VERIFICATION BULLETIN

MARCH - APRIL -MAY 2022

Table of Content

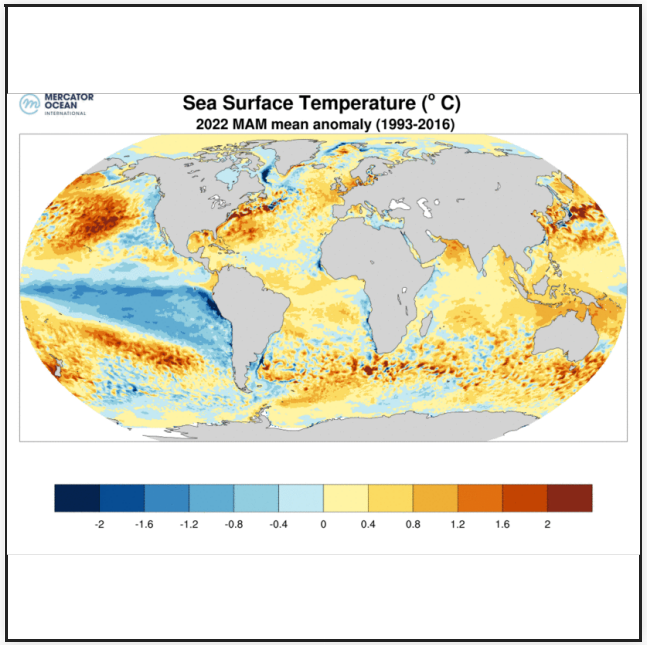
Introduction : Objective

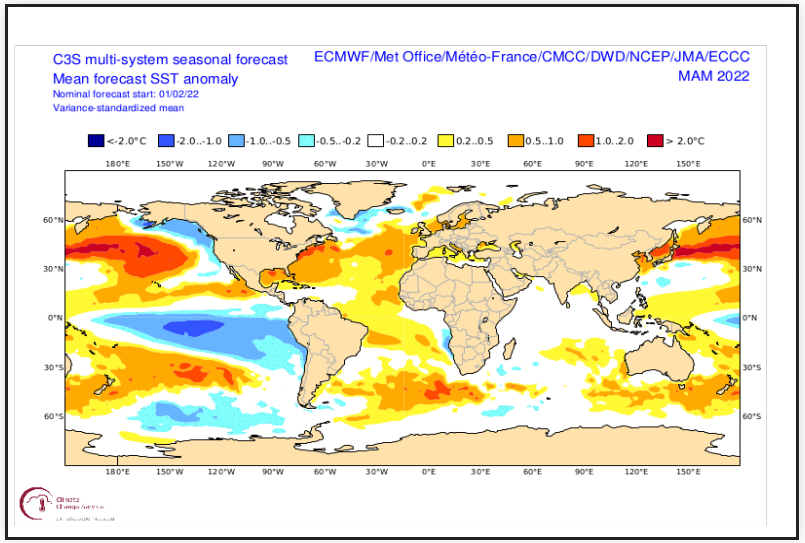
- **The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean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

