

Météo-France Seasonal Forecast Bulletin

NOVEMBER - DECEMBER 2023 - JANUARY 2024

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General synthesis : ND 2023 - J 2024

The El Nino phenomenon will peak at the end of the year, while the IOD is at its highest at the beginning of the period. Atmospheric circulation is largely conditioned by these two phenomena.

A) Oceanic forecast :

- ENSO : El Niño conditions.
- IOD : Positive phase.
- Equatorial and tropical Atlantic, Northeastern Atlantic : Positive anomaly.

B) Drivers :

Positive phase of ENSO and IOD indexes.

QBO easterly wind phase.

C) Atmospheric circulation :

Between the tropics, atmospheric circulation is largely influenced by the positive phases of ENSO and IOD, with subsidies over the eastern Indian Ocean and ascents over the Pacific Ocean. Teleconnections are expected from the Pacific Ocean to North America and from the Indian Ocean to the Middle East.

Overall, EA mode is favored, but with nuances depending on the model.

D) Most likely conditions :

Temperatures : Warmer-than-normal scenario over Western and Southern Europe.

Precipitations : Scenario wetter than normal on the west coast of Europe.

Next bulletin : scheduled on November 20th

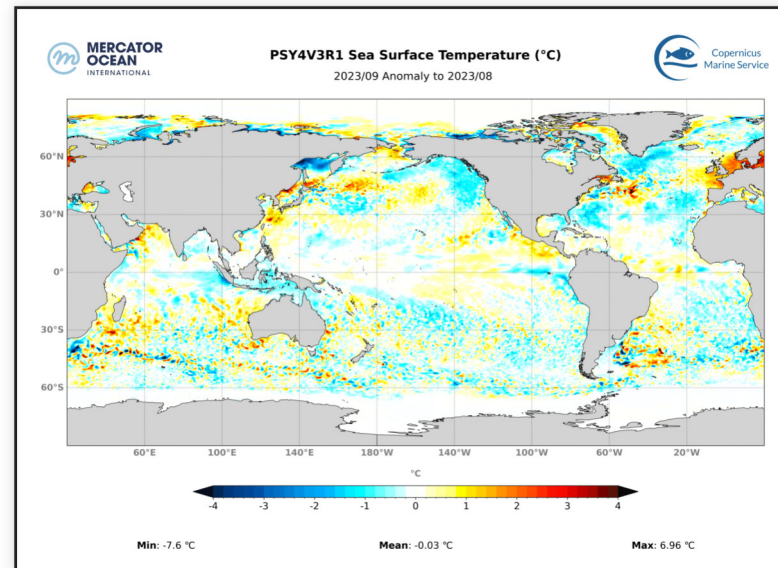
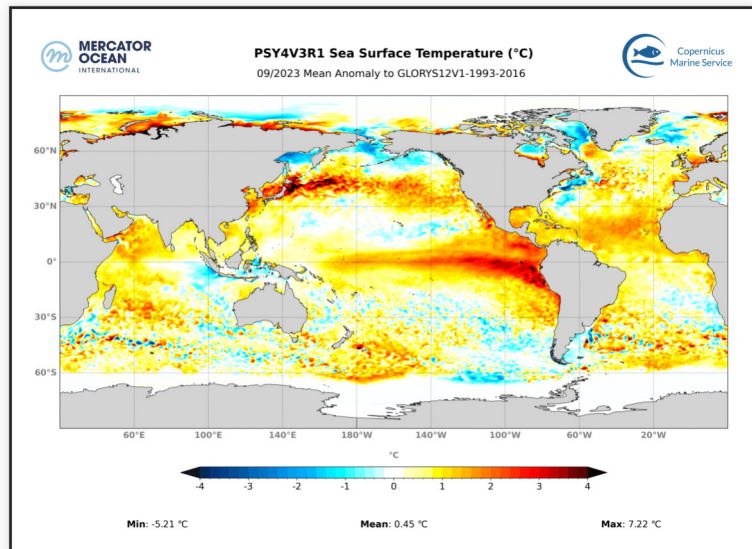
Oceanic analysis of September 2023 : SST anomalies

Current ENSO situation : positive phase

In the Pacific Ocean : In the equatorial zone, the positive SST anomaly is still marked near the South American coast. However, it is spreading westwards (cf. the cooling in the east and slight warming in the center of the basin). In the Northern Hemisphere, the PDO-pattern is again reinforced by cooling near the American coast.

In the Indian Ocean : Little change, with a continuing contrast between warmer conditions in the west and colder conditions in the east of the basin.

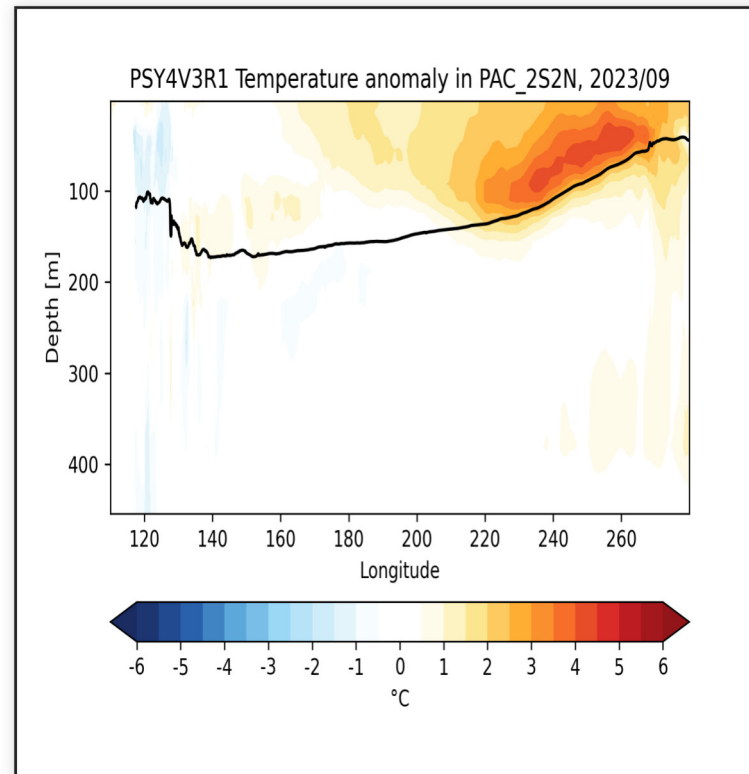
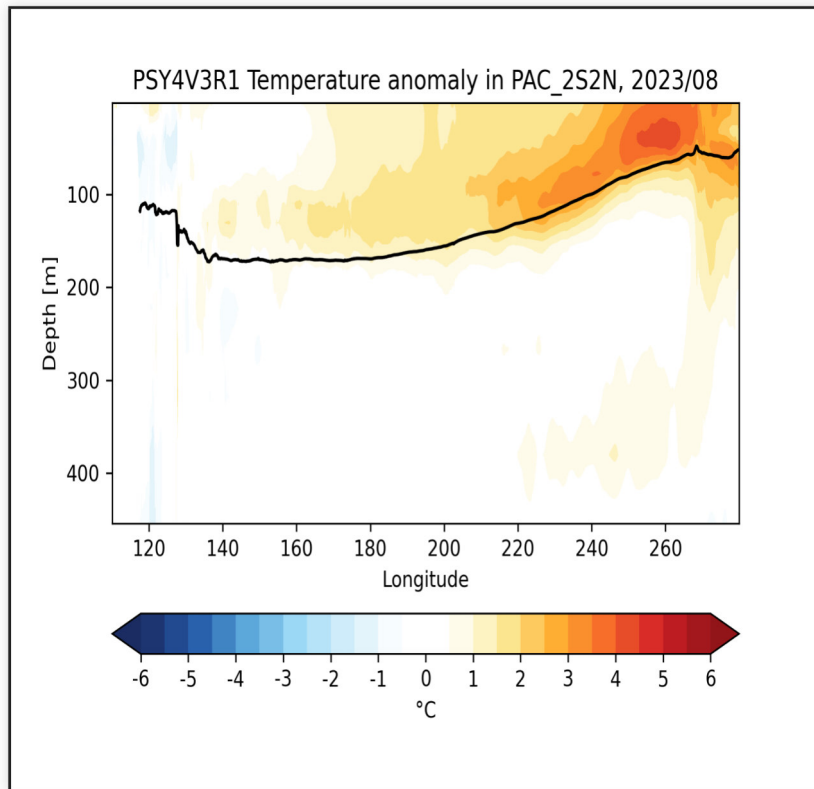
In the Atlantic Ocean : From the equatorial zone to the Northern Hemisphere, the positive SST anomaly persists, even if it is tending to weaken.



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

Oceanic analysis of September 2023 : Pacific vertical section

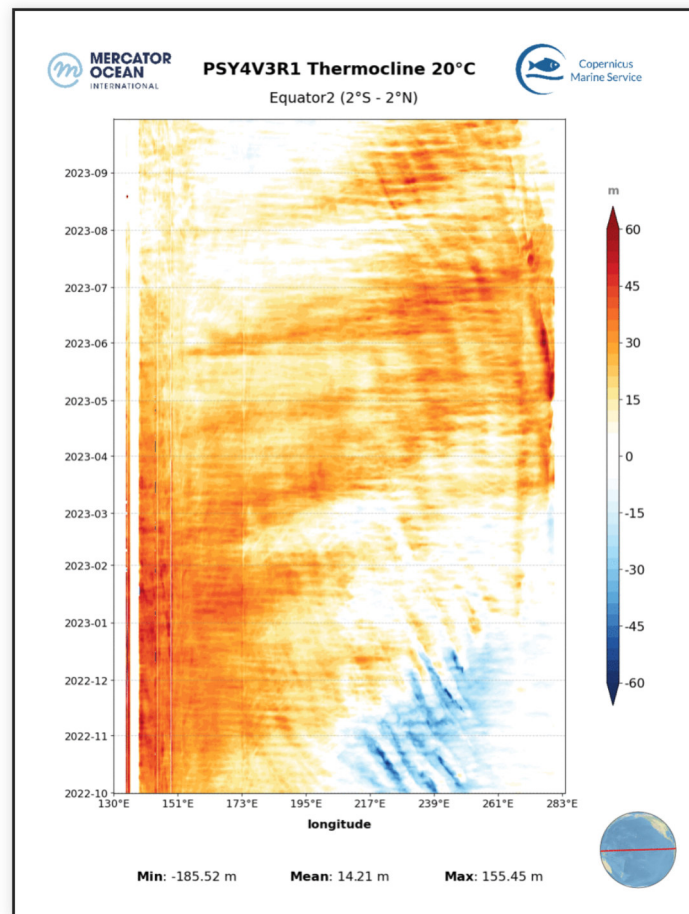
In the subsurface, the warm anomaly is spreading slowly westwards.



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

Oceanic analysis of September 2023 : Hovmöller diagram of the 20°C isotherm

Little change in the thermocline.

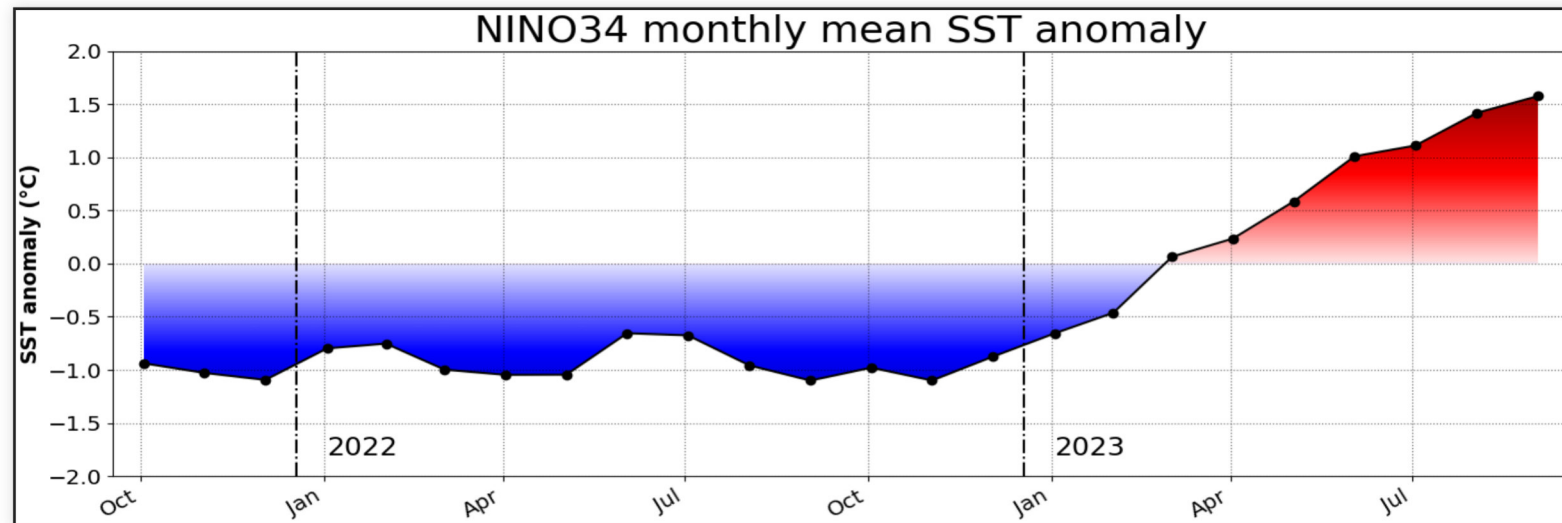


Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 °C isotherm) (c) Mercator-Ocean

