Météo-France Seasonal Forecast Bulletin

APRIL - MAY - JUNE 2023

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General synthesis : AMJ 2023

La Niña fades next quarter, while in the Indian Ocean conditions remain neutral.
However the atmospheric response looks like La Niña with teleconnections cleary visible in the Pacific

A) Oceanic forecast :

- ENSO : neutral conditions.

- IOD : neutral to slightly positive index

- Tropical Atlantic : positive anomaly

B) Drivers :

- end of sudden stratospheric warming during march.

C) Atmospheric circulation :

The last traces of "La Niña" are still visible with the PNA- phase still remaining over Alaska.

D) Most likely conditions :

Temperatures : A warmer than normal scenario is most likely over a large part of the eastern Mediterranean Basin. No favored scenario elsewhere.

Precipitations : The near normal scenario is the most likely from the northern two-thirds of France to the Baltic States. No favored scenario elsewhere.

Next bulletin : scheduled on April 18th

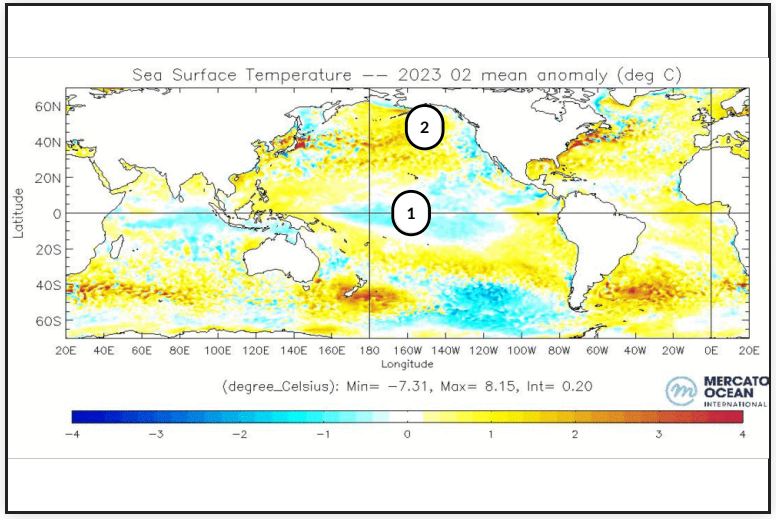
Oceanic analysis of February 2023 : SST anomalies

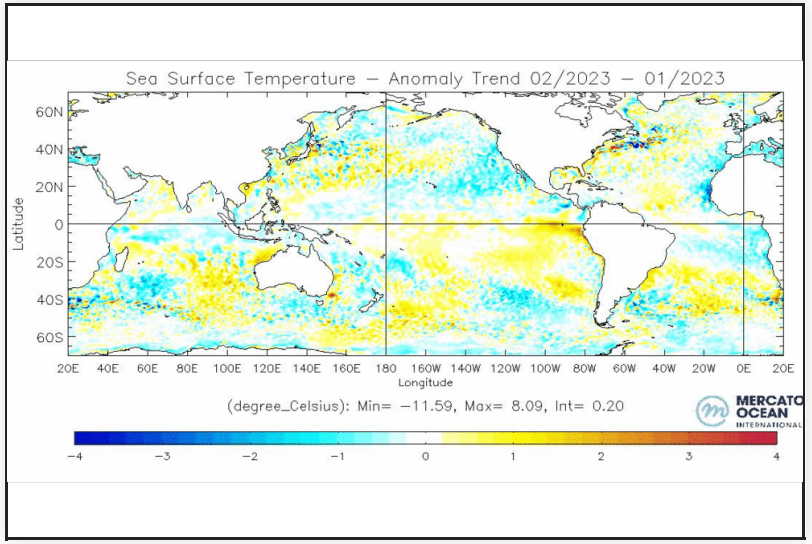
Current ENSO situation : "La Niña" weakening

In the Pacific Ocean : In the Equatorial area, the traces of "La Niña" are fading but are still visible. In the Northern Hemisphere, the PDO- pattern is still present.

In the Indian Ocean : The signal is weak. However, we can see a refreshment on the eastern part of the basin.

In the Atlantic Ocean : A cooling is visible on the eastern side of the basin, from the African coasts to Europe, and in the Mediterranean Sea.



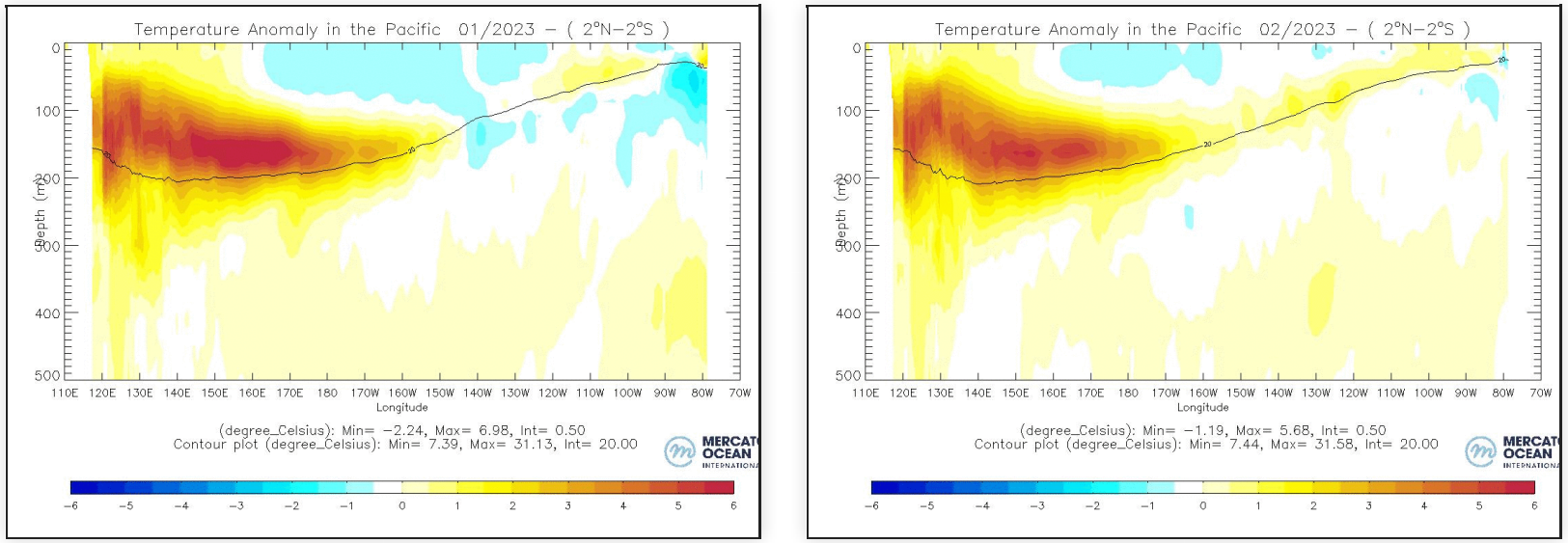


SST Anomalies and trend with the previous month (c) Mercator-Ocean

1 - weakening "la Niña" pattern
2 - Look like PDO- pattern

Oceanic analysis of February 2023 : Pacific vertical section

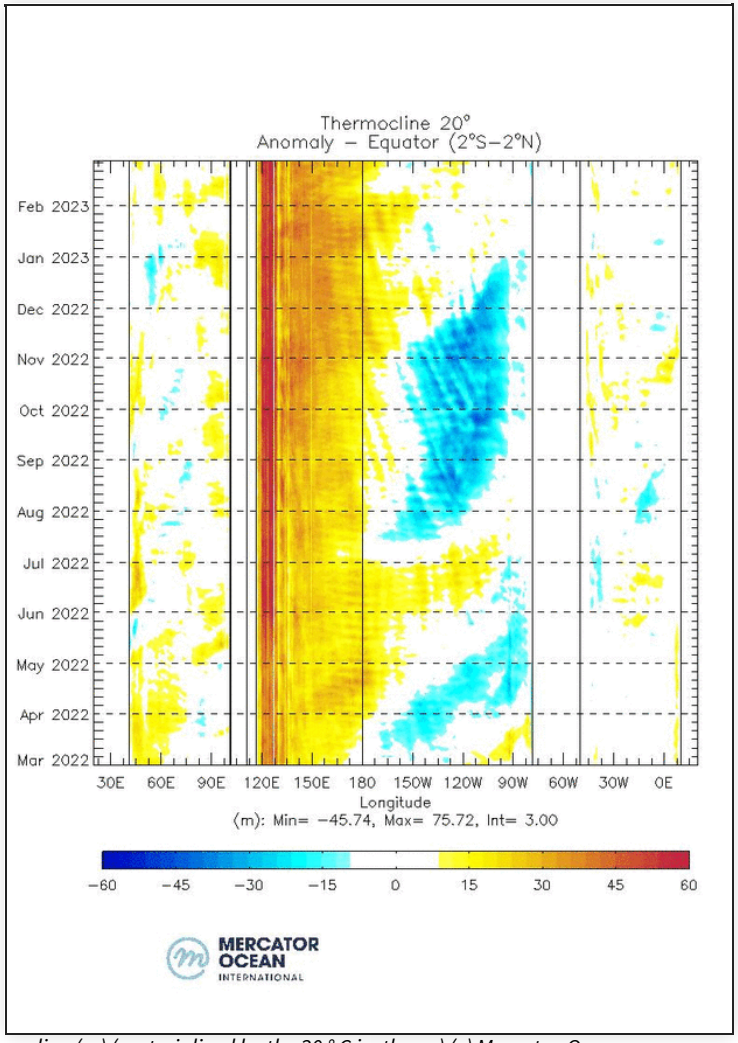
A subsurface warming is taking place on the eastern part of the basin.



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

Oceanic analysis of February 2023 : Hovmüller diagram of the 20°C isotherm

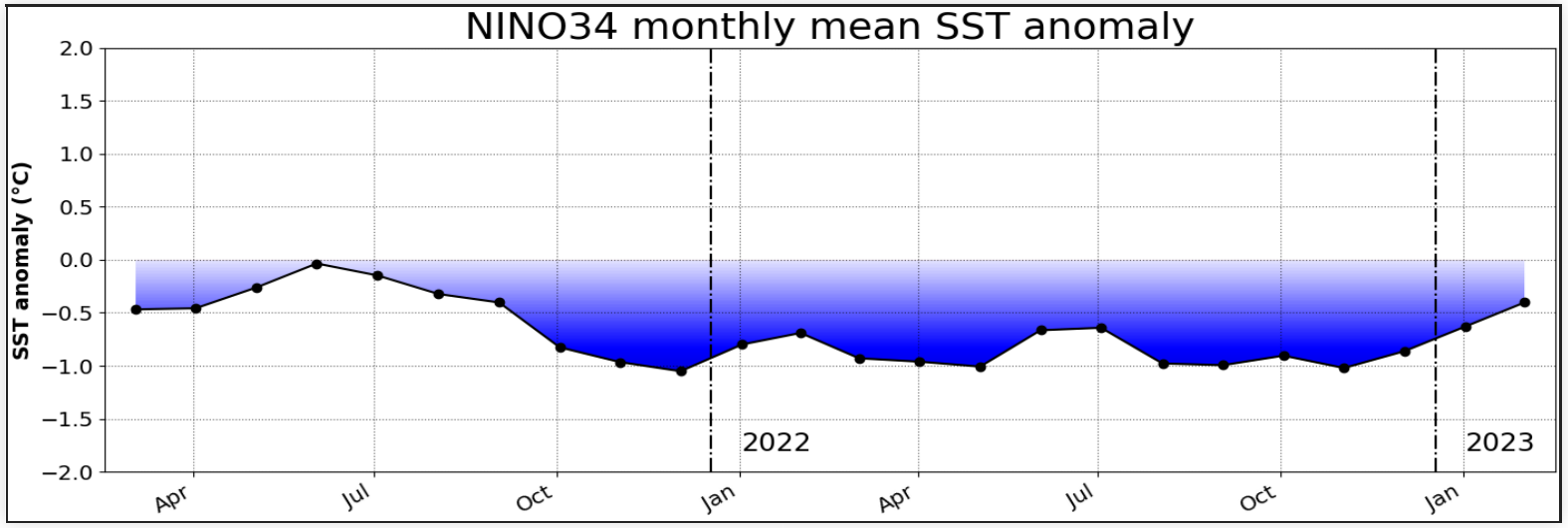
Same comment as before.



