

VERIFICATION BULLETIN

MARCH - APRIL - MAY 2023

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Introduction : Objective

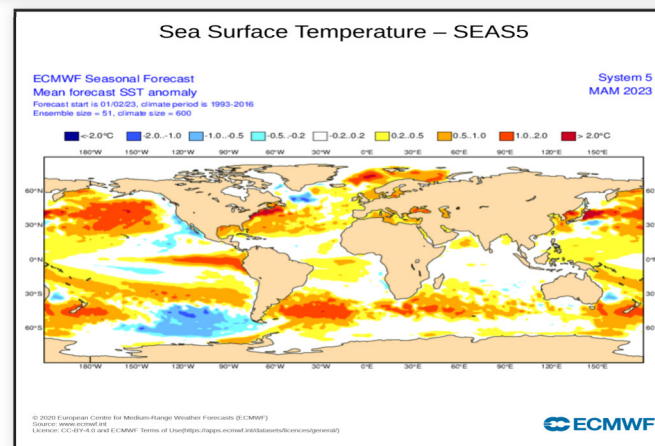
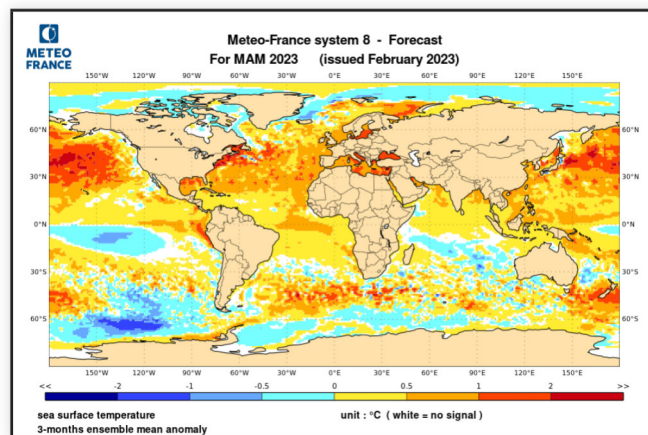
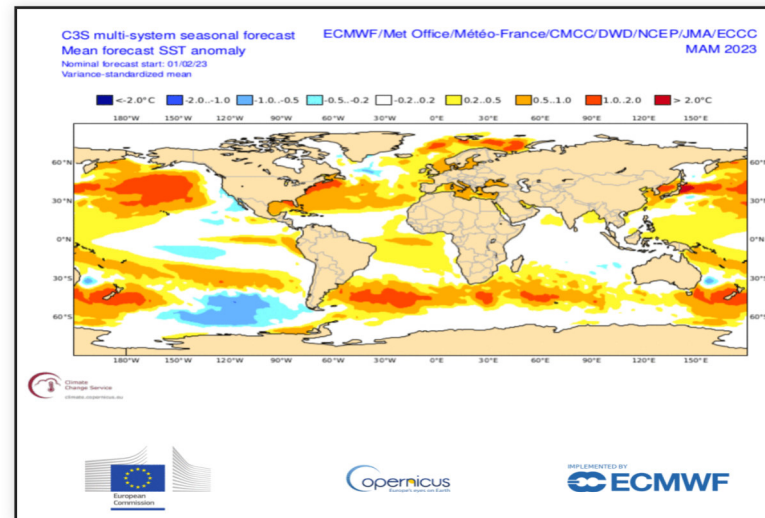
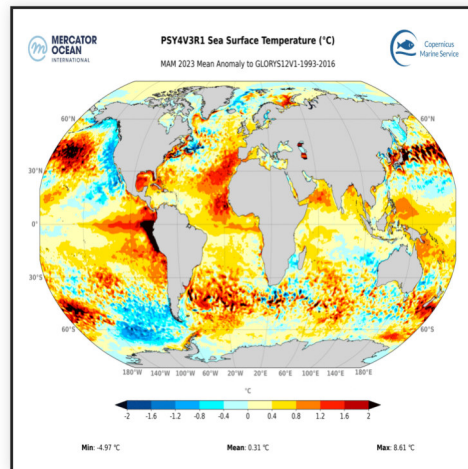
- The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean Basin.
- The aim is not to evaluate the mean skill of Seasonal Forecast models, for which scores are calculated over the whole hindcast period, but to enhance the knowledge of the behavior of models for advanced users (as National Meteorological Services), in parallel with an assessment of expertised forecast. This approach meets the need of many users, who want to know the recent real-time performances of forecasts, for specific events.
- Thanks to Mercator-Ocean and DWD (RCC-Climate Monitoring node for Europe) for providing products and analysis on the monitoring part.

Oceans : surface temperature anomalies

In the Pacific Ocean, warming near the South American coast, which is very visible on analysis, is not sufficiently anticipated by models. On the other hand, the PDO- pattern is well seen by the models.

In the Indian Ocean, there is little signal.

In the Atlantic Ocean, there is a marked positive anomaly from Spain to Western Africa. This is seen, although underestimated, by MF8, but not by ECMWF-SAE5.

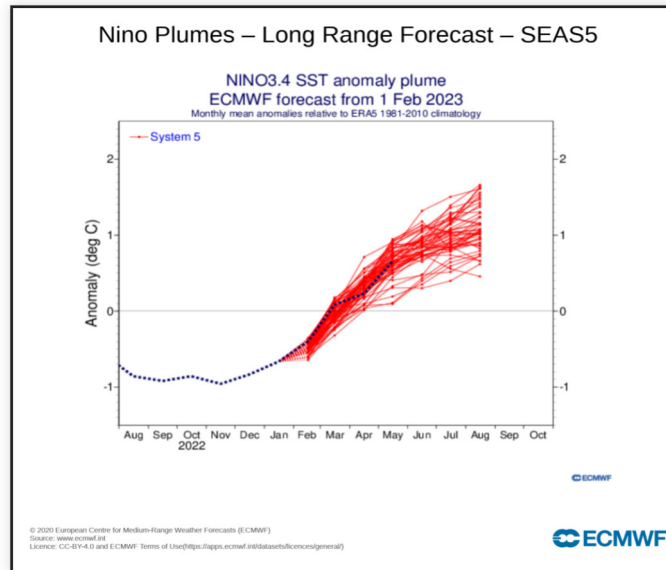
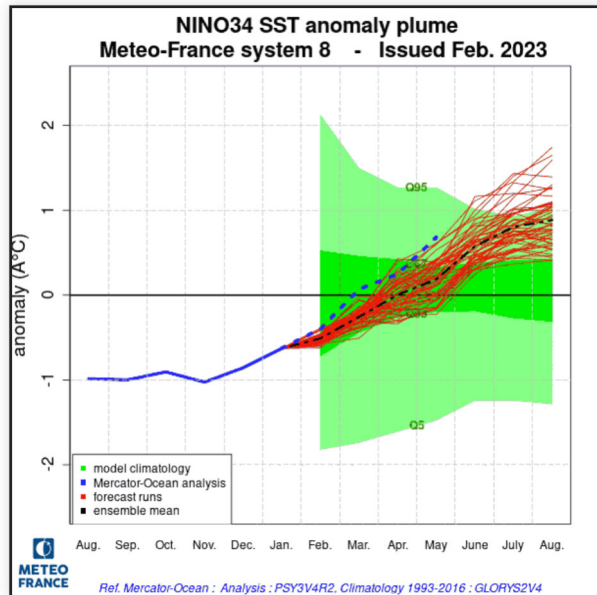


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

Oceans : ENSO

CAUTION : reference analyses differ between MF-S8 (Mercator-Ocean 1993-2016) and ECMWF-SEAS5 (NCEP 1981-2010).