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

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : above +1.5 °C

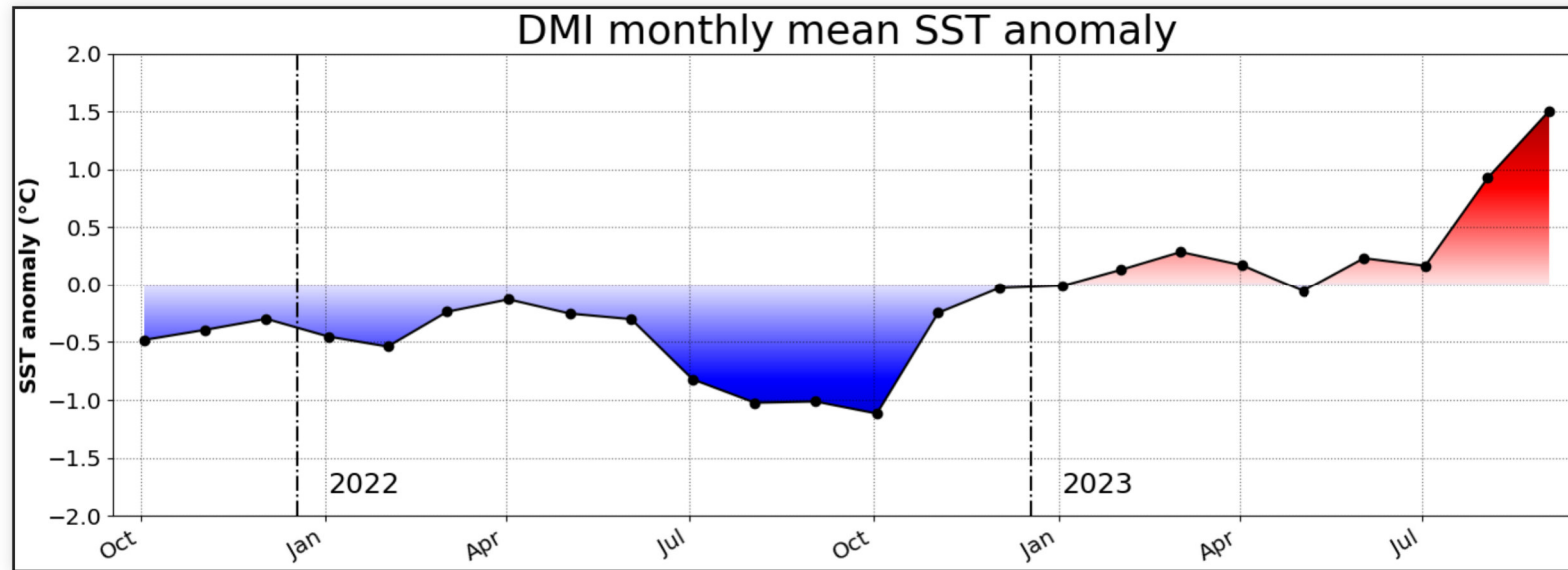
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png)



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

Oceanic analysis of September 2023 : Indien Ocean - DMI index history

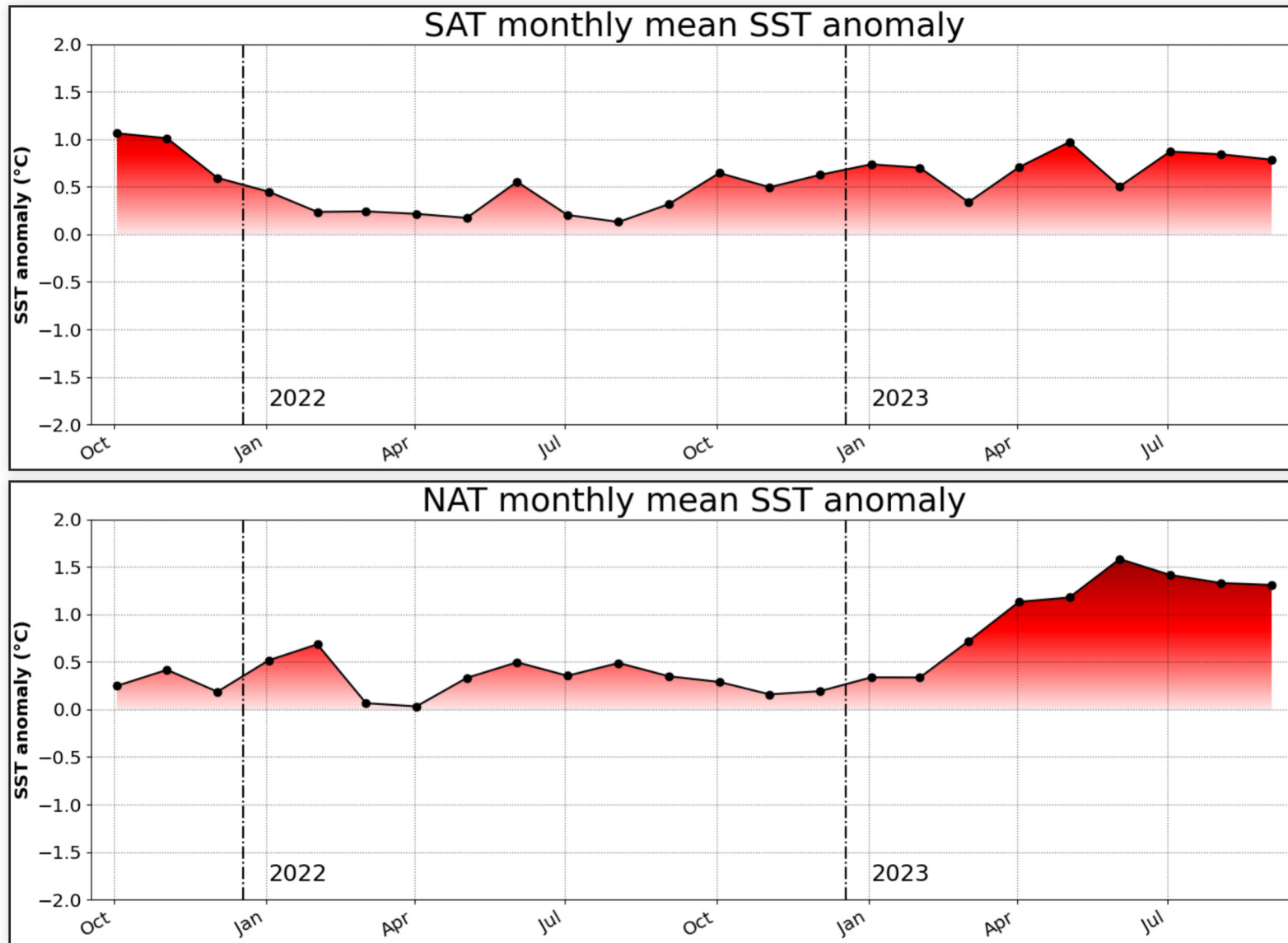
DMI Index issued from Mercator Ocean PSYV4R2 analysis : close to +1.5°C
(see BOM site for weekly values : <http://www.bom.gov.au/climate/enso/monitoring/iod1.png>)



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

Oceanic analysis of September 2023 : Atlantic Ocean : SAT and NAT index

The warm anomaly remains very strong east of the tropical zone of the Northern Hemisphere, and more moderate in the equatorial zone.



Evolution of SST in the SAT and NAT box (c) Mercator-Ocean

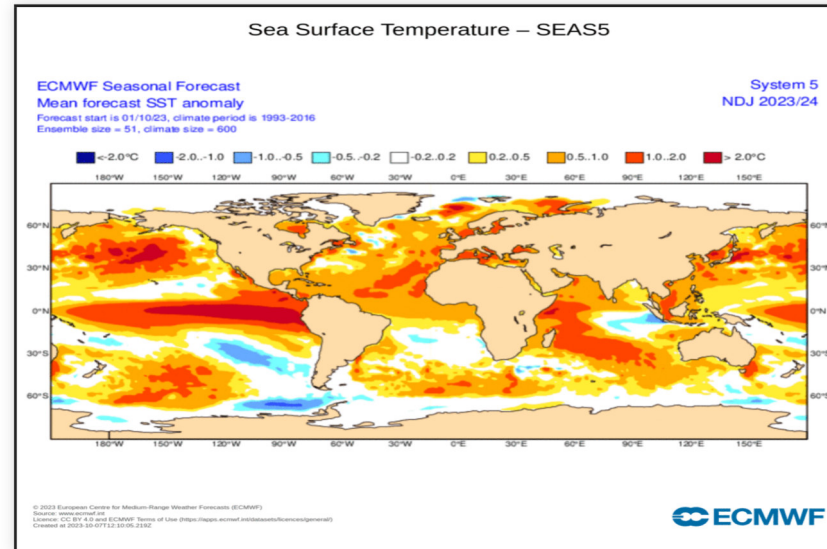
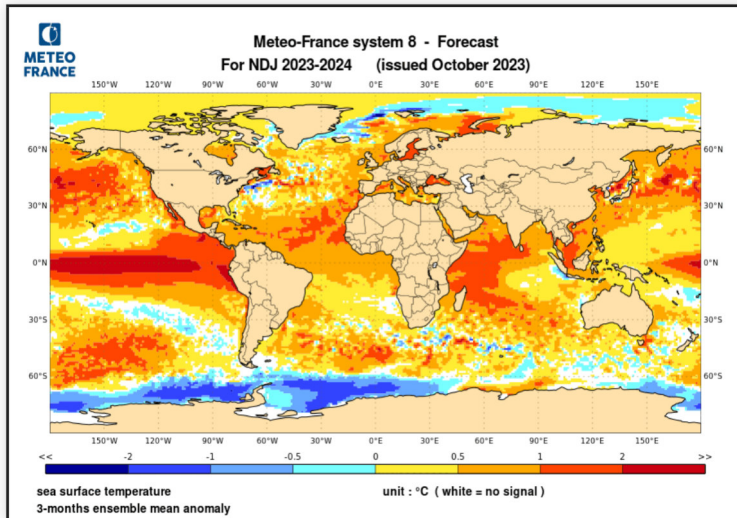
Oceanic forecast : SST anomaly

Very good agreement between the two models on the main anomalies.

In the Pacific Ocean : In the equatorial zone, the warm anomaly continues to move westwards, reaching the Solomon Islands. In the Northern Hemisphere, the PDO- pattern is still present.

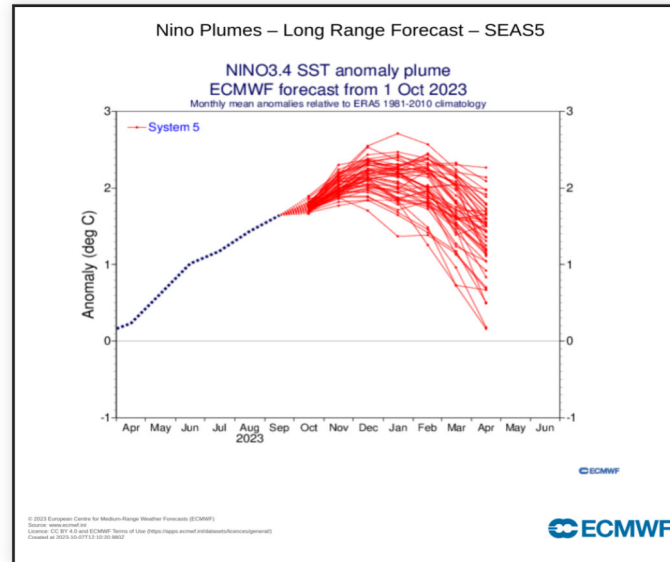
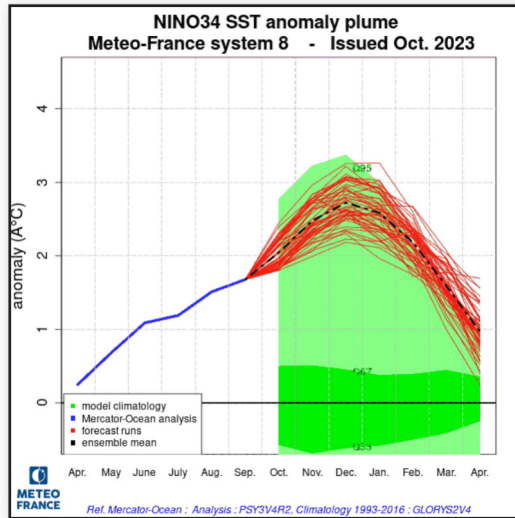
In the Indian Ocean : The east-west gradient in SST, and in particular the warm anomaly near Africa, are predicted by both models.