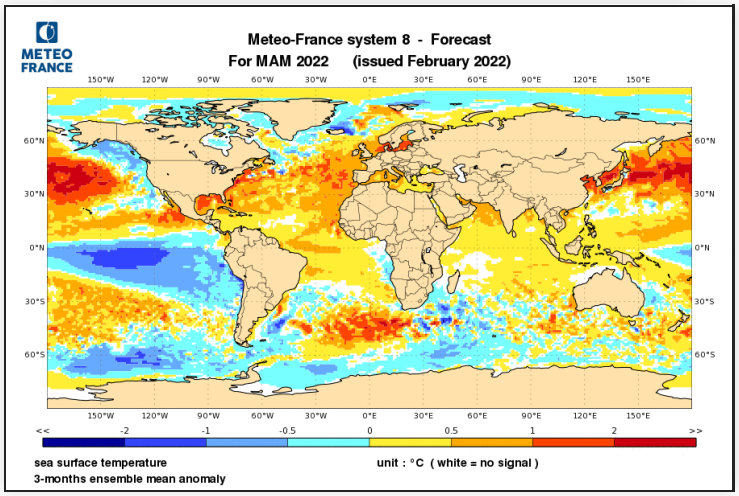
Oceans : surface temperature anomalies

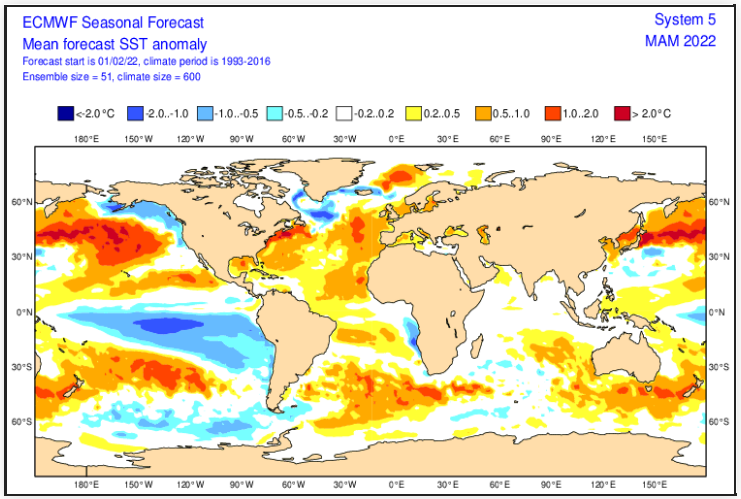
The main patterns were well predicted over the Pacific Ocean (La Nina and PDO-).

In the North Atalntic, the wide warm anomaly was correctly forecasted as well as positive values near the equator and the colb clob south of Greenland. On the other hand cold anomalies near west african coasts weren't anticipated.







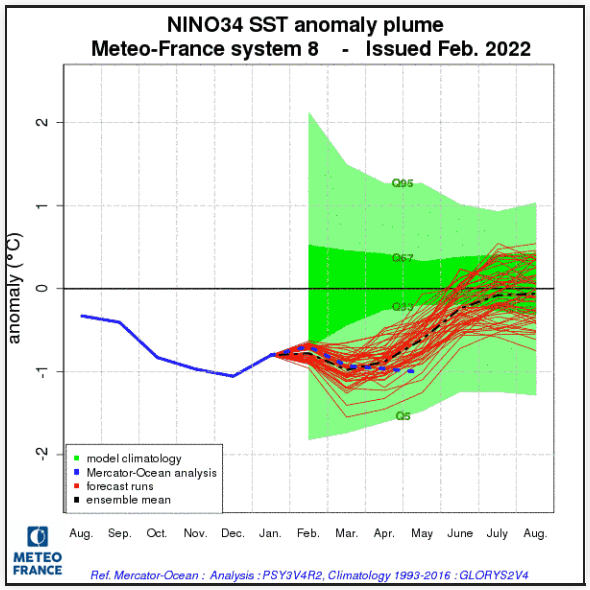


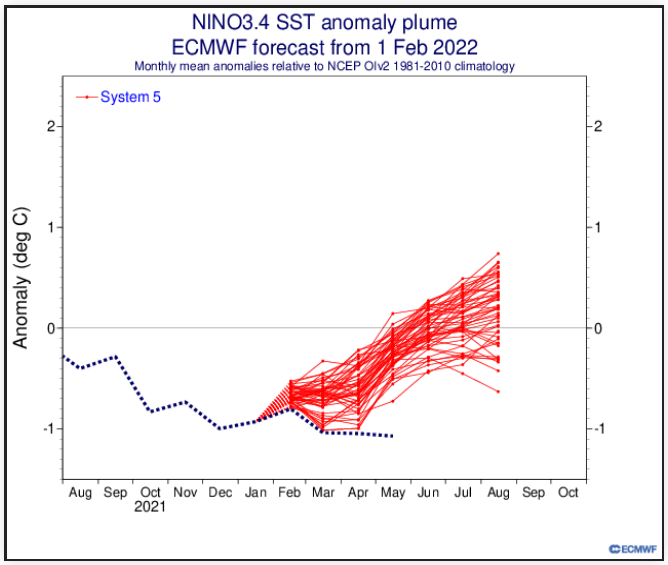
SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

Oceans : ENSO

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

At seasonal scale, MF8 correctly forecasted NINO3.4 index and his dynamic. ECMWF-SEAS5 reduces its anomaly over the quarter while it remained stable. In May, the observed value is out of the spread of ECMWF-SEAS5 forecast.

