

VERIFICATION BULLETIN

APRIL - MAY - JUNE 2023

Table of Content

1. Introduction	
1. Objective	3
2. Oceans	
1. surface temperature anomalies	4
2. ENSO	5
3. tropical Atlantic and Indian Ocean index	6
4. North Atlantic SST	7
3. Atmospheric circulation	
1. Global teleconnection	8
2. 500hPa Geopotential height	9
3. Modes of variability	10
4. Modes verification	11
5. Summer SLP weather regimes	12
6. Variability within the quarter	13
4. Climatic parameters	
1. temperature on the globe	14
2. temperature over Europe	15
3. Precipitations over the globe	16
4. Precipitations over Europe	17
5. General summary	
1. for the period AMJ 2023	18

Introduction : Objective

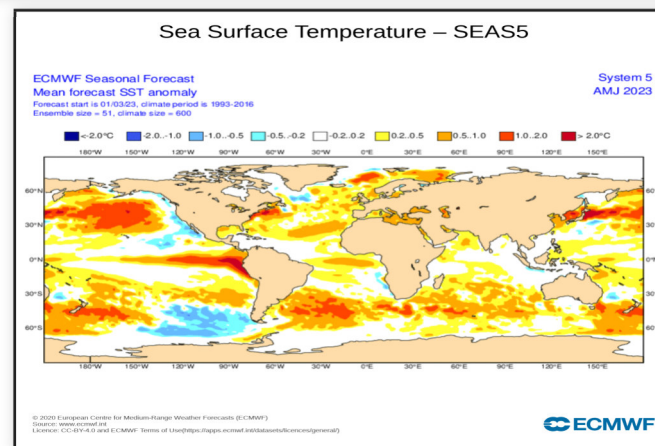
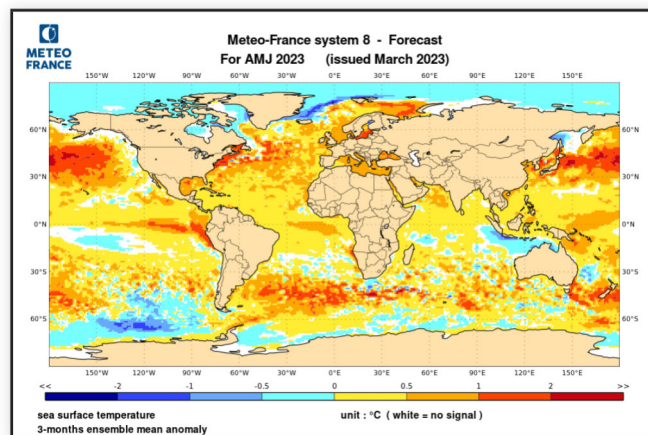
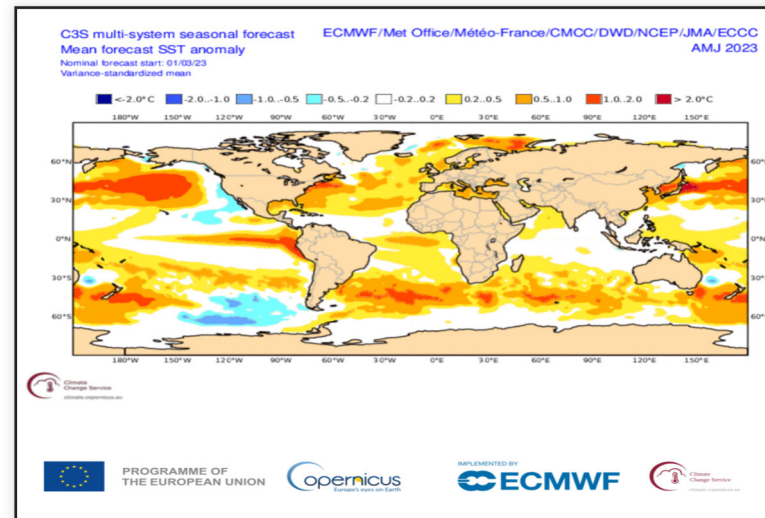
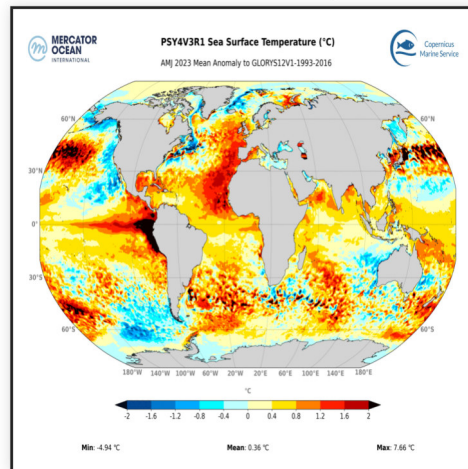
- The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean 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, the strong positive anomaly near the Peruvian coast, stretching westwards along the equator, is seen by the models but underestimated. The PDO- pattern has been well forecast.

In the Indian Ocean, the east/west SST gradient is still weak on analysis.

In the Atlantic Ocean, the anomaly over the equator is well predicted by the models. However, the strong positive anomaly over the eastern North Atlantic basin was not predicted by the models.

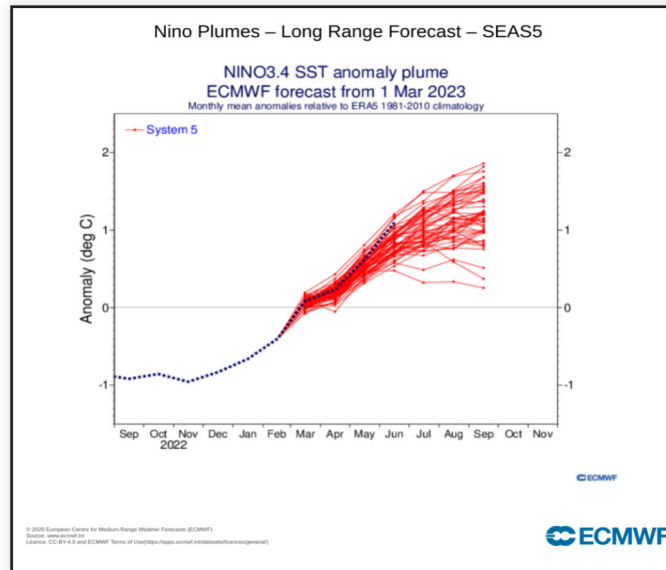
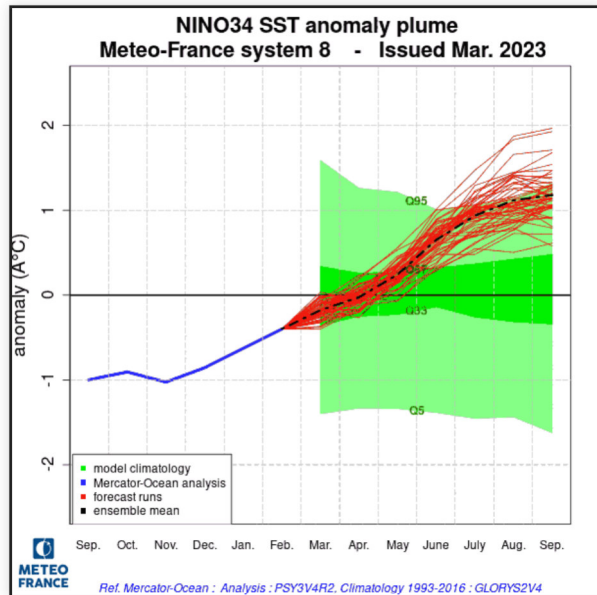