In the Atlantic Ocean : MF8 and ECMWF are now well in phase on positive anomalies over the North and Equatorial Atlantic.



Oceanic forecast : NINO3.4 Plume diagrams

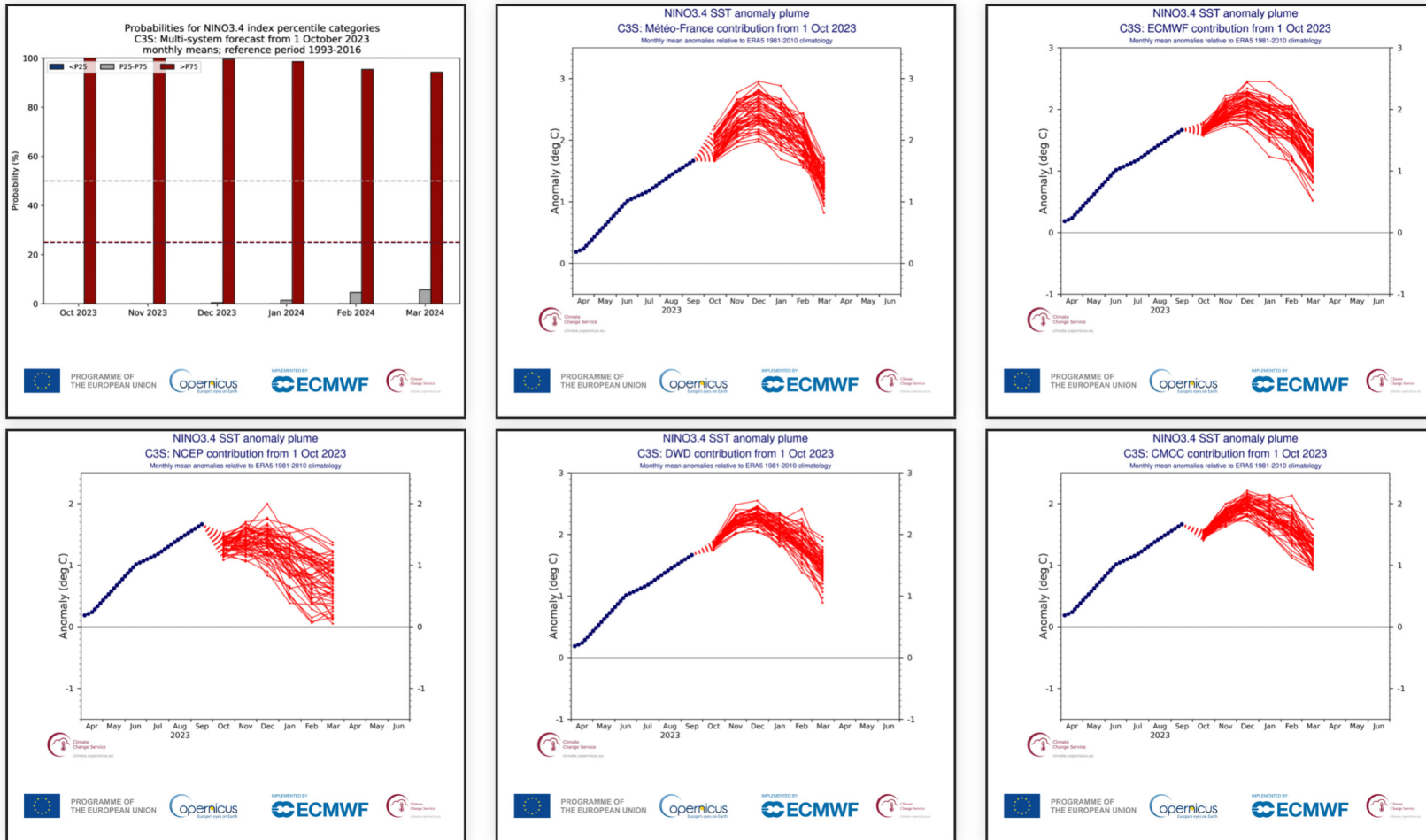
MF8 and ECMWF forecast the peak of the Nino3.4 index for the end of the year. However, MF8 is forecasting higher values than ECMWF.



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

All models forecast an increase in the index until December, above $+2^{\circ}\text{C}$. However, some models (NCEP, CMCC and, to a lesser extent, ECMWF) do not seem to be in line with observations.

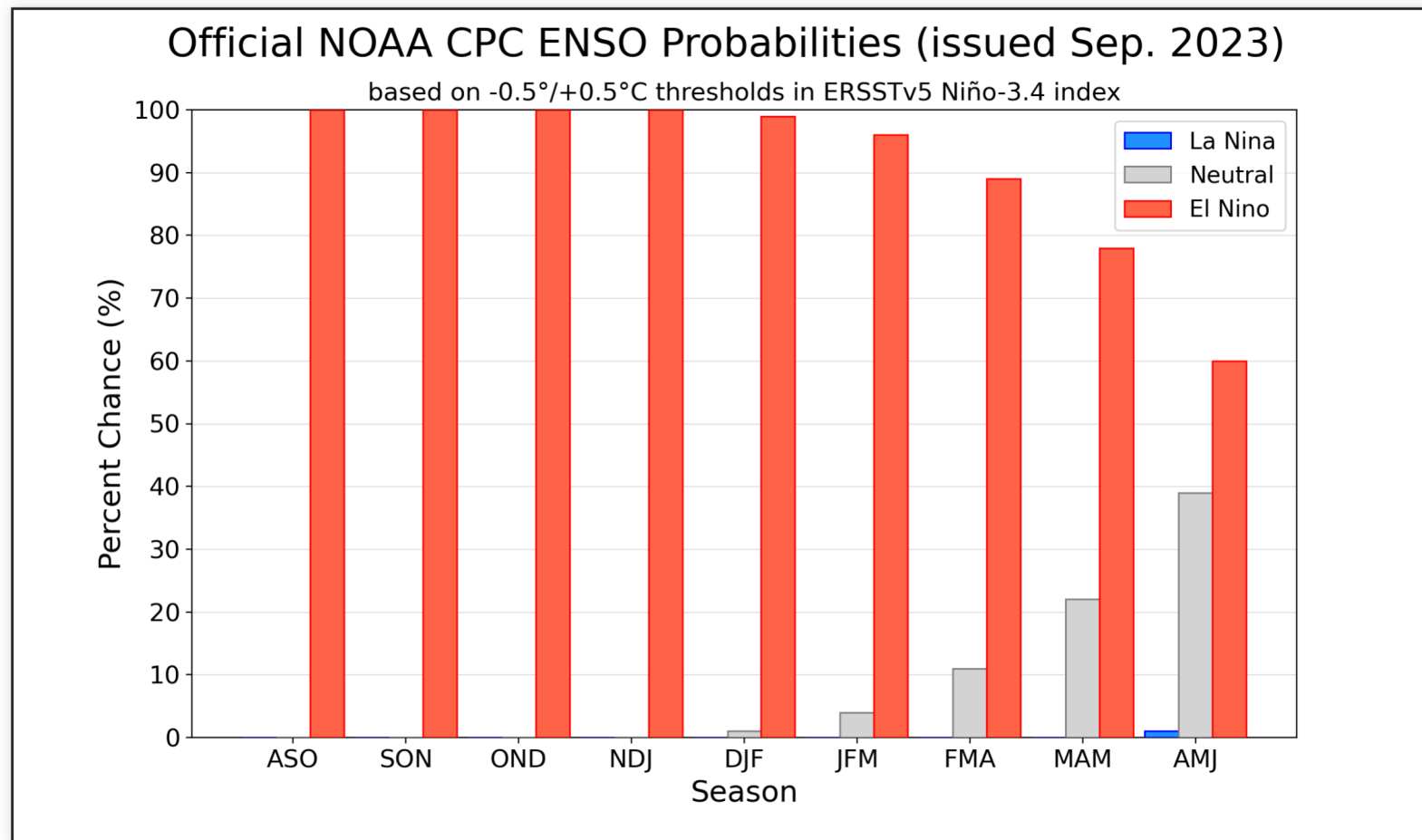
The most likely phase for the next three months : Positive phase



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

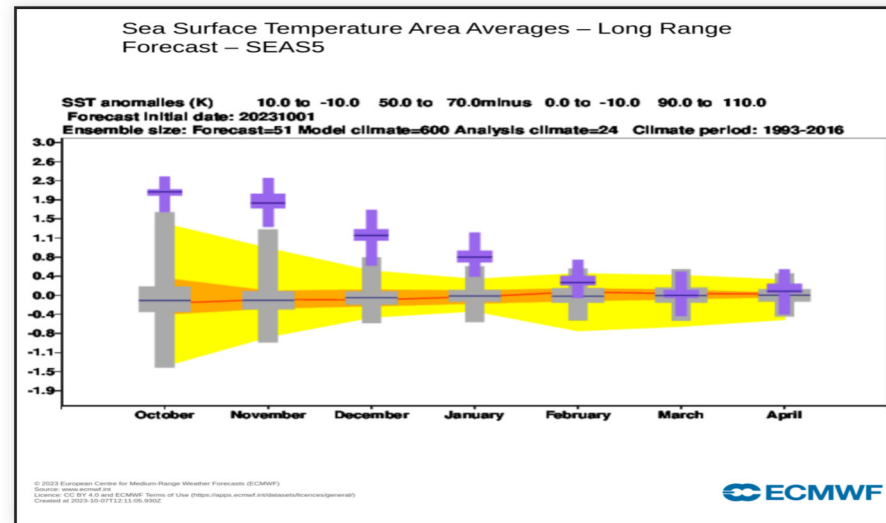
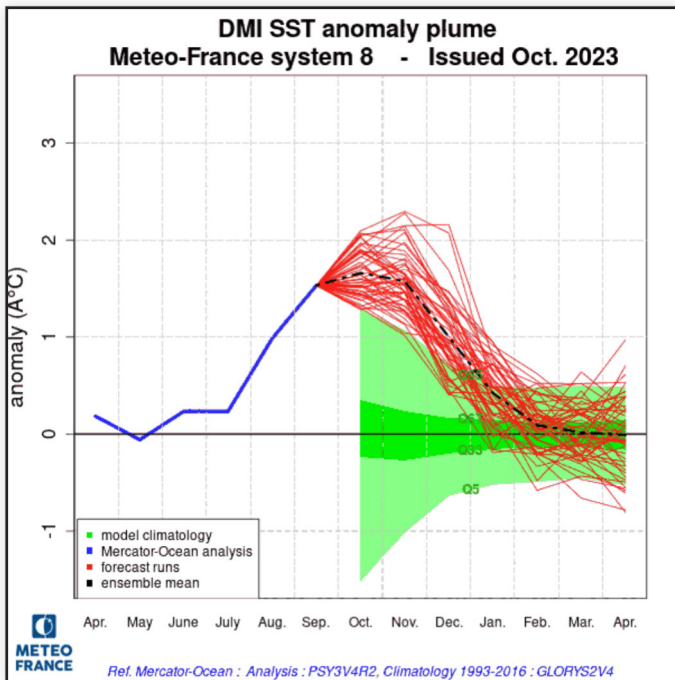
IRI forecast : near 100% probability of El Niño conditions for OND.