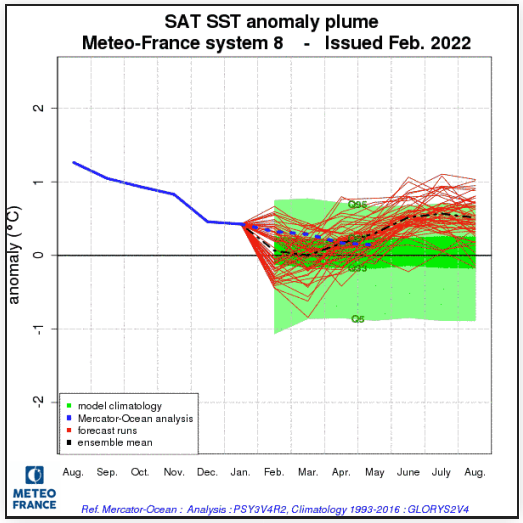


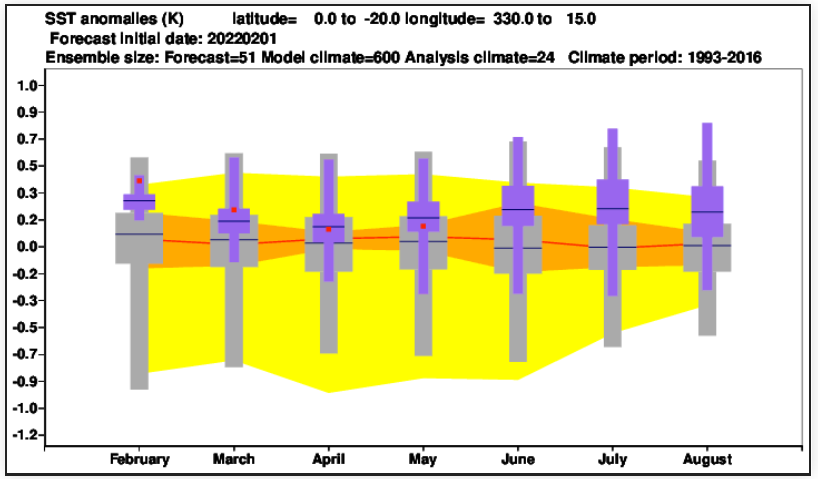


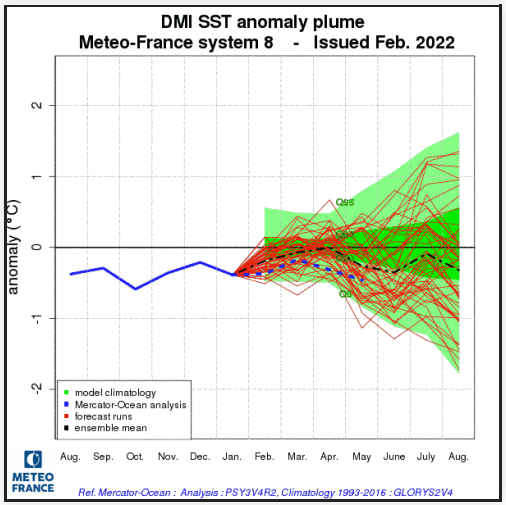
Oceans : tropical Atlantic and Indian Ocean index

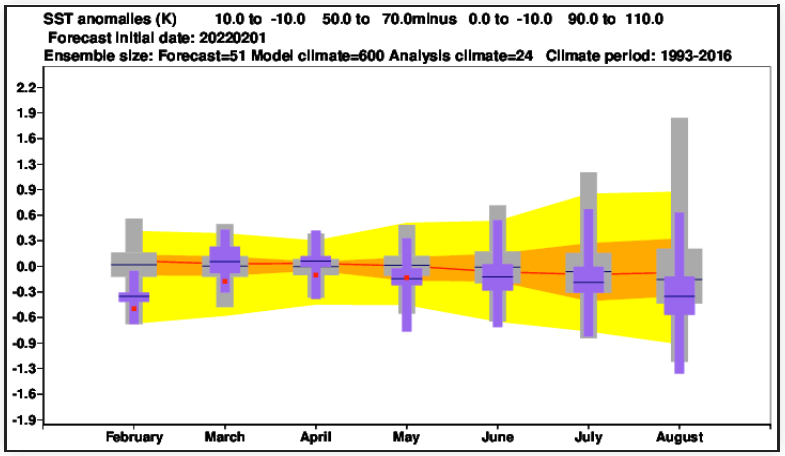
SAT : little differnce between forecast and observation.

DMI : Analysis in the lower tercile of the climatology while the forecast are close to the climatology





