VERIFICATION BULLETIN

SEPTEMBER - OCTOBER - NOVEMBER 2022

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Introduction : Objective

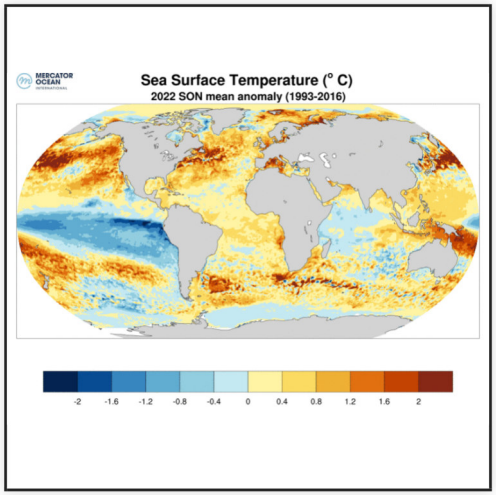
- **The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean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

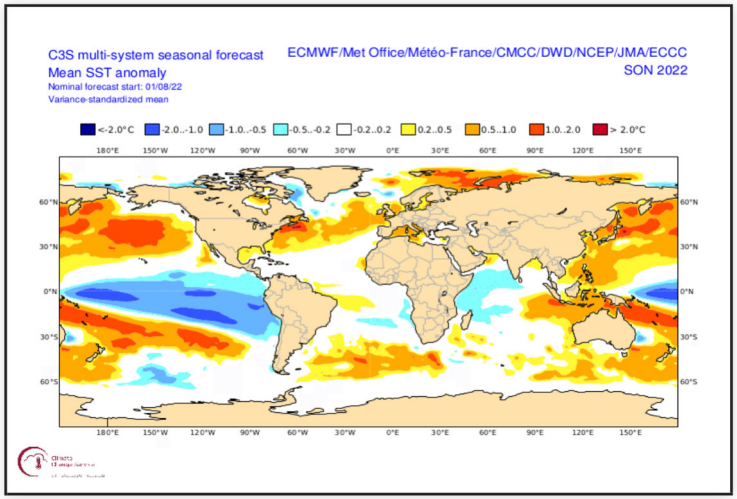
Oceans : surface temperature anomalies

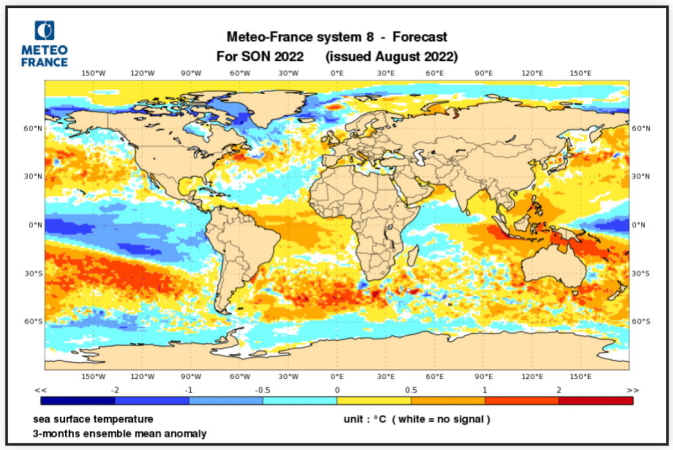
In the Pacific Ocean, the "La Niña" pattern is well seen by the models. On the other hand, the classic PDO- pattern, predicted by the models (see the small cold anomaly along the US coast) is much less visible in the analysis.

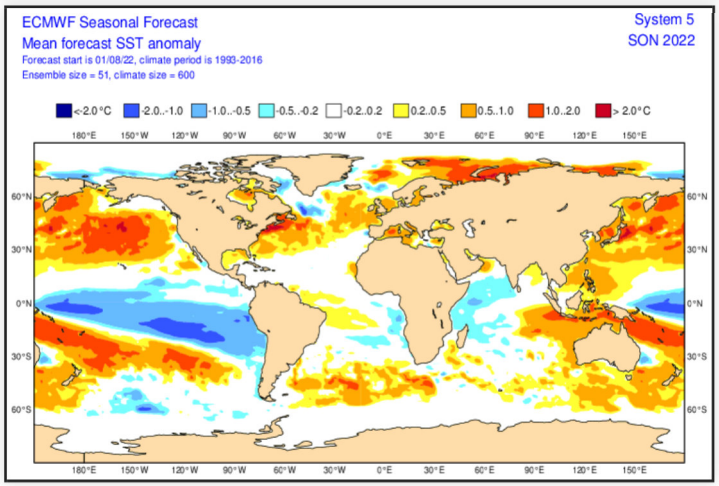
In the Indian Ocean, the IOD- pattern is correctly predicted.

In the Atlantic, there are some discrepancies between the analysis and the forecasts in the mid-latitudes of the northern hemisphere: the warm anomaly off Canada is much more pronounced in the analysis.







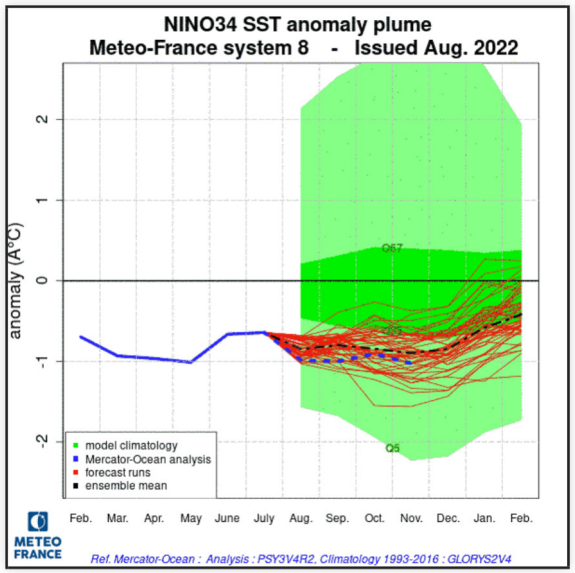


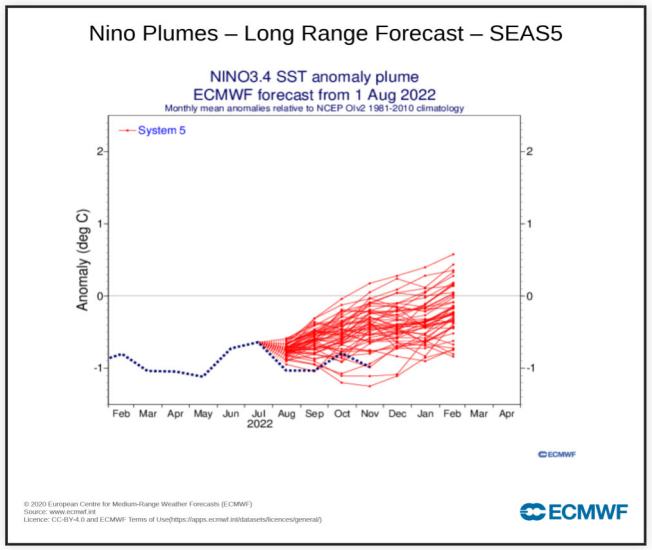
SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

Oceans : ENSO

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

Little evolution of this index during the quarter. Pretty good forecast for MF8 while for SEAS5 the analysis is in the bottom of the plume.