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

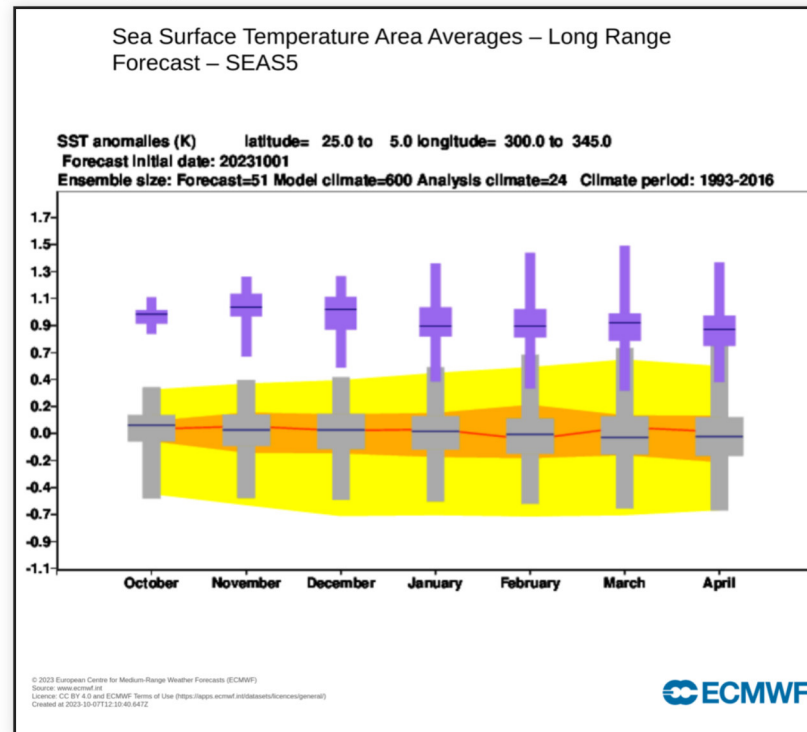
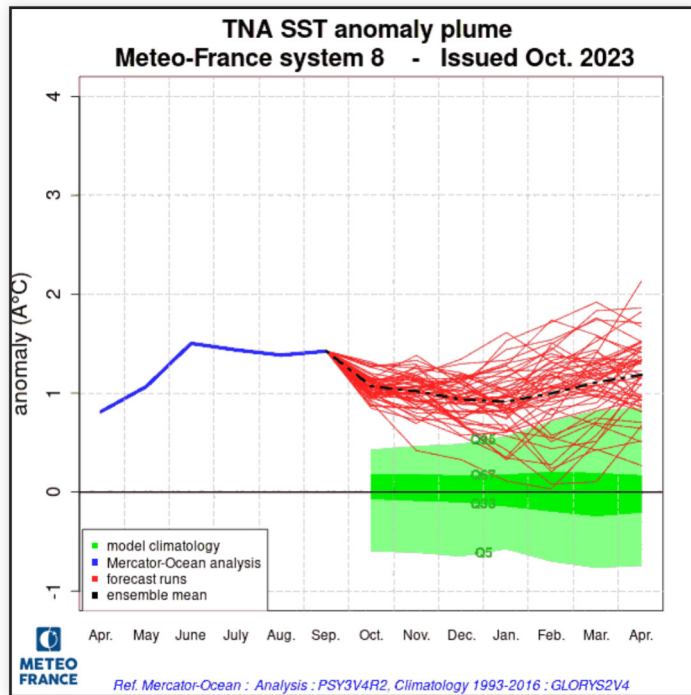
Both models forecast the maximum DMI index for the beginning of this quarter, at very high levels compared to the DMI climatology.



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

Oceanic forecast : Atlantic ocean - TNA evolution

The warm anomaly in the TNA zone predicted by both models is particularly high.

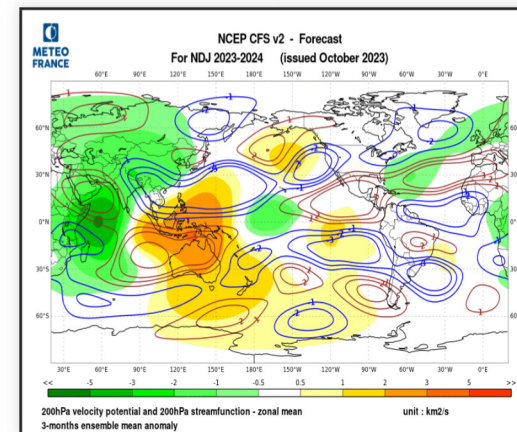
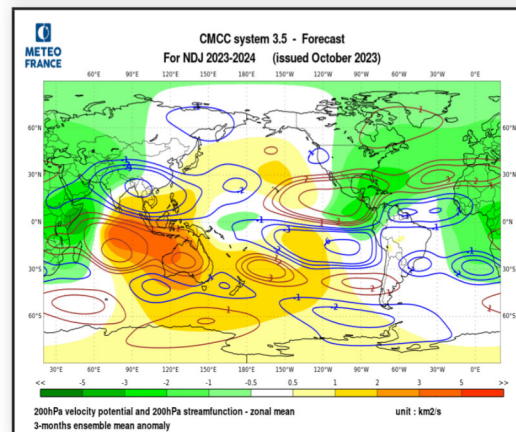
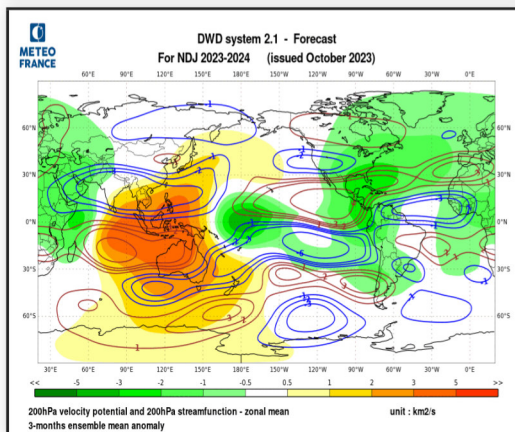
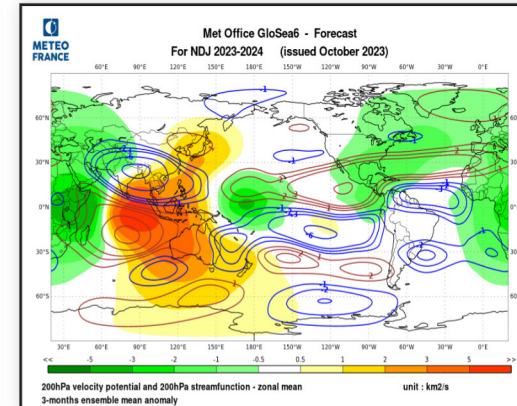
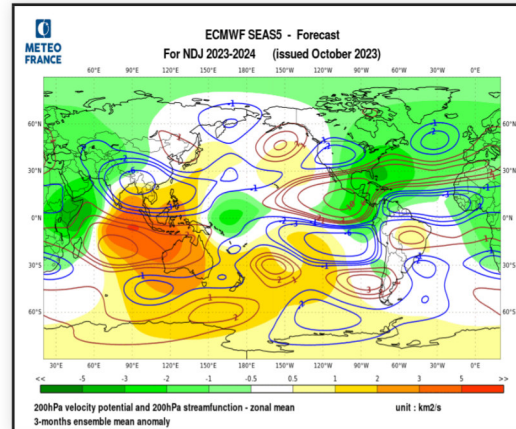
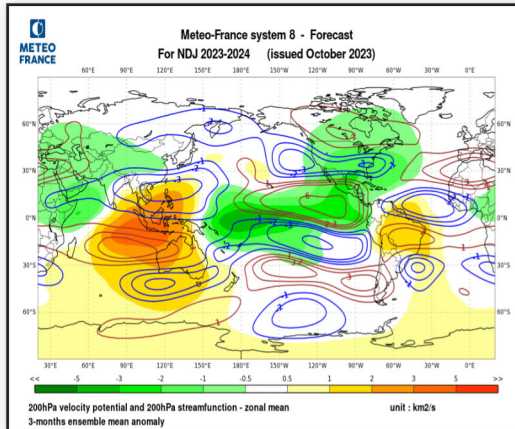


TNA index : analysis, forecasts and model climatology with MF-S8 on the left and ECM-SEAS5 on the right

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

Velocity Potential : The models all agree on the strong anomaly of subsidences over the eastern Indian Ocean (linked to El Nino and IOD+). On the other hand, lift anomalies over the Pacific are more marked with MF8 and DWD than with Met Office and ECMWF. Finally, most models predict subsidences over the Amazon and lifts over Africa and Europe.

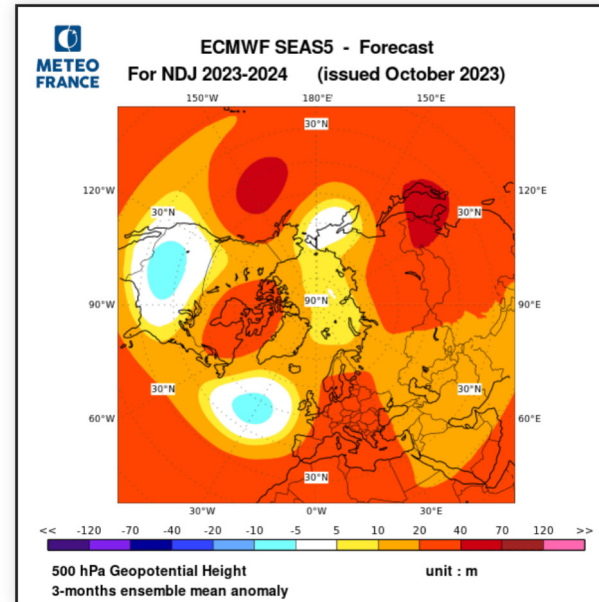
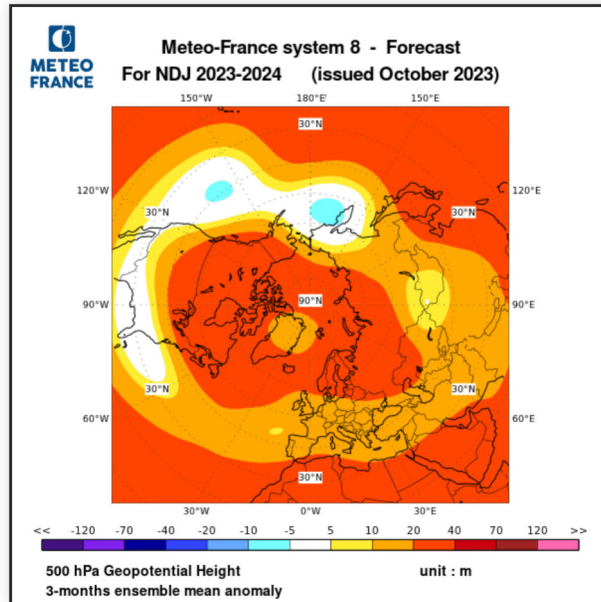
Streamfunction : Dipoles over the Indian, Pacific and Atlantic oceans are clearly visible. In the northern hemisphere, teleconnections have been set up, particularly on the Pacific towards North America. All models also show teleconnections from the Indian and Atlantic basins (anticyclonic curvature over northern Africa). However, circulations over the North Atlantic and Europe differ from model to model: a marked cyclonic curvature in the Atlantic for ECMWF, and anticyclonic south of Greenland for MF8 and DWD.



MF8, SEASS, 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).

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

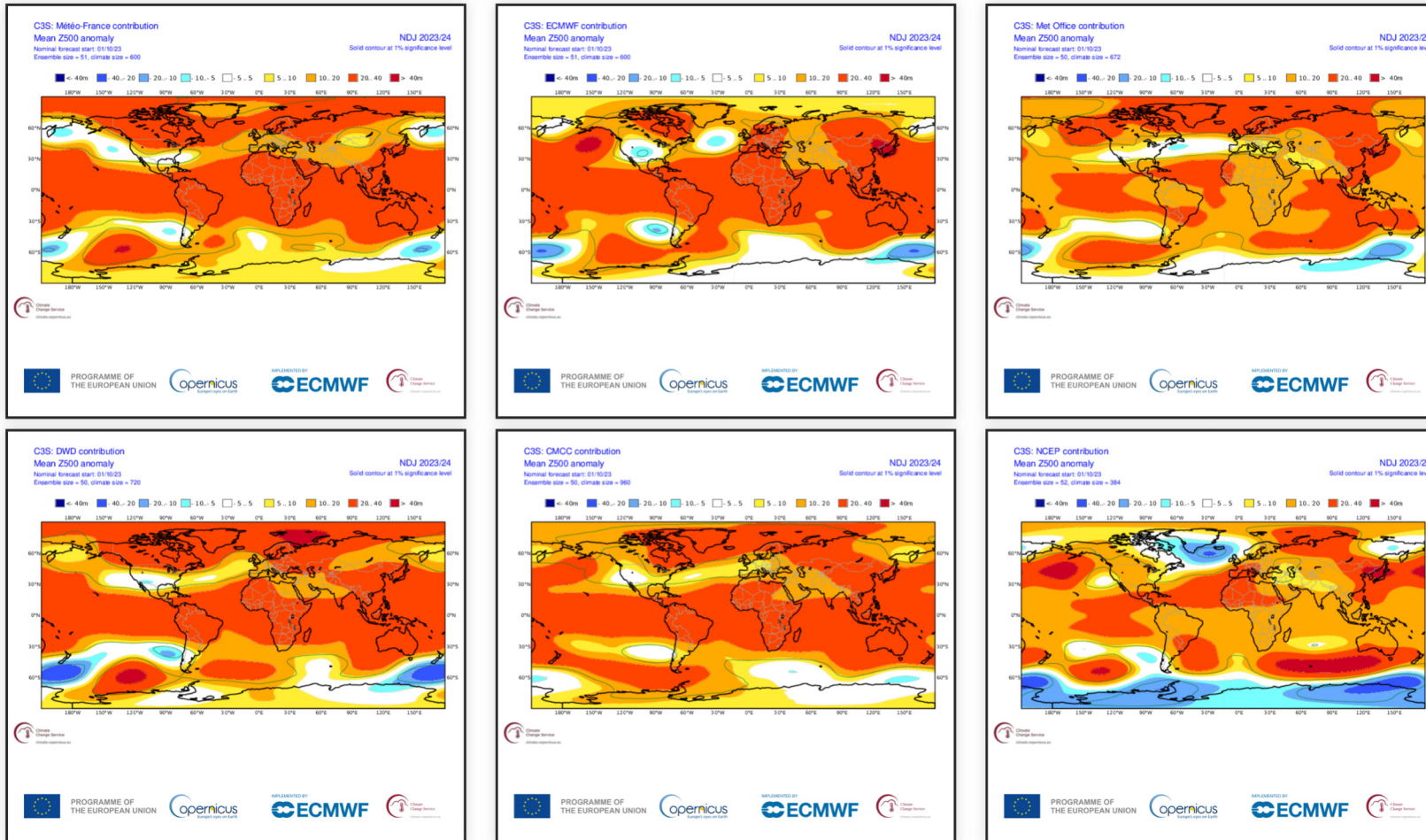
En lien avec la circulation à 200 hPa, les schémas à 500 hPa diffèrent entre les deux modèles, aussi bien sur les Etats-Unis que sur l'Europe. Le pattern PNA- esquissé par ECMWF n'est pas vu par MF-8. En Atlantique, ECMWF maintient un minimum rappelant la réponse à un El Nino fort en début d'hiver. MF-8 propose une anomalie positive aux hautes latitudes et des champs en Z500 moins élevés de la Floride à l'Europe.



