

# Météo-France Seasonal Forecast Bulletin

JUNE - JULY - AUGUST 2022

# Table of Content

|                                                          |    |
|----------------------------------------------------------|----|
| 1. General synthesis                                     |    |
| 1. JJA 2022                                              | 3  |
| 2. Oceanic analysis of March 2022                        |    |
| 1. SST anomalies                                         | 4  |
| 2. Pacific vertical section                              | 5  |
| 3. Hovmöller diagram of the 20°C isotherm                | 6  |
| 4. Pacific Ocean - Nino3.4 index history                 | 7  |
| 5. Indian Ocean - DMI index history                      | 8  |
| 3. Oceanic forecast                                      |    |
| 1. SST anomaly                                           | 9  |
| 2. NINO3.4 Plume diagrams                                | 10 |
| 3. C3S Nino3.4 re-scaled plume diagrams                  | 11 |
| 4. Synthesis from IRI                                    | 12 |
| 5. Indian ocean - DMI evolution                          | 13 |
| 6. C3S IOD re-scaled plume diagrams                      | 14 |
| 7. Atlantic ocean - SAT evolution                        | 15 |
| 4. Drivers                                               |    |
| 1. soil wetness                                          | 16 |
| 5. Atmospheric circulation forecasts                     |    |
| 1. velocity potentiel and stream function at 200hPa      | 17 |
| 2. 500 hPa Geopotential anomalies                        | 18 |
| 3. Z500 anomalies in C3S models                          | 19 |
| 4. Z500 anomalies multi-systems                          | 20 |
| 5. MSLP probabilities                                    | 21 |
| 6. MSLP probabilités multi-systems                       | 22 |
| 6. Modes of variability                                  |    |
| 1. forecast                                              | 23 |
| 2. NAO impacts                                           | 24 |
| 3. EA impacts                                            | 25 |
| 7. Weather regimes                                       |    |
| 1. summer MSLP                                           | 26 |
| 2. Impacts                                               | 27 |
| 8. Forecast of climatic parameters                       |    |
| 1. Temperature probabilities                             | 28 |
| 2. T2M probabilities over Europe in C3S models           | 29 |
| 3. Precipitation                                         | 30 |
| 4. Precipitation probabilities over Europe in C3S models | 31 |
| 5. Heat waves                                            | 32 |
| 9. Synthesis map for Europe                              |    |
| 1. Temperature                                           | 33 |
| 2. Precipitation                                         | 34 |

## General synthesis : JJA 2022

In the Pacific Ocean, the "La Niña" event 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 teleconnections, 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
- IOD : negative
- Equatorial Atlantic : warm anomaly

### **B) Drivers :**

- "La Niña" and negative IOD
- currently, dry soil wetness in western Europe

### **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 Europe (except the United Kingdom and Scandinavia) and the Mediterranean Basin. No scenario elsewhere.

The dry tercile is most likely over southern Europe. Wet conditions are favored from Iceland to Scandinavia. No scenario elsewhere.

**Next bulletin : scheduled on June 20th**

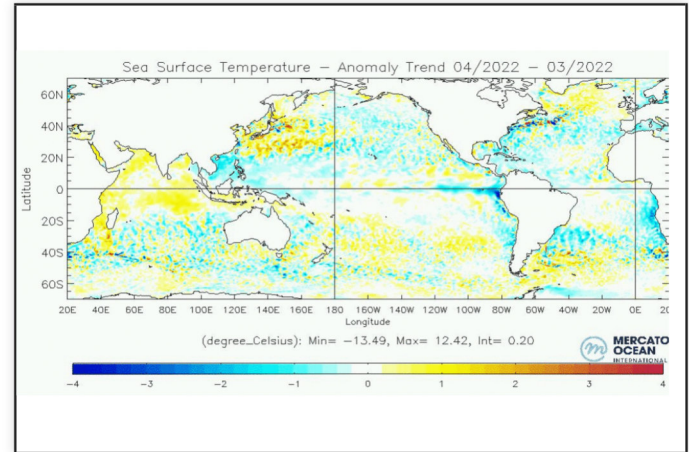
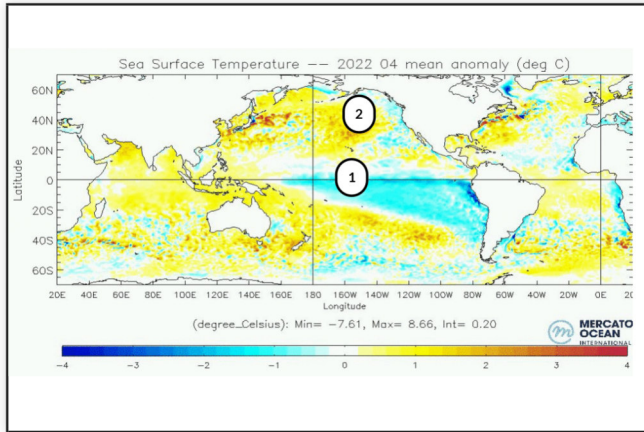
## Oceanic analysis of March 2022 : SST anomalies

### Current ENSO situation : moderate La Niña

In the Pacific Ocean : persistence of "La Niña" anomaly along the equator, even strengthening in the eastern part of the basin. In the North Pacific, the PDO- Pattern is still very present.

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

In the Atlantic Ocean : warm anomalies around the equator, except in the gulf of Guinea (neutral). Neutral to cold anomalies in the tropical north Atlantic. And warm anomalies at mid latitudes in North Atlantic



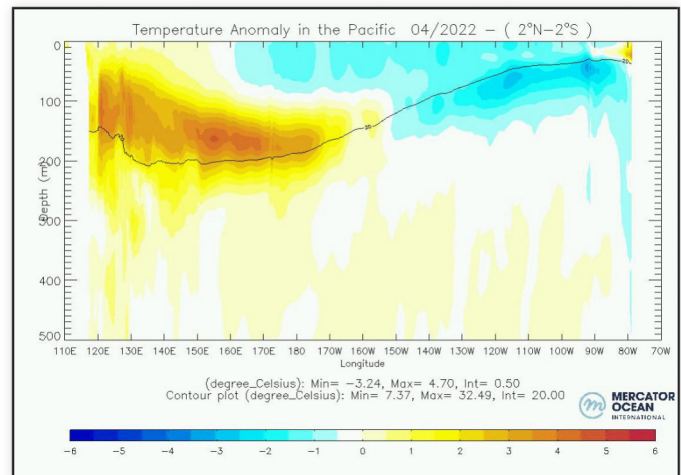
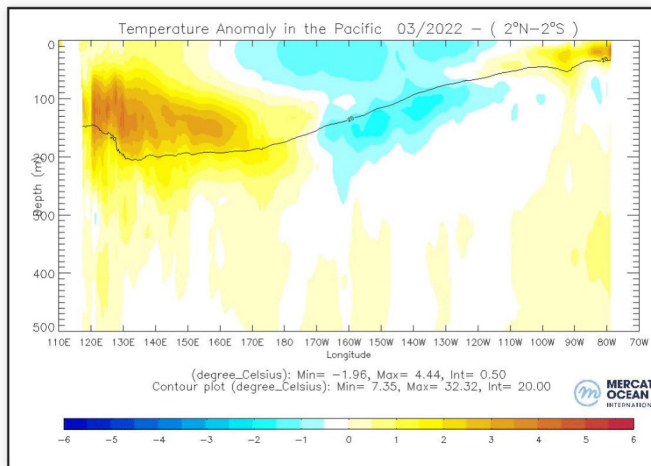
SST Anomalies and trend with the previous month (c) Mercator-Ocean

- 1 - La Niña pattern
- 2 - Negative PDO pattern



## Oceanic analysis of March 2022 : Pacific vertical section

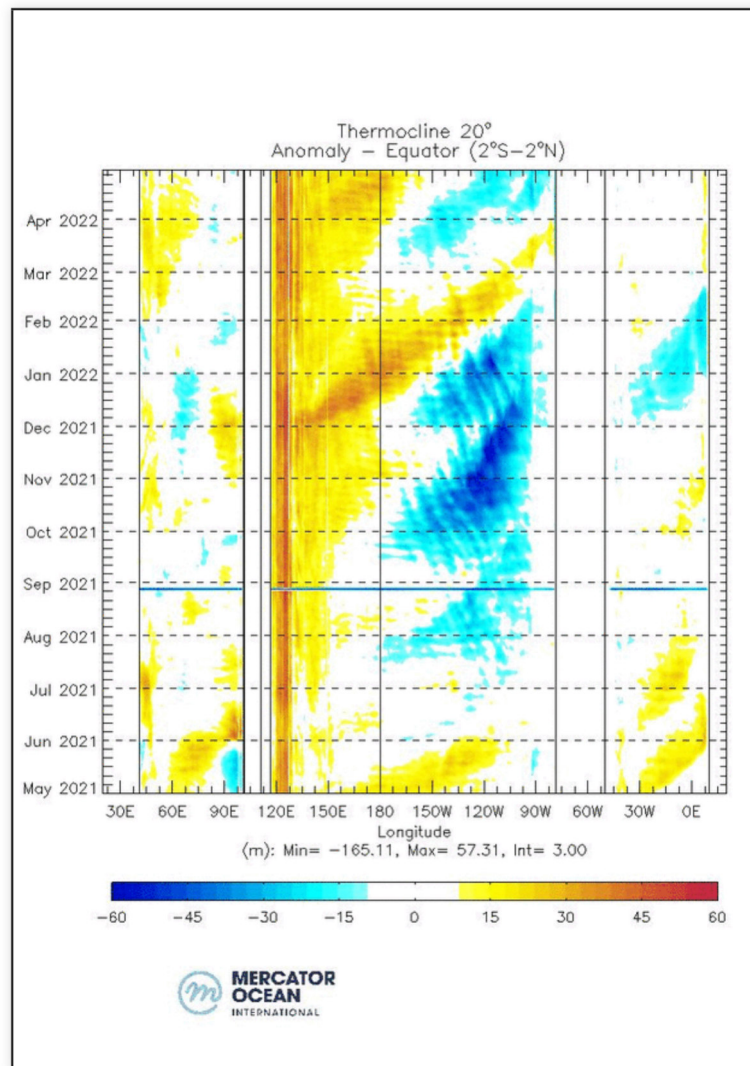
Strengthening of the east-west gradient in subsurface, thanks to a warming trend in the west and the cold anomaly in the east (linked to the circulation of a kelvin wave visible in the middle of the basin in March).



