

VERIFICATION BULLETIN

JULY - AUGUST - SEPTEMBER 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 JAS 2023	18

Introduction : Objective

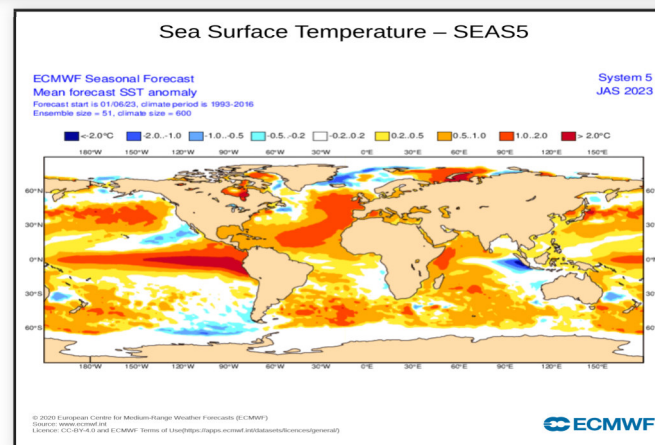
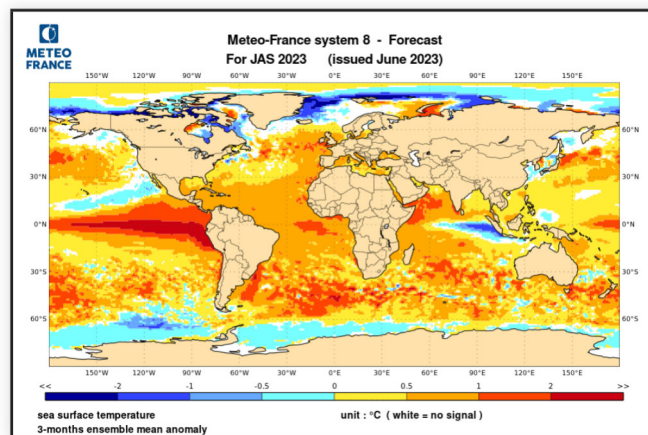
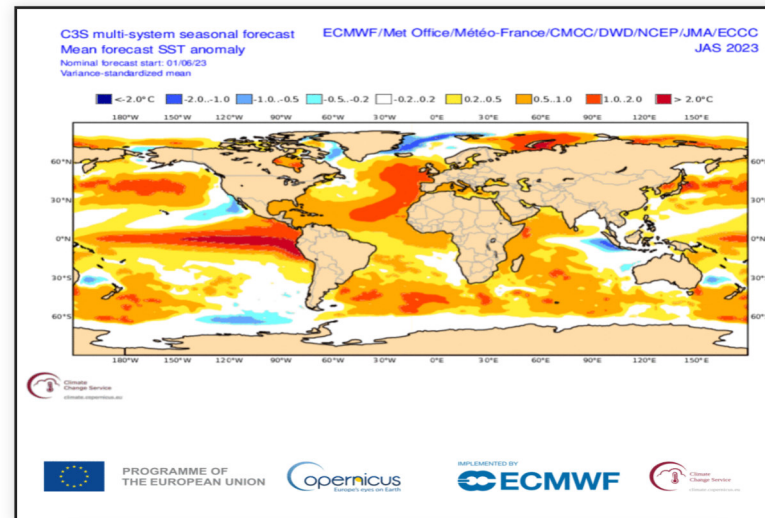
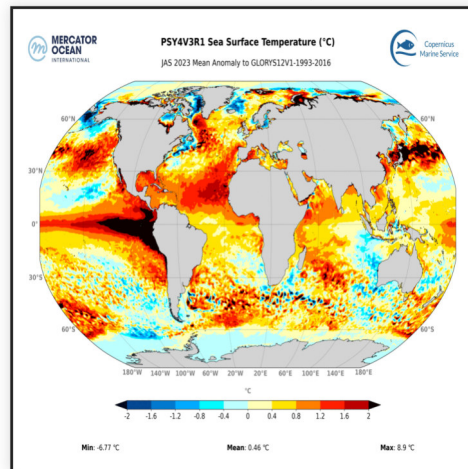
- The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean 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 marked positive SST anomaly from the Ecuadorian coast to the center of the basin is well seen by the models, as is the PDO- pattern in the north of the basin.

In the Indian Ocean, the warming near the African coast is confirmed by analysis.

In the Atlantic Ocean, the positive SST anomaly from the equator to Europe was well predicted by the models, particularly ECMWF. MF-8 remains too warm near the equator and not warm enough towards Europe.

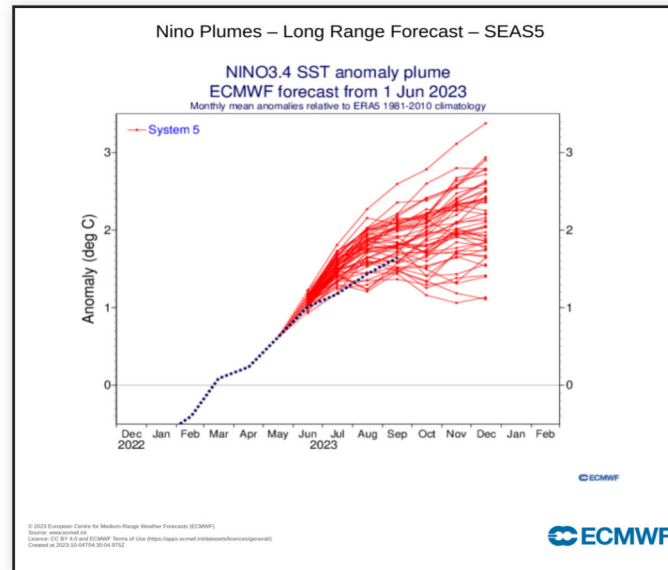
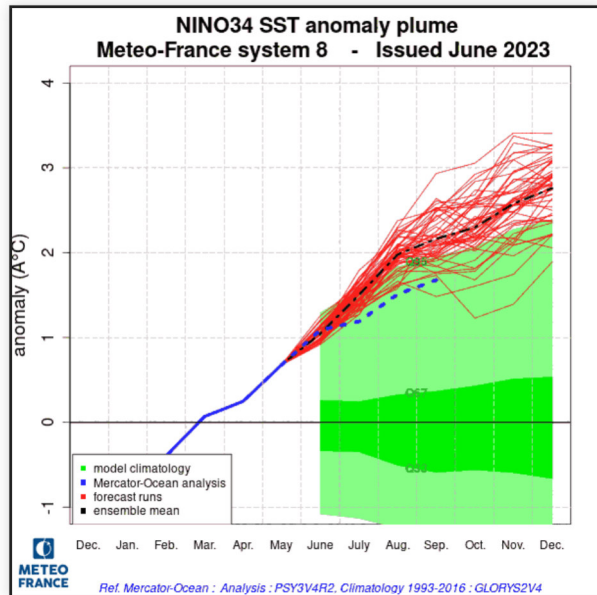