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

Atmospheric circulation forecasts : Z500 anomalies in C3S models

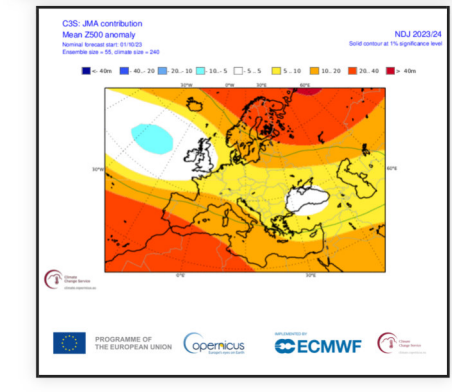
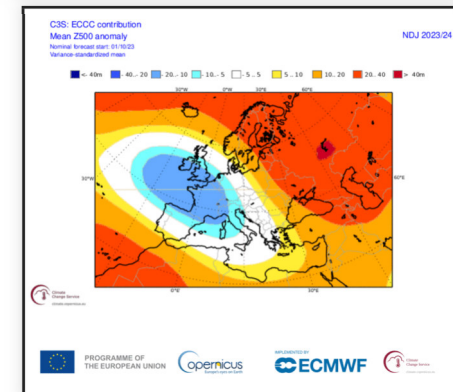
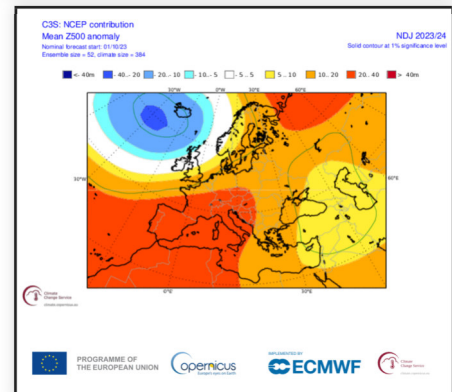
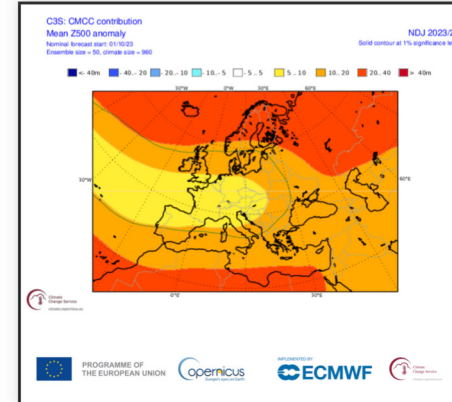
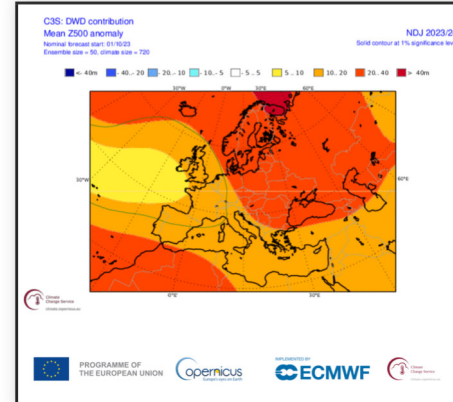
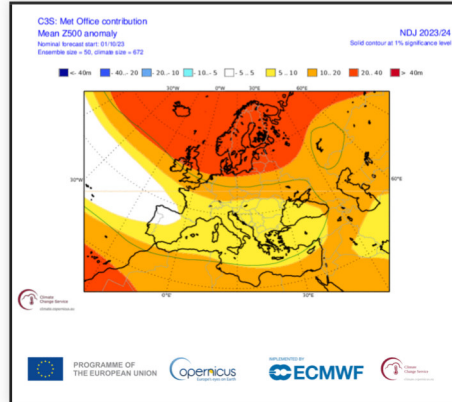
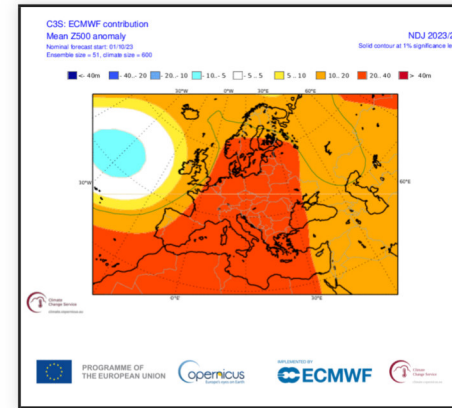
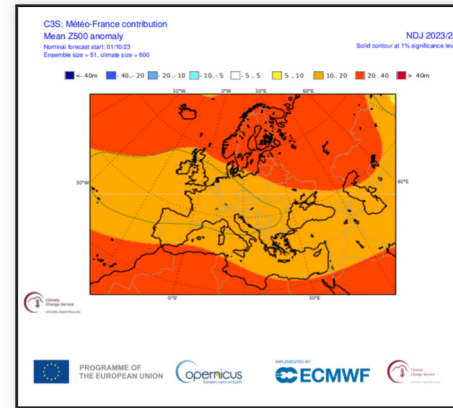
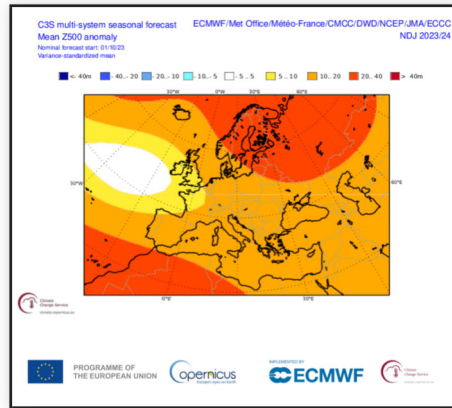
ECMWF is the only model to isolate a minimum over the near Atlantic and to limit the positive anomaly over Greenland. The other models (including MF-8) forecast a positive anomaly from Canada to Greenland and northern Russia, and relative weakness from the Gulf of Mexico to Europe.



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

Atmospheric circulation forecasts : Z500 anomalies in C3S models

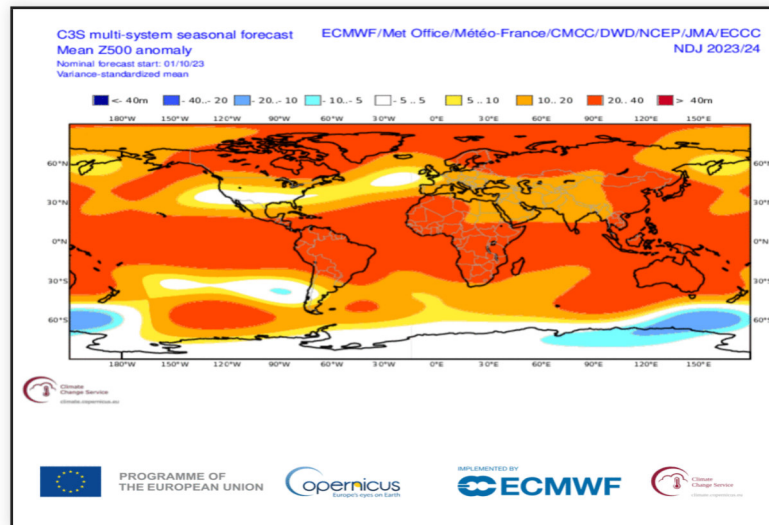
ECMWF is the only model to propose a positive anomaly over Central Europe (with perhaps NCEP). All other models predict a more or less marked weakness over Europe and a positive anomaly further north.



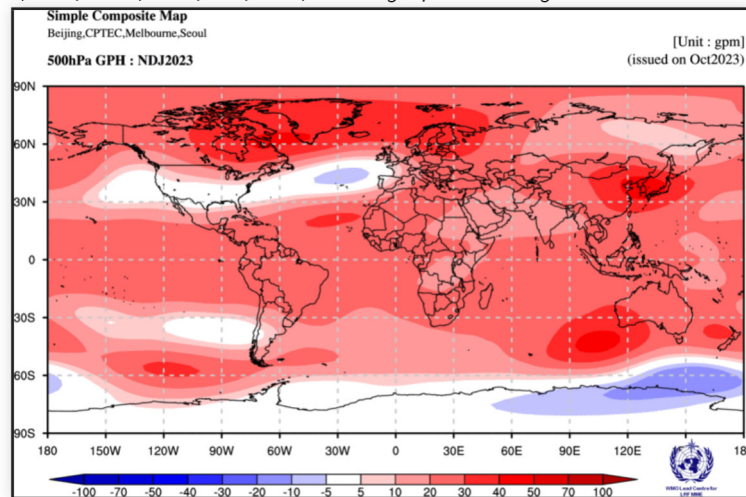
multi-models 500hPa geopotential height anomalies

Atmospheric circulation forecasts : Z500 anomalies multi-systems

The 500 hPa circulation proposed by the two multi-models follows the patterns of most of the individual models, with the exception of the ECMWF model.



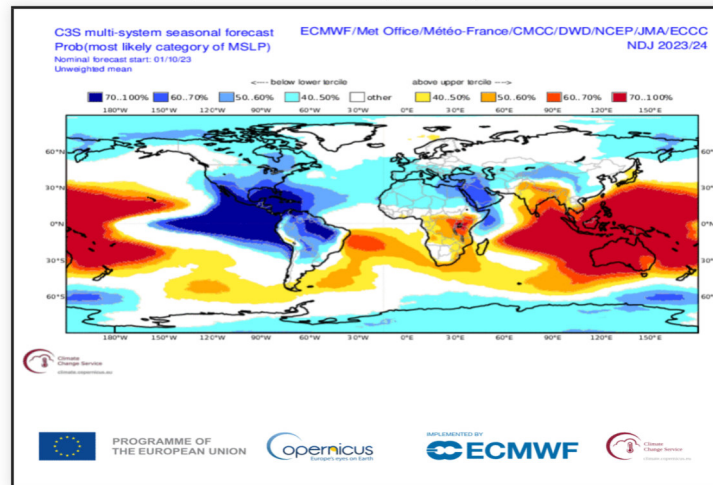
C3S multi-models (MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC, NCEP, JMA, ECCC) 500hPa geopotential height anomalies.



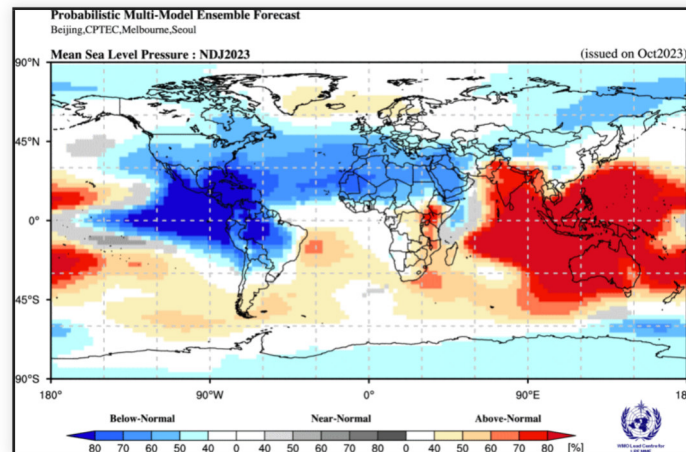
Others models of WMO multi-models 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : MSLP probabilities multi-systems

MF-8 and ECMWF are very close in the intertropics, with almost identical anomaly patterns. In the Northern Hemisphere, the two multi-models are also very close, with a negative anomaly extending from the USA to the southern half of Europe and the Mediterranean Basin. Further north, the WMO multi-model shows a positive anomaly, barely visible on the C3S multi-model.