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

Oceans : ENSO

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

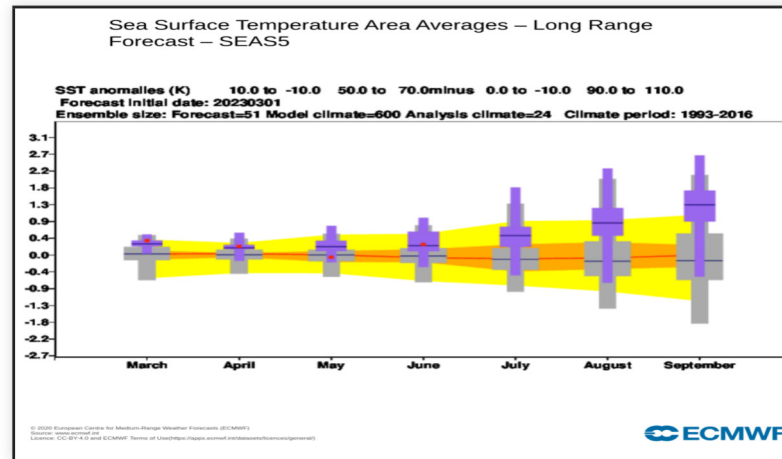
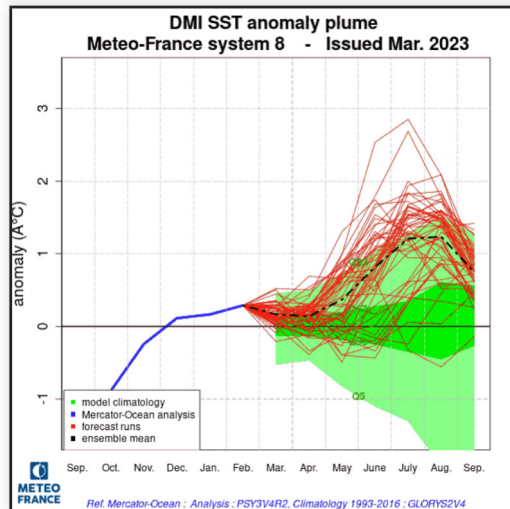
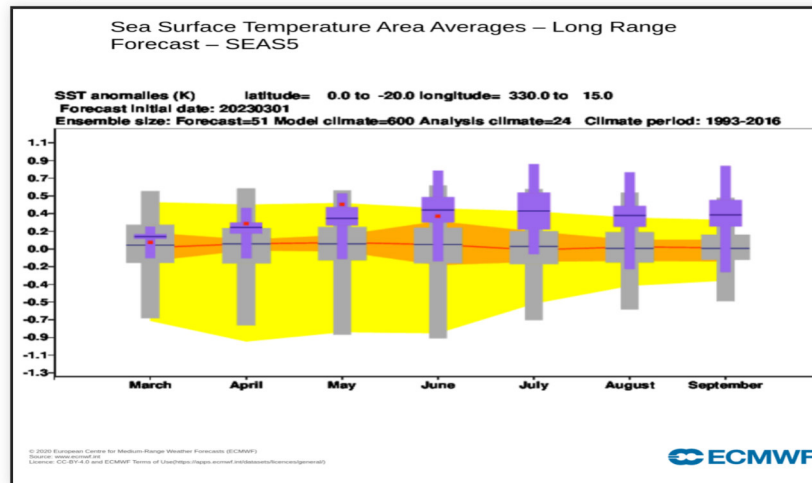
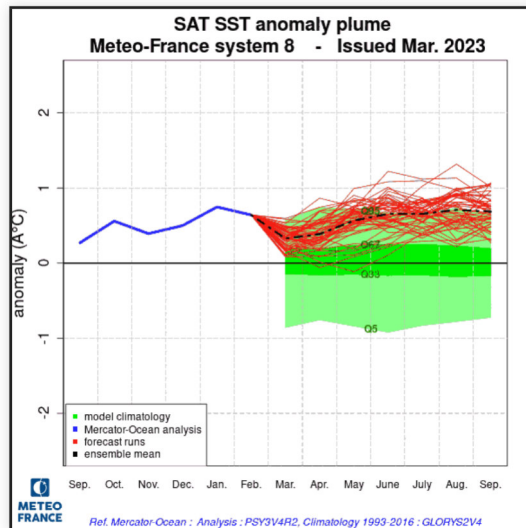
While the trend is good for both models, they (particularly MF-8) reduce the index value at the end of the quarter



Oceans : tropical Atlantic and Indian Ocean index

SAT : The anomaly is well located in the upper tercile by both models.

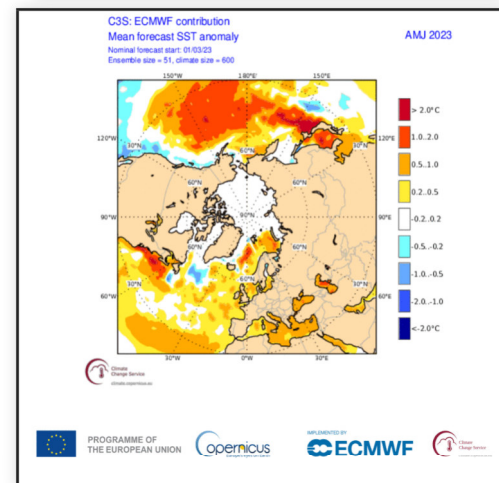
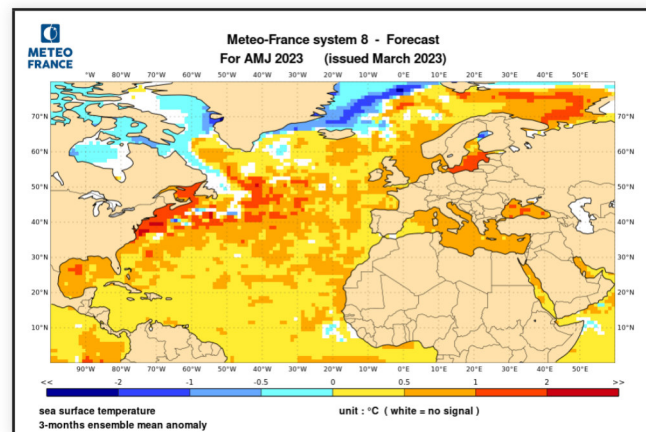
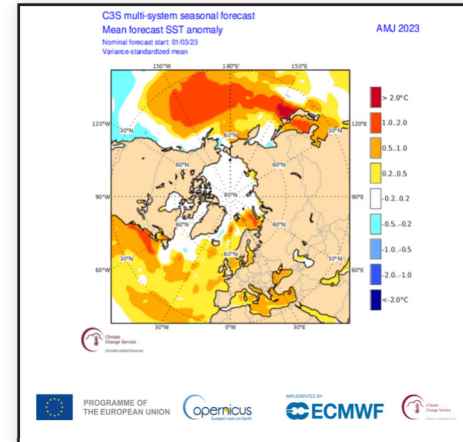
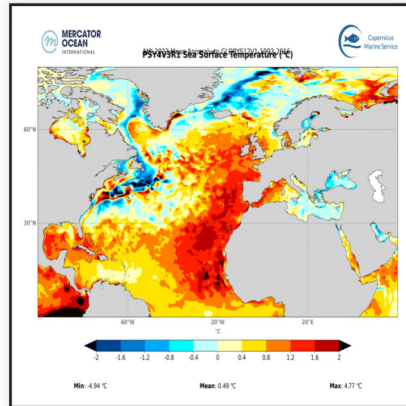
DMI : ECMWF-SAE5 is close to analysis. The DMI value predicted by MF-S8 at the end of the term is too high.