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

Oceanic analysis of February 2023 : Pacific Ocean - Nino3.4 index history

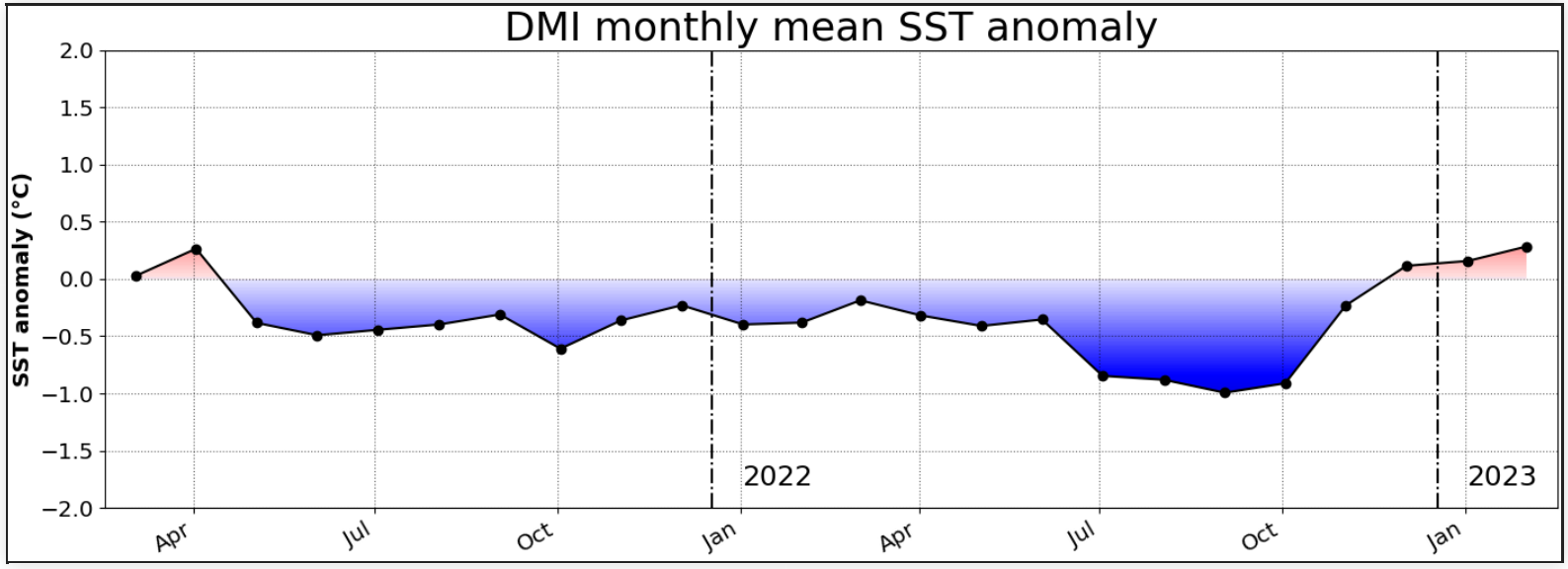
Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -0.4°C
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png)



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

Oceanic analysis of February 2023 : 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

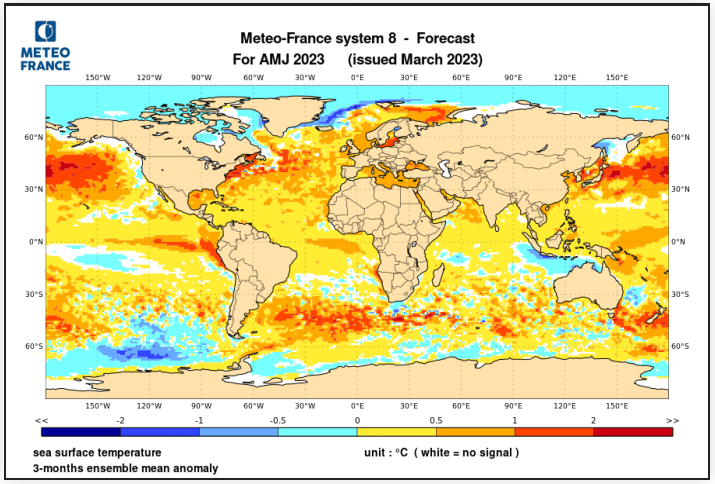
Oceanic forecast : SST anomaly

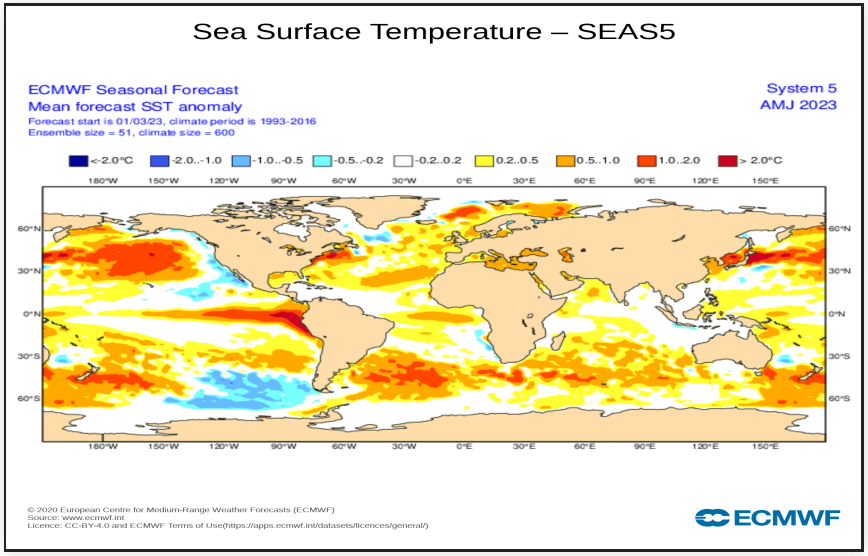
Good agreement between MF-S8 and ECMWF-SEAS5 in the main anomaly patterns.

In the Pacific Ocean : A warm anomaly over the Eastern Equatorial Pacific Ocean is starting to be well established. In the Northern Hemisphere, the PDO- pattern is maintained (warm anomaly in the center of the basin and cold anomaly along the US coast).

In the Indian Ocean : The signal is still weak, but a small cold anomaly is emerging near the Maritime Continent.

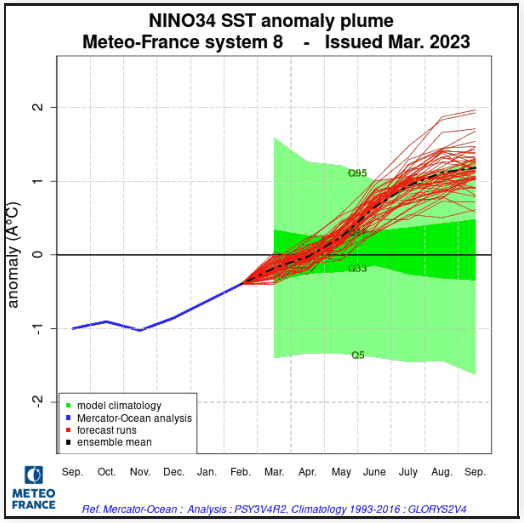
In the Atlantic Ocean : A positive anomaly is forecast by both models over the equatorial zone.
Similarly, a moderate warm anomaly is forecast over the North Atlantic and the Mediterranean Sea.

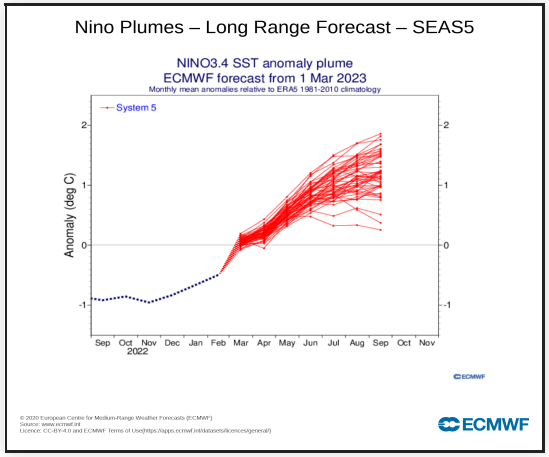




Oceanic forecast : NINO3.4 Plume diagrams

Both models predict a rapid and sustainable return to clearly positive values.

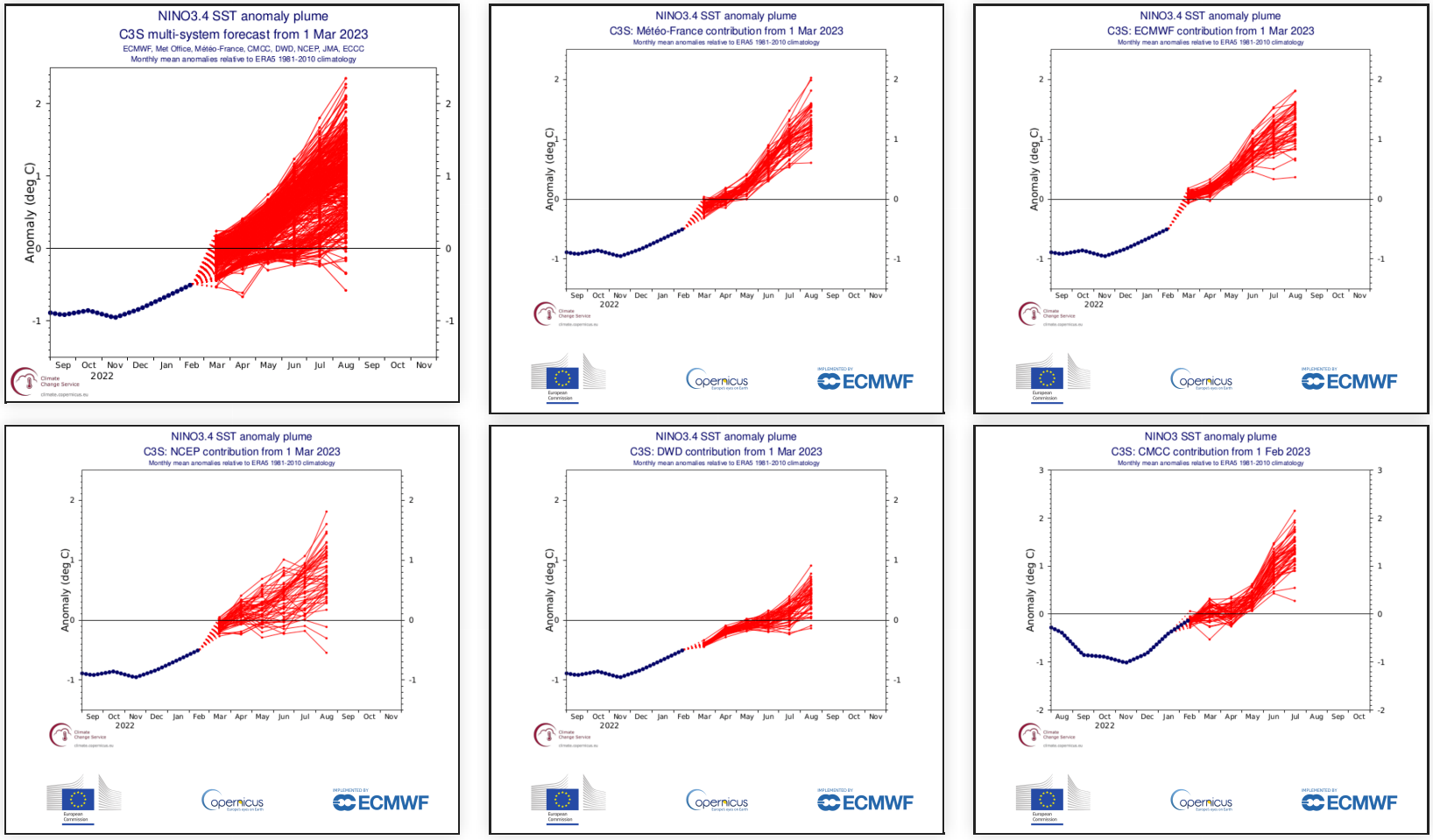




Oceanic forecast : C3S Nino3.4 re-scaled plume diagrams

All models predict a return to a positive index, but still moderate at the end of the period. However, the evolution is slower with the DWD and CMCC models. Conditions remained generally neutral during the quarter.

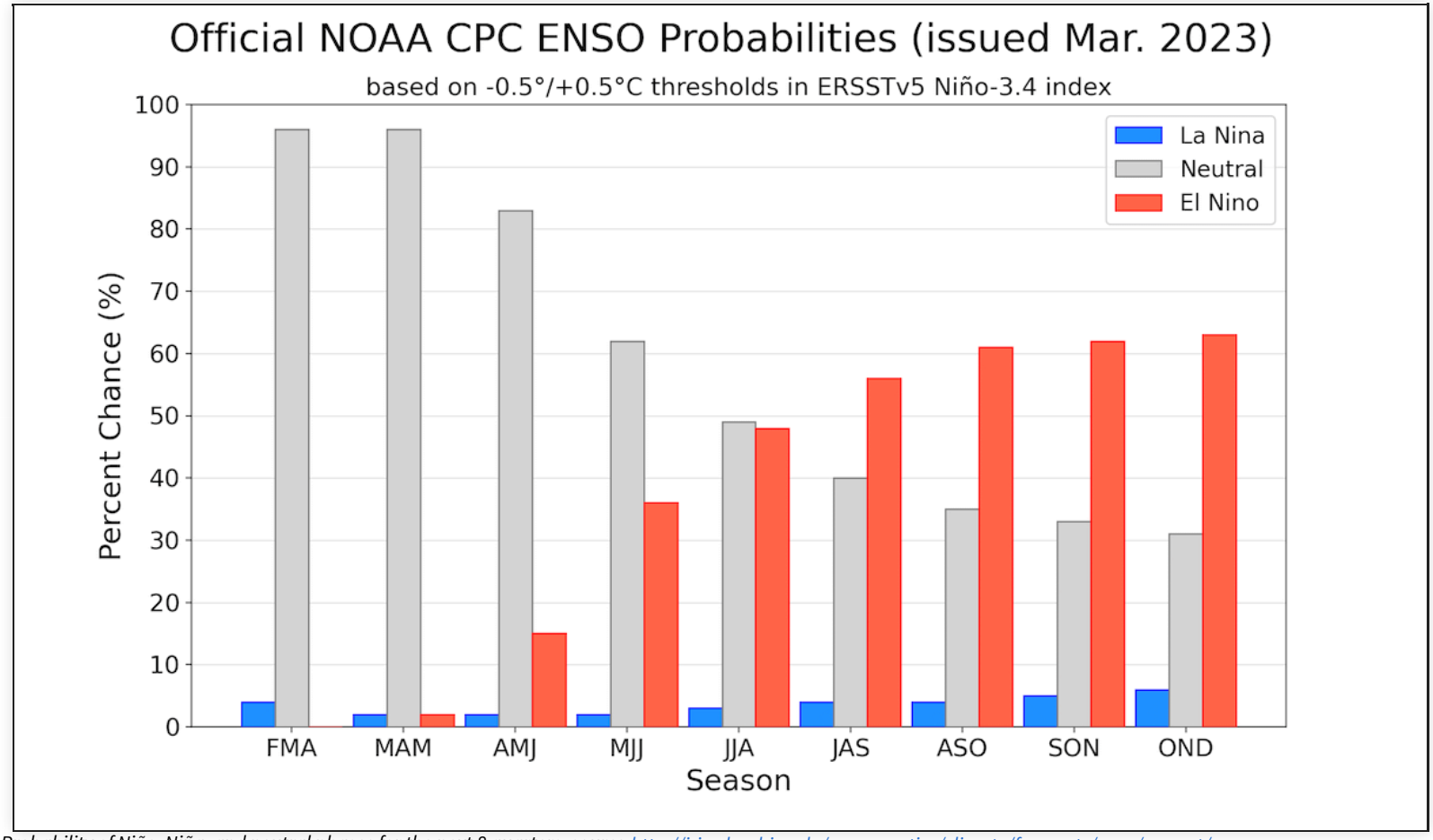
The most likely phase for the next three months : Neutral