C3S multi-models MSLP terciles probability.

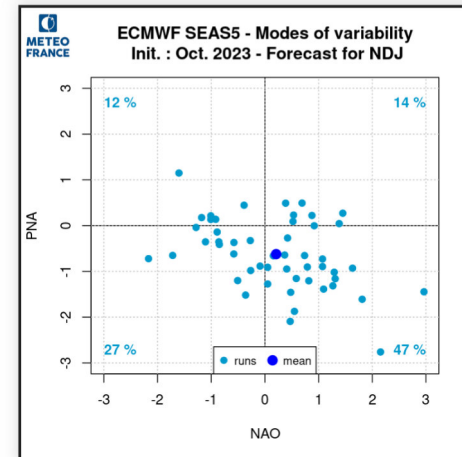
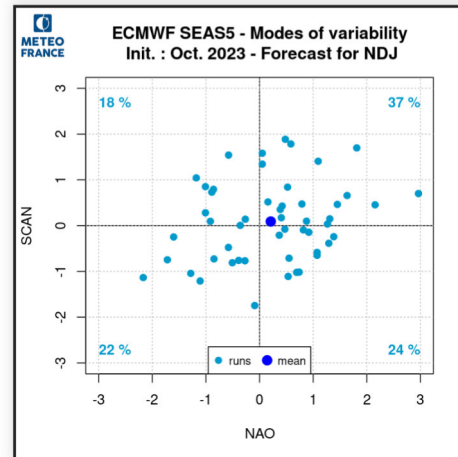
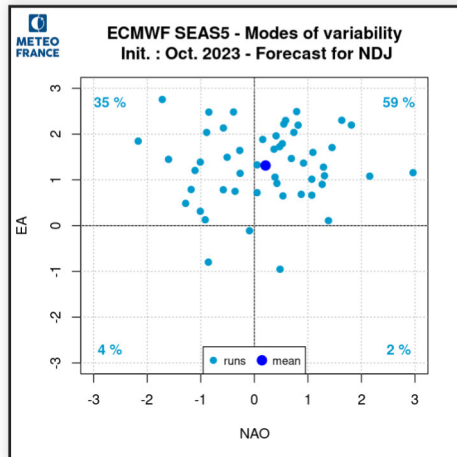
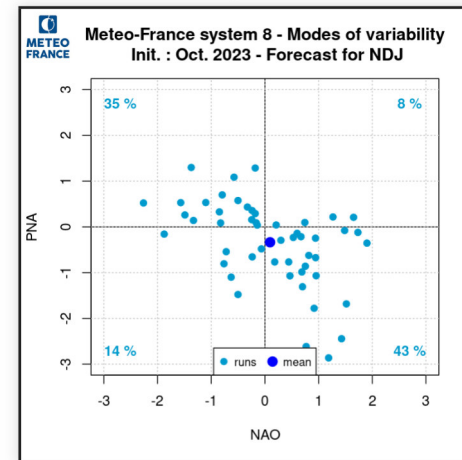
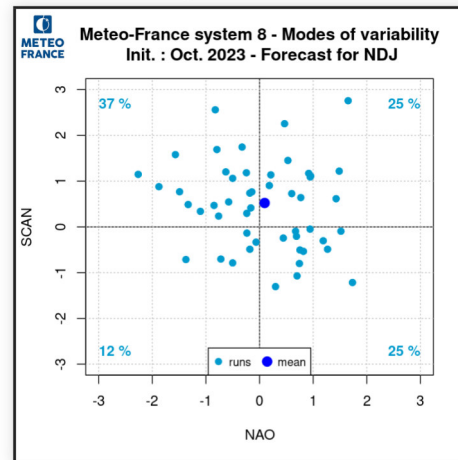
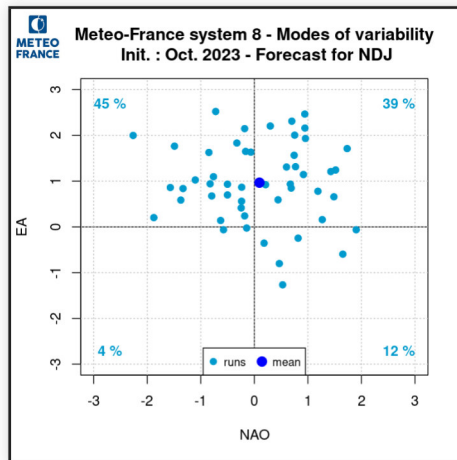


Others models of WMO multi-models MSLP terciles probability.

Modes of variability : forecast

The EA+ mode is preferred by both models.

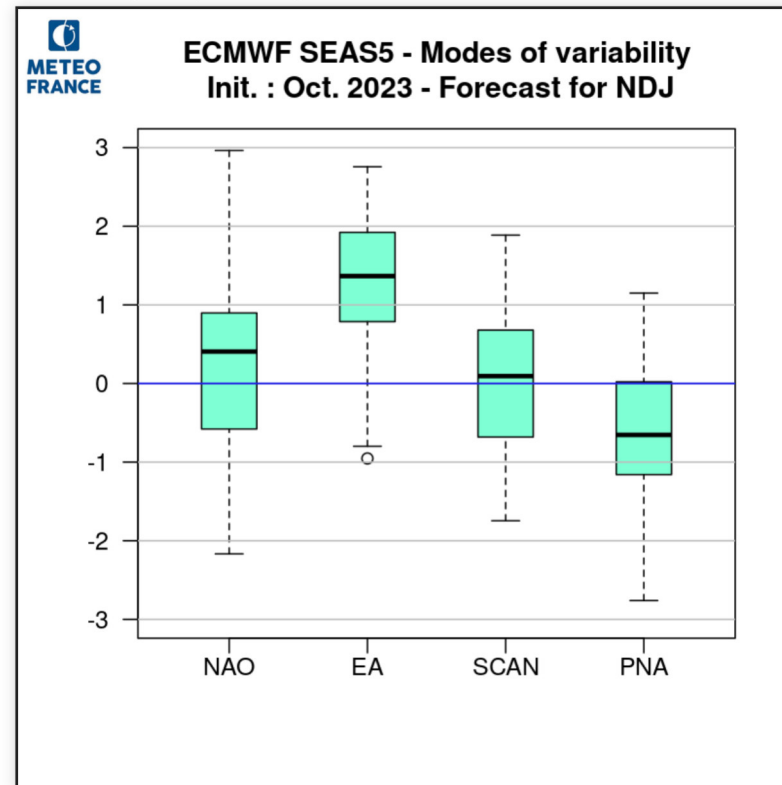
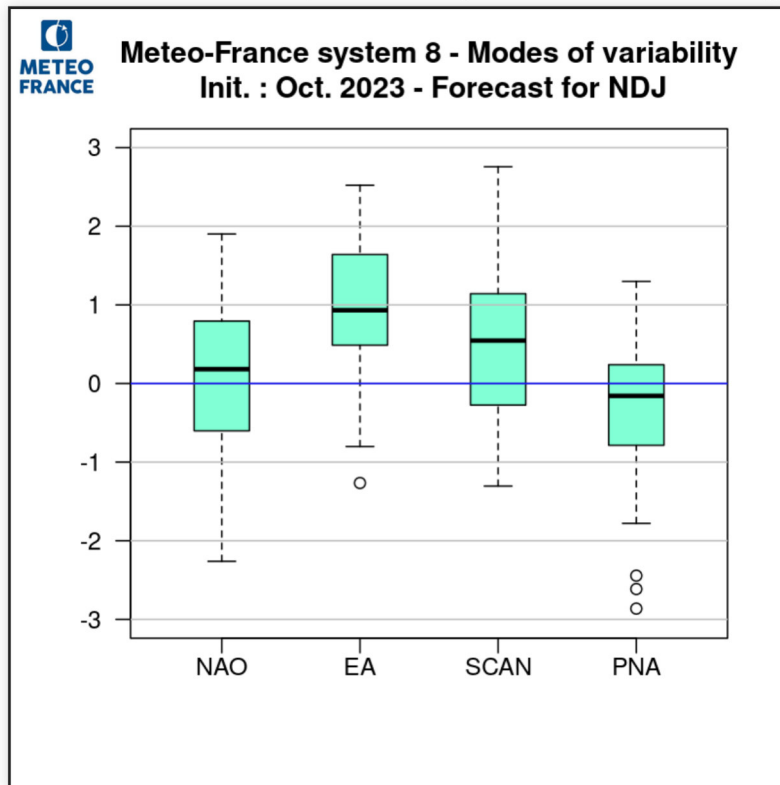
Signals are weak for all other modes. SCAN+ mode is favored by MF-8, while NAO+ and PNA- modes are favored by ECMWF.



See the modes of variability patterns

Modes of variability : forecast

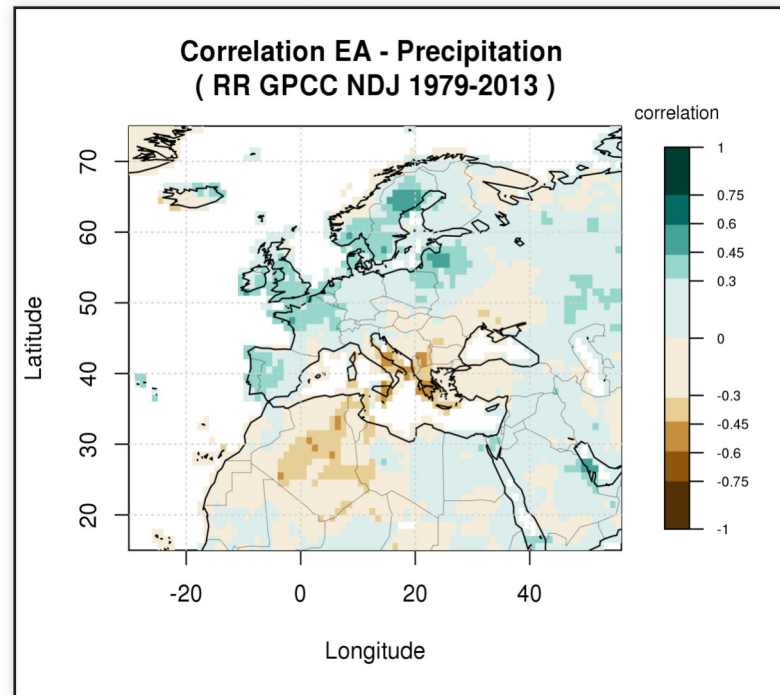
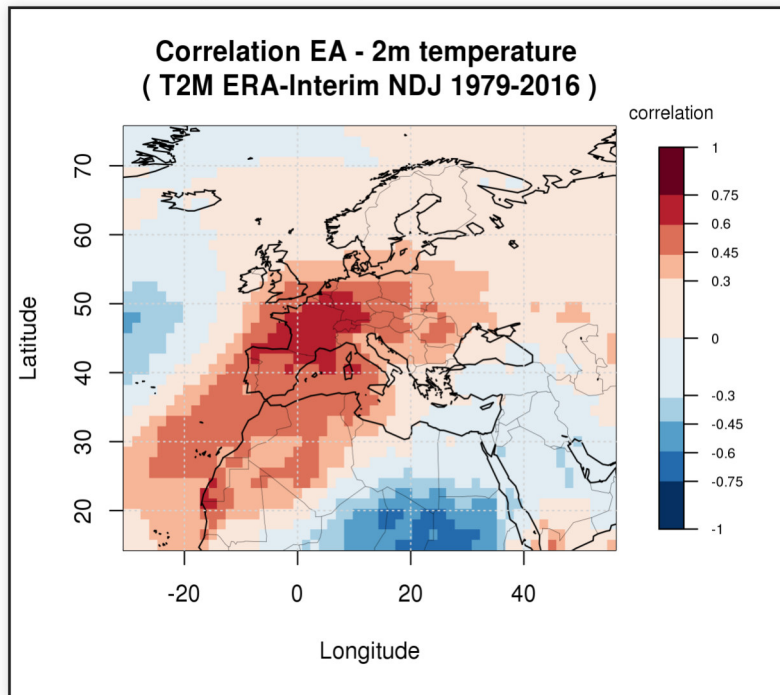
On the Atlantic and Europe the atmospheric circulation is strongly influenced by the positive phase of EA mode.