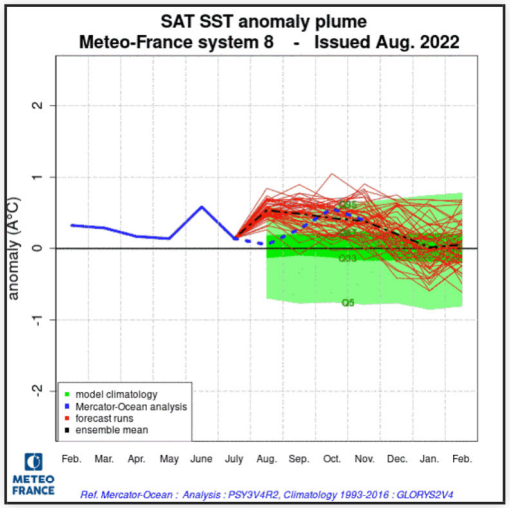


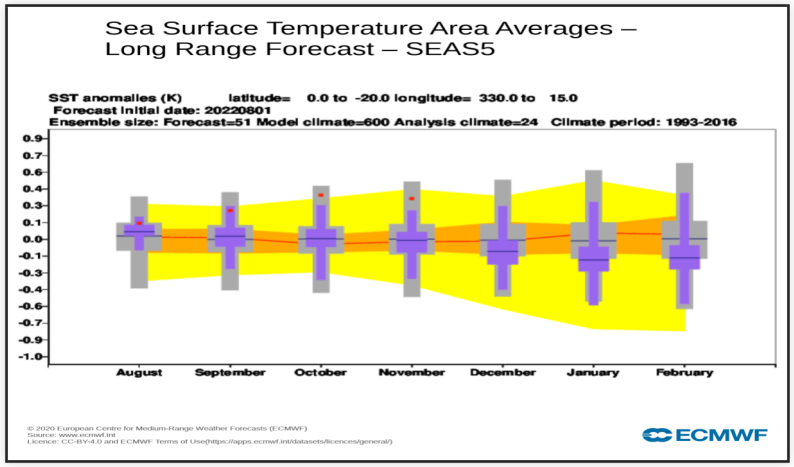


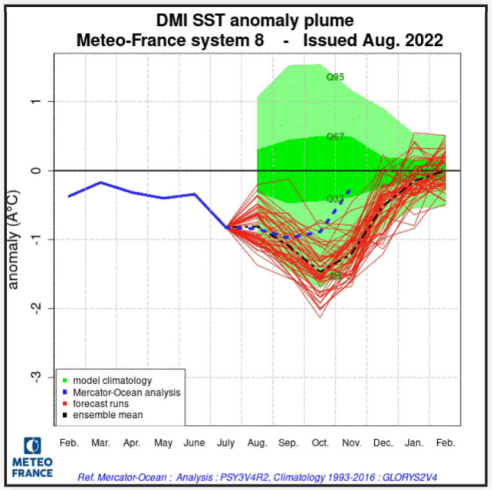
Oceans : tropical Atlantic and Indian Ocean index

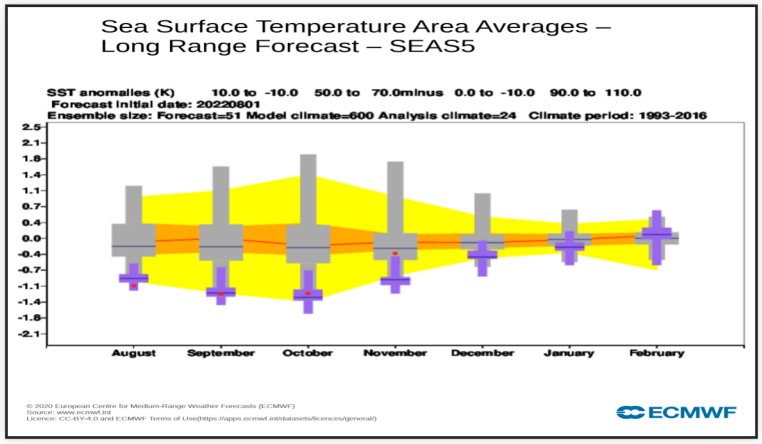
SAT : MF-S8 is too hot at the beginning of the period. Slight warming not anticipated by SEAS5

DMI : MF-S8 is too cold while ECMWF is very close to the analysis.





