# Météo-France Seasonal Forecast Bulletin

JULY - AUGUST - SEPTEMBER 2022

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# General synthesis : JAS 2022

In the Pacific Ocean, an atmospheric reponse of type "La Niña" should continue in the coming months. In parallel, the Indian Ocean Dipole should strengthen (mainly due to a warming anomaly close to the maritime continent). These two forcings contribute to strong modifications in the tropical circulation (see VP & SF 200hPa), and lead to a higher predictability than usual. In mid-latitudes, even if we don't detect clear teleconnexions, it could explain (at least partly) the good consistency between models in terms of Z500 circulation, and the high values of probabilities for T and RR in Europe.

**A) Oceanic forecast** :

- ENSO : La Niña or neutral index. Atmospheric reponse like "La Niña"

- IOD : negative

- Equatorial Atlantic : warm anomaly

**B) Drivers :**

- "La Niña" and negative IOD

**C) Atmospheric circulation :**

The expected atmospheric circulation is characterized by a positive Z500 anomaly stretching from the United States to Europe. This pattern is close to a NAO+ and EA+ situation.

**D) Most likely conditions :**

The warm tercile is the most probable over a large part of Europe.

The dry tercile is most likely on a large part of southern Europe. No scenario elsewhere.

**Next bulletin : scheduled on July 22th**

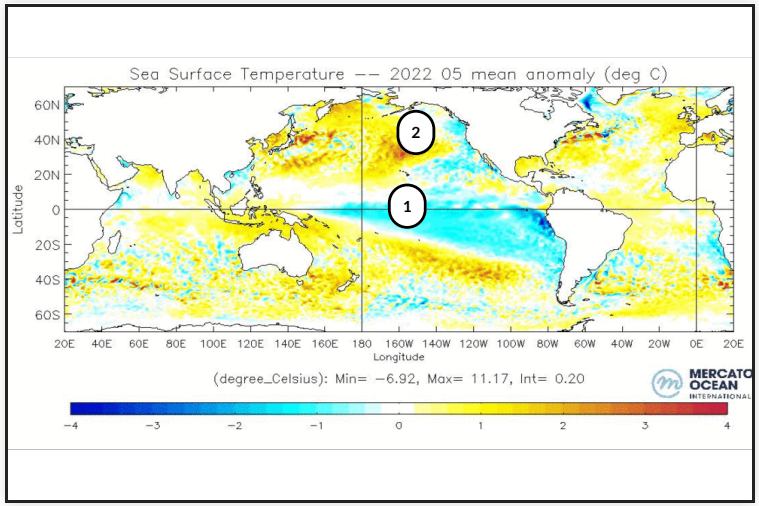
# Oceanic analysis of May 2022 : SST anomalies

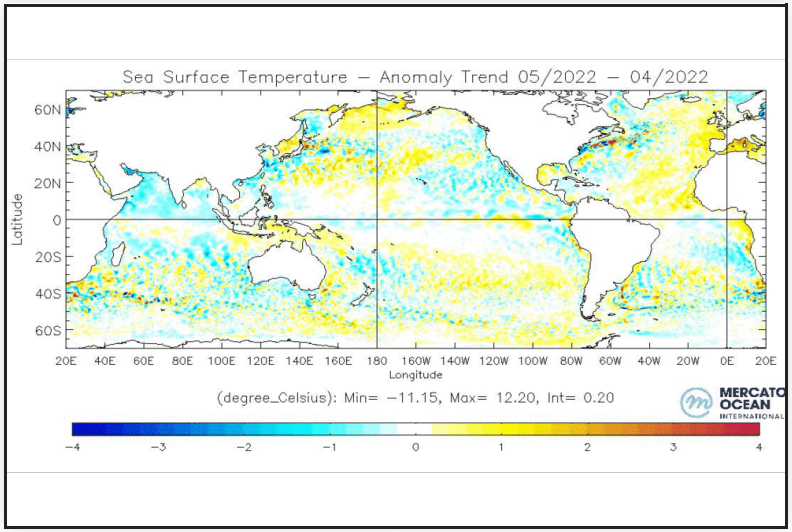
## Current ENSO situation : moderate La Niña

In the Pacific Ocean : No changes compared to the previous month.  Persistence of "La Niña" anomaly along the equator. In the North Pacific, the PDO- Pattern is still very present.

In the Indian Ocean  : generalised postive anomalies with a slight contrast between west and east (negative IOD)

In the Atlantic Ocean : warm anomalies around the equator. weak anomalies in the tropical north Atlantic. And warm anomalies at mid latitudes in North atlantic



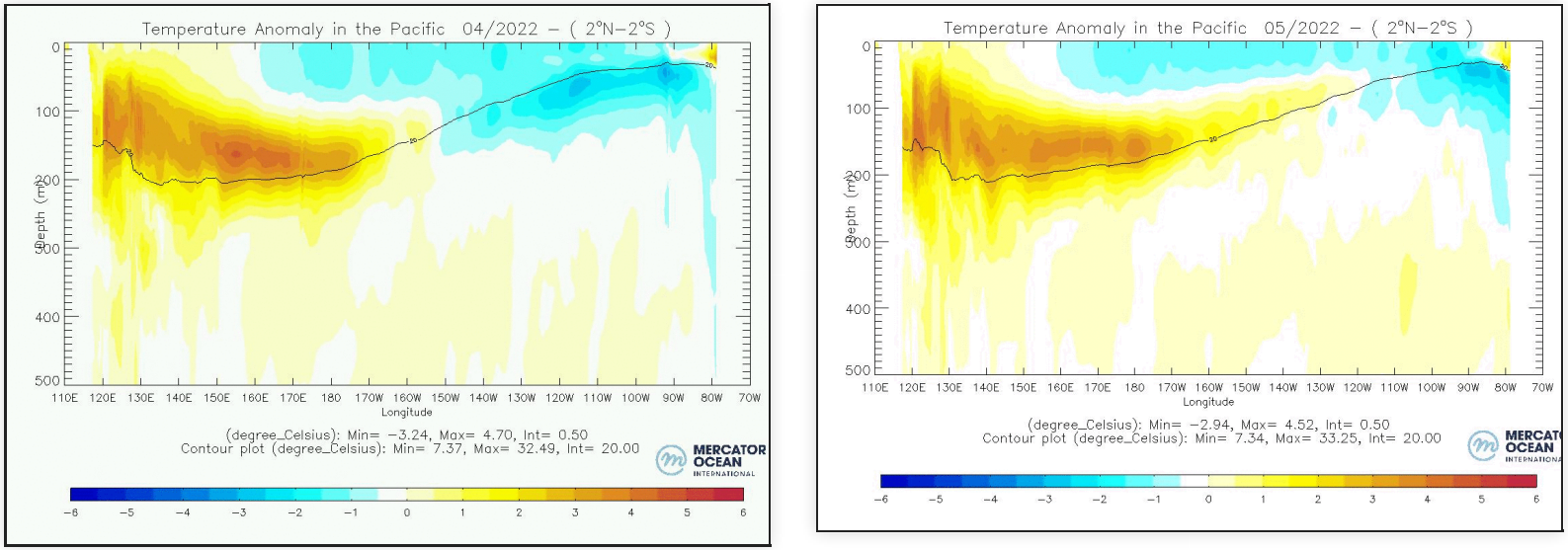




*SST Anomalies and trend with the previous month (c) Mercator-Ocean*

1 - La Niña pattern
2 - Negative PDO pattern

# Oceanic analysis of May 2022 : Pacific vertical section

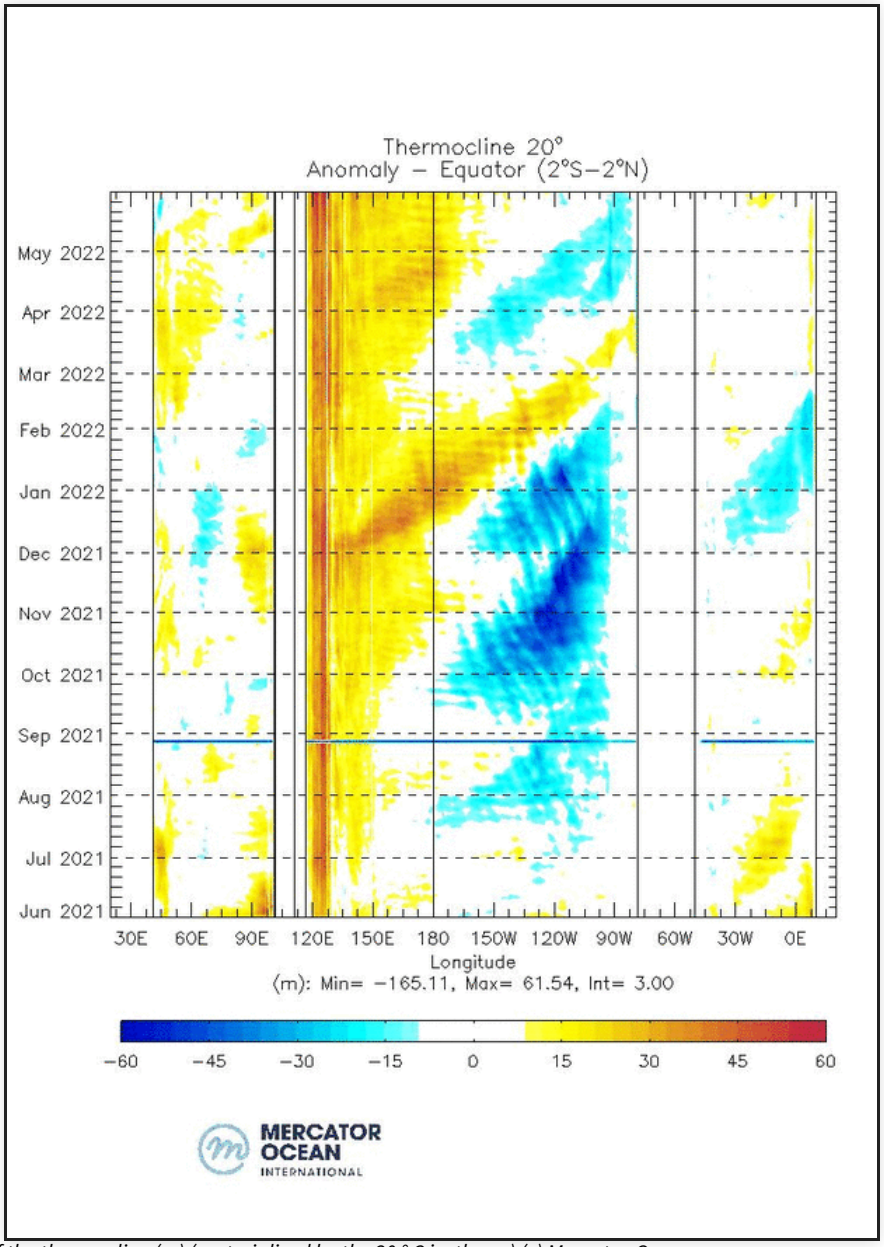
Subsurface heating on the center of the basin in connection with the propagation of a kelvin wave. On the surface no changes : cold and homogenous anomaly.




*Ocean temperature anomalies in the first 500 meters of the equatorial Pacific basin, monthly average. (c) Mercator-Ocean*

## Oceanic analysis of May 2022 : Hovmüller diagram of the 20°C isotherm

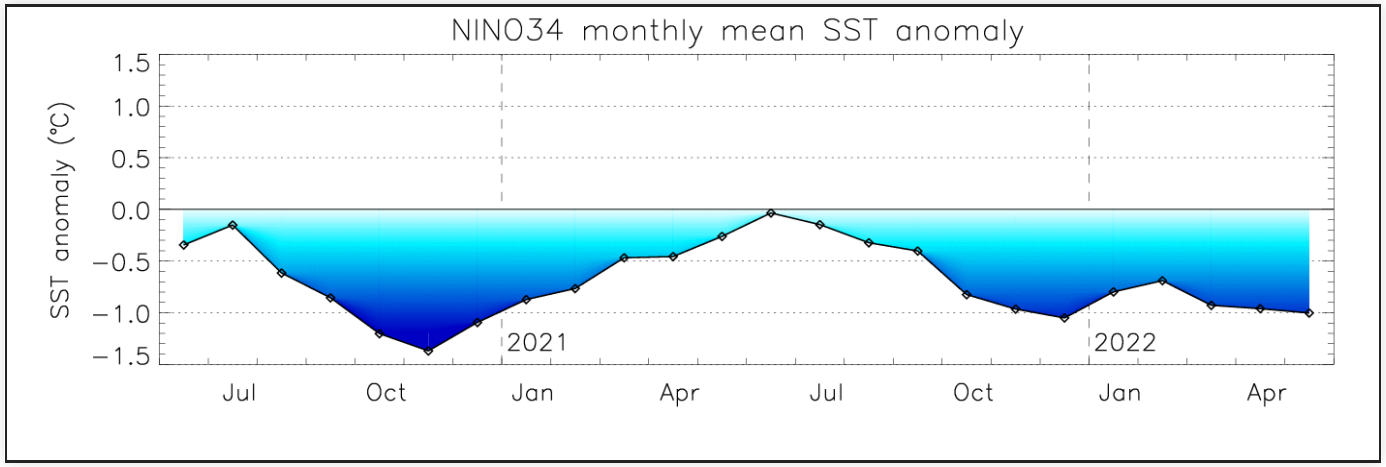
In the Pacific Ocean, the cold Kelvin wave reached the eastern part of the basin in May. And an other (warm) propagated on the center of the basin.




*Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 ° C isotherm) (c) Mercator-Ocean*

# Oceanic analysis of May 2022 : Pacific Ocean - Nino3.4 index history

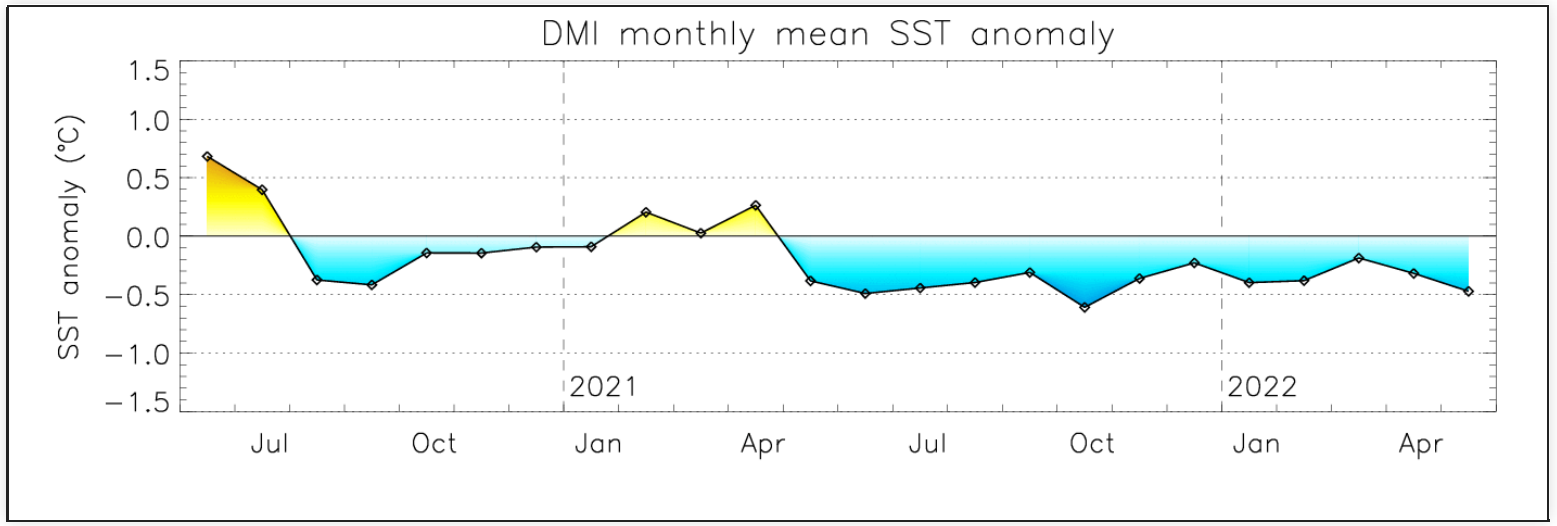
**Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -1.0°C**
BOM weekly values : -0.43°C
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png )




*Evolution of SST in the NINO3.4 box (c) Mercator-Ocean*

# Oceanic analysis of May 2022 : Indien Ocean - DMI index history

**DMI Index issued from Mercator Ocean PSYV4R2 analysis : -0.5°C**
Bom weekly value : -0.37°C
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/iod1.png )




*Evolution of SST in the DMI box (c) Mercator-Ocean*

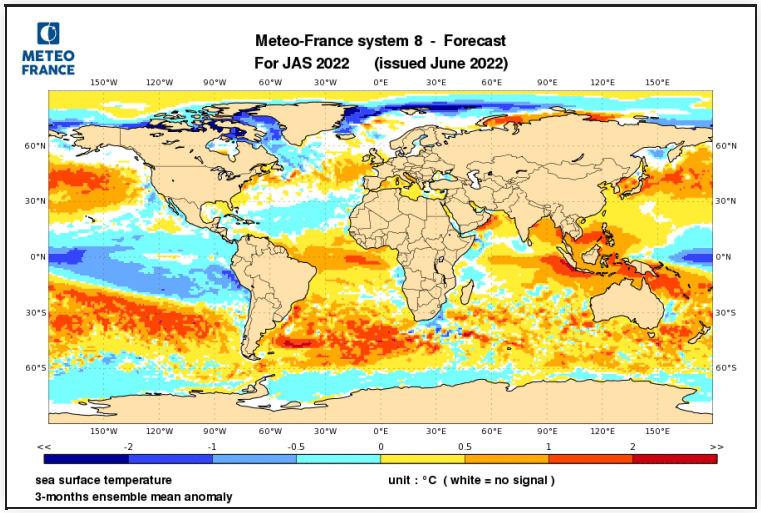
# Oceanic forecast : SST anomaly

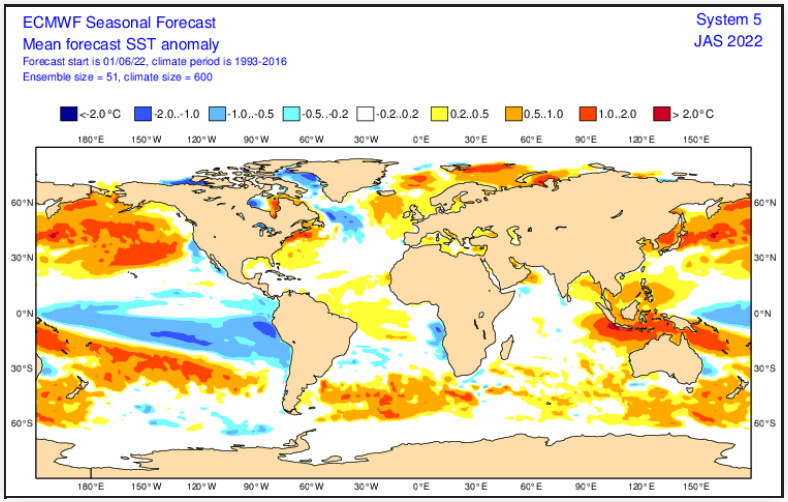
Very good agreement between MF-S8 and ECMWF-SEAS5 in the main anomaly patterns.

In the Pacific Ocean : persistence of the two main patterns, La Niña and PDO - .

In the Indian Ocean : the east/West contrast is stronger compared to the current conditions.

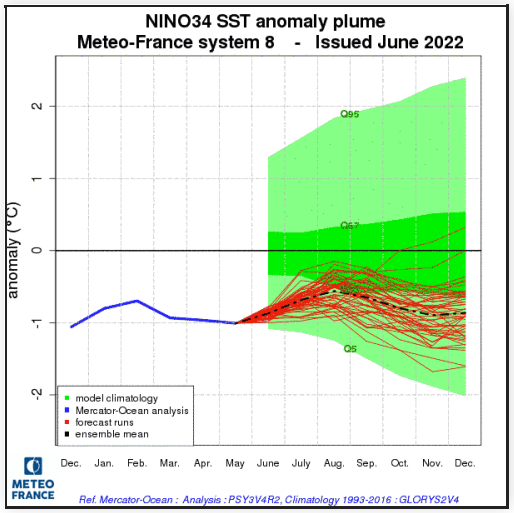
In the Atlantic Ocean : persistence of zonal anomaly patterns. The warm anomaly along the equator is stronger with MF-S8 than with ECMWF-SEAS5. A cold anomaly in tropical North Atlantic with MF-S8, not in ECMWF-SEAS5 : maybe just due to the different color palette thresholds.

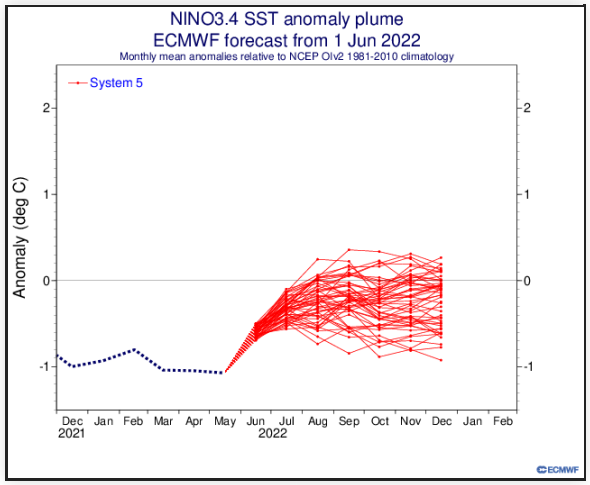


# Oceanic forecast : NINO3.4 Plume diagrams

Noticeable difference in the evolution of La Niña.

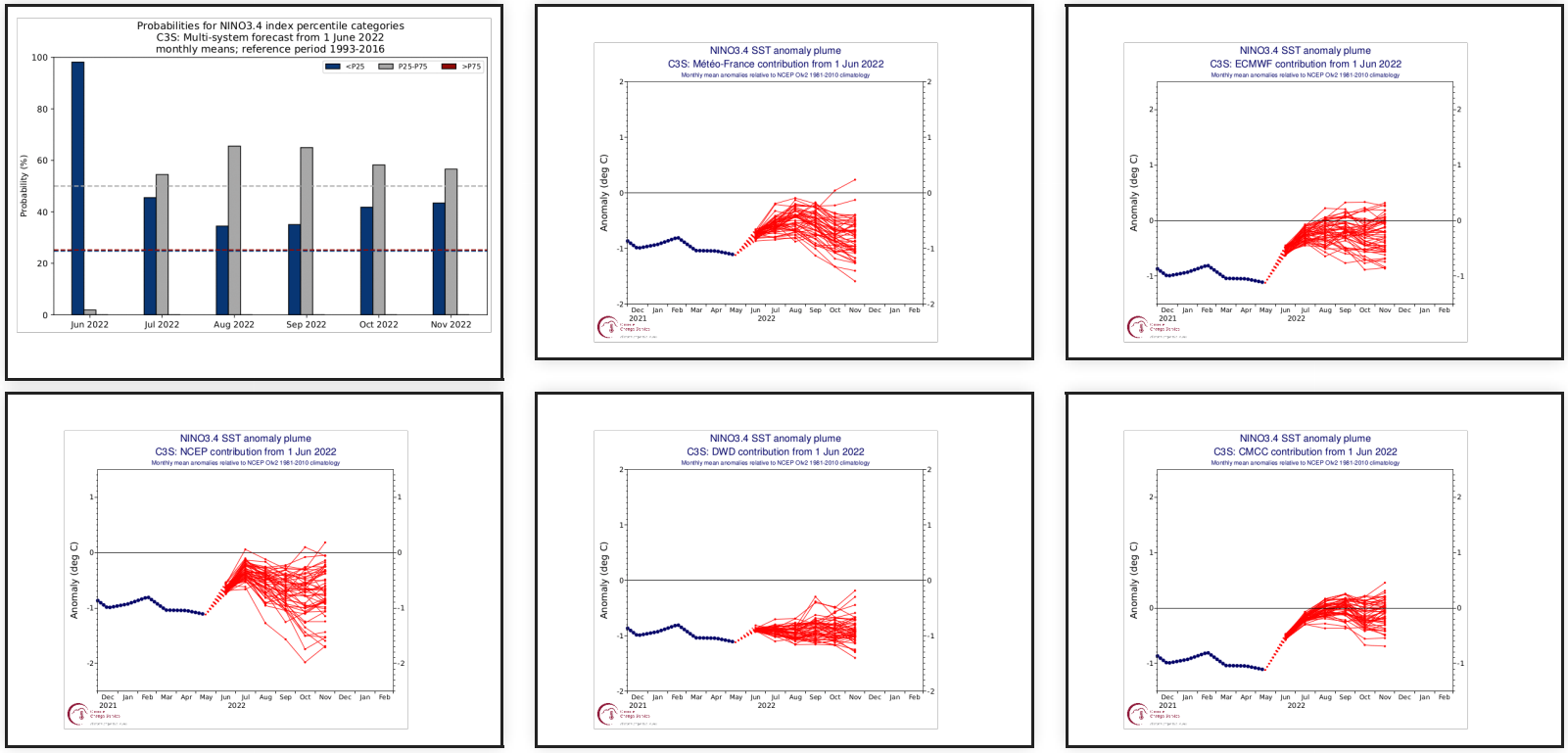


# Oceanic forecast : C3S Nino3.4 re-scaled plume diagrams

This index has recently risen and is currently around -0.5°C. The models are split between a neutral scenario or a weak la Niña for the coming months. And as seen before, the SST anomaly pattern remains a "La Niña".