MF-S8 and ECMWF-SEAS5 boxplot of modes of variability

Modes of variability : EA impacts

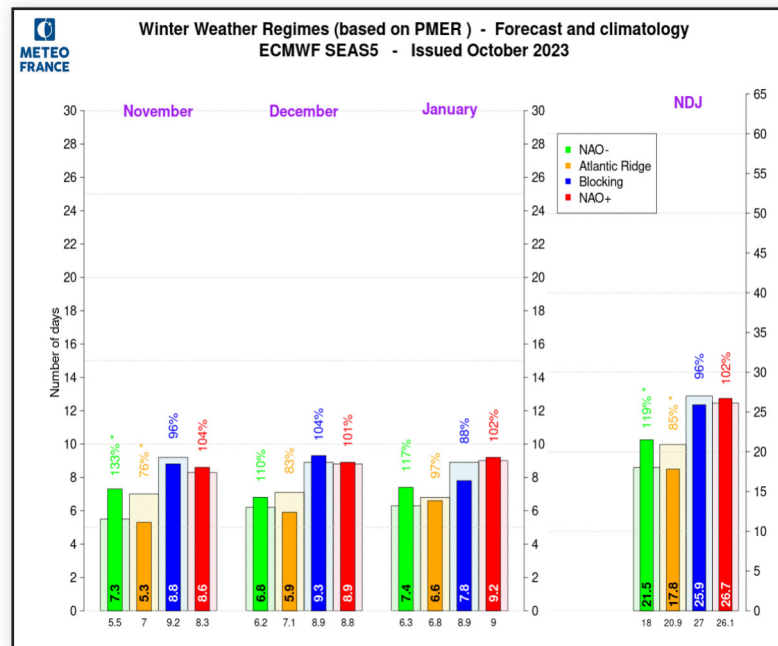
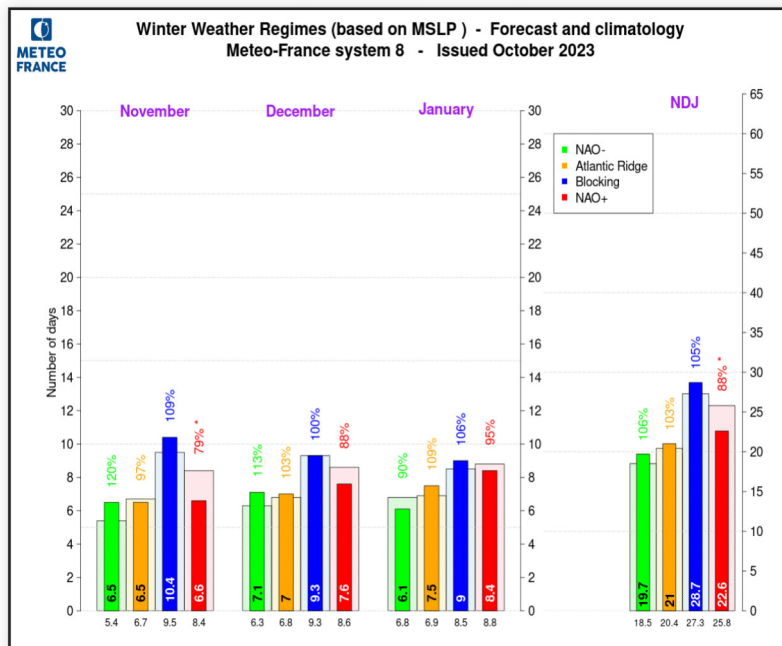
Positive EA is expected next quarter. This mode has a strong influence in particular on the temperature on the south-western Europe.



Weather regimes : winter MSLP

For MF-8, the NAO+ regime is significantly lower than its climatology.

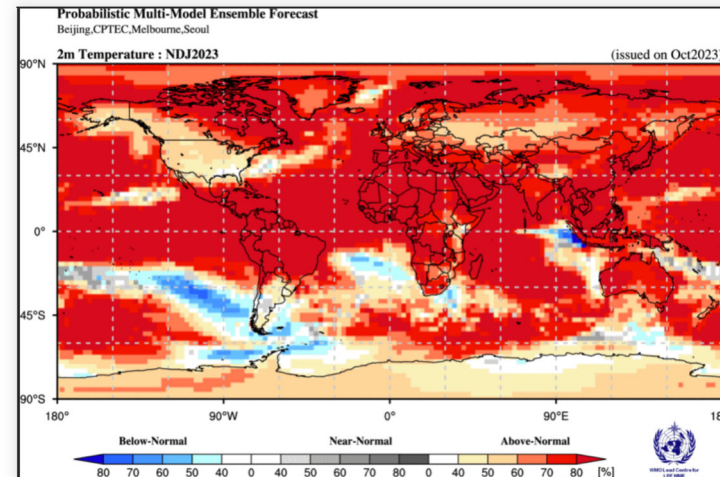
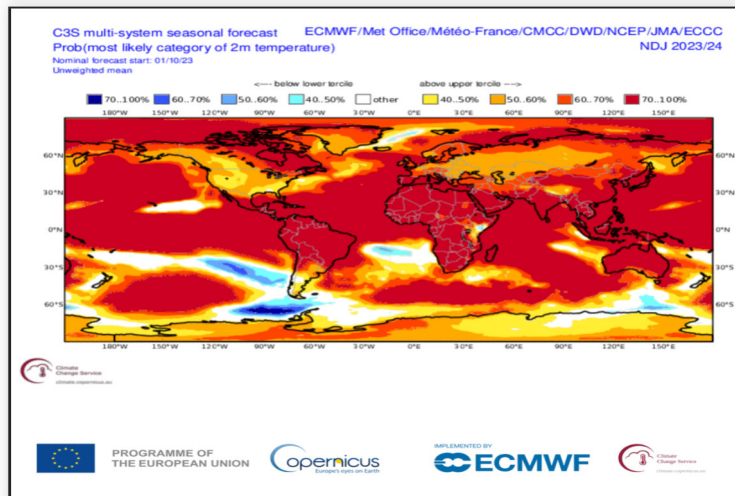
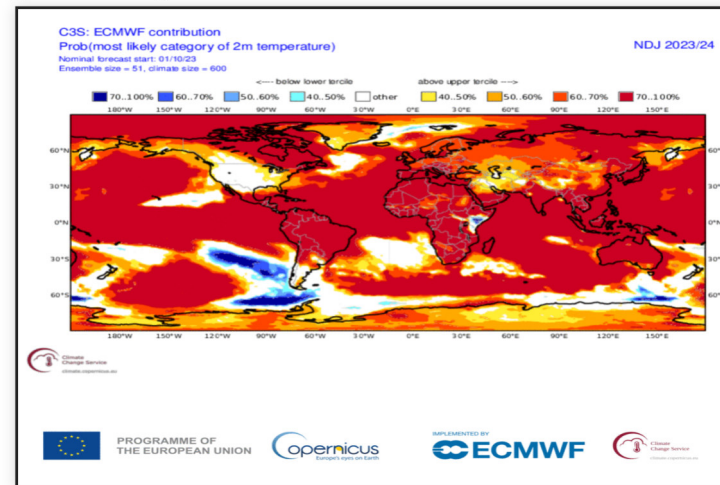
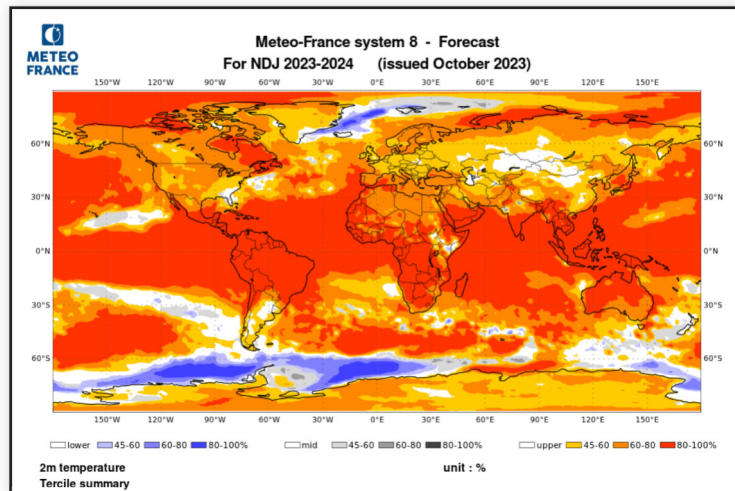
For ECMWF, the NAO- regime is significantly above its climatology, while the Blocking regime is below.



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).

Forecast of climatic parameters : Temperature probabilities

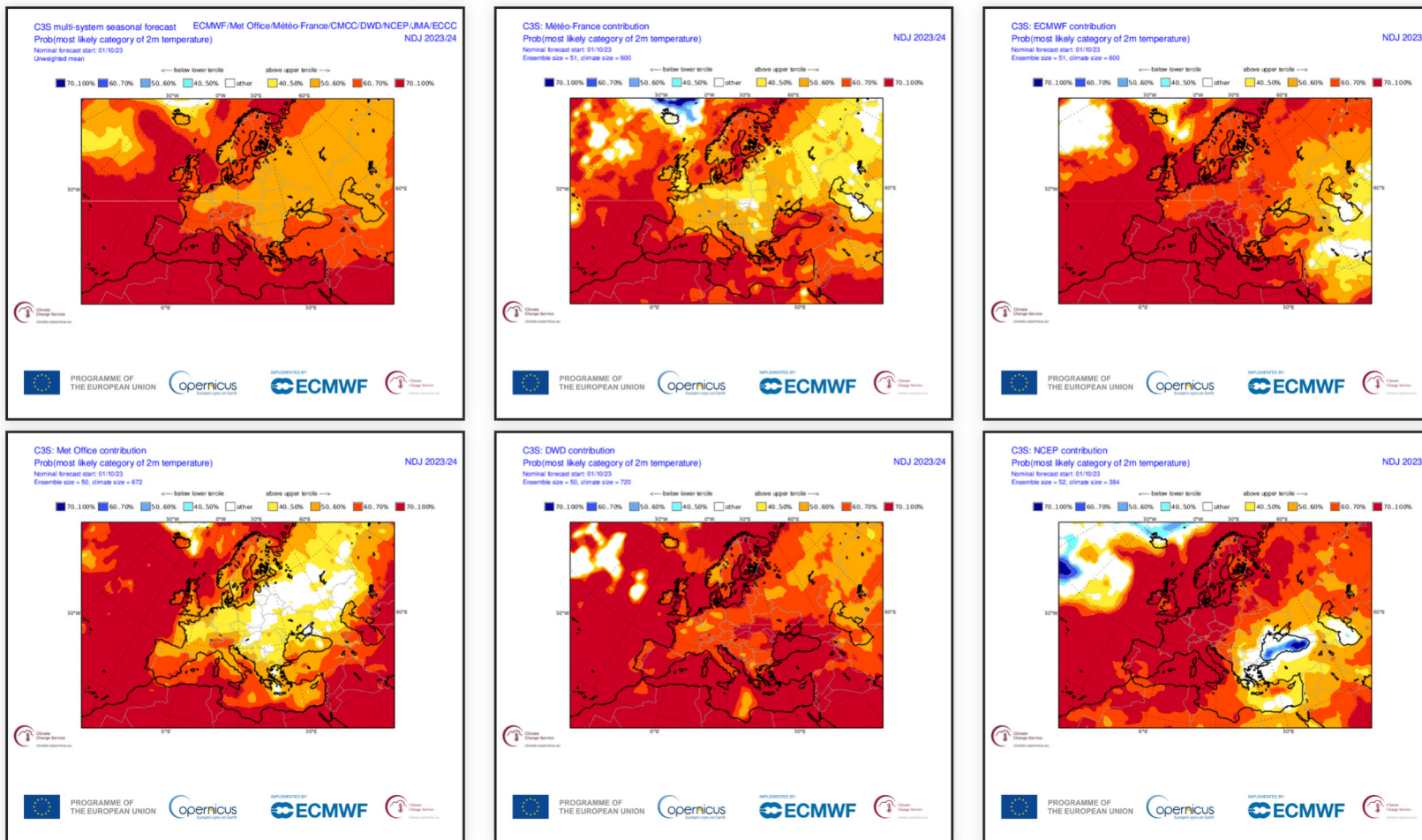
Warmer-than-normal conditions are likely, even very likely, over most regions of the globe.