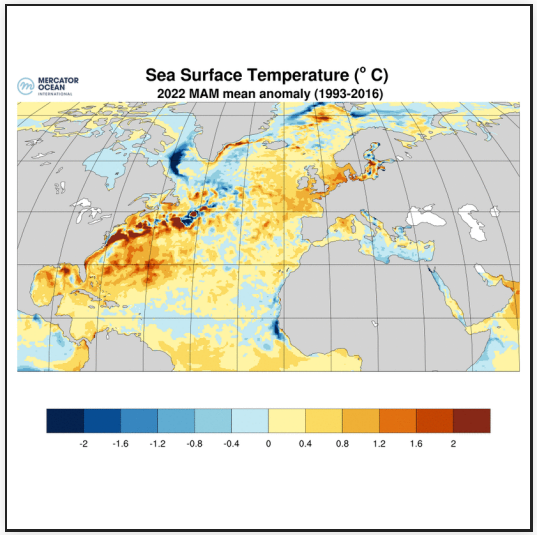


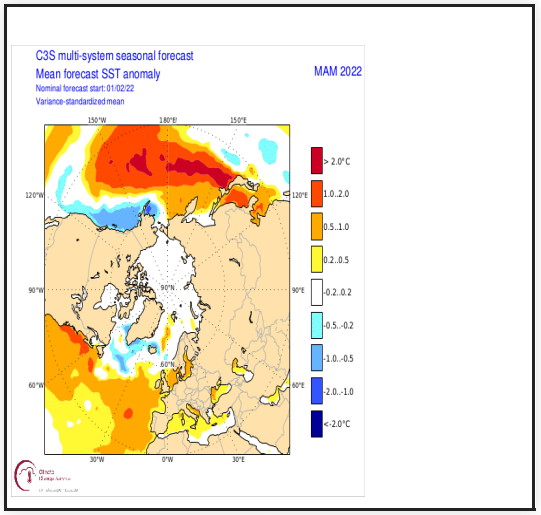


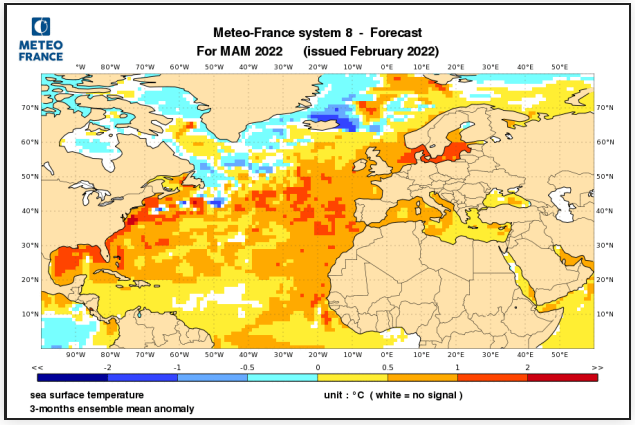
Oceans : North Atlantic SST

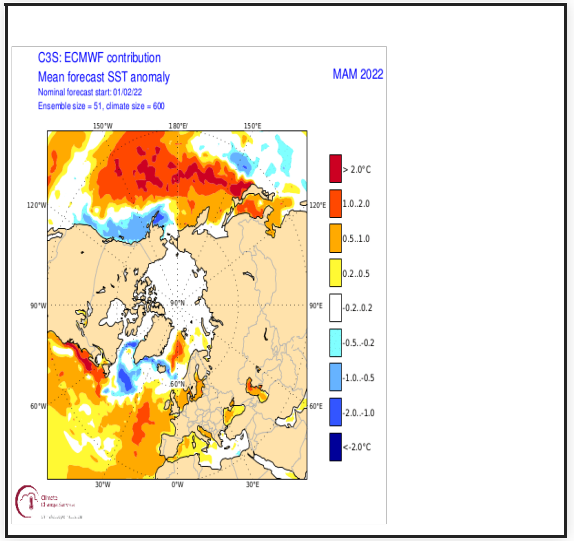
The global pattern is correct over North Atlantic (wide warm anomaly) except near the coasts of West Africa where the cold anomaly was not expected.

The cold anomaly observed in the Eastern Mediterranean Sea was not correctly forecasted by the models.







