VERIFICATION BULLETIN

AUGUST - SEPTEMBER - OCTOBER 2022

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Introduction : Objective

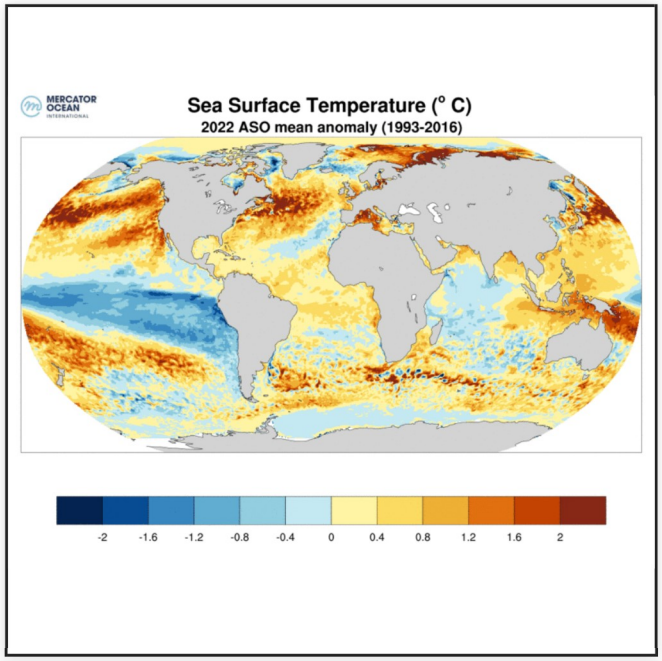
- **The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean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

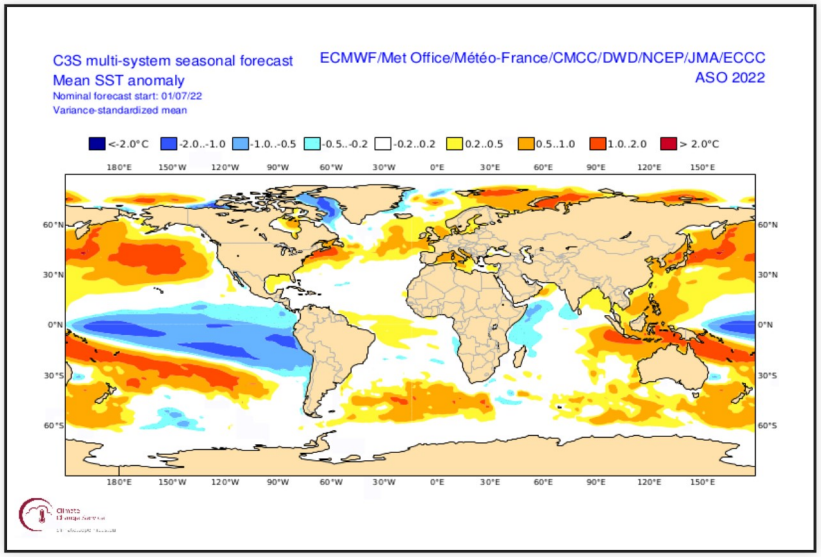
Oceans : surface temperature anomalies

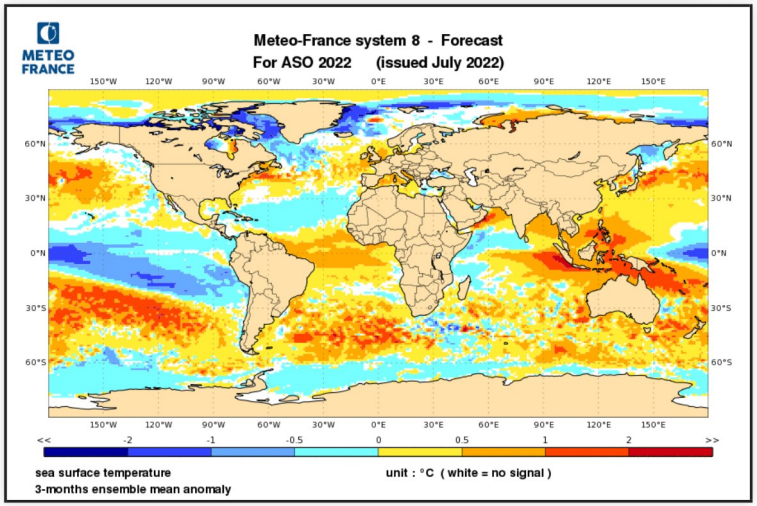
In the Pacific Ocean, the "La Niña" pattern is well seen by the models. On the other hand, the classic PDO- pattern, predicted by the models (see the small cold anomaly along the US coast) is much less visible in the analysis.

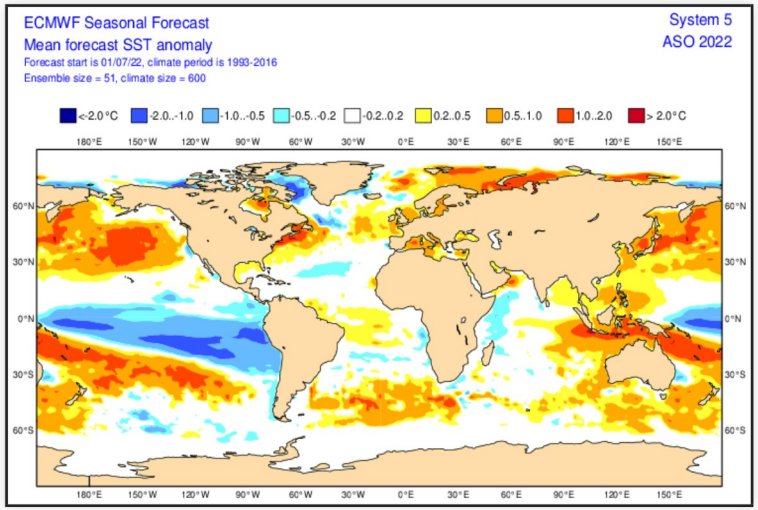
In the Indian Ocean, the IOD- pattern is correctly predicted.

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.







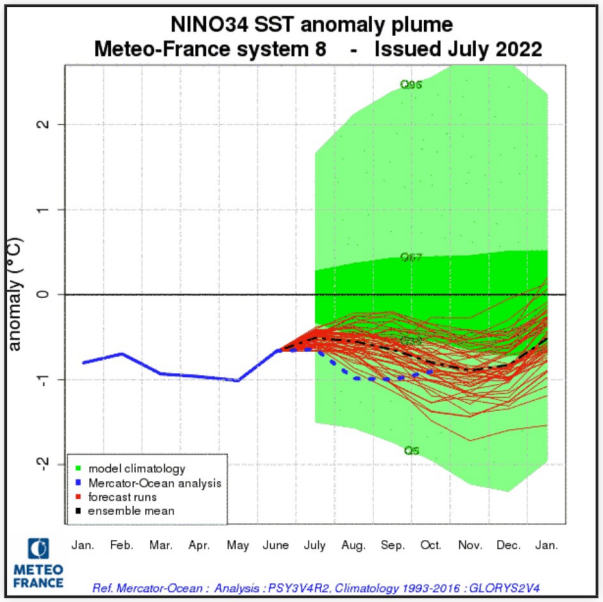


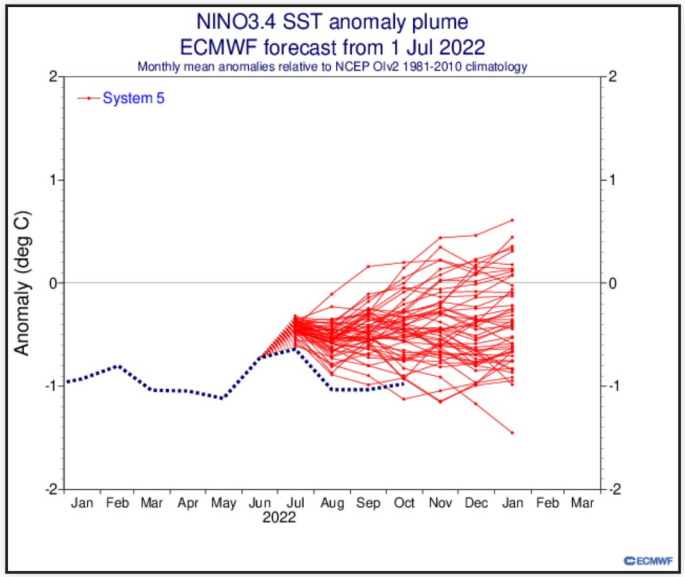
SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

Oceans : ENSO

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

None of the models saw cooling in August. They are too cold, although MF-S8 is getting close to the analysis again in October.