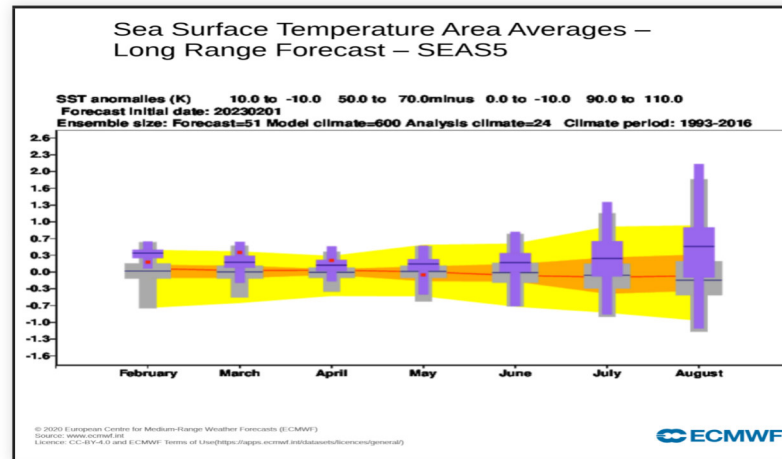
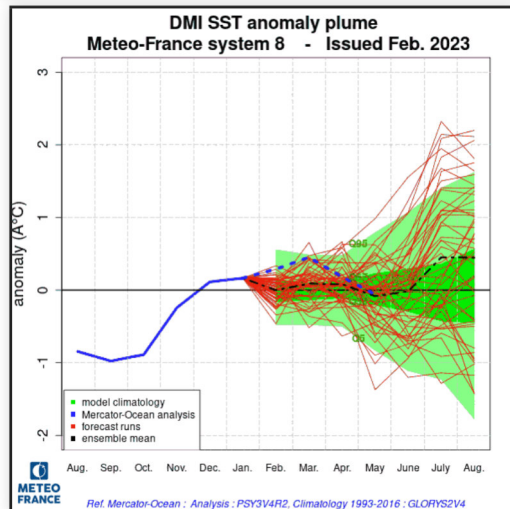
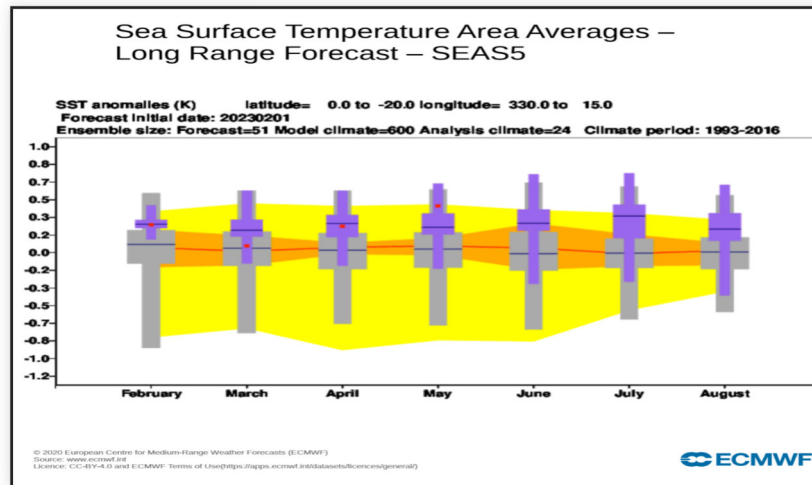
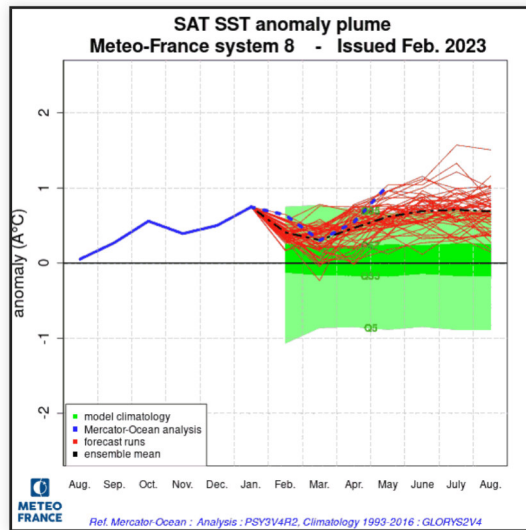
The trend is good for both models. ECMWF-SEAS5 is very well positioned, while MF8 underestimates the rise in the index.



Oceans : tropical Atlantic and Indian Ocean index

SAT : The anomaly located in the upper tercile is well seen, as a whole, by both models.

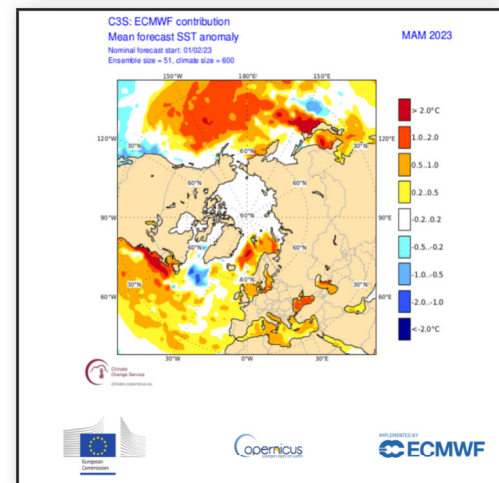
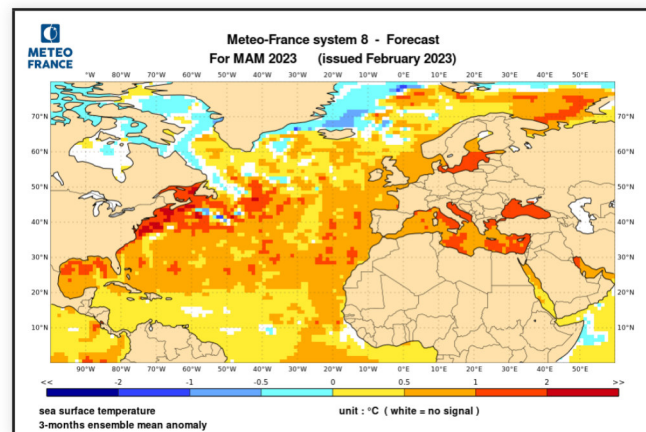
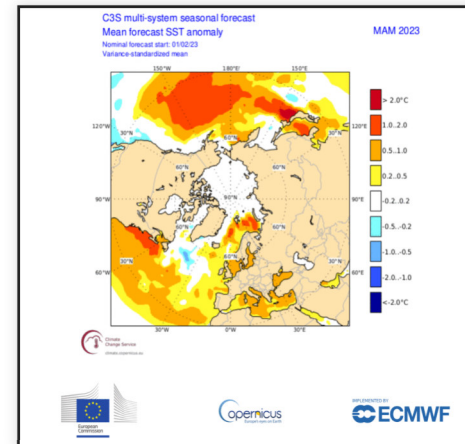
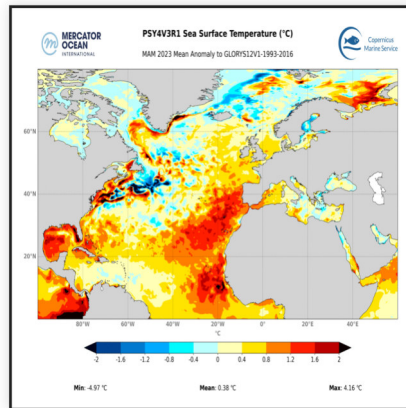
DMI : Values are low over the period. However, ECMWF-SAE5 is closer to the analysis than MF8.



