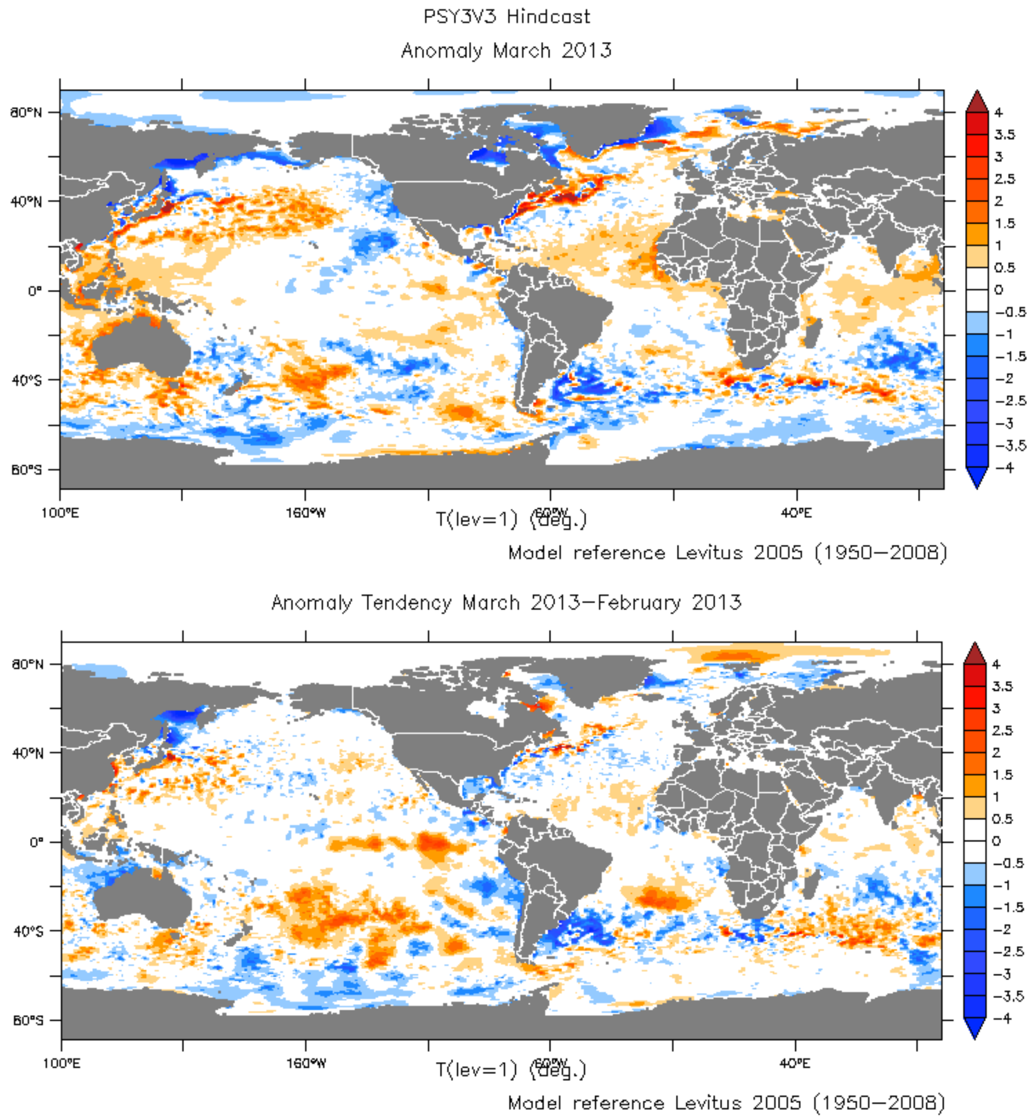


fig.1: top : SSTs Anomalies (°C) (reference 1950-2008); bottom : SST tendency (current – previous month)
http://bcg.mercator-ocean.fr/

For the Atlantic : little evolution everywhere to the exception of sub-tropics and mid-latitudes in the Southern hemisphere. Slight warming of the North Tropical Atlantic (mostly warmer than normal). The Guinean Gulf faces some positive anomaly. The South Tropical Atlantic is slightly cooler than normal.
In the Indian Ocean : Little evolutions in the Northern hemisphere where SST are still mostly warmer than normal in equatorial region and the Bay of Bengal. In the Southern Hemisphere, to be quoted the cooling between Australia and the maritime continent. Then cooling in the sub-tropics and warming in the mid-latitudes. The DMI is close to neutral but corresponding to positive anomalies on both western and eastern side.
In subsurface (fig.2) :
Generally speaking the heat Content anomalies look very similar to the ones from the previous month to the exception of the Central Pacific equatorial waveguide.
In the Pacific : in the Tropics (including the equatorial waveguide), heat content anomalies mostly negative East to 160°W and positive West to this limit. Note the positive anomalies in the most Western part off equator (in the Northern hemisphere between 10°N and 20°N. In the SPCZ region this positive anomaly decreased while some cooling is visible East to the SPCZ. In the mid/high latitudes of the Northern hemisphere, great consistency with the surface signal (and same pattern than for the Tropics).
In the Atlantic : in the equatorial waveguide and along the western coast of the African continent little anomalies. Persistence of the strong positive anomaly in the North-Eastern part of the basin (close to the mid-latitudes) up to the equatorial region. Over South Tropics anomalies are consistent with SST despite the patterns are quite fragmented.
In the Indian Ocean : heat content consistent with SST signal in the Northern hemisphere and Australia. In the equatorial waveguide note the extension of the negative anomaly.

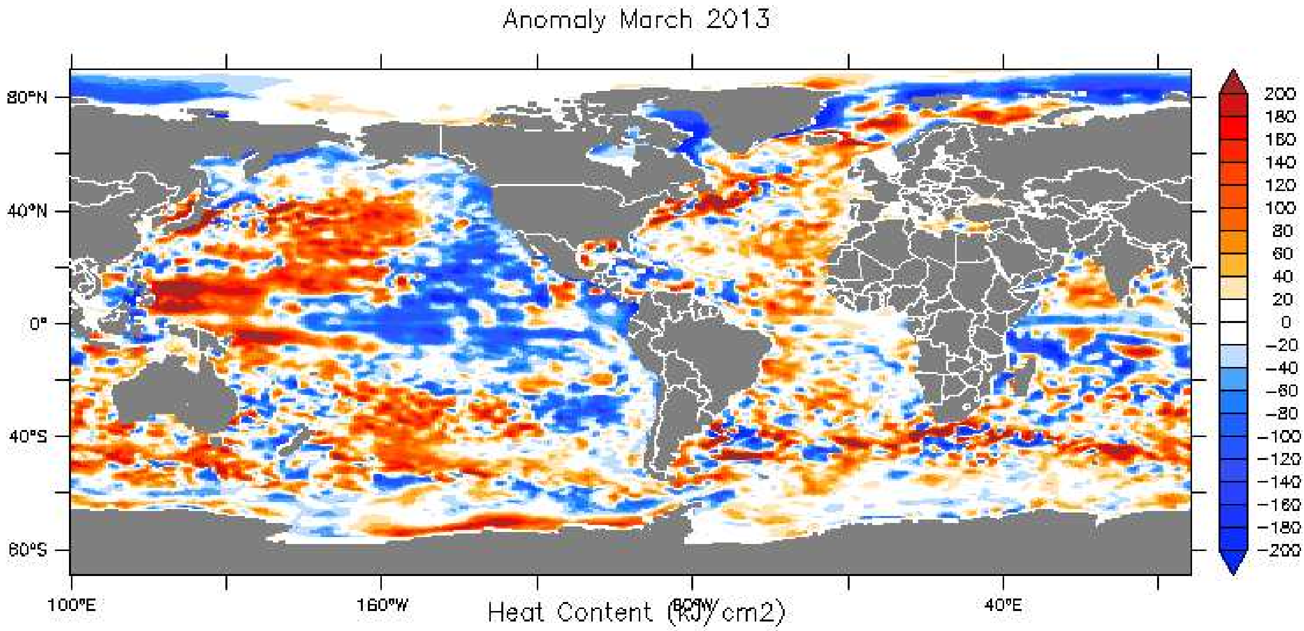


fig.2: map of Heat Content Anomalies (first 300m) (in kJ/cm²). (reference 1950-2008) http://bcg.mercator-ocean.fr/

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

Despite the anomalies are relatively weak, a tripole pattern is visible with positive anomalies on the western and Eastern side and negative anomalies in the Central part. Not too much trade wind anomalies over most of the basin. The SOI is positive (+1.5) despite neutral SST conditions in relationship with the velocity potential field (see fig. 6) in the Southern Tropics of the Pacific.

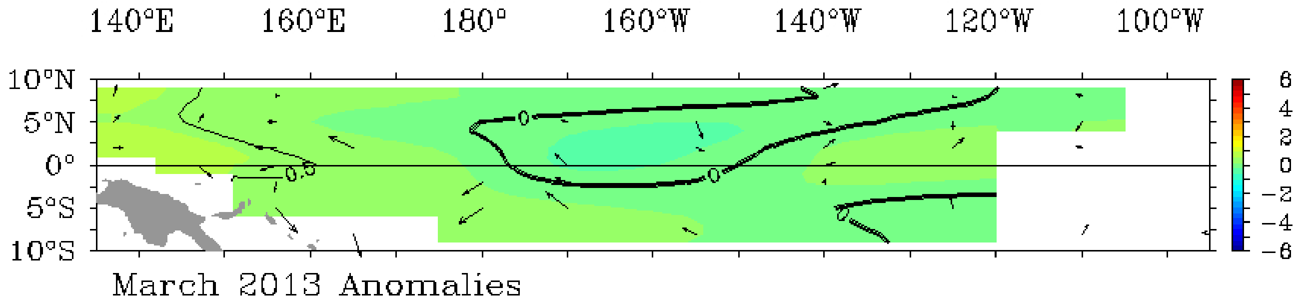


fig.3: SST Anomalies and Wind anomalies over the Equatorial Pacific from TAO/TRITON. **http://www.pmel.noaa.gov/tao/jsdisplay/monthly-summary/monthly-summary.html**

In the Niño boxes (4, 3.4, 3 et 1+2 ; see definition in Annex) the SST anomalies illustrate the netral conditions in the Pacific. The monthly averages are respectively -0,2°C, -0,2°C, 0,1°C and 0,1°C from West to East.

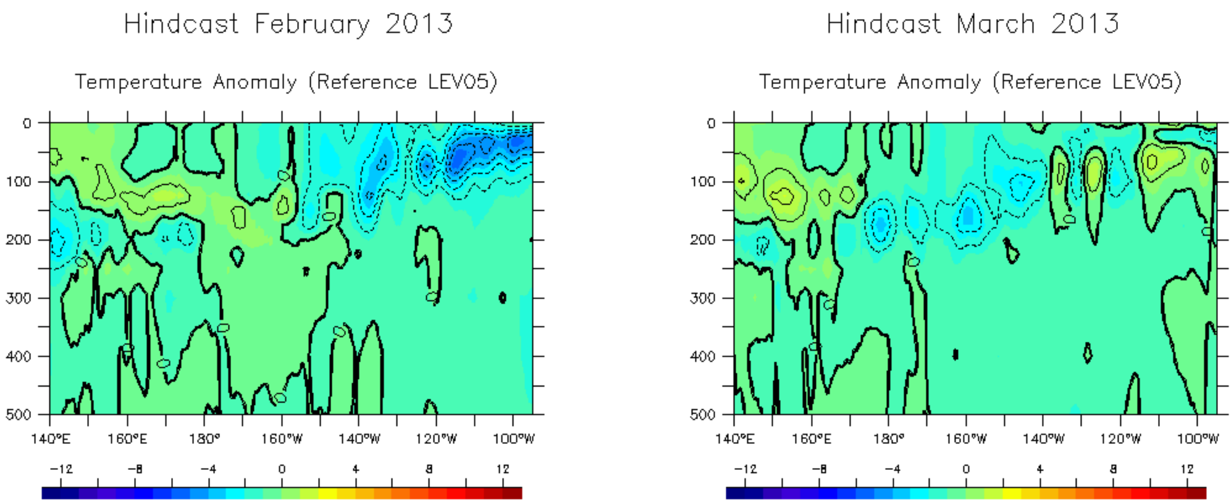


fig.4: Oceanic temperature anomaly in the first *500 metres* in the Equatorial Pacific, in previous month (left) and current month (right) http://bcg.mercator-ocean.fr/

<u>In the equatorial waveguide (fig. 4)</u> : still traces of propagation of Kelvin waves (both warmer and colder than normal) in March under the surface from the most western part (warm signal) up to the eastern part. On the most Western part, the warm reservoir us deepening and strengthening. This signal is to be carefully monitored with respect of next months and possible evolution for the end of this year.
The thermocline structure (fig. 5) : some traces of wave propagation signal of both anomalies as already pointed out in the previous comment. The deepening and strengthening of the warm reservoir on the most western side is visible at the end of the period.

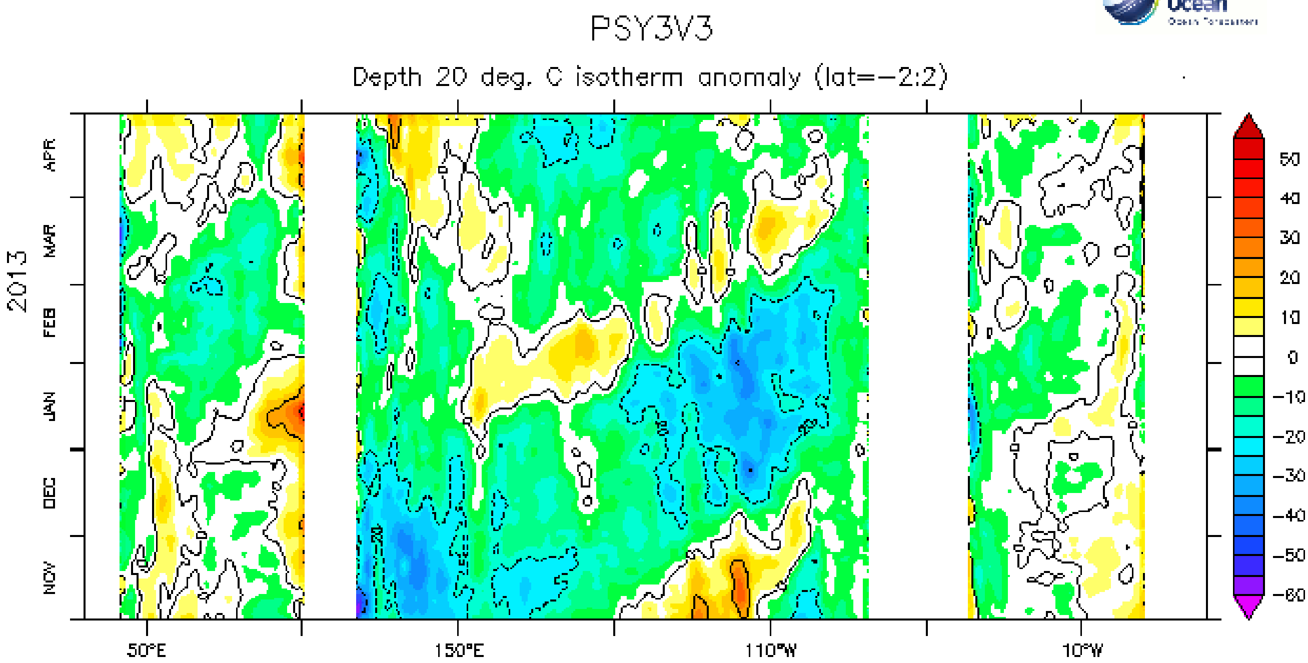


fig.5: Hovmüller diagram of Thermocline Depth Anomalies (m) (depth of the 20°C isotherm) along the equator for all oceanic basins over a 6 month period. http://bcg.mercator-ocean.fr/

I.1.c Atlantic Basin

Northern Tropical Atlantic : mostly warmer than normal and slightly warming.
Equatorial waveguide : weak dipole structure (slightly cooler than normal on West and warmer than normal on East), with trace of wave propagation.
The Southern Tropical Atlantic : Still cooler than normal. Some traces of warmer than normal conditions along the most Eastern part of the basin.

I.1.d Indian Basin

Southern Tropical Indian Ocean : a cooling is observed between Australia and the maritime continent. Then cooling in the sub-tropics and warming in the mid-latitudes.
Equatorial waveguide : some trace of wave propagation. The surface signal (mostly warmer than normal) is not consistent with the sub-surface signal (mostly thermocline structure thinner than normal). The DMI is close to normal.
Northern Tropical Indian Ocean : slightly warmer than normal especially close to the Bay of Bengal.

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) : a quasi 3 wave number likely related to MJO activity as there is only little SST forcing.
On the Pacific : Divergent circulation anomaly (upward anomaly motion) on the Western equatorial region in the region of the SPCZ. This signal is likely related to the MJO activity. Then on the Eastern part of the basin positive anomaly (downward anomaly motion) followed on the most Eastern side and the North-Western part of South America by a negative anomaly (upward anomaly motion). These patterns could be related to the MJO activity. In addition, note the linkage to other similar patterns of the Northern sub-tropics (South US and Eastern Atlantic respectively). Please visit Mickey Mouse pattern over South America (this bulletin is sponsored by the Disney Company). .

On the Atlantic : Strong Convergent circulation anomaly (downward anomaly motion) over the Southern Tropical Atlantic (likely in relationship with sub-regional dynamical forcing). In the Northern hemisphere, to be quoted the dipole structure positive/negative anomalies (downward/upward anomaly motion) between the Southern US and Eastern Atlantic (this later likely partly related to mid-latitude activity and partly to tropics).
On the Indian Ocean : Strong positive anomaly (convergent circulation anomaly - downward anomaly motion) from South-West Indian Ocean up to South-East and East Asia.