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

Oceans : ENSO

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

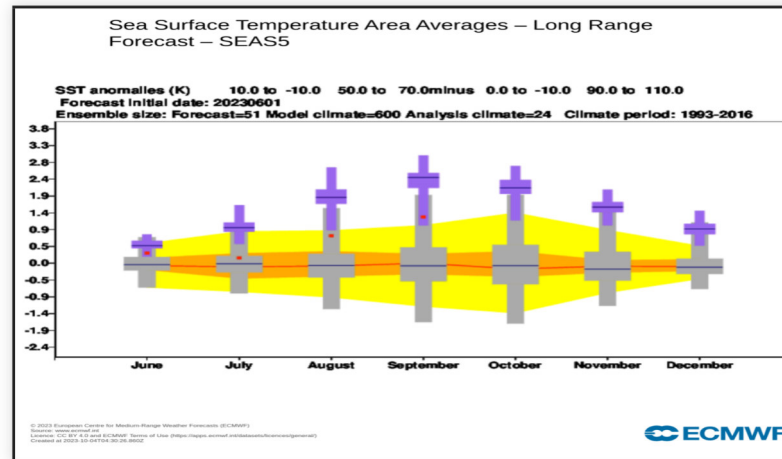
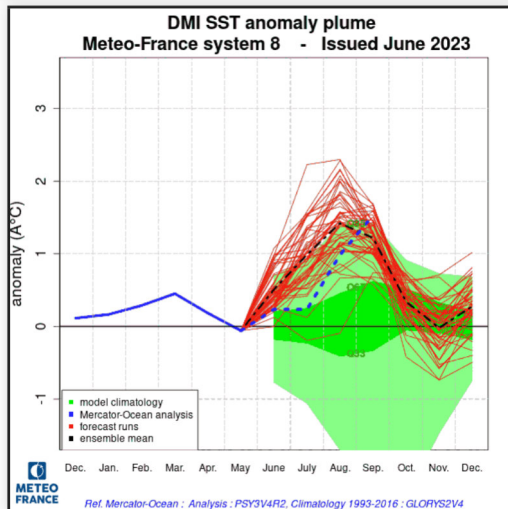
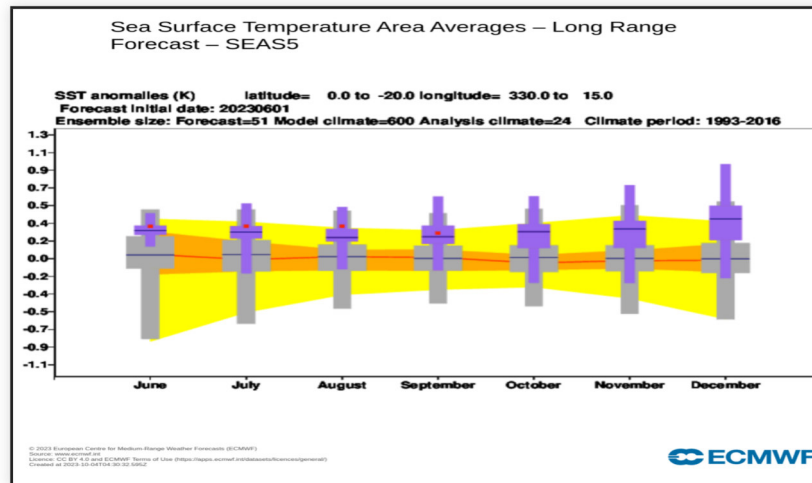
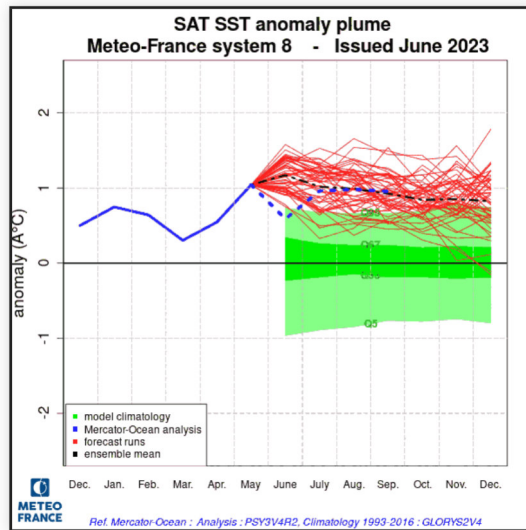
The increase in the index is well seen by both models. However, both have overestimated warming.



Oceans : tropical Atlantic and Indian Ocean index

SAT : the forecasts made by the two models are correct overall.

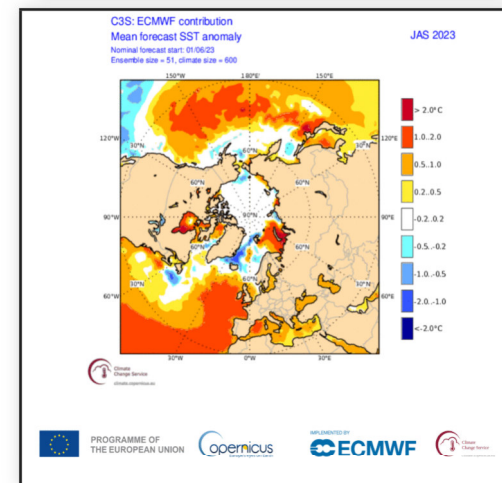
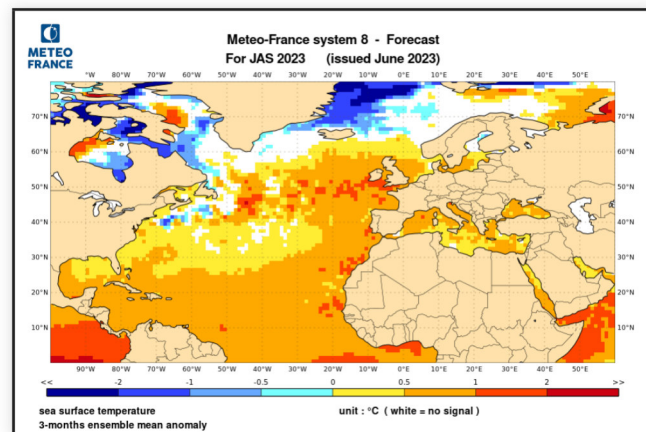
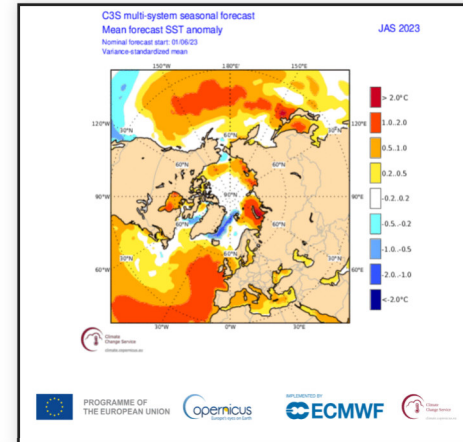
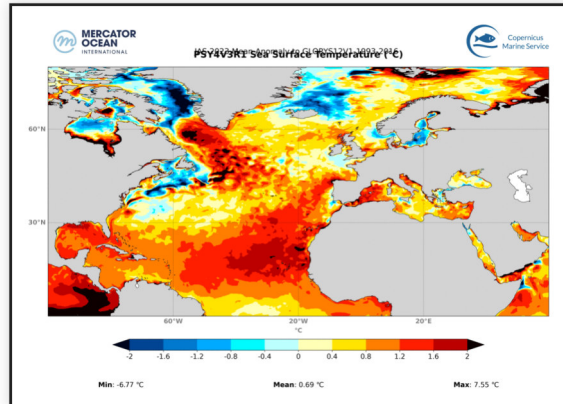
DMI : the increase in the index was over-anticipated by both models.