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

## Oceanic analysis of March 2022 : Hovmöller diagram of the 20°C isotherm

In the Pacific Ocean, trace of the Kelvin wave that reached the eastern part of the basin in April. AND a new one (warm) appeared in April in the west.

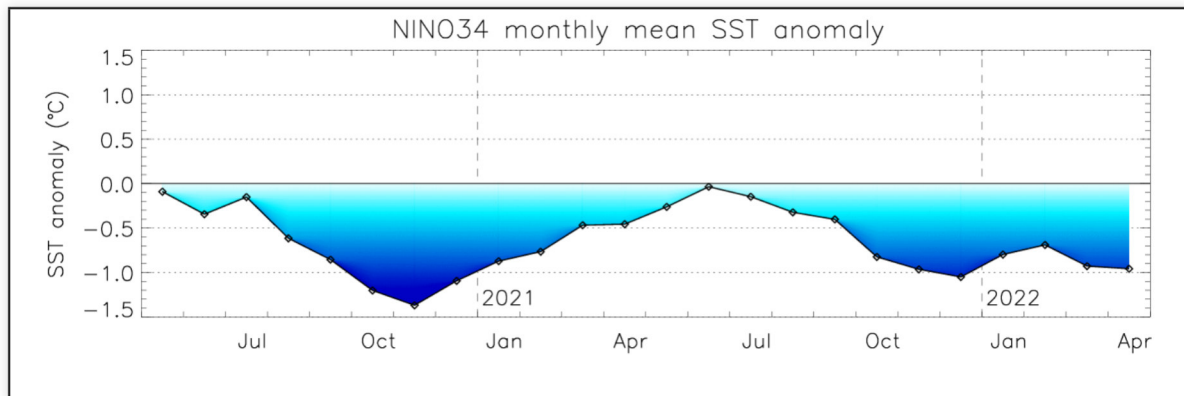


Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 °C isotherm) (c) Mercator-Ocean

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

**Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -0.9°C**

(see BOM site for weekly values : [http://www.bom.gov.au/climate/enso/monitoring/nino3\\_4.png](http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png) )

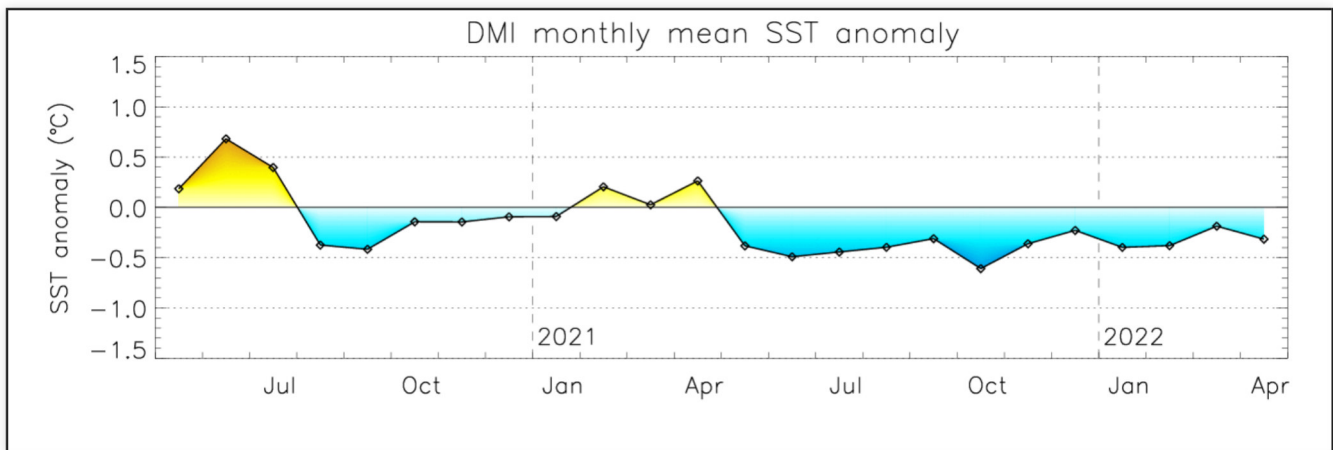


Evolution of SST in the NINO3.4 box (c) Mercator-Ocean

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

**DMI Index issued from Mercator Ocean PSYV4R2 analysis : -0.3°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

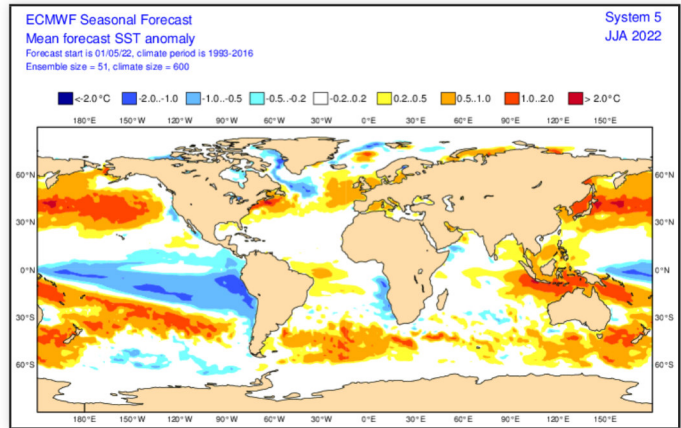
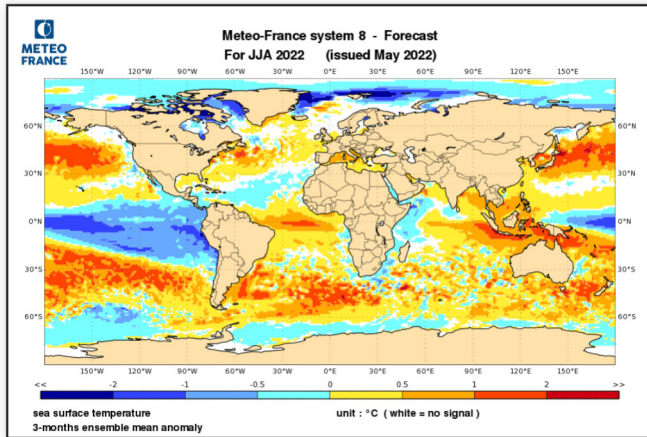
## Oceanic forecast : SST anomaly

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. However along the equator, MF-S8 is colder than ECMWF-SEAS5.

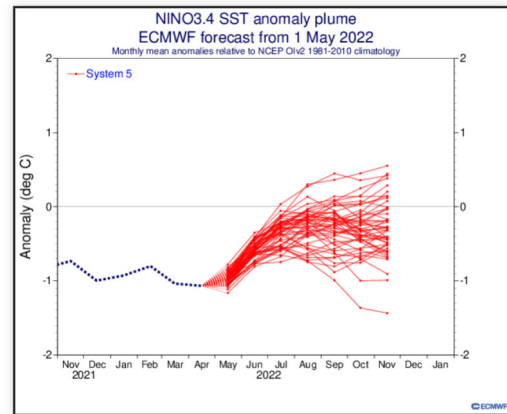
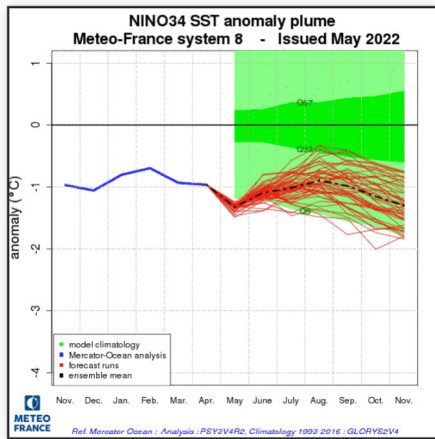
In the Indian Ocean : the east/West contrast seems to strengthen.

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

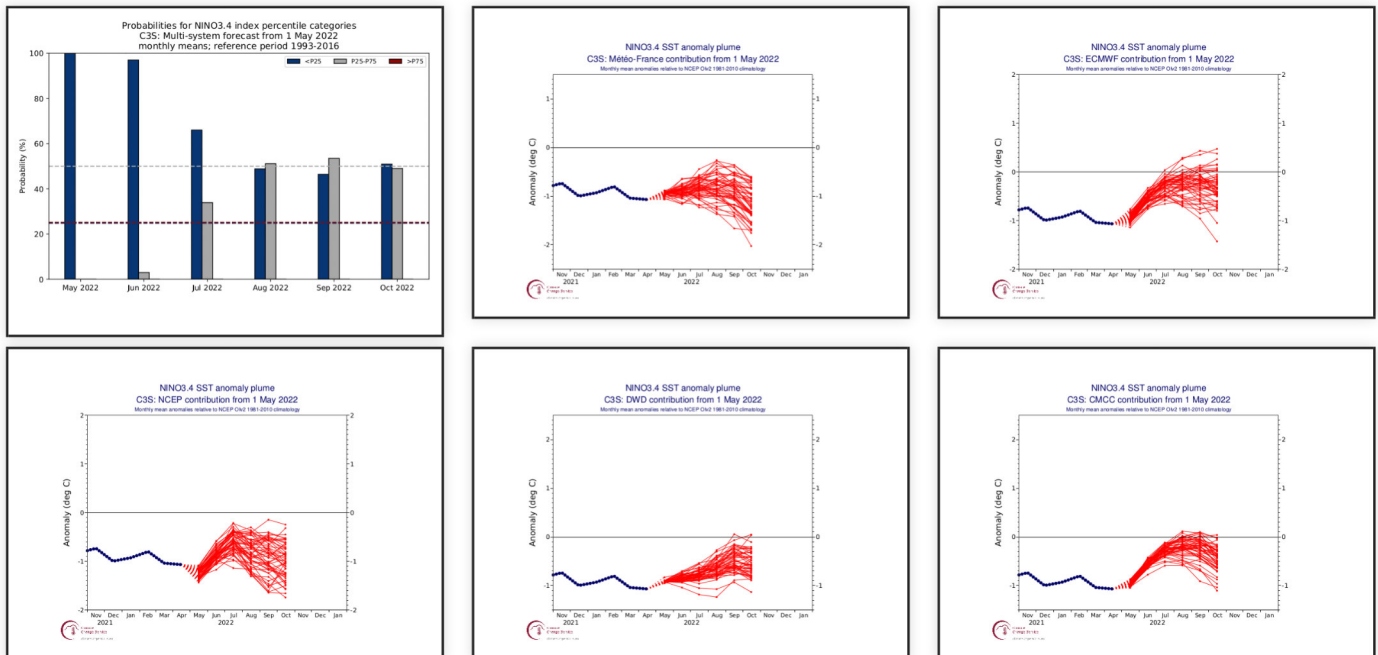
Noticeable difference in the evolution of La Niña.