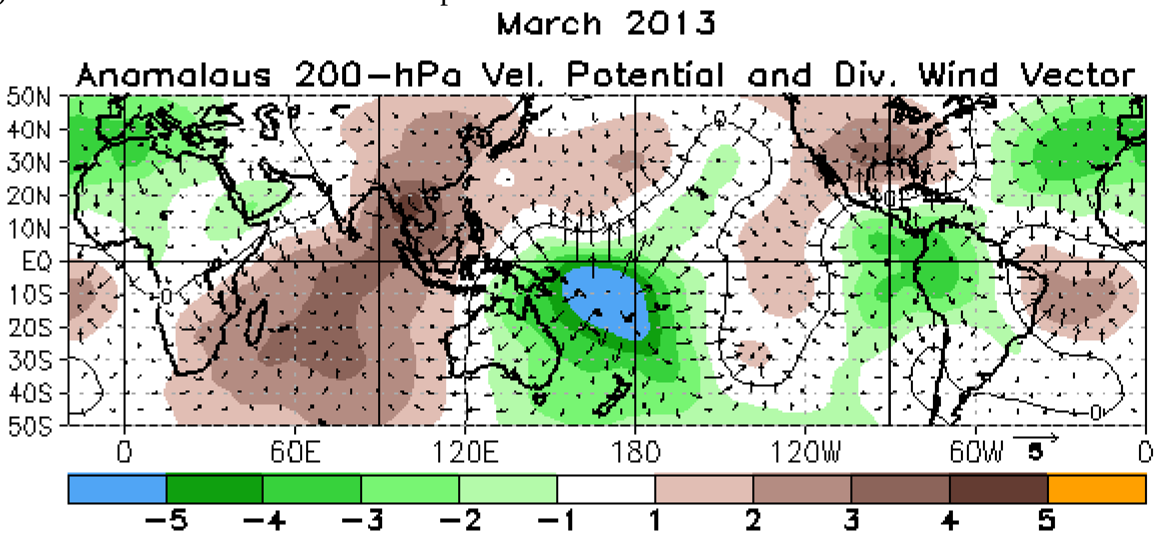


fig.6: Velocity Potential Anomalies at 200 hPa and associated divergent circulation.
Green (brown) indicates a divergence-upward anomaly (convergence-downward anomaly).
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt24.shtml

Stream Function anomalies in the high troposphere (fig. 7 – insight into teleconnection patterns tropically forced) : quite a lot of signal likely related to both mid-latitude and tropical activity.
Over the Pacific, East to the dateline, a dipole pattern (North and South) which could correspond to the impact of subsidence anomaly and which seems to interact with mid-latitudes of the Northern Hemisphere (see fig. 8).
A similar dipole is present close to Eastern coast of Africa with weak teleconnection patterns toward both Northern and Southern Hemispheres.
A large positive anomaly is observed from the Caribbean up to Morocco. Northward to it there is a negative anomaly across the Atlantic sector. This dipole strongly contributed to the occurrence/strengthening of the NAO – circulation over the Atlantic and Europe.

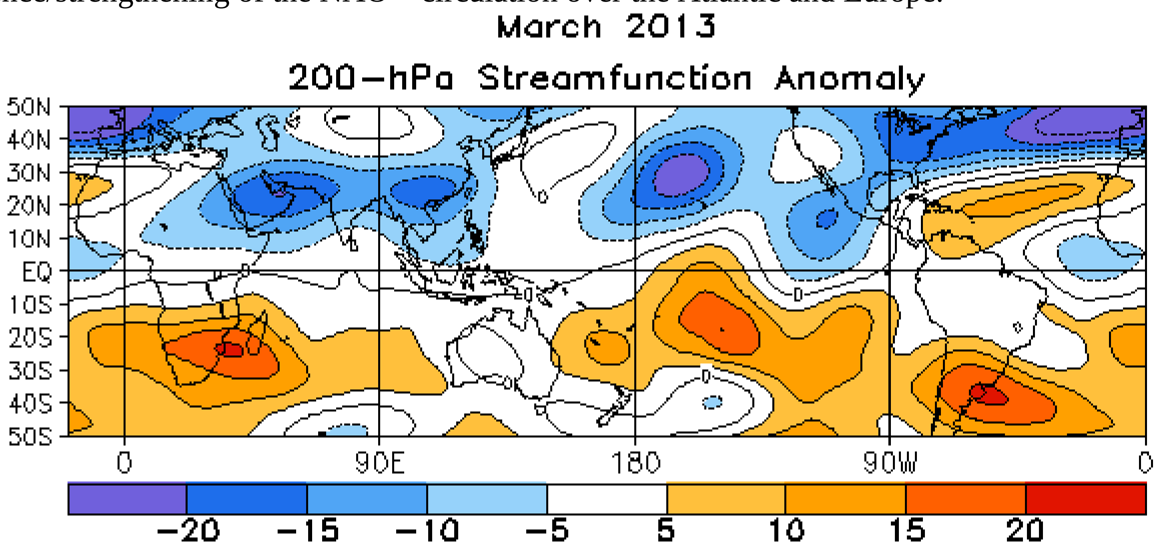


fig.7: Stream Function Anomalies at 200 hPa.
http://www.cpc.ncep.noaa.gov/products/CDB/Tropics/figt22.shtml

<u>Geopotential height at 500 hPa</u> (fig. 8 – insight into mid-latitude general circulation) : The greatest anomaly is observed in the Polar Vortex ; weak vortex corresponding to a negative phase of the AO. Consistently with the previous discussion, one founds traces of Z500 anomaly coming from the Tropics in the Pacific. The main active modes are the NAO (-2.5 – consistent with the previous discussion fig 5 & 6) and the East Atlantic/West Russia (+2.3) in relationship with the negative anomaly over West Russia and partly related to the occurrence of NAO – situation.

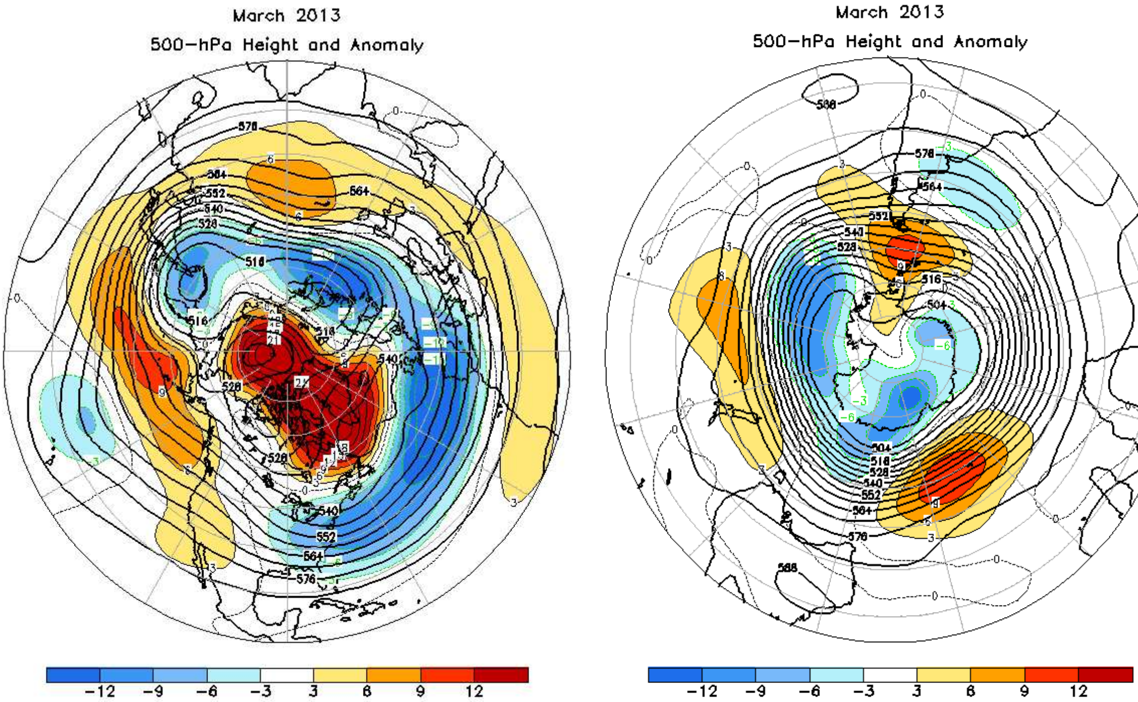


fig.8: Anomalies of Geopotential height at 500hPa in February (left North Hemisphere http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/fige9.shtml, and right South Hemisphere http://www.cpc.ncep.noaa.gov/products/CDB/Extratropics/fige15.shtml)

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
MAR 13	**-2.1**	**-0.2**	**0.6**	**0.7**	**-0.3**	**---**	**2.3**	**-0.6**	**-1.9**
FEB 13	-1.0	0.1	1.5	-0.9	0.3	0.9	-1.3	1.0	0.3
JAN 13	-0.1	0.9	0.1	0.1	0.1	1.3	0.5	0.1	-1.9
DEC 12	0.1	0.7	-0.6	---	-1.3	-1.3	-0.9	2.0	0.4
NOV 12	-0.7	1.1	-2.0	0.1	-1.1	---	-0.6	0.7	-0.2
OCT 12	-1.7	-0.3	-2.5	0.6	-1.1	---	-1.0	-0.3	-0.2

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

I.2.b Precipitation

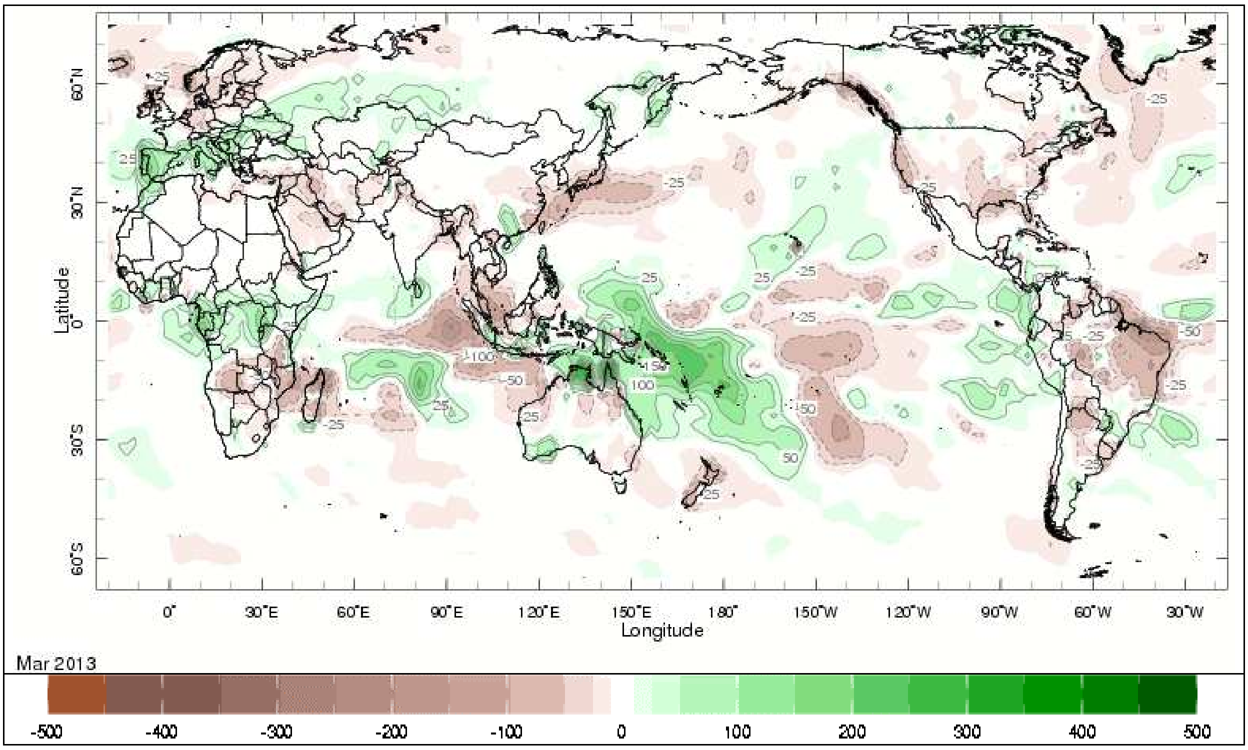


fig.9: Rainfall Anomalies (in mm) (departure to the 1979-2000 normal) – Green corresponds to above normal rainfall while brown indicates below normal rainfall.
http://iridl.ldeo.columbia.edu/maproom/.Global/.Precipitation/

Most of the rainfall patterns in the Topics are consistent with the Velocity Potential anomaly field, to the exception of the central part of the Indian Ocean in the Southern Hemisphere :

Pacific : good consistency with the Divergent Circulation anomalies and the MJO activity; especially over the West Equatorial regions and the SPCZ region. In the sub-tropics of the Northern Hemipshere, good relationship between the rainfall anomaly and the velocity potential anomaly field (see coastal Western and Eastern Pacific regions).

Atlantic/Africa : Strong negative anomaly over the Northern Brazil and over the East-Southern part of Africa. The positive anomalies over Central Africa could be related to the warm SSTs in the Guinean Gulf and the weak but existing divergent circulation anomaly over these regions. Most of the Eastern coast of US presents a negative anomaly consistently with the velocity potential field.

Indian Ocean : Clear patterns of negative anomalies consistent with the velocity potential field. However, a large positive anomaly in the South-Central ocean is more difficult to interpret. To be quoted some positive anomaly in the most Southern region of India.

Australia : great spatial variability. But strong positive anomaly over Northern regions in relationship with the previous analysis.

North America : mostly dry over coastal area of West Canada and US (see Pacific) and close to the Gulf of Mexico (extending along the Eastern coast of US and Canada).

Europe : clear trace of NAO – influence. Wet conditions in South-West Europe and dry conditions in North-West Europe. The positive anomaly extends over the Northern part of the Mediterranean basin up to Eastern regions .

I.2.cTemperature

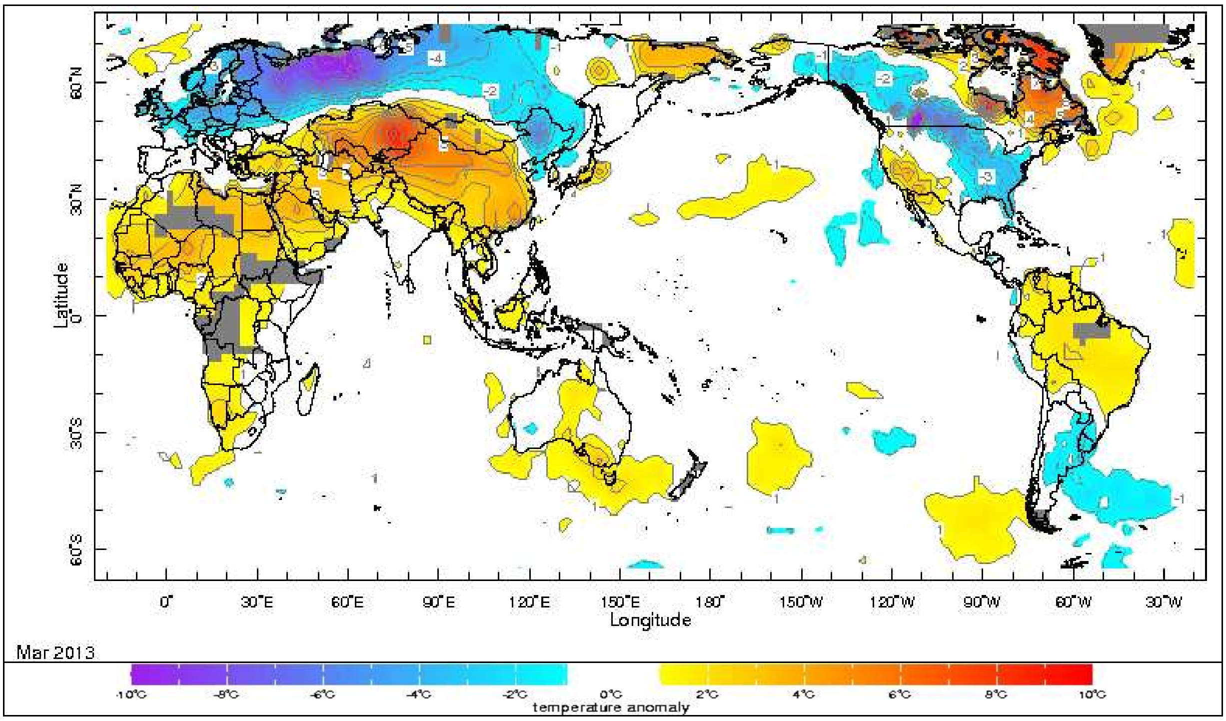


fig.10: Temperature Anomalies (in °C) (departure to the 1979-2000 normal)
http://iridl.ldeo.columbia.edu/maproom/.Global/.Atm_Temp/Anomaly.html

North-America : Strong anomalies ; Colder than normal conditions over most of Canada and Eastern US.
South-America : mostly Warmer than normal conditions in the Tropics and sub-Tropics ; Colder than normal conditions over Eastern regions (especially Argentina).
Australia : some traces of Warmer than normal conditions in the South-Eastern coastal area.
Asia : Strong Warm anomaly over Kazakhstan, Mongolia and China which extends toward South-East Asia. Negative anomaly over North-East China and Siberia.
Africa : Mostly Warmer than normal conditions everywhere (including the Arabic Peninsula) to the exception of Eastern part of Africa (close to normal).
Europe : Below normal conditions over most of European regions to the exception of the South-Western part (close to normal).

I.2.d Sea Ice

In Arctic (fig. 11 - left) : well below normal sea-ice extension especially over the Atlantic side (negative anomaly below the value of last year).
In Antarctic (fig. 11 - right) : well above normal sea-ice extension anomaly with some large regional modulation.