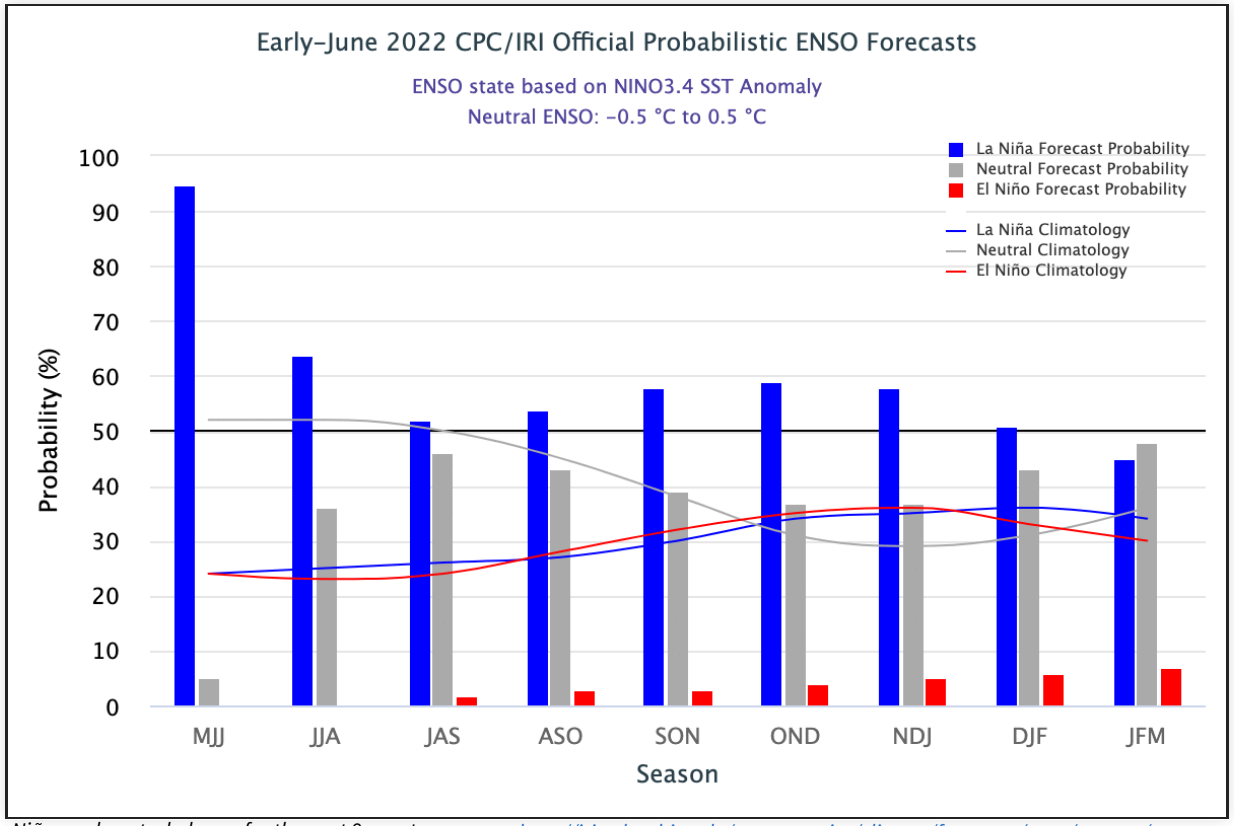
**The most likely phase for the next three months : Neutral or weak La Niña.**




*C3S multi-system probabilty forecast (top left figure) and C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010.*

# Oceanic forecast : Synthesis from IRI

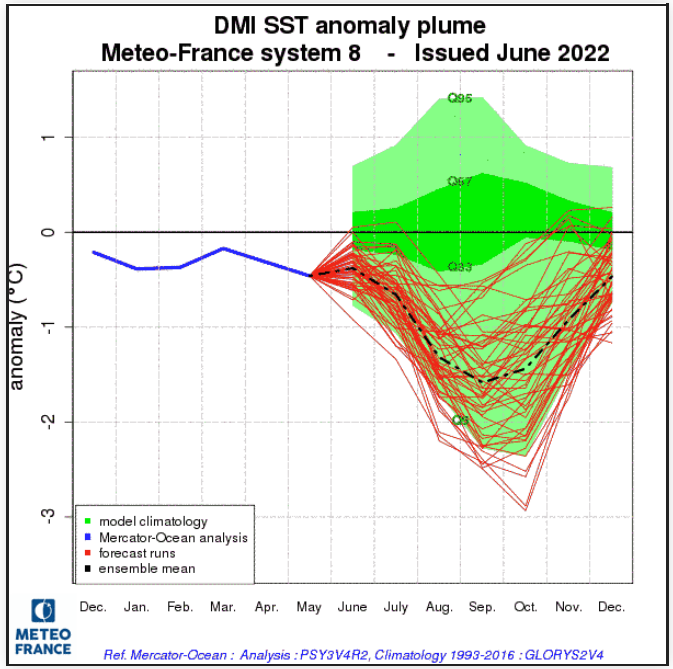
IRI forecast : about 50% chance of "La Nina" and 45% of neutral condition for JAS. This is conform to C3S forecast.

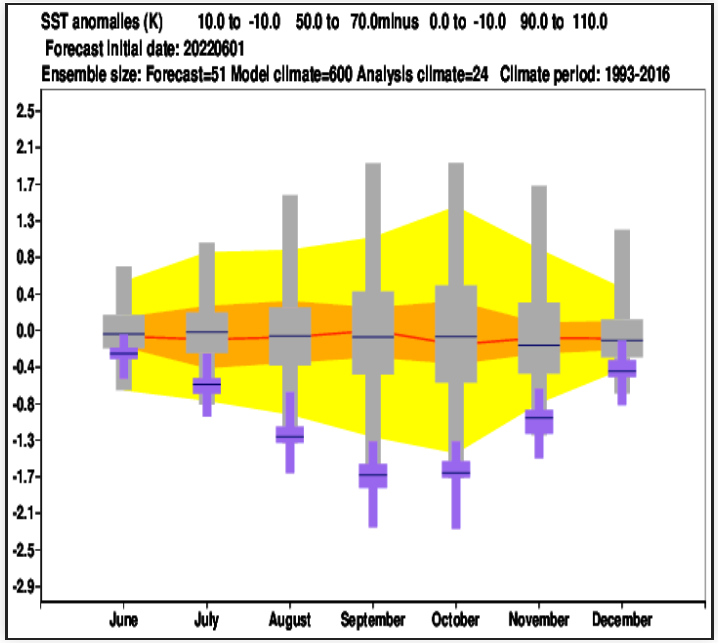



*Probability of Niño, Niña, and neutral phases for the next 8 quarters. source* *http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/*

# Oceanic forecast : Indian ocean - DMI evolution

Very negative DMI expected in the coming months, for the two models.



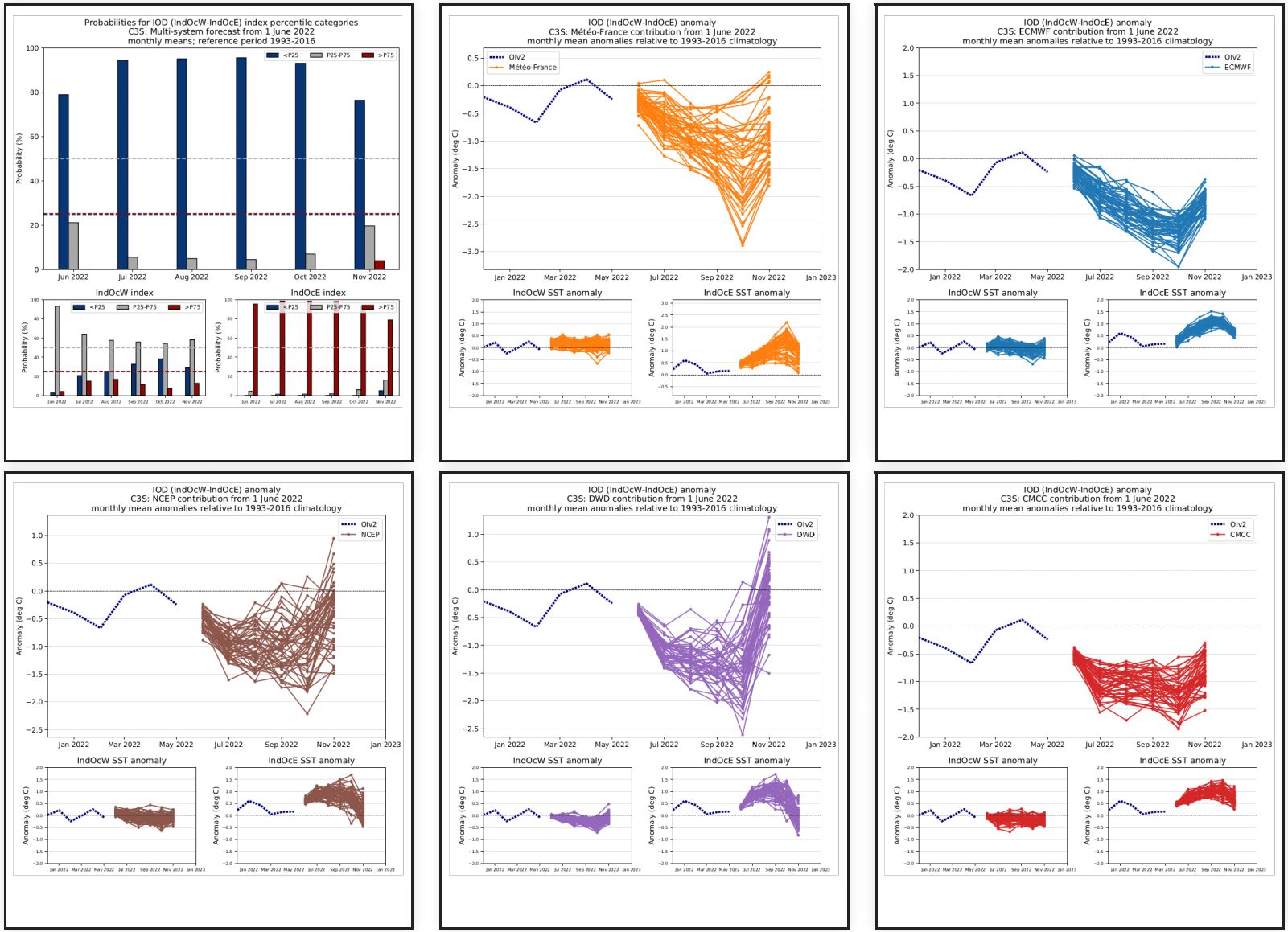




*DMI index : analysis, forecasts and model climatology with MF-S8 on the left and ECM-SEAS5 on the right*

# Oceanic forecast : C3S IOD re-scaled plume diagrams

Good agreement between C3S models on a marked warming in the east box, responsible for a negative IOD .