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

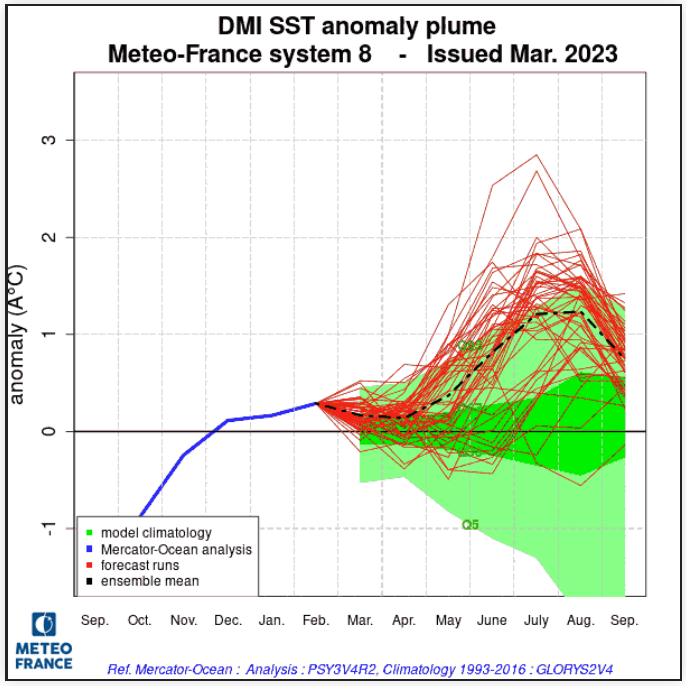
IRI forecast : more than 80 % of neutral condition for AMJ.

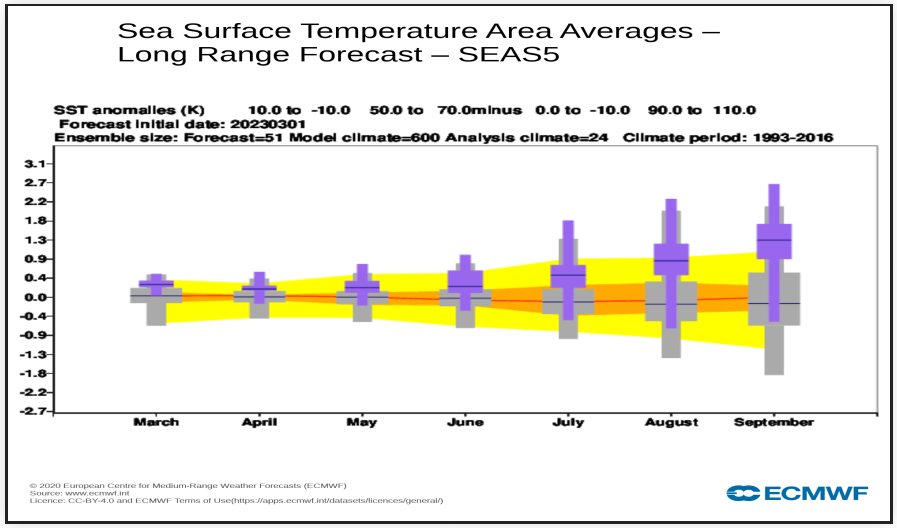


Probability of Niño, Niña, and neutral phases for the next 8 quarters. source http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

Oceanic forecast : Indian ocean - DMI evolution

The forecasted conditions are neutral at the beginning of the period before moving towards more clearly positive values. The spread is quite wide.

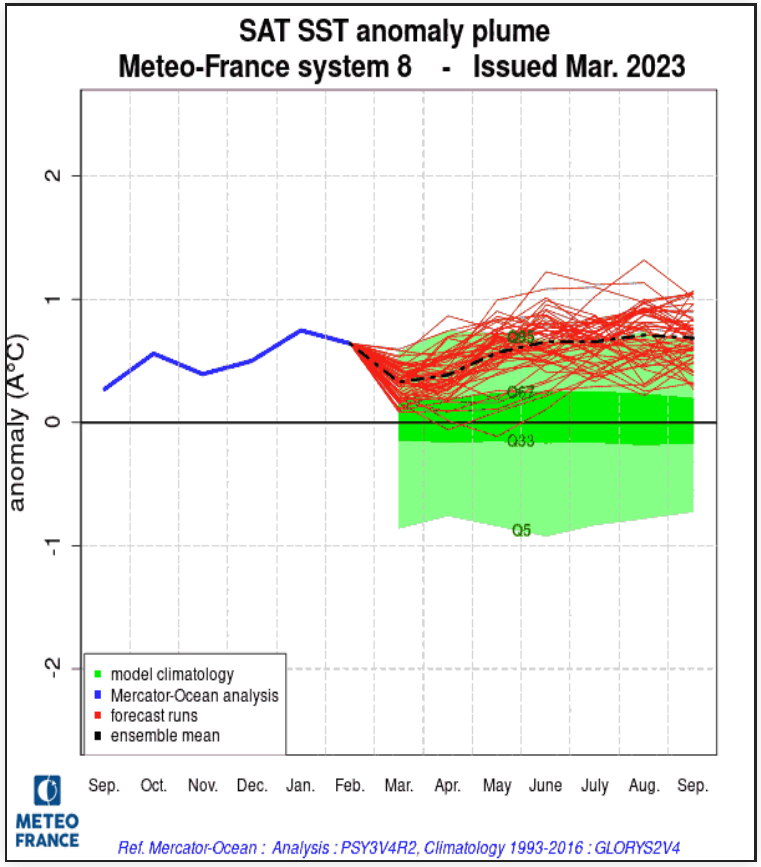


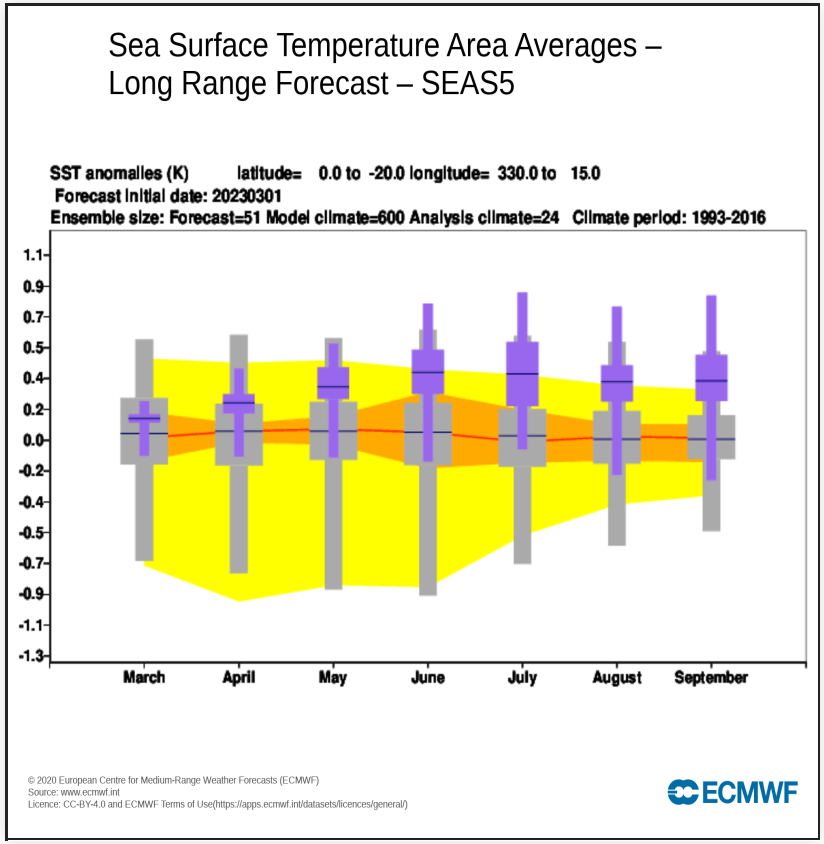


DMI index : analysis, forecasts and model climatology with MF-S8 on the left and ECM-SEAS5 on the right

Oceanic forecast : Atlantic ocean - SAT evolution

Both models predict that the index will remain in the warm tercile.

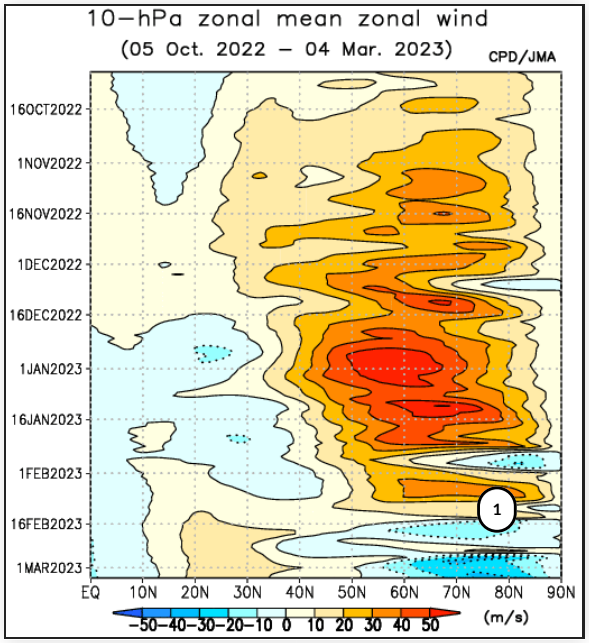


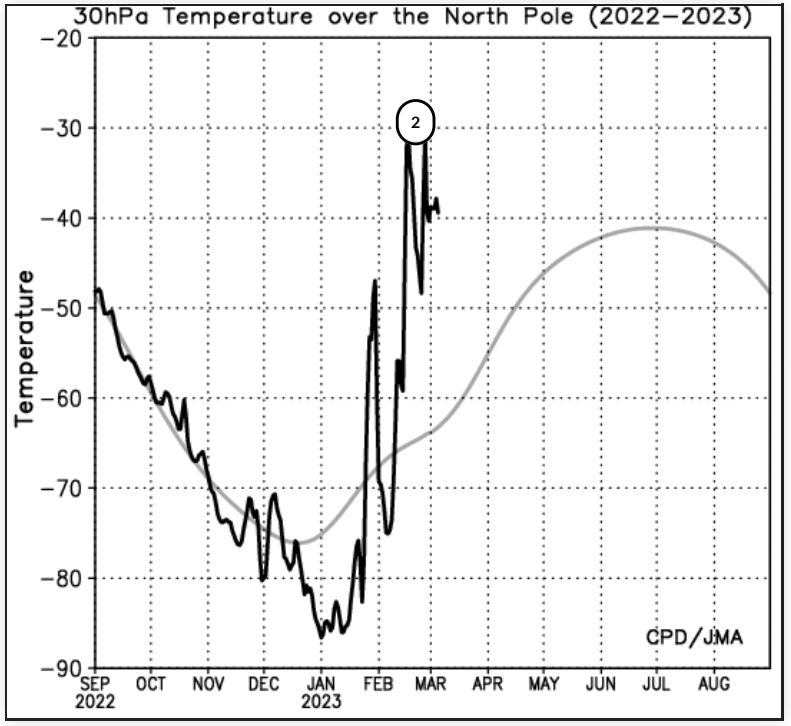


Anomaly on the SAT box : analysis, forecasts and model climatology with MF-S8 on the left and SEAS5 on the right

Drivers : SSW

The SSW that began in mid-February continues into early March.
The consequences on the zonal wind are very clear.