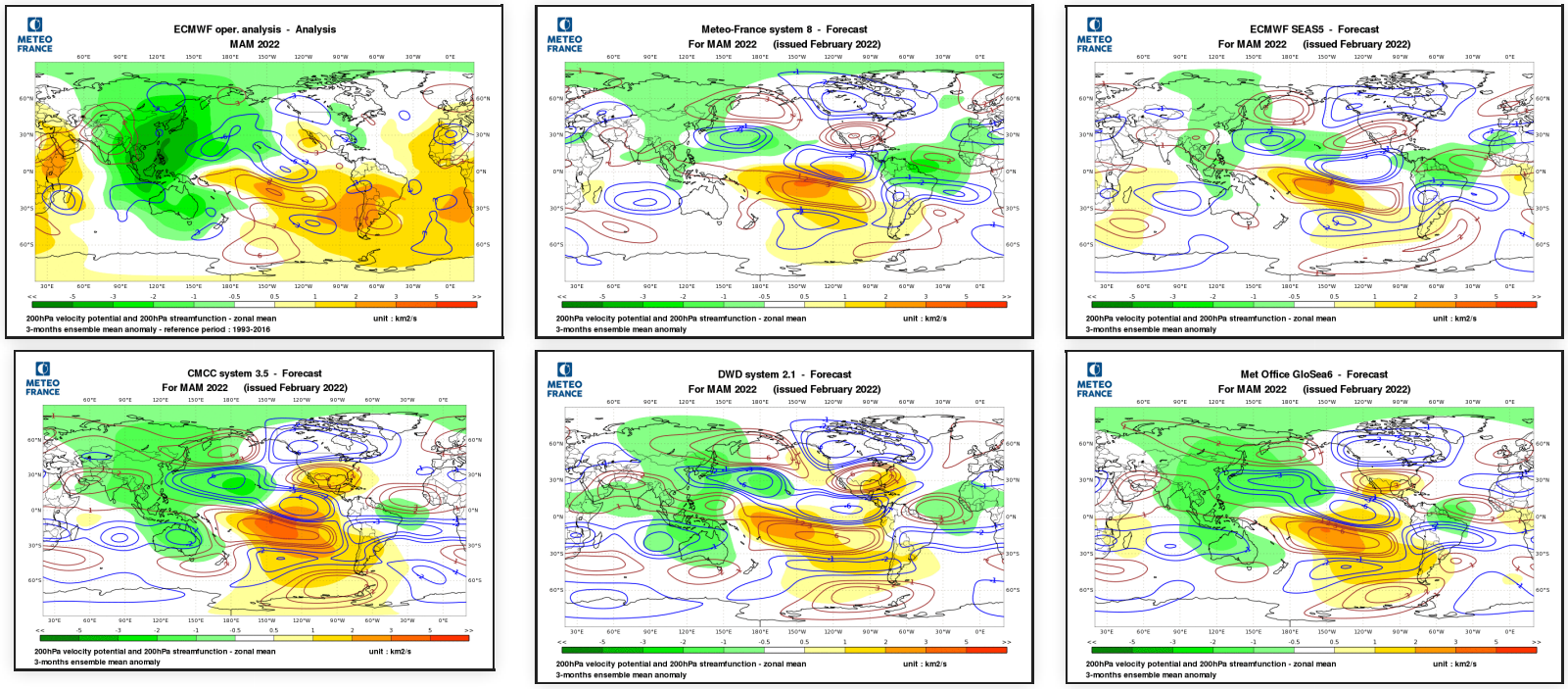


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : The main effect of the "La Niña" phenomenon is clearly visible with a downward anomaly over the central and east Pacific Ocean, it was well forecasted by all the models. The dipole formed by the negative anomaly centred over the maritime continent, associated with the downward anomaly over East Africa, is linked to a negative IOD situation. This dipole was underestimated by the models, as was underestimated the negative IOD. Over equatorial Atlantic and West Africa, the pattern was not correctly forecasted, but the anomaly gradient (relatively weaker VP anomalies in the west compared to the east) was suggested by several models.

SF : On the analysis we find weak traces of the teleconnections proposed by the models from North Pacific or North Atlantic. The positive anomaly centred on India was suggested by the models.