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

Two scenarios emerge : continuation of La Niña at its current intensity, or a slight weakening of the index with a return to slightly negative values. However, almost all the runs forecast a negative value of Nino3.4 index for the coming months. And as seen before, the SST anomaly pattern remains a "La Niña" one.

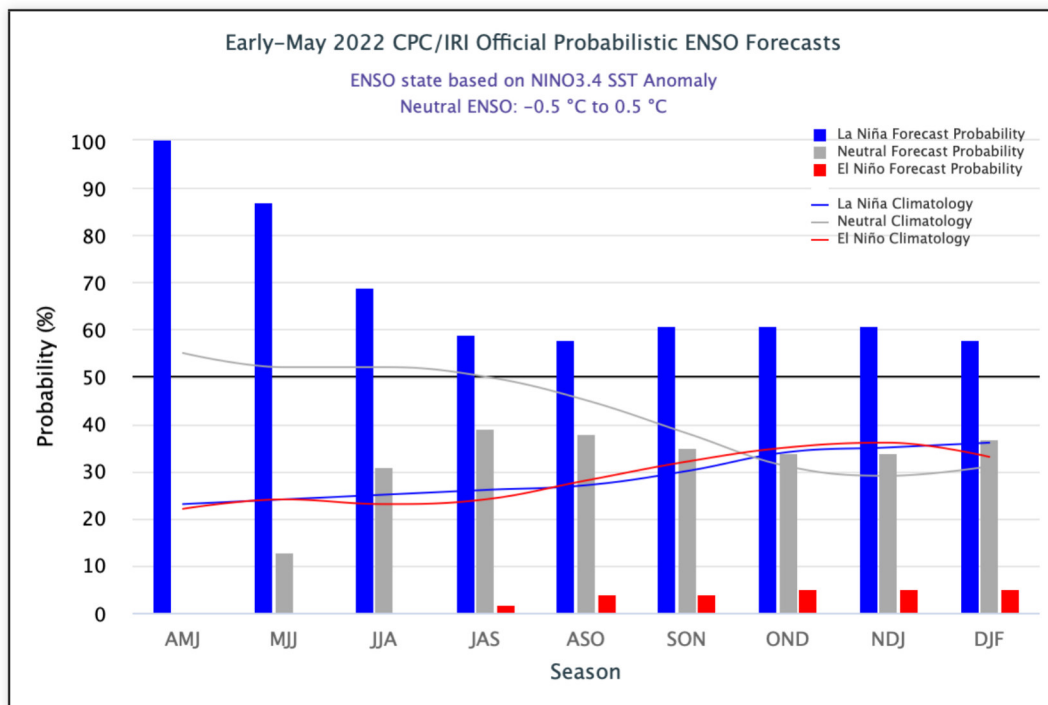
**The most likely phase for the next three months : Weak La Niña.**



C3S multi-system probability 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 70% chance of "La Nina" for JJA. This is conform to C3S forecast.

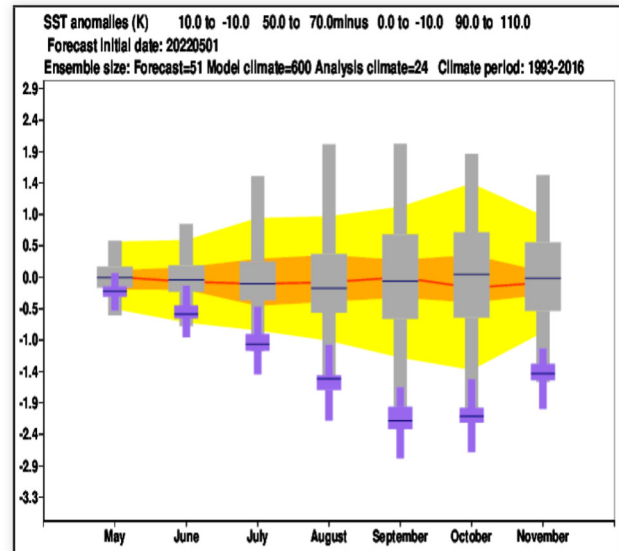
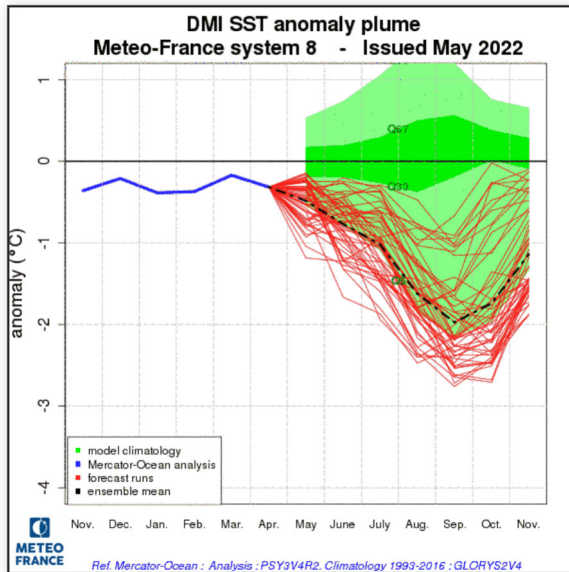


Probability of Niño, Niña, and neutral phases for the next 8 quarters. source <http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/>



## Oceanic forecast : Indian ocean - DMI evolution

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

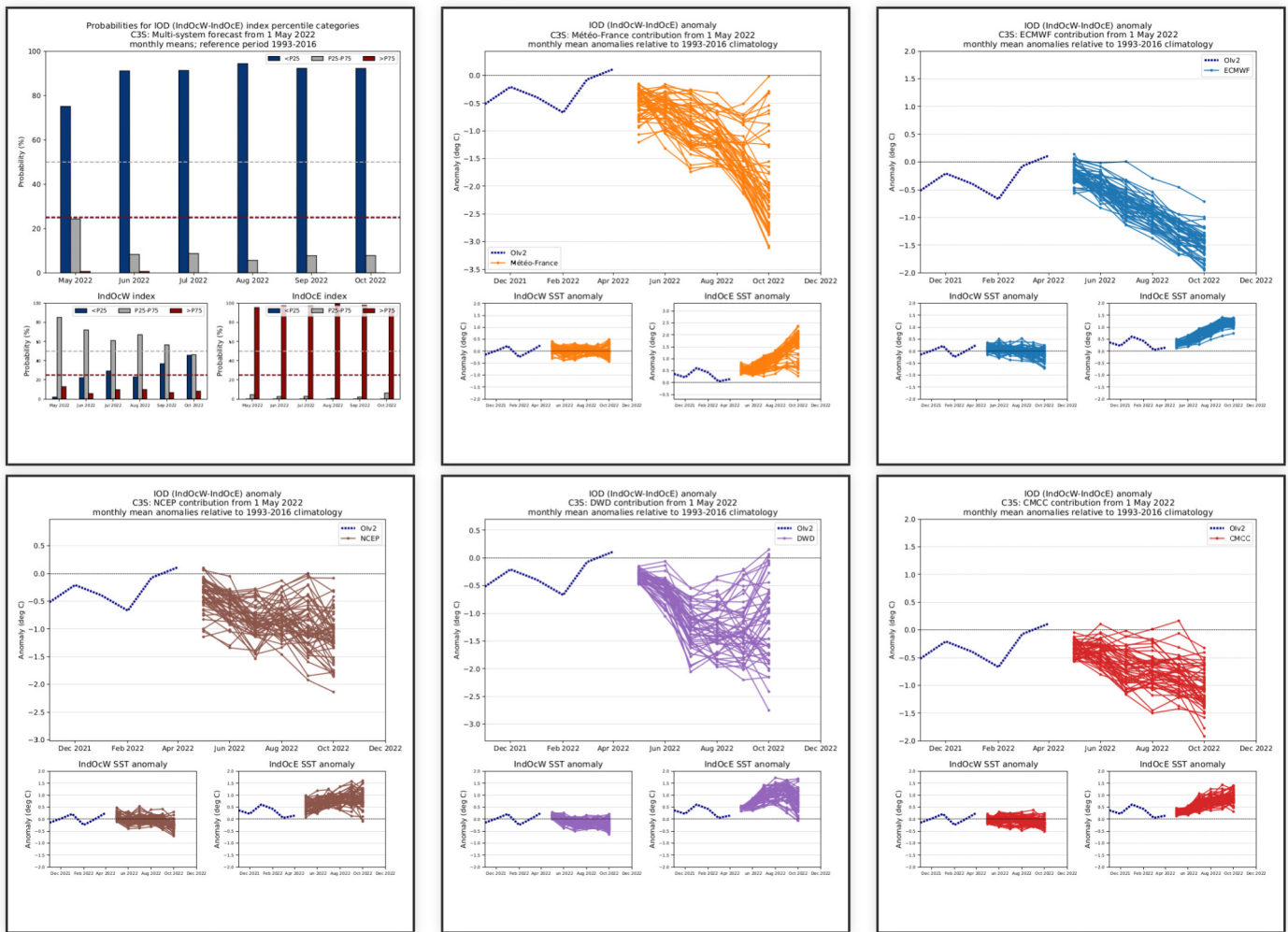


DMI index : analysis, forecasts and model climatology with MF-S8 on the left and ECM-SEAS5 on the right