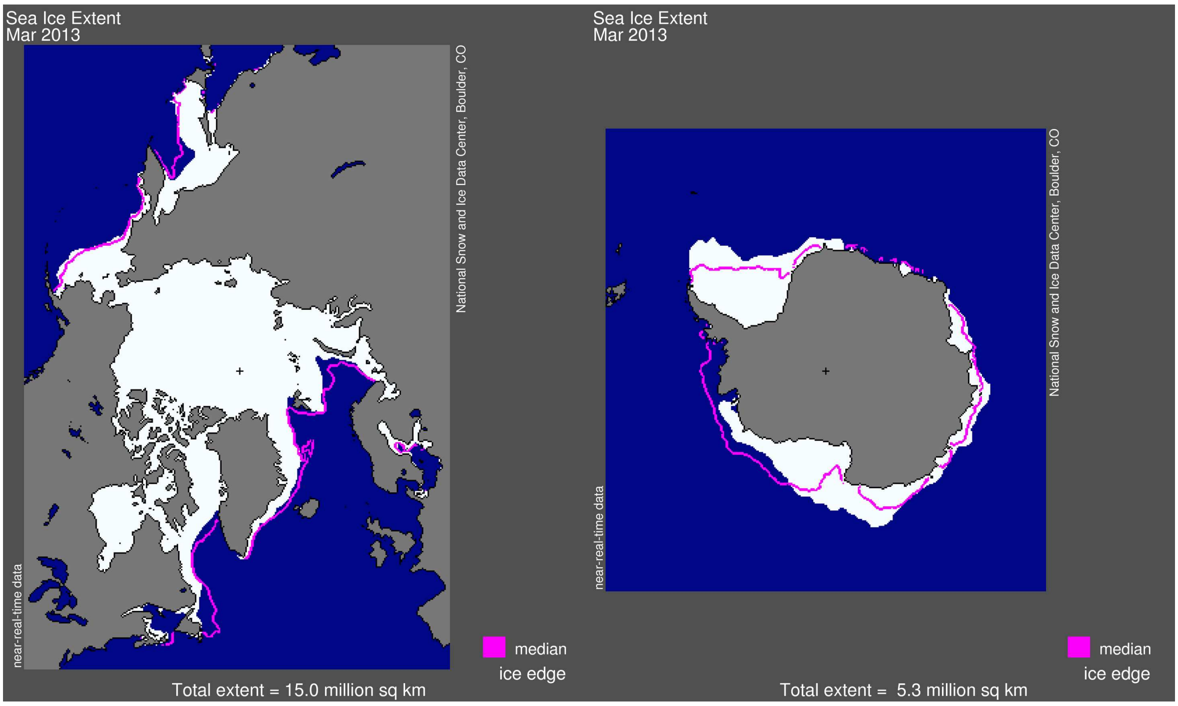


fig.11: Sea-Ice extension in Arctic (left), and in Antarctic (right). The pink line indicates the averaged extension (for the 1979-2000 period). **http://nsidc.org/data/seaice_index/**

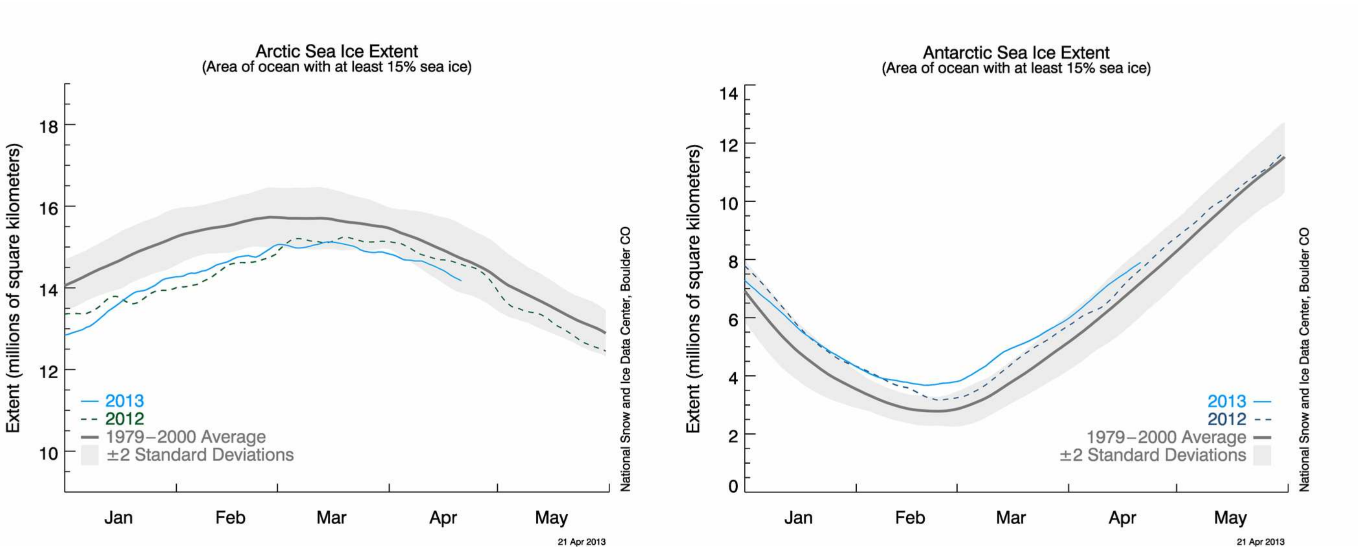


fig. 9bis : Sea-Ice extension evolution from NSIDC

http://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png

II.SEASONAL FORECASTS FOR MJJ FROM DYNAMICAL MODELS

II.1. OCEANIC FORECASTS

II.1.a Sea Surface Température (SST)

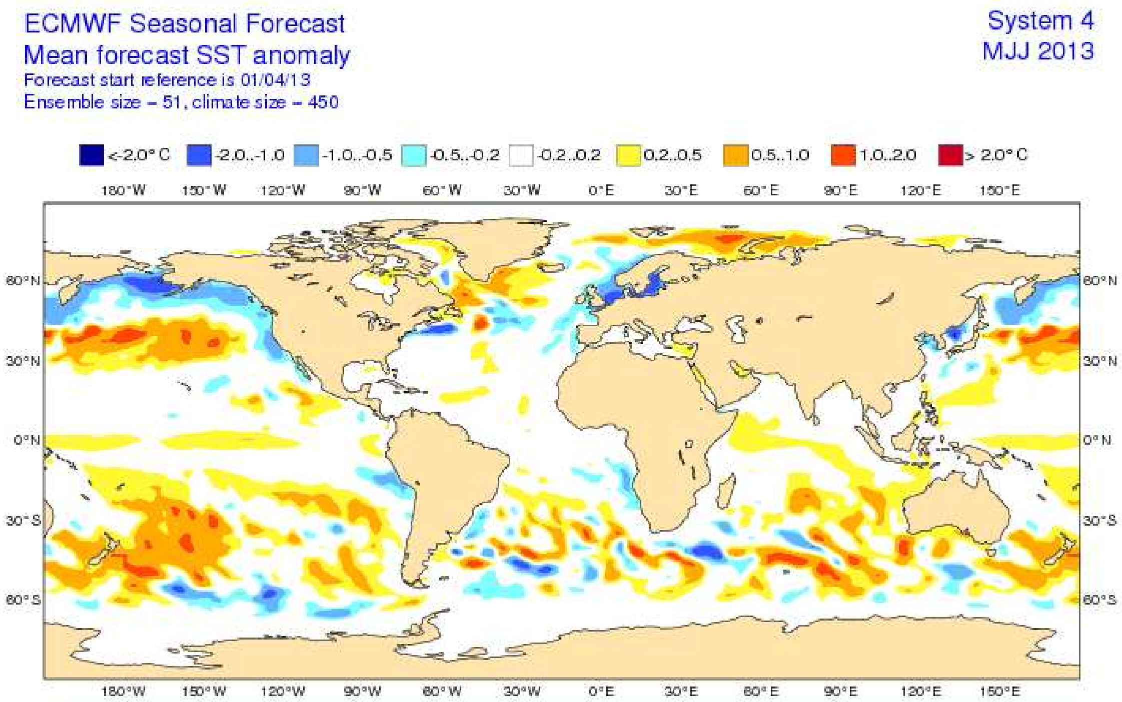


fig.12: SST anomaly forecast (in °C) from ECMWF for MJJ, issued in April. http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/group/

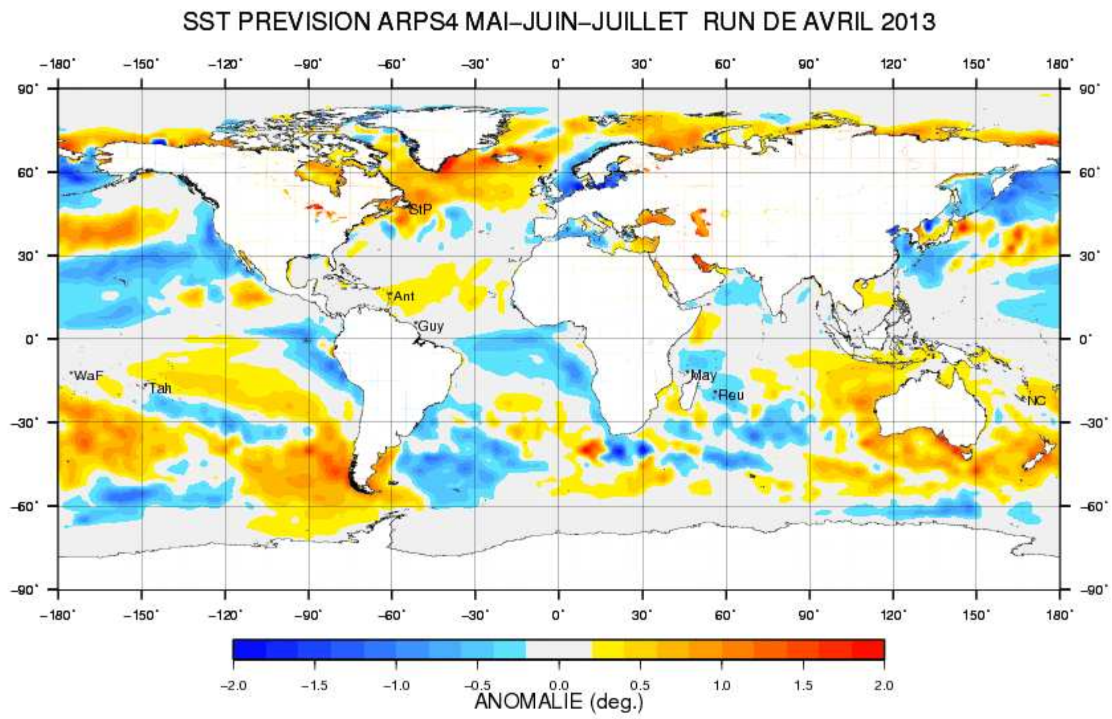


fig.13: SST Anomaly forecast (recalibrated with respect of observation) from Météo-France for MJJ, issued in April. http://elaboration.seasonal.meteo.fr/

<u>For the 2 individual models</u> :
Even at large scale it appears some differences between the 2 models. The main differences are seen over the Northern Tropical Pacific, the Tropical Atlantic, the Eastern Indian Ocean 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).
Pacific : along the equator the conditions are close to normal in MF while there is already some trace of warmer than normal conditions (weak anomalies) in ECMWF. It seems that relatively warm conditions develop a bit later on in MF (during JAS period) with respect of ECMWF. In the Northern Tropics, MF shows clear colder than normal conditions while they are only close to normal in ECMWF. Both models are developing warmer than normal conditions in the Southern Pacific to the exception of strips of negative anomaly ; the greater uncertainty being close to French Polynesia.
Atlantic : in both model consistency in Northern Tropical Atlantic and mid-latitudes of North Atlantic (mostly warmer than normal conditions) even if anomalies are not too strong. There is more differences in the Southern Hemisphere starting in the equatorial waveguide (neutral in ECMWF and mostly colder than normal in MF) and following in the Tropics (Colder than normal scenario in MF while there is only little cold signal in ECMWF).
Indian Ocean : mostly consistent East to 90°E with warmer than normal conditions in the Southern Indian Ocean and close to normal in the Northern part. Weak and consistent signal in the equatorial waveguide. Then in the South-West Indian ocean some large differences especially from Comores up to Mauritius with colder than normal conditions in MF and close to normal in ECMWF.
<u>In Euro-SIP</u> :
The robust patterns appear mostly in the tropics and sub-tropics but not in the equatorial waveguide.
Pacific : Equatorial waveguide : close to normal excepted over the most Western and most Eastern part of the basin (respectively weak positive and negative anomalies). Cold anomaly developing along the coast of South America. Quite consistent patterns in the mid-latitudes of both hemispheres.
Atlantic : Weak signal over the Tropics (both South and North). Some consistency over the mid and higher latitudes of the Northern and Southern Hemisphere.
Indian Ocean : weak signal over most of the basin to the exception of warmer than normal conditions close to Australia.

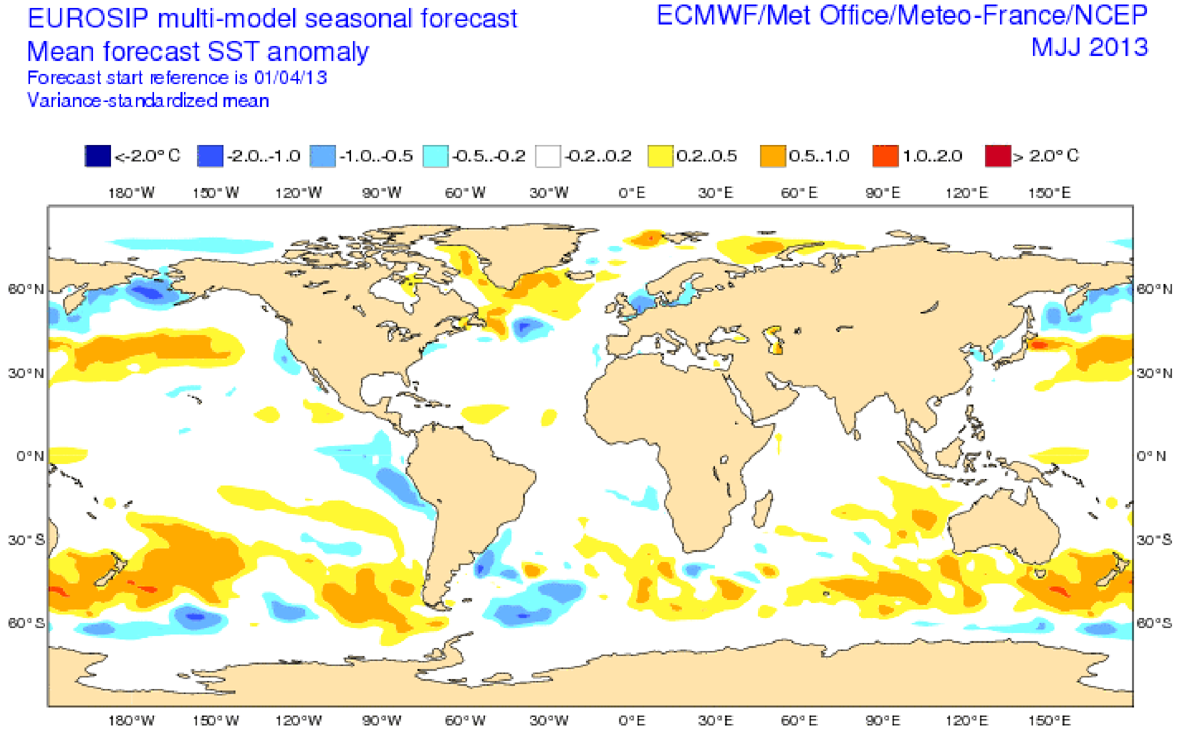


fig.14: **SST Forecasted anomaly (in °C) from Euro-SIP for MJJ, issued in April.**

II.1.b ENSO Forecast :

Forecasted Phase for AMJ : neutral

For MJJ : the majority of the models indicate close to neutral conditions for the targeted period. Most of the dynamical models show a tendency to a slight warming while most of the statistical models are indicating a cooling for the end of the year. Note that because of the Spring barrier of predictability, it's difficult to infer long time evolutions.

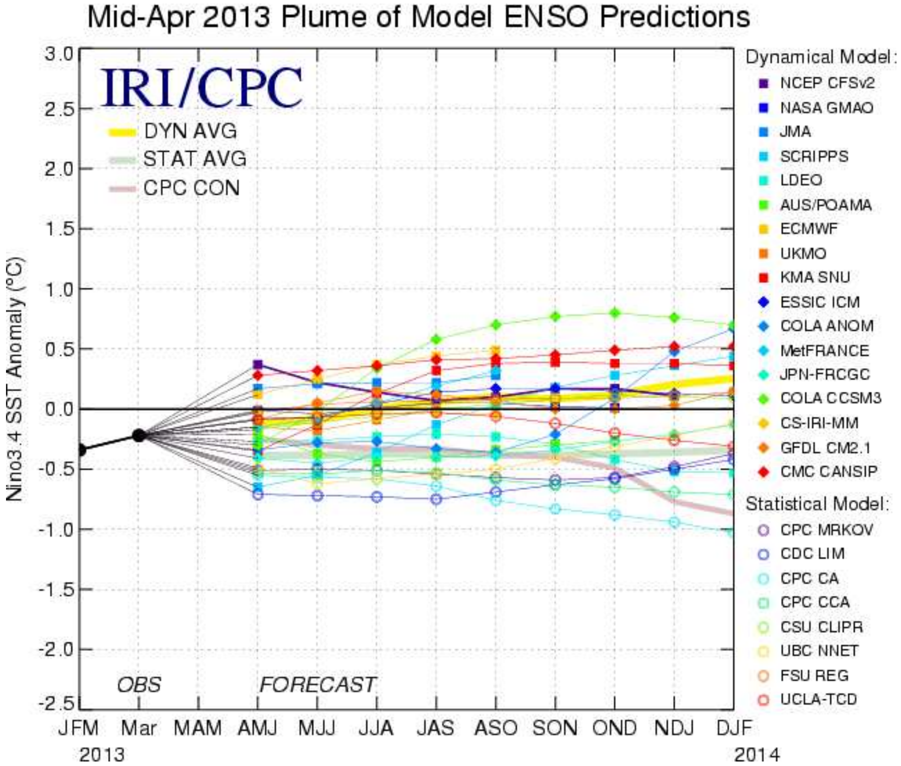


fig.15: Synthesis of Niño 3.4 forecasts (120° to 165°W) issued in April by IRI : **http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html**

Plumes from Météo-France and ECMWF for the 3 Niño boxes (see definition in Annex – fig. 16) :
In both models the ENSO thresholds are not reached on average for the MJJ period ; both models are indicating a progressive warming. One can notice that also in both models the spread dramatically increase from the Centre up to the East of the basin and in time (very likely in relationship with the Spring barrier of predictability and actual prevailing conditions). In EuroSIP Plumes, the close to normal conditions on average and the spring barrier of predictability (see spread) is conspicuous.