Oceans : North Atlantic SST

The anomalies in the North Atlantic (negative anomaly near the American coast and positive anomaly to the east) are not correctly seen by the models.

In the Mediterranean, the east/west SST gradient was not predicted by both models.

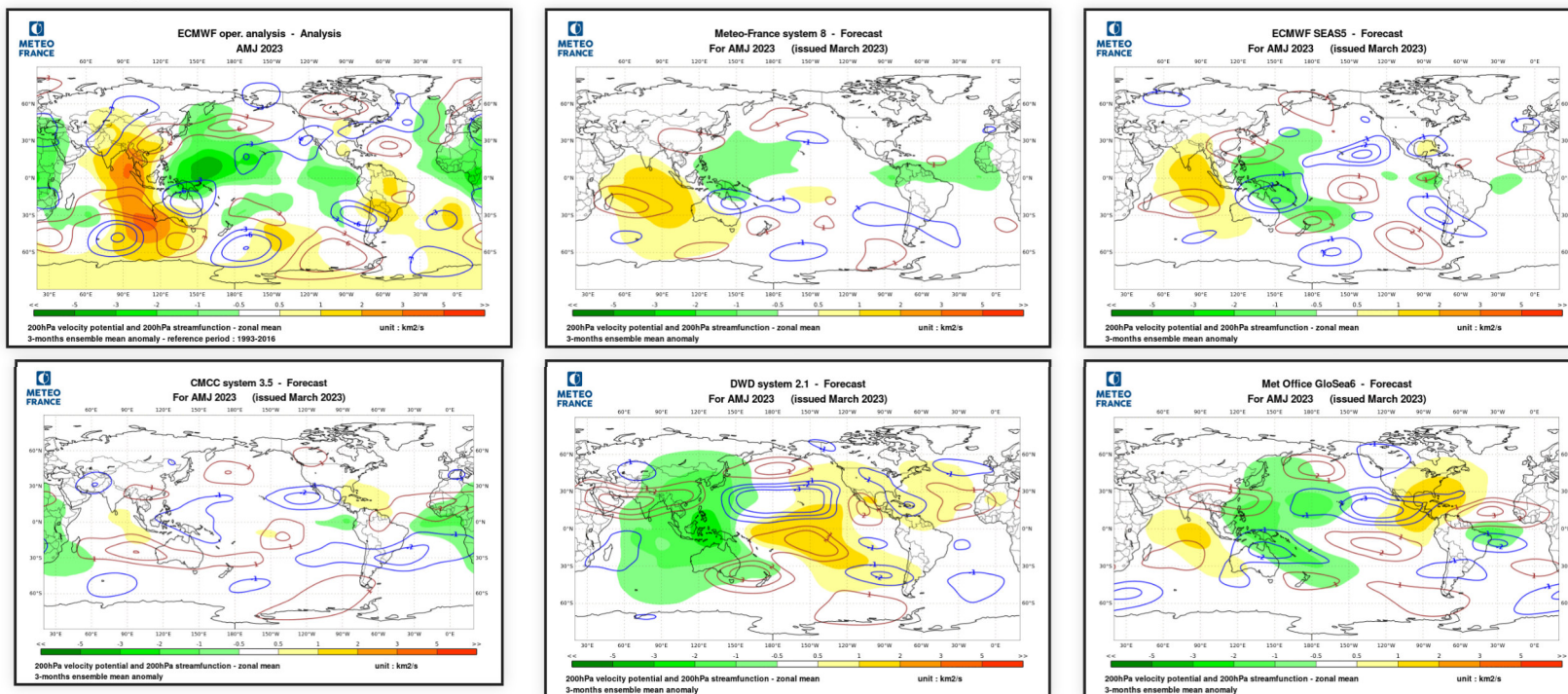


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : The dipole around the Maritime Continent is well seen by three models. The DWD model still retains a "La Niña" pattern and the CMCC remains neutral. On analysis, a zone of ascending winds is positioned over Africa, not predicted by most models.

SF : The SF cores around the Maritime Continent are well positioned by the models. Near Europe; analysis shows a cyclonic curvature zone over the eastern Mediterranean Basin and an anticyclonic curvature zone from Morocco to the British Isles and Scandinavia, not forecast by the models.



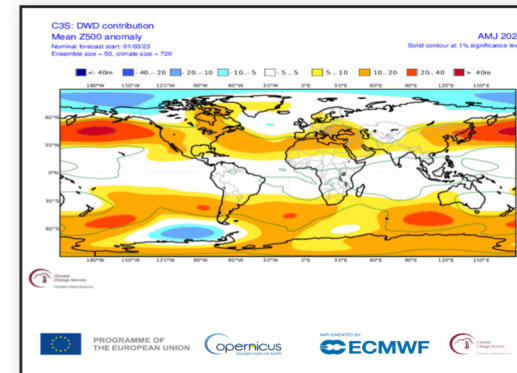
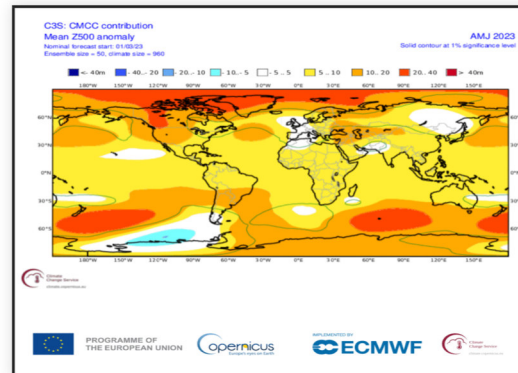
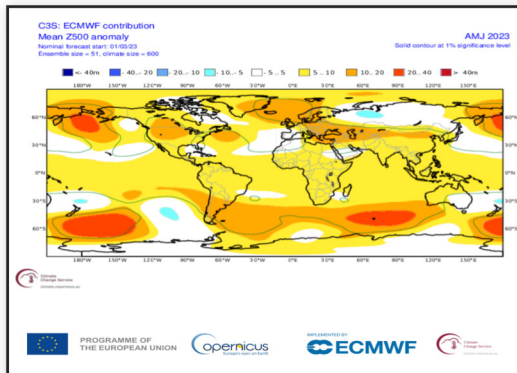
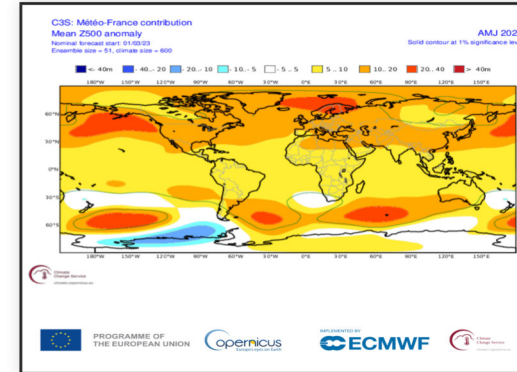
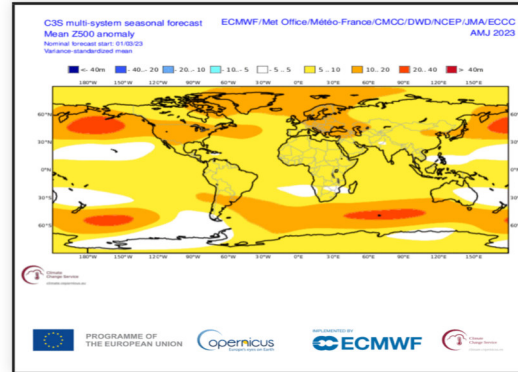
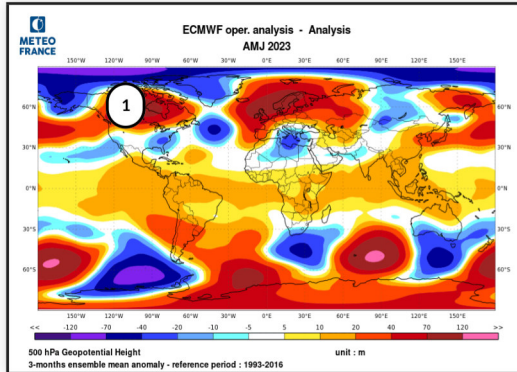
ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange : subsidence) and stream function anomalies (isolines, red : anticyclonic in the northern hemisphere, blue : cyclonic in the northern hemisphere).