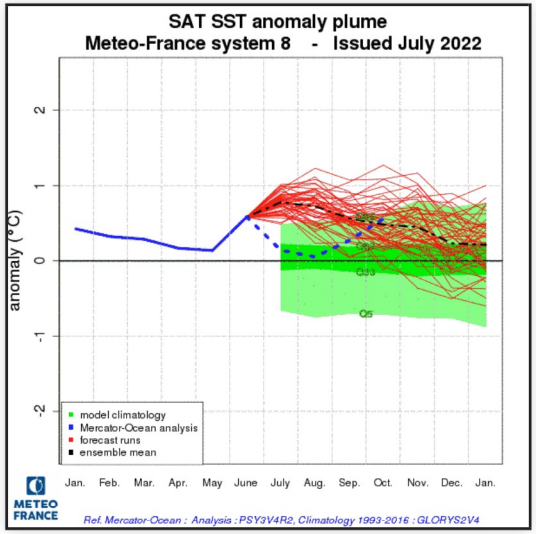


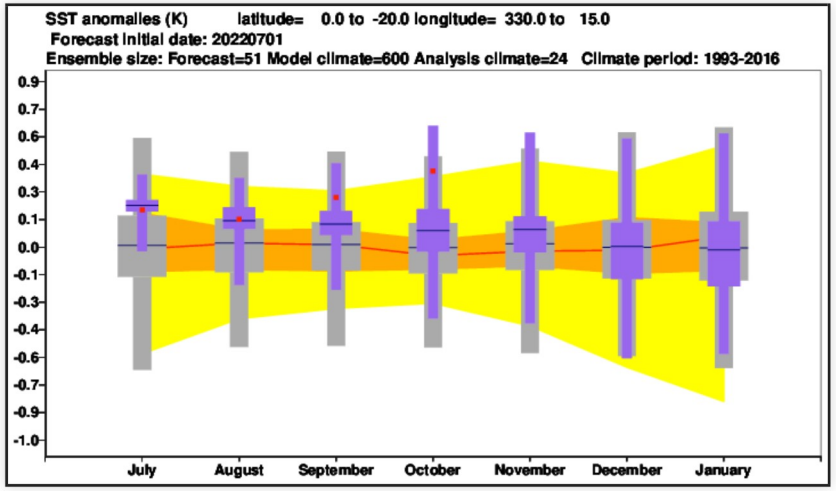


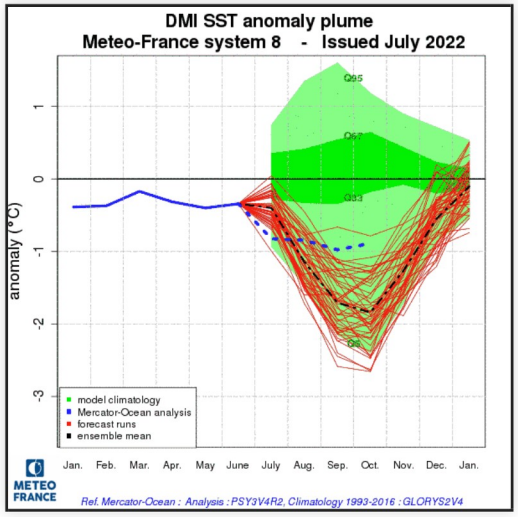
Oceans : tropical Atlantic and Indian Ocean index

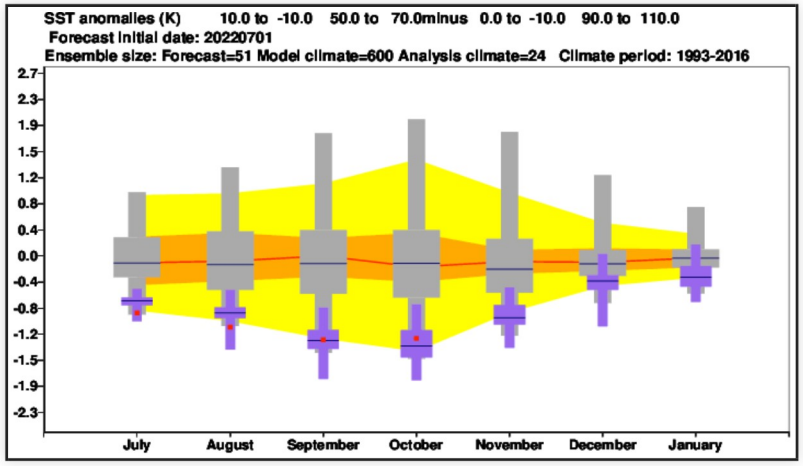
SAT : MF-S8 is too hot even if it resets at the end of the period.