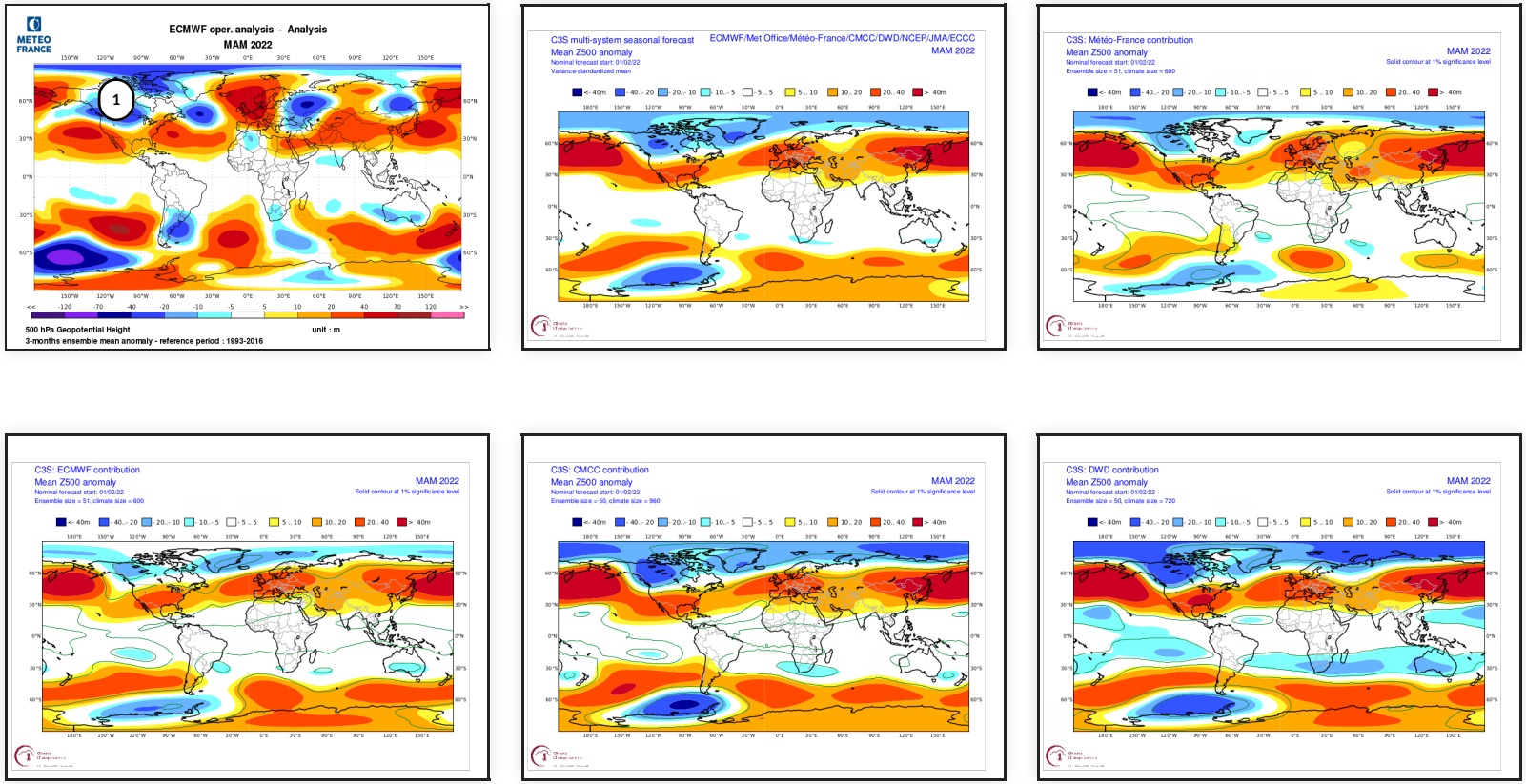


ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

Atmospheric circulation : 500hPa Geopotential height

North America : The PNA- pattern linked to La Nina.

Over Europe/Atlantic the large-scale signal is quite well forecasted with a positive anomaly from the American coasts to Europe. This signal is disturbed by synoptic elements (minimum off Newfoundland, north of the Caspian and east of Russia) at the origin of meridian circulations.



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

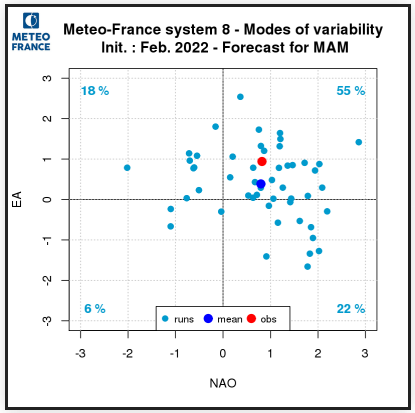
1 - Look like PNA -

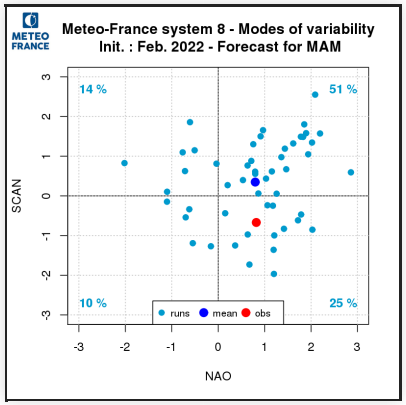
Atmospheric circulation : Modes of variability

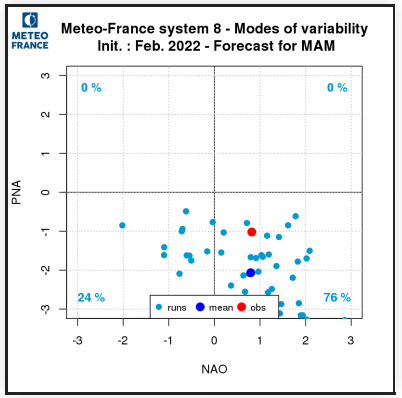
For both models, the most probable scenario was "positive NAO and positive EA" with a higher confidence for NAO than EA. This was a good forecast.

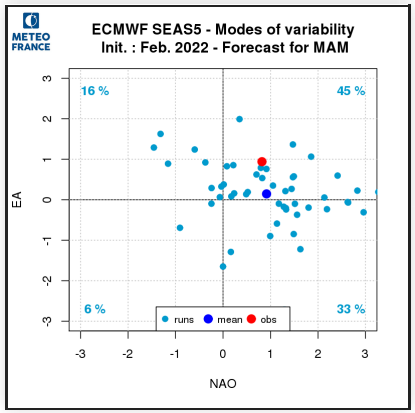
The negative SCAN was not predicted.