## 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 .

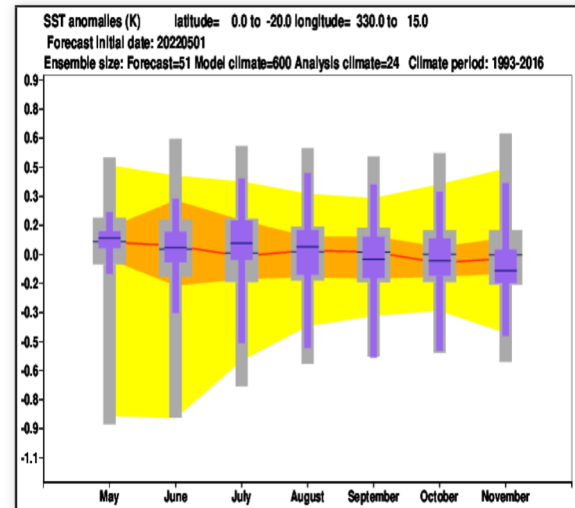
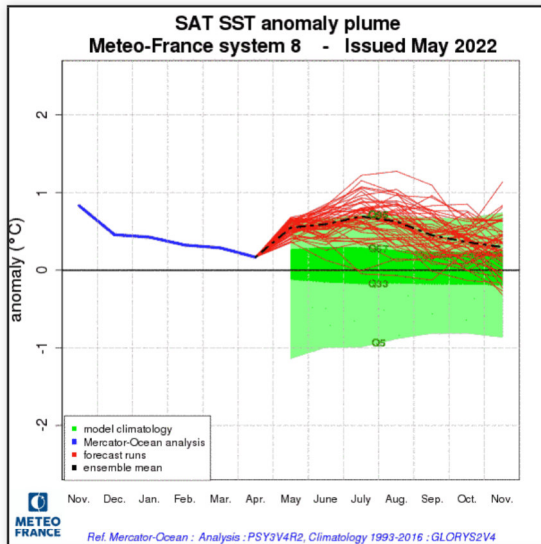
**Expected Phase for the next three months : negative.**



C3S multi-system probability 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.

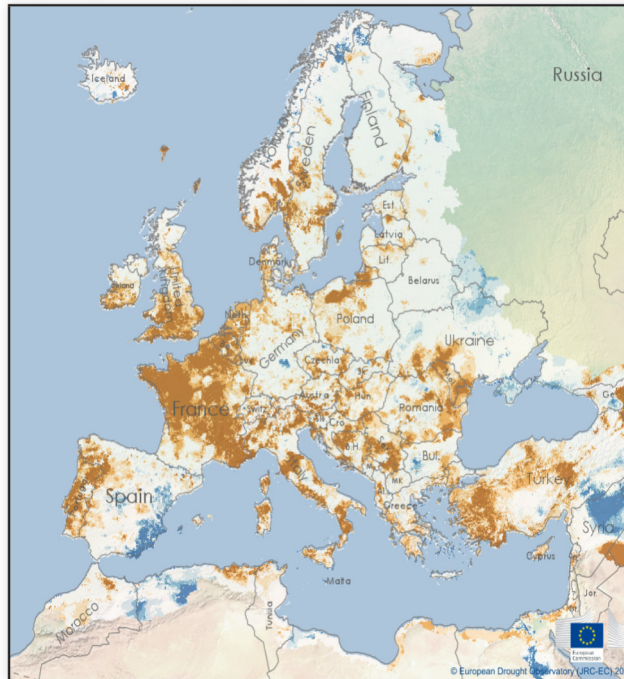


Anomaly on the SAT box : analysis, forecasts and model climatology with MF-S8 on the left and SEAS5 on the right

## Drivers : soil wetness

At the beginning of May, many European countries are concerned by dry conditions.

In case of durable anticyclonic periods during next months, it may amplify positive temperature anomalies (and risk of heat waves).



*Soil Moisture Index (SMI) Anomaly for 10-day periods : May 2022 first ten-day period*

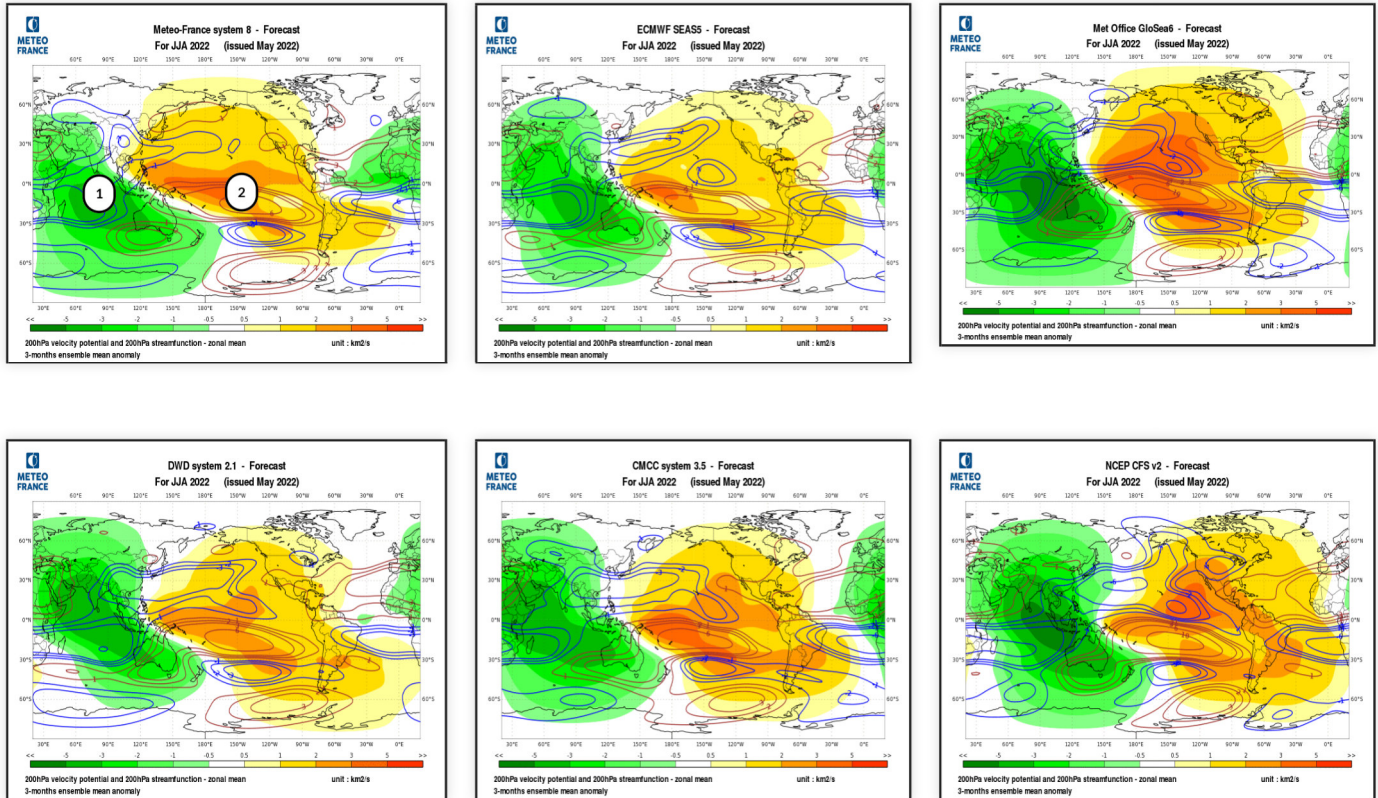
<https://edo.jrc.ec.europa.eu/>

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

Very 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.



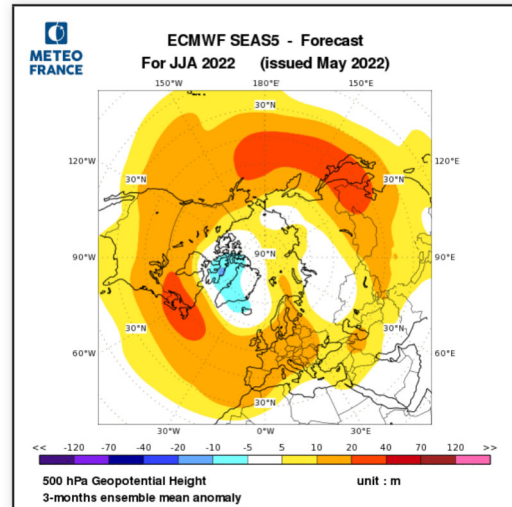
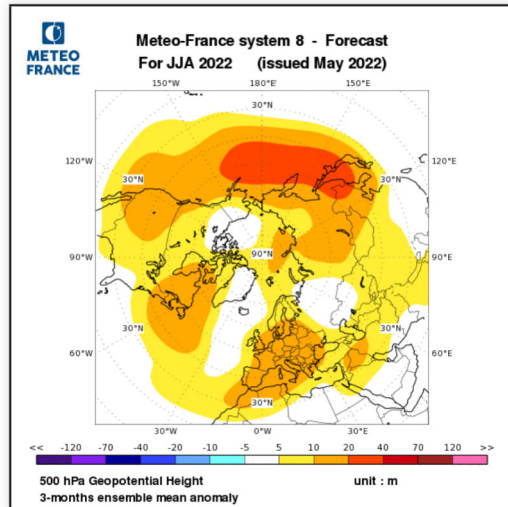
MF8,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

- 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

Good agreement between the 2 models around the Pacific with a PNA- pattern and over Eurasia. They differ on the centre of North Atlantic, where ECMWF-SEAS5 forecast a stronger anomaly than MF-S8.

Note that the high values over Europe are partly due to the climate trend (see [http://seasonal.meteo.fr/sites/data/Modeles/MF8/clim/Z500/Z500\\_MF8\\_TrendBTrim\\_1993-2016\\_05\\_Globe\\_LT1.gif](http://seasonal.meteo.fr/sites/data/Modeles/MF8/clim/Z500/Z500_MF8_TrendBTrim_1993-2016_05_Globe_LT1.gif)).