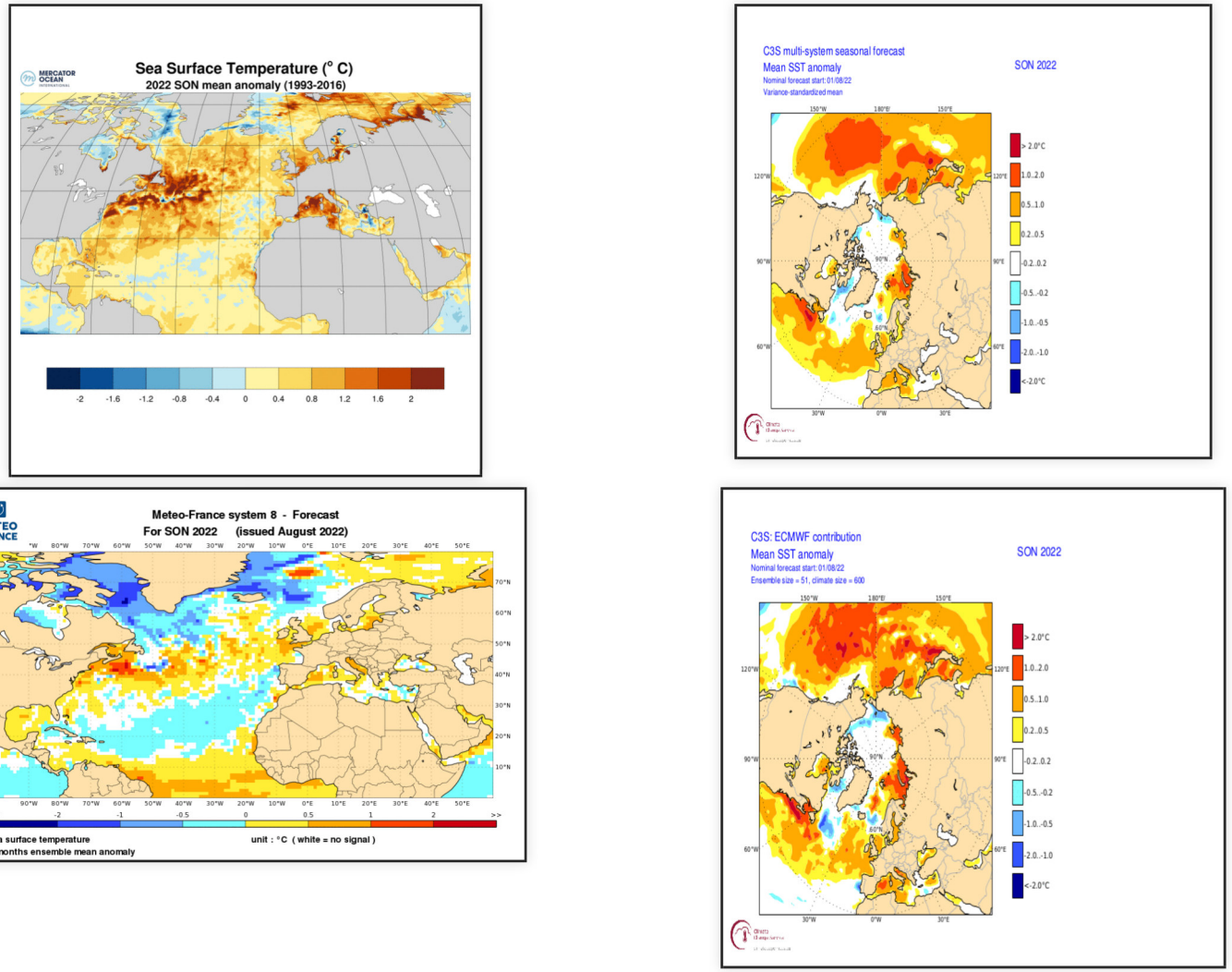




Oceans : North Atlantic SST

Very clear differences between the analysis and the two models off Canada: no cold anomaly south of Greenland in the analysis and the warm anomaly between Canada and the British Isles is much stronger than expected.

Good forecasts in the Mediterranean.

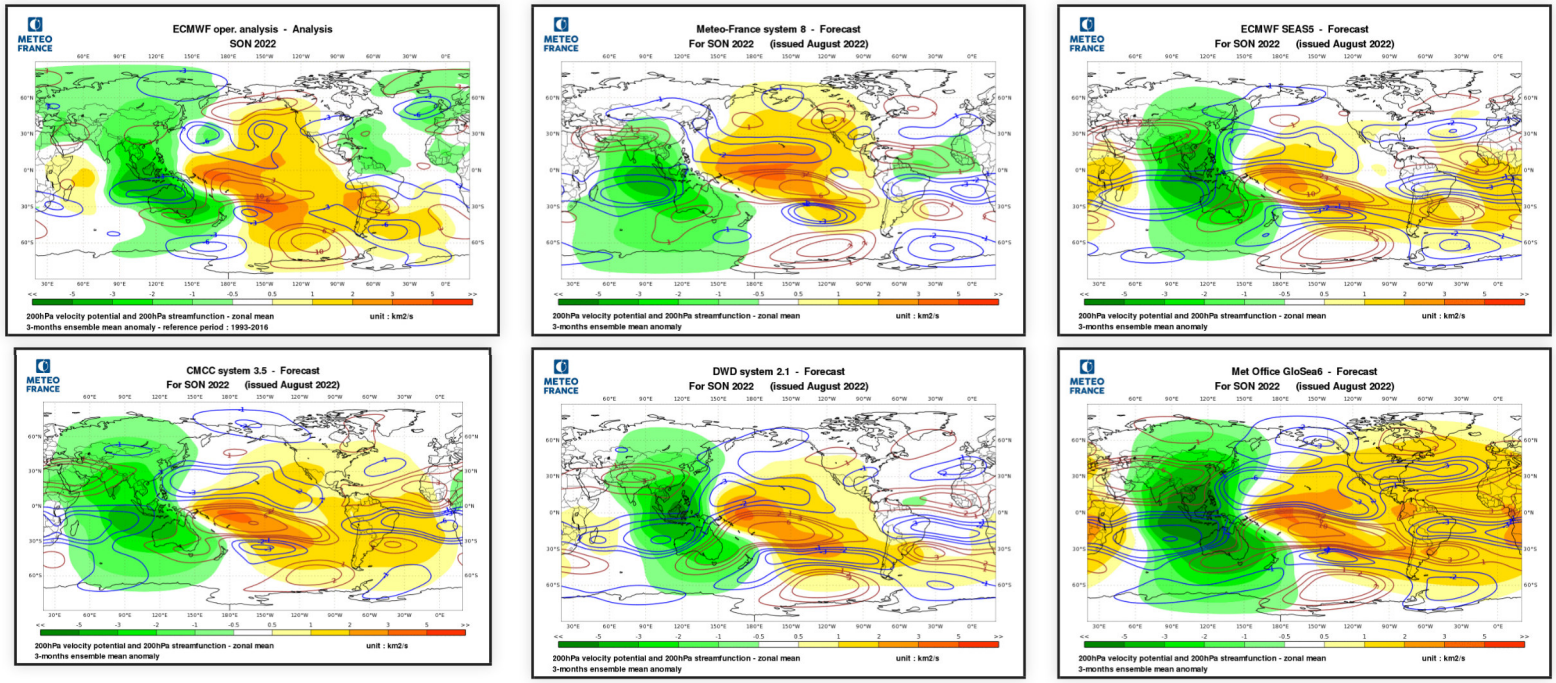


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : The analysis shows a large-scale dipole: downward motion anomaly over the Pacific and east of the Indian ocean and upward motion anomaly over the Maritime Continent, and from West Africa to the Carribean. This pattern, linked to the "La Niña" phase and the negative phase of the IOD, has been well predicted by all models.

SF : The dipoles around the equator over the Pacific and Atlantic Oceans were well seen by all models. The teleconnections on the southern hemisphere are more or less well predicted by the models. On the norterh hemisphere there isn't clear teleconnection visible in the analysis