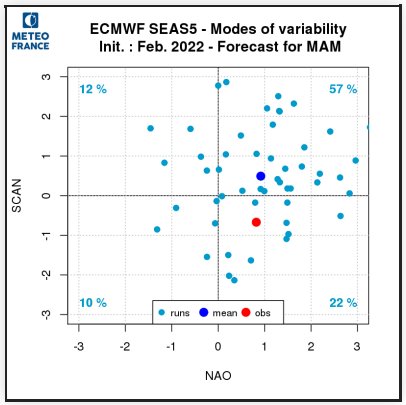
The negative PNA value was well forecasted

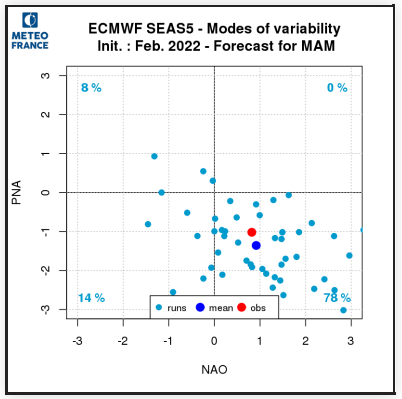






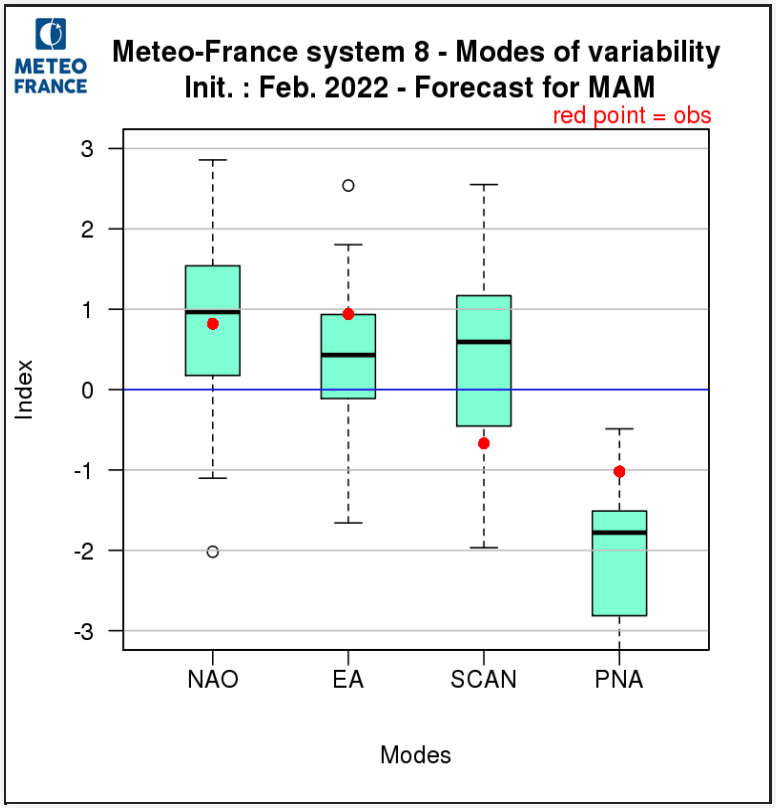


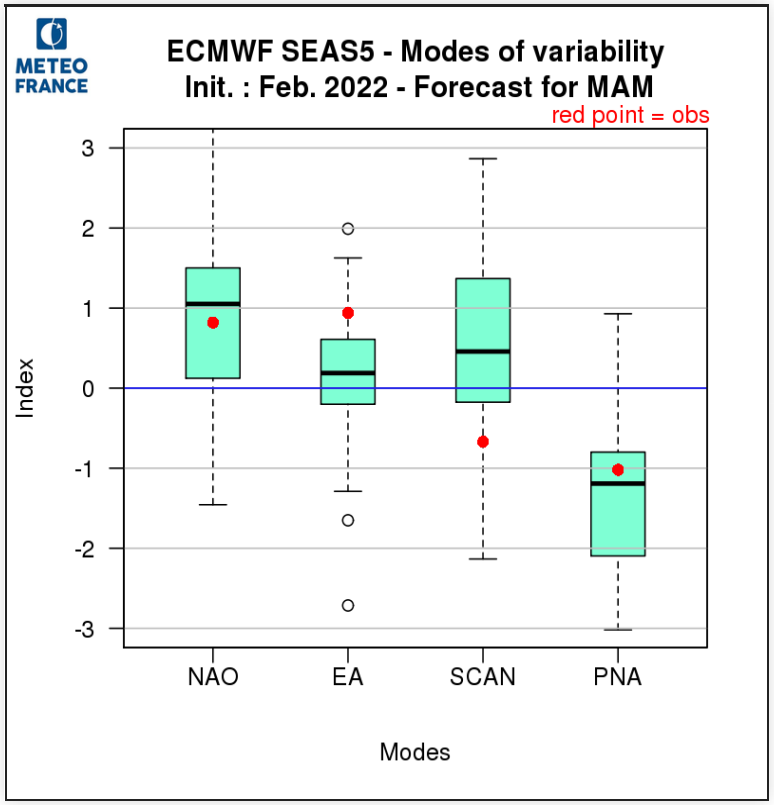




Atmospheric circulation : Modes verification

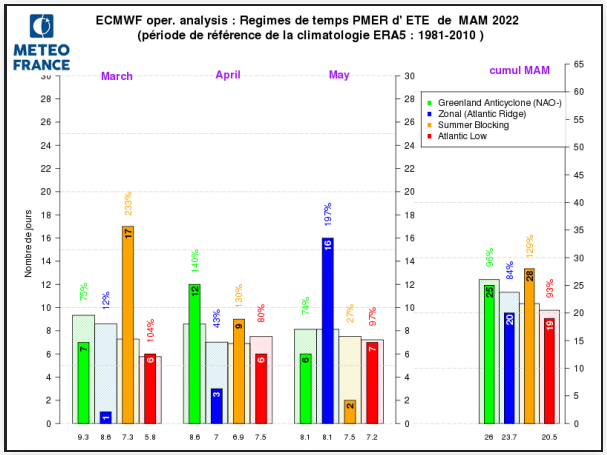
Same observation as for the previous slide