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





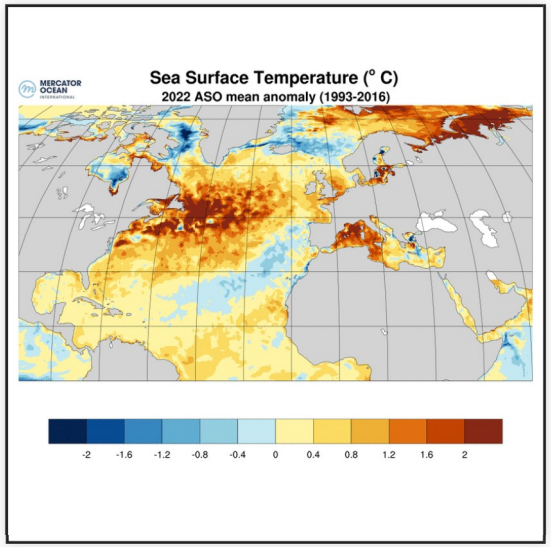


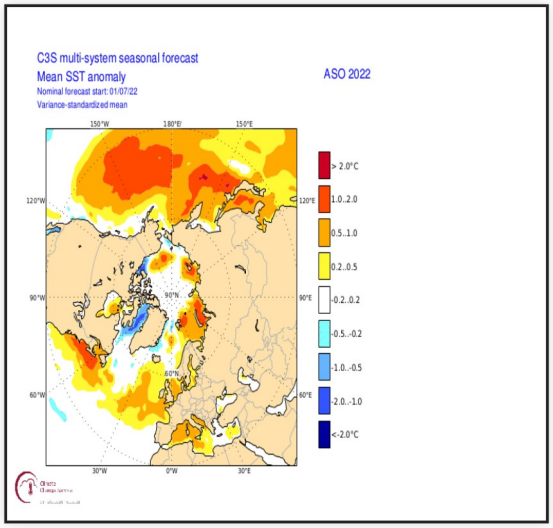


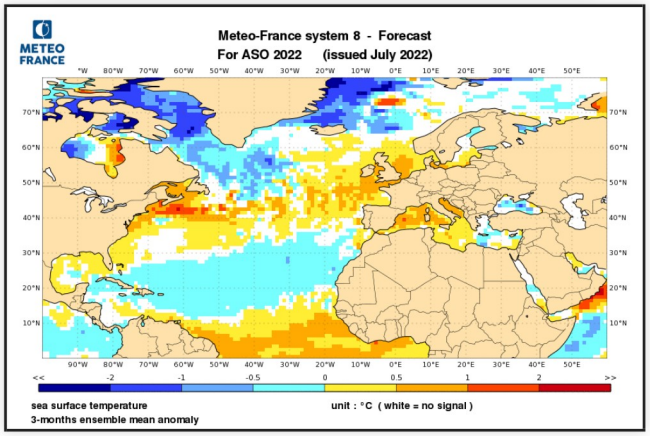
Oceans : North Atlantic SST

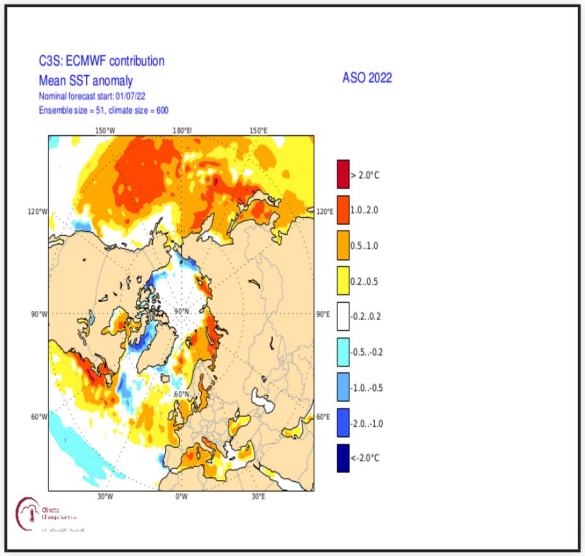
Very clear differences between the analysis and the two models off Canada: no cold anomaly south of Greenland in the analysis and the warm anomaly between Canada and the British Isles is much stronger than expected.

Good forecasts in the Mediterranean.







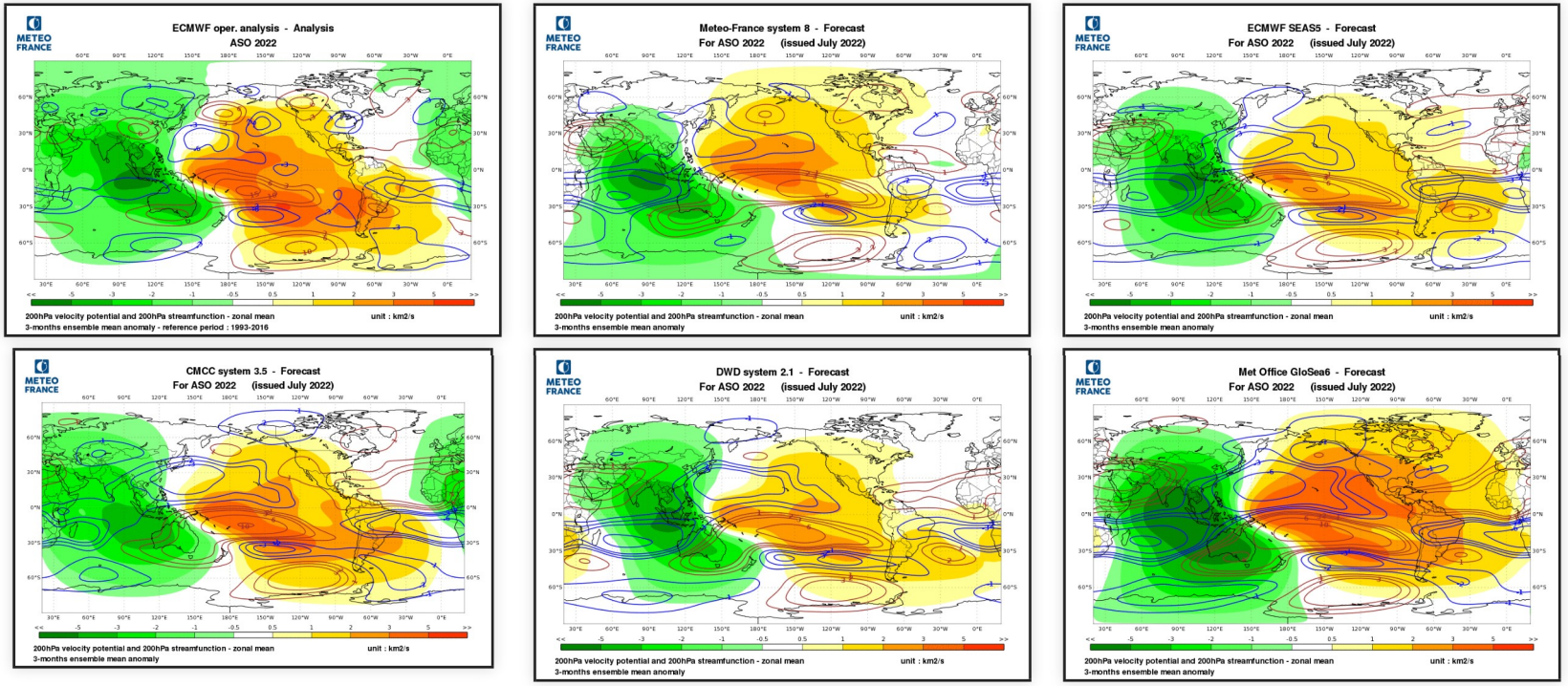


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : The analysis shows a large-scale dipole: downward motion anomaly over the Pacific and the Americas and upward motion anomaly over the Maritime Continent, the Indian Ocean, Asia, Africa and Europe. This pattern, linked to the "La Niña" phase and the negative phase of the IOD, has been very 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 to North America and Europe, which are clearly visible in the analysis, are more or less well predicted by the models.

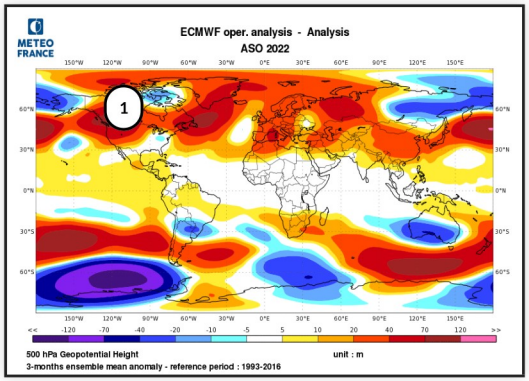


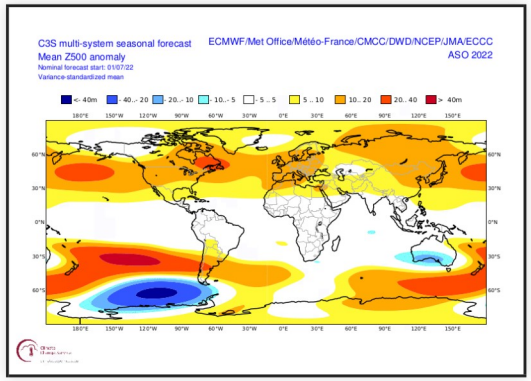
ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

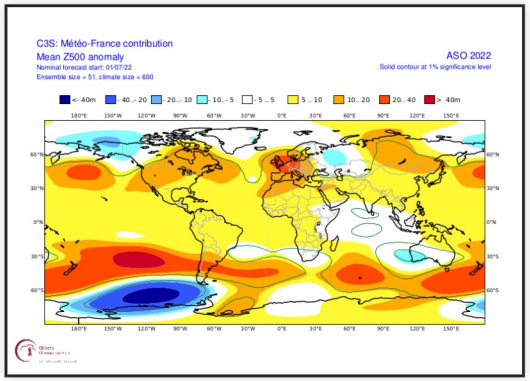
Atmospheric circulation : 500hPa Geopotential height

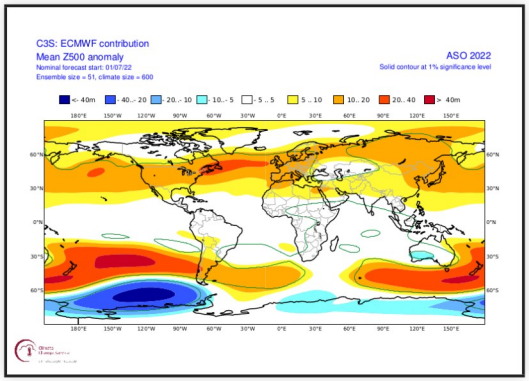
In North America, the PNA- pattern forecasted by all the models, linked to "La Niña", is is shifted to the west on analysis.