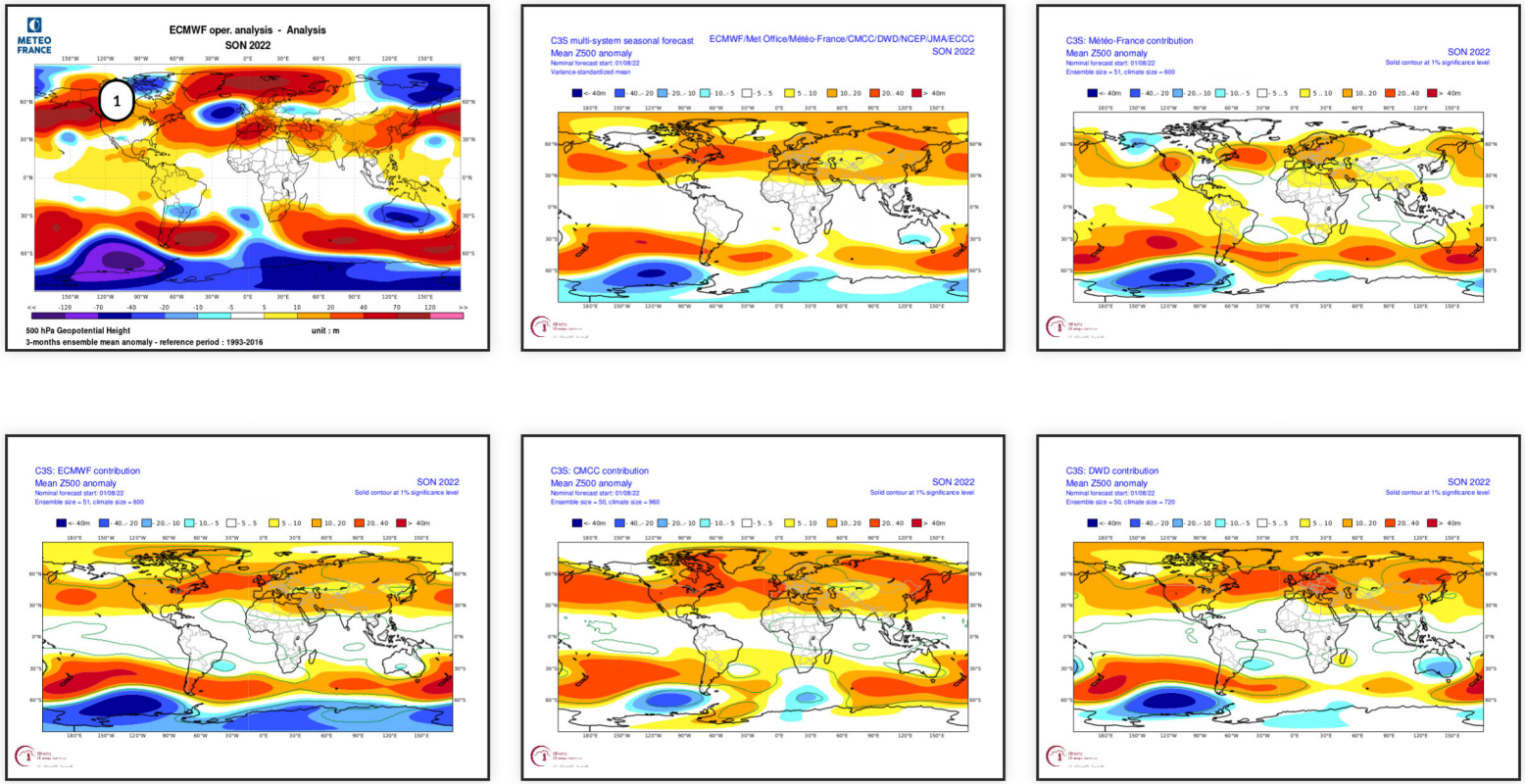


ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

Atmospheric circulation : 500hPa Geopotential height

South hemisphere : the main structures are well predicted

North hemisphere : Bad forecast : The negative PNA forecasted is not observed. On the Atlantic the expected and observed anomalies are in opposition.



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

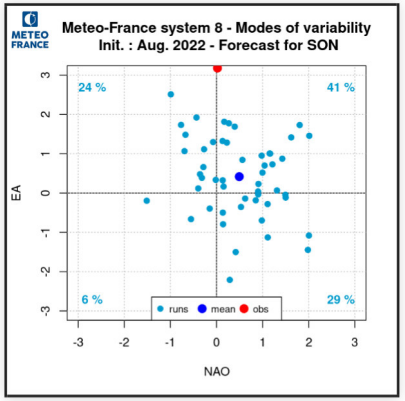
1 - Look like PNA -

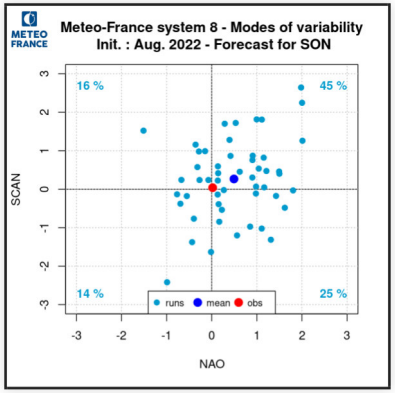
Atmospheric circulation : Modes of variability

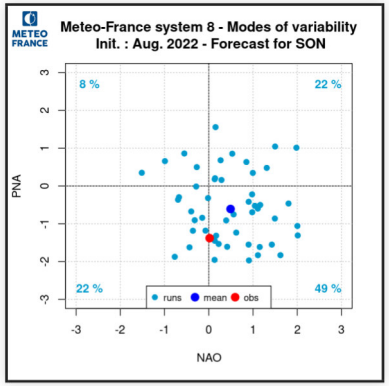
SCAN+ and NAO+ modes are favored by models while the analysis of these modes are close to zero.

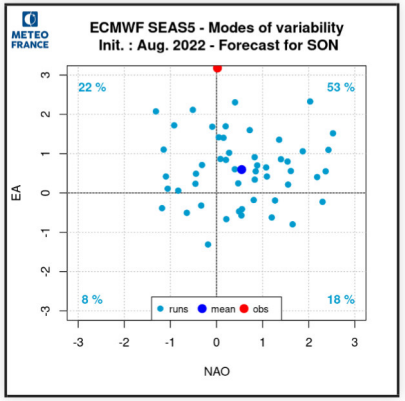
Positive EA is anticipated by model by not its exceptional intensity

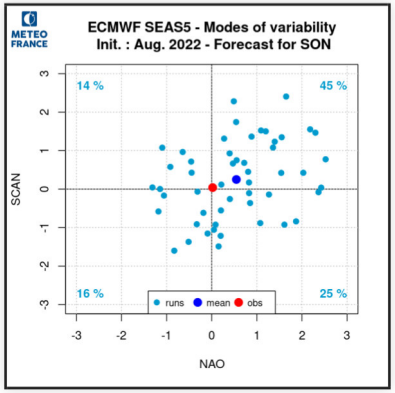
Negative PNA is well predicted by model.