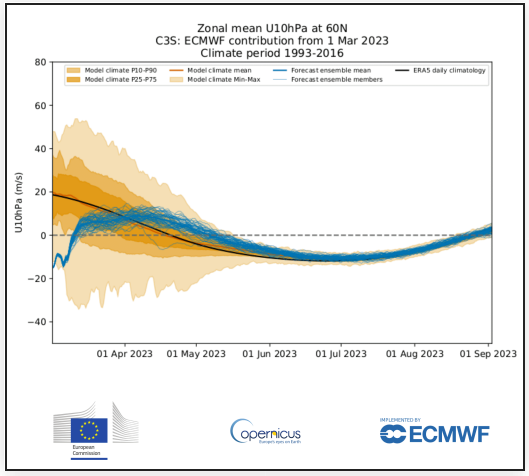


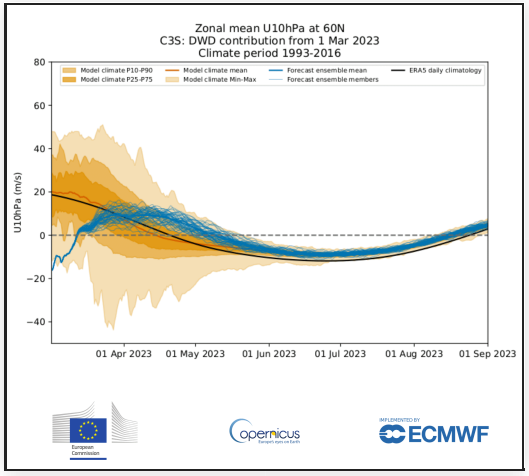
10 hPa zonal wind Hovmuller diagram and 30 hPa temperature histogram. (c) Tokyo Climat Center JMA

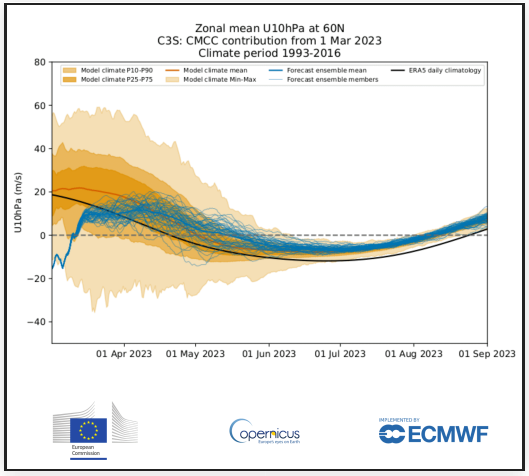
1 - zonal wind reversal
2 - SSW in progress

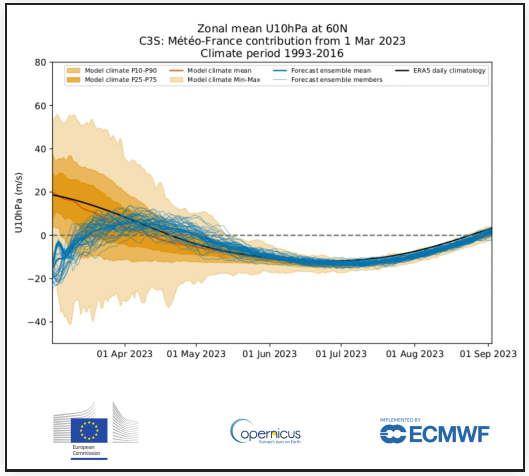
Drivers : polar vortex (U010 plumes)

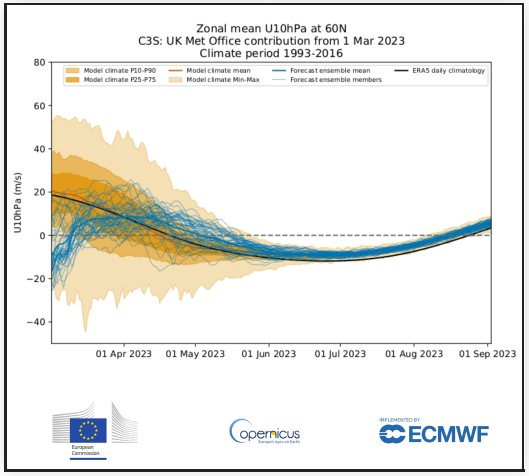
Good agreement between the models

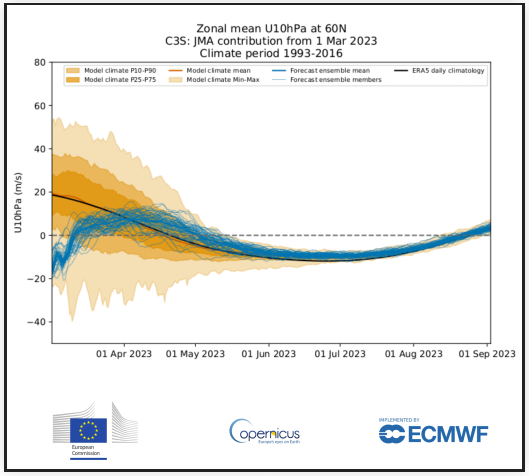












ECMWF-SEAS5, DWD, CMCC, MF-S8, UKMO, and JMA 010hPa zonal mean of u componant of wind at 60°N.

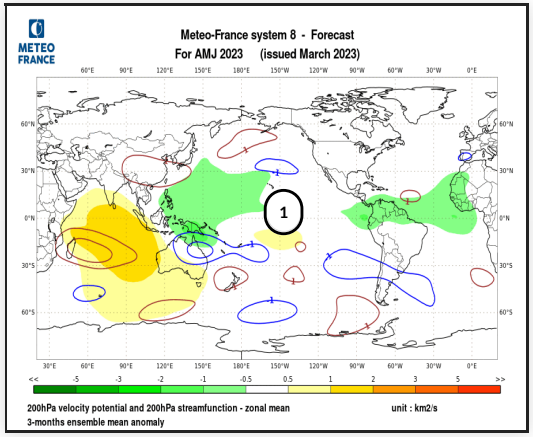
Drivers : Summary

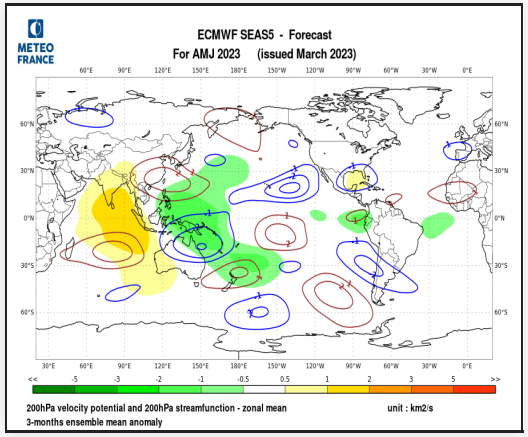
The SSW still in progress leads to a higher probability of a NAO-phase in the coming weeks and therefore at the beginning of next quarter.

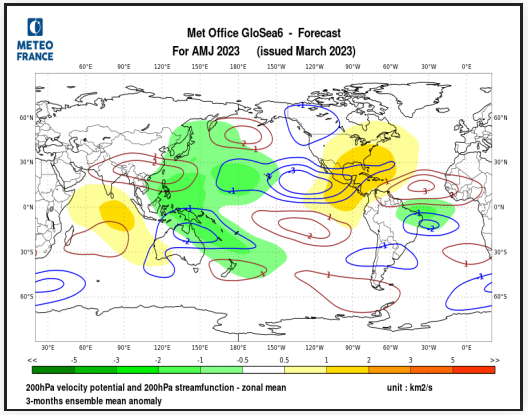
Atmospheric circulation forecasts : velocity potentiel and stream function at 200hPa

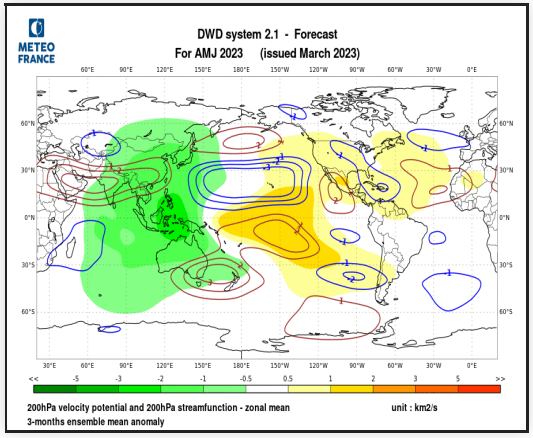
Velocity Potential : Divergences appear between the models. Most of them predict the disappearance of the Pacific dovnward motion anomaly. Only the DWD model, which is slow to warm up the Nino3.4 index, maintains a typical "La Niña" velocity potential distribution.

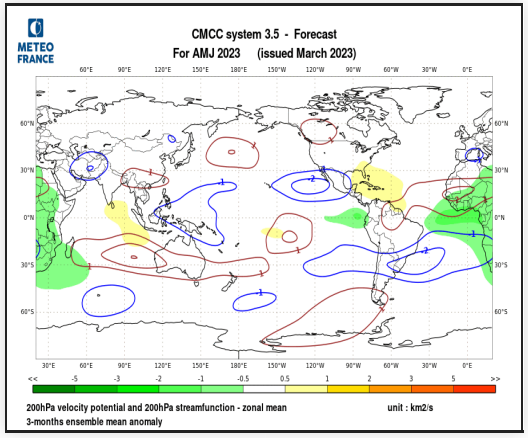
Streamfunction : The dipoles on the Pacific, the Maritime Continent and the Atlantic Ocean are more or less attenuated depending on the model. They have almost disappeared with MF-S8. On the contrary, they are still present in the DWD and Met Office models. These same models are the only ones to predict teleconnections to the northern hemisphere. Little signal in Europe, except a cyclonic curve over Spain with MF-S8 and ECMWF.

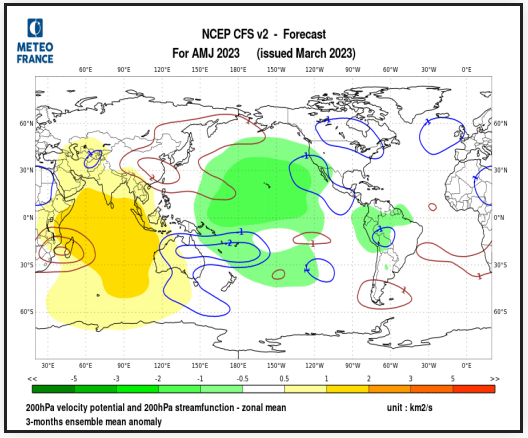












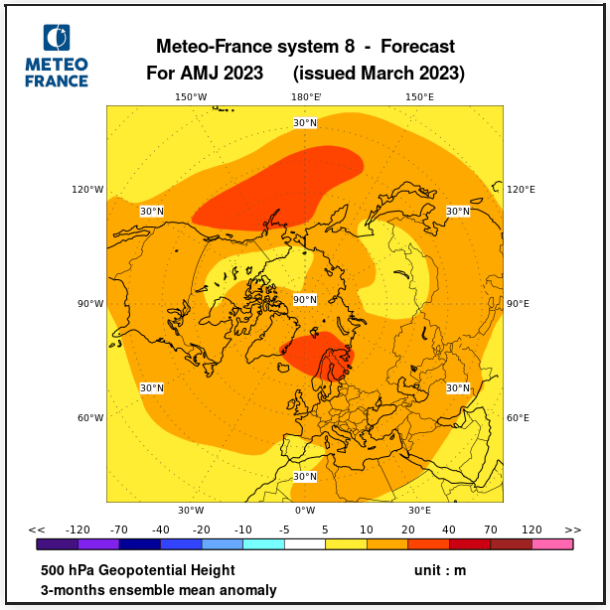
MF8,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

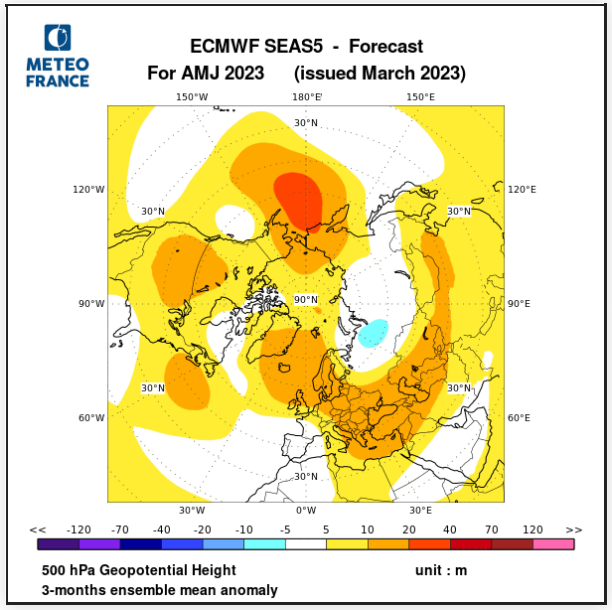
1 - disappearance of downward motion anomalies

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

The positive anomalies are more marked with the MF-S8 model. However, both models agree on a positive anomaly off Alaska -look like PNA-) and another over Scandinavia.

A negative anomaly over central Russia is predicted by ECMWF, but much weaker according to MF-S8.

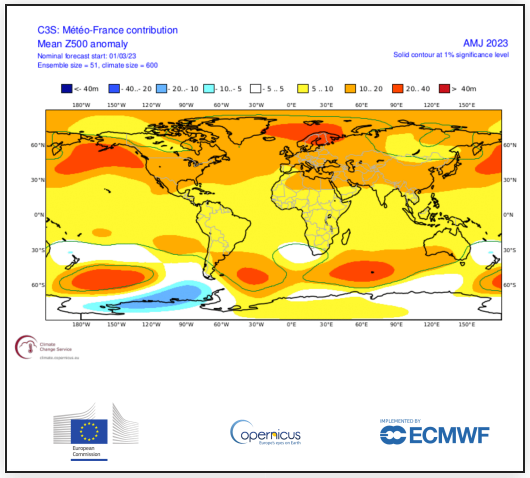


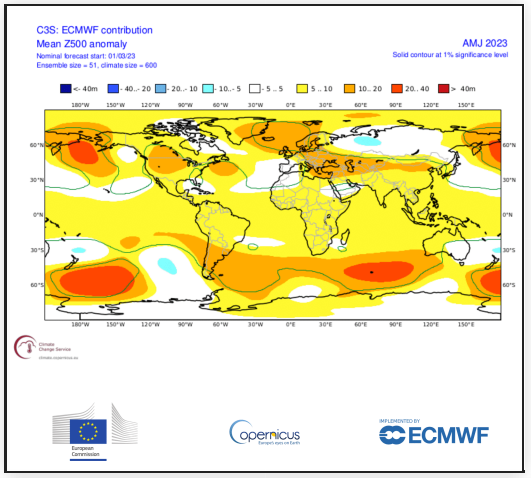


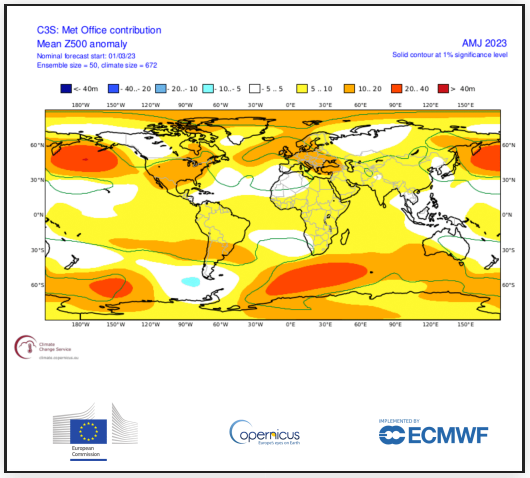
polar projection of MF8 and SEAS5 500hPa geopotential height anomalies.