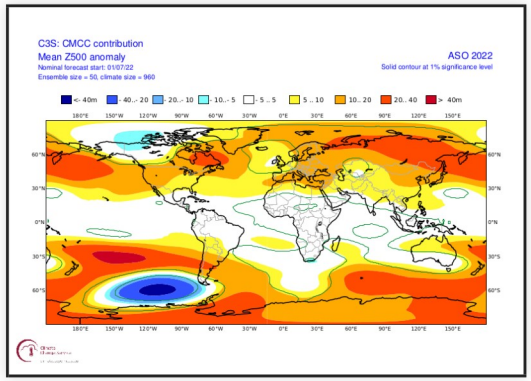
The multi-model is representative of the analysis over the North Atlantic and Europe, with a positive anomaly centered over Newfoundland, another centered over Western Europe and two relative minima over the near Atlantic and western Russia. MF-S8 is closer to the analysis than ECMWF-SAE5 which smoothes more positive anomalies.

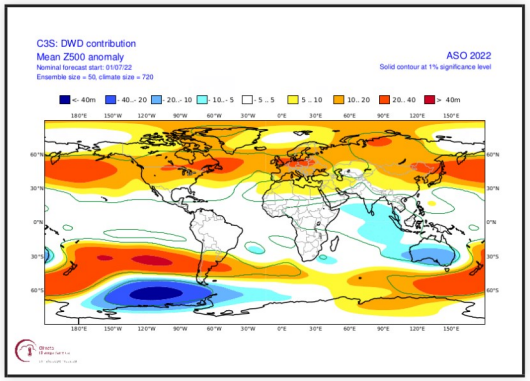












ECMWF analysis, C3S multi-system, MF-S8, ECMWF-SEAS5, CMCC and DWD 500hPa geopotential height anomalies.

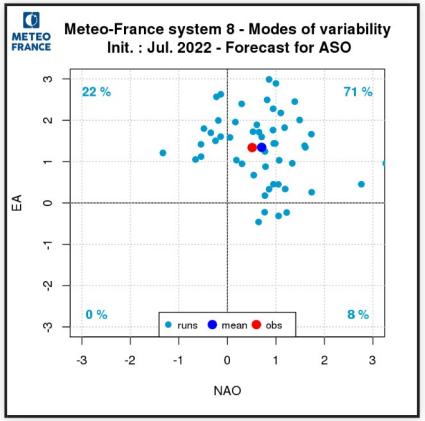
1 - Look like PNA -

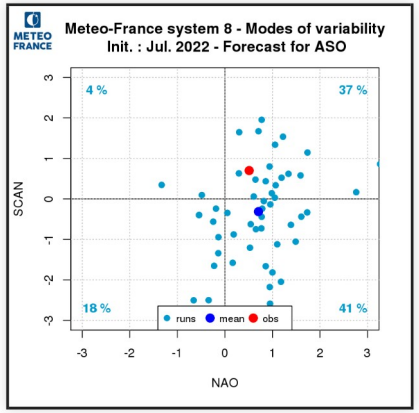
Atmospheric circulation : Modes of variability

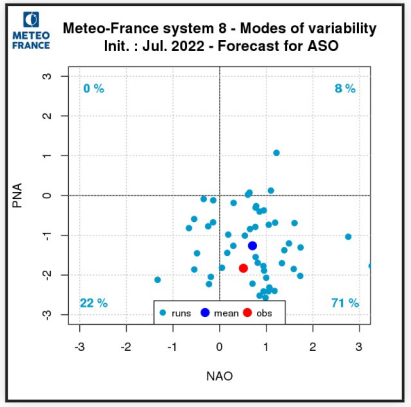
Both models are fairly close in analysis, with PNA-, NAO+ and EA+ modes.

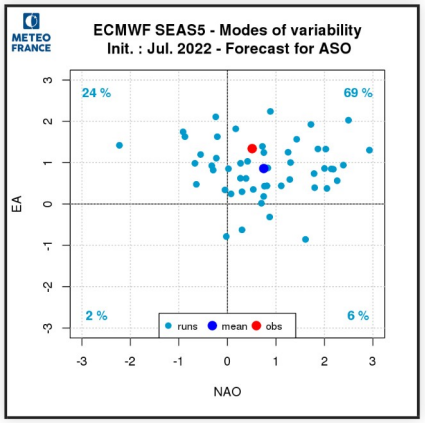
Only SCAN mode is less well predicted by MF-S8.

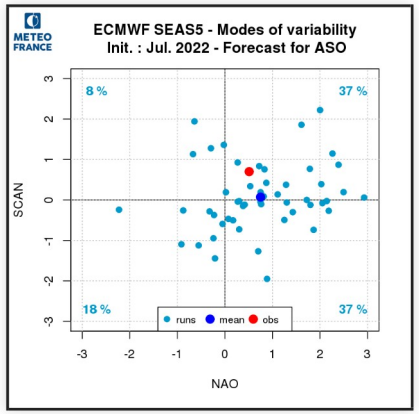
Note the lower dispersion of the MF-S8 model.