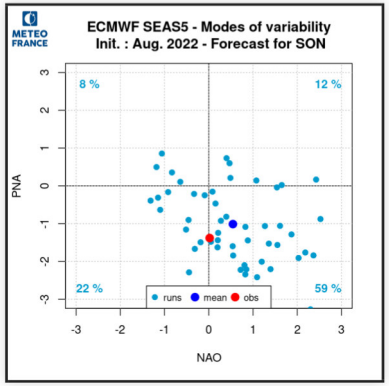






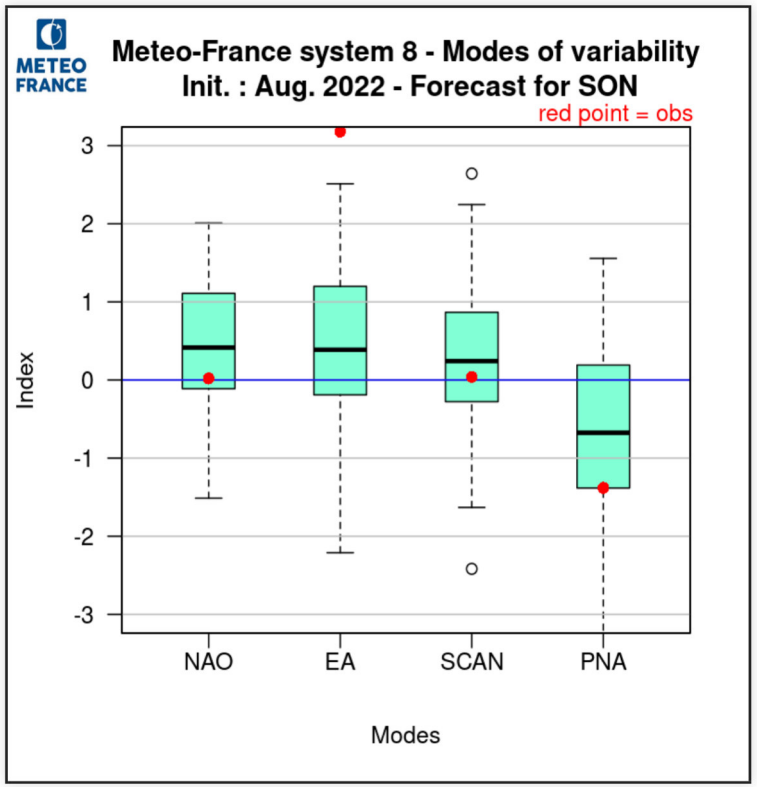


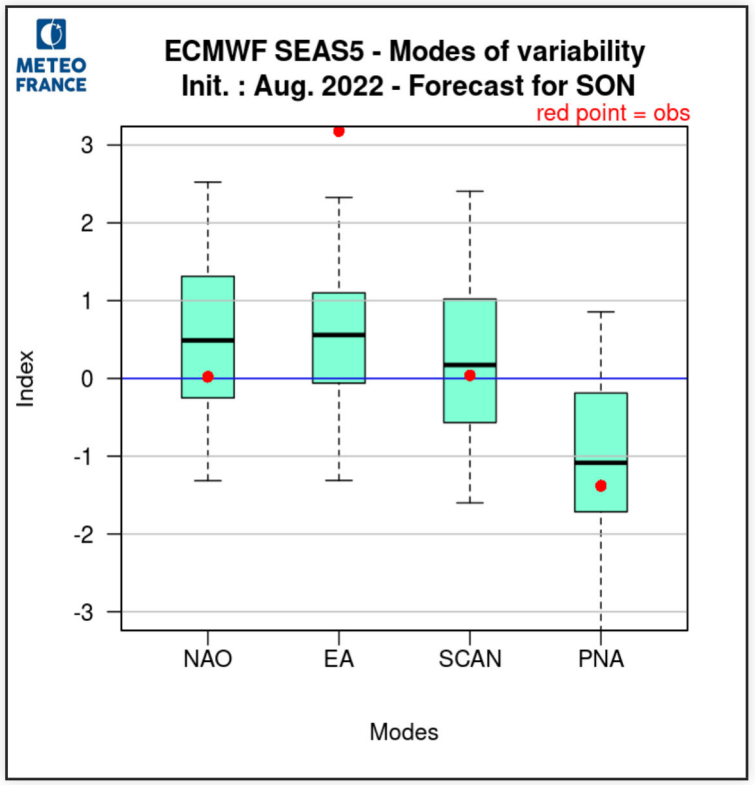




Atmospheric circulation : Modes verification

Same observation as for the previous slide

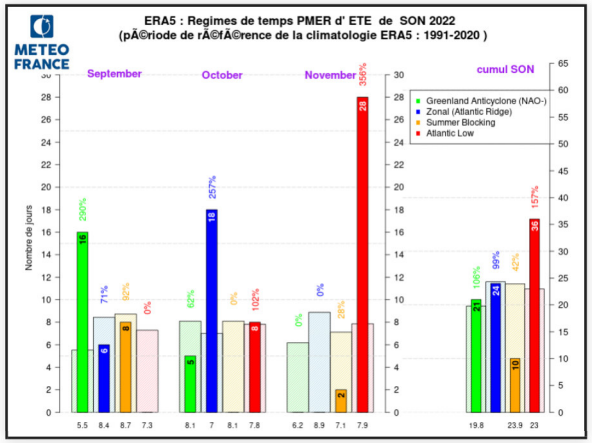


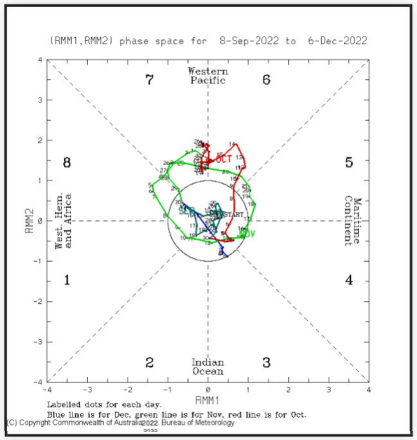


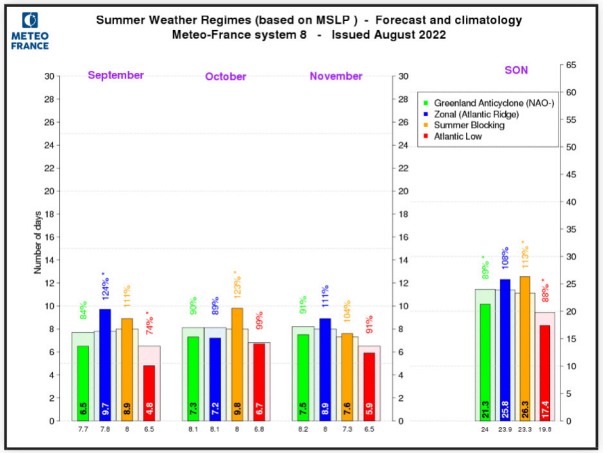
Atmospheric circulation : Summer SLP weather regimes

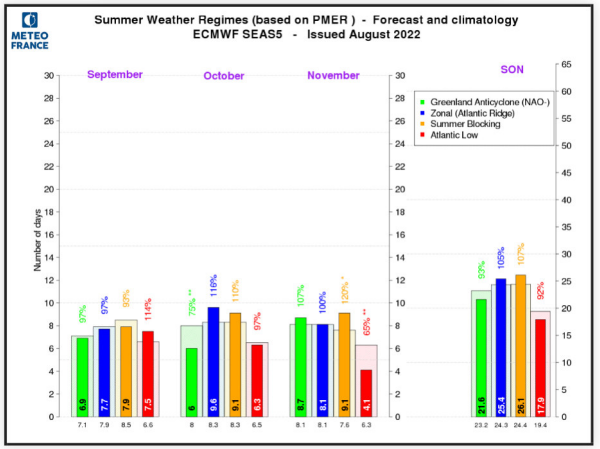
Each month is largely dominated by a different scheme. In the end, Atlantic-Low regime is the only to significantly exceed climatology .

Both models have highlighted the zonal and blocking regimes, but not the predominance of the Atlantic-Low