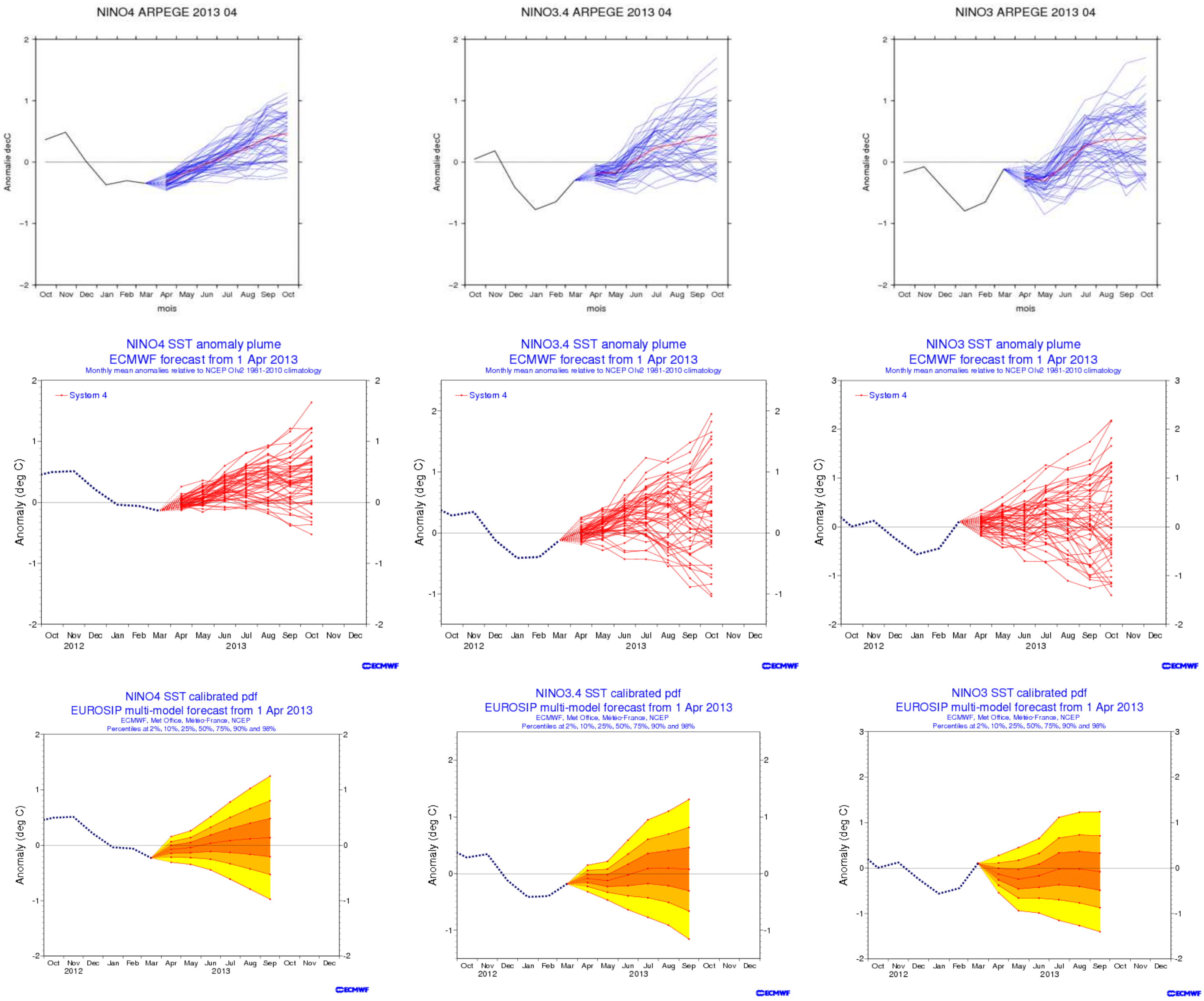


fig.16: SST anomaly forecasts in the Niño boxes from Météo-France (top) and ECMWF (middle) - monthly mean for individual members - and EuroSIP (bottom) – recalibrated distributions - issued in April (http://www.ecmwf.int/)

II.1.c Atlantic Ocean forecasts :

Forecasted Phase: ***close to normal/slightly colder than normal in Northern/Southern Tropics***

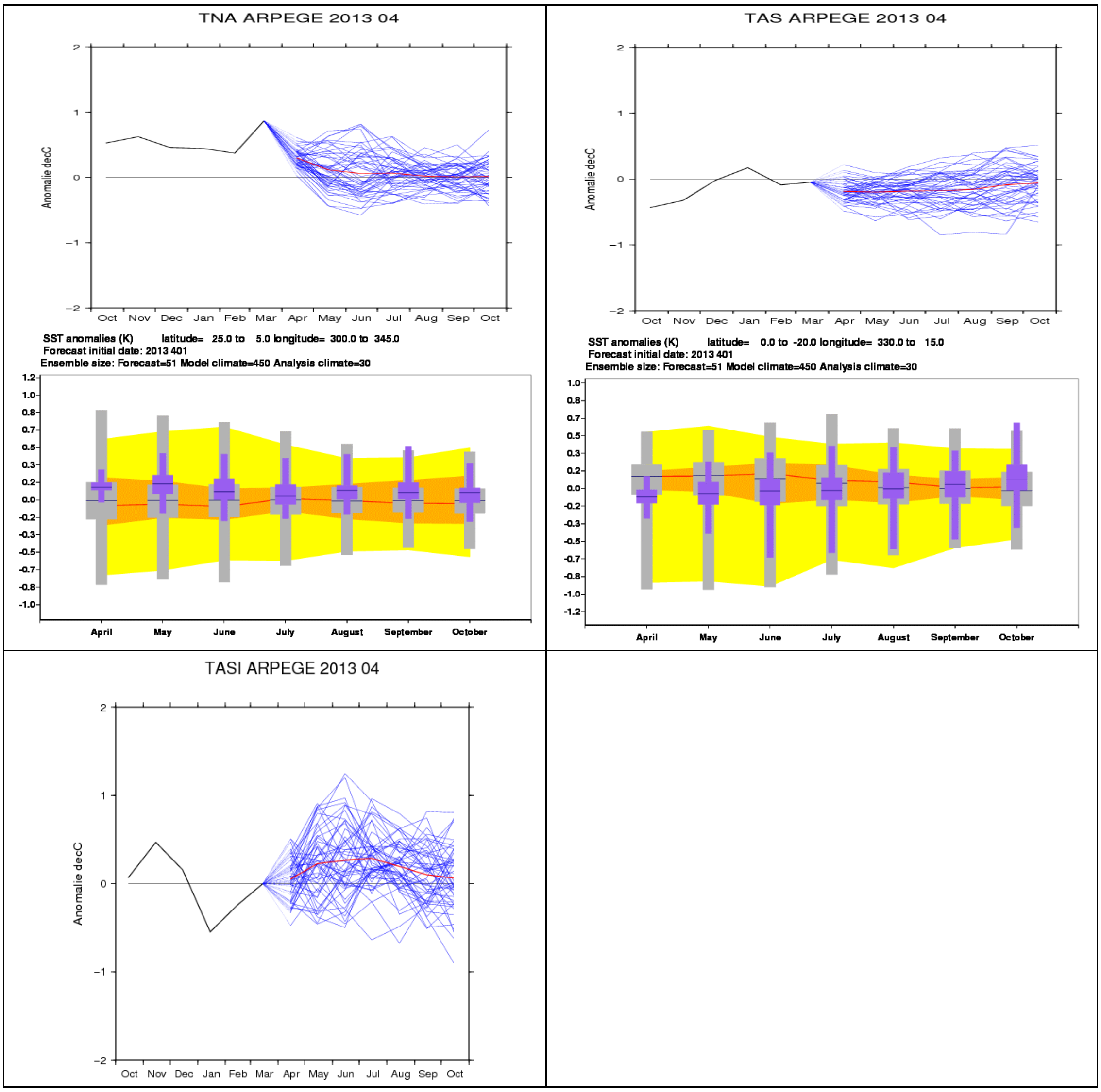


fig.17: SSTs anomaly forecasts in the Atlantic Ocean boxes from Météo-France and ECMWF, issued in April, plumes / climagrams correspond to 51 members and monthly means.

North Tropical Atlantic : slightly warmer than normal conditions in both models with a reasonable spread.
South Tropical Atlantic : in both models slightly colder than normal conditions.
The inter-hemispheric SST gradient should stay positive which is interesting to look at with respect of the monsoon behaviour in West Africa (possibly more active than normal monsoon over Sahel).
TASI : the TASI index is positive in MJJ. Despite the large spread, there is a good consistency between the two models and this is consistent with the expected behaviour of the inter-hemispheric gradient.

II.1.d Indian Ocean forecasts :

Forecasted Phase: *IOD close to neutral*

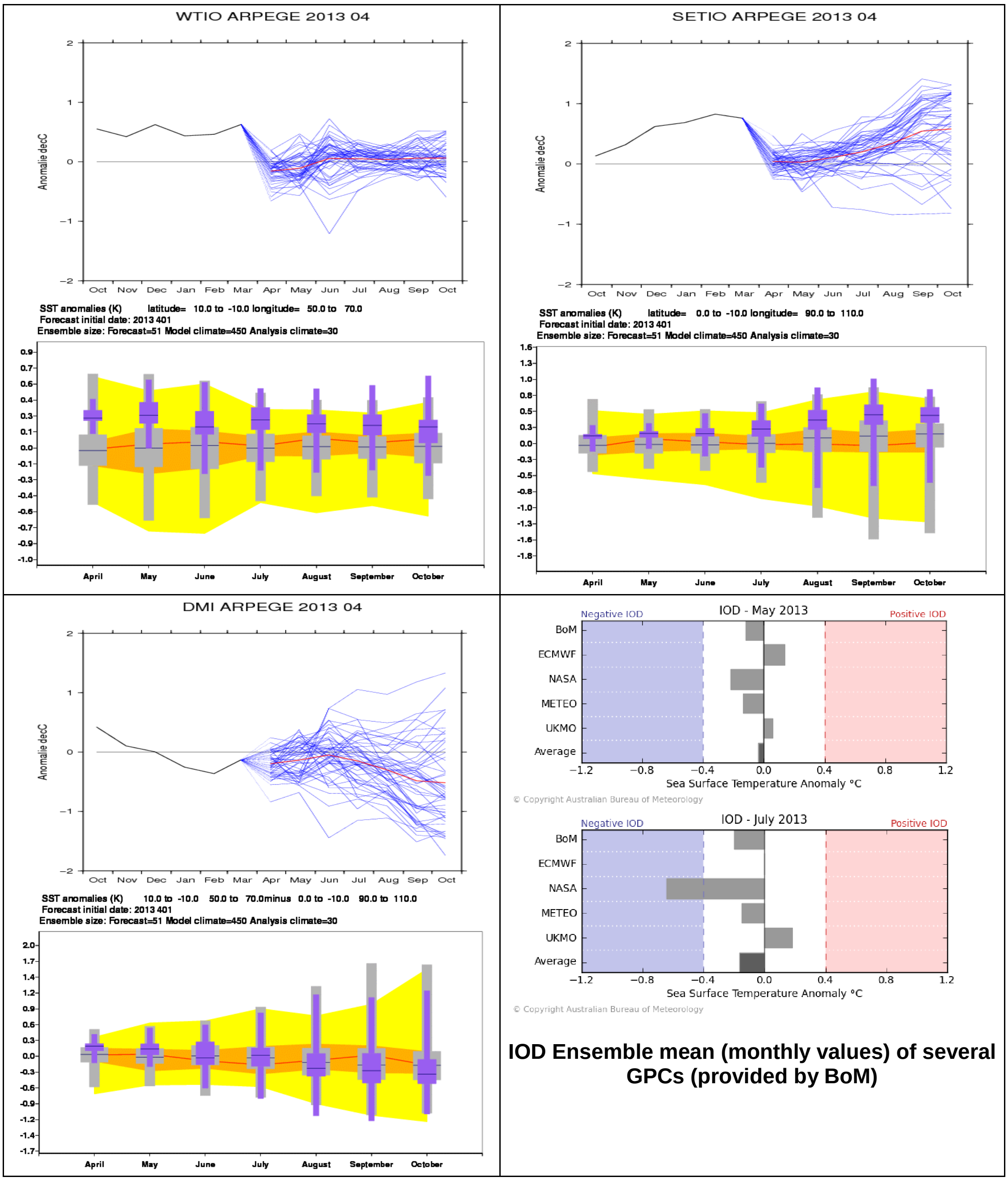


fig.18: SSTs anomaly forecasts in the Indian Ocean boxes from Météo-France and ECMWF, issued in April, plumes / climagrams correspond to 51 members and monthly means.

In WTIO : close to normal conditions in MF and warmer than normal conditions in ECMWF; both models with reasonable spread and stable conditions along the whole period. However the MF graph could indicates an oceanic analysis problem.
In SETIO : Close to normal in MF and ECMWF and then progressive warming ; likely consistently with the Western Pacific SSTs behaviour. Reasonable spread in both models.
DMI (IOD) : Close to normal conditions in both models becoming progressively negative (in relationship with SETIO evolutions) especially in August and beyond.

II.2. GENERAL CIRCULATION FORECAST

II.2.a Global Forecast

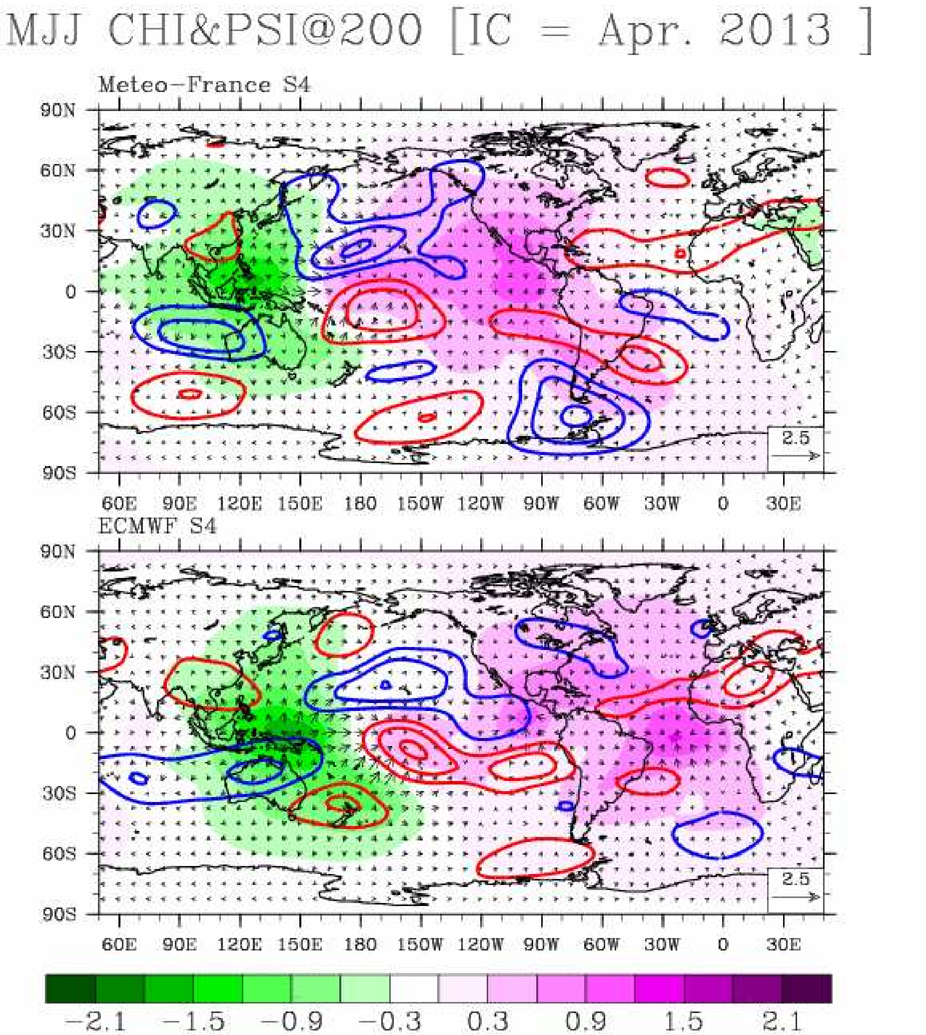


fig.19: Velocity Potential anomaly field χ (shaded area – green negative anomaly and pink positive anomaly), associated Divergent Circulation anomaly (arrows) and Stream Function anomaly ψ (isolines – red positive and blue negative) at 200 hPa for AMJ, issued in March by Météo-France (top) and ECMWF (bottom).

Velocity potential anomaly field (cf. fig. 19 – insight into Hadley-Walker circulation anomalies) :
in the Tropics : atmospheric response quite consistent but with a very weak signal likely in relationship with the spring barrier of predictability and the quasi neutral conditions in the Tropical Oceanic basins.
Over the Pacific : Good consistency between the 2 models on the Western part with negative anomaly over the maritime continent and the warm pool. Consequently Divergent circulation anomaly (upward motion) over the West Tropics but weak and with a limited meridional extension. Still a consistent pattern just East to the dateline (convergent circulation anomaly – downward anomaly motion).
Over Indian Ocean : very weak signal in both models ; some enhanced Divergent circulation anomaly over North-East Indian Ocean in MF.
Over Atlantic : weak signal and little consistency between the 2 models. Over South Atlantic ; positive anomaly in the equatorial regions (just South to the equator – downward anomaly motion) in ECMWF which extends up to the Caribbean.
Stream Function anomaly field (cf. fig. 19 – insight into teleconnection patterns tropically forced) :
In both models, over the Pacific the atmospheric response is quite consistent in both models despite the weak signal. However, there is no propagation of the signal toward mid-latitudes. Over the Atlantic it's

difficult to infer any specific atmospheric response. However, the positive anomaly starting from the Caribbean up to the Eastern side of Mediterranean regions could be partly associated to some tropical influence in MF. As a conclusion the predictability is very limited over mid-latitudes regions everywhere and especially over Europe (to the possible exception of Eastern Mediterranee). This conclusion is very consistent also with the Spring barrier of predictability (considering the present forecast).

II.2.b North hemisphere forecast and Europe

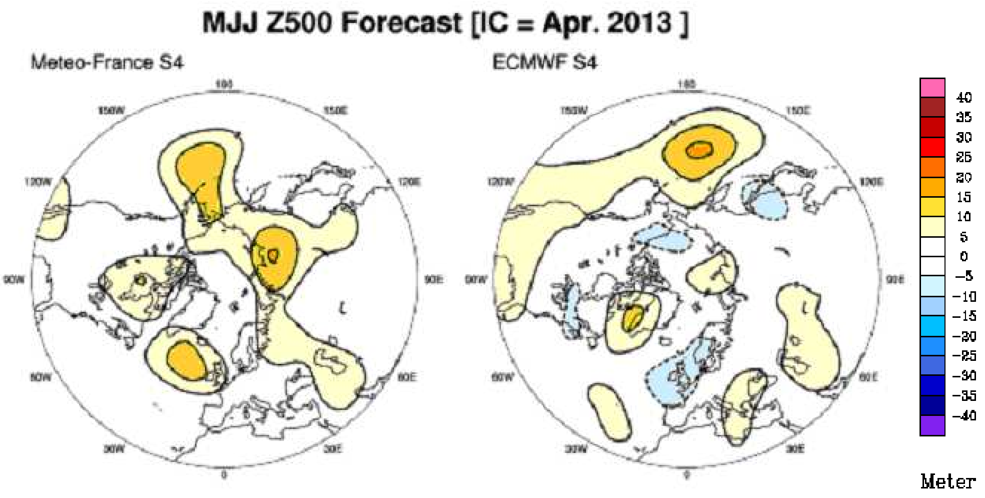


fig.20: Anomalies of Geopotential Height at 500 hPa for MJJ issued in April, from Météo-France (left) and ECMWF (right). http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip

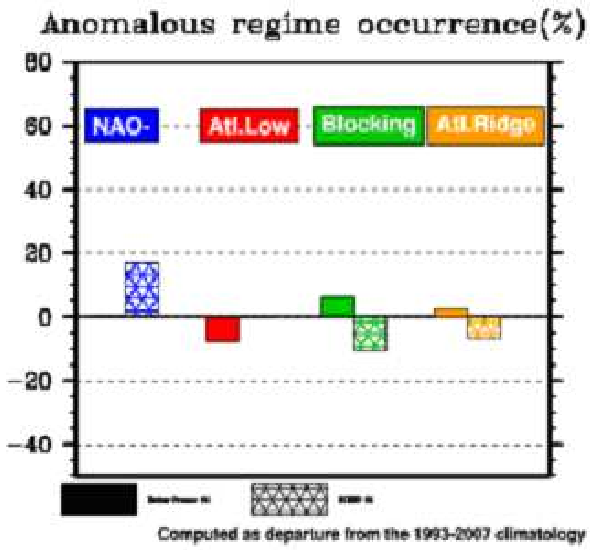


fig.21: North Atlantic Regime occurrence anomalies from Météo-France and ECMWF : vertical bars represent the excitation frequency anomaly (in %) for each of the 4 regimes.