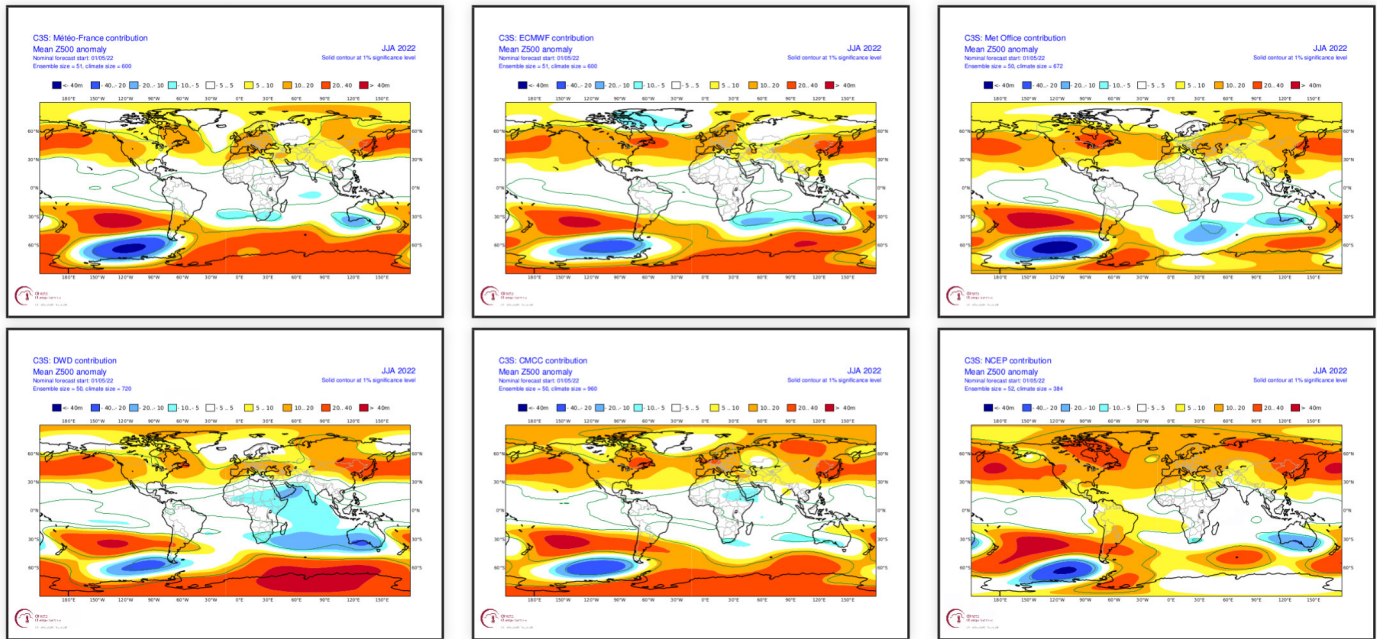


polar projection of MF8 and SEAS5 500hPa geopotential height anomalies.



## Atmospheric circulation forecasts : Z500 anomalies in C3S models

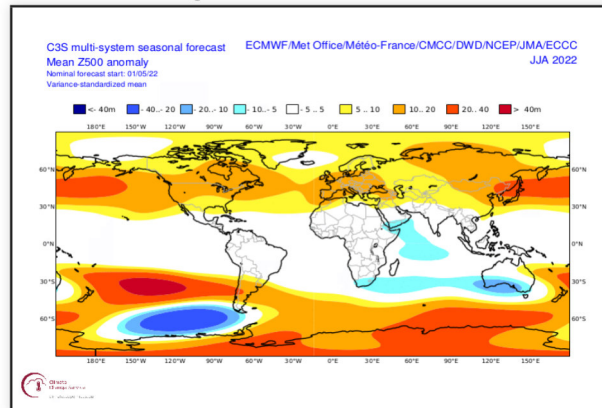
All models agree in forecasting a positive anomaly from Quebec to Europe.



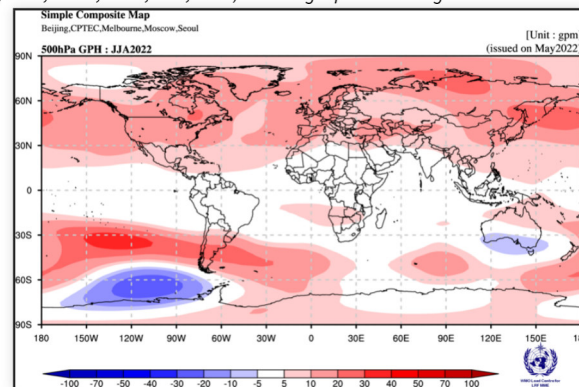
MF-S8, SEASS, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

## 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.



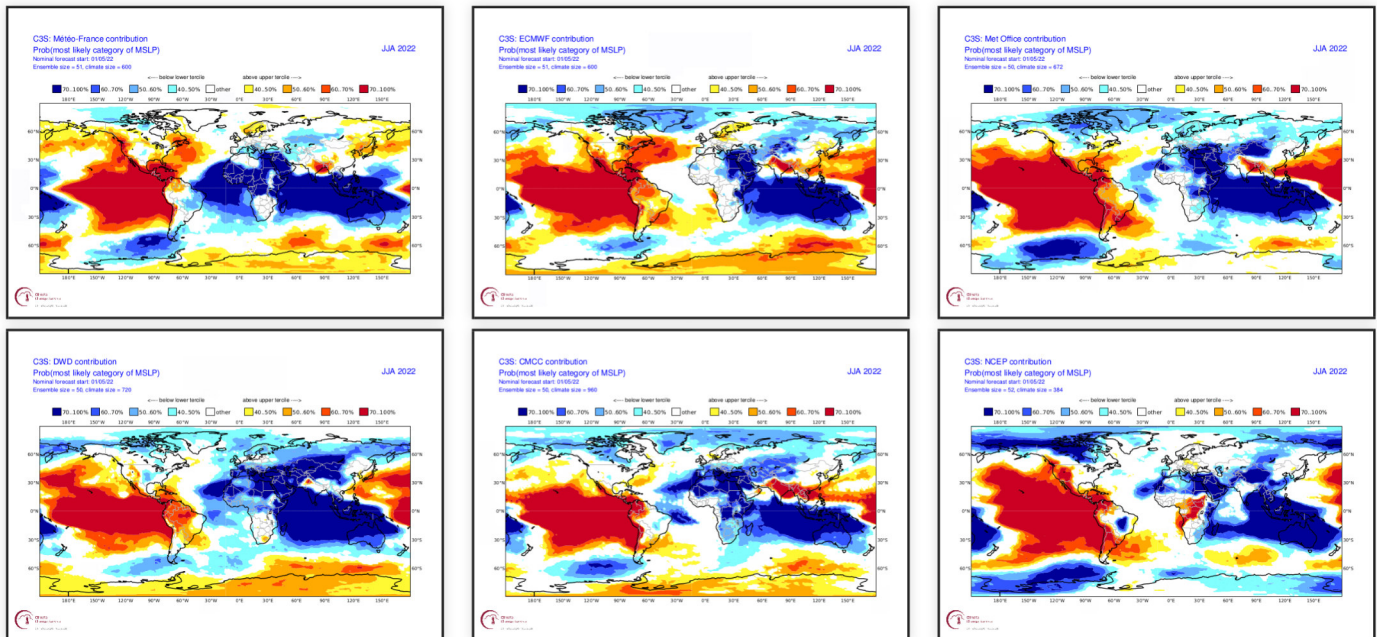
Others models of WMO multi-models 500hPa geopotential height anomalies.



## Atmospheric circulation forecasts : MSLP probabilities

In the intertropical regions, strong anomalies on the Pacific and Indian Ocean, in connection with the Velocity Potential anomalies. Less agreement in the anomaly patterns over the Atlantic and Africa, but the majority has higher probabilities for the lowest tercile.

In mid-latitudes, weak signal.

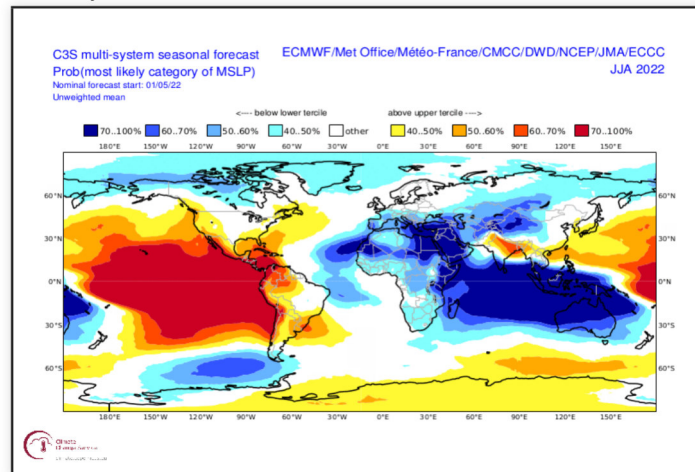


MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP models probability maps.

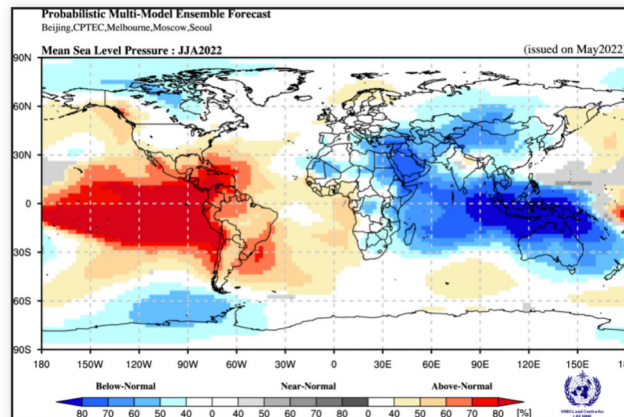
## Atmospheric circulation forecasts : MSLP probabilities multi-systems

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 may be linked with a thermic low.



C3S multi-models MSLP terciles probability.