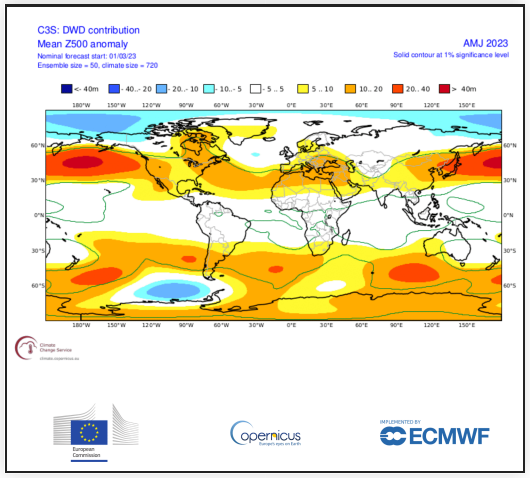
Atmospheric circulation forecasts : Z500 anomalies in C3S models

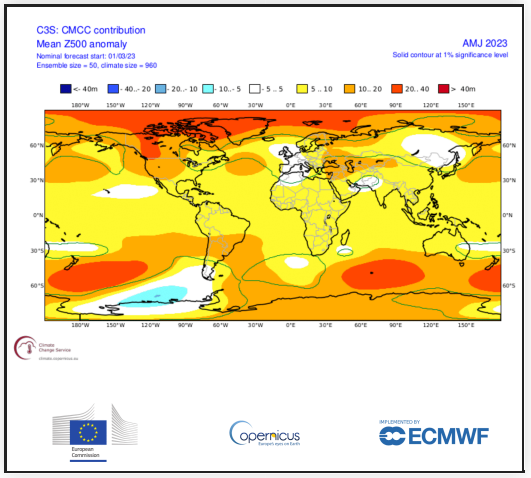
Divergences appear between the models.
Most still see a pattern close to PNA- over Alaska. Three of the models (MF-S8, ECMWF, Met Office) predict a positive anomaly from Scandinavia to the Black Sea with weaker values on both sides (Central Russia and Spain).
The DWD model is quite different, related to the slower warming of its Nino index3.4).

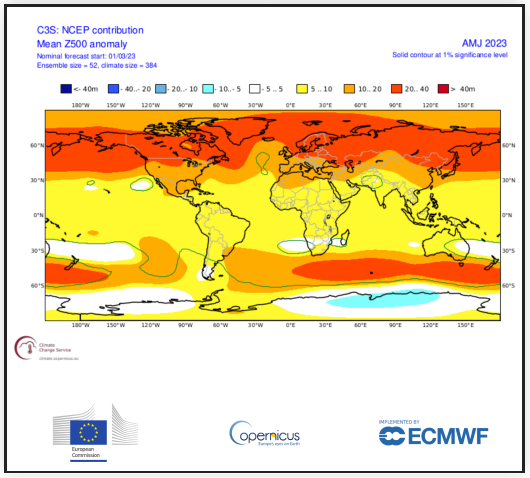








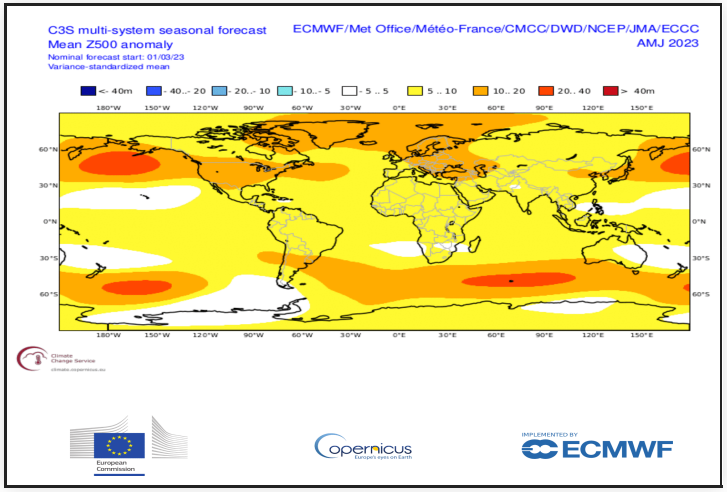




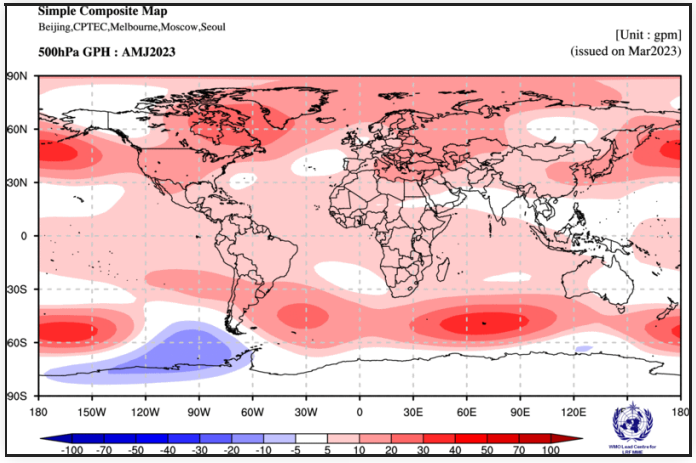
MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies multi-systems

The two multi-models agree for the main anomalies in the Southern Hemisphere and over the American continent.
Over Eurasia, the patterns are close (positive anomaly over eastern Europe and neutral areas on both sides). However, taken individually, the WMO models are very divergent.



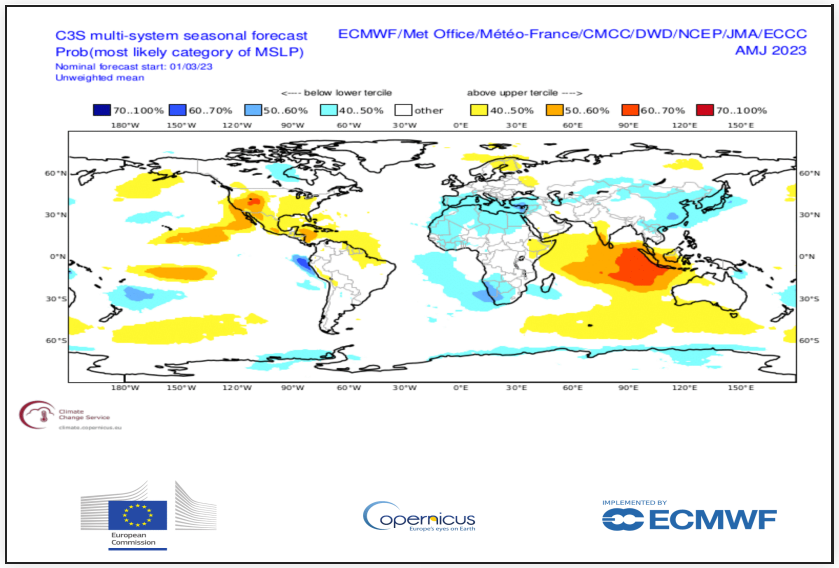
C3S multi-models (MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC, NCEP, JMA, ECCC) 500hPa geopotential height anomalies.



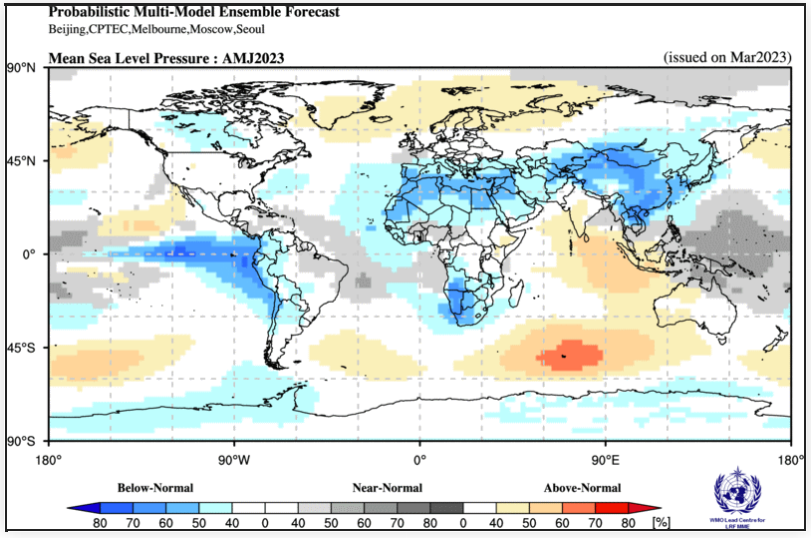
Others models of WMO multi-models 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : MSLP probabilites multi-systems

The two multi-models agree on most of the anomalies.



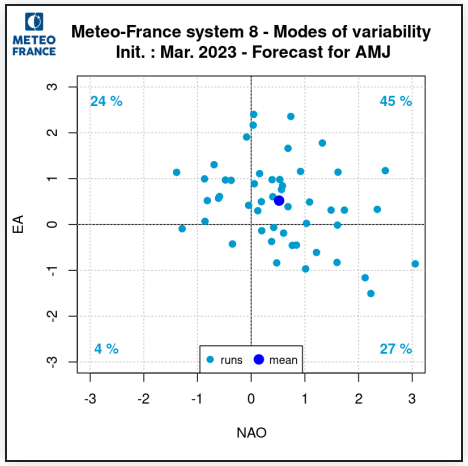
C3S multi-models MSLP terciles probability.

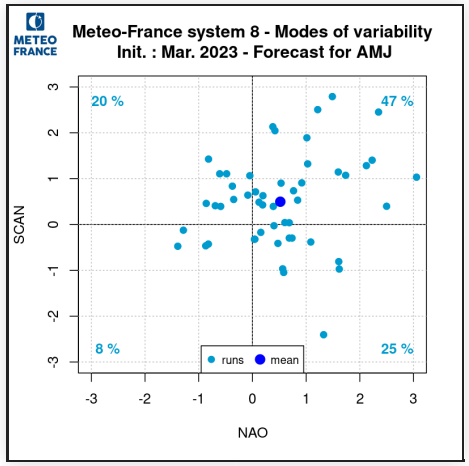


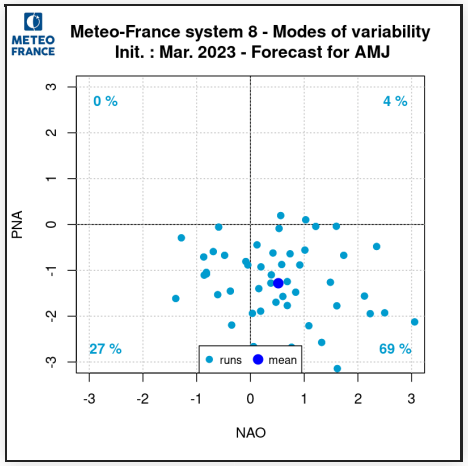
Others models of WMO multi-models MSLP terciles probability.

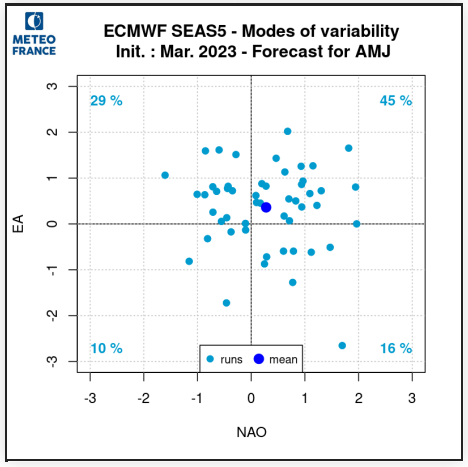
Modes of variability : forecast

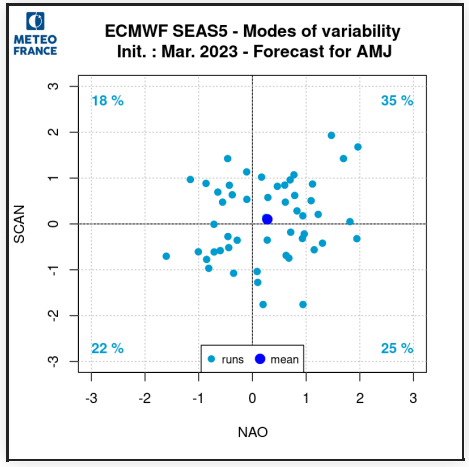
The two models are quite close, with a little less spread for ECMWF.
They both foresee the PNA- mode, more marked with MF-S8.
They also agree for the NAO+ and EA+ modes.