Atmospheric circulation : 500hPa Geopotential height

Southern Hemisphere : The main anomalies are well located by the models.

Northern Hemisphere : The models agreed on the PNA- pattern, also visible on analysis.

In Europe, the strong positive anomaly over Scandinavia is relatively well forecast by the multi-models, MF-S8 and ECMWF. On the other hand, the negative anomaly over the eastern Mediterranean is not seen by any model.



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

1 - Look like PNA -

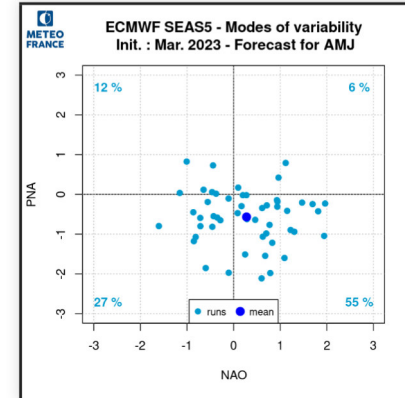
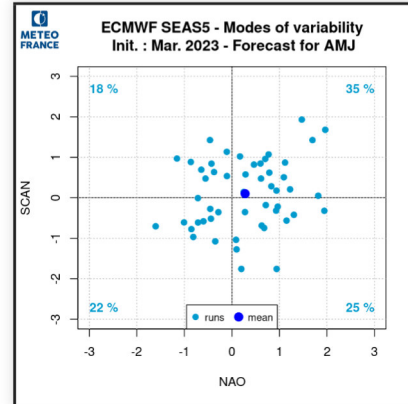
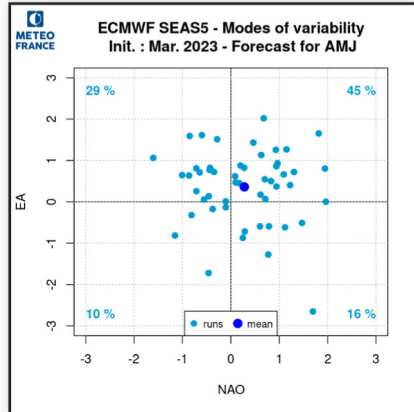
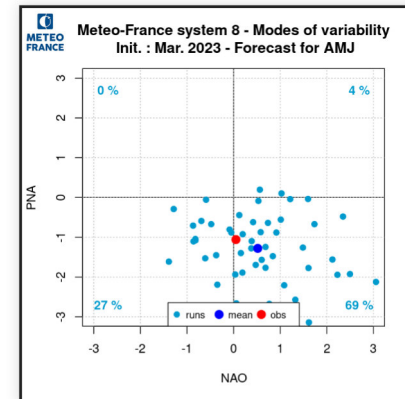
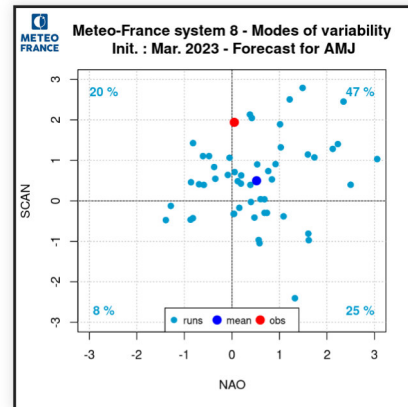
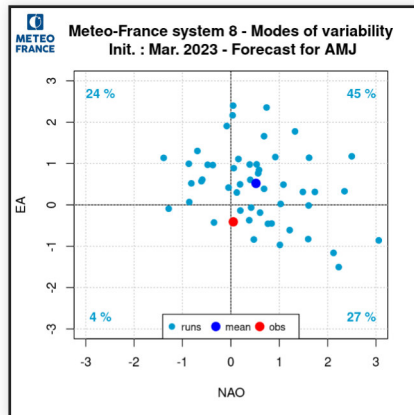
Atmospheric circulation : Modes of variability

The PNA- mode is well seen by both models.

The SCAN+ mode is much stronger than expected.