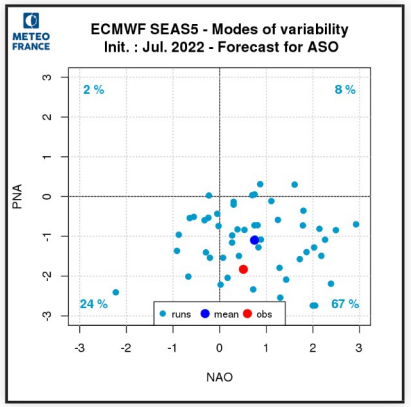






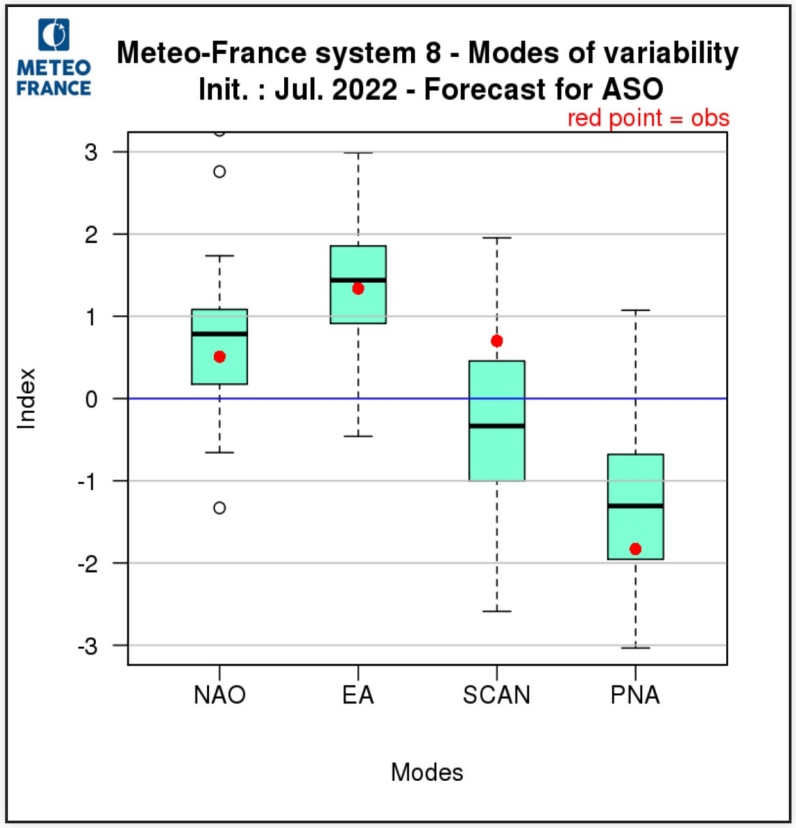


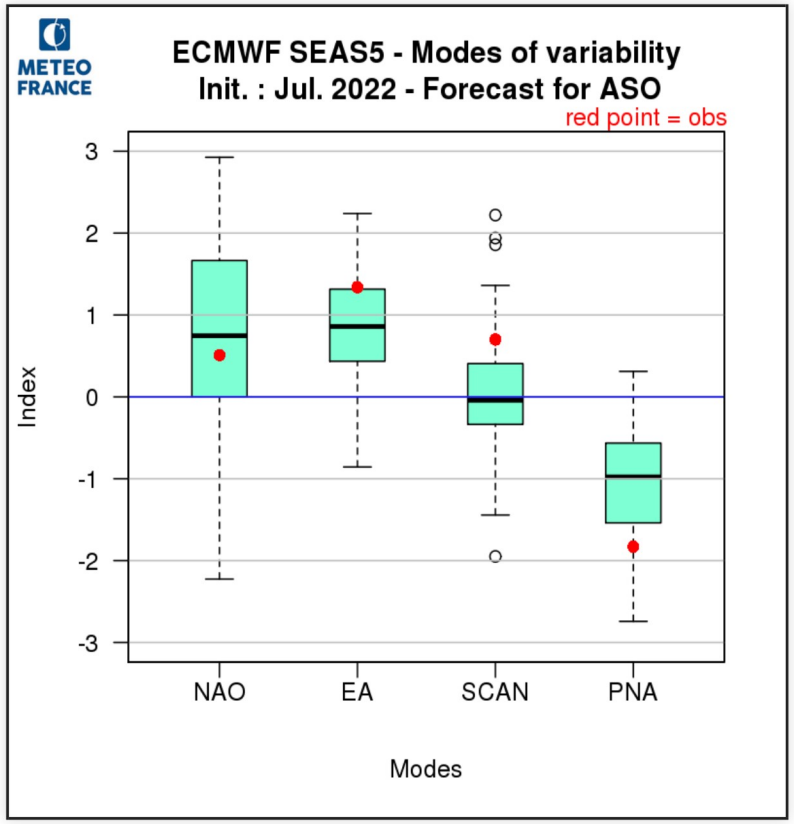




Atmospheric circulation : Modes verification

Same observation as for the previous slide

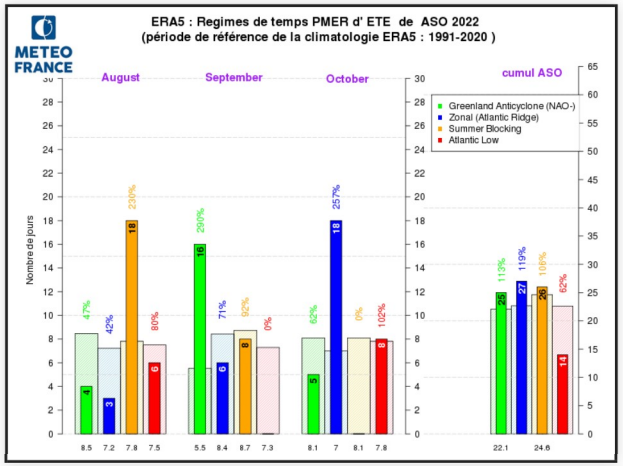


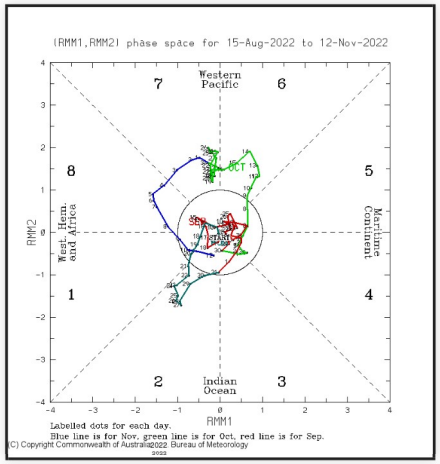


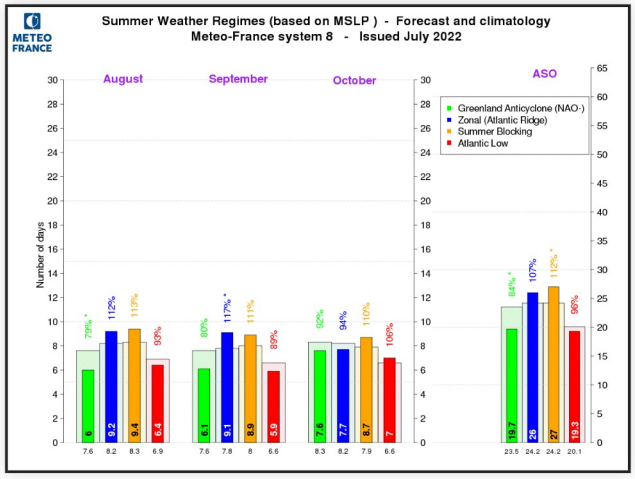
Atmospheric circulation : Summer SLP weather regimes

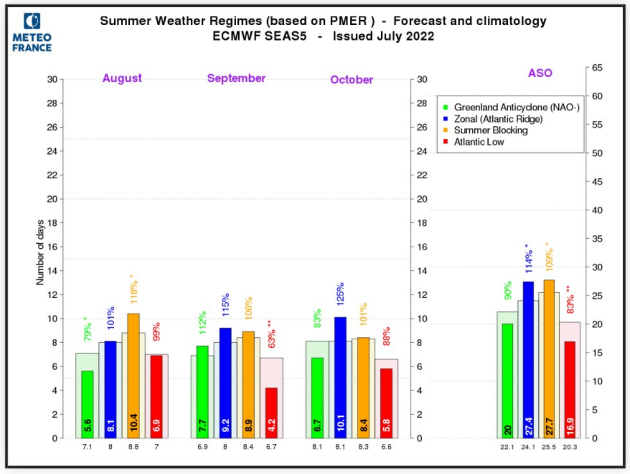
Each month is largely dominated by a different scheme. In the end, all three schemes stand out in the quarterly balance, with a small lead for the zonal regime.

Both models have well highlighted the zonal and blocking regimes, but have underestimated the NAO- regime.