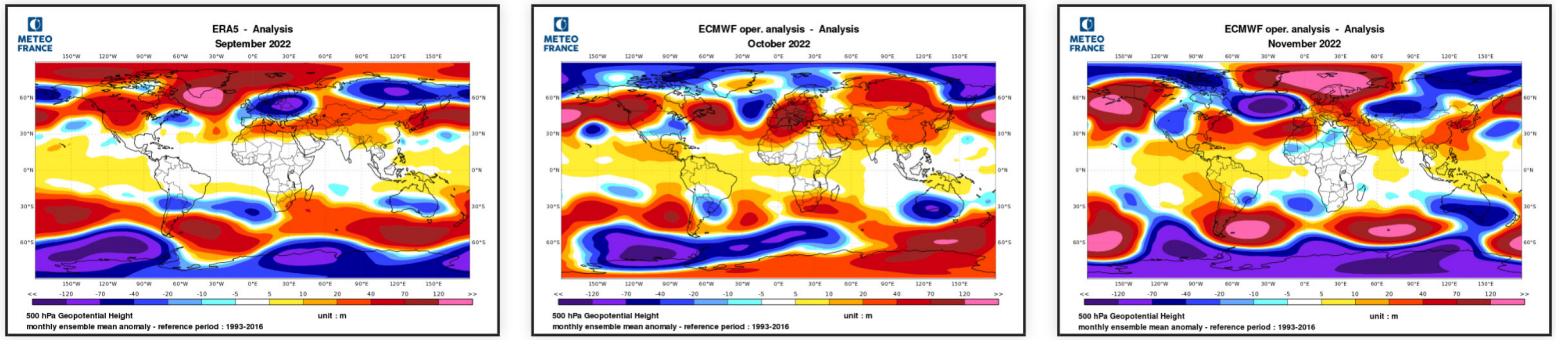




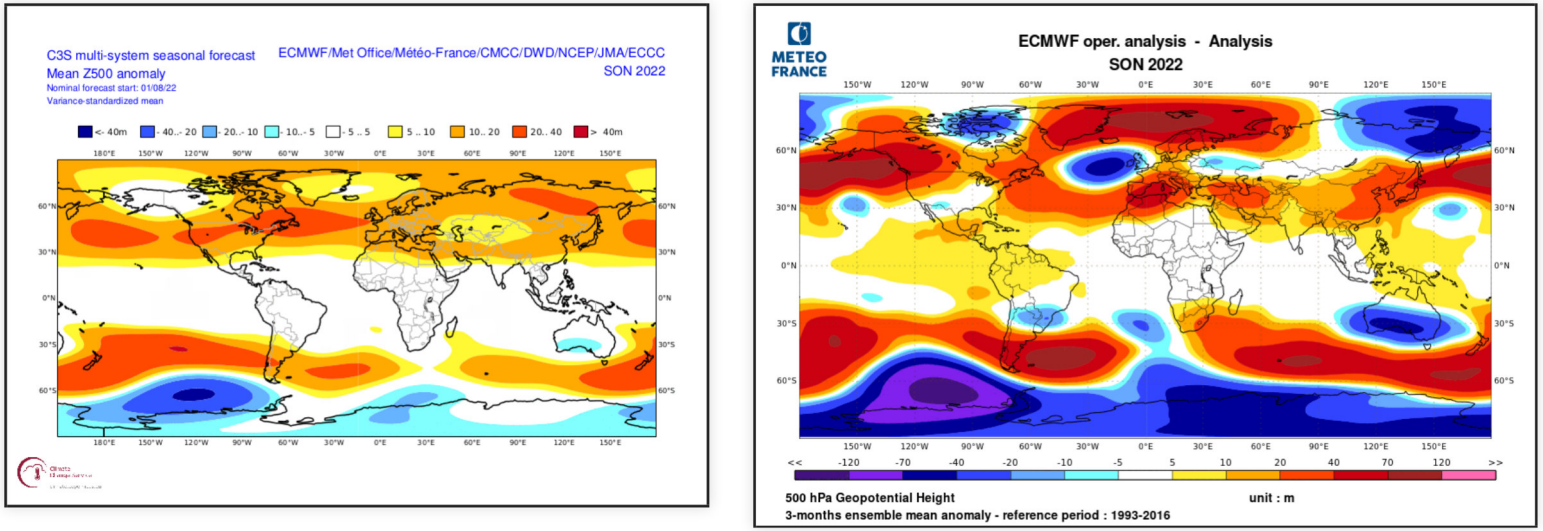
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

Atmospheric circulation : Variability within the quarter

As suggested by the regime analysis, significant inter-monthly variability exists this quarter. Strong anomalies of November in the northern hemisphere, particulary in the Atlantic and Eurasia, are strongly influenced the quarter.



ECMWF analysis : January, February and March 500 geopotential height anomalies



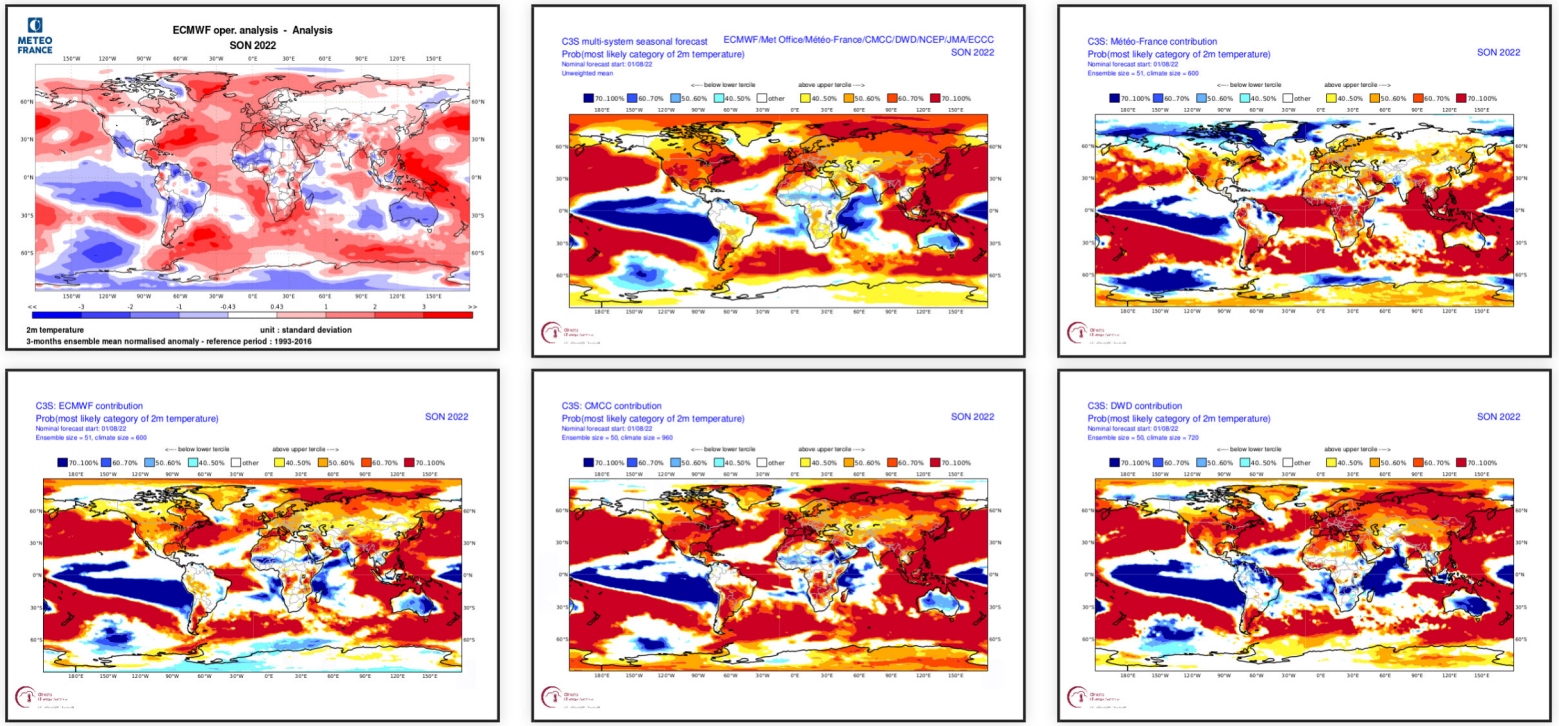
C3S multi-sytem forecast and ECMWF analysis 500 geopotential height anomalies for JFM

Climatic parameters : temperature on the globe

In North America, the observed warm anomalie from western Canad to Alaska is an area without a forecast signal. Elsewhere the warm signal emerges from the models while the temperatures are close to normal

In South America, the cold anomaly is not well predicted.