Geopotential height anomalies (fig. 20 – insight into mid-latitude general circulation anomalies) :
As seen on the Stream Function anomalies, there is a weak signal in both Velocity Potential anomalies and Stream Function Anomalies. So it's difficult to interpret these anomalies with respect of tropical forcing sources. The differences between the two models can likely be related to the model uncertainty.
North Atlantic Circulation Regimes (fig. 21) : As a consequence, there is only little signal in the circulation regimes forecasts. This is very consistent with the very limited predictability already pointed out.

General atmospheric circulation in MF in the low troposphere (see fig. 22) : the mid-latitude circulation in MF seems to be clearly related to the internal dynamic; So the zonal and meridionnal circulation over Europe don't show strong signal. In addition, due to the limited predictability, these patterns are not directly interpretable in term of teleconnection pattern.

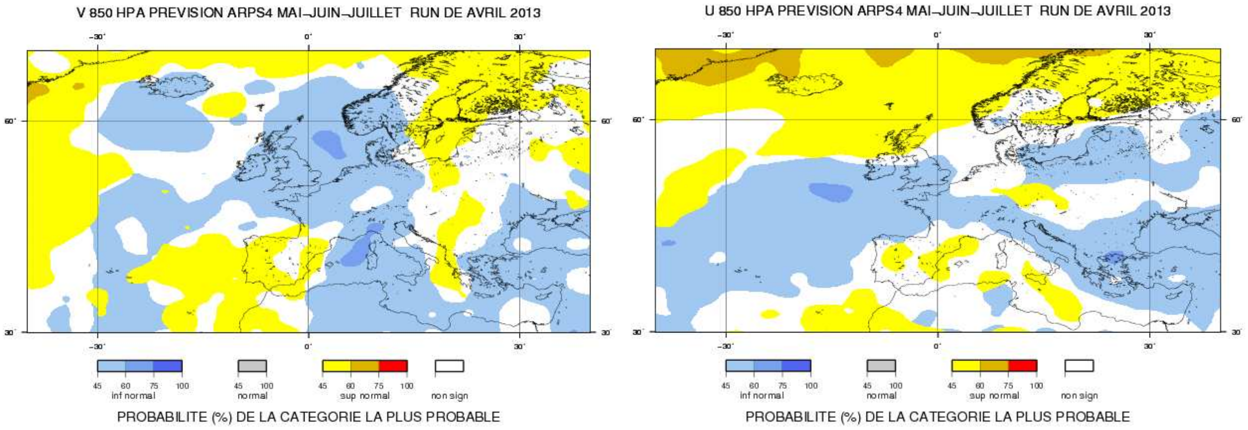


fig.22: Most likely category for the meridional (left) and zonal (right) wind at 850 hPa for MJJ, issued in April from Météo-France.

II.3. IMPACT : TEMPERATURE FORECASTS

II.3.a ECMWF

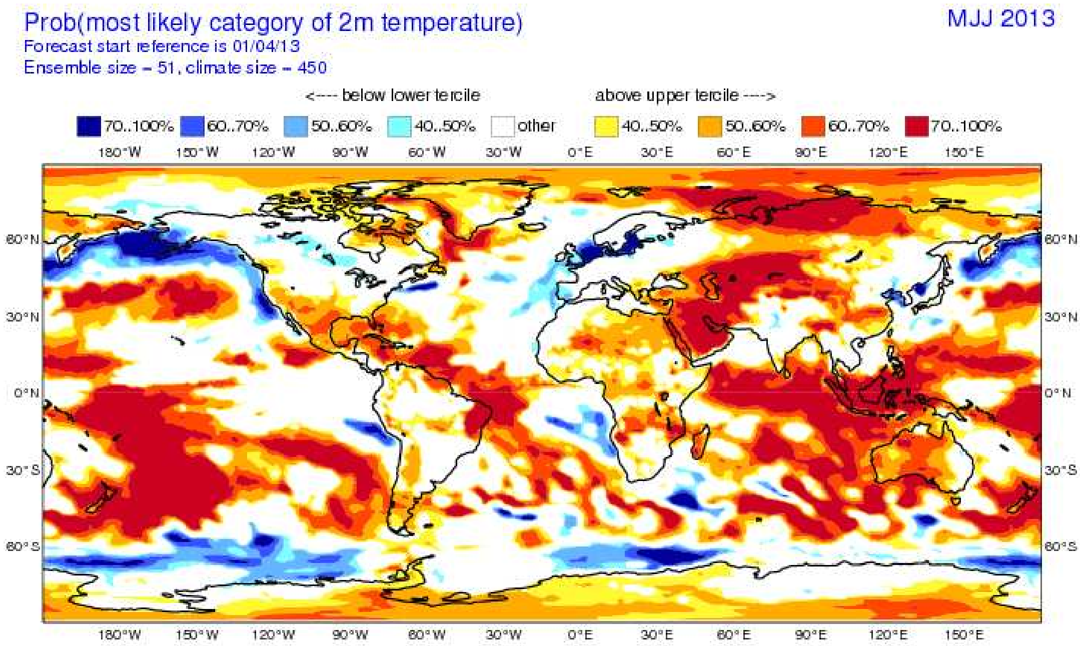


fig.23: Most likely category probability of T2m from ECMWF for MJJ, issued in April. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/seasonal_range_forecast/group/

II.3.b Météo-France

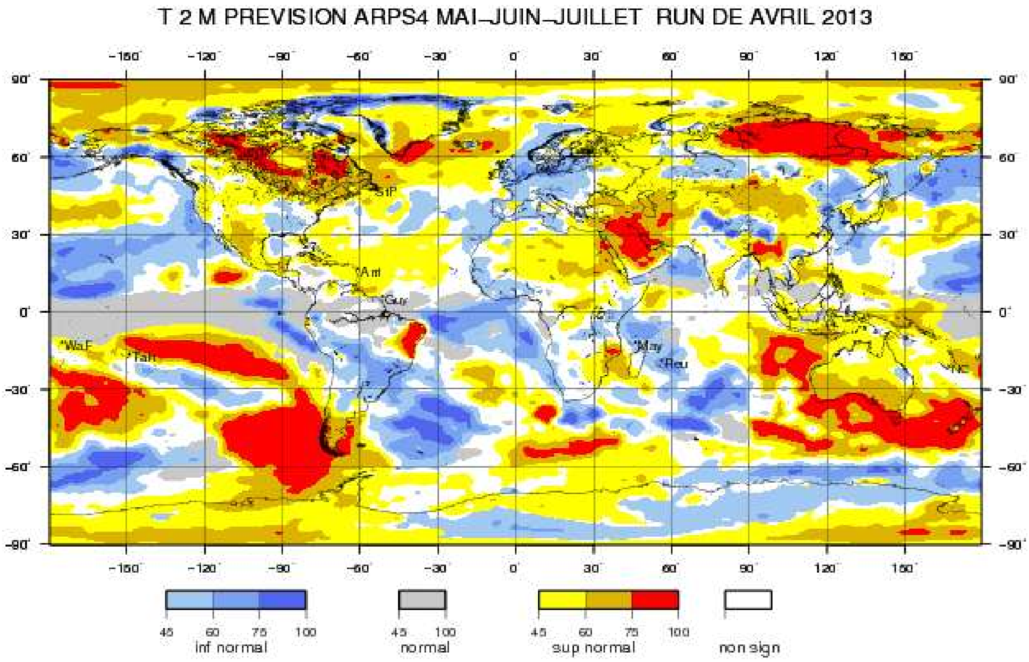


fig.24: Most likely category of T2m for MJJ, issued in April. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://elaboration.seasonal.meteo.fr/

II.3.c Met Office (UKMO)

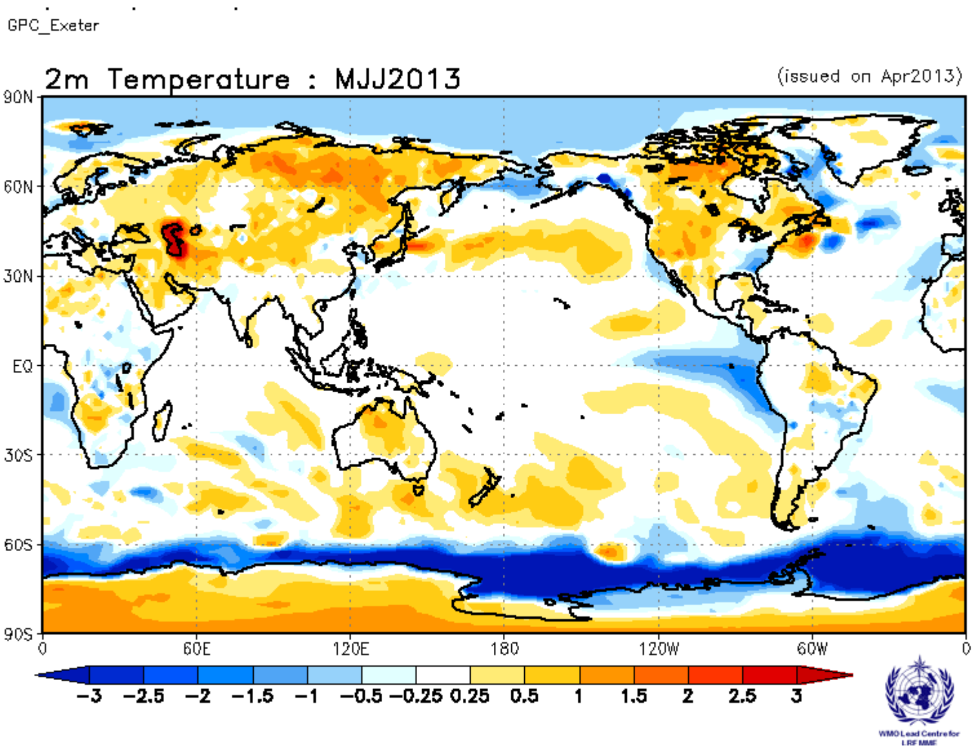


fig.25: T2m anomaly for MJJ, issued in April from UK Met Office. https://www.wmolc.org/

II.3.d Climate Prediction Centre (CPC)

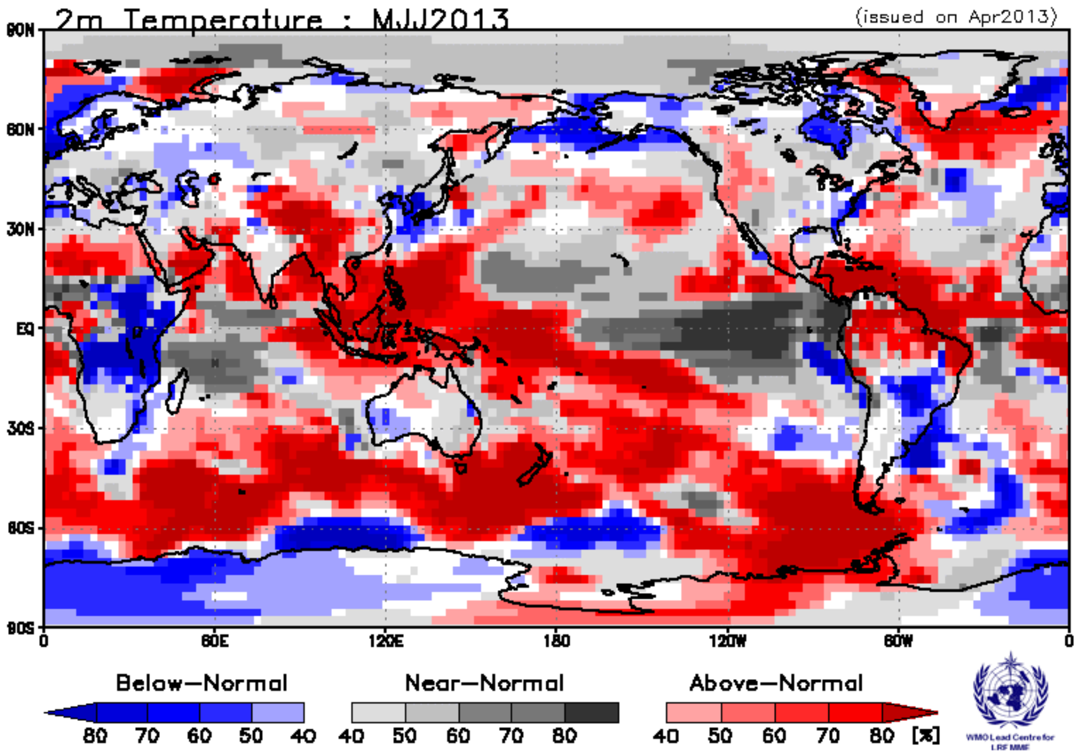


fig.26: Most likely category of T2m Anomaly for MJJ, issued in April from CPC. https://www.wmolc.org/

II.3.e Japan Meteorological Agency (JMA)

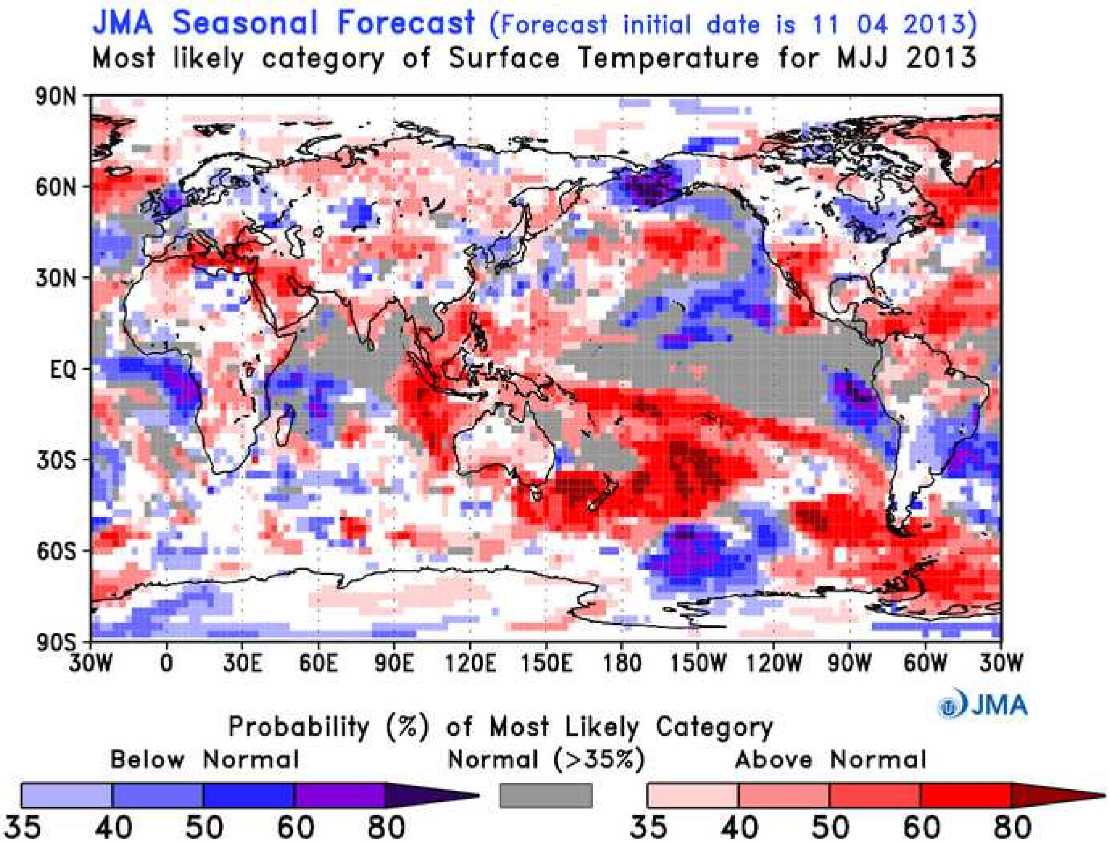


fig.27: **Most likely category of T2m for MJJ, issued in April. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://ds.data.jma.go.jp/tcc/tcc/products/model/**

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

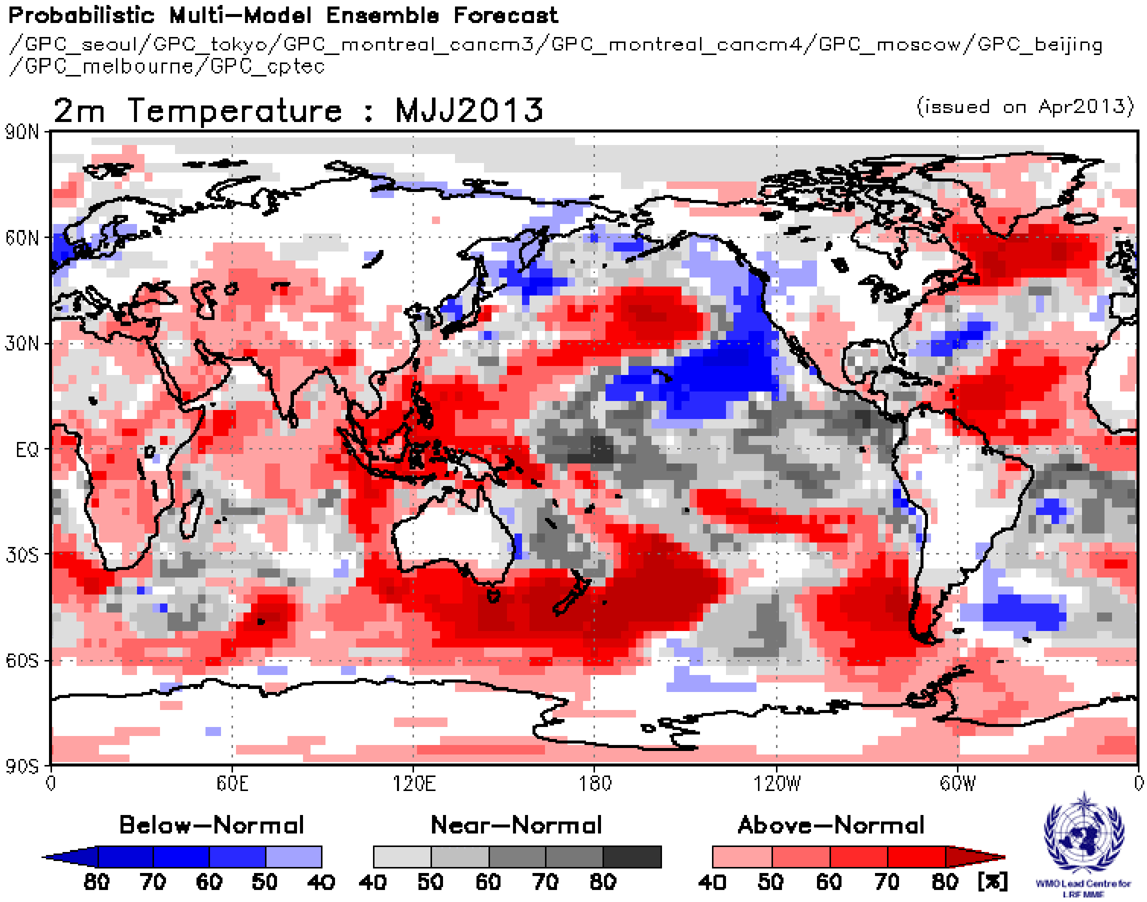


fig.28: **T2m MME Anomaly for MJJ, issued in April from LC-MME. The MME composition corresponds to the GPCs not used in EuroSIP https://www.wmolc.org/**