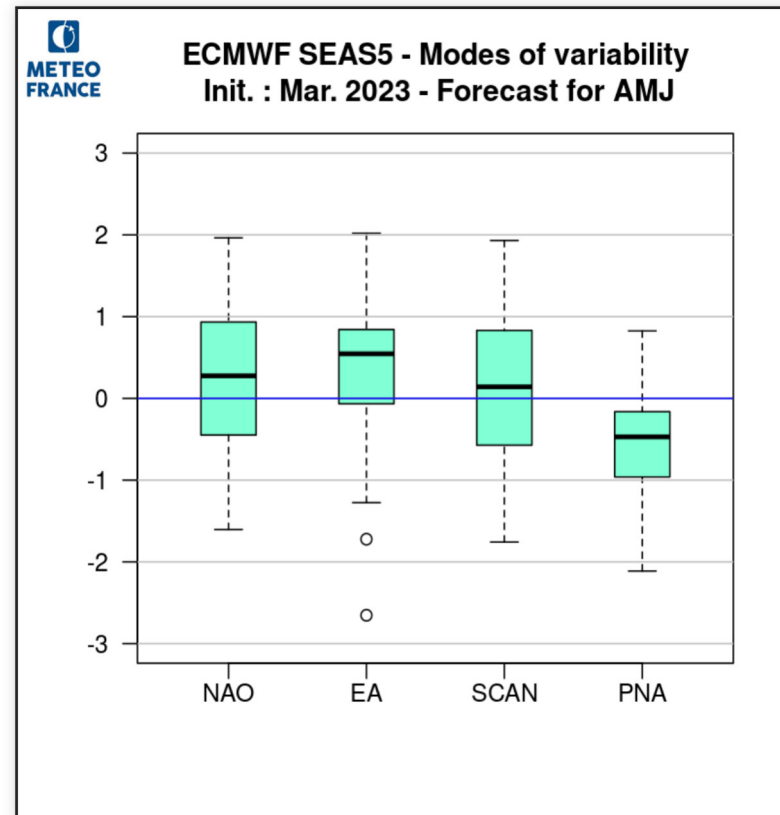
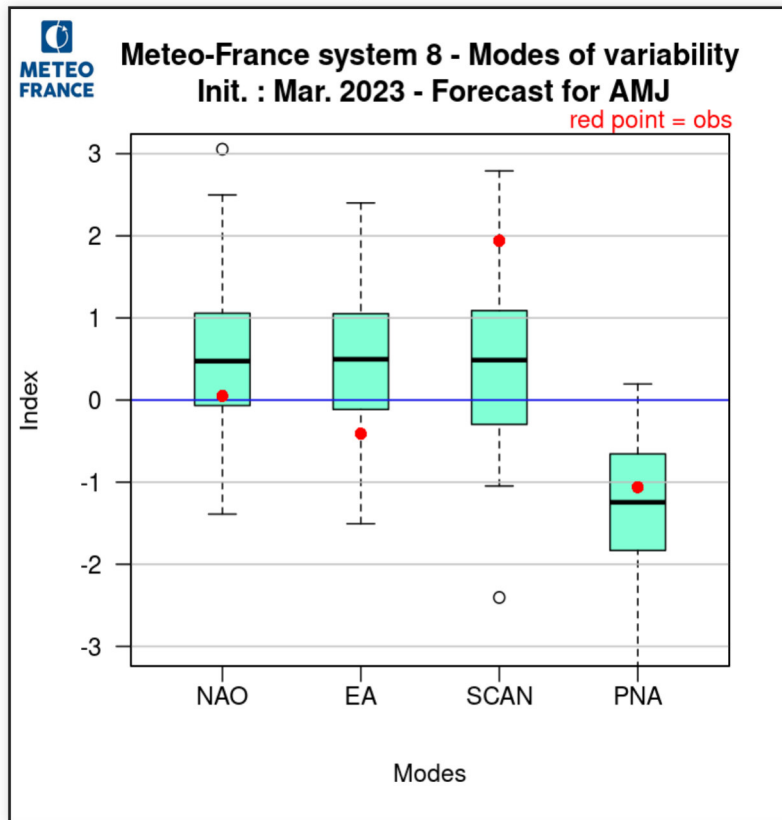
The EA+ was expected whereas the négative pahse is observed.

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



Atmospheric circulation : Modes verification

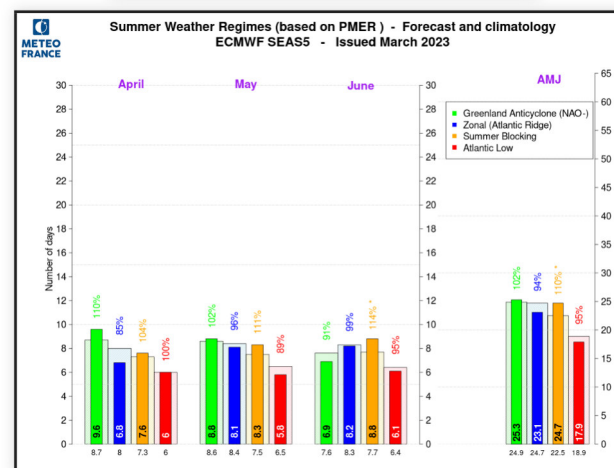
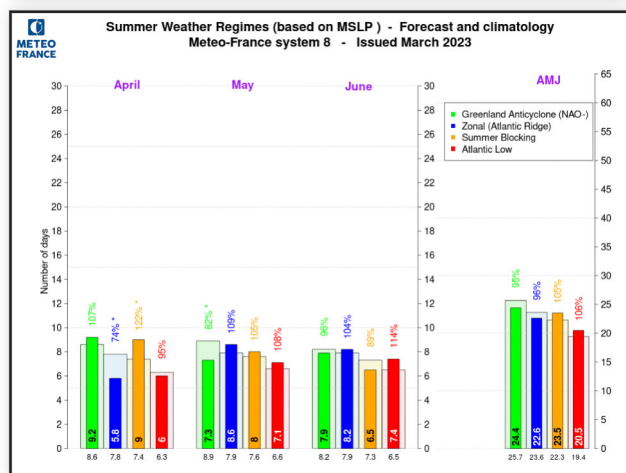
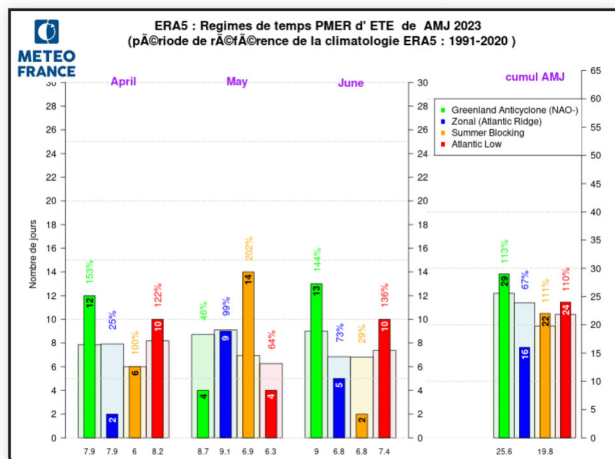
Same observation as for the previous slide



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.

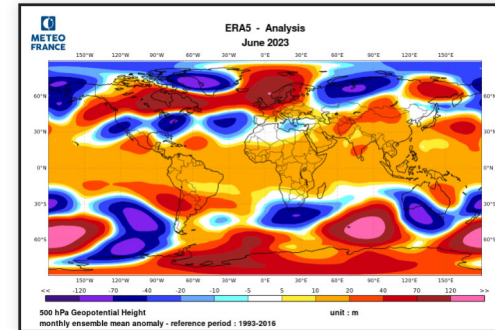
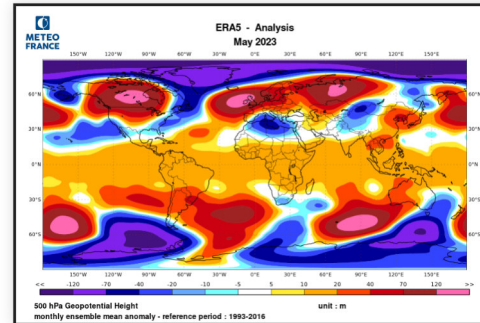
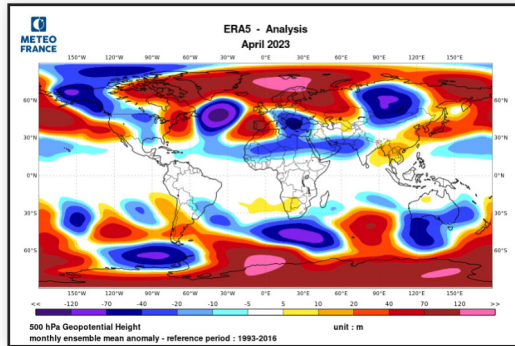
Both models show this distribution, but only the "Summer Blocking" regime is significantly above its climatology for ECMWF.