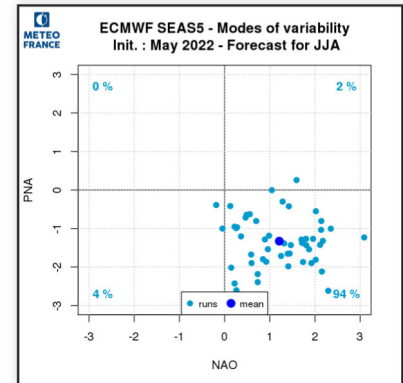
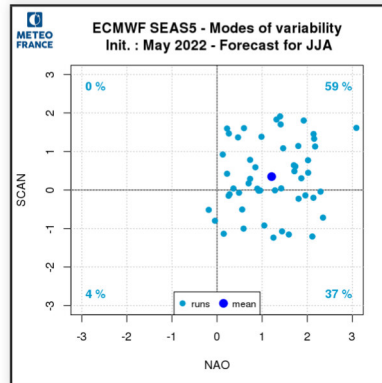
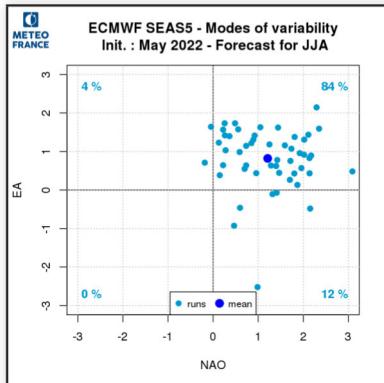
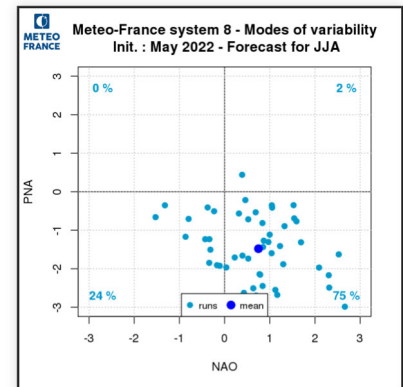
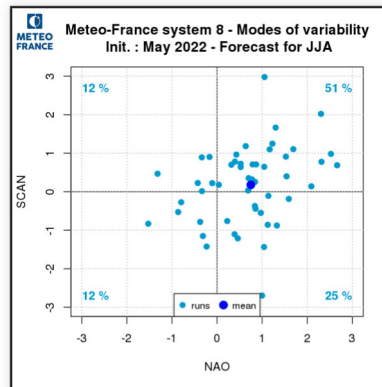
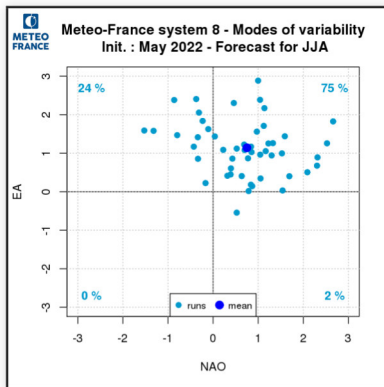
Others models of WMO multi-models MSLP terciles probability.

## Modes of variability : forecast

High confidence in a negative PNA

Strong signal for positive NAO and EA.

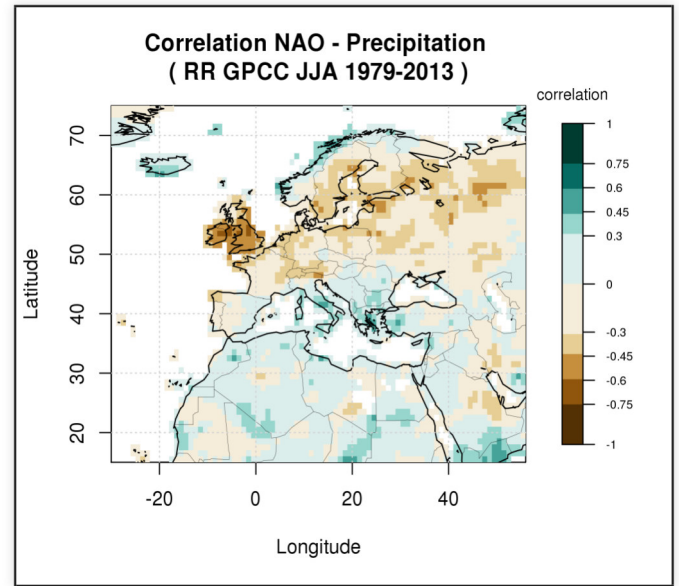
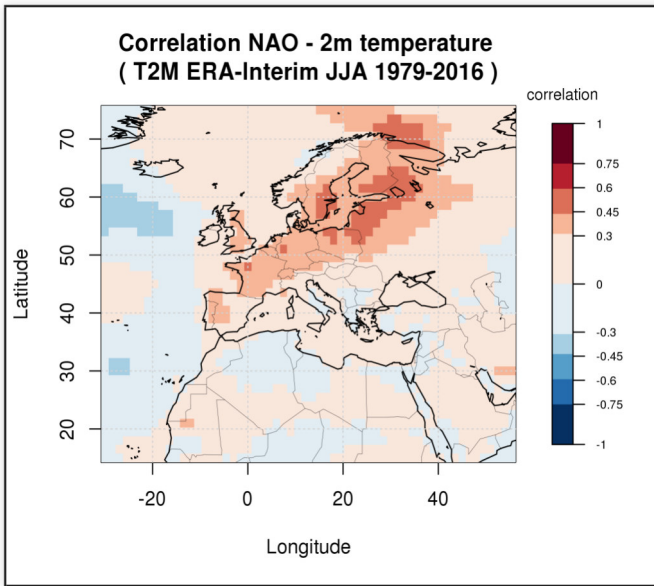
No clear signal for SCAN.



[See the modes of variability patterns](#)

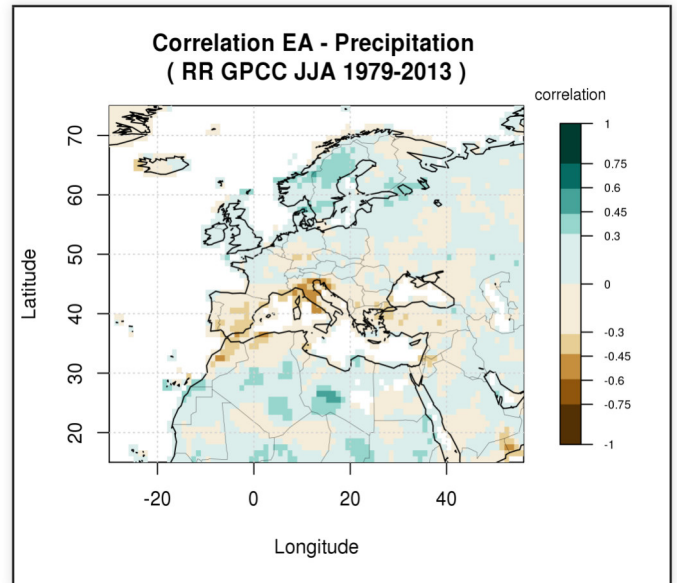
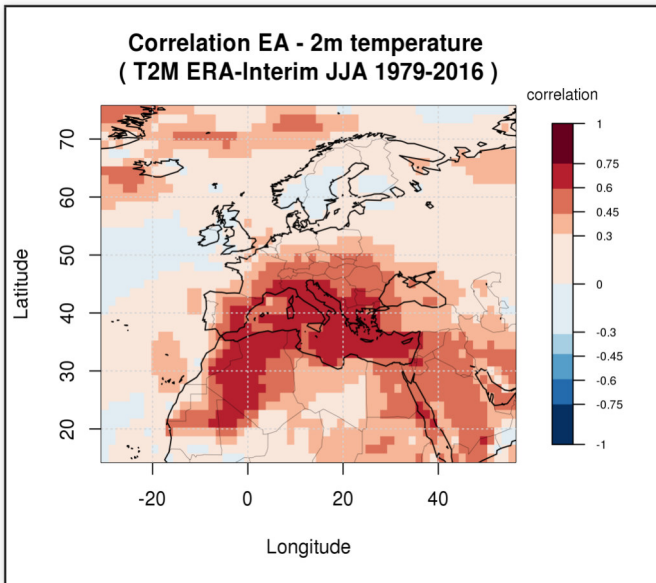
## Modes of variability : NAO impacts

Positive phase of the NAO next quarter



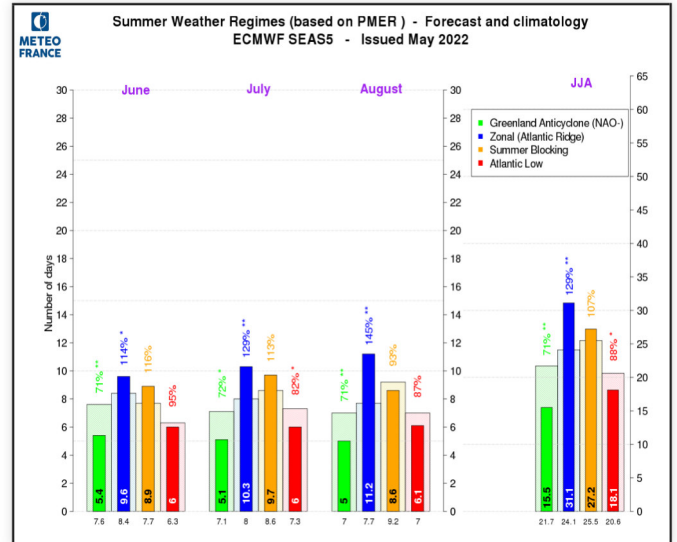
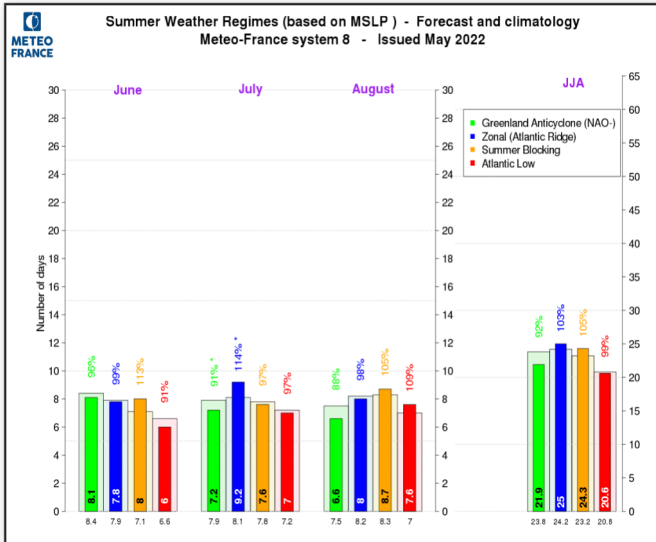
## Modes of variability : EA impacts