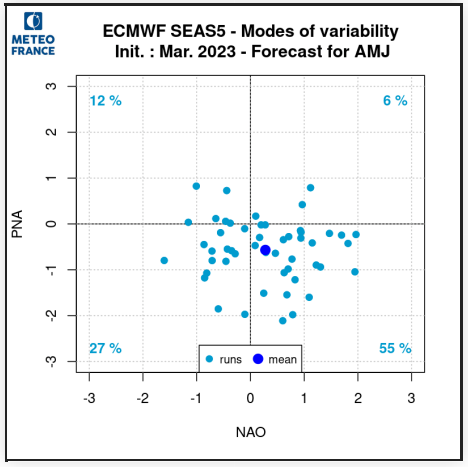








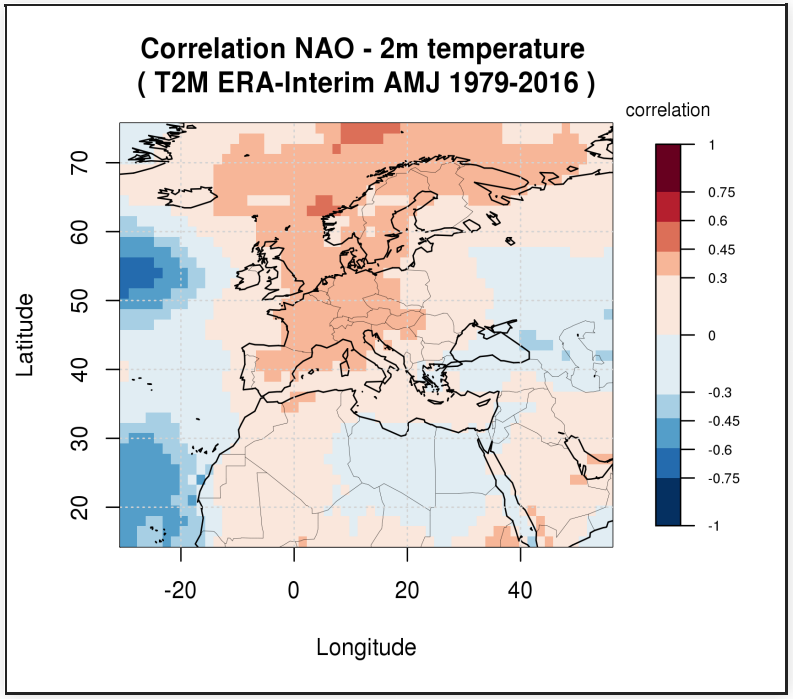


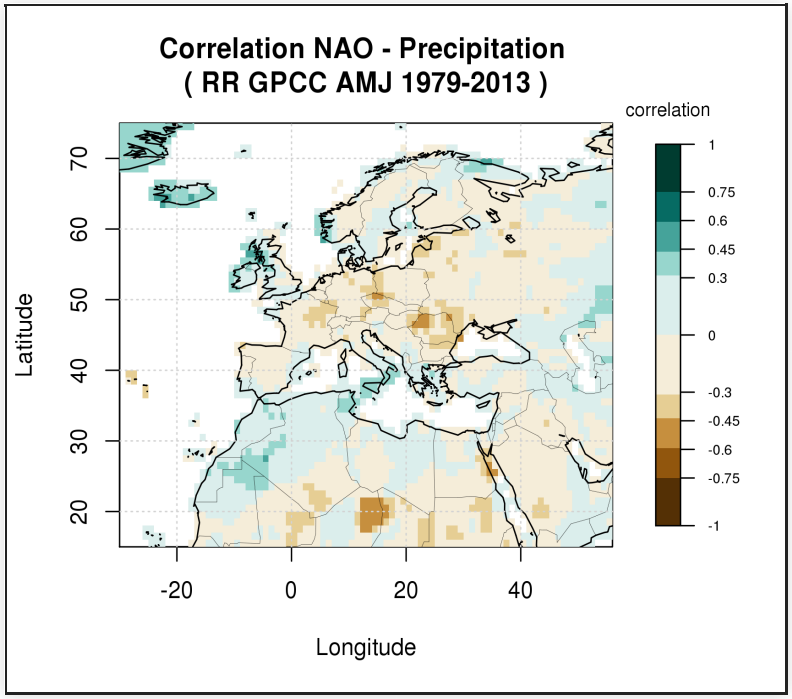


See the modes of variability patterns

Modes of variability : NAO impacts

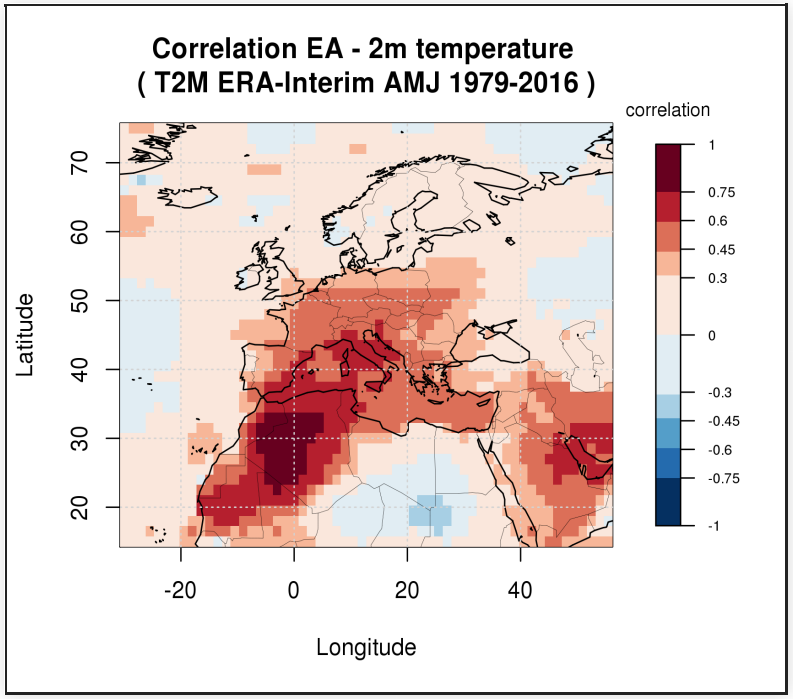
Positive phase of the NAO next quarter

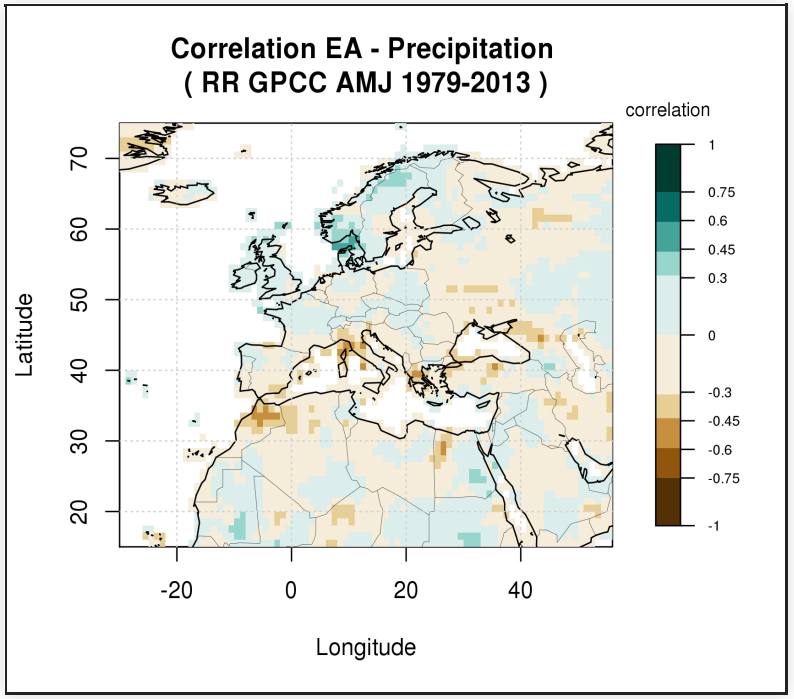




Modes of variability : EA impacts

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

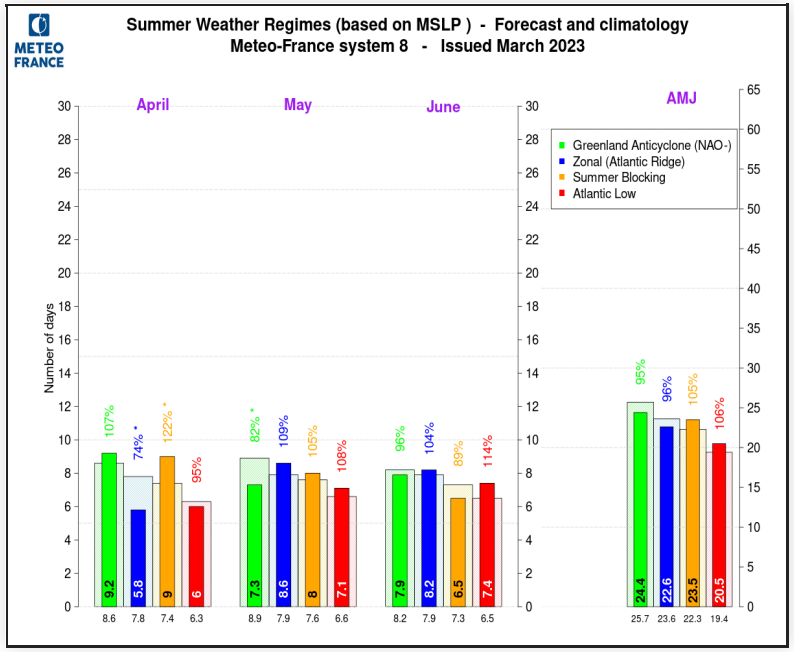


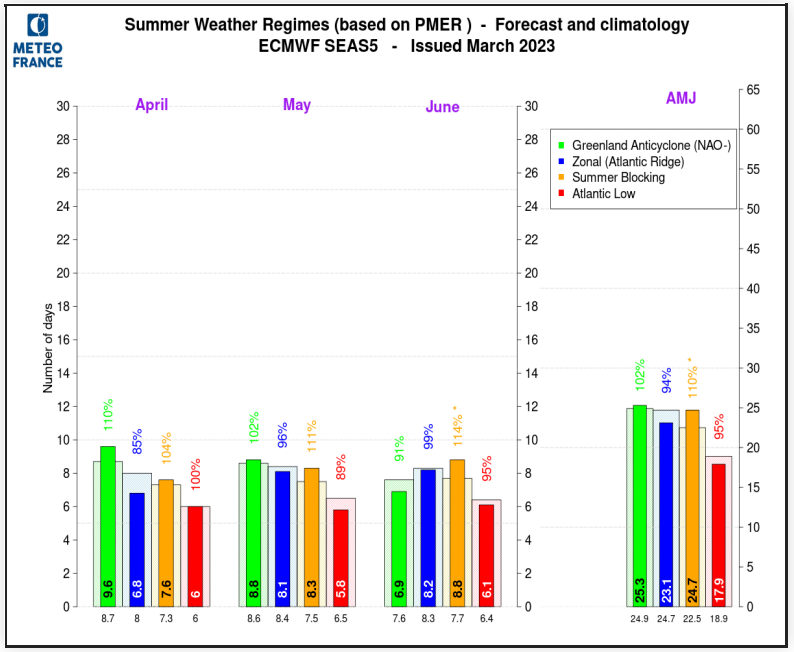


Weather regimes : summer MSLP

The quarterly data are close to the climatology with a limited overrepresentation of the "Summer Blocking" regime, but still significant for ECMWF.

Note that, for the month of April, both models predict a frequency of the Greenland Anticyclone (NAO-) regime higher than its climatology, which may be related to the SSW of this early month.

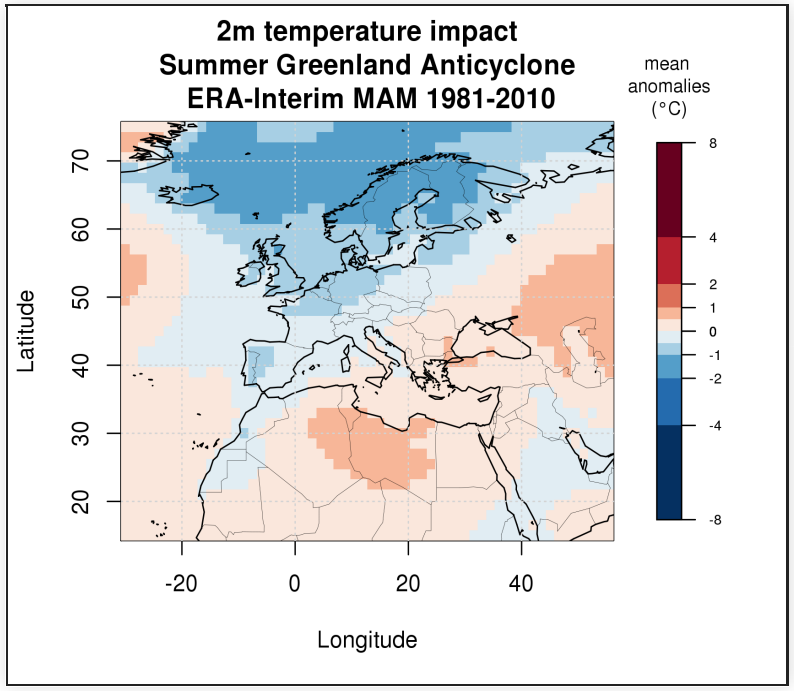


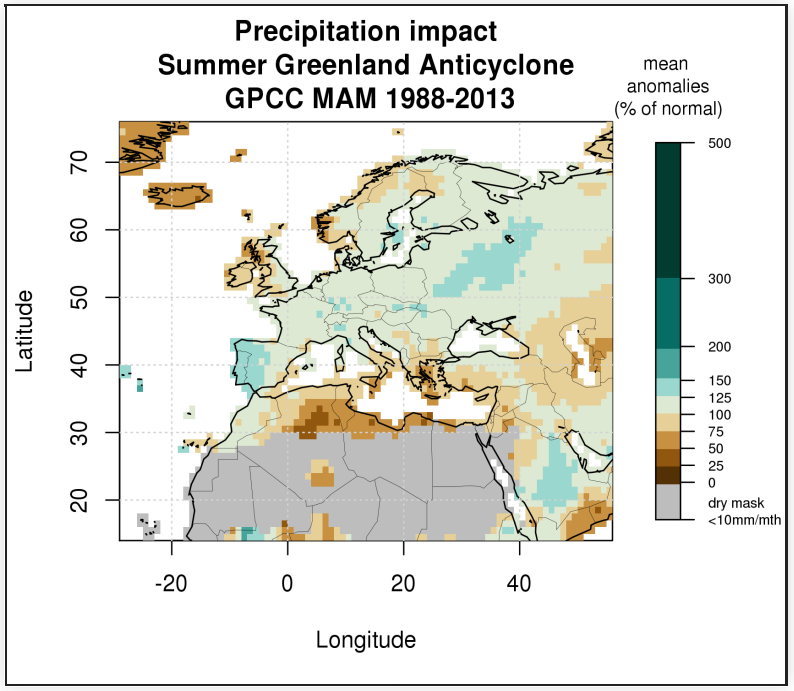


Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S8 (left) and SEAS5 (right).