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

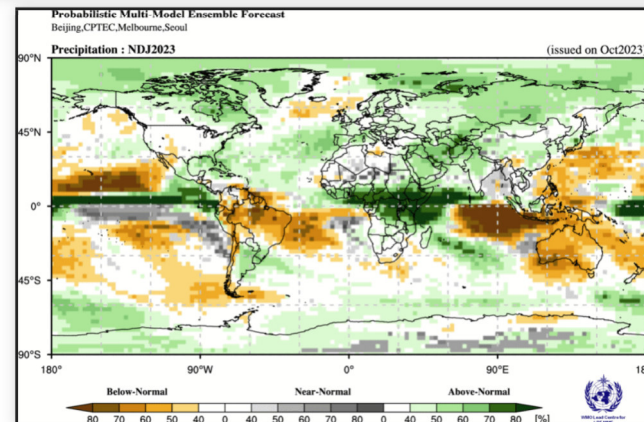
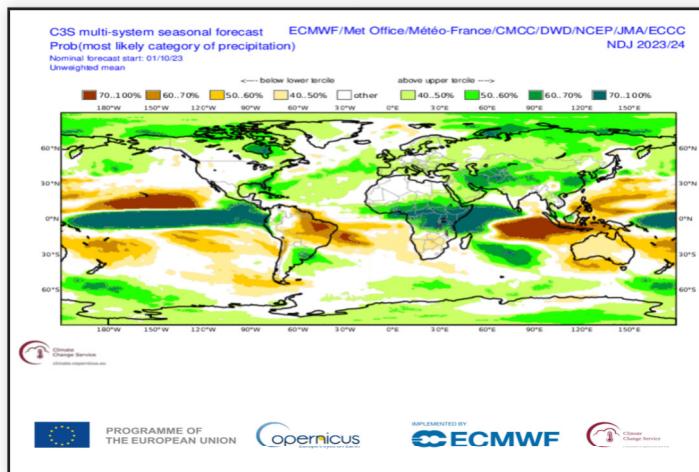
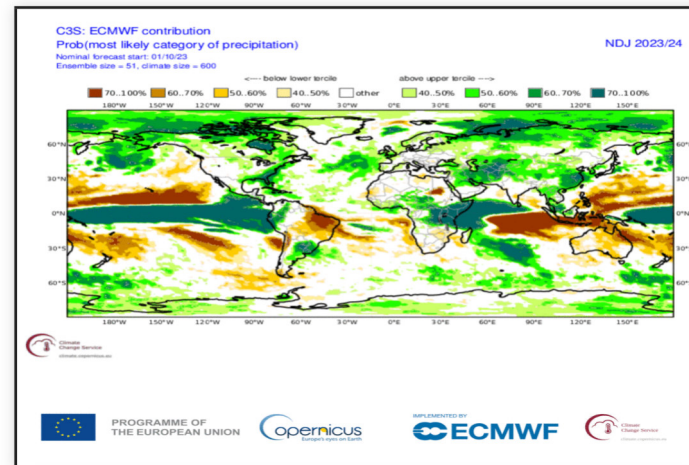
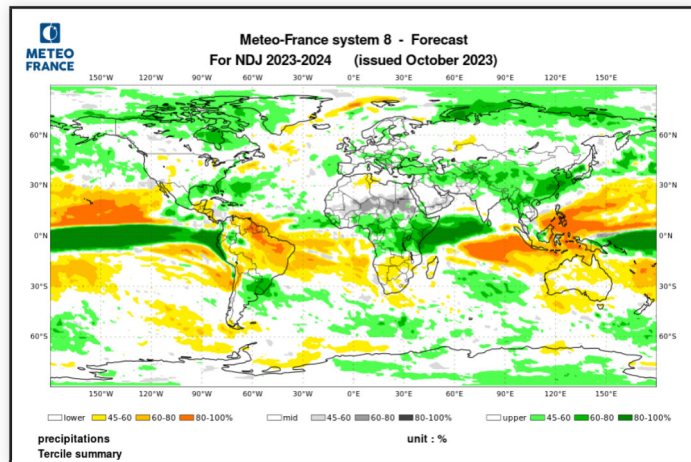
The probability of a warmer-than-normal scenario remains high over the Mediterranean Basin and western Europe. The probabilities are more uncertain from Central Europe to Russia.



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

Forecast of climatic parameters : Precipitation

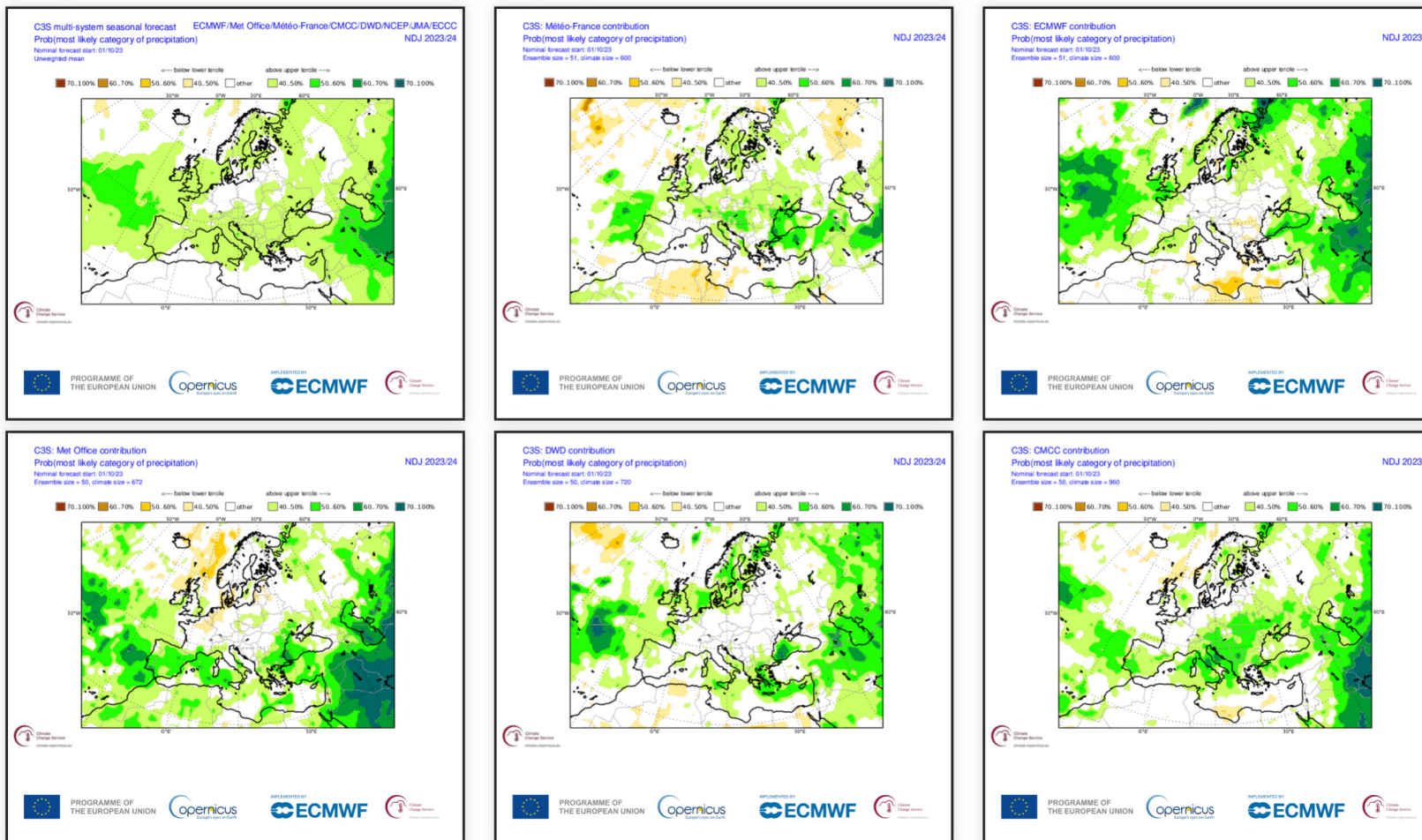
Very good agreement between models across the tropics, with patterns consistent with the impact of a strong El Niño (dry over the Maritime Continent and Amazon, wet over the Horn of Africa). In the Northern Hemisphere, large-scale patterns are close between models.



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

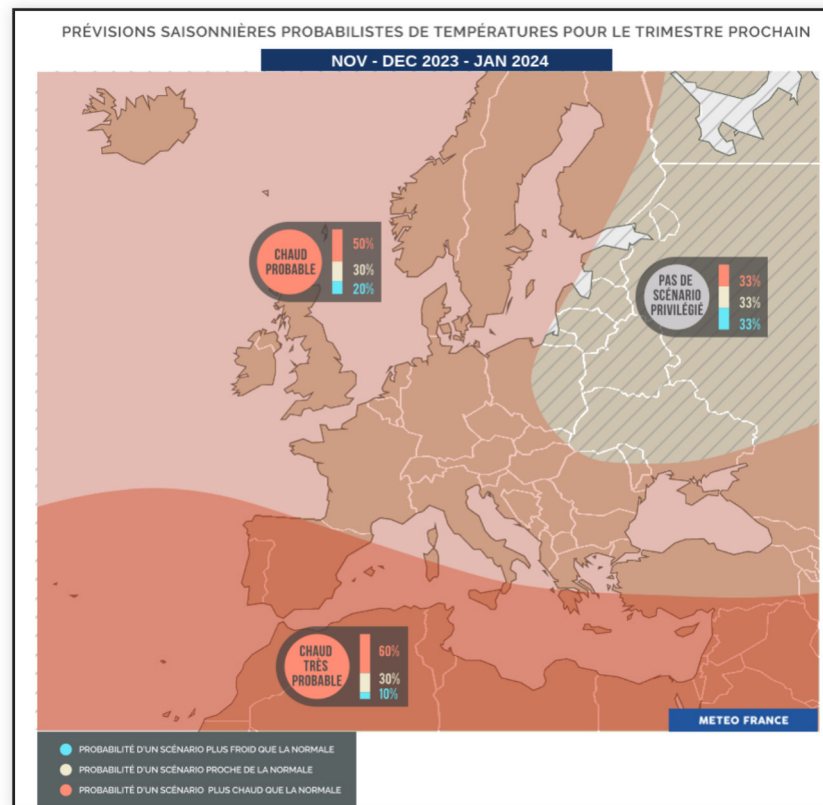
The models agree that a wetter signal is likely over the near Atlantic to the west, and the Middle East. In between, over Europe, models disagree on the location of wetter-than-normal signal probabilities.



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

Synthesis map for Europe : Temperature

A warmer-than-normal scenario is likely, if not very likely, over much of Europe and Mediterranean regions.

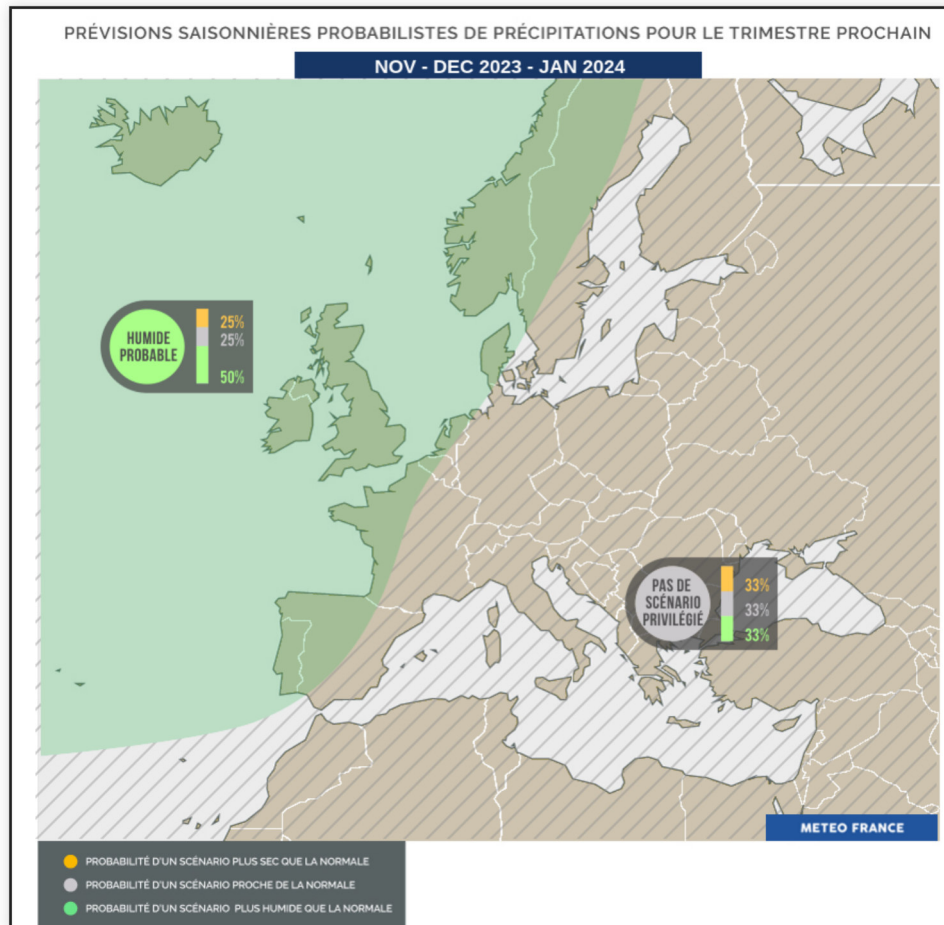


Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS

Synthesis map for Europe : Precipitation

Most models converge on a wetter than normal scenario for the western Europe and Middle East

No scenario is preferred elsewhere.



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