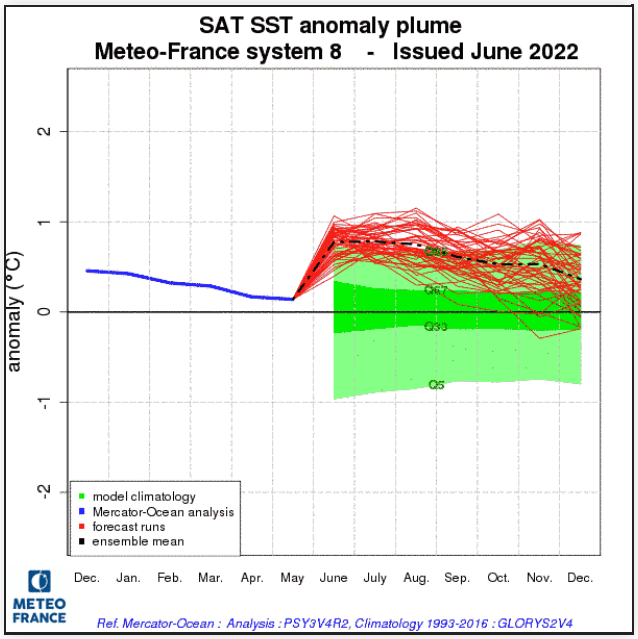
**Expected Phase for the next three months : negative.**

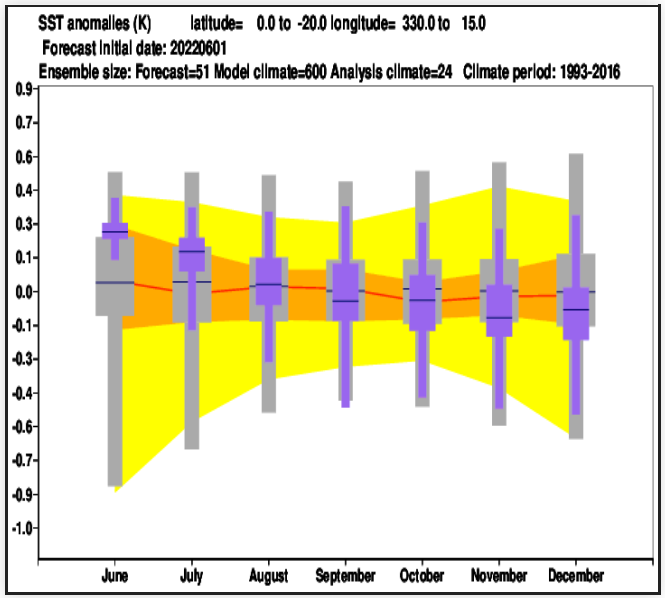



*C3S multi-system probabilty forecast (top left figure) and C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010.*

# Oceanic forecast : Atlantic ocean - SAT evolution

The two models forecast warmer than normal conditions with a more marked amplitude for MF-S8.



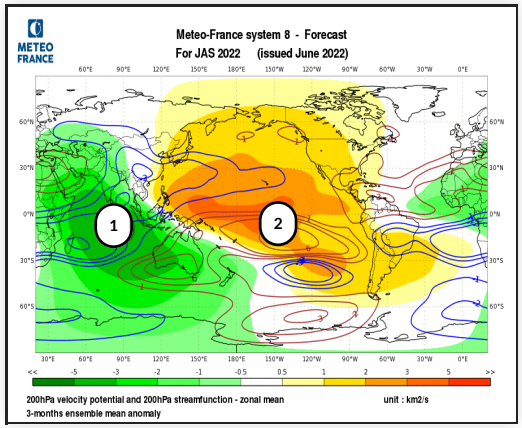

*Anomaly on the SAT box : analysis, forecasts and model climatology with MF-S8 on the left and SEAS5 on the right*

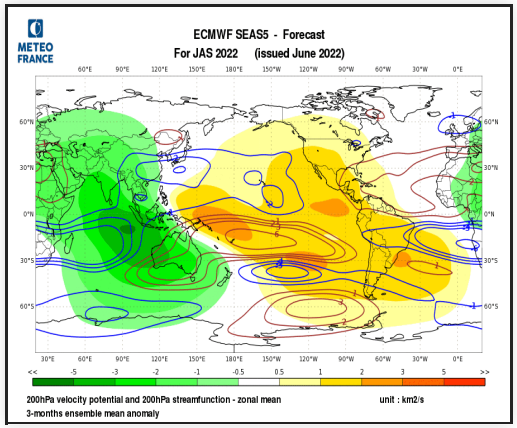
# Atmospheric circulation forecasts : velocity potentiel and stream function at 200hPa

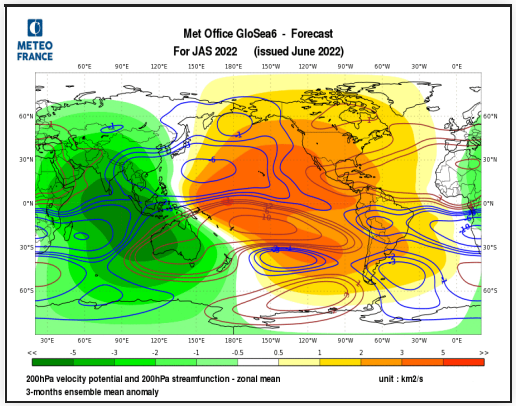
Good agreement between models.

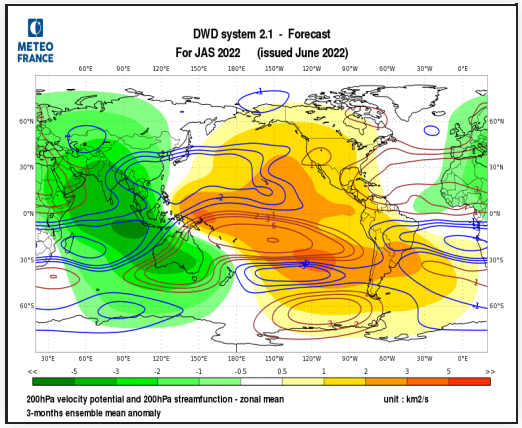
Velocity Potential : strong dipole with downward anomaly motion over the Central Pacific (linked to La Niña) and upward anomaly motion on the east of the Indian Ocean (link to the negative IOD), with an extension up to Africa. Over the Atlantic, some differences between models.

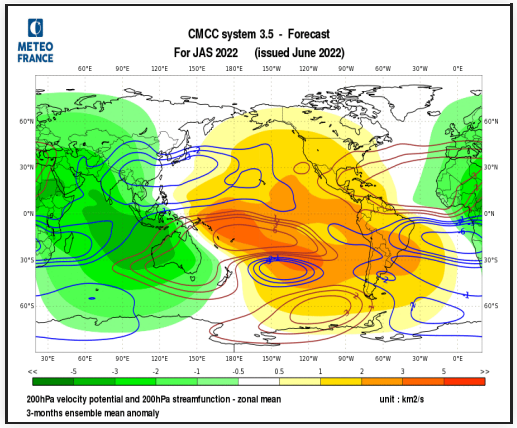
Streamfunction : strong dipole around the equator over the Pacific, but no teleconnection visible in the North Pacific. In North Atlantic and North Africa, even if models differ in VP200, they quite agree on a positive anomaly over the Northern tropics.

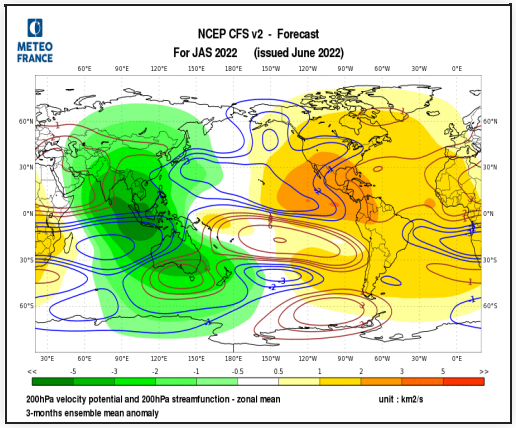


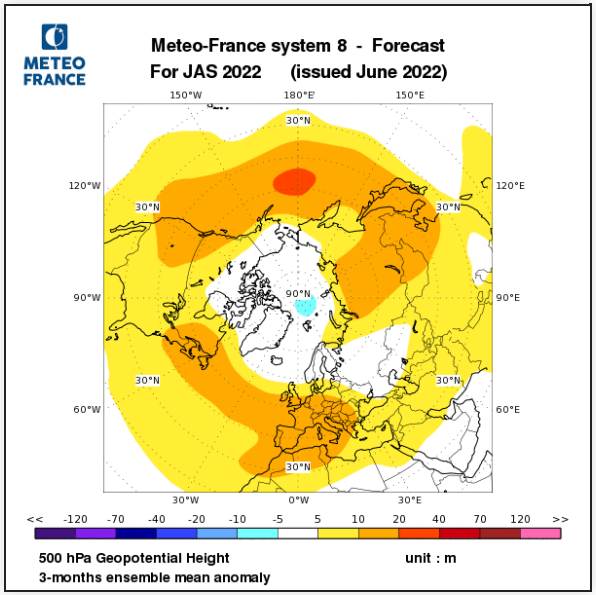

*MF8,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).*

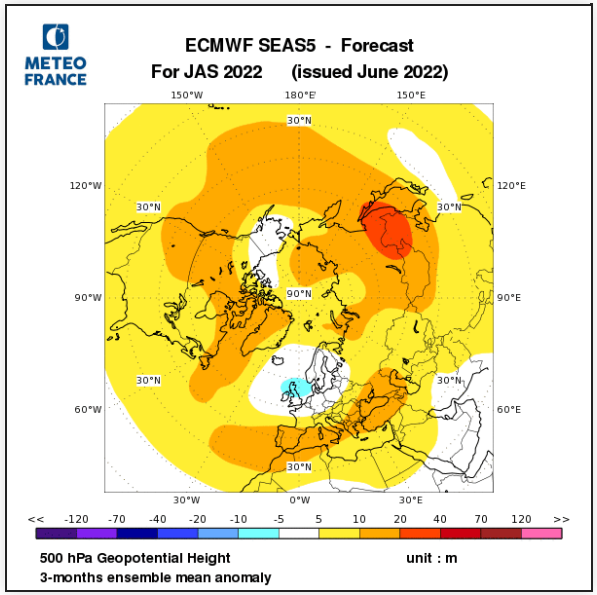
1 - VP : upward motion anomaly related to La Nina and the SST anomaly gradient in the Indian Ocean
2 - VP : downward motion anomaly related to La Nina

# Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Significant differences over North America (MF8 looks like PNA - while SEAS5 has a PNA- pattern shifted to the west. They differ around Europe, where MF8 forecasts a large positive geopotential anomaly while SEAS5 predicts a dipole (negative in the north and positive in the south)

Note that the high values over Europe avec partly due to the climate trend (see http://seasonal.meteo.fr/sites/data/Modeles/MF8/clim/Z500/Z500_MF8_TrendBTrim_1993-2016_06_Globe_LT1.gif ).