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



## Weather regimes : summer MSLP

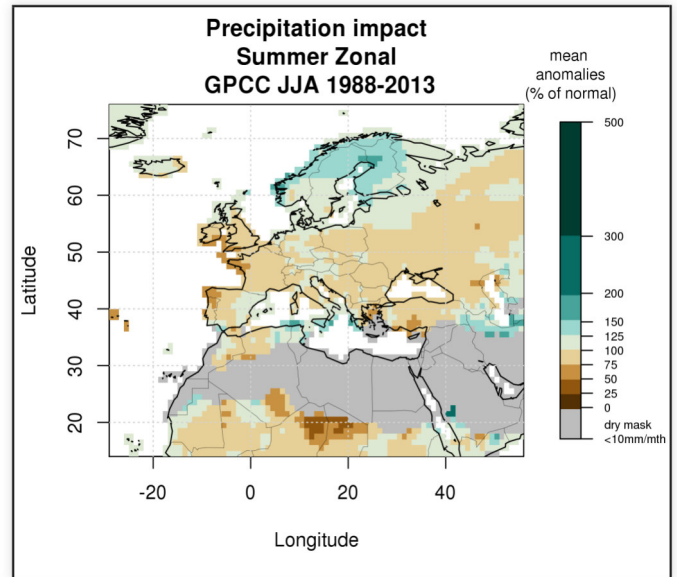
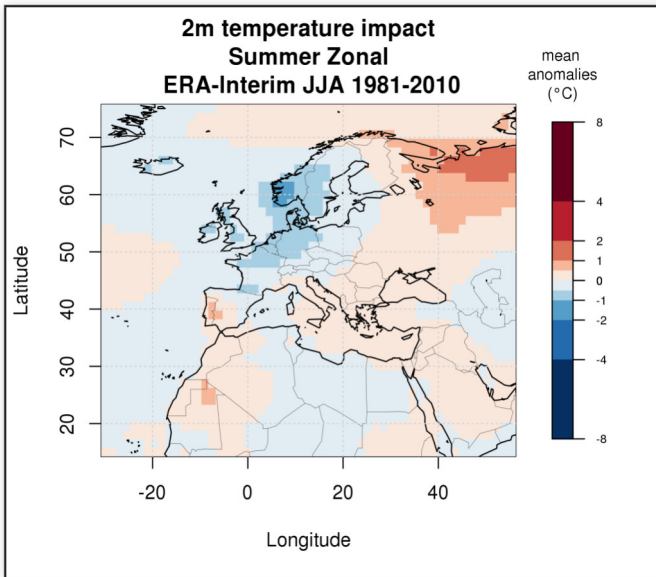
The zonal regime is significantly privileged by ECMWF-SEAS5. No clear signal with MF-S8.



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.



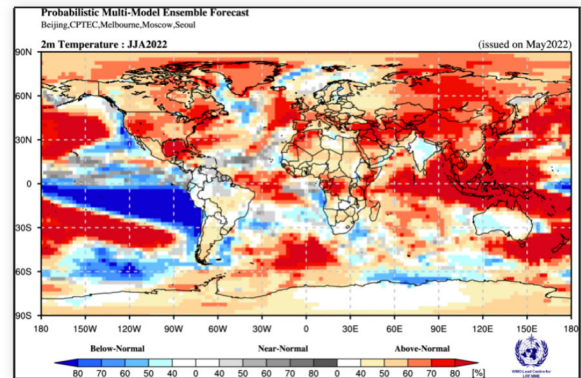
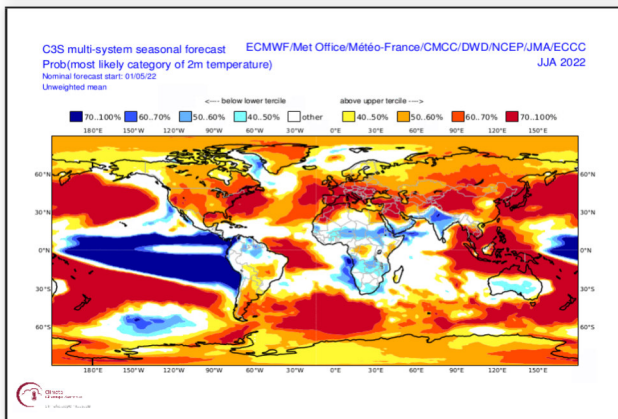
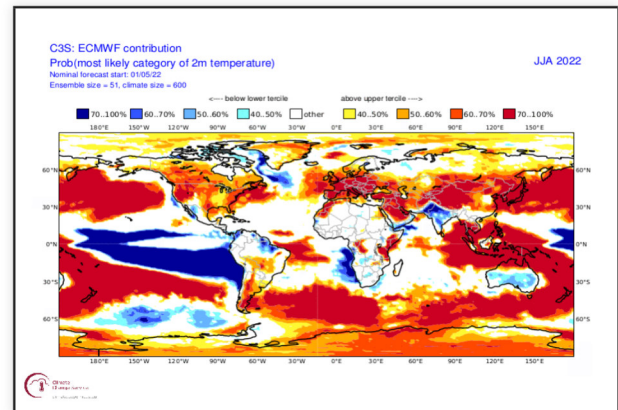
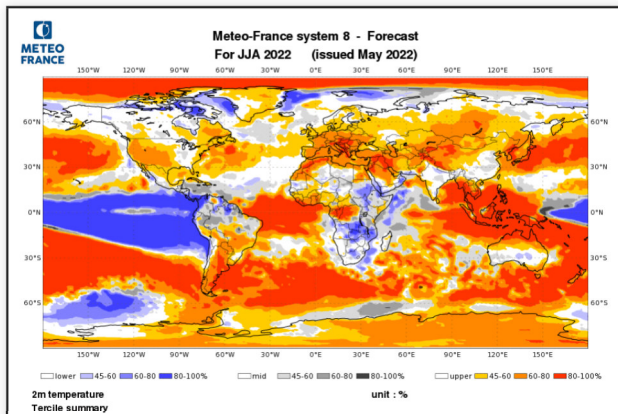
*Impact of Summer Zonal weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)*



## Forecast of climatic parameters : Temperature probabilities

Good agreement between models.

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

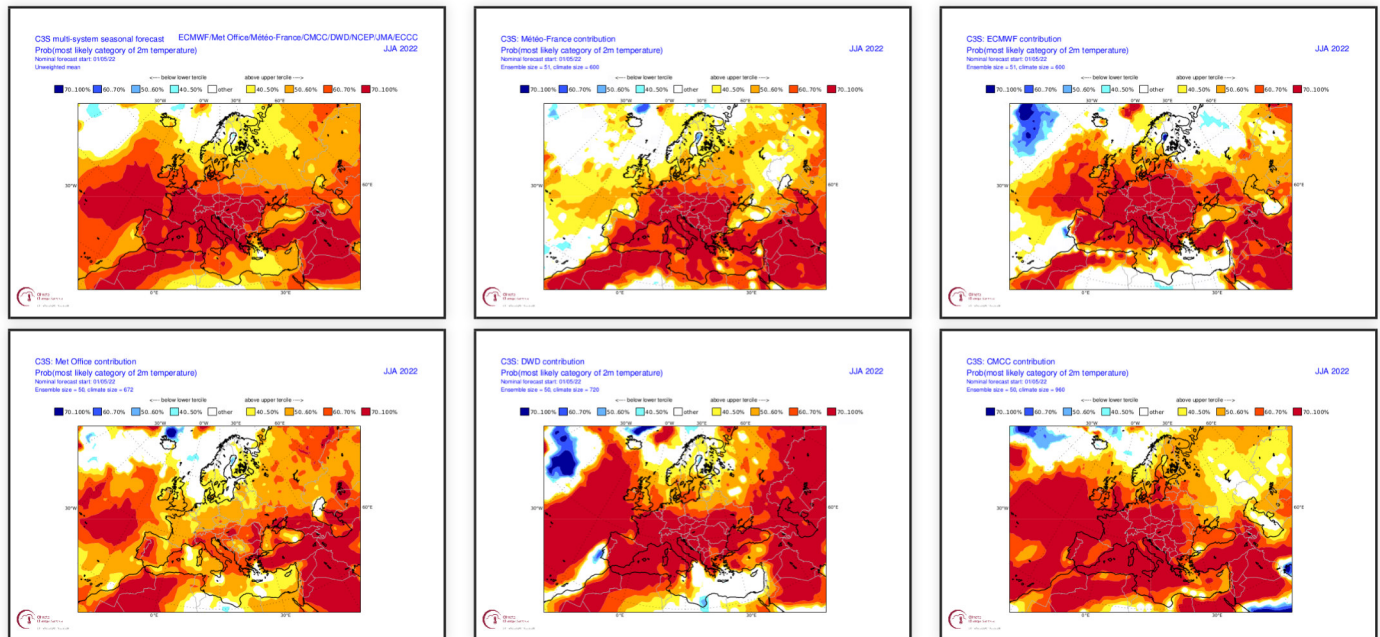


2m temperature probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)



## 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 explain partly these predictions.



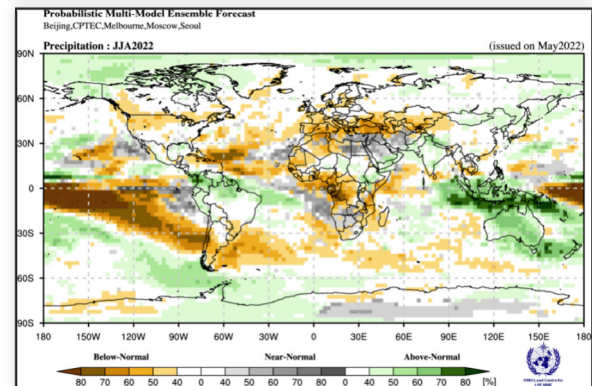
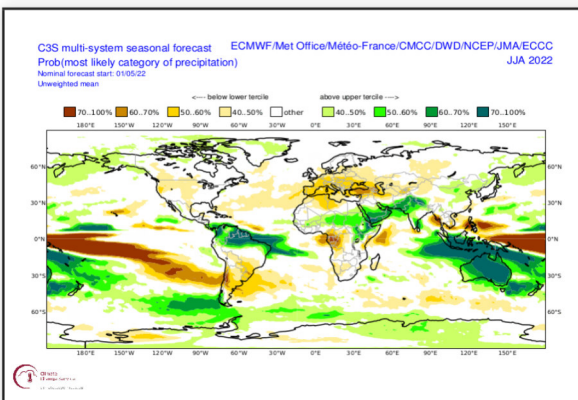
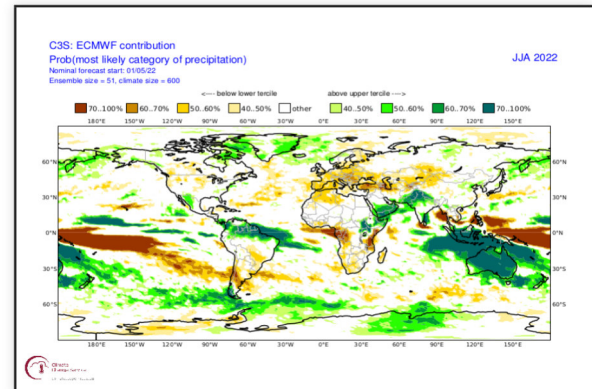
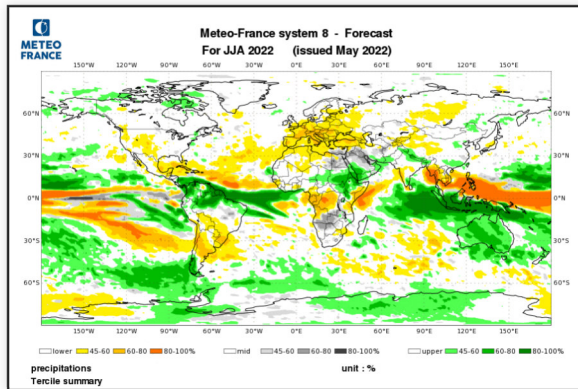
C3S multi-models probability map (top left) and MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC models.