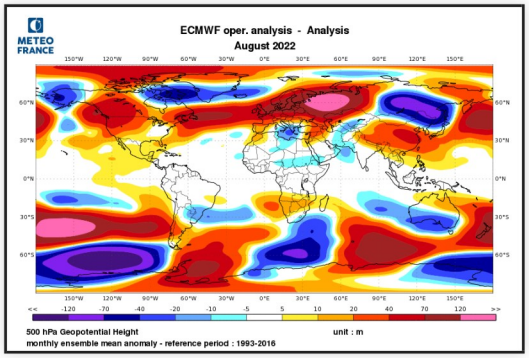


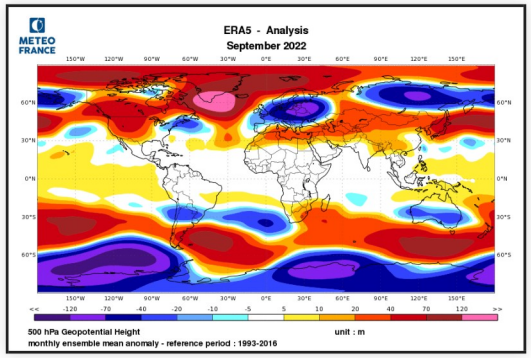


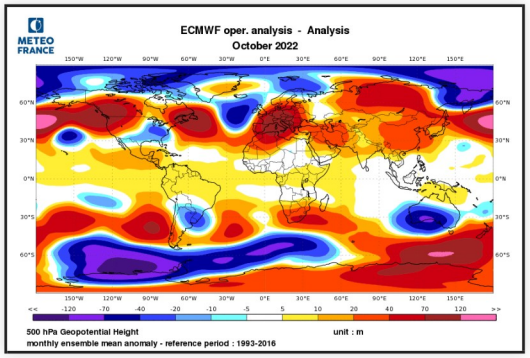
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

Atmospheric circulation : Variability within the quarter

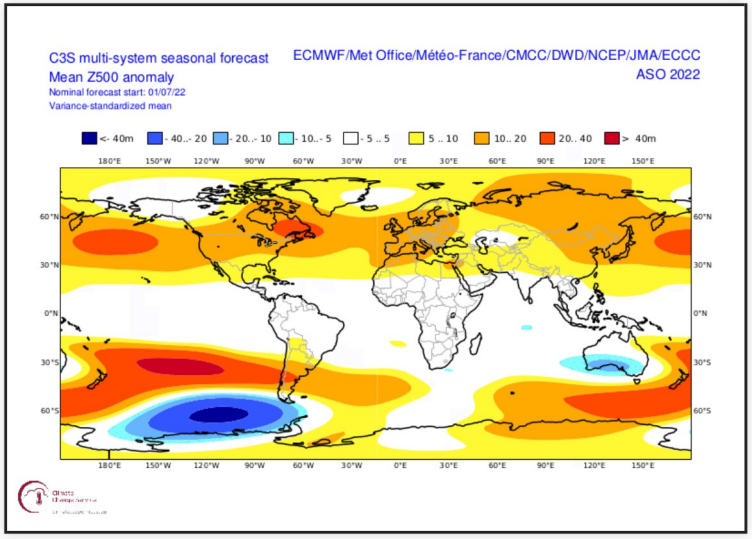
As suggested by the regime analysis, significant inter-monthly variability exists this quarter. Nevertheless, the large-scale quarterly average circulation is well captured by the multi-model.

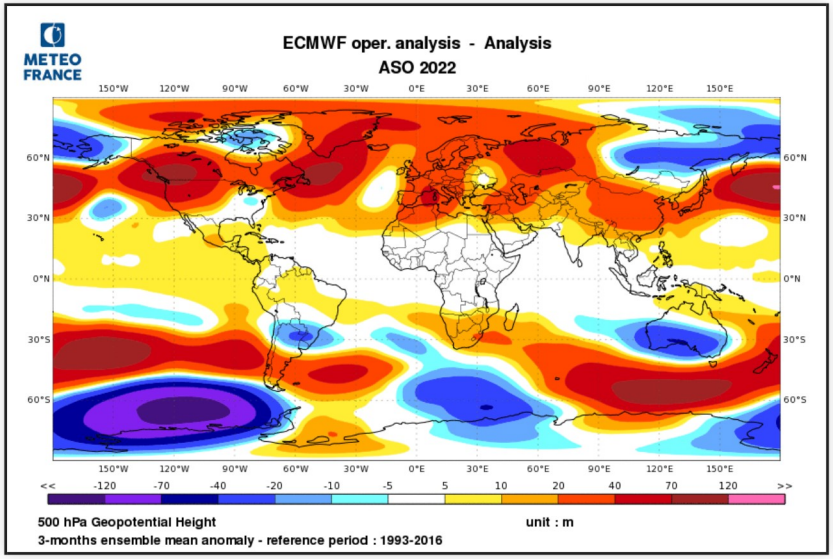






ECMWF analysis : January, February and March 500 geopotential height anomalies





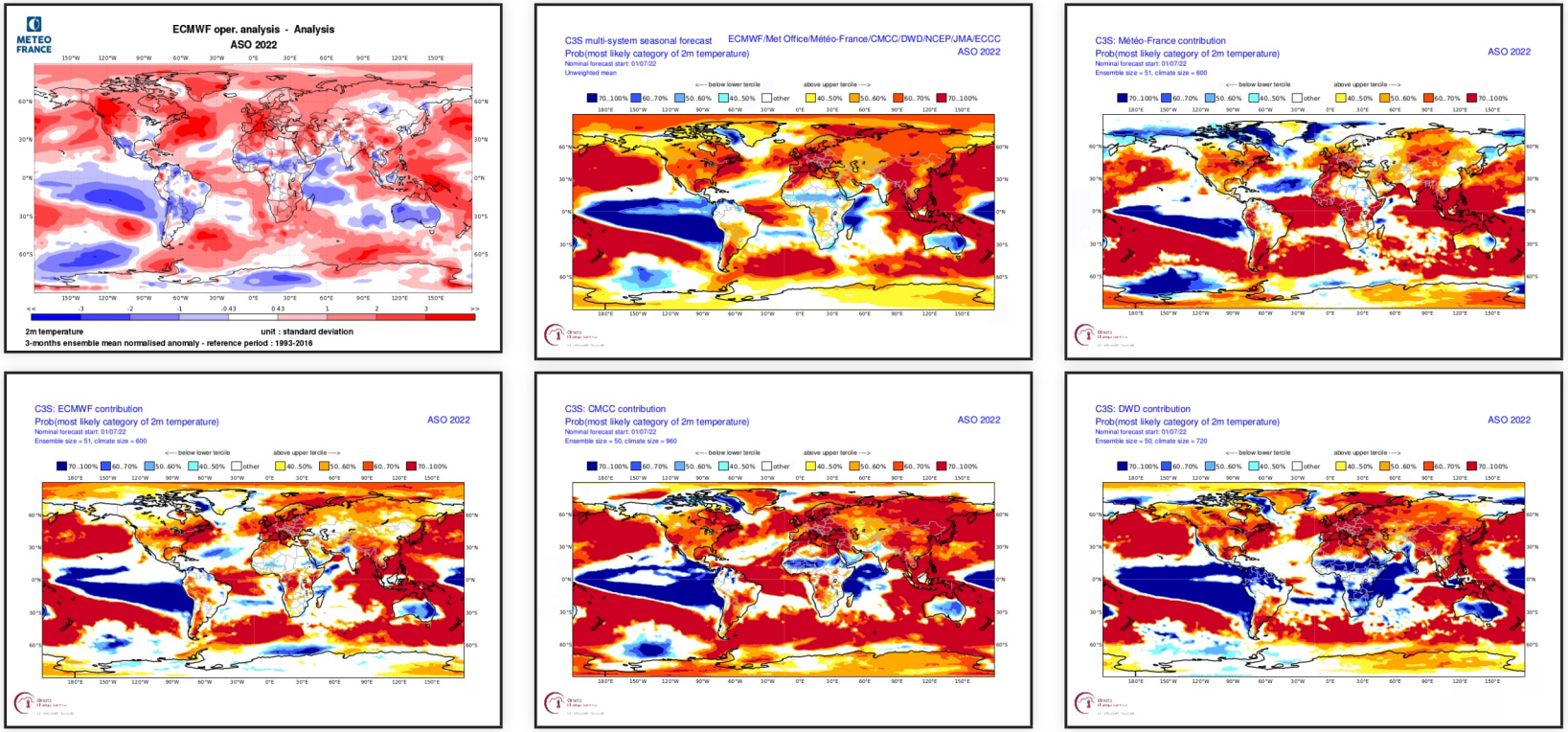
C3S multi-sytem forecast and ECMWF analysis 500 geopotential height anomalies for JFM

Climatic parameters : temperature on the globe

In North America, the warm anomaly over western Canada is poorly positioned, related to the shift in the PNA- pattern.