Oceans : North Atlantic SST

In the North Atlantic basin, the ECMWF model is close to the analysis. MF-8 underestimated the intensity of the SST anomaly over the eastern part of the basin.

In the Mediterranean, the warm anomaly over the western part of the basin is anticipated, although it has been underestimated.

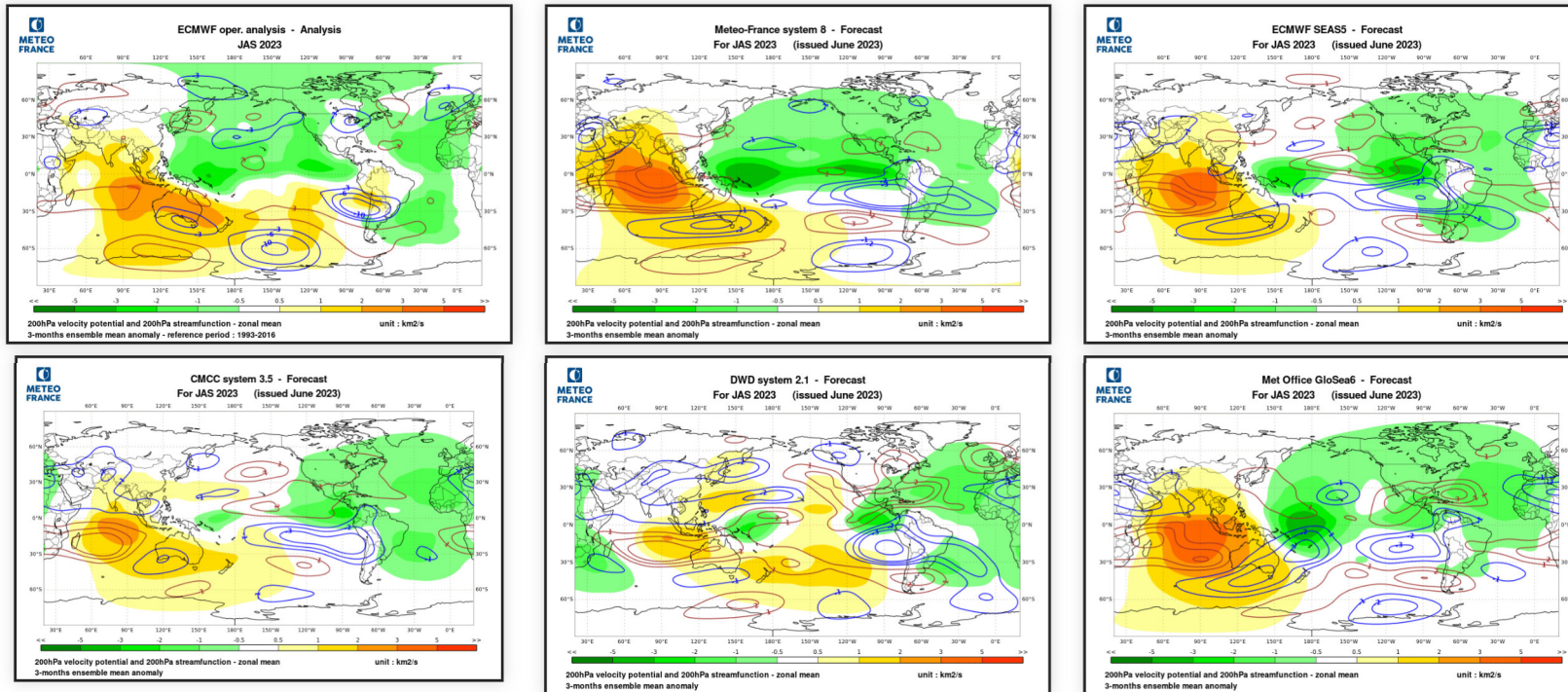


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : VP patterns over the Indian and Pacific Oceans, but also over America, Africa and the Atlantic Ocean, are correctly forecast by the models.

SF : In the southern hemisphere, the structures predicted by the models are confirmed by analysis. In the Northern Hemisphere, model signals are as weak as on analysis. However, the analysis reveals a cyclonic curvature centered on Ireland and an anticyclonic curvature from Spain to northern Russia, a structure not seen by the models.

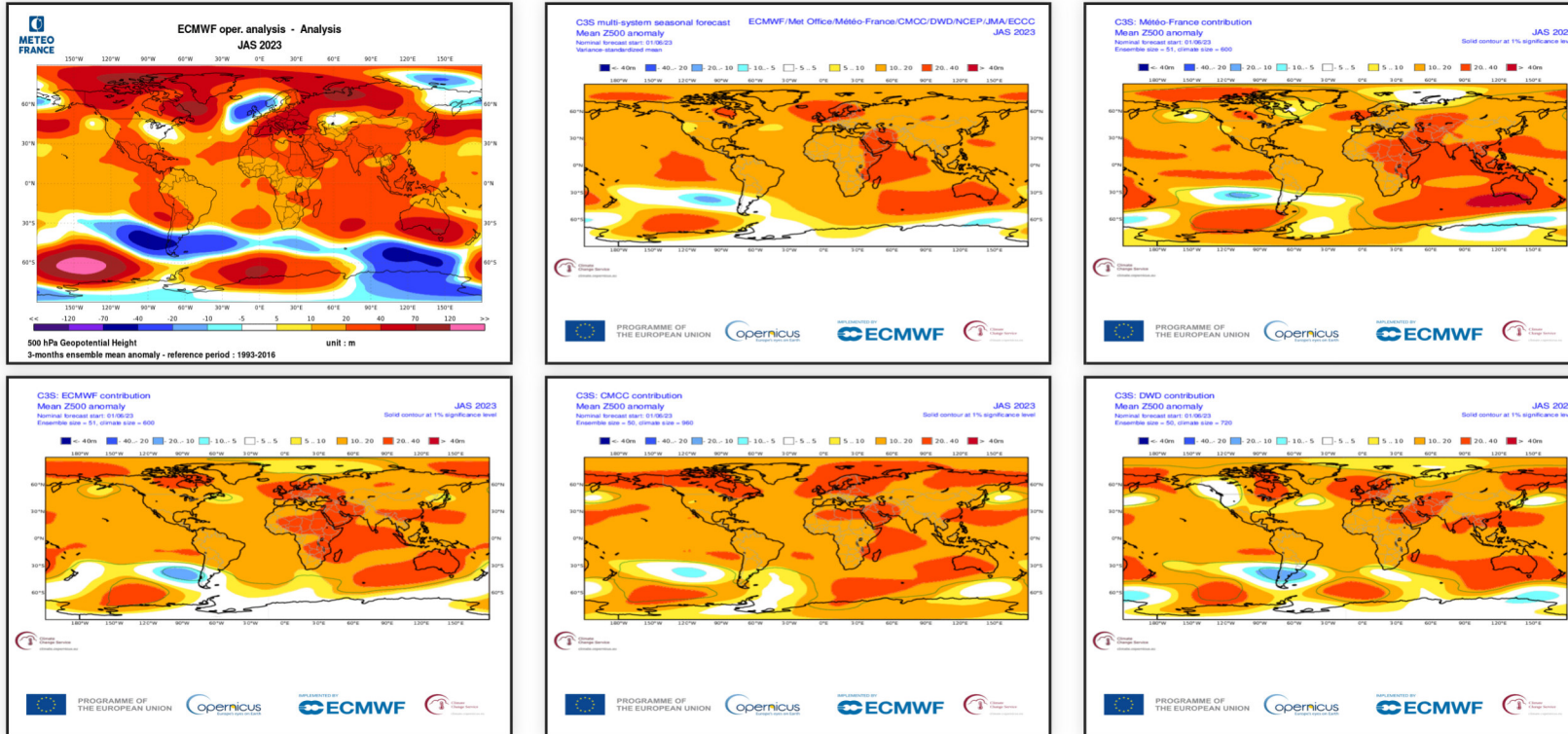


ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

Atmospheric circulation : 500hPa Geopotential height

Southern Hemisphere : The main patterns are foreseen by the models.

Northern Hemisphere : In line with the cyclonic curvature of the SF, a negative Z500 anomaly is centered on Ireland in the analysis, in dipole with a positive anomaly over Central Europe. The models predicted an opposite pattern, with a positive anomaly over Northern Europe.



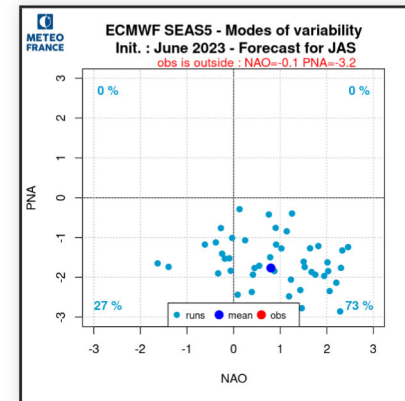
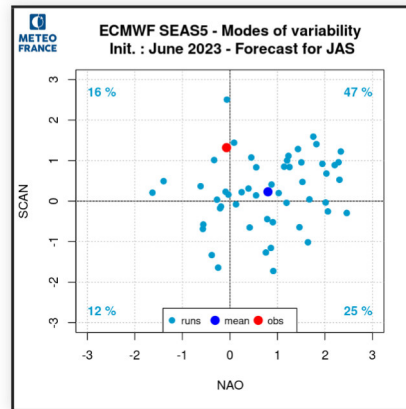
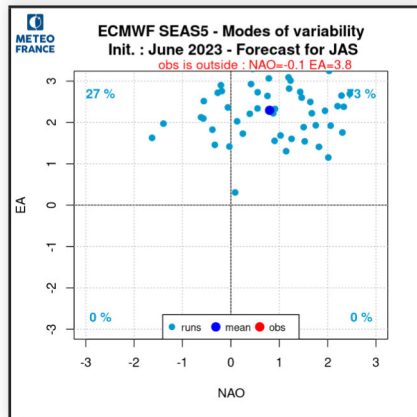
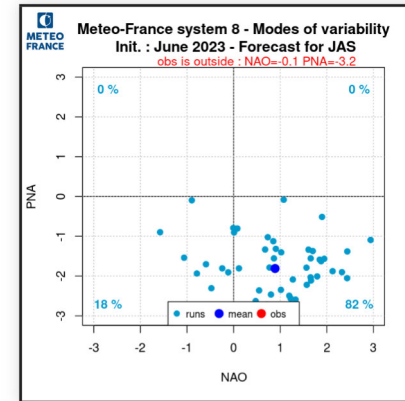
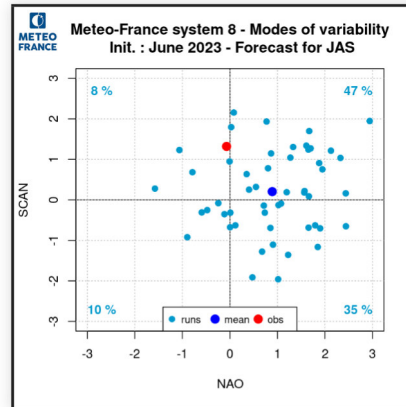
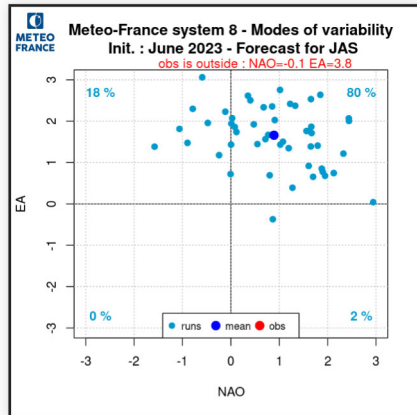
ECMWF analysis, C3S multi-system, MF-S8, ECMWF-SEAS5, CMCC and DWD 500hPa geopotential height anomalies.

Atmospheric circulation : Modes of variability

The PNA- and EA+ modes were planned but clearly underestimated.

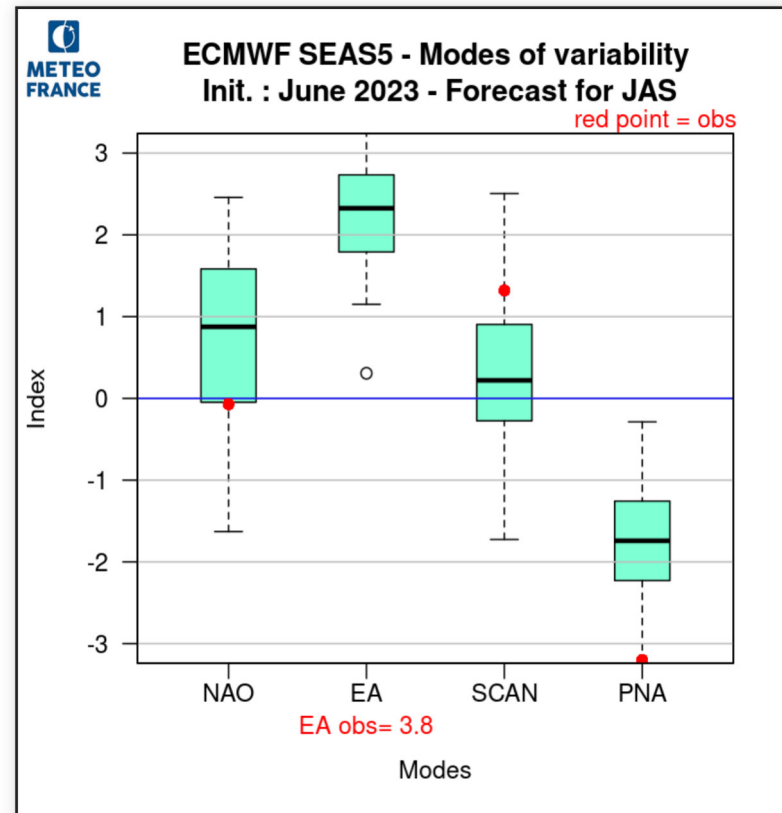
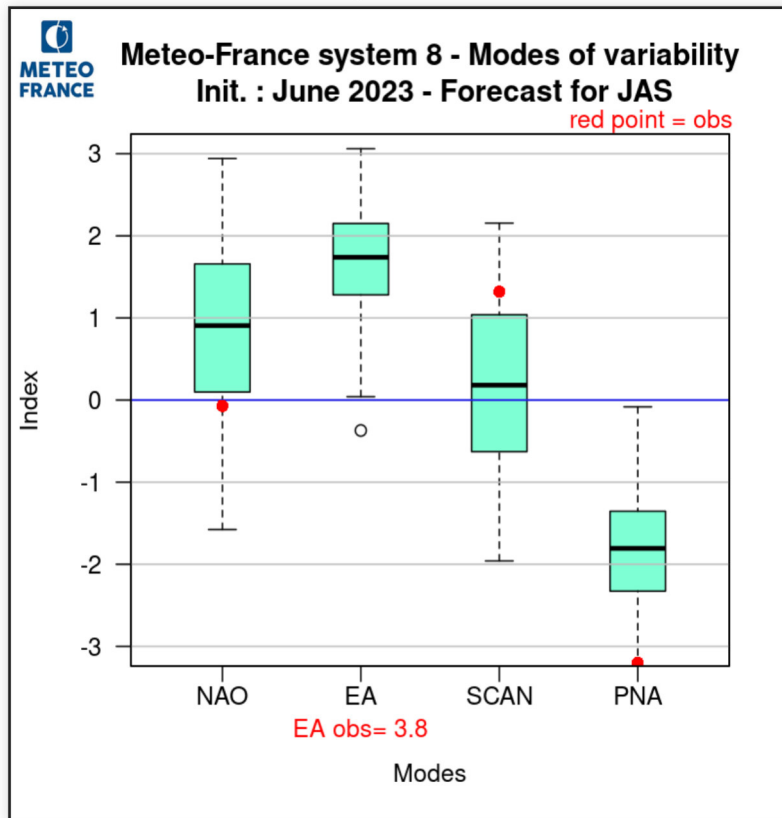
The SCAN mode, neutral for the models, is positive in the analysis.

Finally, the NAO mode, positive for the models, is neutral in the analysis.



Atmospheric circulation : Modes verification

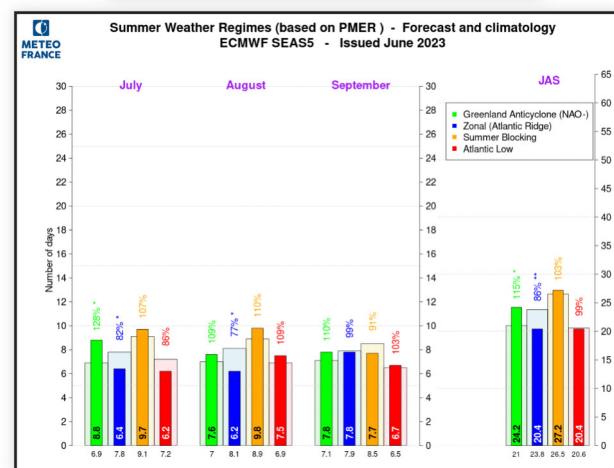
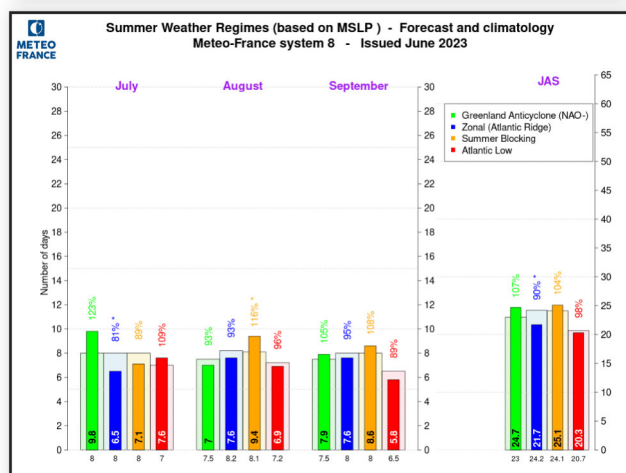
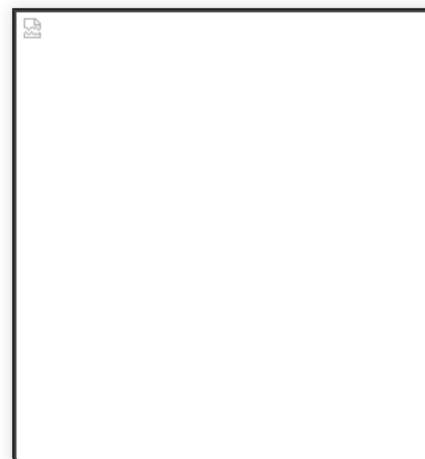
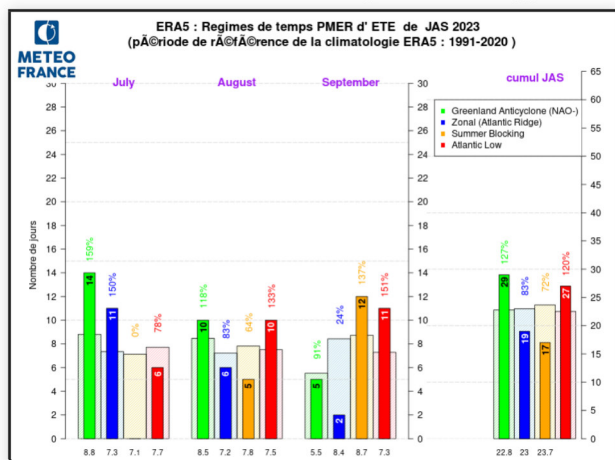
Same observation as for the previous slide



Atmospheric circulation : Summer SLP weather regimes

The distribution of weather regimes is very different in September compared to the other two months. In the end, the NAO- and Atlantic Low regimes dominate, to the detriment of the Zonal and Summer Blocking regimes, which are under-represented.

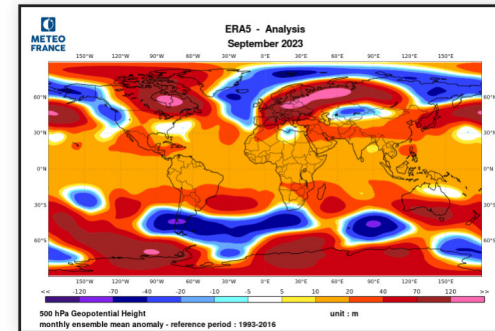
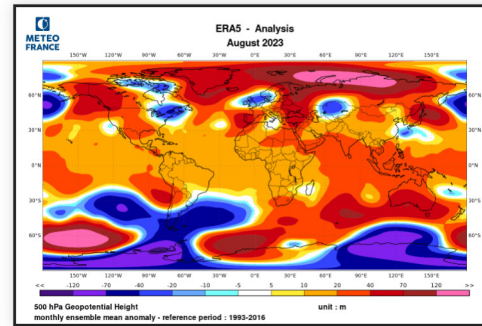
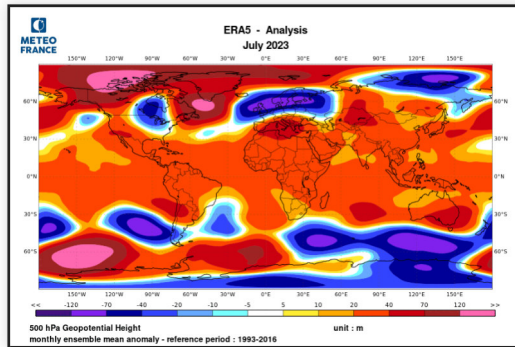
Trends in NAO- and Zonal weather regimes are suggested by the models.



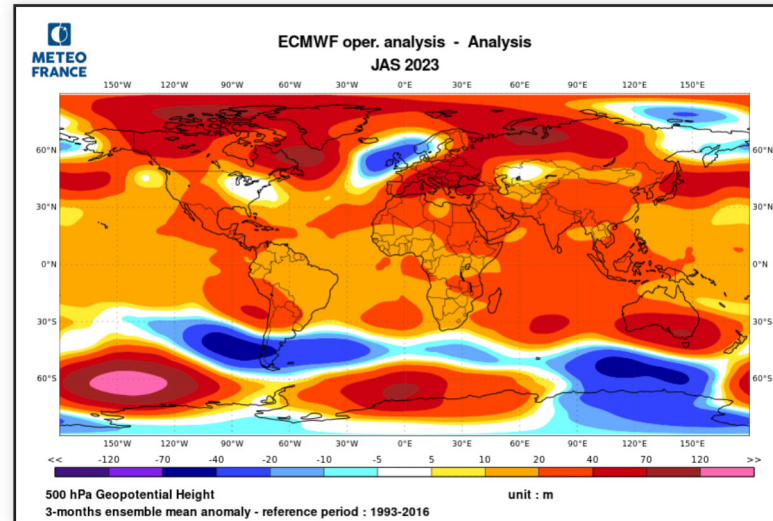
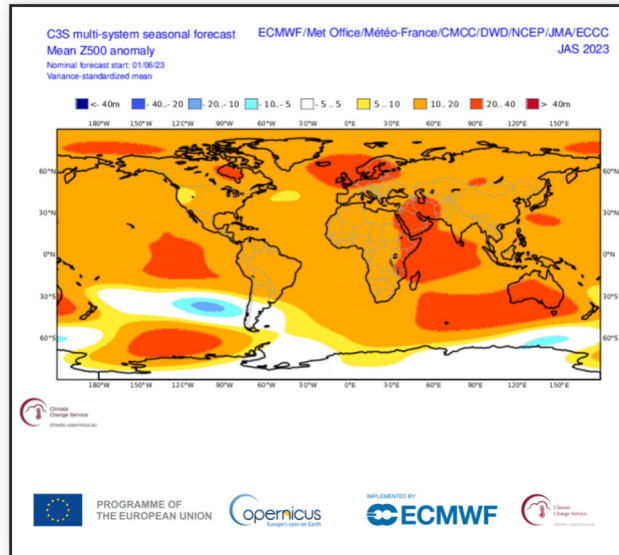
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

Atmospheric circulation : Variability within the quarter

A monthly analysis of atmospheric circulation clearly shows the succession of very different months over Atlantic/Europe



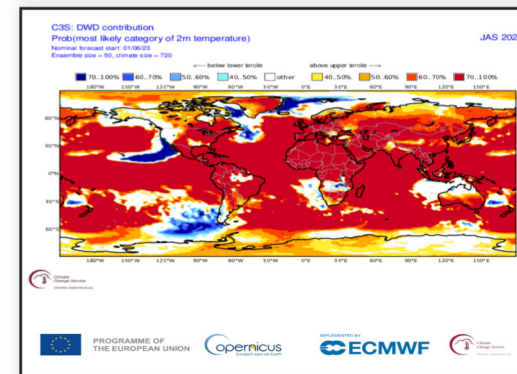
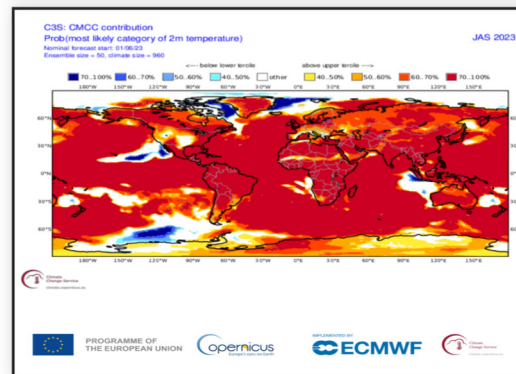
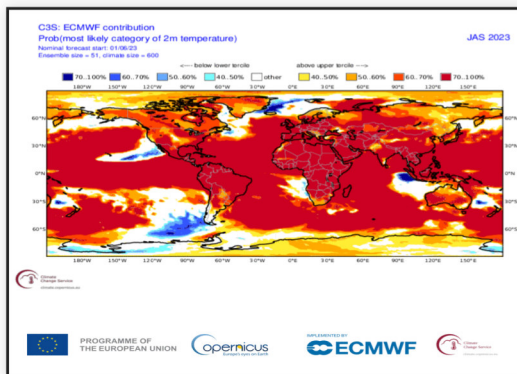
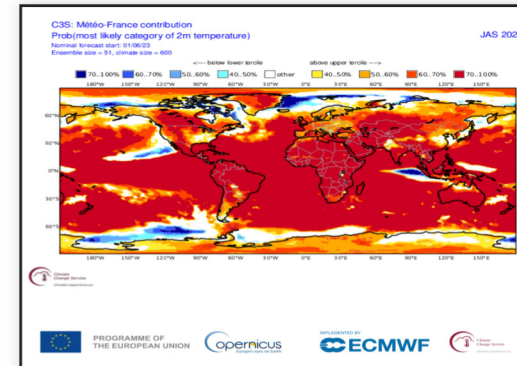
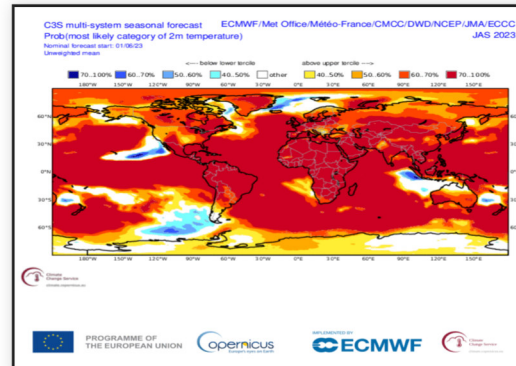
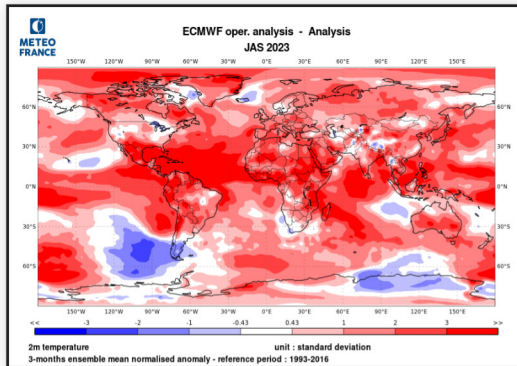
ECMWF analysis : March, April and May 500 geopotential height anomalies



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

Climatic parameters : temperature on the globe

Cold anomalies are few in number in the analysis, but are generally well seen by the models.

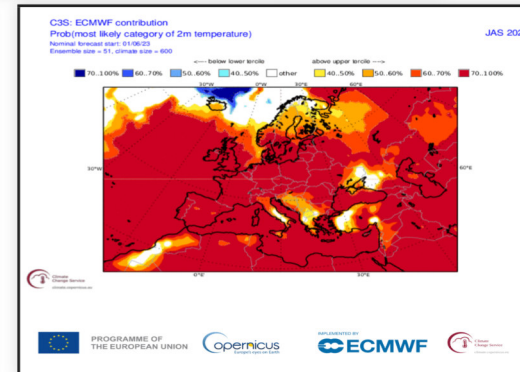
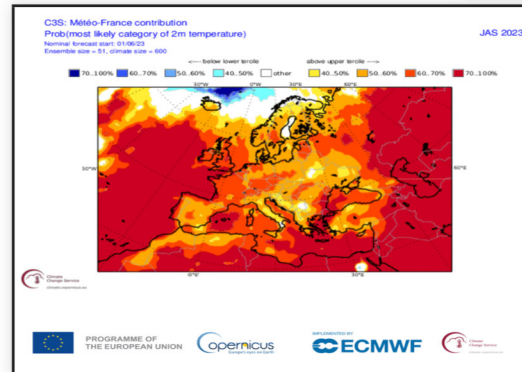
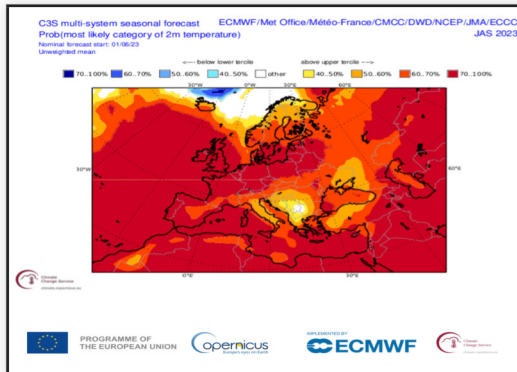
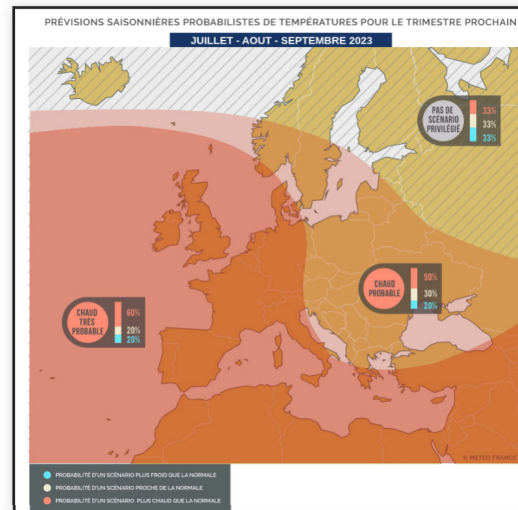
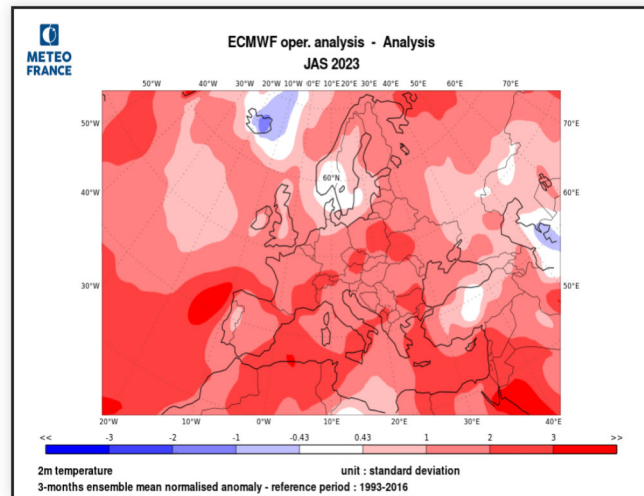


ECMWF analysis top left, forecast for multi-model top center and forecast for MF-S8 top right, ECMWF-SEAS5, CMCC, DWD on the bottom line.

Climatic parameters : temperature over Europe

The differences between the analysis and forecasts of atmospheric circulation over Europe had no significant impact on temperatures.

The warmer-than-normal scenario forecast is confirmed by the analysis.

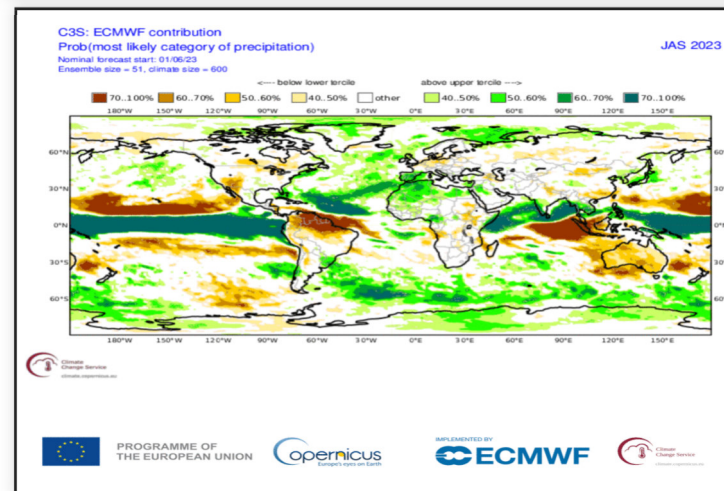
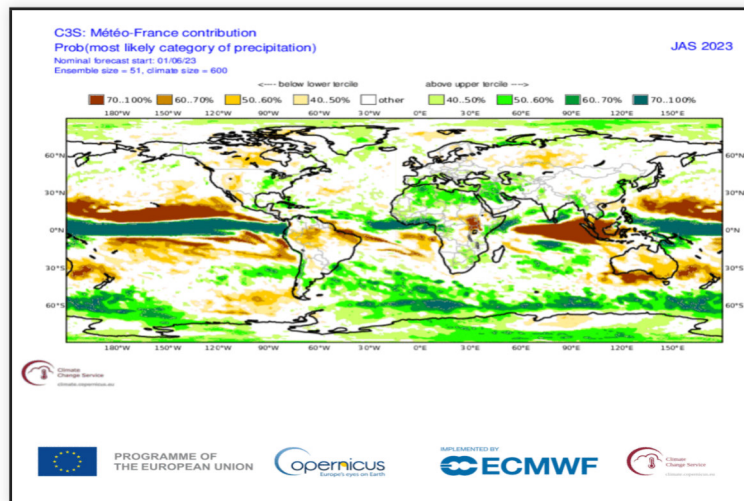
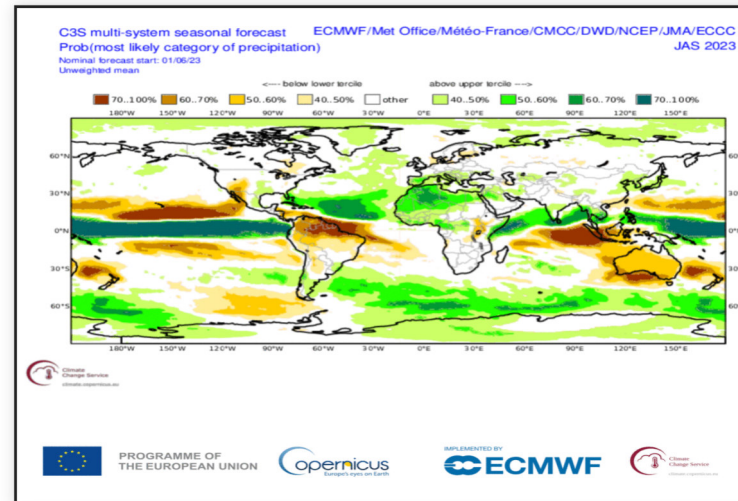
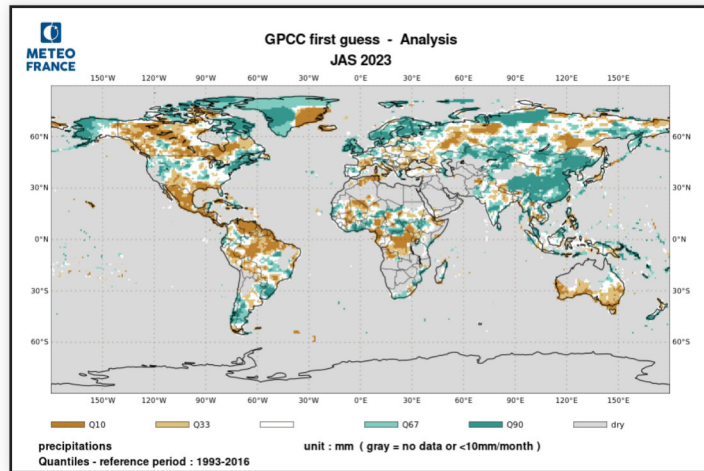


ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system, MF-S8 and SEAS5 on the bottom line.

Climatic parameters : Precipitations over the globe

In the tropics, the main dry anomalies predicted by the models are found in the analysis (Australia, northern South America).

At mid-latitudes in the northern hemisphere, the models showed little sign of this (except over northern Africa), so contrasts are visible on the different continents.

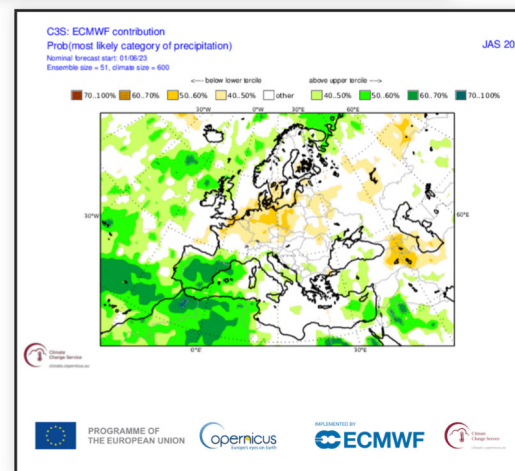
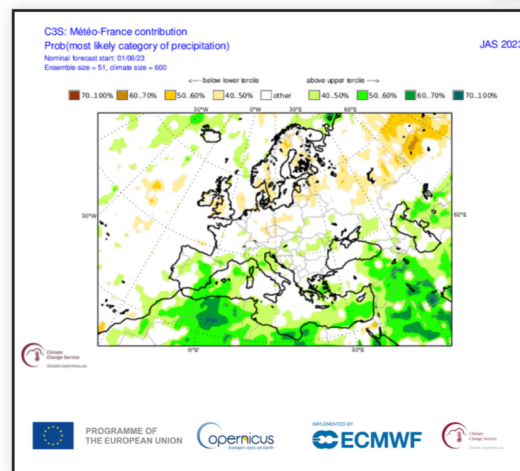
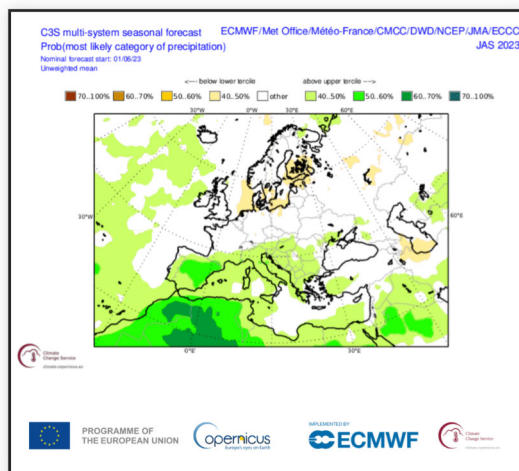
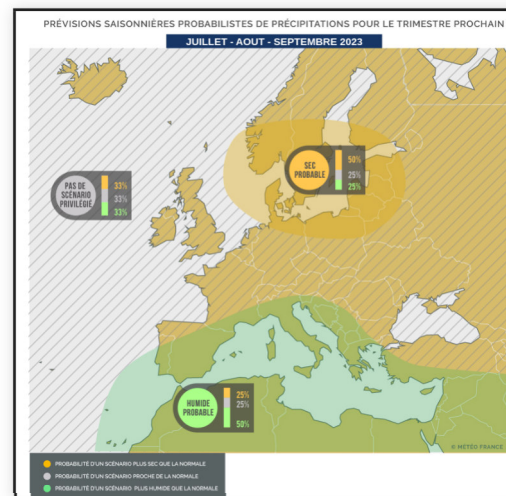
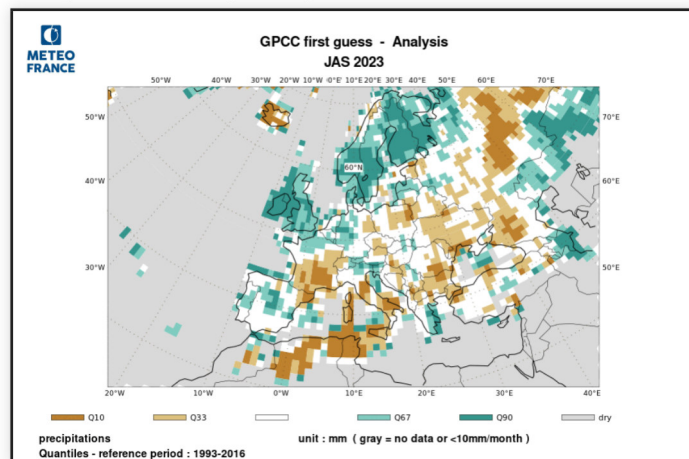


Standardized Precipitation Index analysed by IRI top left, forecast for multi-model top right and MF-S8 and SEAS5 on the bottom line.

Climatic parameters : Precipitations over Europe

On analysis, western Europe benefited from wetter-than-normal conditions, corresponding to the impact of an EA+ mode. Conditions were drier in Central Europe. This pattern was not seen by the models.

For the eastern Mediterranean basin, in the absence of analysis data, it is not possible to verify the relevance of forecasts. Note that this region experienced very heavy rainfall (storm Daniel).



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 JAS 2023

1) Oceans :

The main SST anomalies in the three oceans have been correctly forecast.

2) Large scale atmospheric circulation :

VP 200 hPa : The upward motion anomalies in Pacific and Atlantic Oceans were well-forecast. The downward motion zone was predicted to be a little too strong and too far west by the main models.

SF 200 hPa : The discrepancy between analysis and forecasts for VP in the Indian Ocean may have led to differences for SF over the Mediterranean Basin and Europe (inverted anticyclonic and cyclonic curves).

Z500 : In connection with the above, the negative Z500 anomaly centered on the northern British Isles was not anticipated.

3) Climatic parameters over Europe :

Temperatures : However, good forecast for the warm anomaly over Europe

Precipitations : The wet anomaly from England to Scandinavia, linked to the strongly positive EA mode, was not predicted by the models.