## Forecast of climatic parameters : Precipitation

Again a good agreement between models.

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

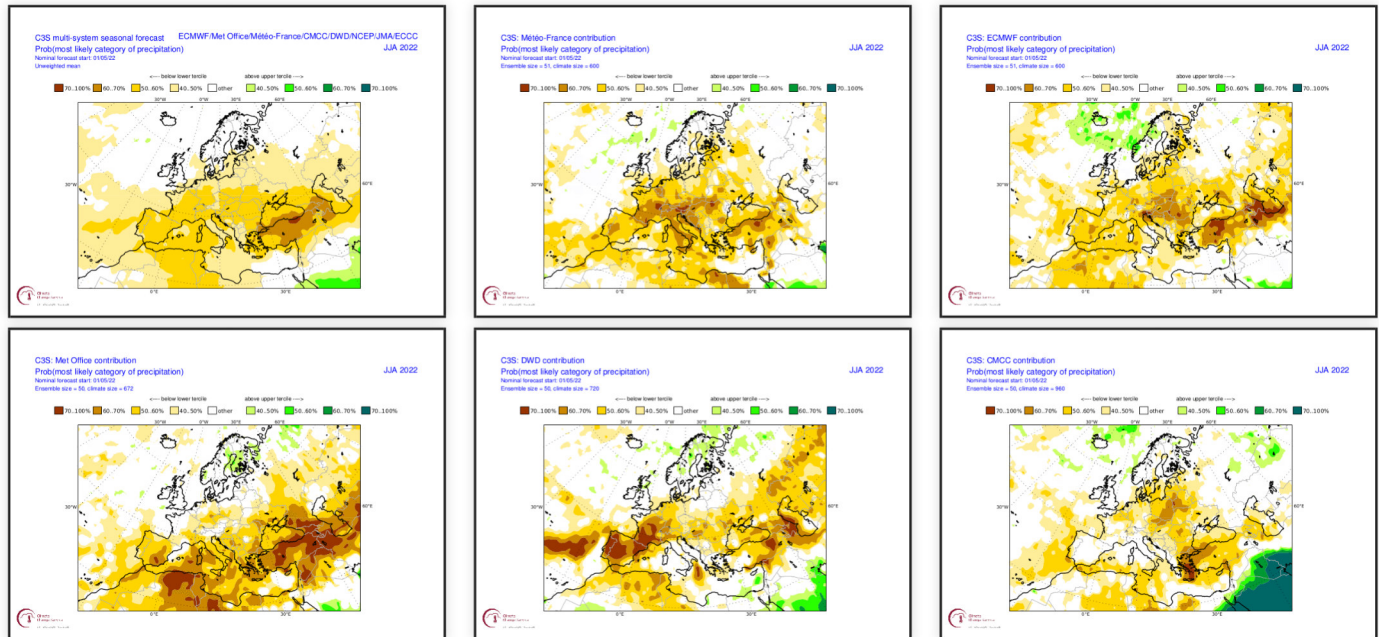
Over Europe, marked dry signal.



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

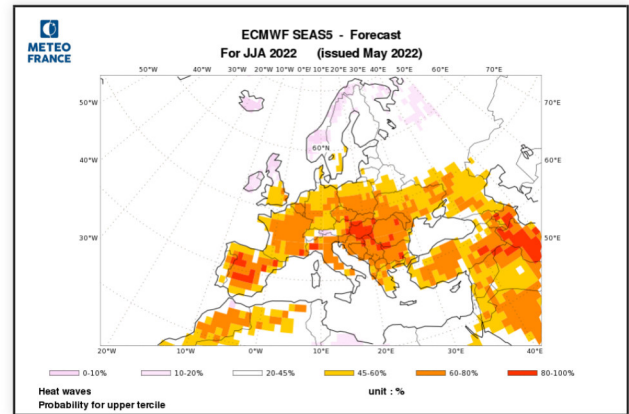
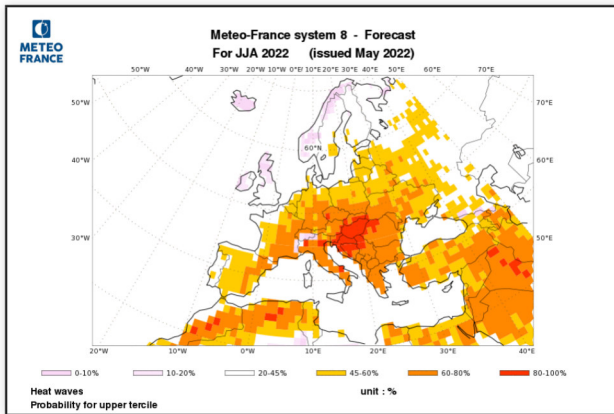
All the models forecast dry conditions over most regions of the domain. Remarkably high probabilities values.



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

## Forecast of climatic parameters : Heat waves

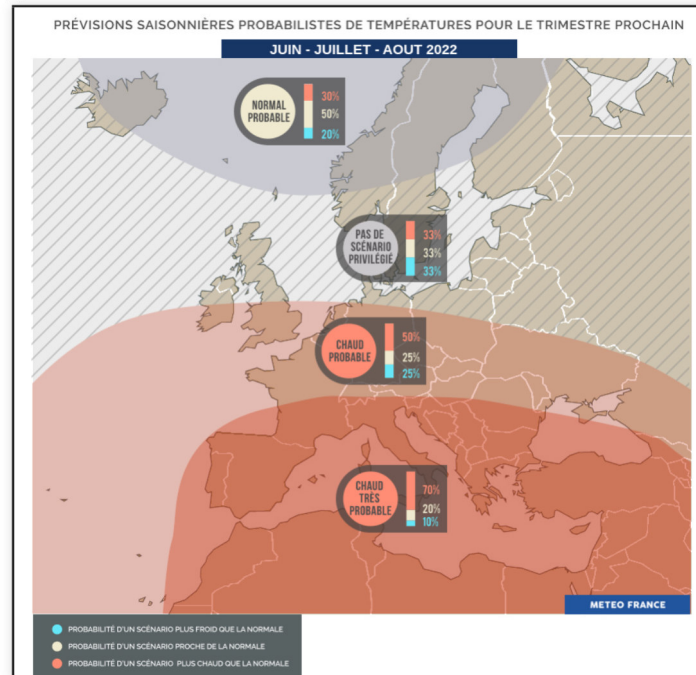
The enhanced probability of heat waves is similar in the 2 models, it would affect the continental countries below the 50th North.



Heat wave probability for MF8 (right) and ECMWF (left). A heat wave is detected if the corrected  $T_{2M}$  is above the daily 90th percentile and a fixed  $20^{\circ}\text{C}$  threshold. [more details here](#)

## Synthesis map for Europe : Temperature

Preponderant NAO+ 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.

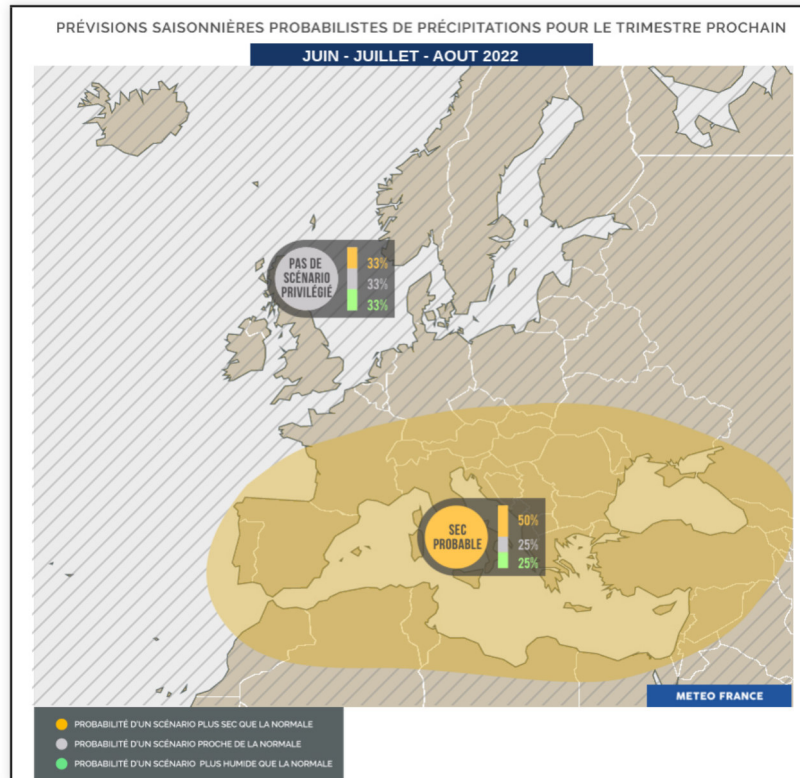


Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS



## Synthesis map for Europe : Precipitation

Still in agreement with a NAO+ type circulation, the models predict dry conditions from the Mediterranean basin to southern Europe and rather wet conditions from Iceland to Scandinavia



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