II.3.g Euro-SIP

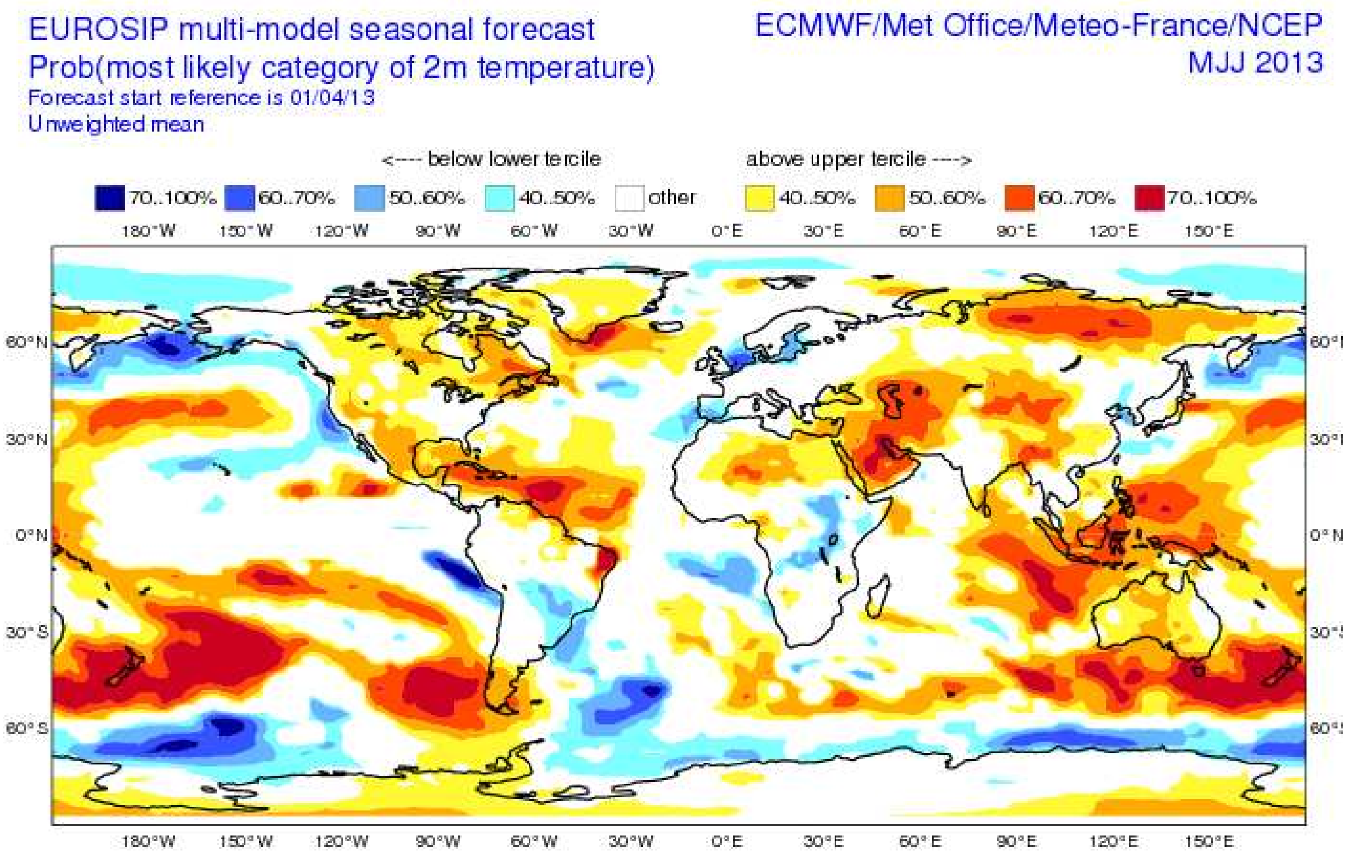


fig.29: Multi-Model Probabilistic forecasts for T2m from EuroSip for MJJ, issued in April. (2 Categories, Below and Above normal – White zones correspond to No signal and Normal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

North-America : Warmer than normal conditions over a large portion of the North American continent and Central America. Colder than normal over the coastal area of Alaska.
South-America : Limited signal along the North Eastern coast (warmer than normal), close to Argentina (colder than normal) and the most southern part (warmer than normal).
Australia : Warmer than normal over most of the country.
Asia : Warmer than normal conditions over the maritime continent, from Bengla Desh up to Siberia and the Arabic Peninsula and regions close to the Caspian Sea.
Africa : Warmer than normal conditions over North Africa (to the exception of western side), colder than normal conditions from Sudan to the Tanganyika region.
Europe : No signal over most of the continent. To the exception of the Iberic peninsula (colder than normal) and the most eastern part of South Europe (warmer than normal).
Take care that part of the signal could be related to the climate trend.

II.4. IMPACT : PRECIPITATION FORECAST

II.4.a ECMWF

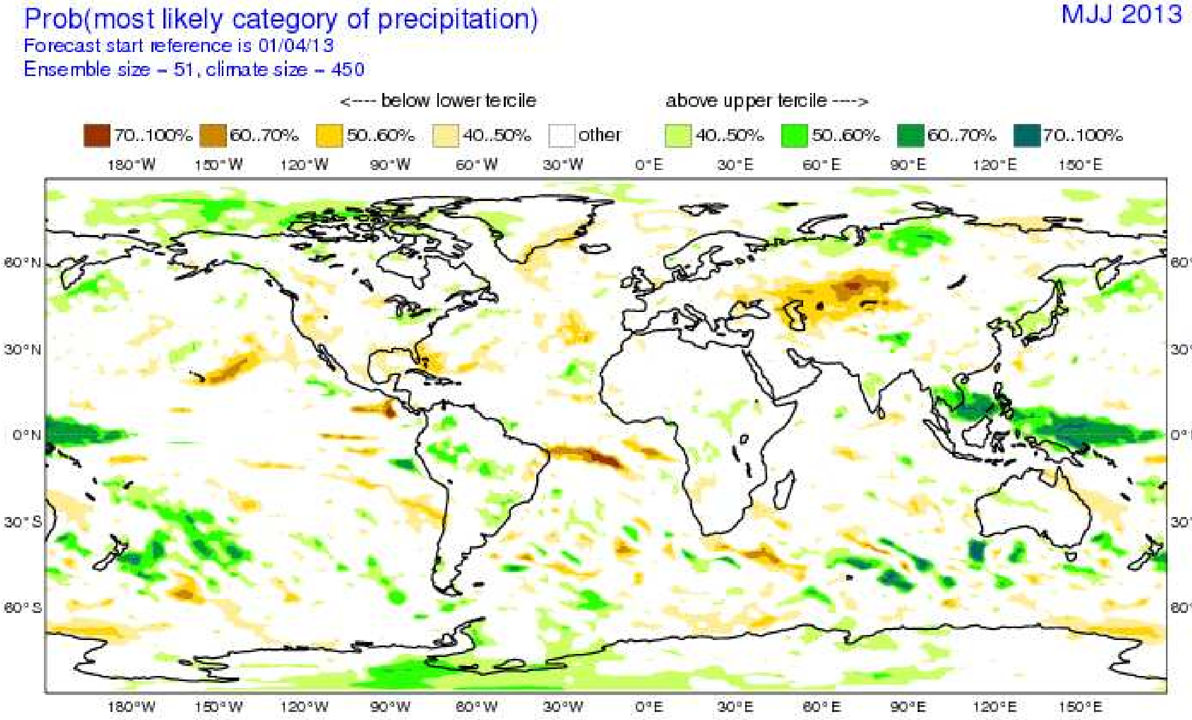


fig.30: Most likely category probability of rainfall from ECMWF for MJJ, issued in April. Categories are Above Normal, Below Normal and « other » category (Normal and No Signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/charts/seasonal_charts_s2/

II.4.b Météo-France

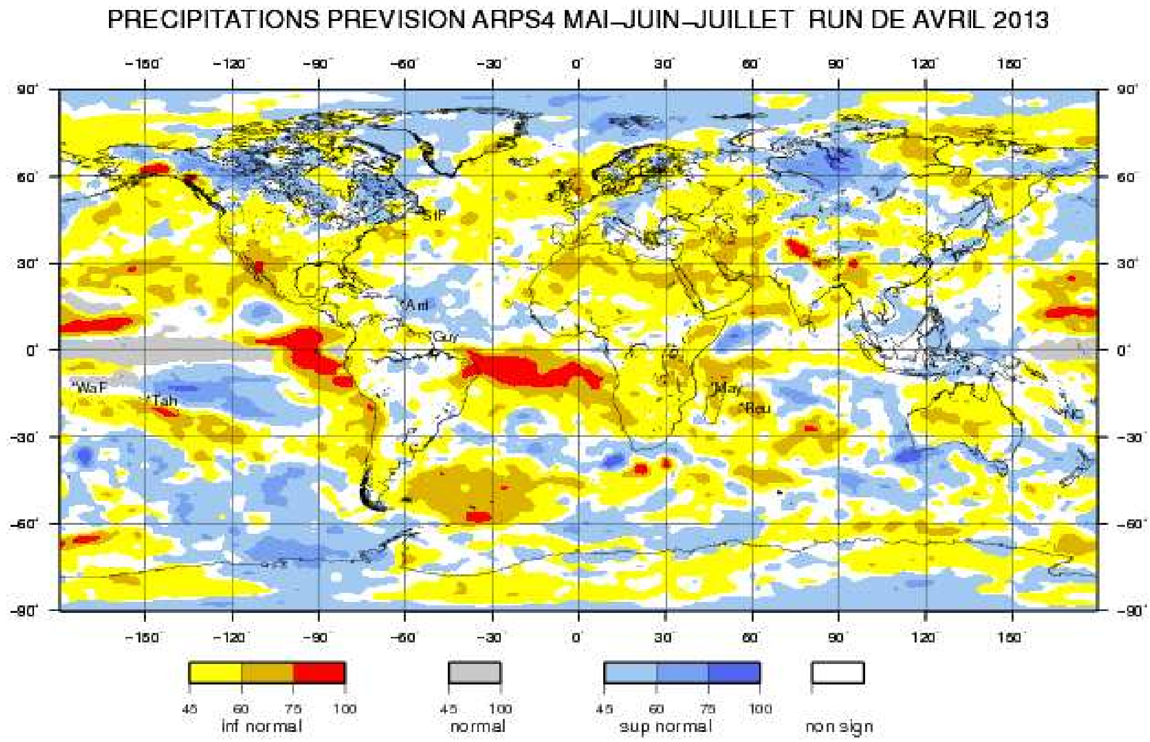


fig.31: Most likely category of Rainfall for MJJ, issued in April. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. **http://elaboration.seasonal.meteo.fr/**

II.4.c Met office (UKMO)

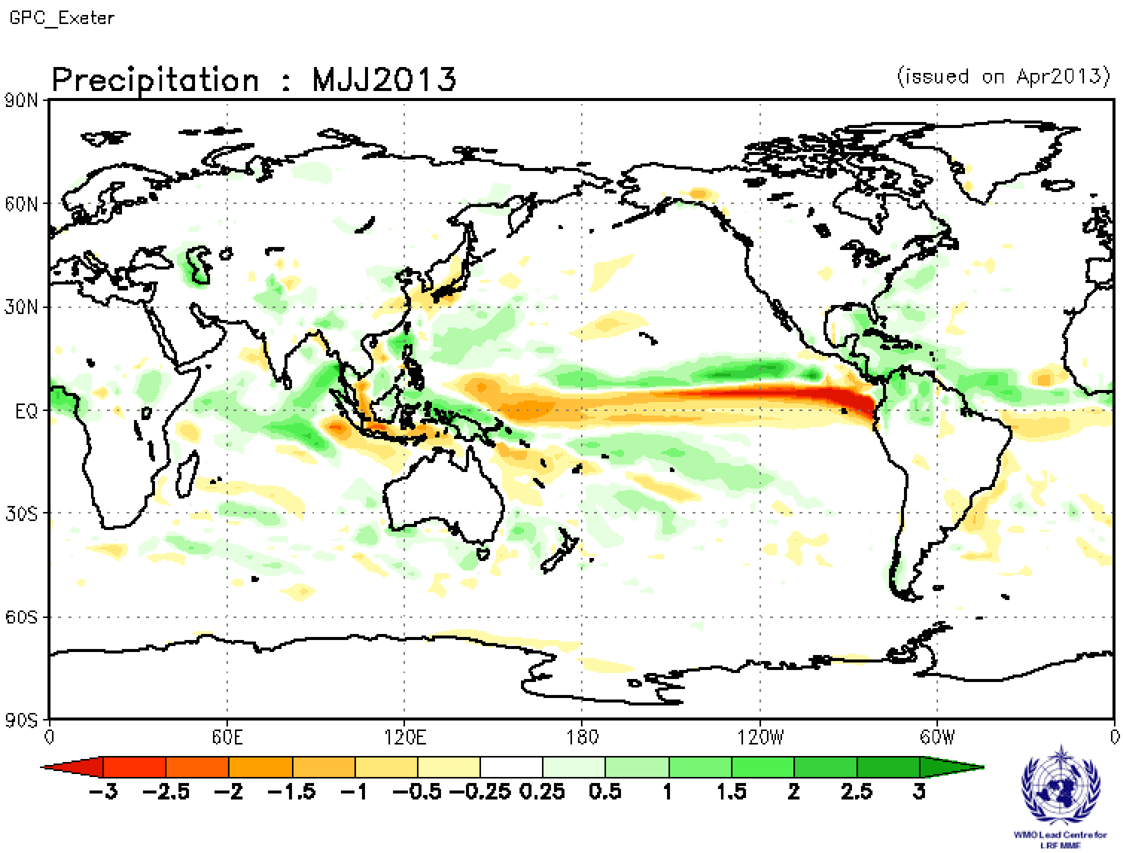


fig.32: **Rainfall anomaly for MJJ, issued in April from UK Met Office.** https://www.wmolc.org/

II.4.dClimate Prediction Centre (CPC)

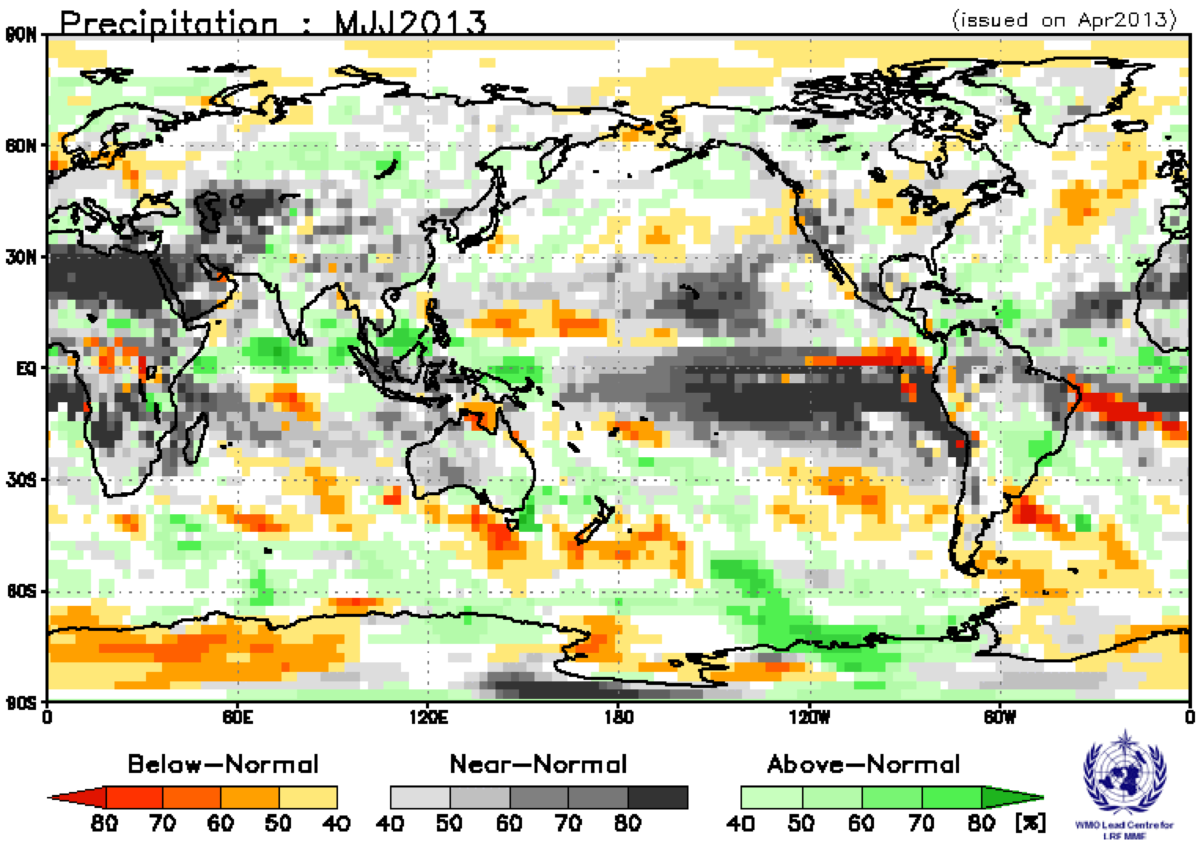


fig.33: **Most likely category of Rainfall for MJJ, issued in April from CPC.** https://www.wmolc.org/

II.4.e Japan Meteorological Agency (JMA)