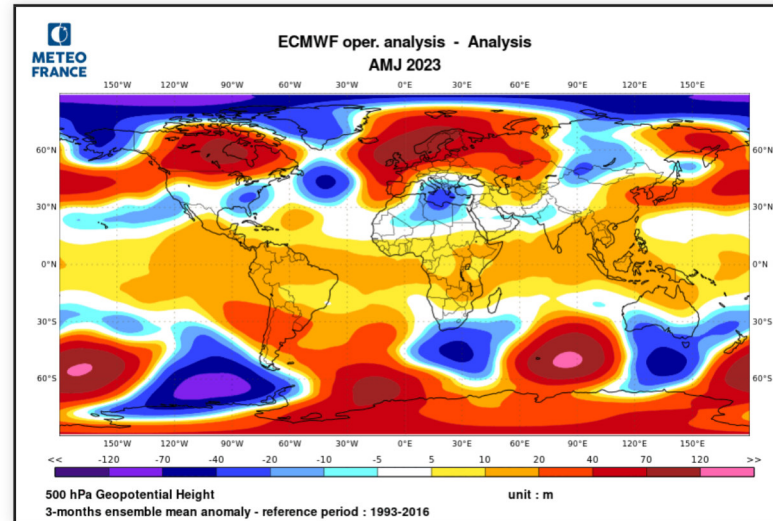
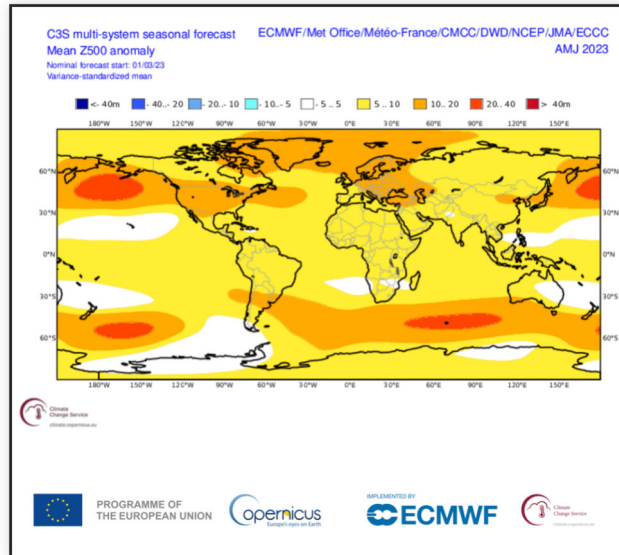
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

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

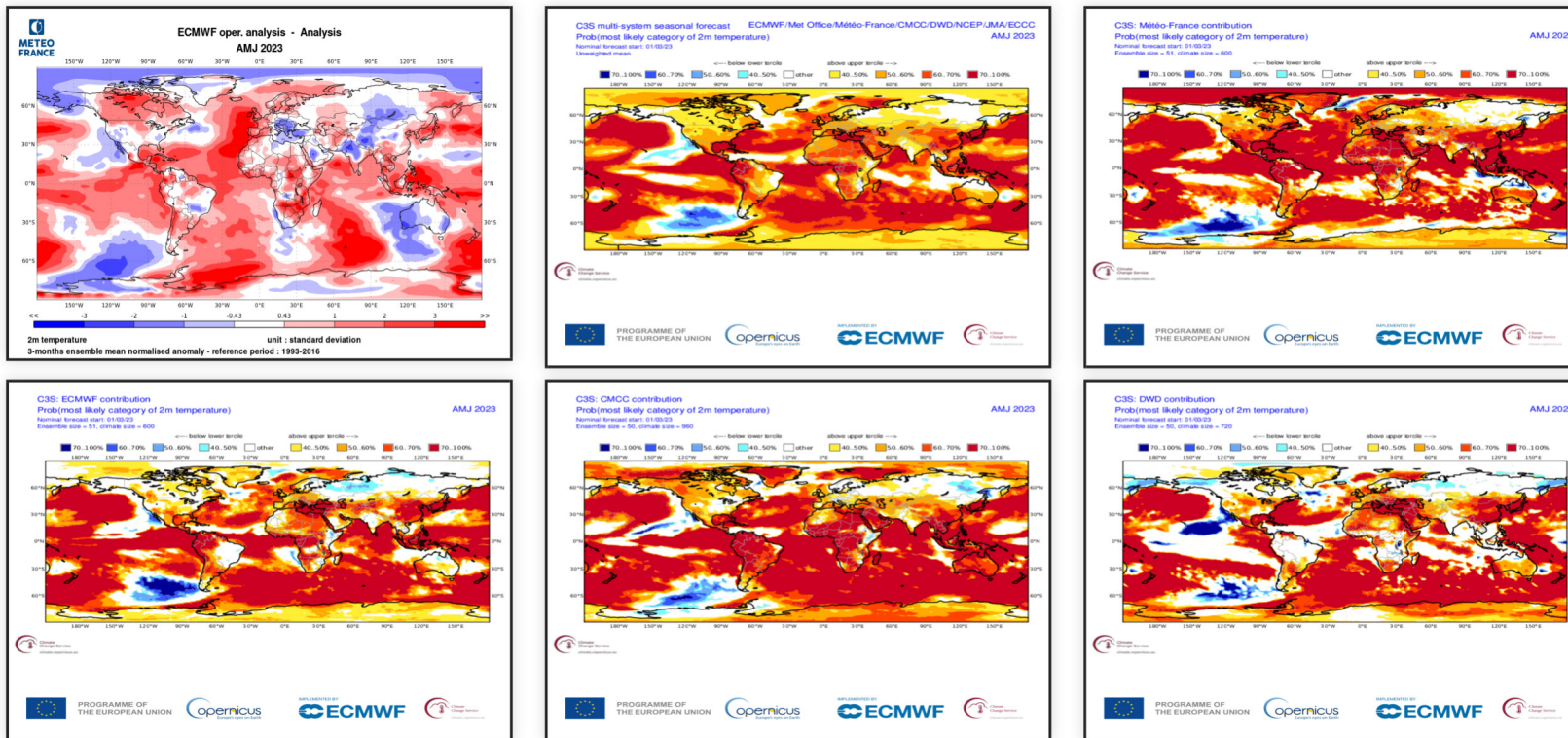


C3S multi-sytem forecast and ECMWF analysis 500 geopotential height anomalies for JFM

Climatic parameters : temperature on the globe

The two main cold anomalies in the Americas (North and South) are well predicted by the models, unlike those in Australia and Asia.

In Europe and the North Atlantic, there are differences.