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

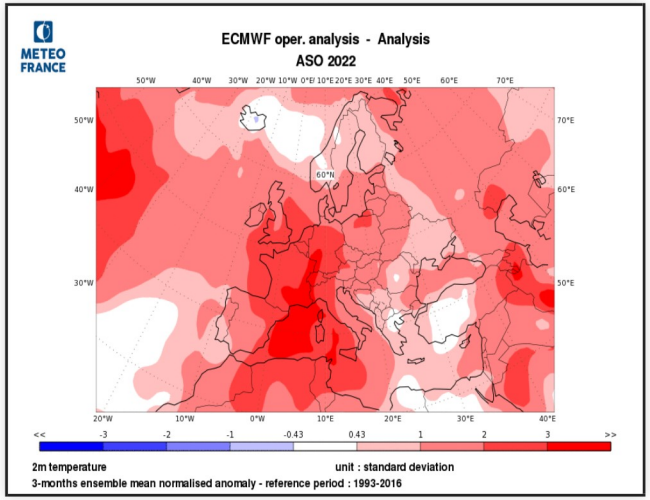
The cold anomaly over Mongolia is not expected either, with the exception of ECMWF-SAE5 which weakly suggests it.

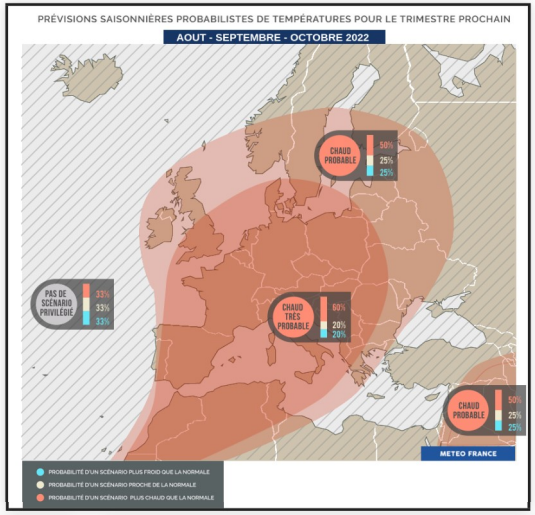


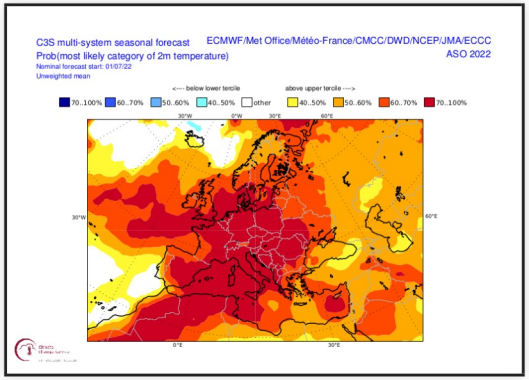
ECMWF analysis top left, forecast for multi-model top center and forecast for MF-S8 top right, ECMWF-SEAS5, CMCC, DWD on the bottom line.

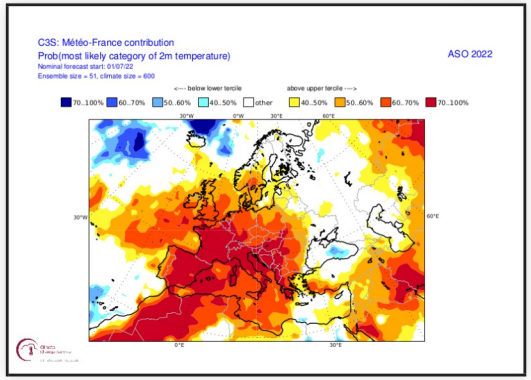
Climatic parameters : temperature over Europe

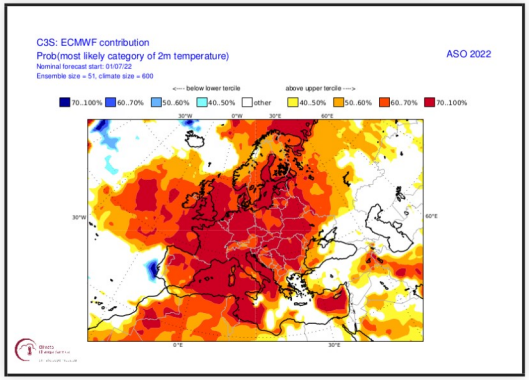
The models and the synthesis map are very close to the analysis.







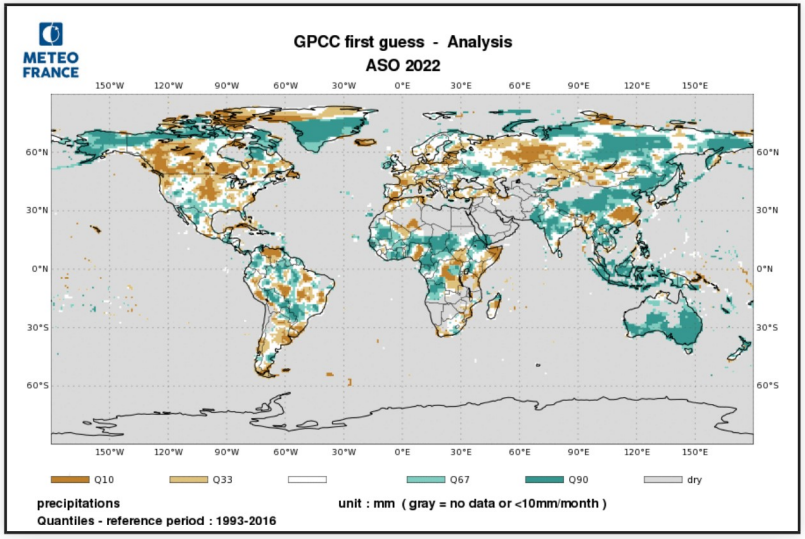


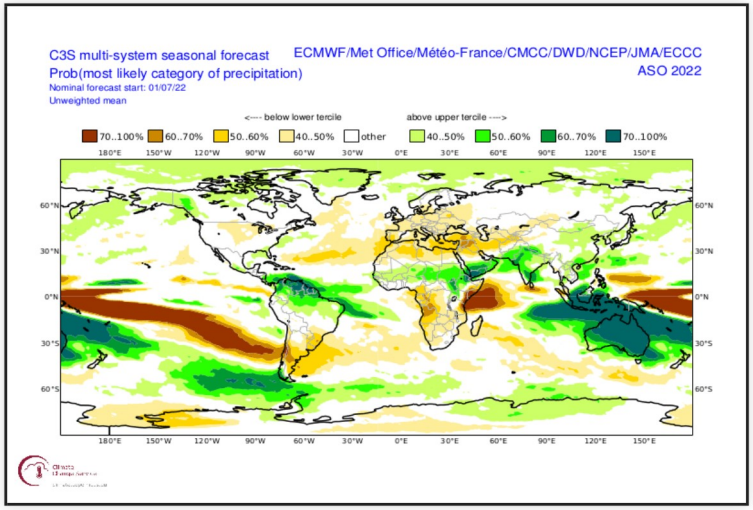


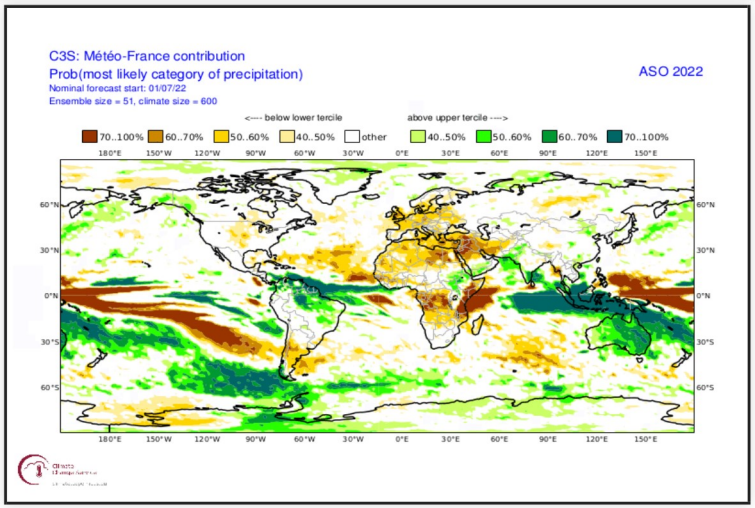
ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system , MF-S8 and SEAS5 on the bottom line.