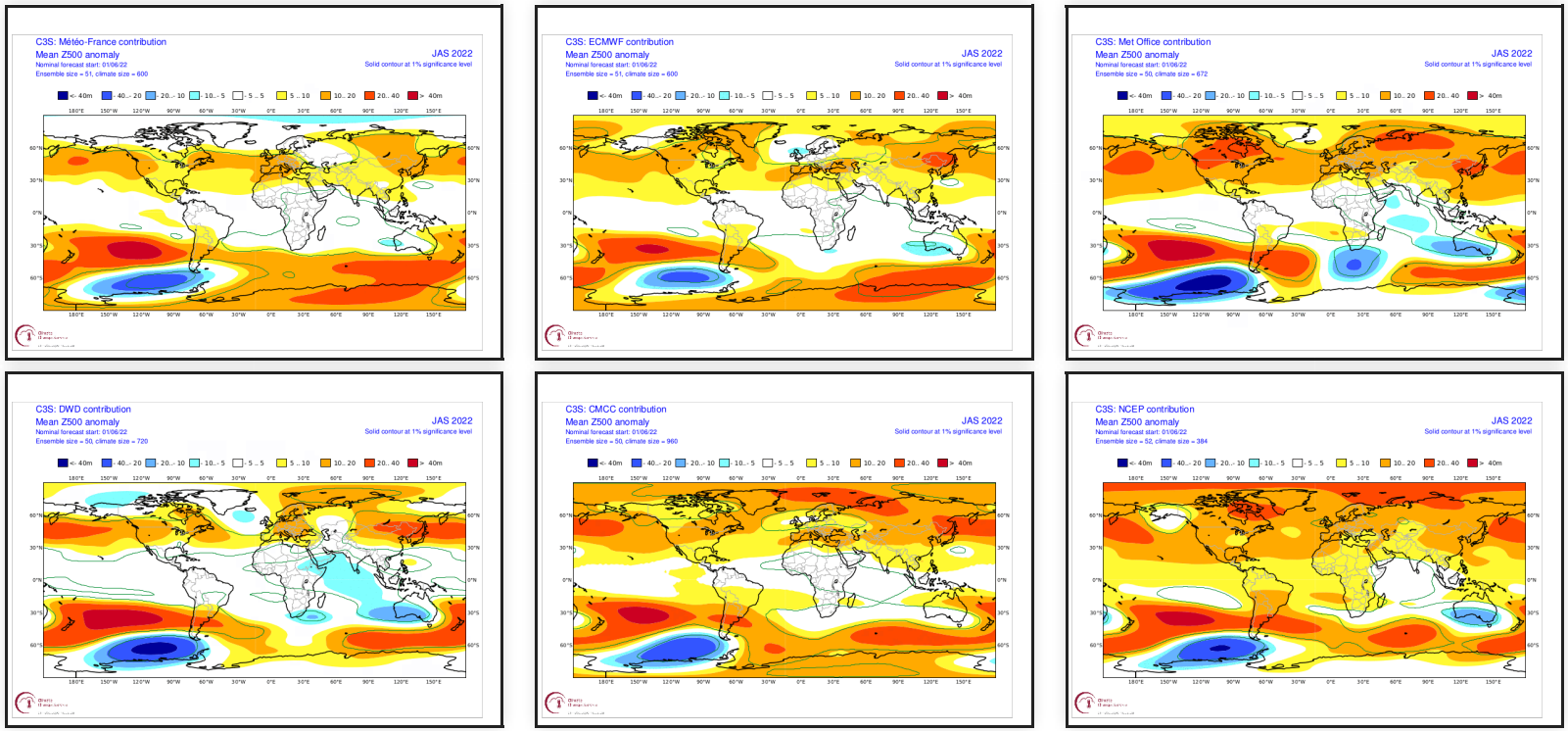



*polar projection of MF8 and SEAS5 500hPa geopotential height anomalies.*

# Atmospheric circulation forecasts : Z500 anomalies in C3S models

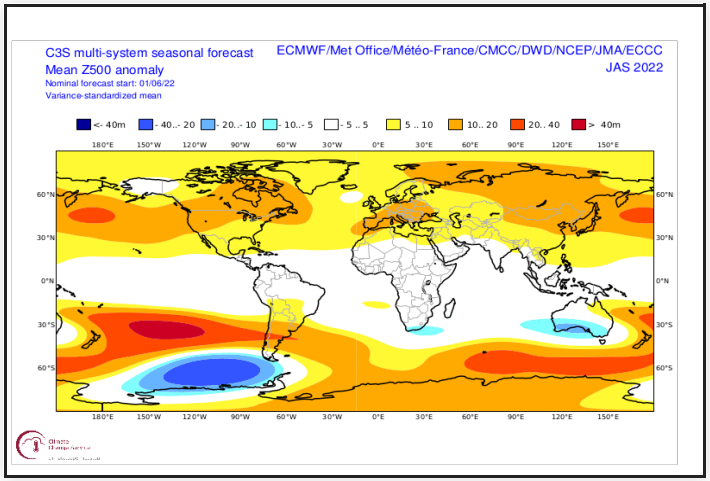
All models agree in forecasting a positive anomaly from Quebec to Europe.



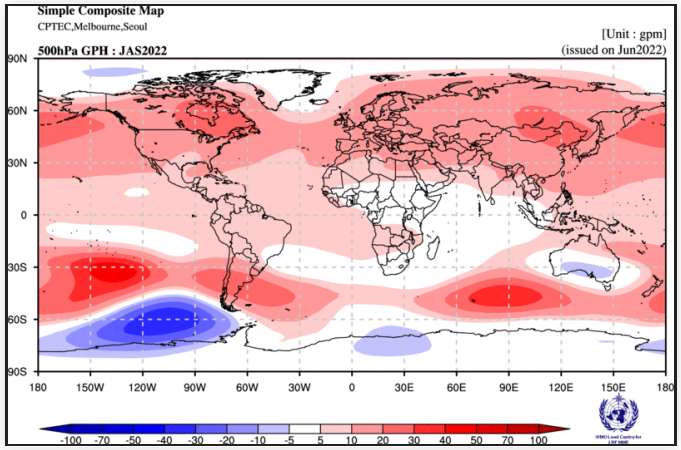

*MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.*

# Atmospheric circulation forecasts : Z500 anomalies multi-systems

Similarities between models, in the southern hemisphere due to teleconnections and in the northern hemisphere where the signal is shifted towards positive anomalies due to climate change.




*C3S multi-models (MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC, NCEP, JMA, ECCC) 500hPa geopotential height anomalies.*

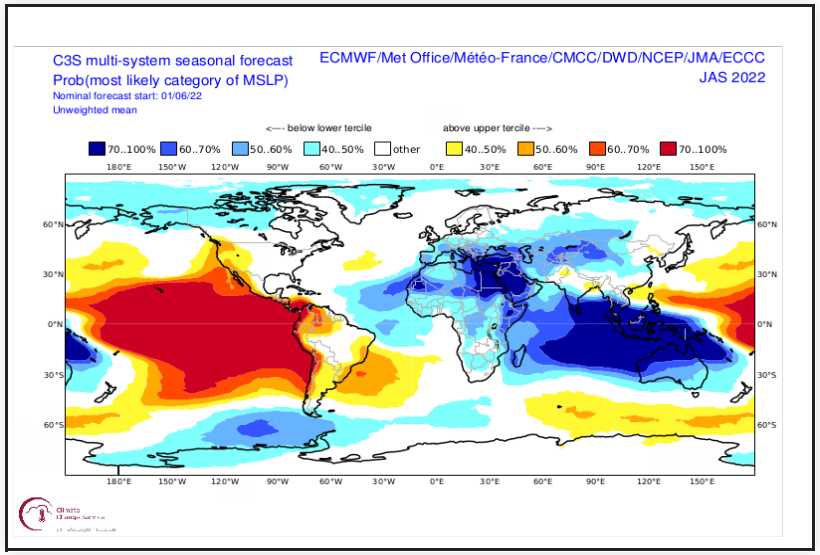



*Others models of WMO multi-models 500hPa geopotential height anomalies.*

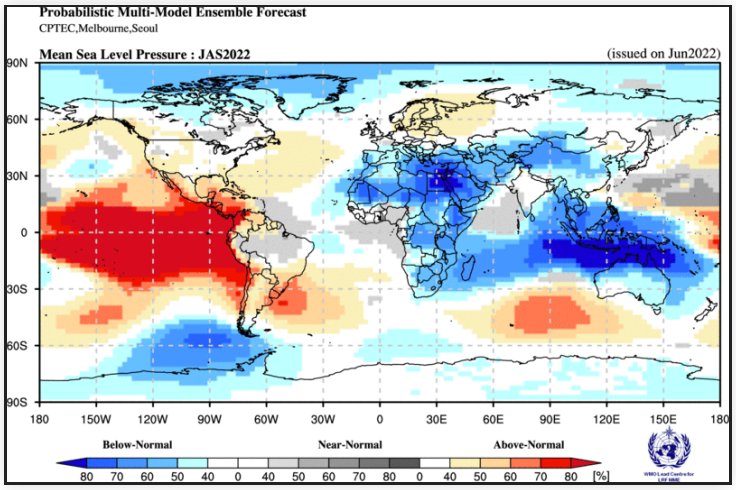
# Atmospheric circulation forecasts : MSLP probabilites multi-systems

Good agreement between the two multi-models in the tropical zone.

At mid-latitudes in the Northern Hemisphere, good agreement over North America. Over South Europe, the most probable scenario for C3S models is "lower than normal" : it my be linked with a thermic low.




*C3S multi-models MSLP terciles probability.*



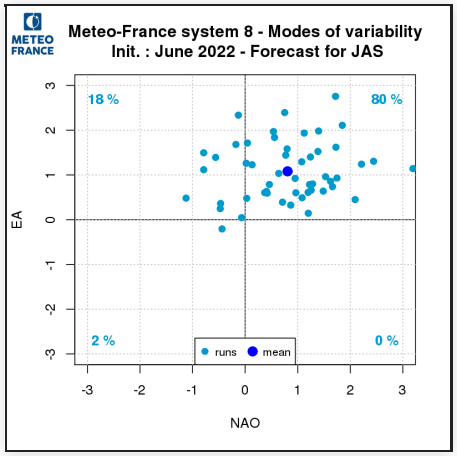

*Others models of WMO multi-models MSLP terciles probability.*

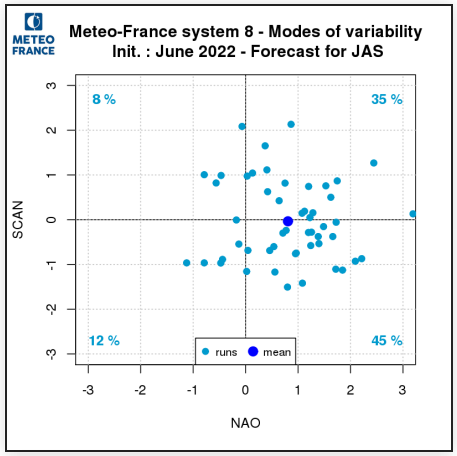
# Modes of variability : forecast

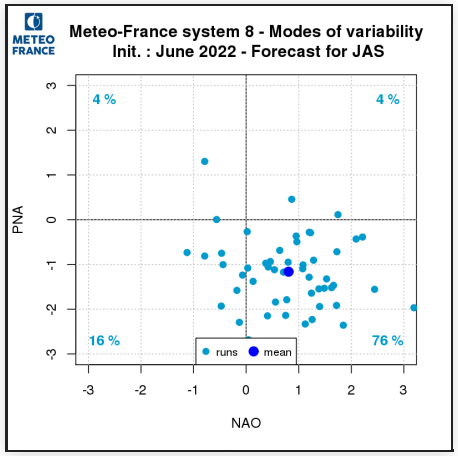
High confidence in a negative PNA

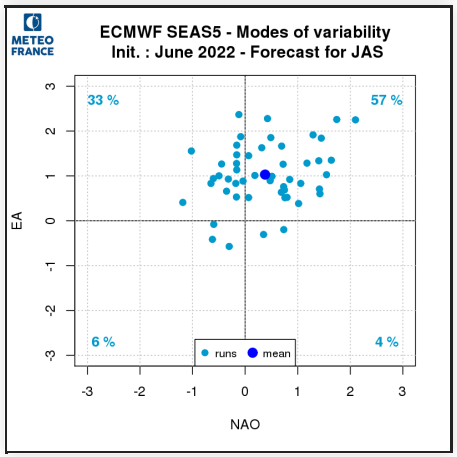
Strong signal for positive NAO and EA.

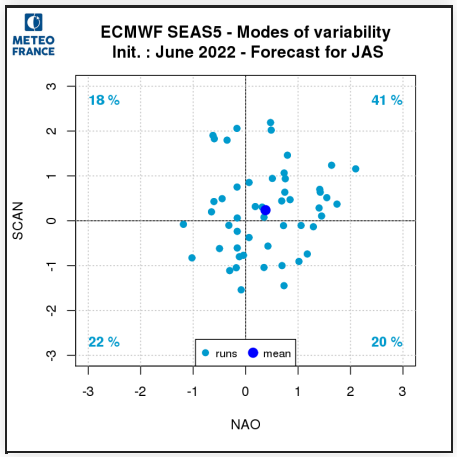
No clear signal for SCAN.