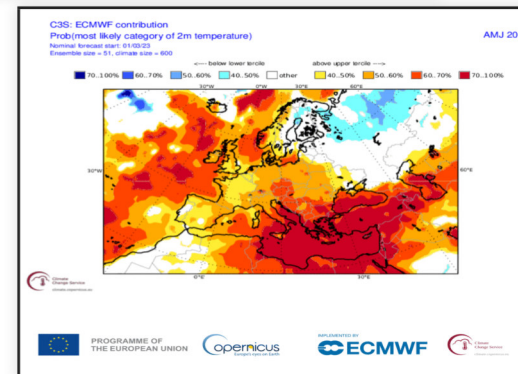
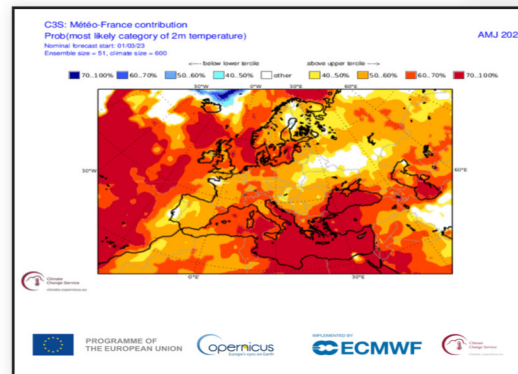
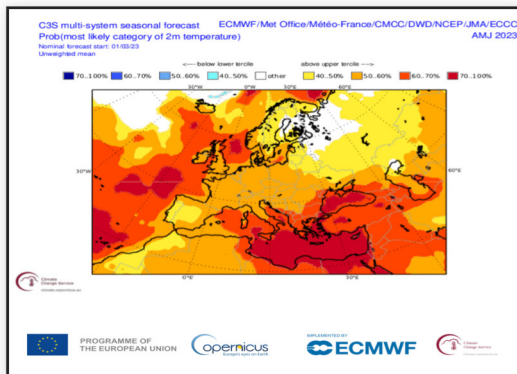
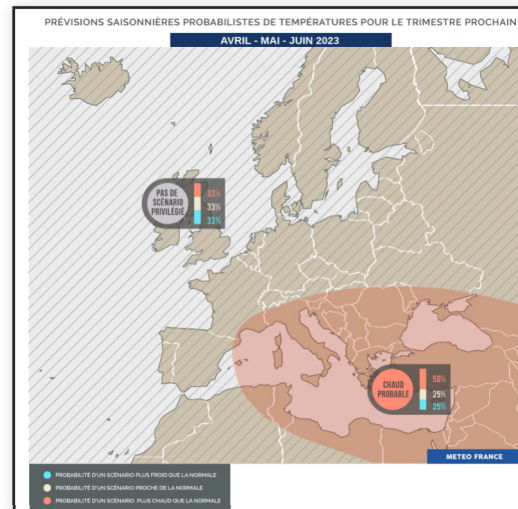
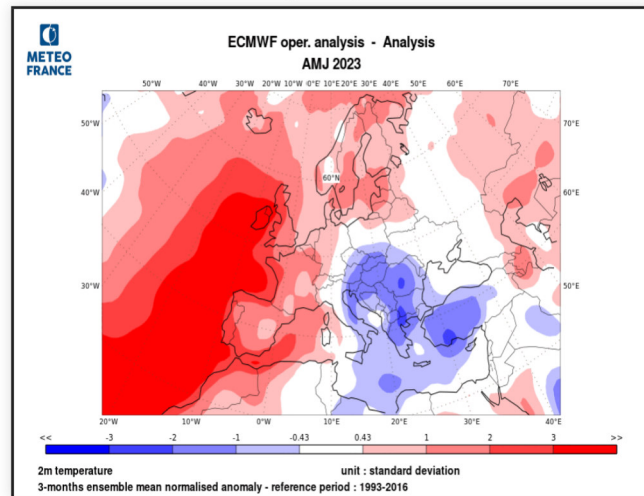


ECMWF analysis top left, forecast for multi-model top center and forecast for MF-S8 top right, ECMWF-SEASS, CMCC, DWD on the bottom line.

Climatic parameters : temperature over Europe

The main Z500 anomalies in Europe have not been foreseen.

Consequently, the corresponding temperature anomalies were not seen either.

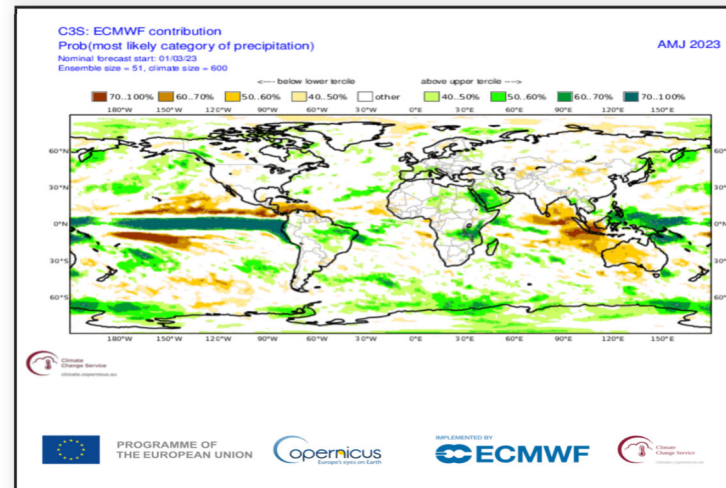
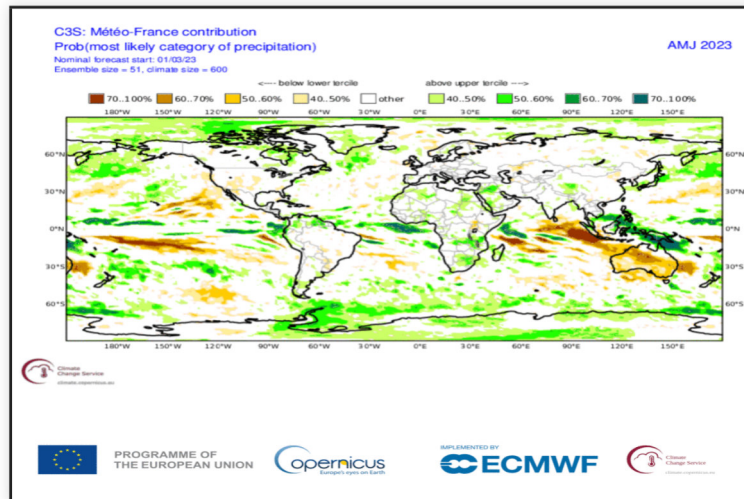
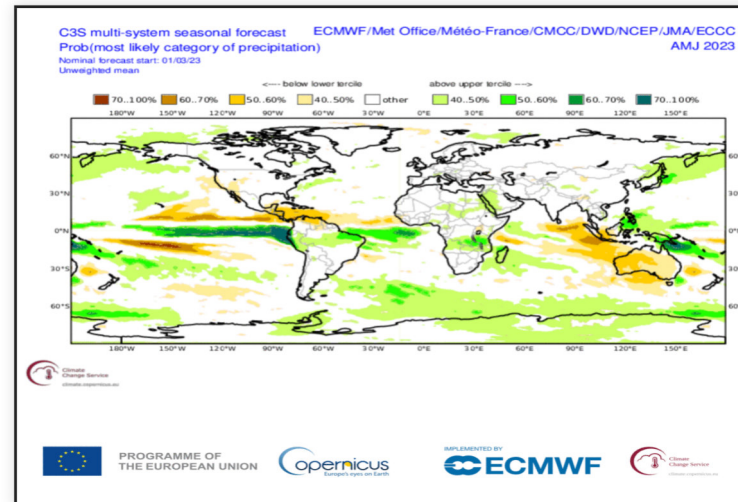
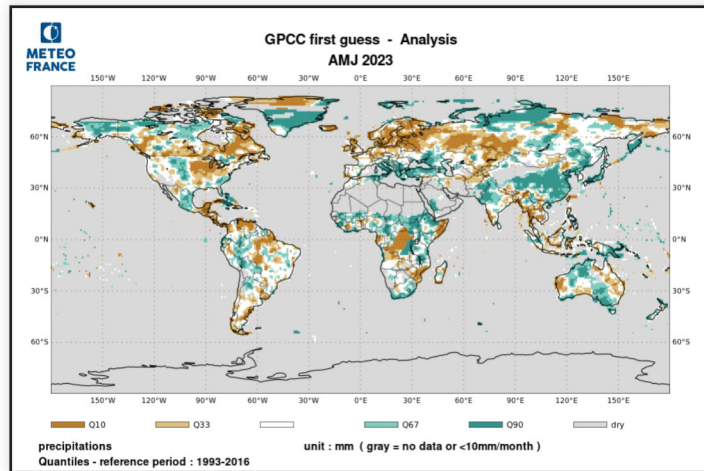


ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system, MF-S8 and SEAS5 on the bottom line.

Climatic parameters : Precipitations over the globe

In the intertropics, the models did not show very strong signals except, for example, in Central America (dry signal confirmed by analysis) or Australia (dry signal contradicted by analysis).

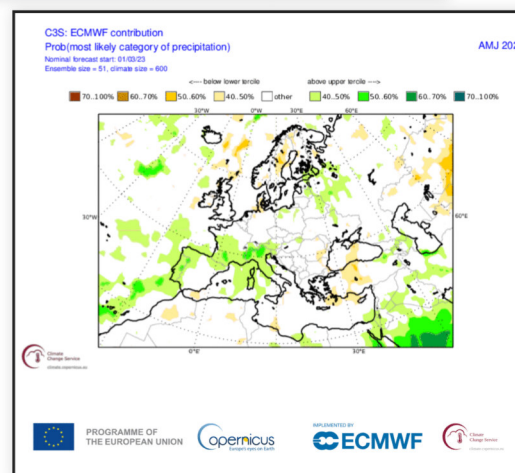
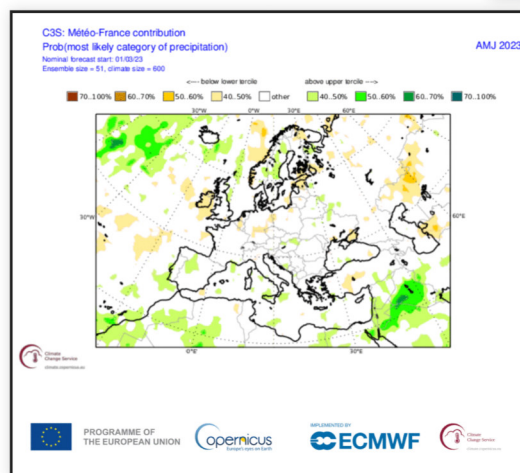
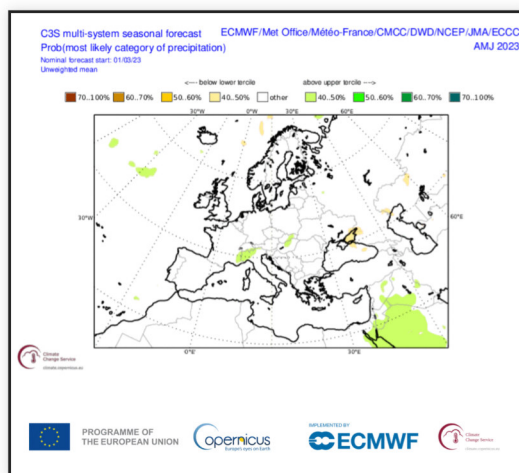
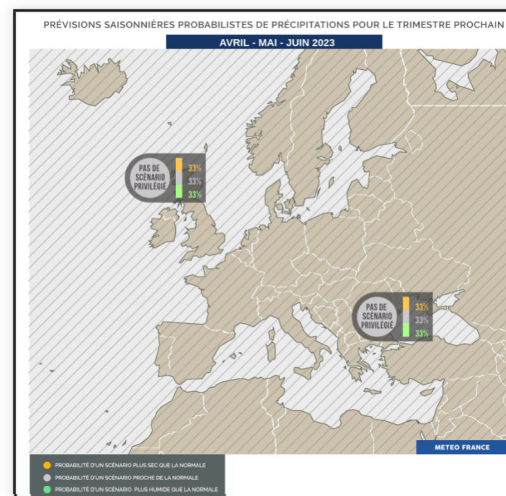
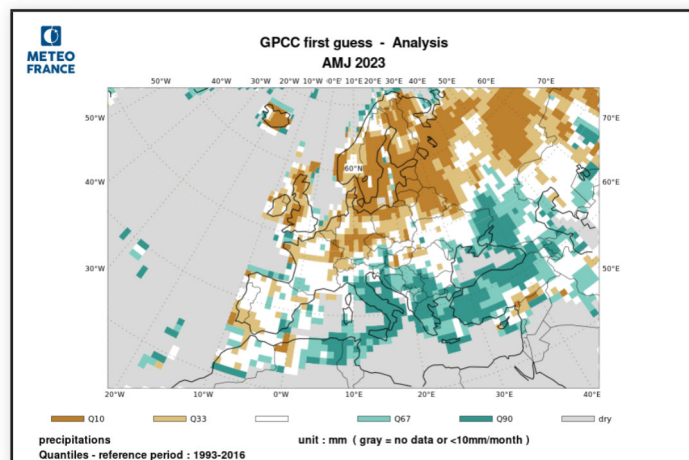
In the northern hemisphere's mid-latitudes, the forecast signals were very weak. They turned out to be stronger in North America, Europe and Asia.



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 C3S multi-model didn't show any significant signals for Europe. No scenario was therefore favored. However, the atmospheric circulation observed (positive Z500 anomaly over Western and Northern Europe, and negative one over the Eastern Mediterranean) produced a highly contrasting precipitation situation : a dry signal in the north and a wet one in the southeast.



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 AMJ 2023

1) Oceans :

With the exception of the Northeast Atlantic, the main SST anomalies were well predicted by the models.

2) Large scale atmospheric circulation :

VP 200 hPa : The dipole around the Maritime Continent was well predicted by the models.

SF 200 hPa : Signals are limited, except for the dipole near the Maritime Continent, which is correctly forecast. On the other hand, traffic over Europe was poorly anticipated.

Z500 : The differences between analysis and models are confirmed over Europe, with major impacts on climatic parameters.s.

3) Climatic parameters over Europe :

Temperatures : poor forecasts

Precipitations : poor forecasts