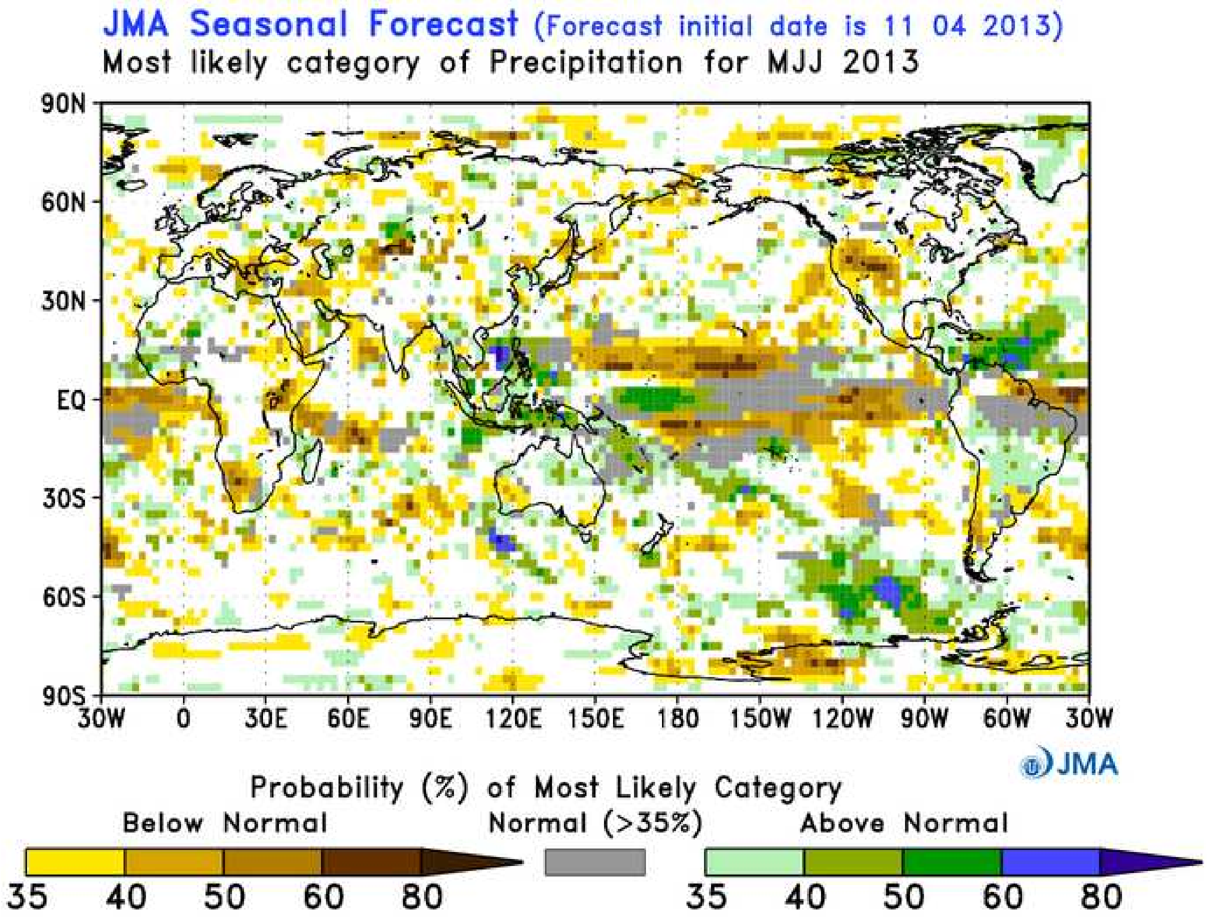


fig.34: Most likely category of Rainfall for MJJ, issued in April from JMA. Categories are Above, Below and Close to Normal. White zones correspond to No Signal. http://ds.data.jma.go.jp/tcc/tcc/products/model/

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

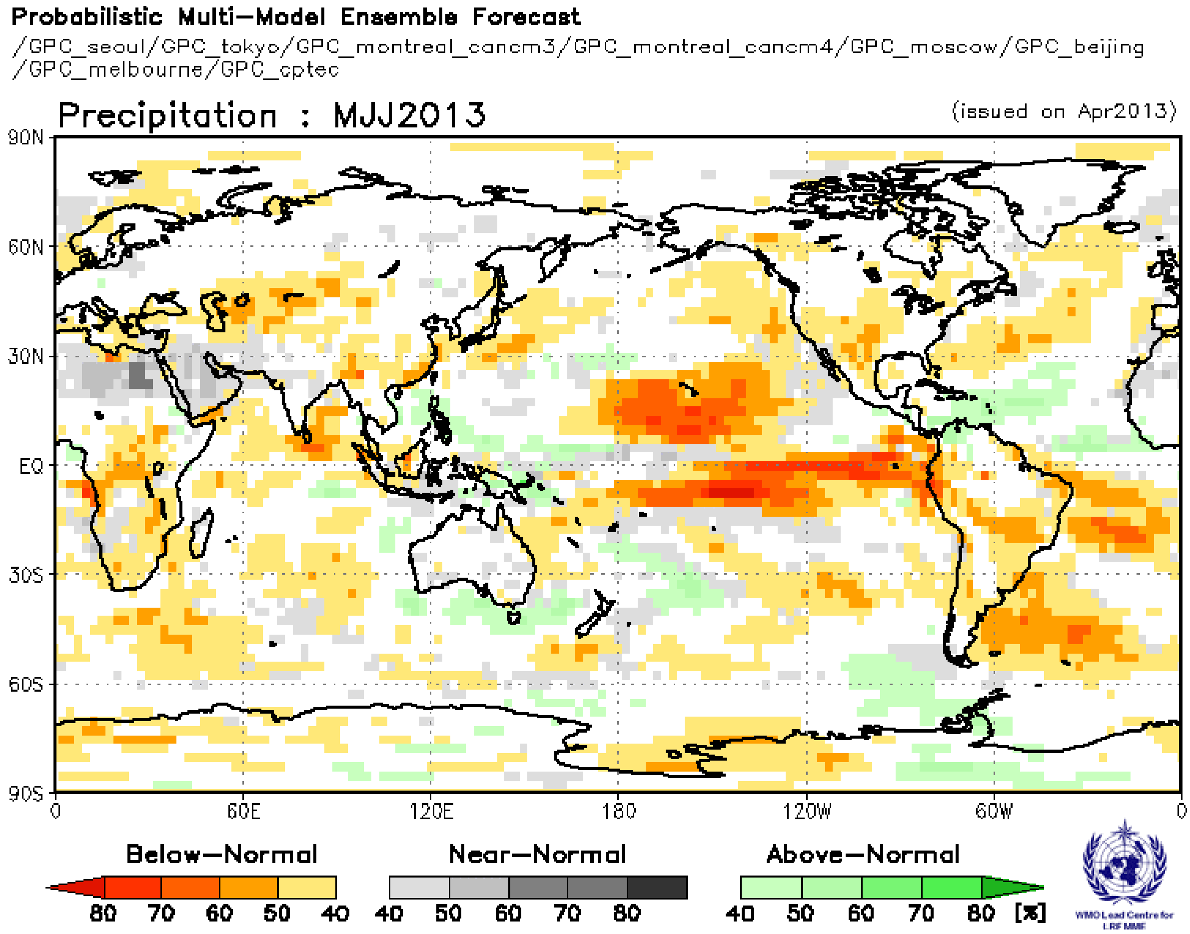


fig.35: **Rainfall MME anomaly for MJJ, issued in April from LC-MME. The MME composition corresponds to the GPCs not used in EuroSIP.** https://www.wmolc.org/

II.4.g Euro-SIP

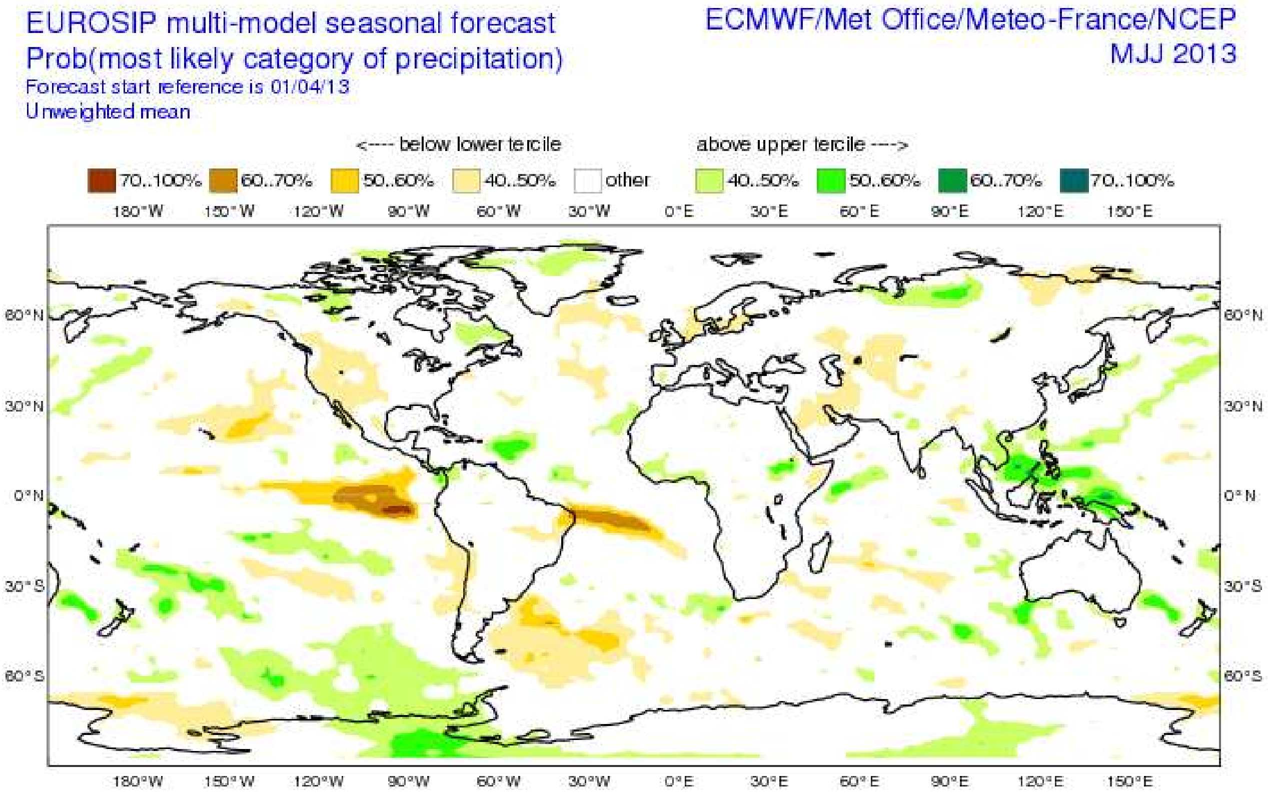


fig.36: Multi-Model Probabilistic forecasts for precipitation from EuroSip for MJJ, issued in April. (2 Categories, Below and Above normal – White zones correspond to No signal).
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmv2/param_euro/seasonal_charts_2tm/

Some consistent signal in the Tropics and especially around the Pacific ; enhanced probabilities for wet scenarios over the maritime continent/part of South-East Asia and SPCZ region, and slightly enhanced probabilities for dry scenarios over the Western side of the North American continent (especially US). **For Europe** No signal everywhere and more generally for most of the mid latitude of Northern Hemisphere, consistently with discussion on predictability and teleconnections.

II.5. REGIONAL TEMPERATURES

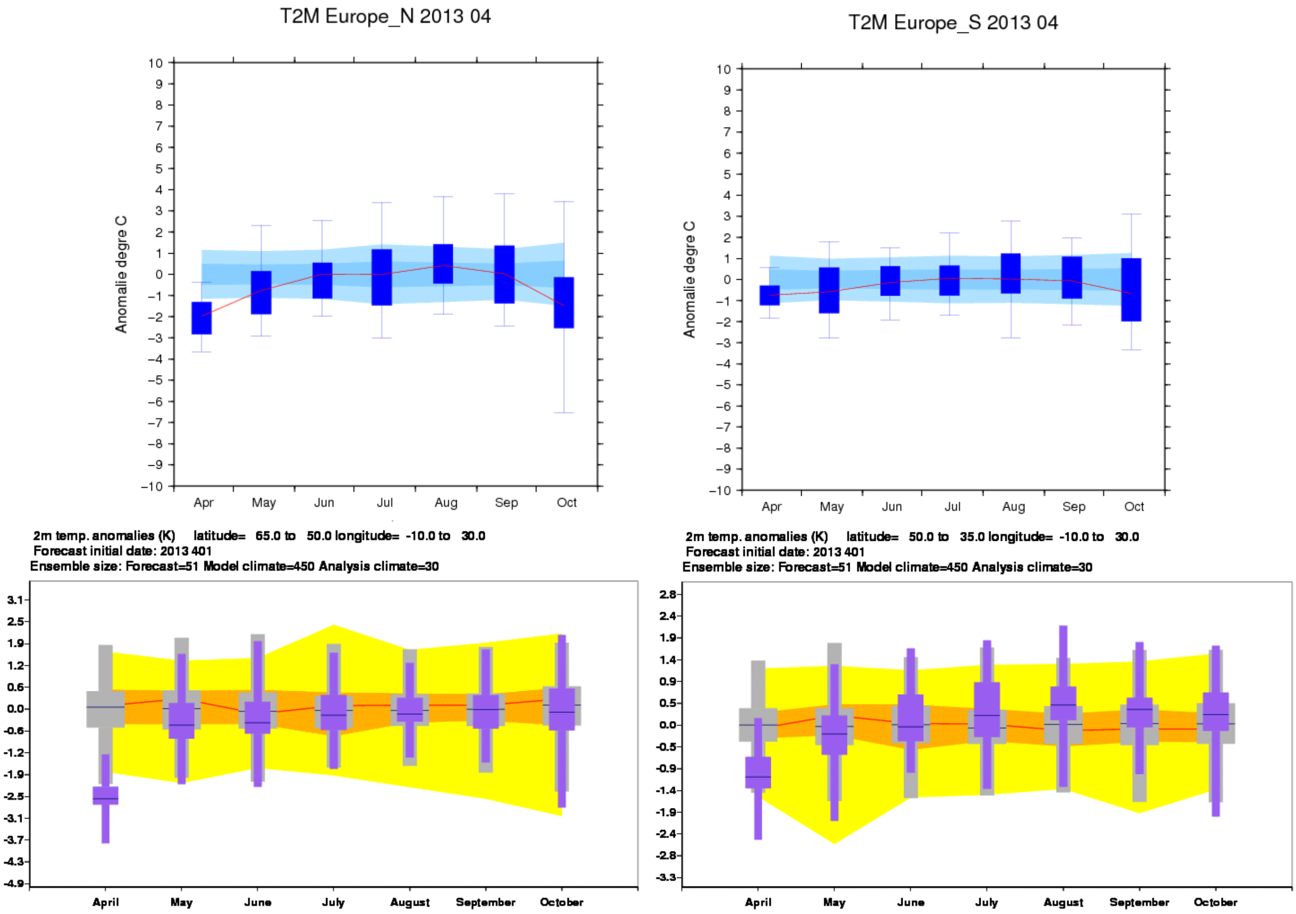


fig.37: Climagrams for T2m in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom) issued in April.

For both Northern and Southern Europe : quite consistent signal between the 2 models. Starting with colder than normal conditions in May and progressively moving toward close to normal conditions (or event Above normal in ECMWF since August) . However, note the large spread (with respect of the climate reference).
Take care that due to the system change (from system 3 to system 4) the verification scores are not available yet.

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

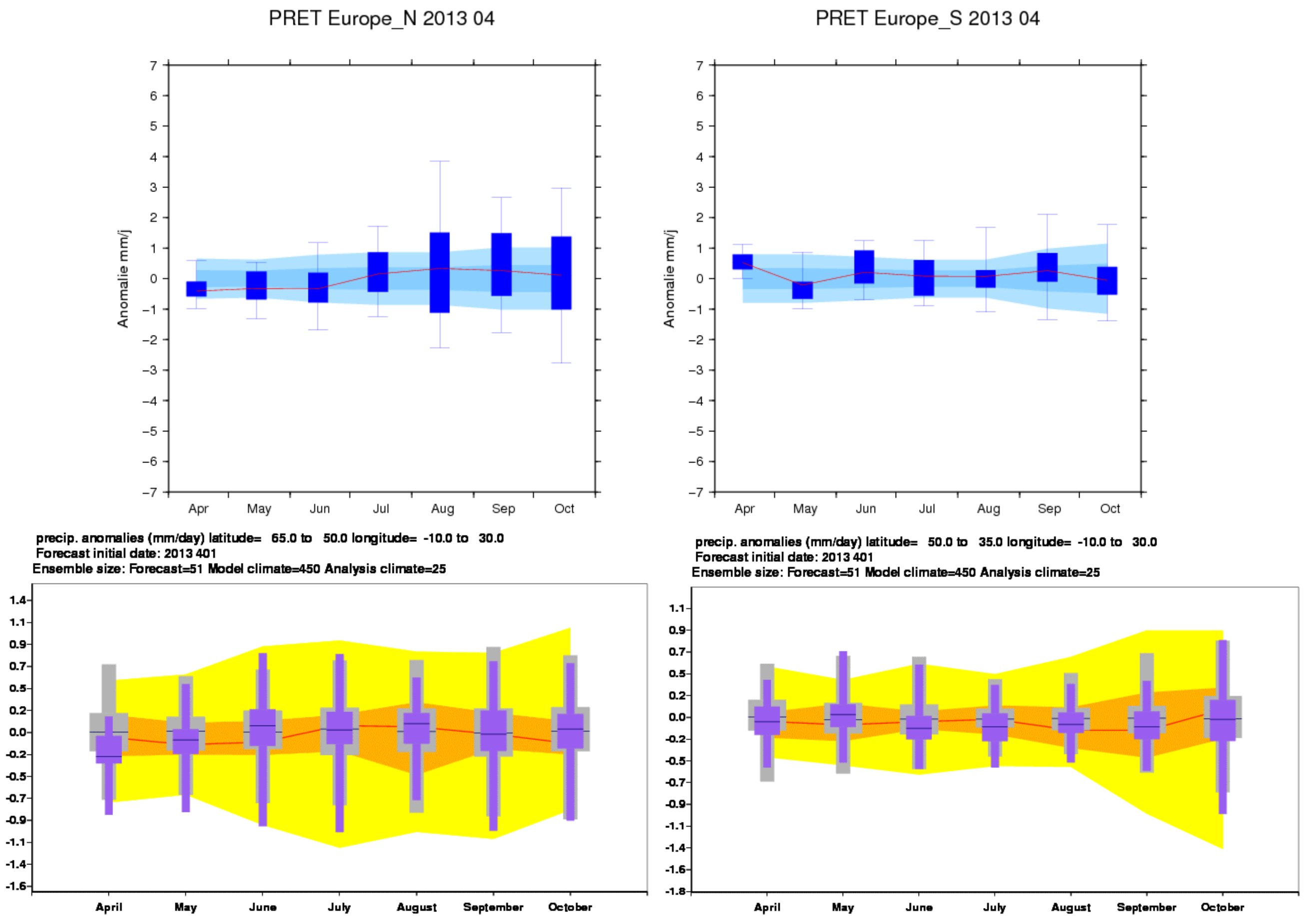


fig.38: Climagrams for Rainfall in Northern Europe (left) and in Southern Europe (right) from Météo-France (top) and ECMWF (bottom), issued in April.

For Northern Europe : Large spread in the evolution of the 2 models. In MF, starting with below normal and reaching close to normal conditions in July and then Above normal conditions. In ECMWF, starting with below normal conditions and then showing Above normal conditions up to July then close to normal conditions.

For Southern Europe : Here also the spread is larger than the climate reference. Signal close to climatology in ECMWF and MF.

Adding the low predictability consideration, these intraseasonal evolutions should be considered as indicating No Signal.

Take care that due to the system change (from system 3 to system 4) the verification scores are not available yet.