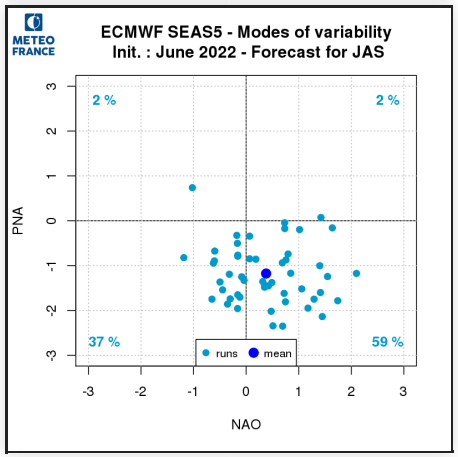


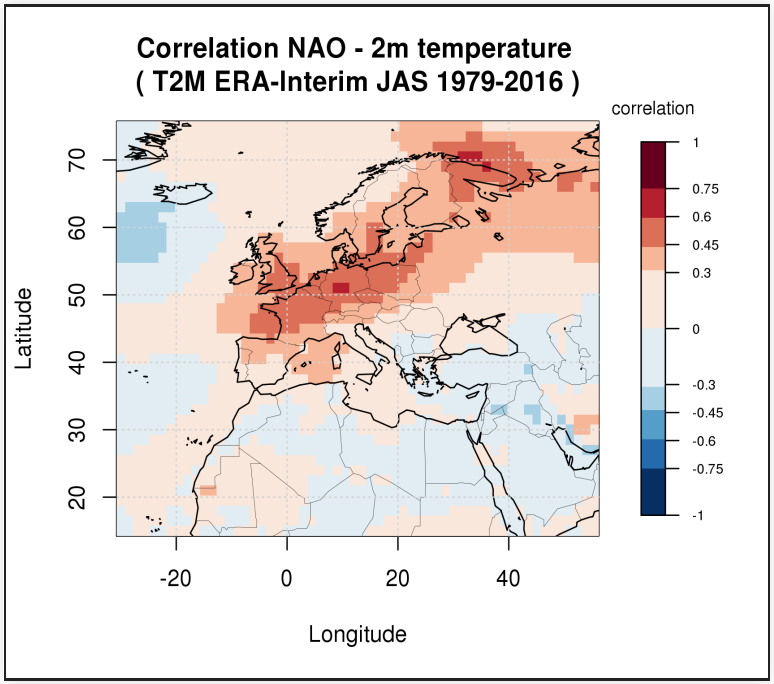



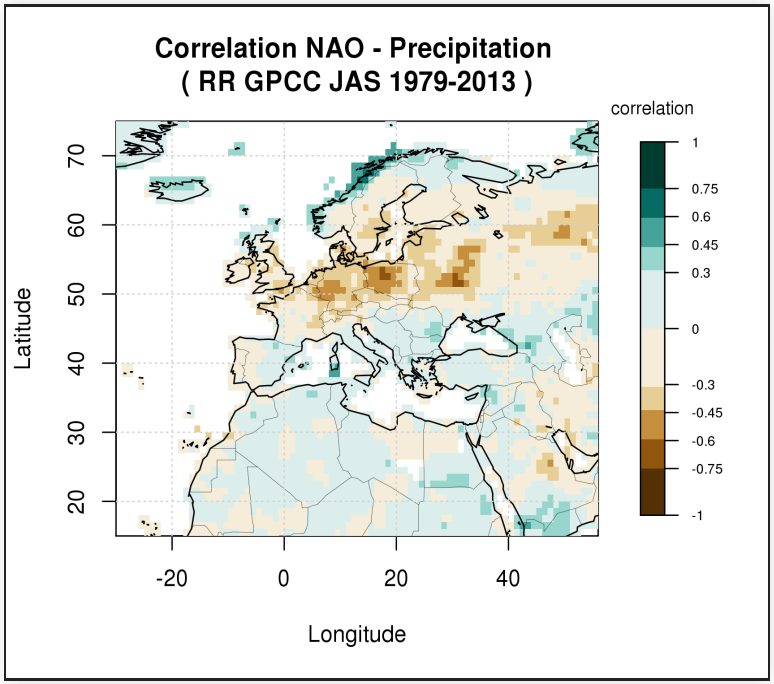




See the modes of variability patterns

# Modes of variability : NAO impacts

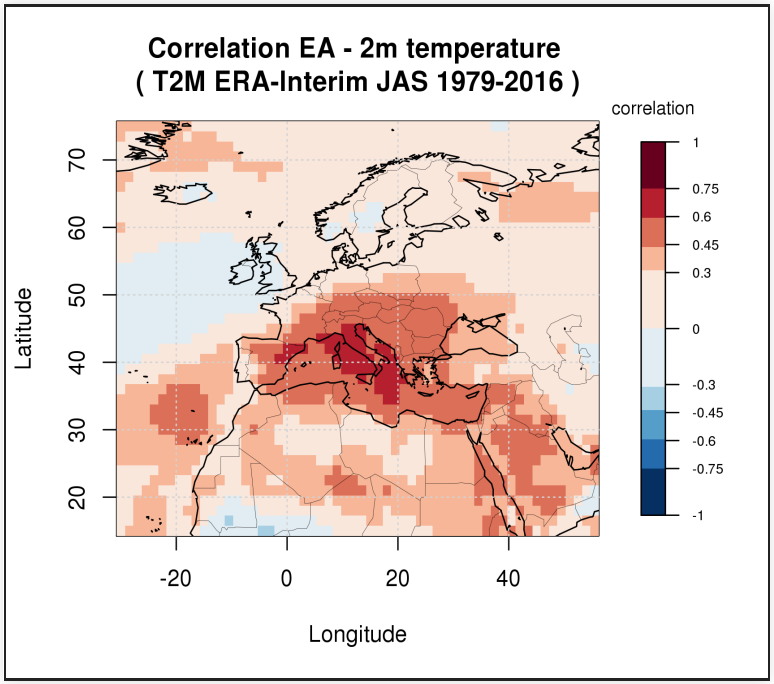
Positive phase of the NAO next quarter

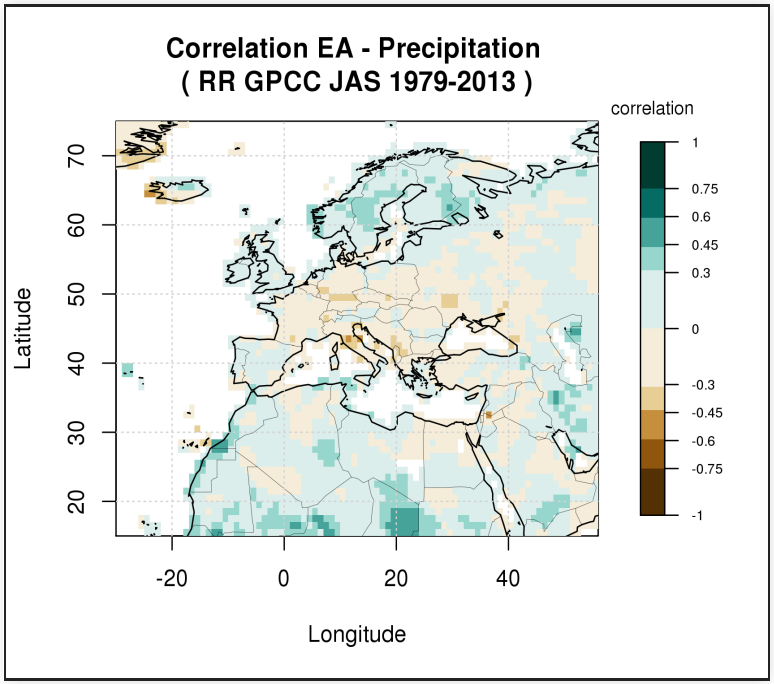


# Modes of variability : EA impacts

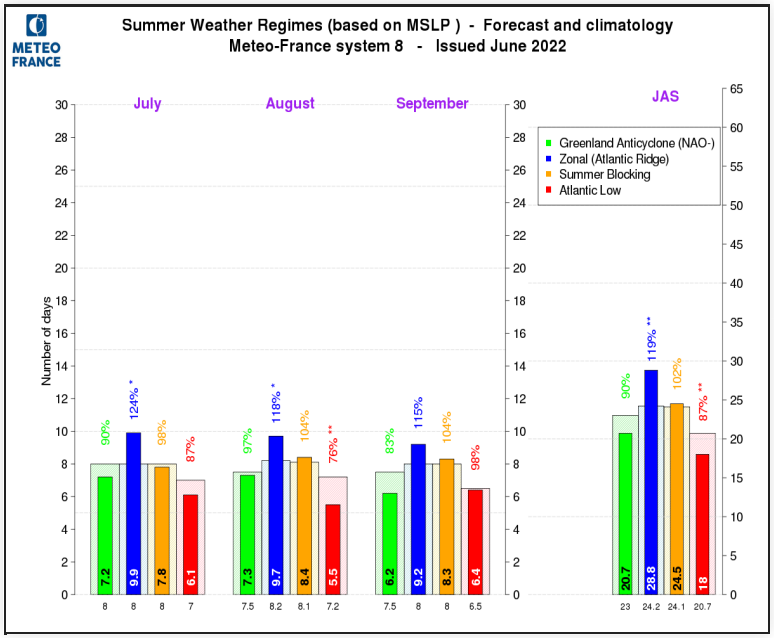
Positive EA is expected next quarter. This mode has a strong influence in particular on the temperature on the south of Europe.

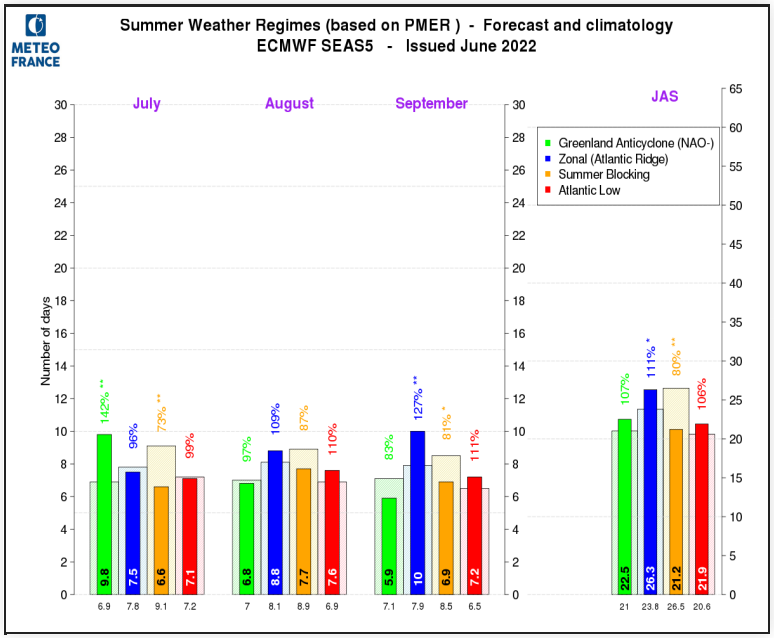


# Weather regimes : summer MSLP

The zonal regime is signicantly privileged by both models.

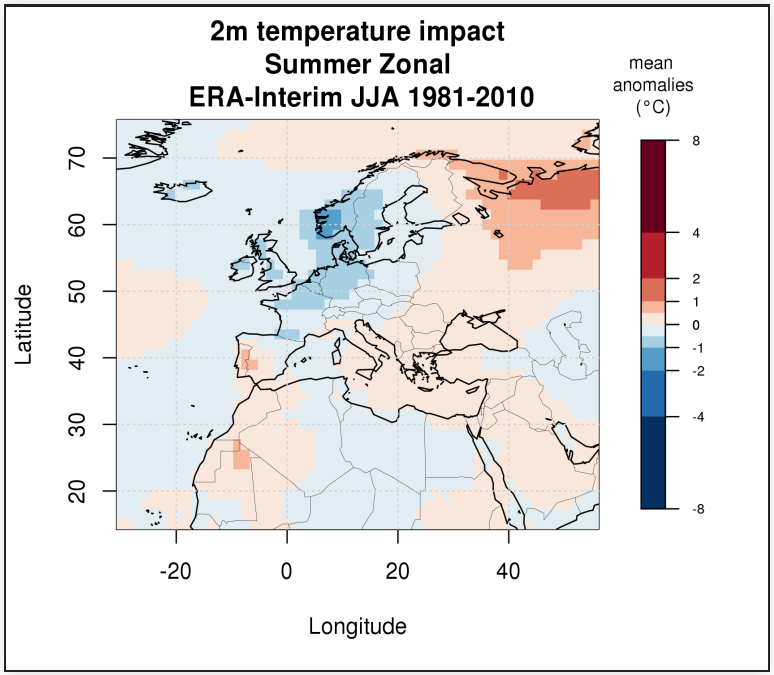


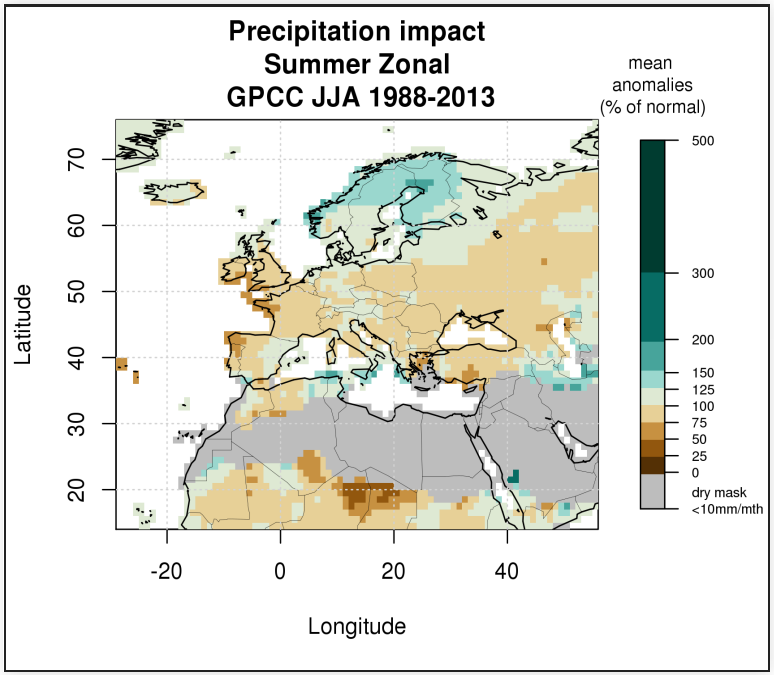




*Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S8 (left) and SEAS5 (right).*

# Weather regimes : Impacts

Summer Zonal weather regime is favored. Over western Europe it is favourable to dry conditions and cool temperature.