Weather regimes : Impacts

The summer greenland anticyclonic regime favors cold temperature over much of northwestern Europe and rather wet conditions over Europe.

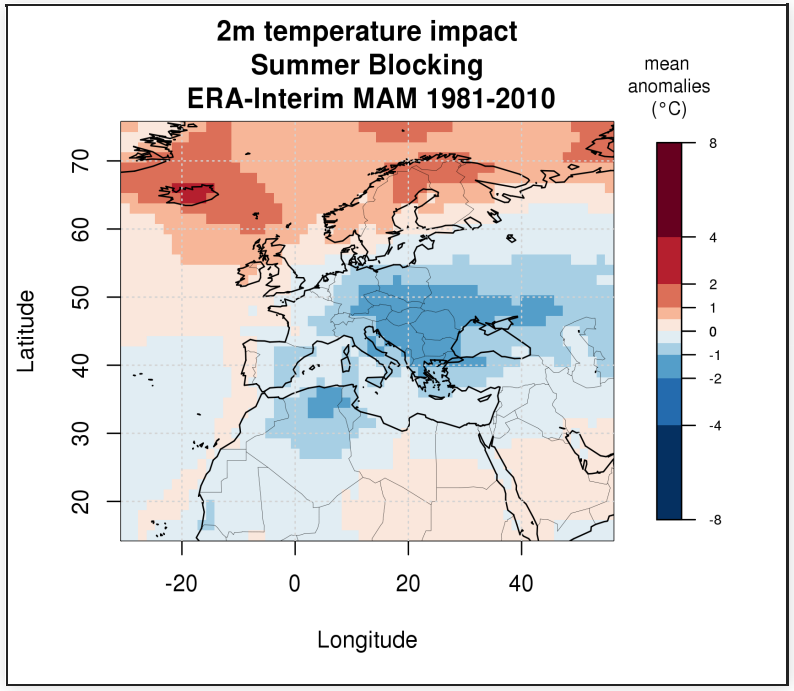


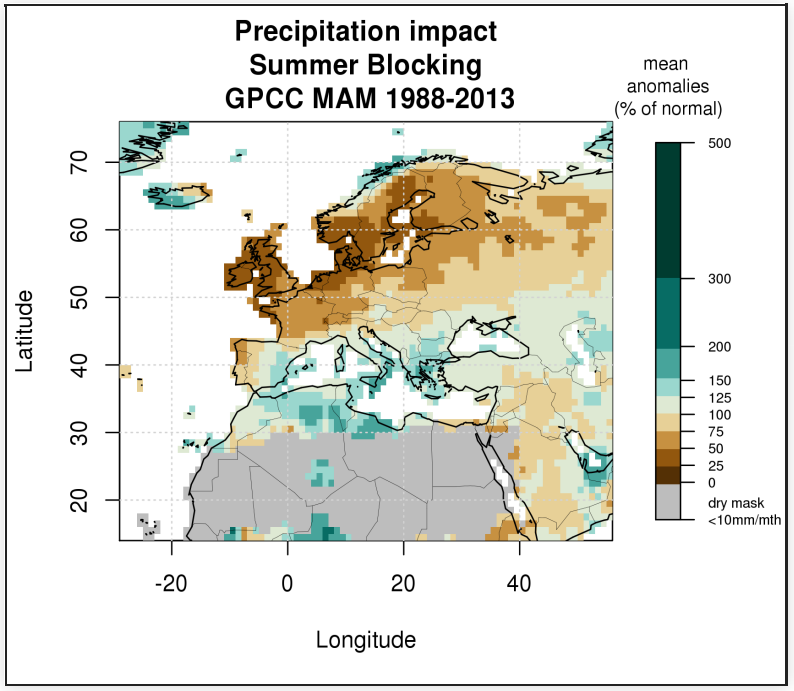


Impact of Summer Atlantic Low weather regime on temperature and precipitation. (ref ERA-interim 1981-2010 and GPCC 1988-2013)

Weather regimes : Impacts

Over Northern Europe, the blocking summer regime favors drier and warmer than normal conditions.

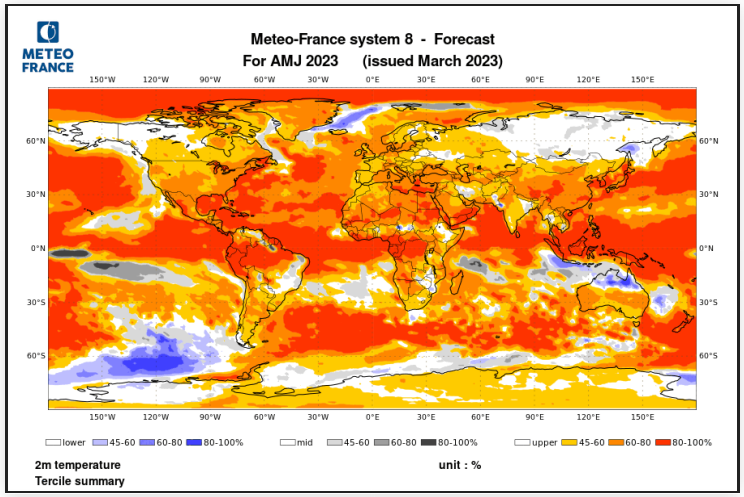


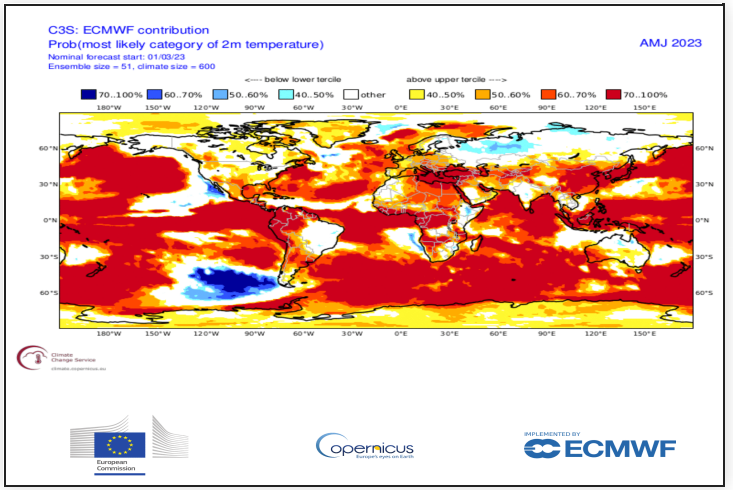


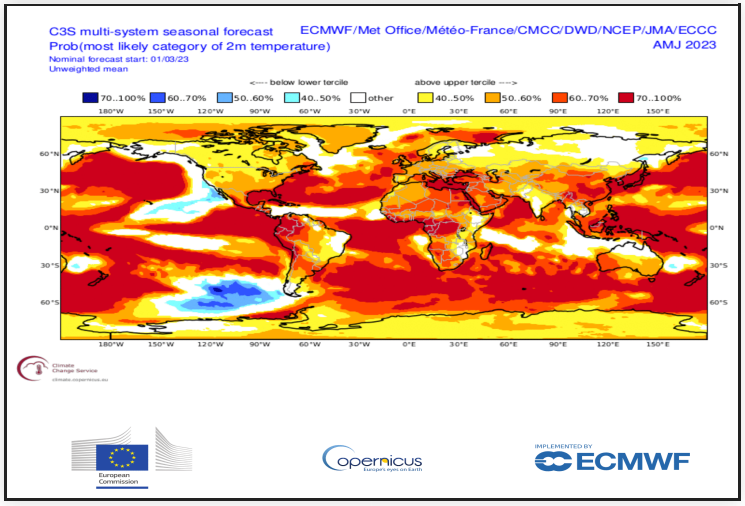
Impact of Summer Zonal weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)

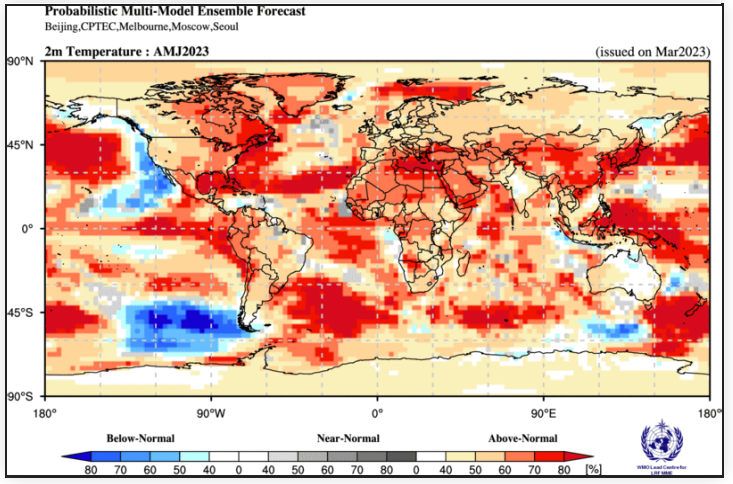
Forecast of climatic parameters : Temperature probabilities

The models agree on most temperature anomalies. However, there is a notable difference over western Russia, where ECMWF predicts a colder-than-normal scenario while MF indicates a warmer scenario.





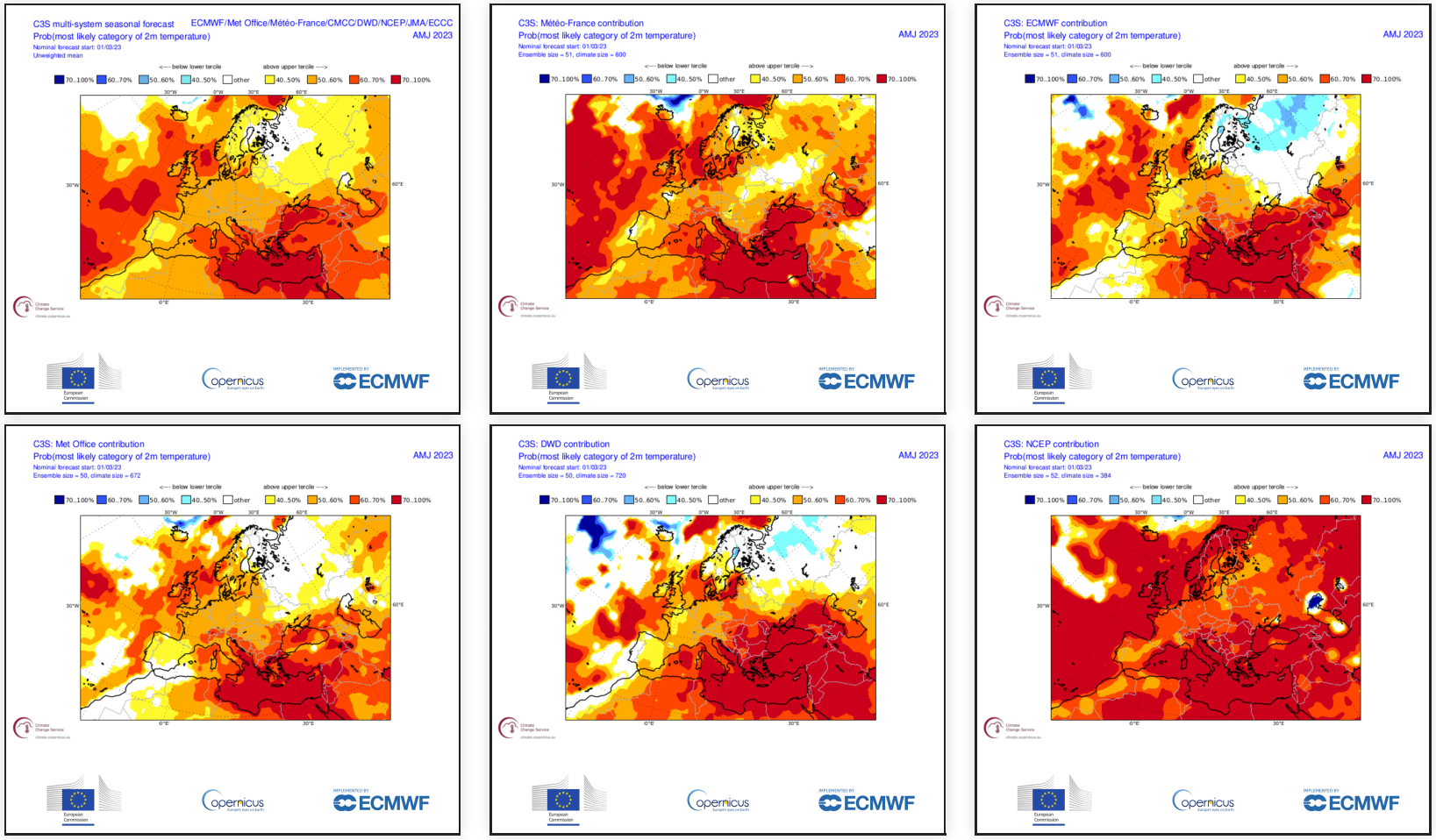




2m temperature probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

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

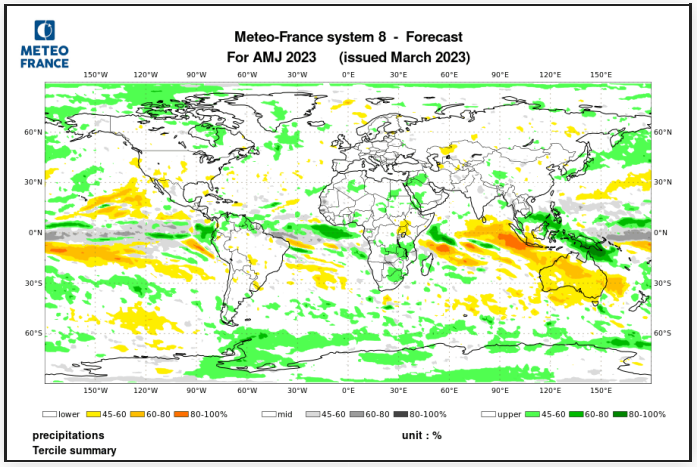
The warm tercile is favored over a large eastern part of the Mediterranean Basin, in connection with the positive Z500 anomaly and the positive SST anomaly.