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

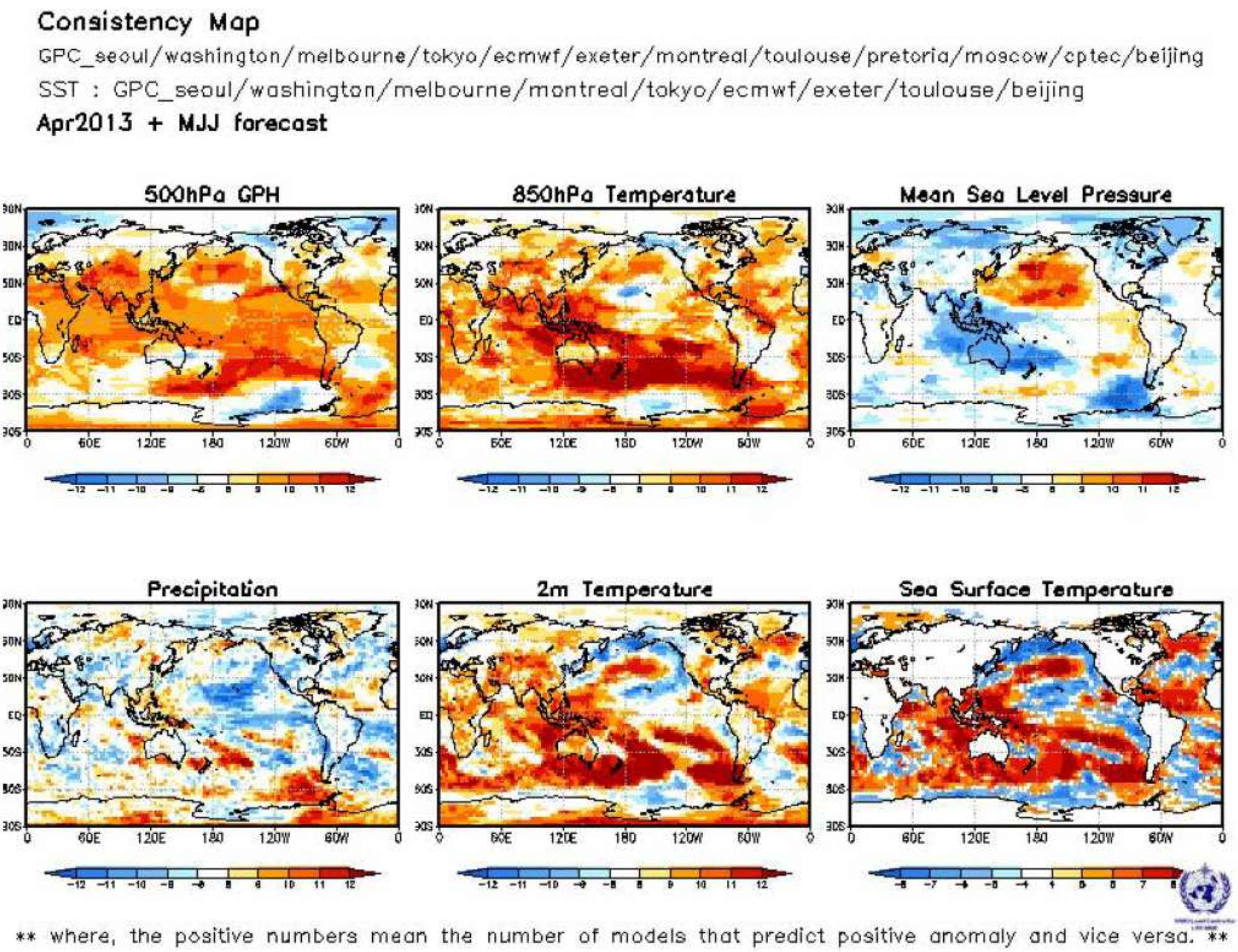


fig.39: ***GPCs Consistency maps from LC-MME*** http://www.wmolc.org/

For SST : Quite large consistency over most of the Pacific, the Atlantic and the Eastern and equatorial Indian Ocean ; Less consistency on the Central Pacific and South-West Indian Ocean.

For Z500 : Across the Atlantic sector poor consistency in the mid-latitudes and relatively better consistency (Above normal conditions) in the Northern Tropics.

For T2m : Consistent signal over a large portion of Asia, the maritime continent, from Central Africa up to the Caspian sea, the most Southern part of South America. For Europe, there is only a little consistency over the Iberic Peninsula.

For precipitation : some robust signal ; Dry scenario over the Western US, The most North-East of Brazil, regions close to the Caspian sea. Wet scenario over the maritime continent, close to the SCPZ region, close to Cameroon and the Caribbean.

II.7. "EXTREME" SCENARIOS

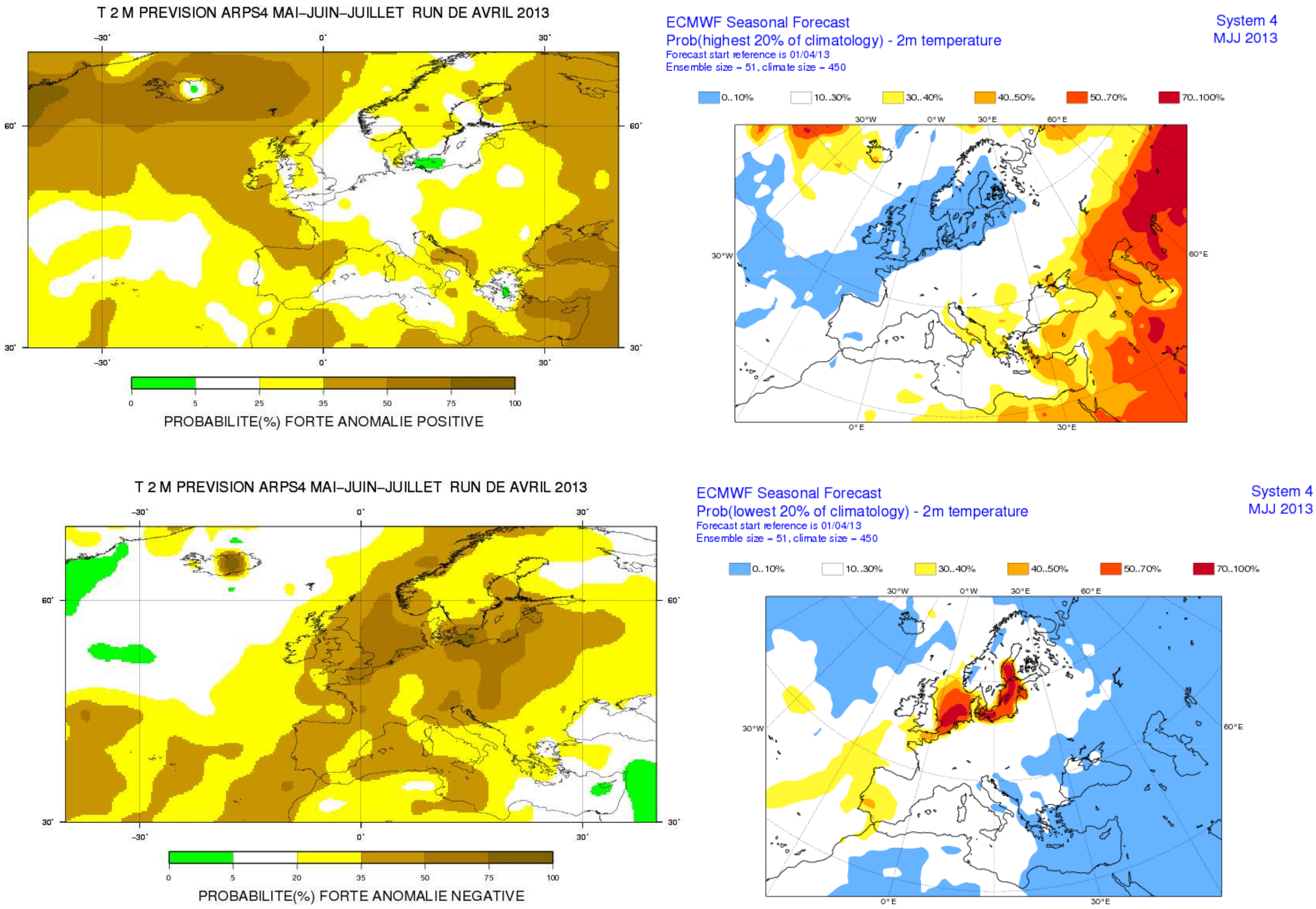


fig.40: Top : Probability of « extreme » above normal conditions for T2m for Meteo-France (left - highest ~15% of the distribution) and ECMWF (right - highest 20% of the distribution).
Bottom : Probability of « extreme » Below normal conditions for rainfall for Meteo-France (left - lowest ~15% of the distribution) and ECMWF (right – lowest 20% of the distribution).
For MJJ, issued in April.

No consistency between the 2 models for the Very Above Normal scenario to the exception of the most Eastern regions of Europe where there is some enhanced probabilities for Very Above temperatures.
No signal for very Below Normal scenario to the exception of the South-West Iberic Peninsula..
So in relationship with the current predictability and the model uncertainties, it seems difficult to use these forecast.
Take care that due to the system change (from system 3 to system 4) the verification scores are not available yet.

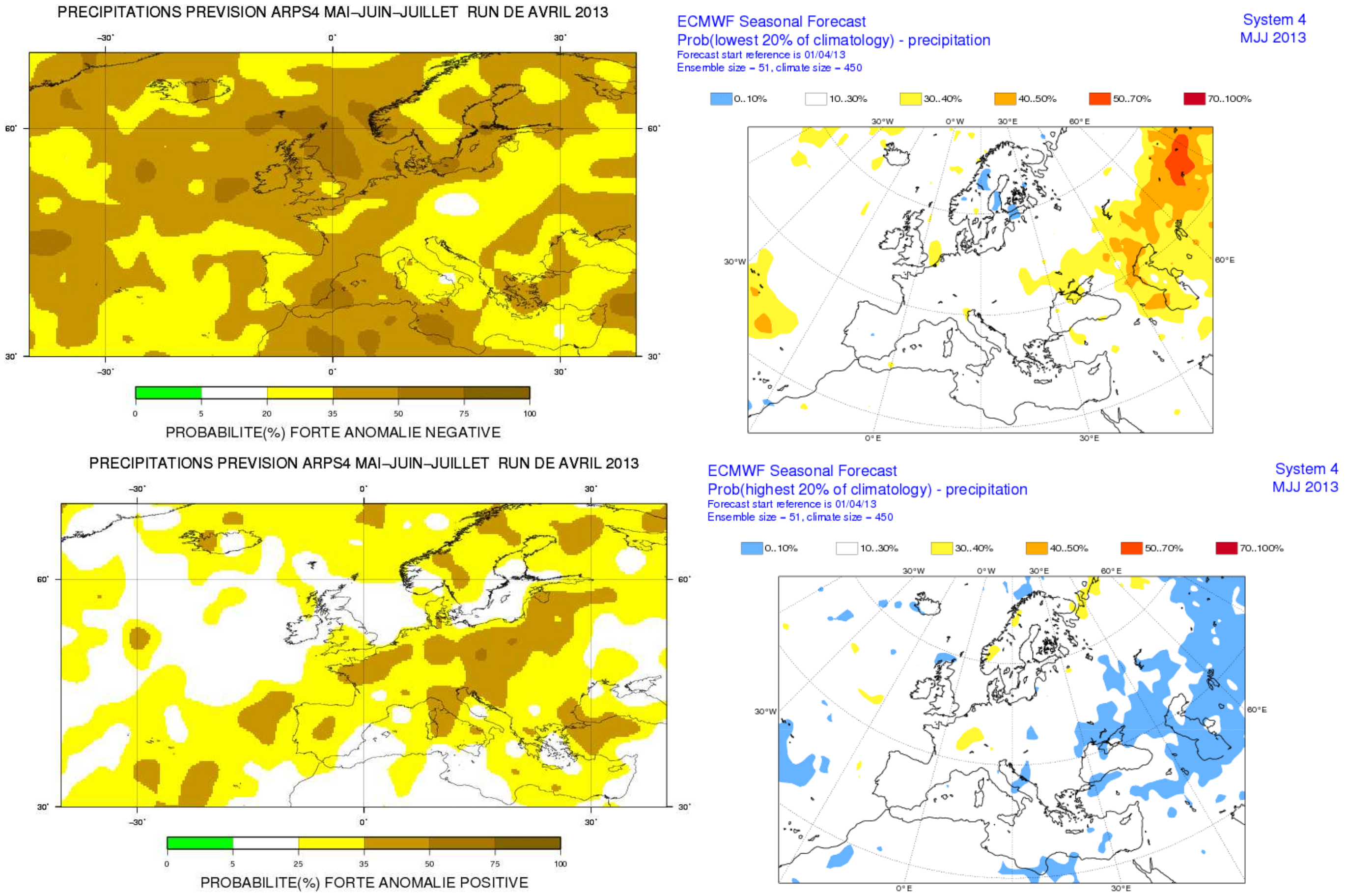


fig.41: Top : Probability of « extreme » Below normal conditions for rainfall for Meteo-France (left - lowest ~15% of the distribution) and ECMWF (right - lowest 20% of the distribution)
Bottom : Probability of « extreme » Above normal conditions for rainfall for Meteo-France (left - highest ~15% of the distribution) and ECMWF (right – highest 20% of the distribution).
For MJJ, issued in April.

Mostly No signal in ECMWF (to the exception of the most Eastern regions) while there are traces of divergent scenarios in MF (enhanced probabilities for both extreme scenarios across the continent).
So in relationship with the current predictability and the model uncertainties, it seems difficult to use these forecast.
Take care that due to the system change (from system 3 to system 4) the verification scores are not available yet.

II.8. DISCUSSION AND SUMMARY

Forecast over Europe

For this forecast the first and main comment is about the predictability in the climate system. The oceanic forcing is low more or less everywhere and no teleconnection patterns seem to be present in the forecasts. As a consequence for Europe the predictability is very limited at seasonal scales.
So in such a context, 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.
For temperature : Even for temperature, there is a large uncertainty over most of the European continent (No privileged scenario). However, the Above Normal scenario could prevail for the most South-Eastern Europe.
Obviously, some downscaled information could details these scenarios for specific countries or sub-regions.

Tropical Cyclone activity

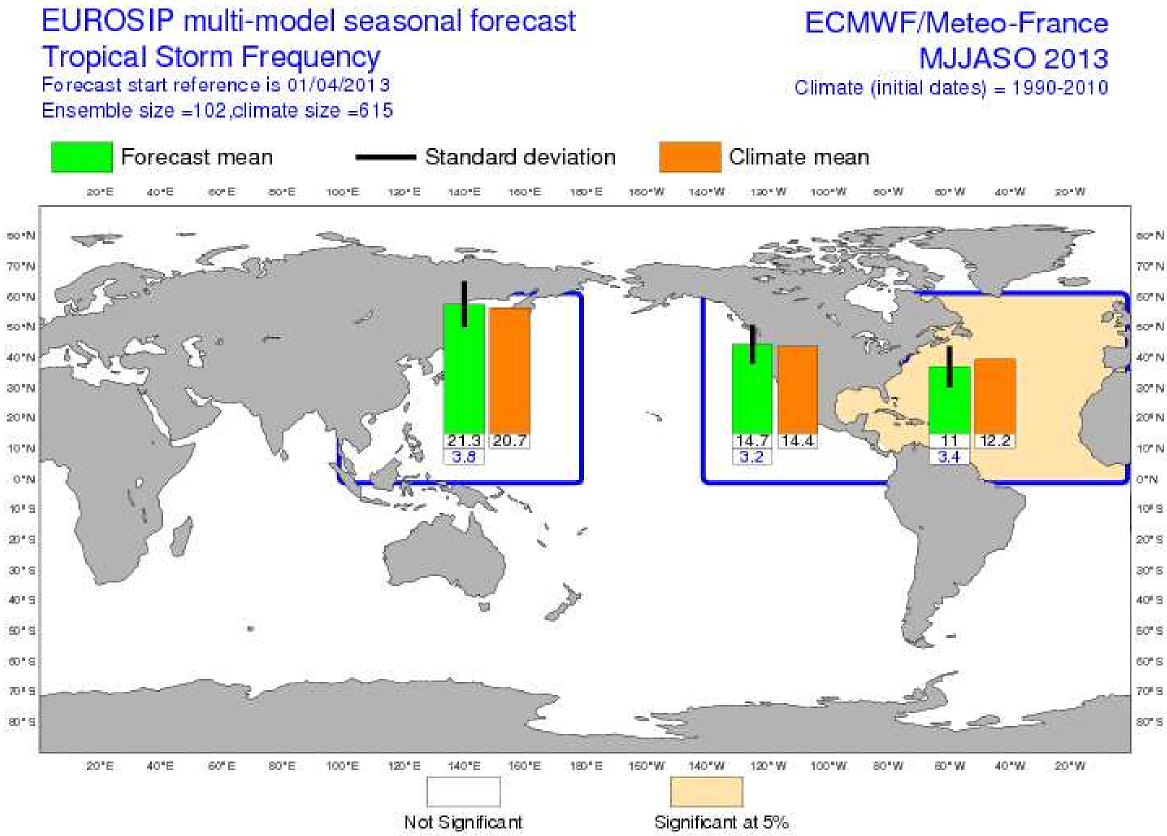


fig.42: Seasonal forecast of the frequency of Tropical Cyclones from EUROSIP (Météo-France & ECMWF) for the AMJJAS period, issued in March.
http://www.ecmwf.int/products/forecasts/d/charts/seasonal/forecast/eurosip/mmtrop/trop_euro/eurosip_tropical_storm_frequency/

For the Tropical Cyclone season and in relationship with the low oceanic forcing, Euro-Sip forecasts indicate a close to normal condition over the Pacific and Below normal activity for the Tropical North Atlantic basin.

Synthesis of Temperature forecasts for May-June-July 2013 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*

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

WMO RA VI
Pilot RCC-Network

Synthesis of Rainfall forecasts for May-June-July 2013 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*	*no privileged scenario*

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.

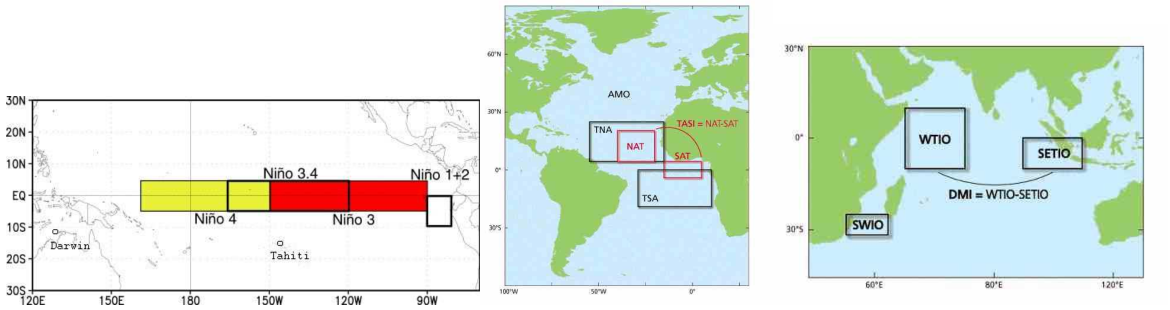
III.2. « NINO », SOI INDICES AND OCEANIC BOXES

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.