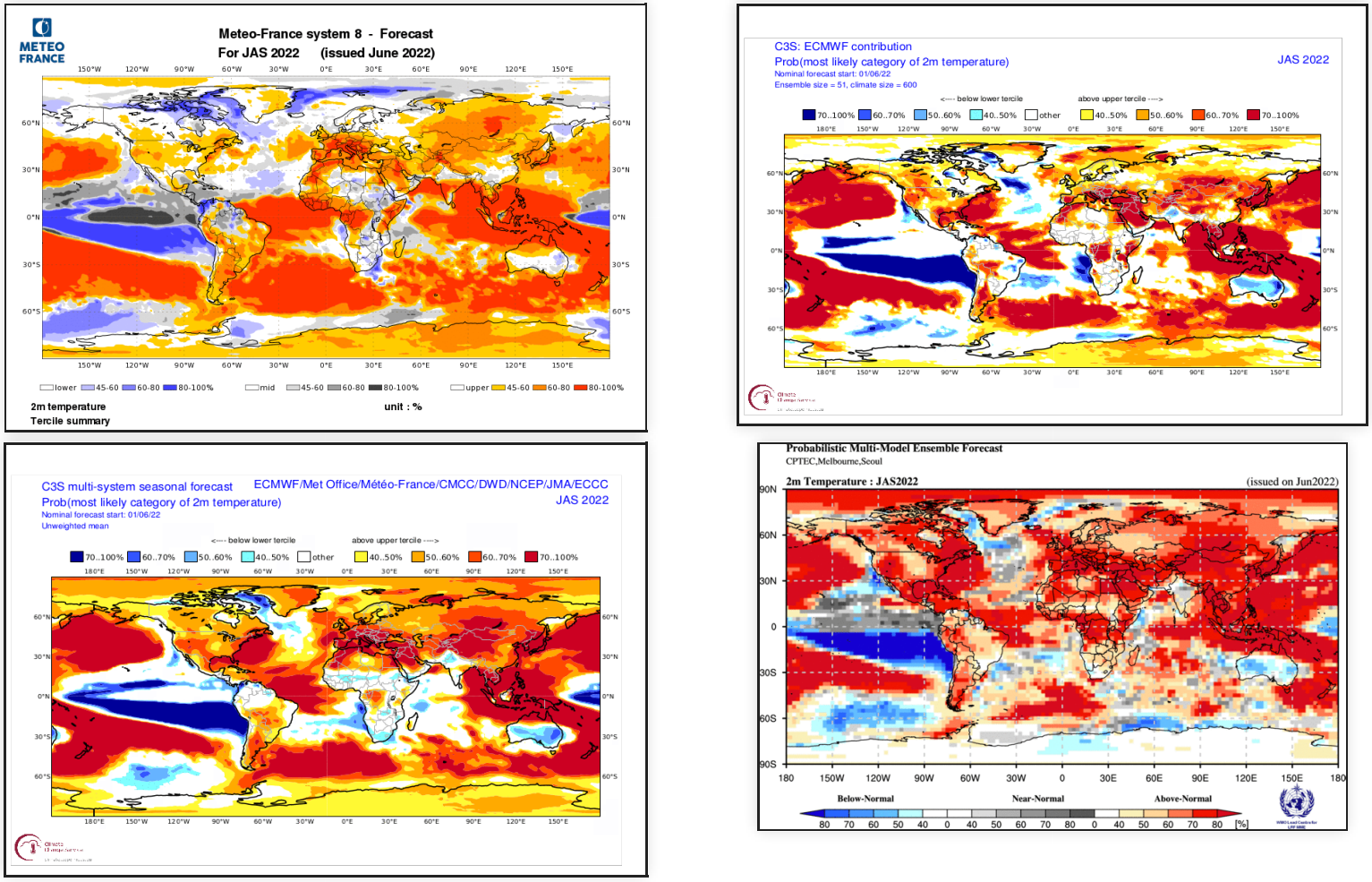




*Impact of Summer Zonal weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)*

# Forecast of climatic parameters : Temperature probabilities

Good agreement between models.

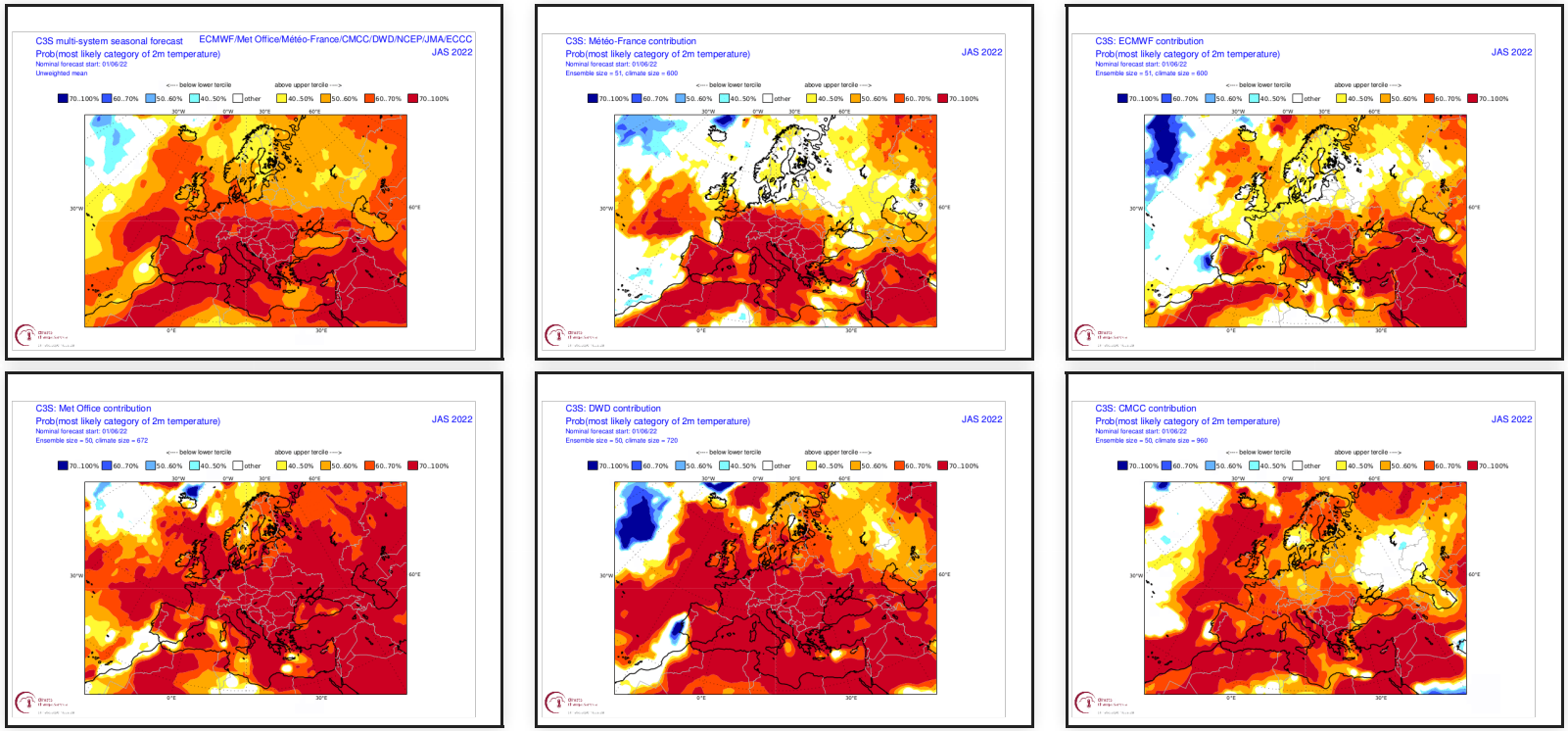
The forecasts are similar both in the intertropical regions and in the middle latitudes.




*2m temperature probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)*

# Forecast of climatic parameters : T2M probabilities over Europe in C3S models

Over a large southern half of Europe, high probabilities for the warm tercile : it could be linked to a positive anomaly of Z500 leading to frequent (more than normal) anticyclonic situations, and worsened by the dry soil currently observed. The trace of climate warming of course could explains partly these predictions.



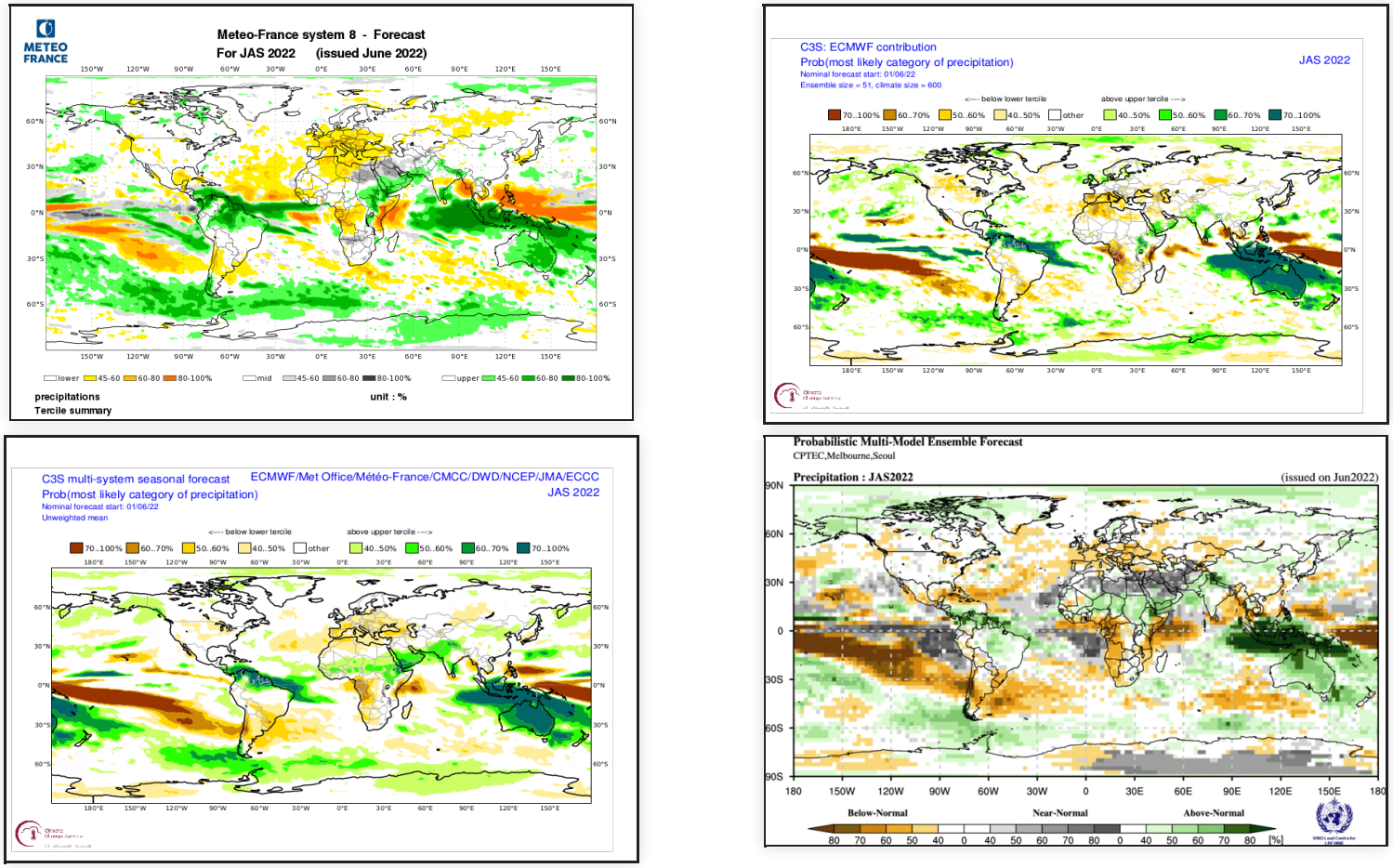

*C3S multi-models probability map (top left) and MF-S8, ECMWF-SEAS5, UKMO , DWD, CMCC models.*

# Forecast of climatic parameters : Precipitation

Good agreement between models on global scale.