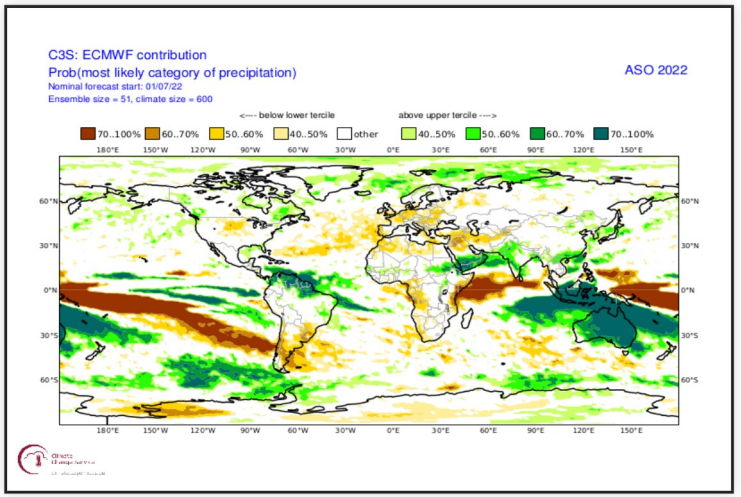
Climatic parameters : Precipitations over the globe

As with the temperatures, the zoning over the American Northwest is not very good. Elsewhere, outside Europe, large anomalies are well seen.





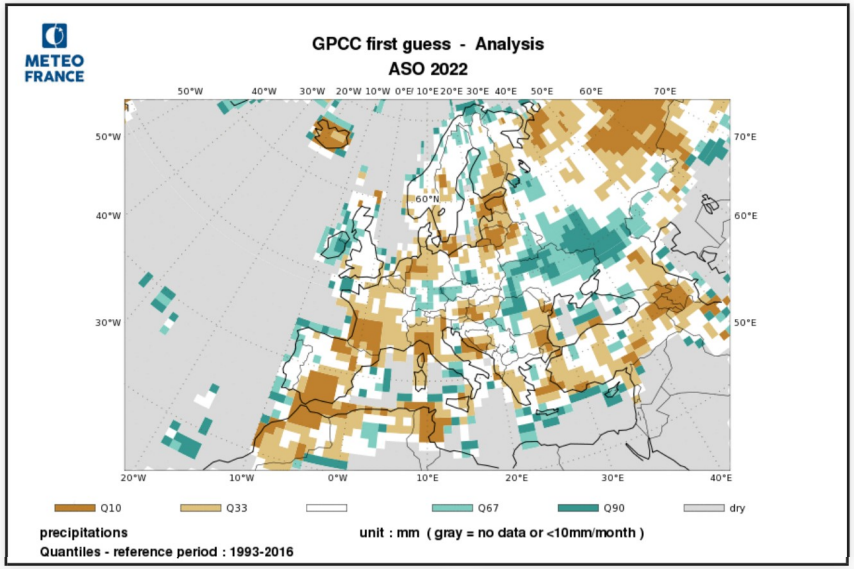


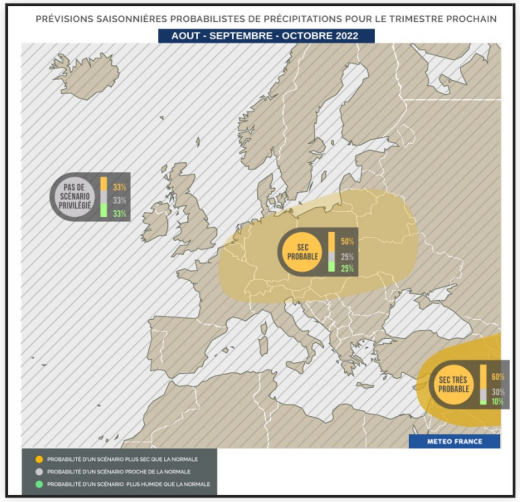


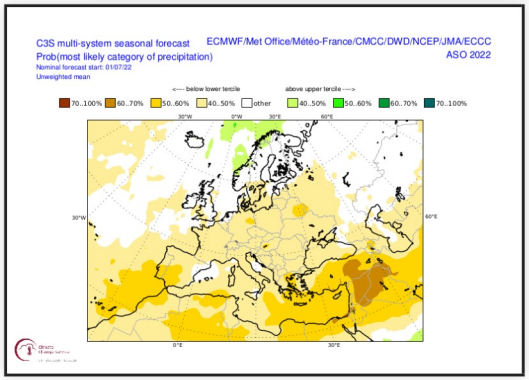
Standardized Precipitation Index analysed by IRI top left, forecast for multi-model top right and MF-S8 and SEAS5 on the bottom line.

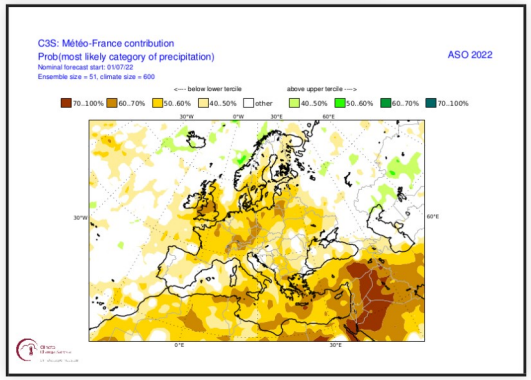
Climatic parameters : Precipitations over Europe

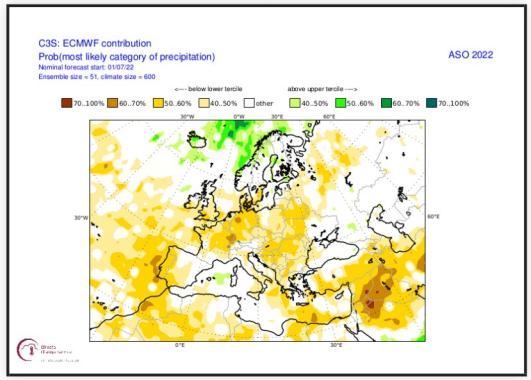
The models suggested a probable drier scenario over most of Europe. The analysis shows a drier than normal scenario over most of Europe, especially from Spain to Denmark and the Baltic States. The area proposed on the synthesis map is too far eastward.











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 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 : Very good 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 clearly visible in the analysis, have been more or less anticipated by the models.

Z500 : The forecast is generally correct in the northern hemisphere, in particular on Europe and North Atlantic

3) **Climatic parameters over Europe :**

Temperatures :The forecast scenario, warmer than normal over Western Europe, is very close to the analysis.

Precipitations : The drier than normal scenario was expected from eastern France to eastern Europe. On analysis, the driest areas are located further west, from Spain to the Netherlands.