Oceans : North Atlantic SST

The models still haven't incorporated cooling along the North American coast. The warm anomaly over the eastern basin is well seen by MF8 (but underestimated) but not by ECMWF-SAE5.

In the Mediterranean, the SST predicted by MF8 are too high.

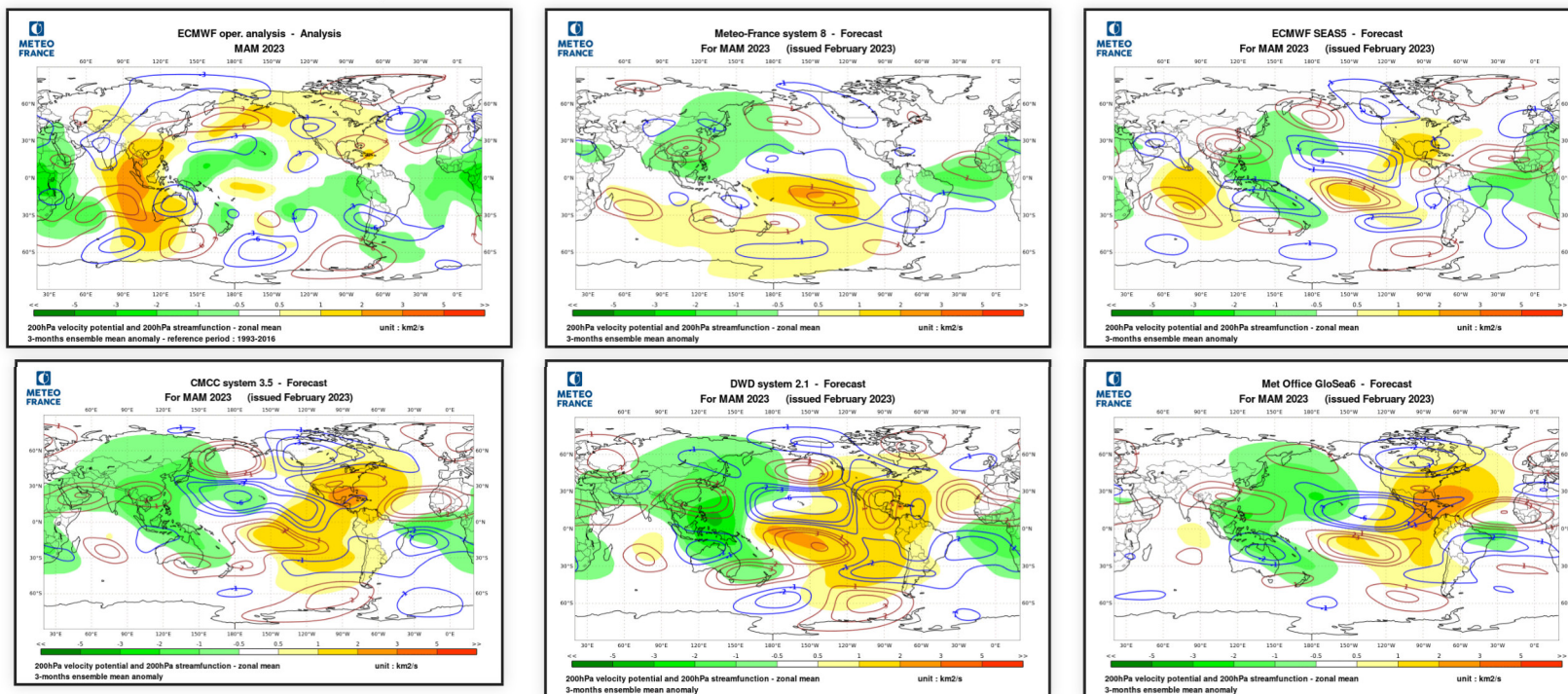


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : Structures associated with La Niña have completely disappeared from the analysis, which most models (Met Office, DWD or CMCC) have not considered. The downward motion anomaly over the eastern Indian Ocean is fairly well seen by ECMWF-SAE5.

SF : Similarly, dipoles around the equator and teleconnections, although predicted by all models, were not visible in the analysis. As a result, the anticyclonic curvature centered on Portugal and the cyclonic curvatures over the eastern Mediterranean basin and off Newfoundland were not seen by the models.



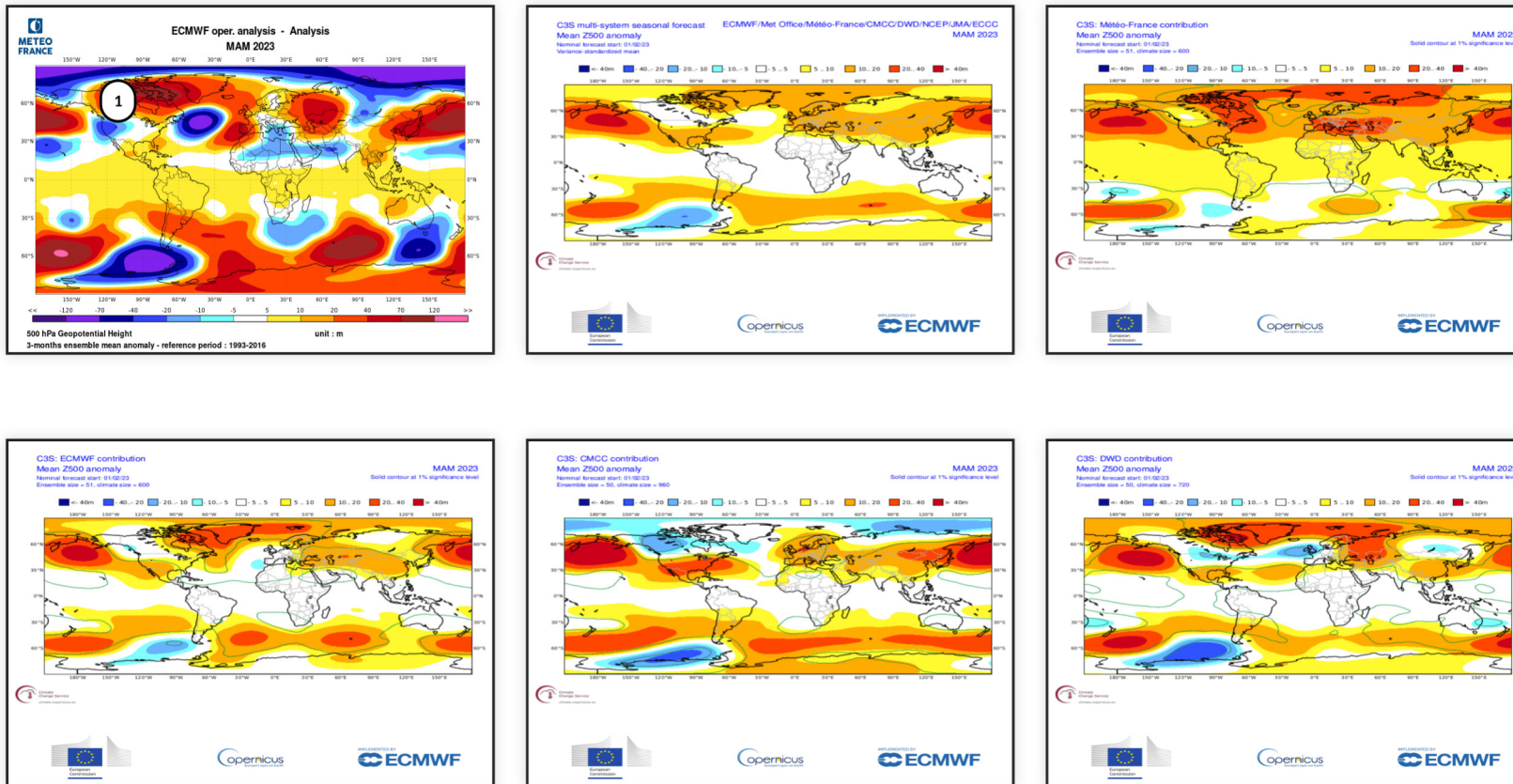
ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

Atmospheric circulation : 500hPa Geopotential height

Southern Hemisphere : The models, which converged in the Pacific Ocean, accurately predicted the main anomalies. This is much less obvious in other regions.

Northern Hemisphere : The models agreed on the PNA- pattern, which is found in the analysis even though it is shifted to the south.

In Europe, we find positive and negative anomalies linked to current functions, in particular the positive anomaly centered on Portugal. None of the models, though divergent, predicted this pattern.



ECMWF analysis, C3S multi-system, MF-S8, ECMWF-SEAS5, CMCC and DWD 500hPa geopotential height anomalies.

1 - Look like PNA -

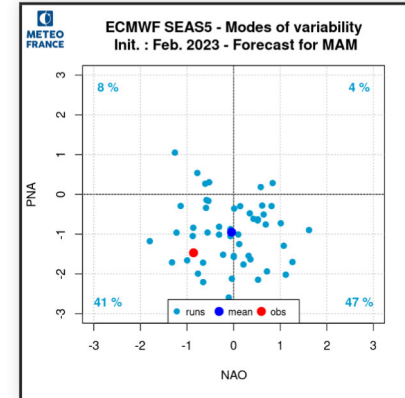
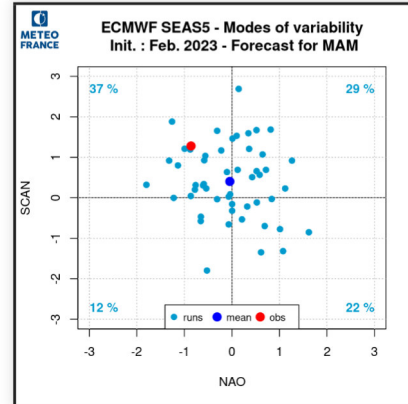
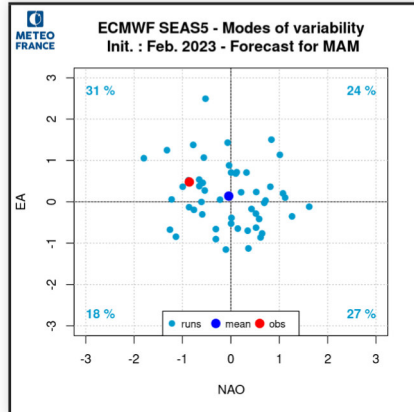
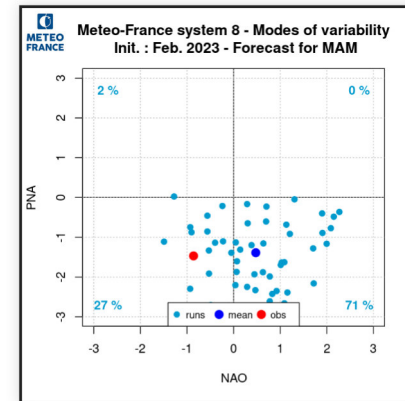
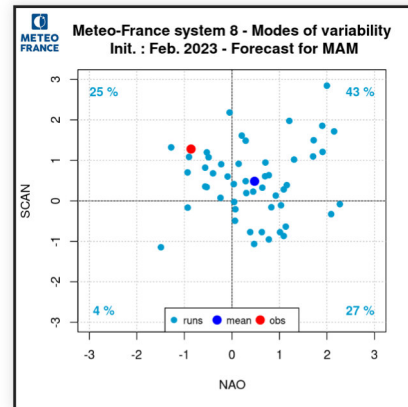
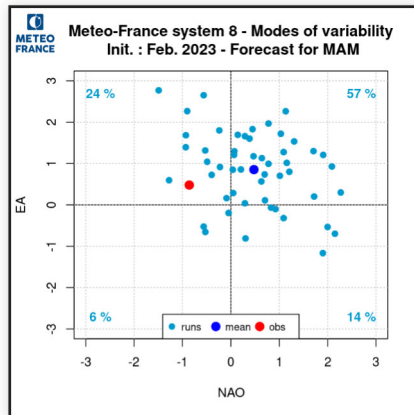
Atmospheric circulation : Modes of variability

The PNA- mode is well seen by both models.

The SCAN+ mode has been well anticipated, even if it is more pronounced on analysis.

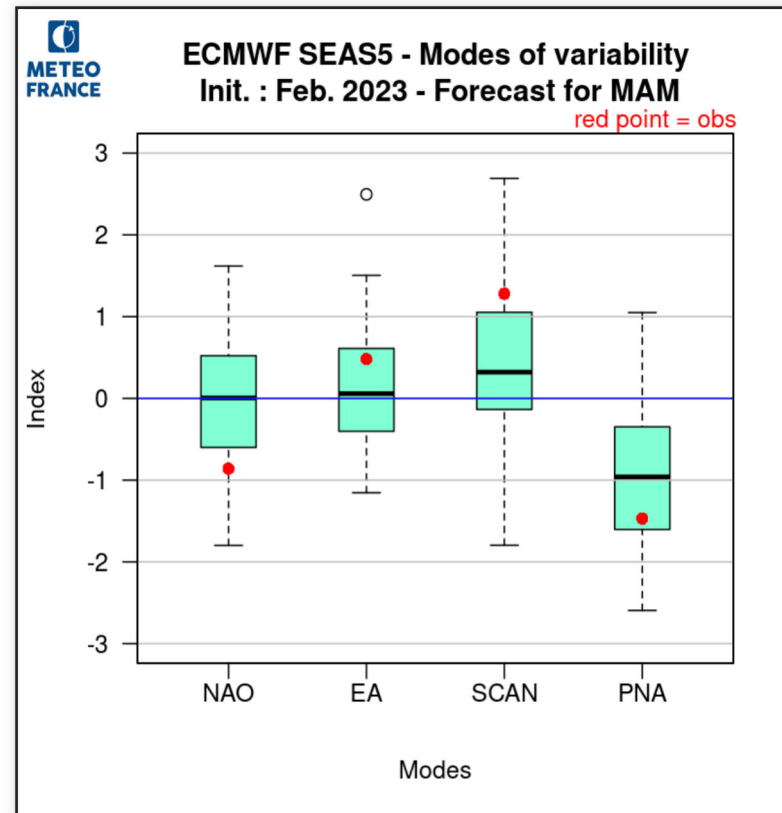
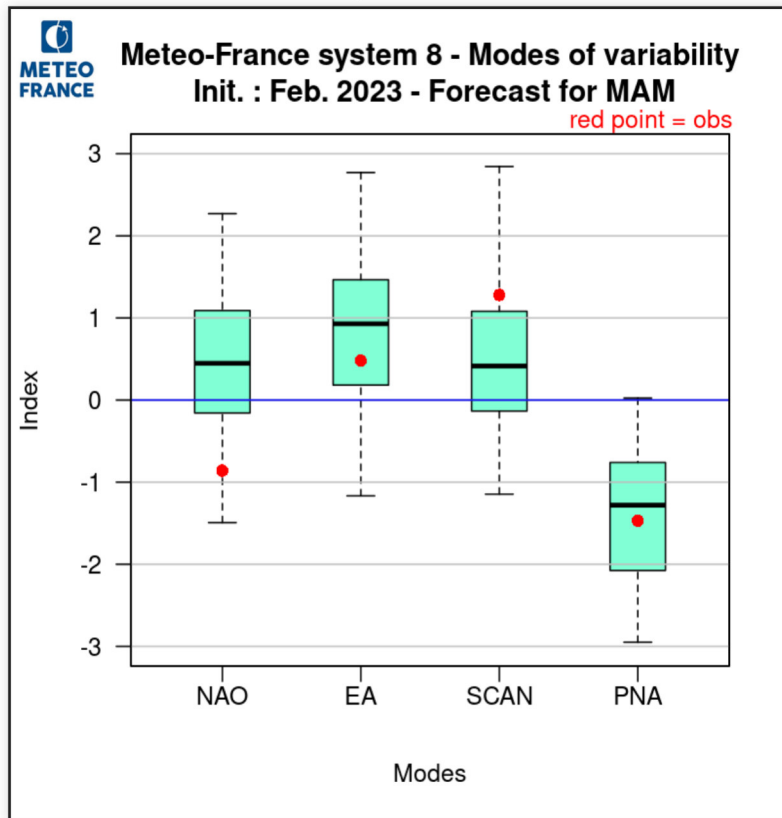
The EA+ was forecasted and is observed.

The expected phase of the NAO mode was neutral or positive, whereas the NAO- phase is observed.



Atmospheric circulation : Modes verification

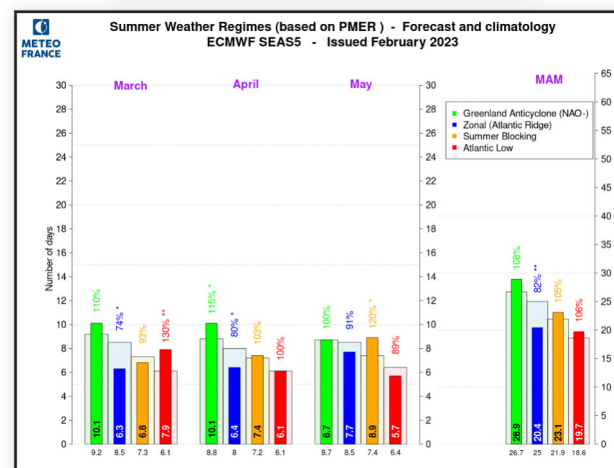
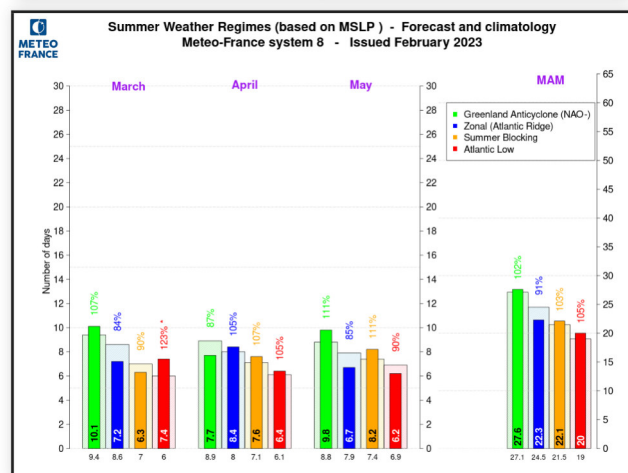
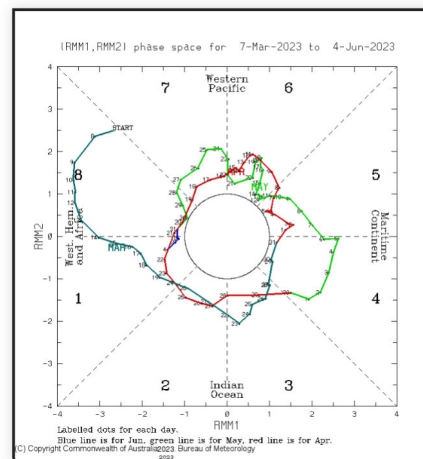
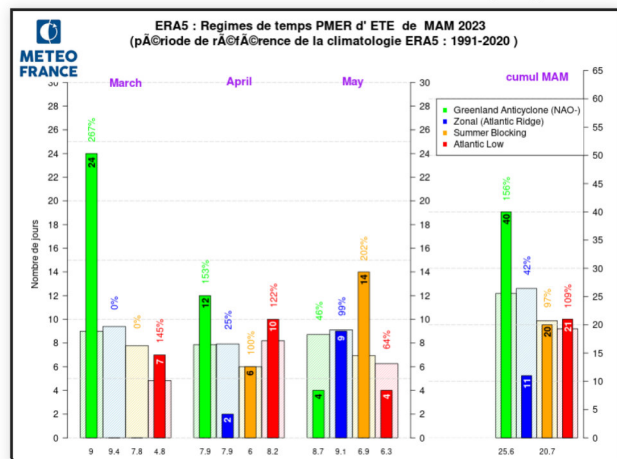
Same observation as for the previous slide



Atmospheric circulation : Summer SLP weather regimes

The classification into weather regimes is very different between the three months. In the end, the NAO- (Greenland Anticyclone) regime dominates and the Zonal regime is under-represented.

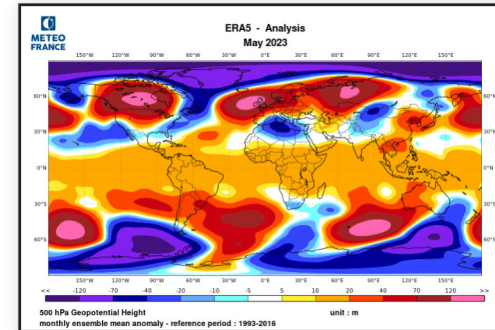
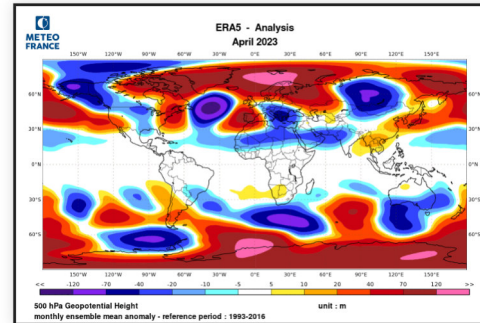
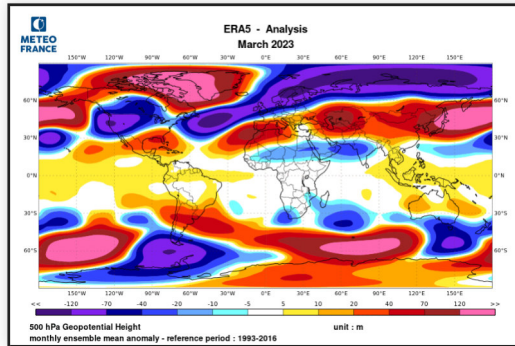
Both models show this distribution, but it is only significant for the Zonal regime with the ECMWF-SEAS5 model.



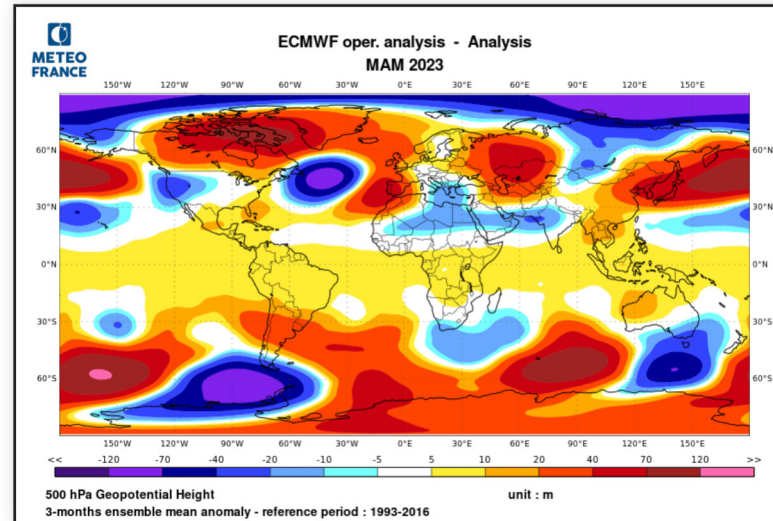
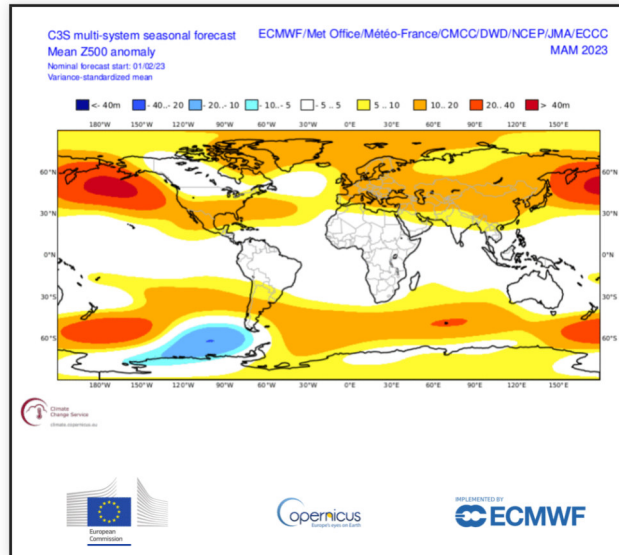
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

Atmospheric circulation : Variability within the quarter

A monthly analysis of atmospheric circulation clearly shows the succession of very different months.



ECMWF analysis : March, April and May 500 geopotential height anomalies

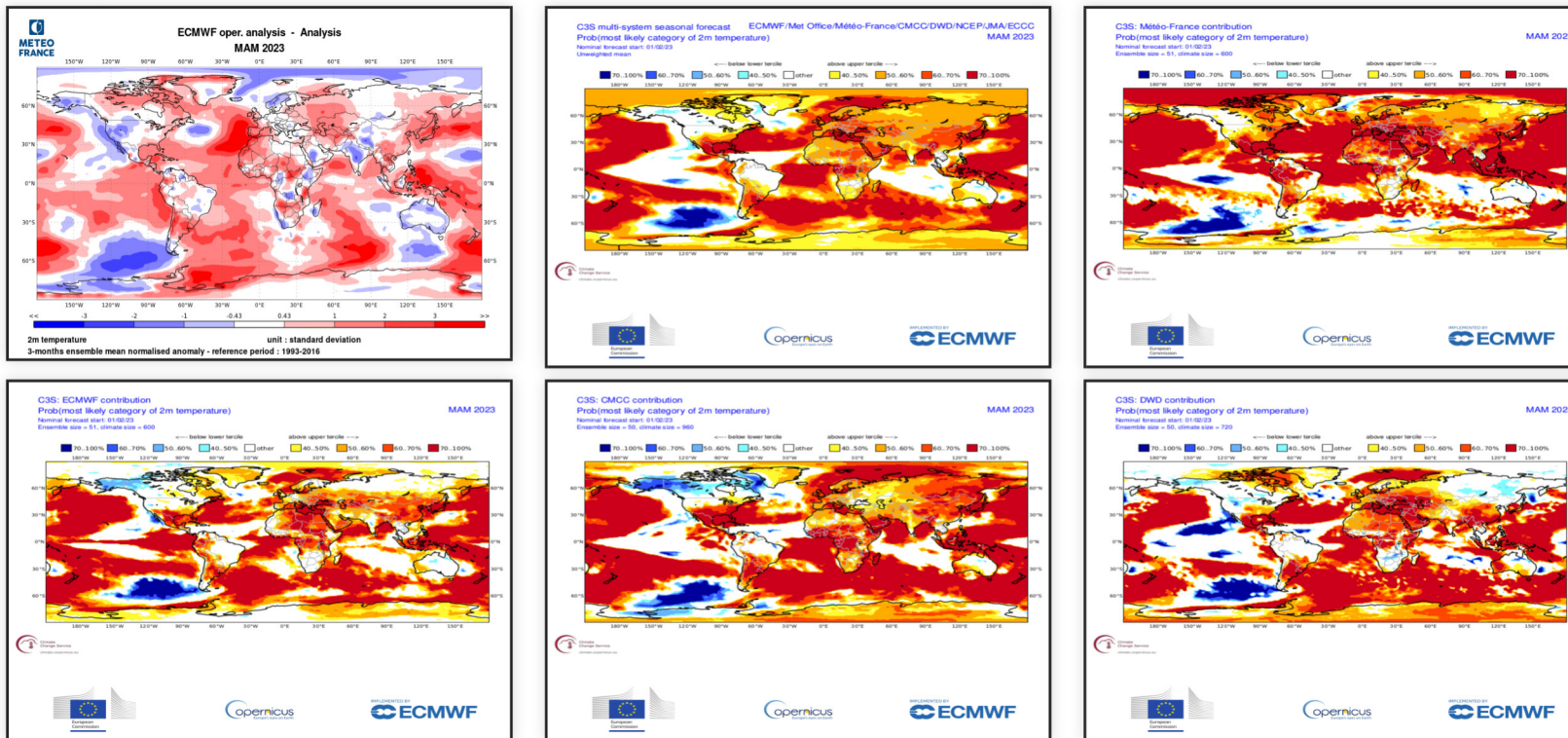


C3S multi-sytem forecast and ECMWF analysis 500 geopotential height anomalies for JFM

Climatic parameters : temperature on the globe

The two main cold anomalies in the Americas (North and South) are well predicted by the models.

In Europe and the North Atlantic, there are differences.

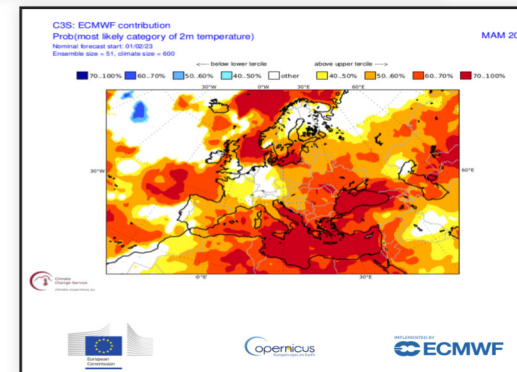
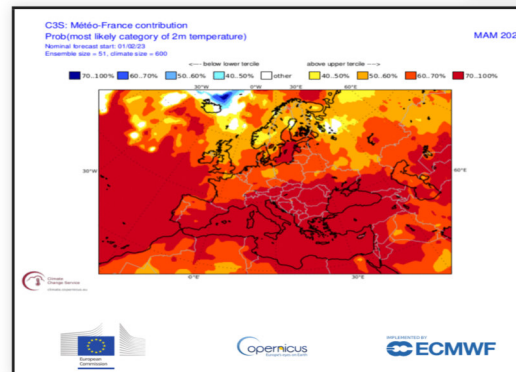
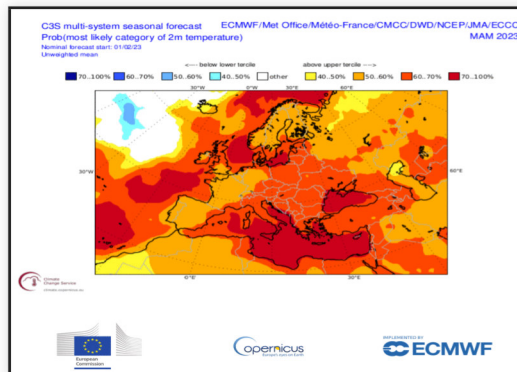
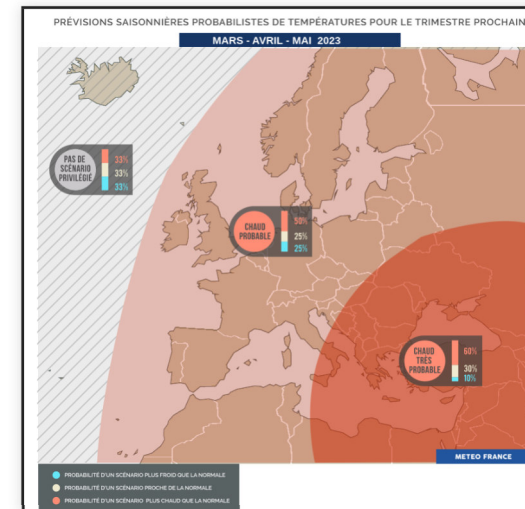
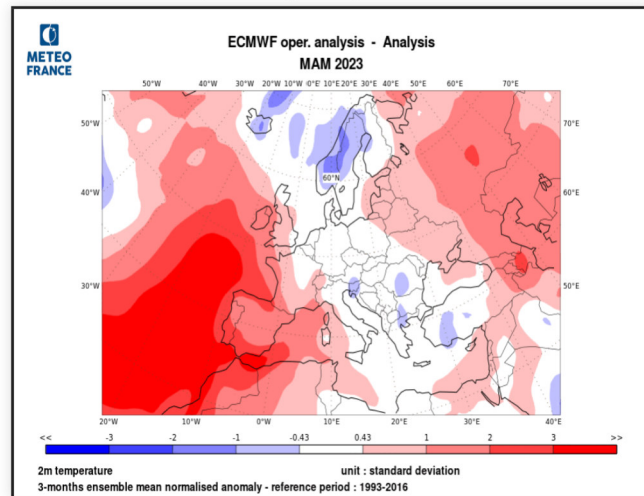


ECMWF analysis top left, forecast for multi-model top center and forecast for MF-S8 top right, ECMWF-SEASS, CMCC, DWD on the bottom line.

Climatic parameters : temperature over Europe

The main Z500 anomalies in Europe have not been foreseen.

Consequently, the corresponding temperature anomalies were not seen either.

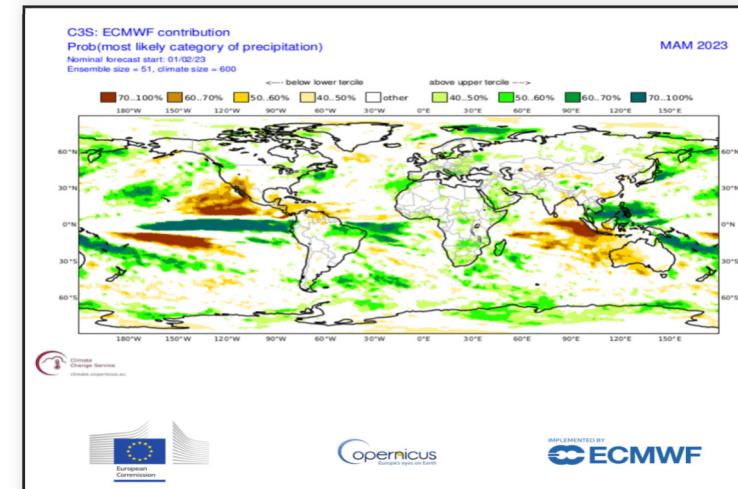
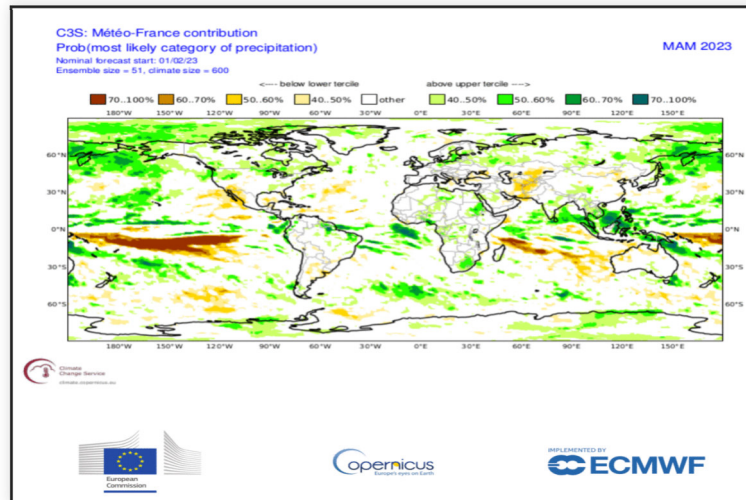
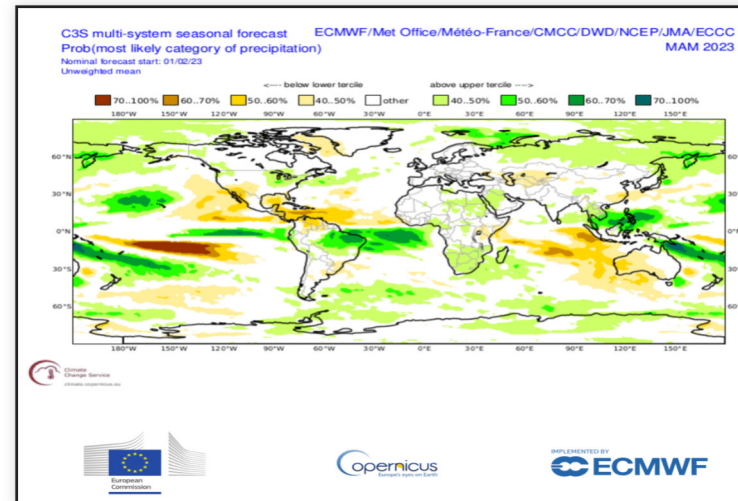
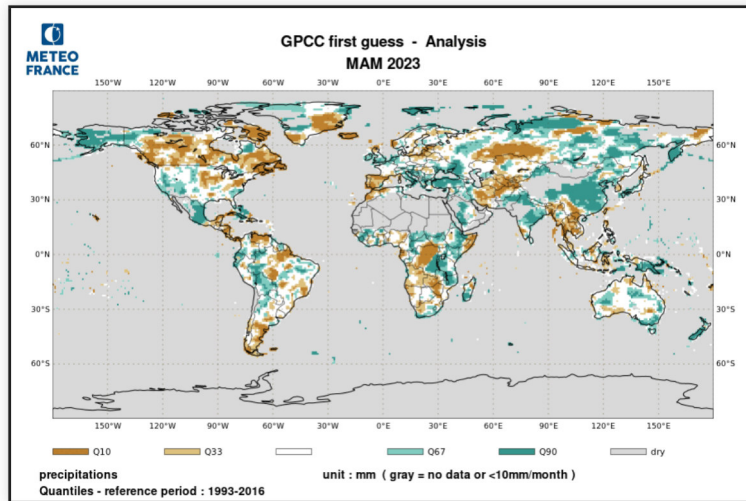


ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system, MF-S8 and SEAS5 on the bottom line.

Climatic parameters : Precipitations over the globe

In the intertropics, the models did not show very strong signals (except, for example, in Central America, with a dry signal validated by analysis).

In North America, forecast anomalies were low. On analysis, the location was not verified, probably due to the shift in the PNA- pattern. In Europe, the models showed little or no anomalies.

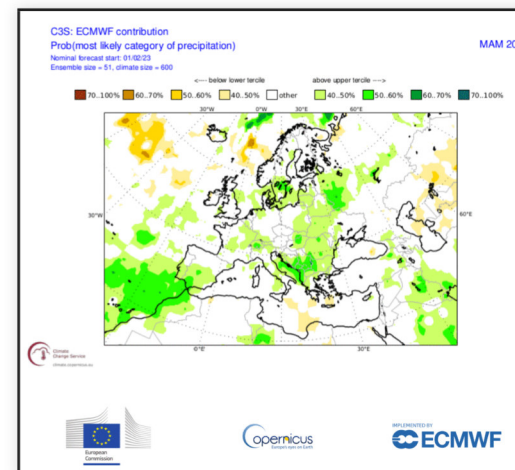
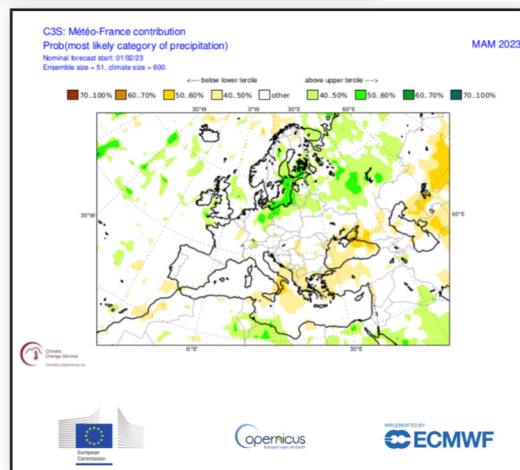
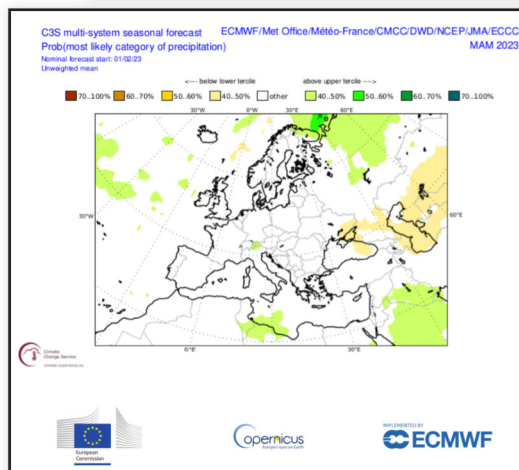
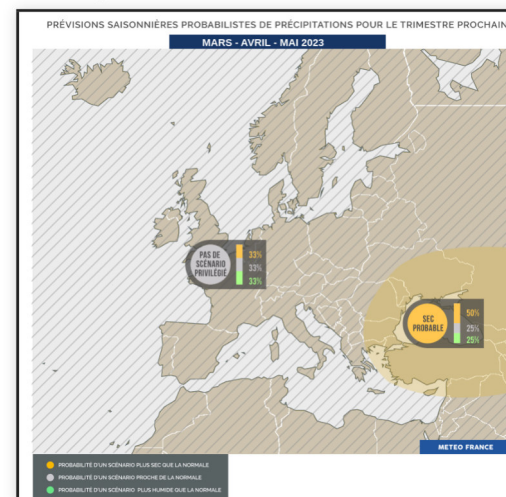
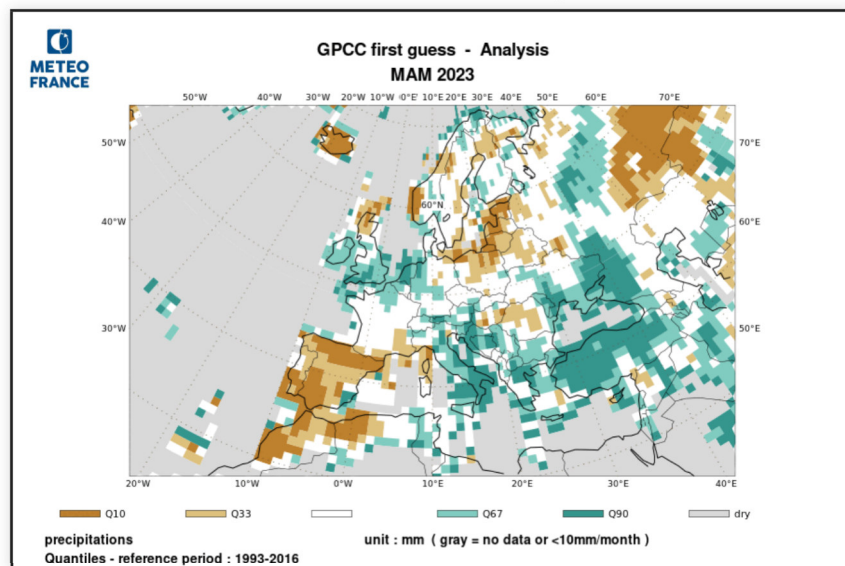


Standardized Precipitation Index analysed by IRI top left, forecast for multi-model top right and MF-S8 and SEAS5 on the bottom line.

Climatic parameters : Precipitations over Europe

The only likely scenario highlighted in the summary map (dryness around the Black Sea) does not hold true at all. In fact, conditions were wetter than normal over southeastern Europe and Turkey.

Linked to the warm anticyclonic conditions, a strong dry anomaly is visible from Spain to the Maghreb.



Precipitation anomalies analysed by IRI (top left). Synthetic forecast map for precipitation (top right) and forecast for multi-model, MF-S8 and SEAS5 (on the bottom line).

General summary : for the period FMA 2023

1) Oceans :

Except for the North Atlantic, the main anomalies were well predicted by the models.

2) Large scale atmospheric circulation :

VP 200 hPa : Downward motion over the Indian Ocean has not been seen by any model, with the exception of ECMWF-SAE5, which merely suggests it.

SF 200 hPa : The dipoles and teleconnections predicted by the models are not verified by analysis. There are therefore significant differences, particularly over Europe (anticyclonic anomaly over Portugal).

Z500 : The PNA- pattern is offset between models and analysis in North America. In Europe, differences on stream functions are reflected on Z500 fields.

3) Climatic parameters over Europe :

Temperatures : poor forecasts

Precipitations : poor forecasts