Classical effects of La Niña over the American continent, Africa, around the Maritime Continent.

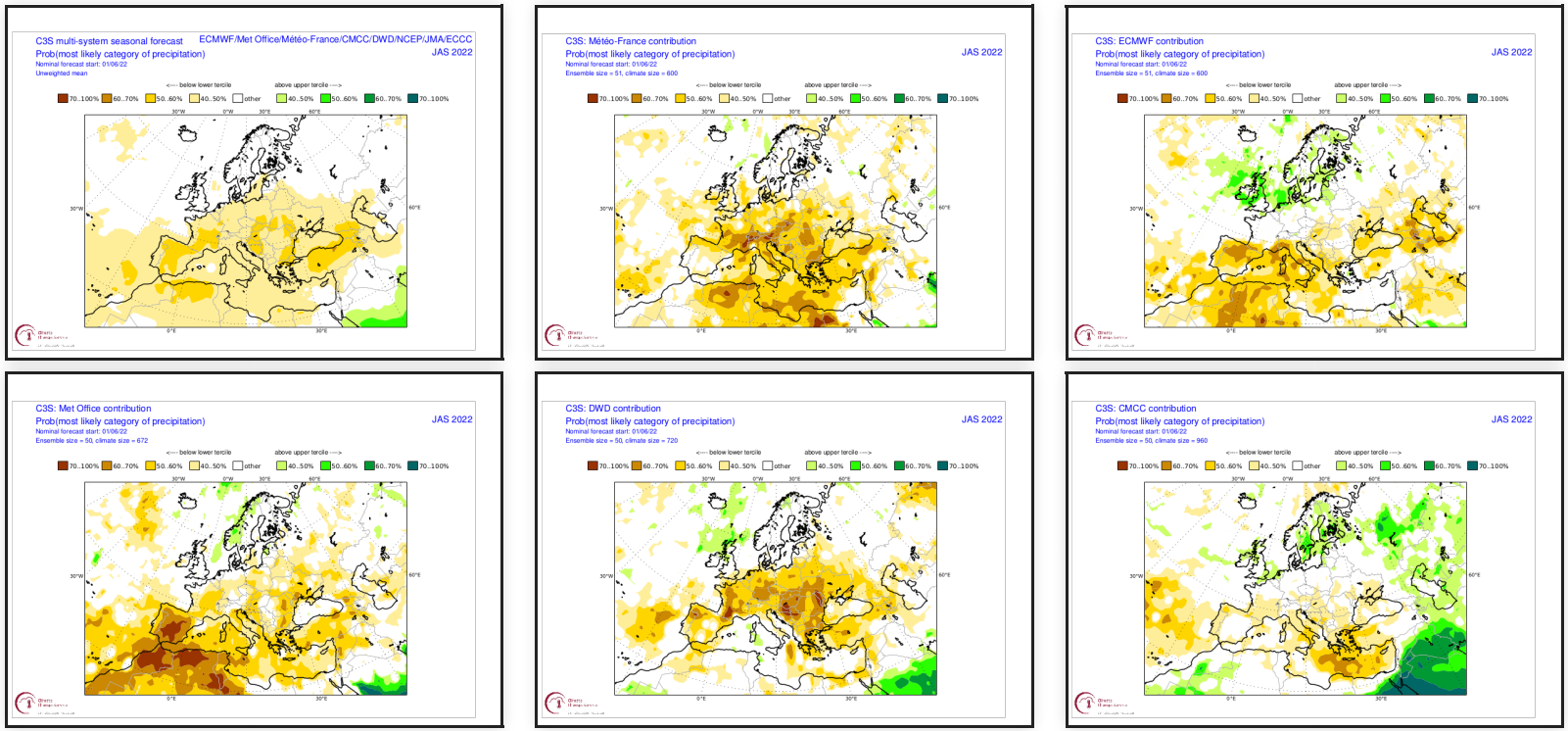
Over Europe, a dry signal emerges from the models.




*precipitation probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)*

# Forecast of climatic parameters : Precipitation probabilities over Europe in C3S models

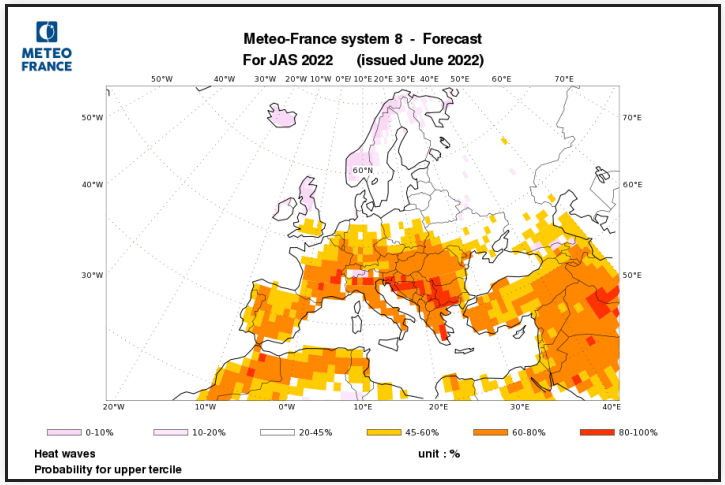
More dispersion than previous months. The dry signal is less marked on the north of Europe with some models like SEAS5 in connection with lower Z500.

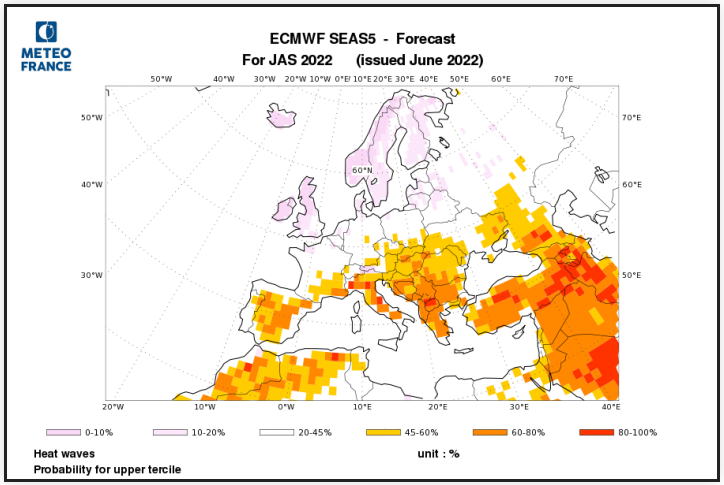



*C3S multi-models probability map (top left) and MF-S8, SEAS5, UKMO, DWD, CMCC models.*

# Forecast of climatic parameters : Heat waves

The enhanced probability of heat waves is more extensive with MF8 in line with preticted temperature and geopotential anomalies.

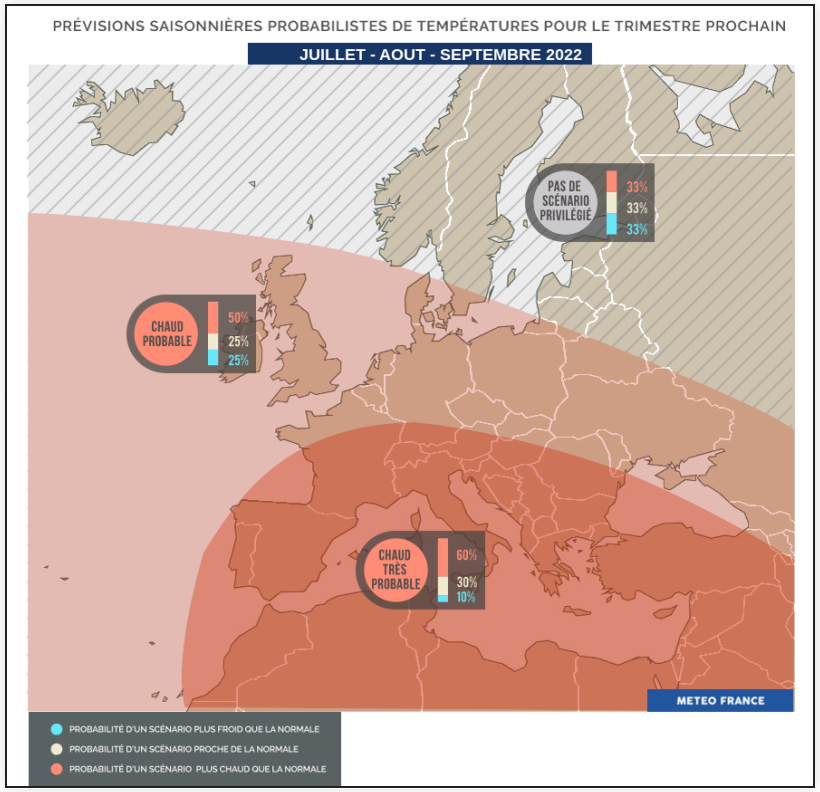



*Heat wave probability for MF8 (right) and ECMWF (left). A heat wave is detected if the corrected T2M is above the daily 90th percentile and a fixed 20°C threshold.* *more details here*

# Synthesis map for Europe : Temperature

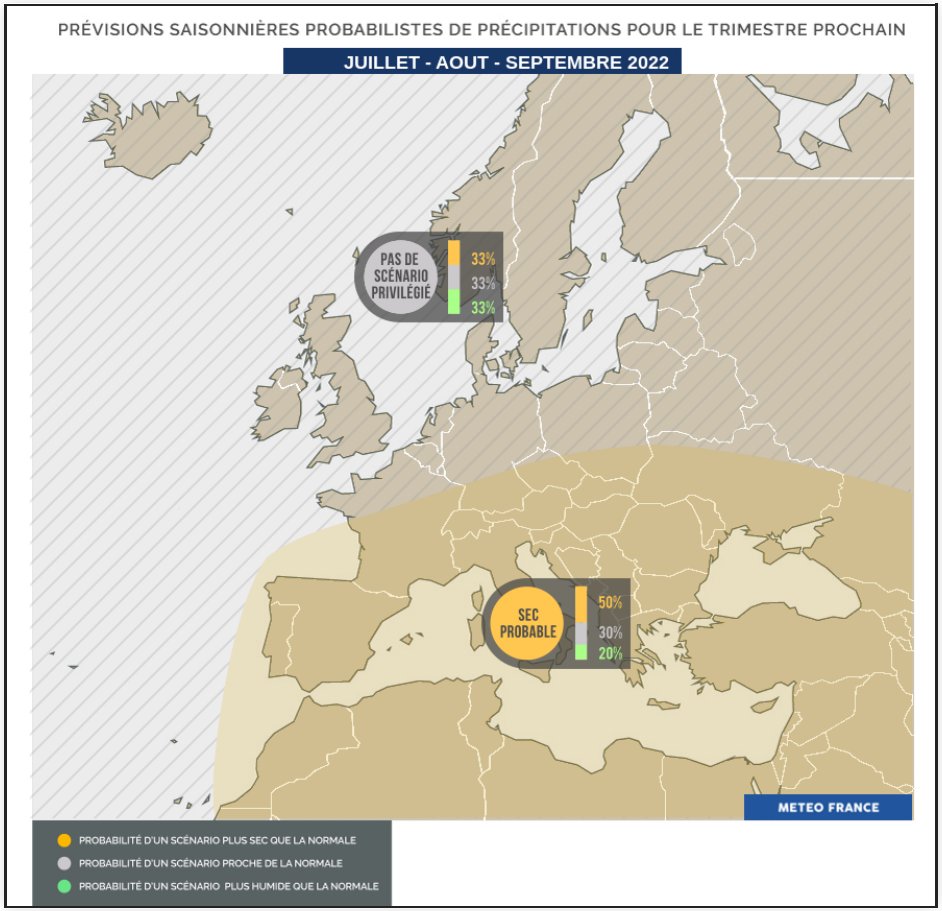
Preponderant NAO+/EA+ is expected over the Atlantic and Europe. The different models agree in predicting a fairly high probability of temperature conditions in the upper tercile over the southern domain.




*Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS*

# Synthesis map for Europe : Precipitation

Still in agreement with a NAO+/EA+ type circulation, the models predict dry conditions over a large part of southern Europe. No signal emerges further north.




*Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS*