VERIFICATION BULLETIN

JUNE - JULY - AUGUST 2023

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Introduction : Objective

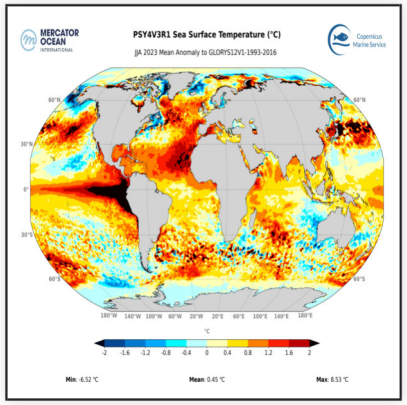
- **The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean 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.**

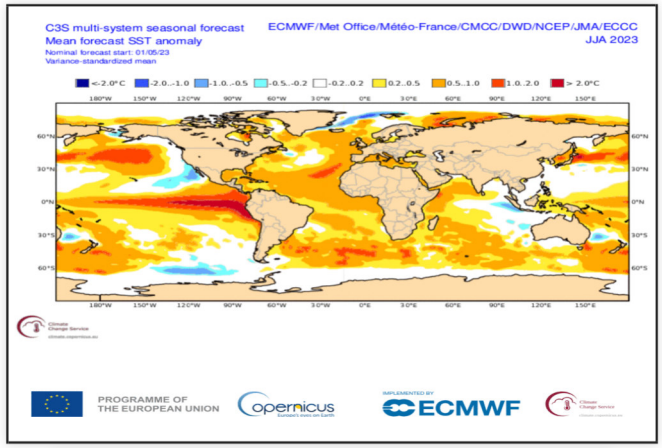
Oceans : surface temperature anomalies

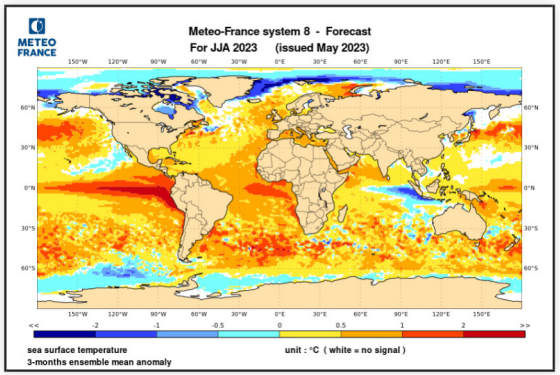
In the Pacific Ocean, the strong positive anomaly near the Peruvian coast, stretching westwards along the equator, is seen by the models but underestimated. The PDO- pattern has been well forecast.

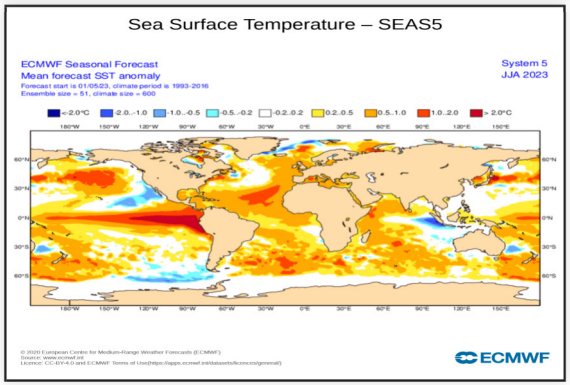
In the Indian Ocean, lthe east/west SST gradient is still weak on analysis.

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 underestimated by others models. Near the equator MF8 is too hot compared to other models and analysis.







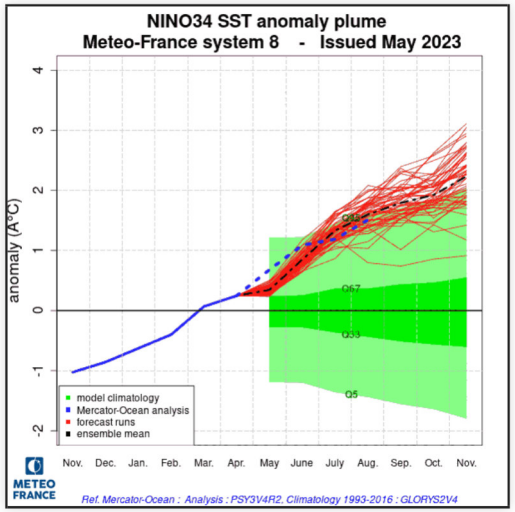


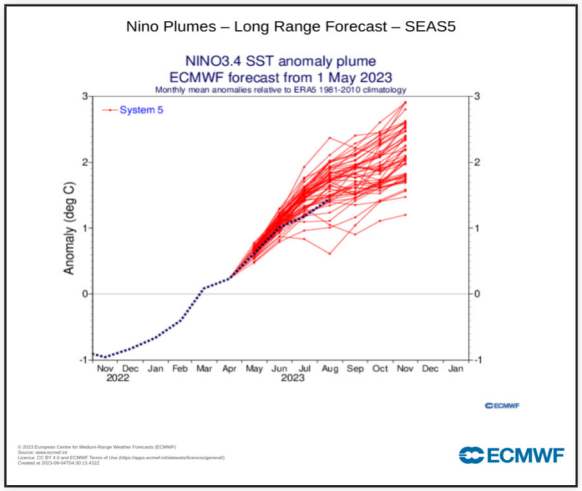
SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

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. SEAS5 slightly underestimates the temperature value while MF8 is close to the observation

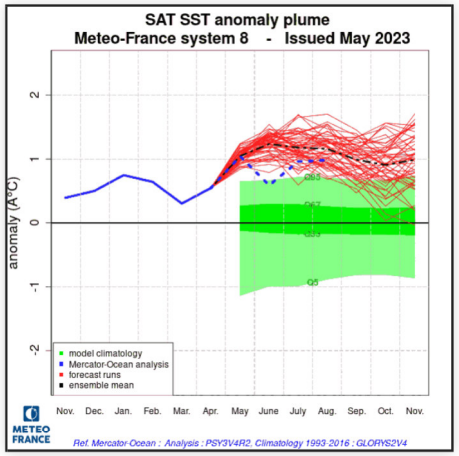


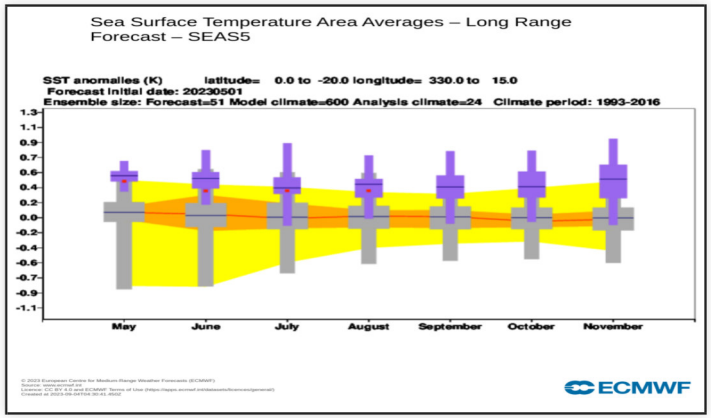


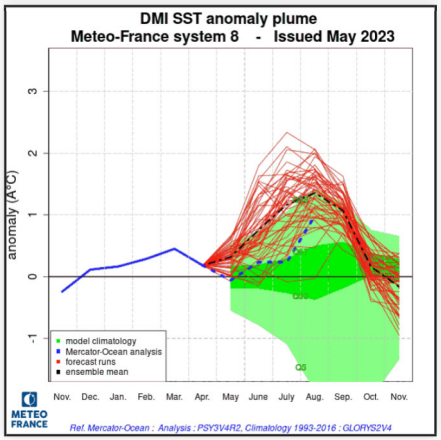
Oceans : tropical Atlantic and Indian Ocean index

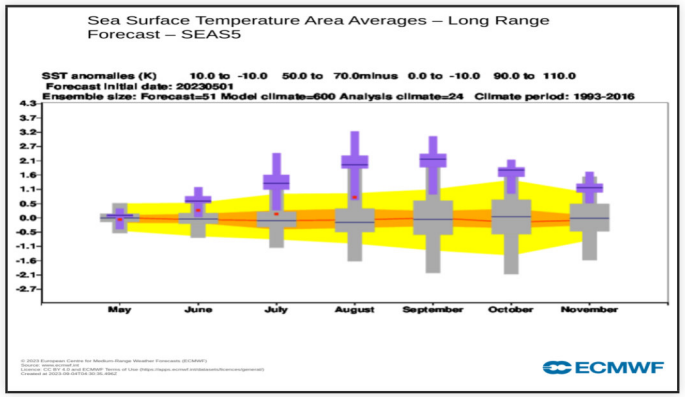
SAT : The anomaly is well located in the upper tercile by both models. MF8 overestimates the values

DMI : The DMI value predicted is too high.





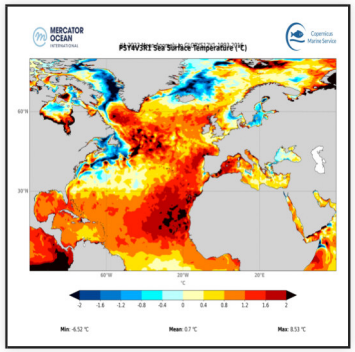


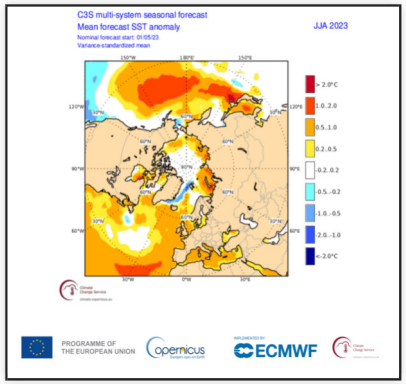


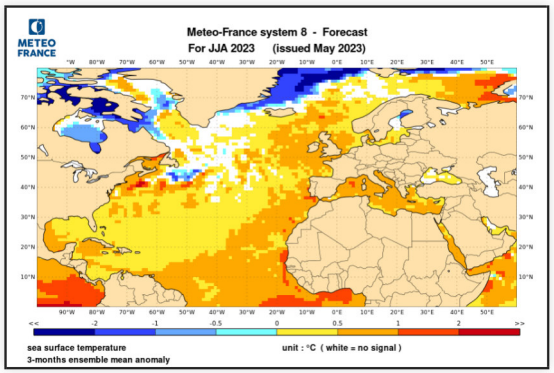
Oceans : North Atlantic SST

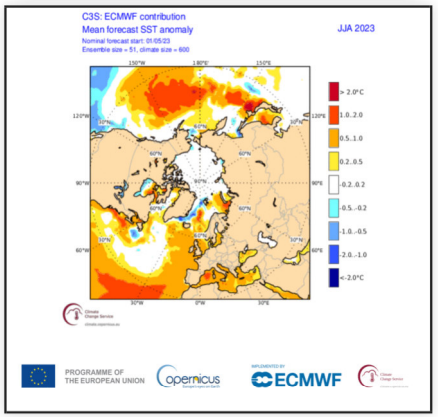
The anomalies in the North Atlantic (negative anomaly near the American coast and positive anomaly to the east) are underestimated by models.

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







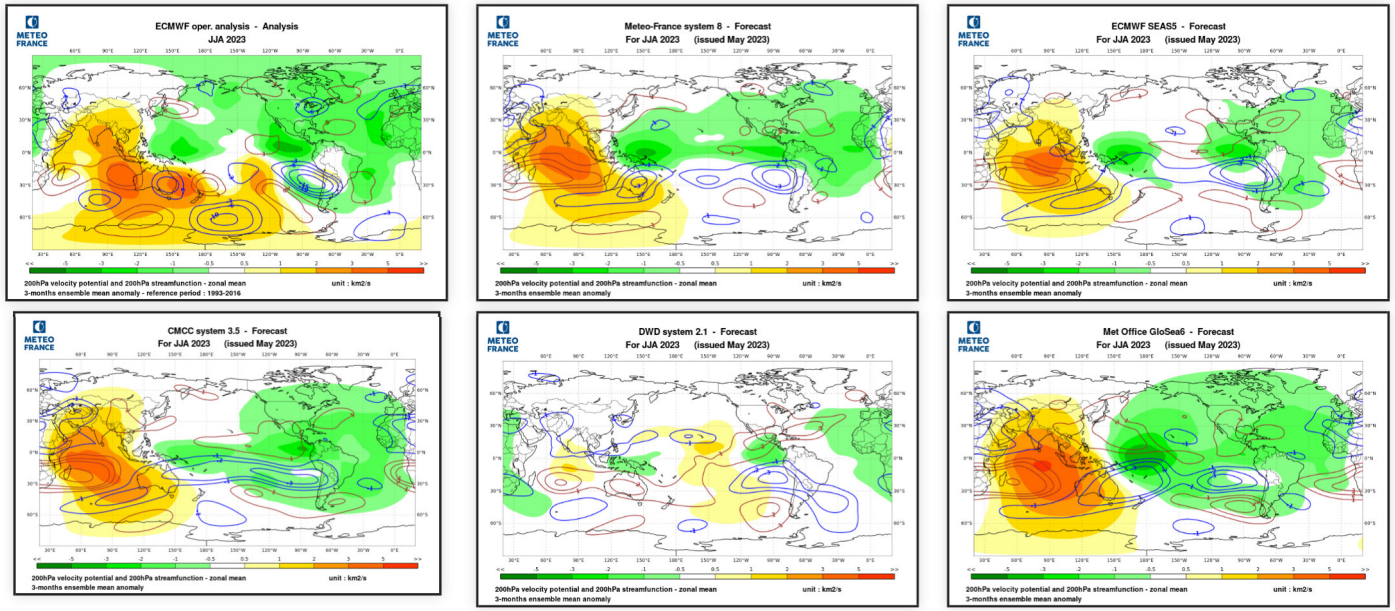


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : The dipole around the Maritime Continent is more or less well seen by models with downwards shifted too far west. The DWD model still retains a "La Niña" pattern. On analysis the updraft zone on west Africa, the Atlantic to the Pacific East was predicted by most models.

SF : In the northern hemisphere very little signal except the positive core suggested by models and analysis on the eastern pacific. On the southern hemisphere we find on analysis the three main structures suggested by the models (negative off South America, on eastern Australia and positive on the Indian Ocean).

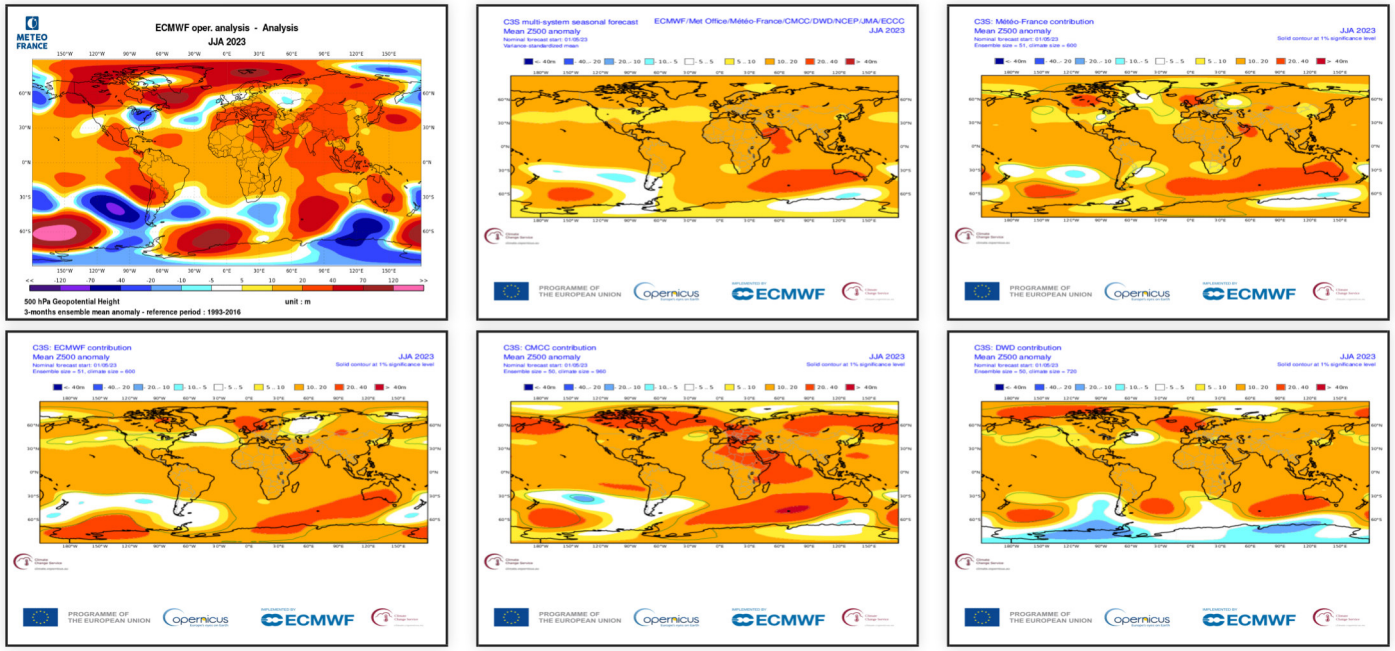


ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

Atmospheric circulation : 500hPa Geopotential height

Southern Hemisphere : Synoptic structruces weren't forecasted by the models except on the Pacific.

Northern Hemisphere : Multi-model highlights a weakness auround the 30th N from Pacific to Africa, also visible on analysis. Further north the strong anomalies observed wern't predicted by models



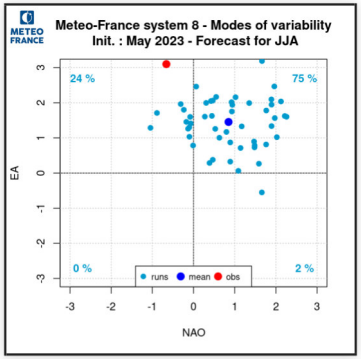
ECMWF analysis, C3S multi-system, MF-S8, ECMWF-SEAS5, CMCC and DWD 500hPa geopotential height anomalies.

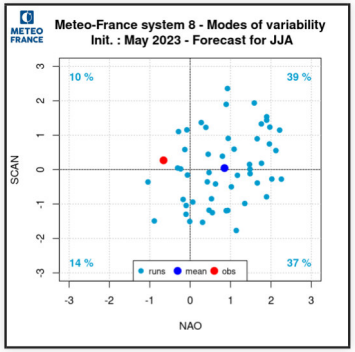
Atmospheric circulation : Modes of variability

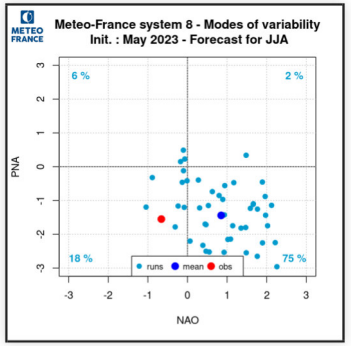
The negative PNA mode and positive EA mode are well seen by both models.

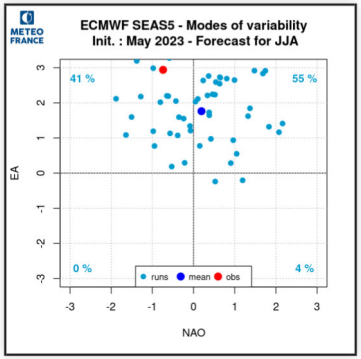
SCAN mode close to zero both in analysis and in forecasting.

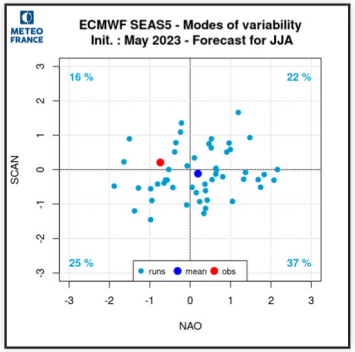
The expected phase of the NAO mode was slightly positive, whereas the neutral phase is observed.

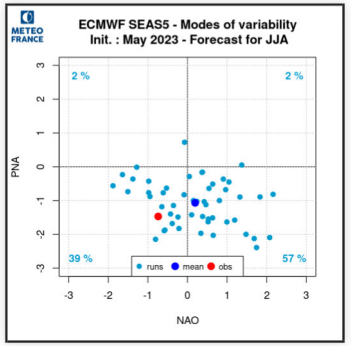






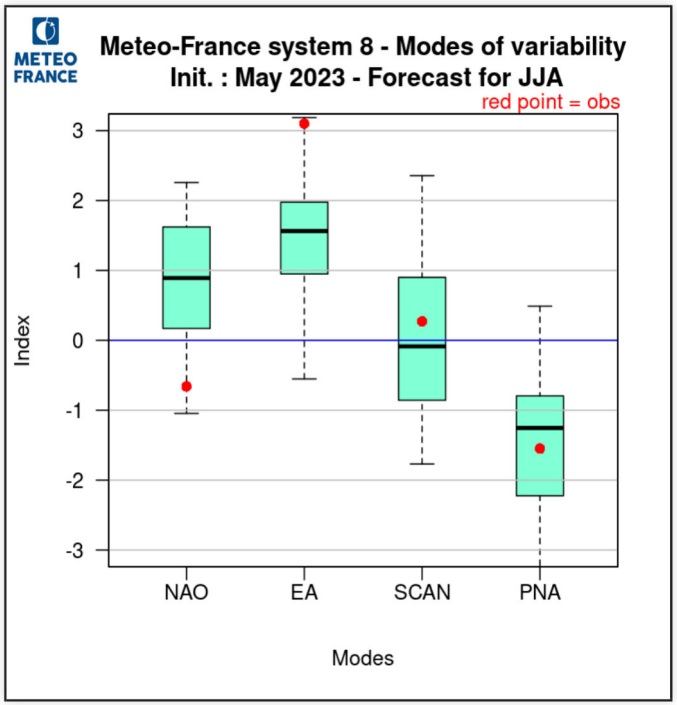


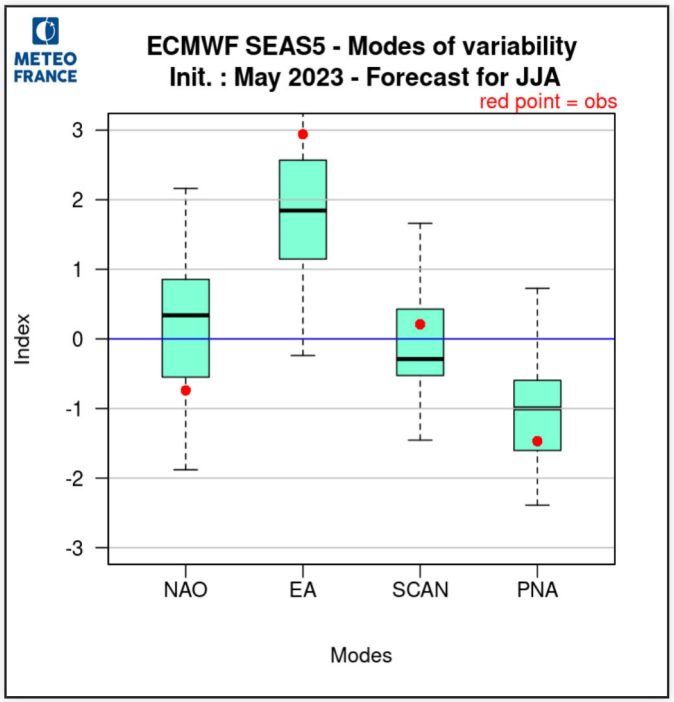




Atmospheric circulation : Modes verification

Same observation as for the previous slide

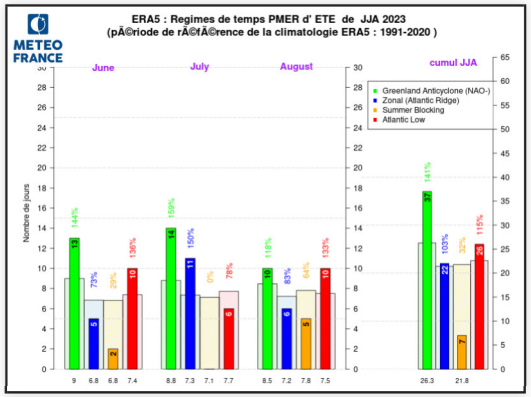


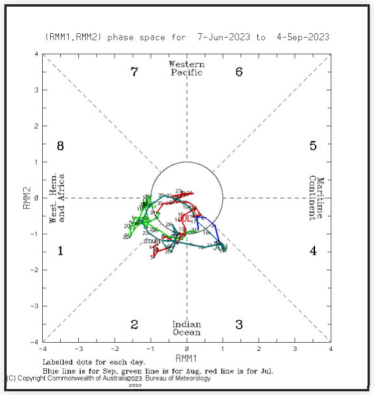


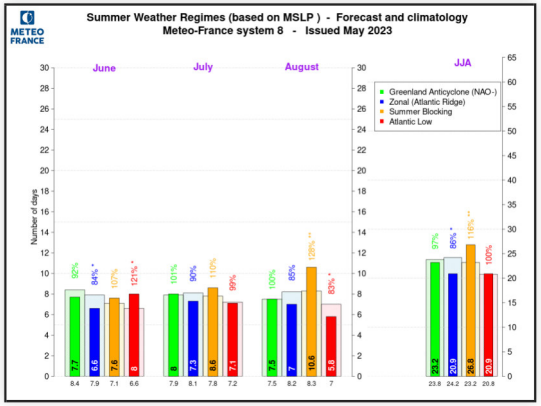
Atmospheric circulation : Summer SLP weather regimes

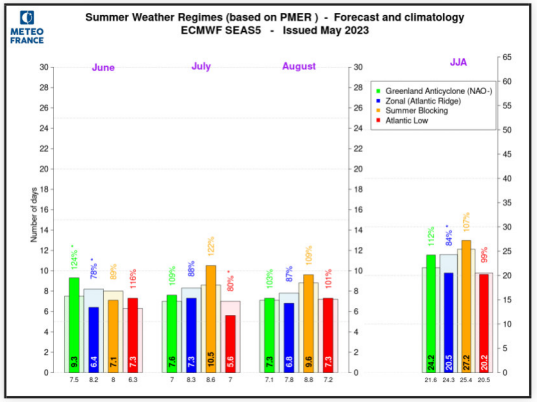
The classification into weather regimes is different between the three months. Over the quarter the NAO- (Greenland Anticyclone) regime dominates and the Blocking regime is under-represented.

Both models didn't anticipate these anomalies.





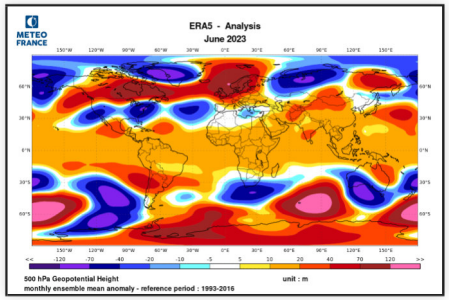


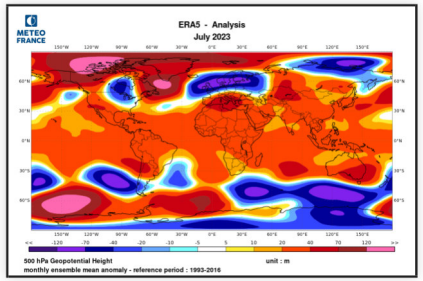


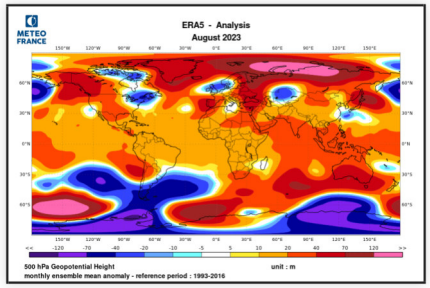
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

Atmospheric circulation : Variability within the quarter

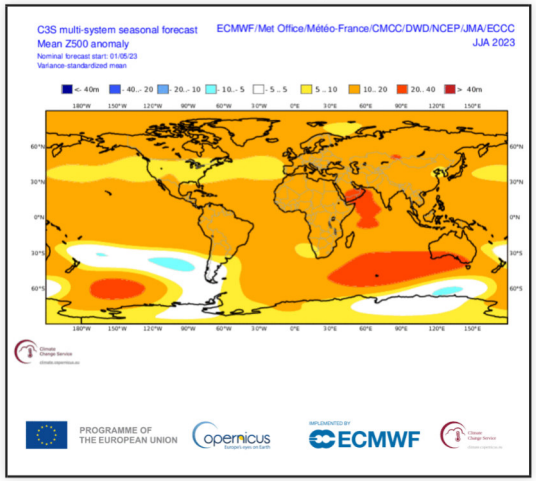
A monthly analysis of atmospheric circulation clearly shows the succession of very different months over Atlantic/Europe

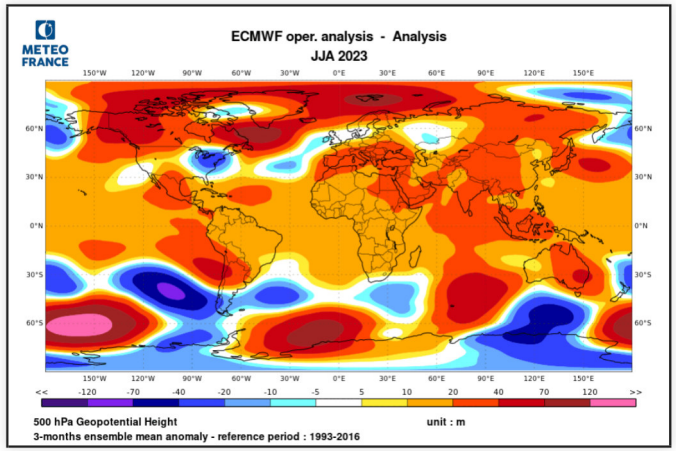






ECMWF analysis : March, April and May 500 geopotential height anomalies



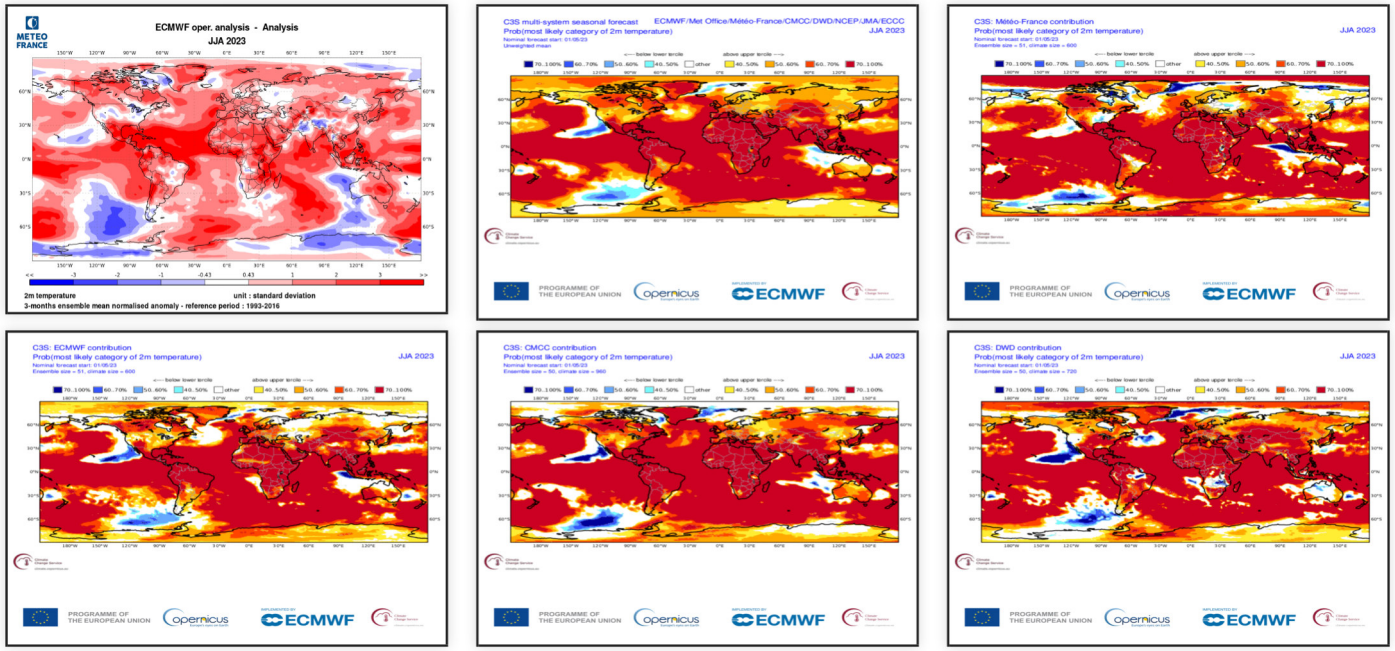


C3S multi-sytem forecast and ECMWF analysis 500 geopotential height anomalies for JJA

Climatic parameters : temperature on the globe

In the tropics the main cold anomalies, west of Australia, are suggested by models (lower probability of warm scenario)

In North hemisphere neutral anomalies (United States, western Russia, around Bering Strait) are suggested by the models (lower probability of warm anomalies)

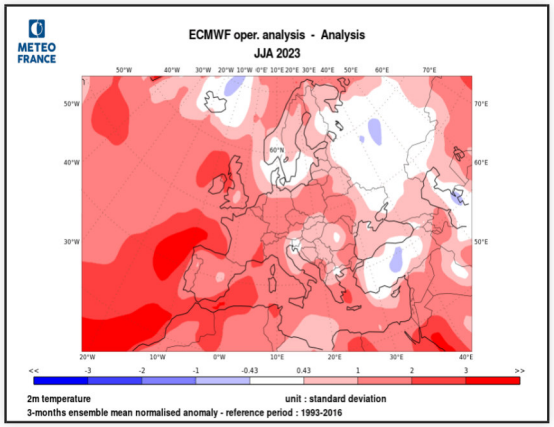


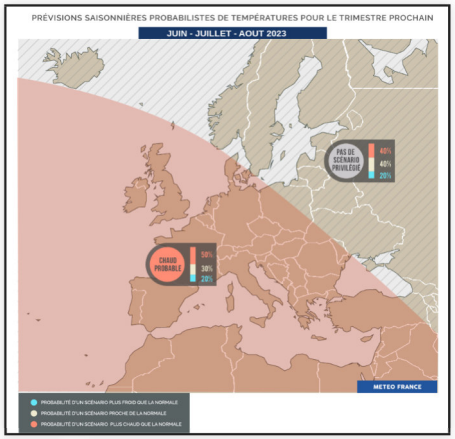
ECMWF analysis top left, forecast for multi-model top center and forecast for MF-S8 top right, ECMWF-SEAS5, CMCC, DWD on the bottom line.

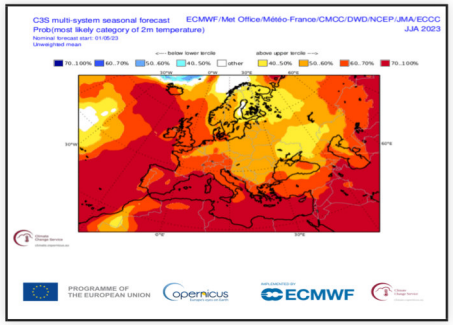
Climatic parameters : temperature over Europe

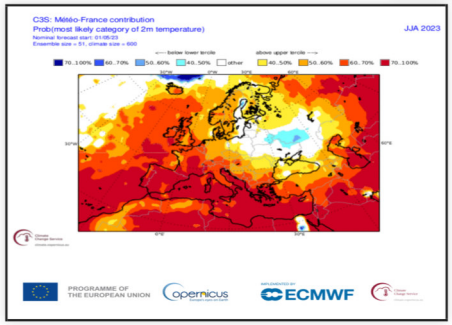
The negative geopotential anomaly on the west of Russia, forecasted by a number of models (such as SEAS5 and MF8), is the cause of near-normal temperature over western Russia.

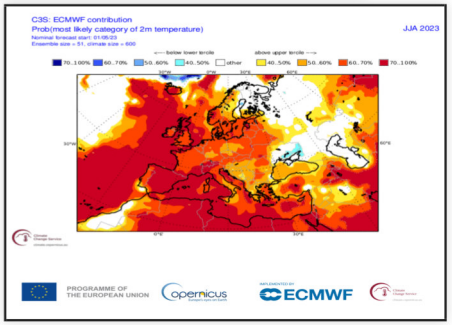
The multi-model and probabilistic forecast map clearly targeted the regions where the temperature were above normal.









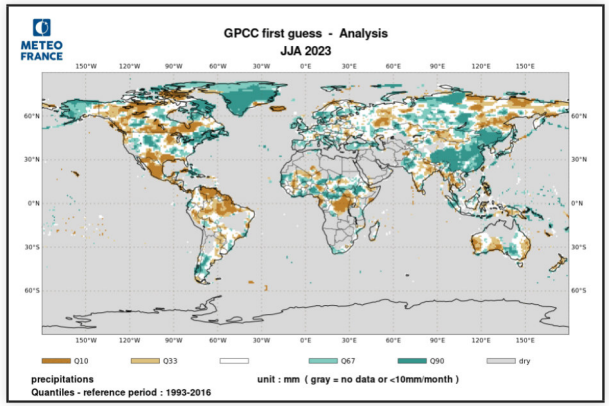


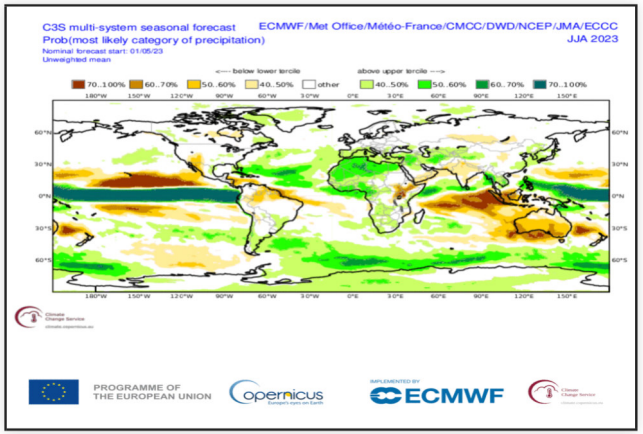
ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system , MF-S8 and SEAS5 on the bottom line.

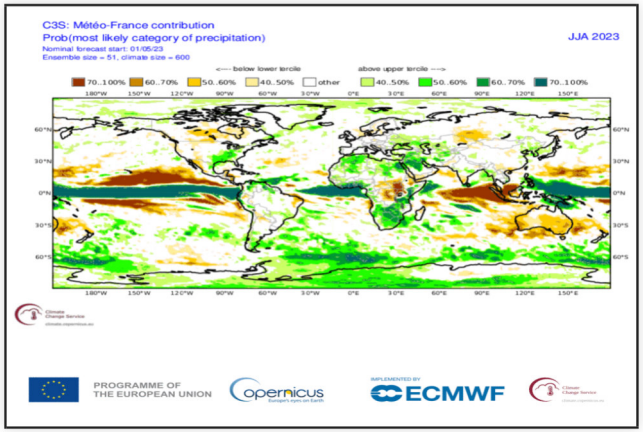
Climatic parameters : Precipitations over the globe

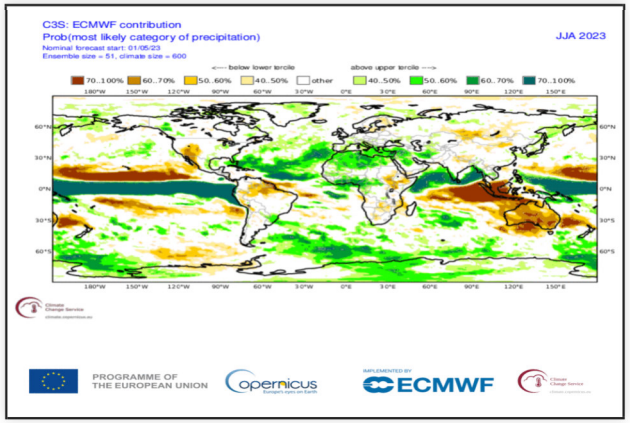
In the intertropics, the models did not show very strong signals except over Australia and Indonesia (dry signal contradicted by analysis) and over north of soutn America (dry signal observed and forecasted by models.

In the northern hemisphere's mid-latitudes, the forecast signals were very weak and the observed is heterogeneous without large-scale structure.





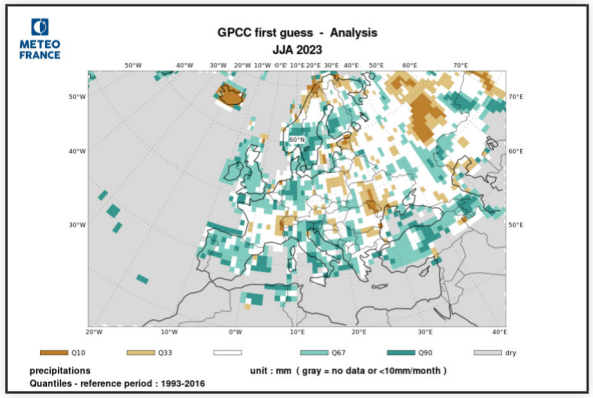


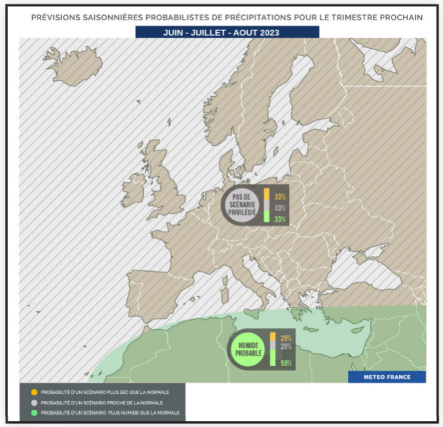


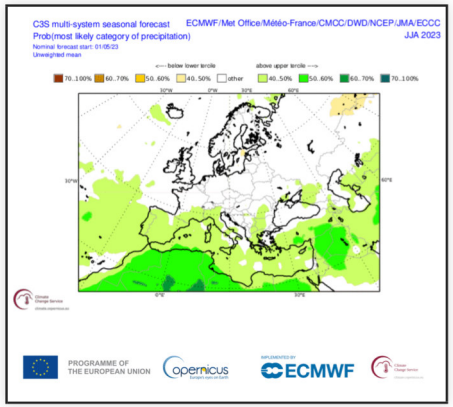
Standardized Precipitation Index analysed by IRI top left, forecast for multi-model top right and MF-S8 and SEAS5 on the bottom line.

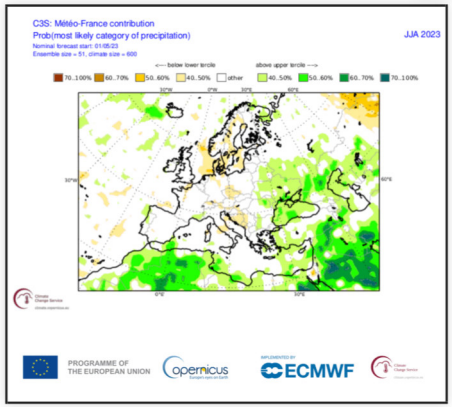
Climatic parameters : Precipitations over Europe

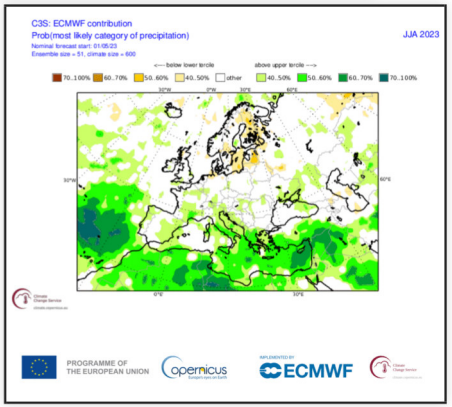
The C3S multi-model favors wetter conditions around the Mediterranean as has generally been the case in this area .











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 JJA 2023

1) **Oceans :**

The main SST anomalies were well predicted by the models.

2) **Large scale atmospheric circulation :**

VP 200 hPa : The upward motions from east Pacific to west Africa was well predicted by the models while the downward motions over Indian Ocean was forecasted too far to the west.

SF 200 hPa : The signal is limited to the southern hemisphere, particularly in the Pacific.

Z500 : The multi-model correctly predicted the weak geopotentials arund 30N from Pacific to the Atlantic as weel as over wesstern Russia.

3) **Climatic parameters over Europe :**

Temperatures : Good forecast of the warm anomaly over a large part of western Europe

Precipitations : Good anticipation of wetter conditions around the Mediterranean