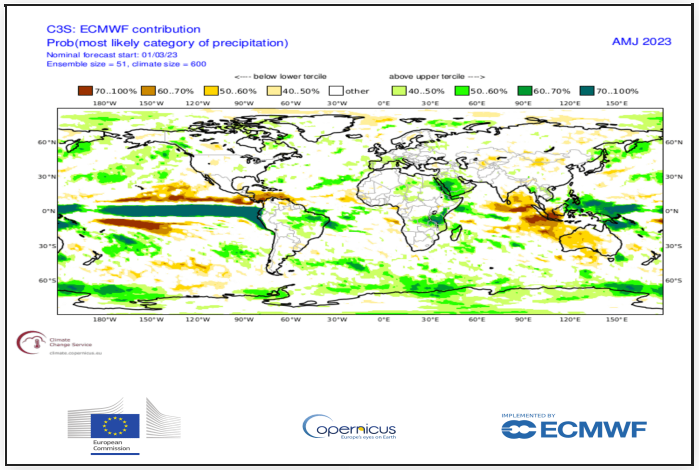


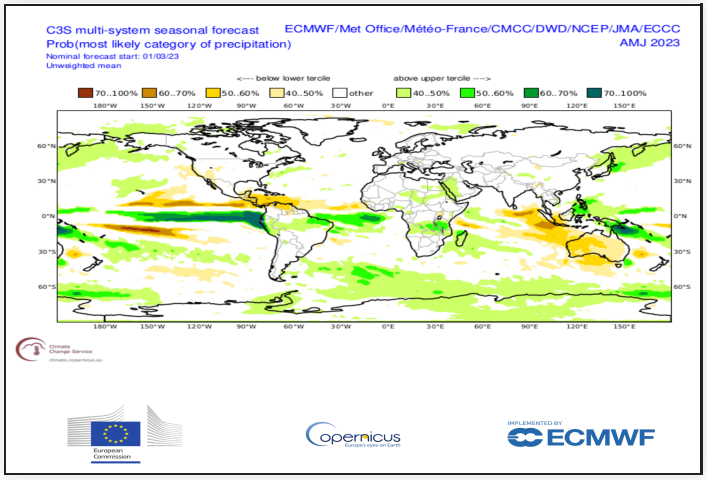
C3S multi-models probability map (top left) and MF-S8, ECMWF-SEAS5, UKMO , DWD, CMCC models.

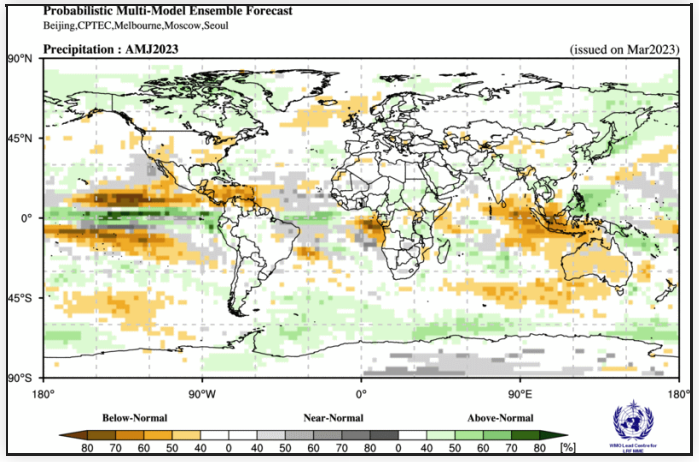
Forecast of climatic parameters : Precipitation

Good convergence between models in the intertropical zone. There is very little signal in the mid-latitudes of the northern hemisphere.





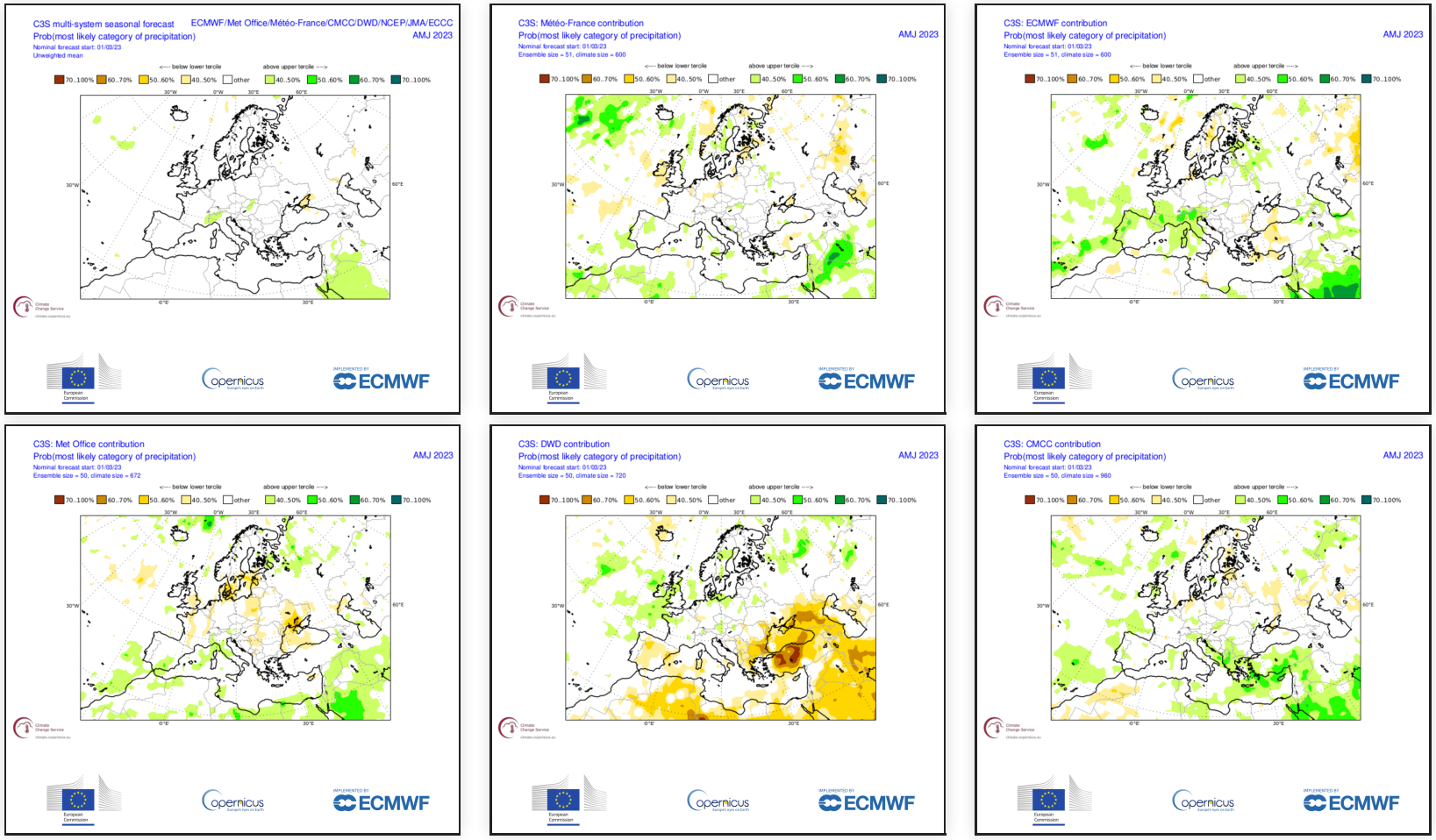




precipitation probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

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

The models, with the exception of the very divergent DWD model, agree in proposing no or little signal over Europe, with imprecise locations in particular around the Mediterranean.

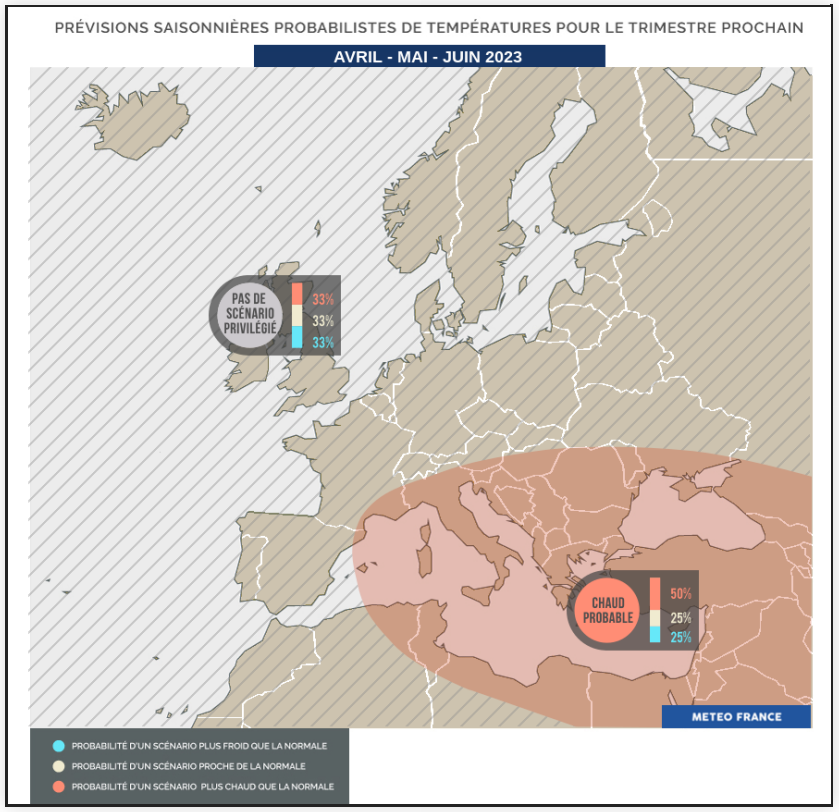


C3S multi-models probability map (top left) and MF-S8, SEAS5, UKMO, DWD, CMCC models.

Synthesis map for Europe : Temperature

In connection with the positive Z500 anomaly over southeastern Europe, a warmer-than-normal scenario is most likely over a large eastern part of the Mediterranean Basin, from the Near East and Black Sea to the Balearic Islands.

Elsewhere, no scenario is preferred.

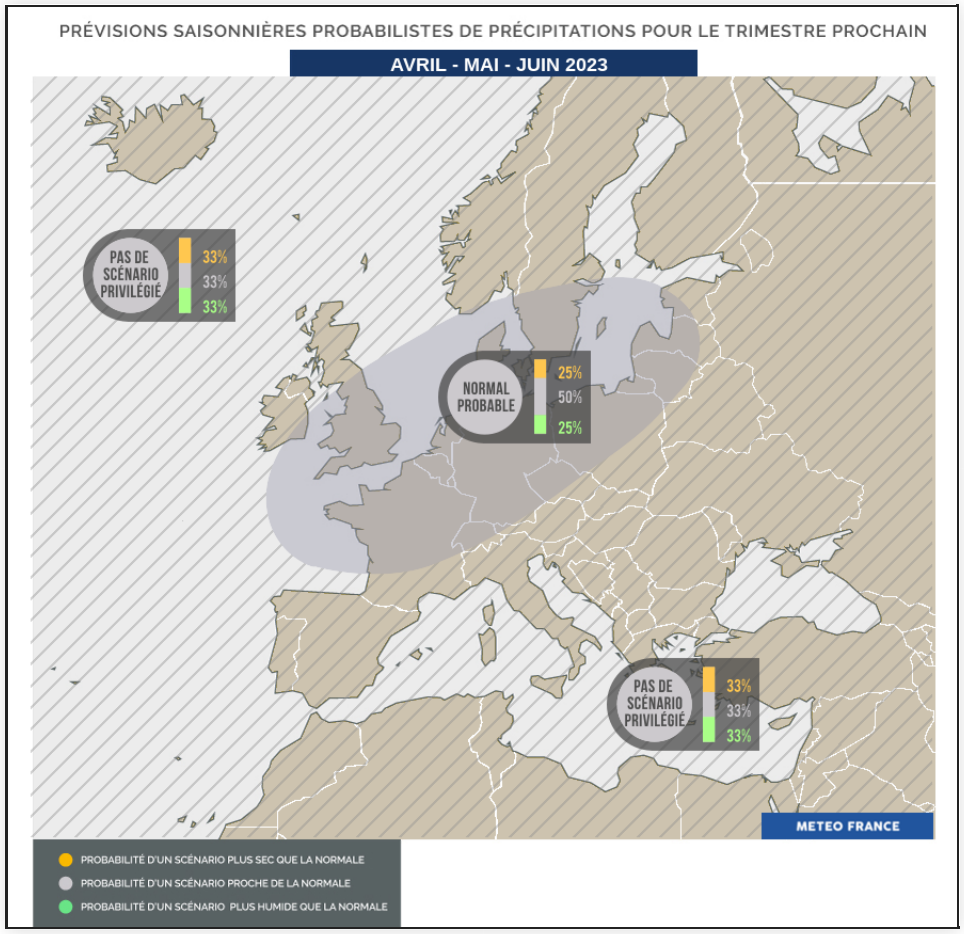


Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS

Synthesis map for Europe : Precipitation

The models suggest little signal on the European continent. However, a near normal scenario is most likely from the northern two-thirds of France to the Baltic States.

No scenario is favored elsewhere.



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