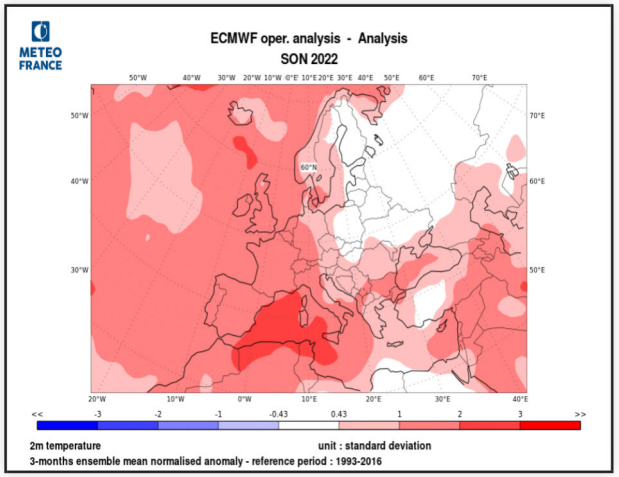
On Eurasia it is a warm signal that dominates in the forecasts while the analysis is in general close to the climatology

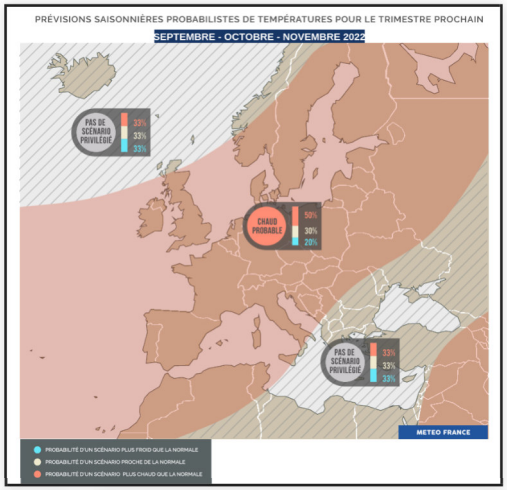


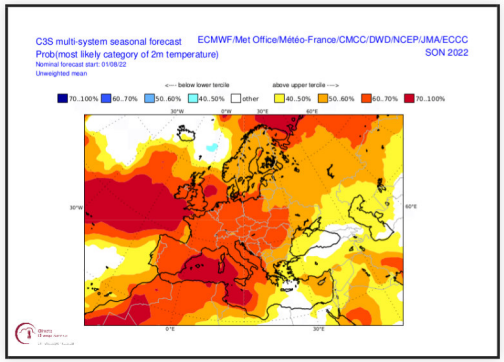
ECMWF analysis top left, forecast for multi-model top center and forecast for MF-S8 top right, ECMWF-SEAS5, CMCC, DWD on the bottom line.

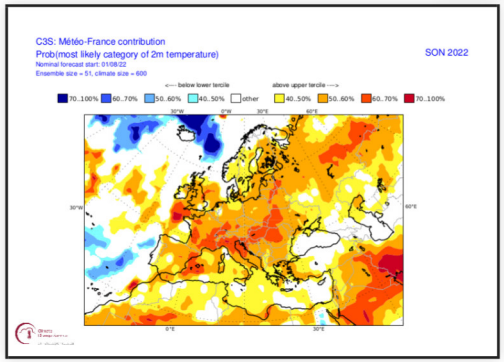
Climatic parameters : temperature over Europe

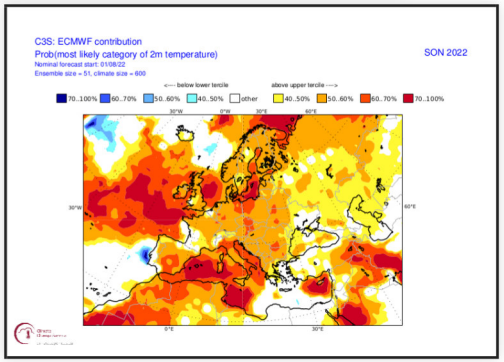
The warm signal didn't extend towards the north-east of Europe contrary to what had been forecasted











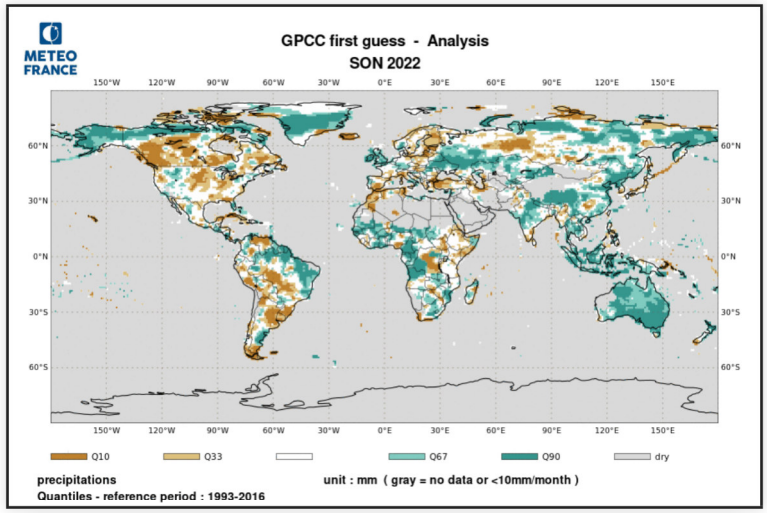
ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system , MF-S8 and SEAS5 on the bottom line.

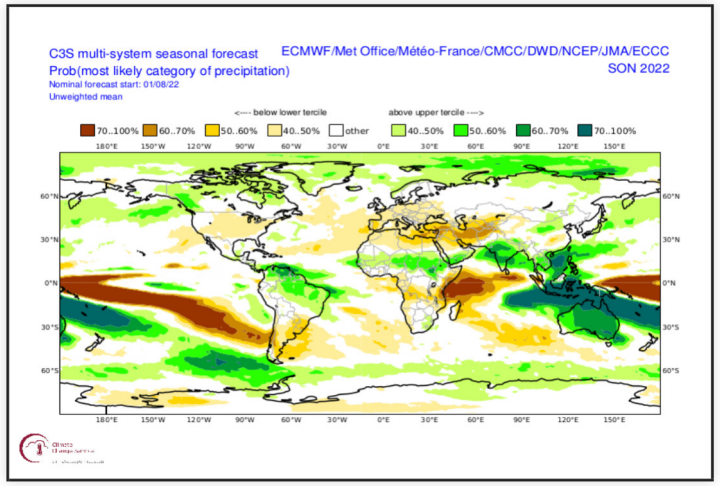
Climatic parameters : Precipitations over the globe

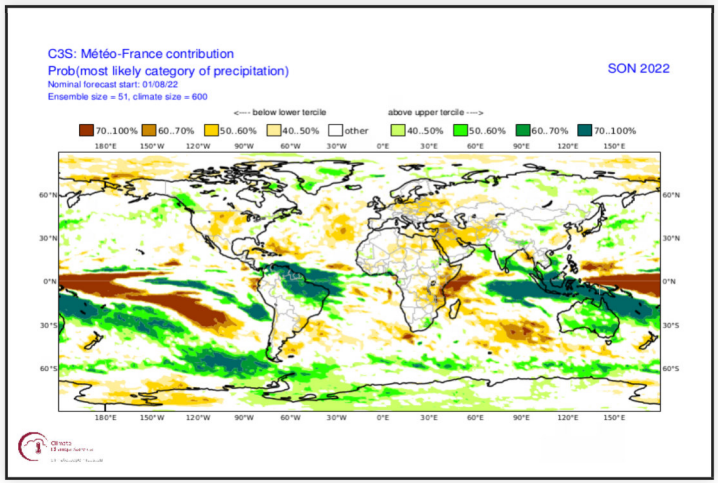
On the tropics we find the expected effect of la Niña and negative IOD.

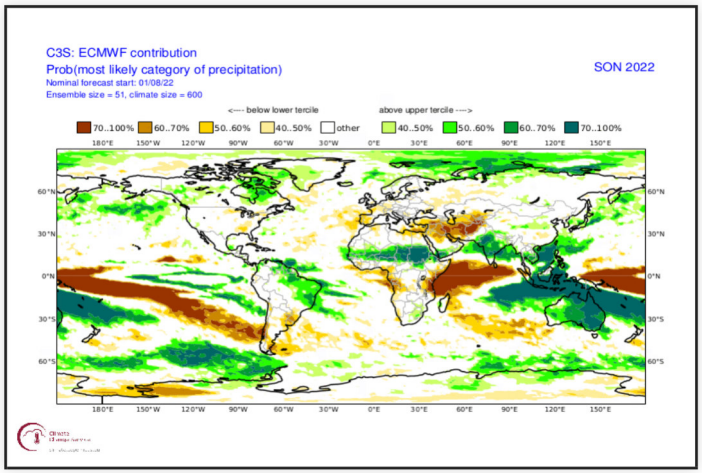
Over North america the dry/wet dipole suggested by the models is shifted to the northwest on the analysis.

In Europe the dry scenario favored by the forecasts didn't occur.





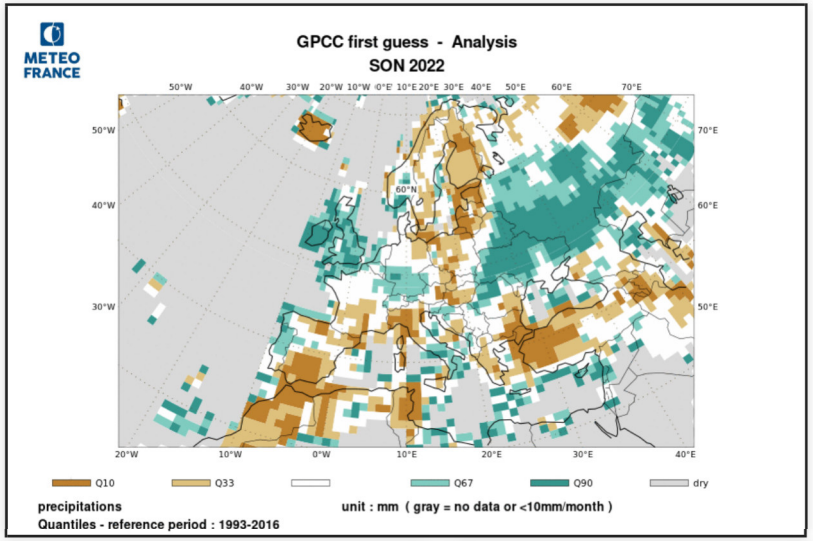


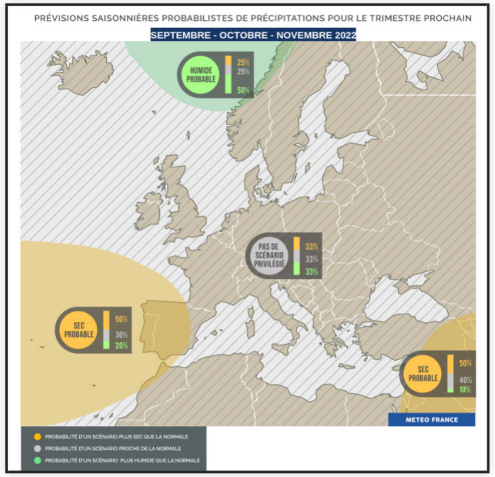


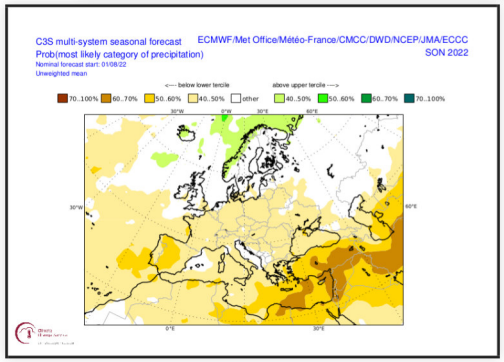
Standardized Precipitation Index analysed by IRI top left, forecast for multi-model top right and MF-S8 and SEAS5 on the bottom line.

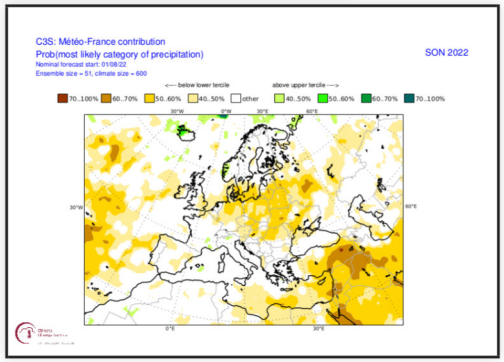
Climatic parameters : Precipitations over Europe

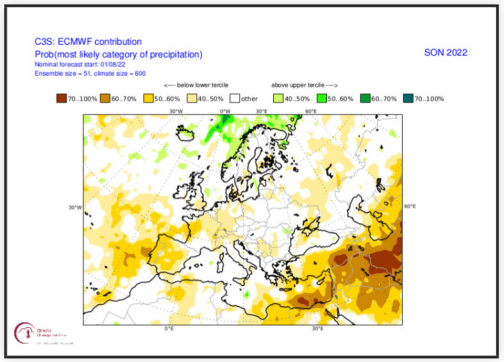
The observed rainfall wasn't anticiapted by the models or the synthesis map.











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 SON 2022

1) **Oceans :**

The main SST anomalies were globally well predicted, except in the mid-latitudes of the North Atlantic.

2) **Large scale atmospheric circulation :**

VP 200 hPa : Correct forecasts for all models.

SF 200 hPa : In the equatorial zones, the dipoles have been well predicted. The teleconnections towards the mid-latitudes of the northern hemisphere, which are not clearly visible in the analysis as well by the models.

Z500 : The forecast is generally not correct in the northern hemisphere, due to strong anomalies in November

3) **Climatic parameters over Europe :**

Temperatures :The forecast scenario, warmer than normal over large part of Europe, only occurred in the south and west of the continent

Precipitations : The observed rainfall wasn't anticipated by the models or the synthesis map.