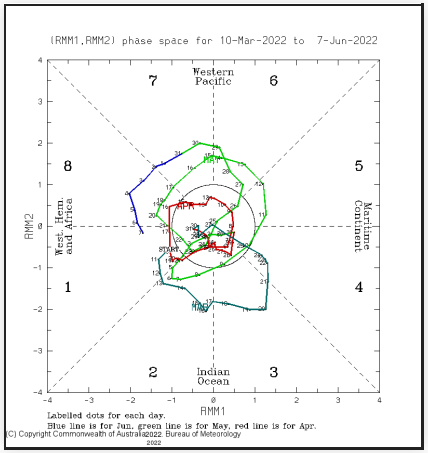


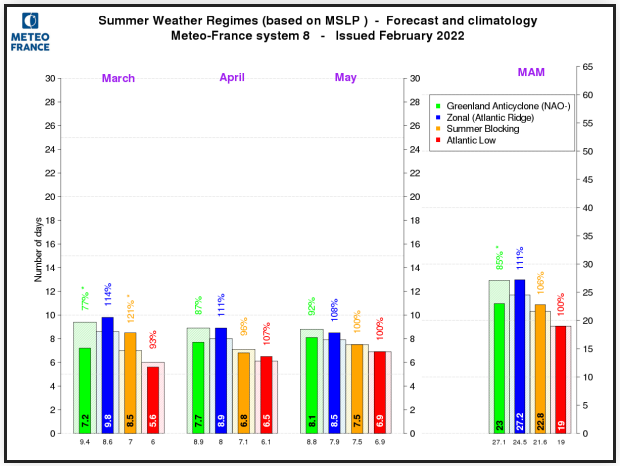


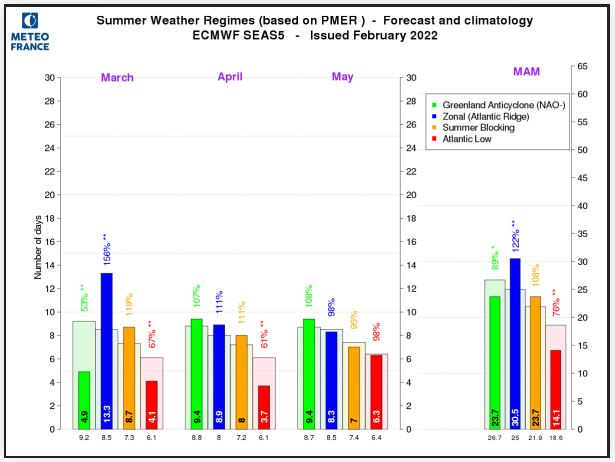
Atmospheric circulation : Summer SLP weather regimes

Strong intra-seasonal variability. At seasonal scale, summer blocking is more frequent while zonal is rarer than climatology what was not predicted by the models.





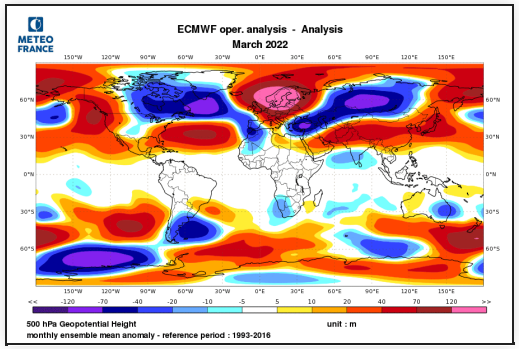


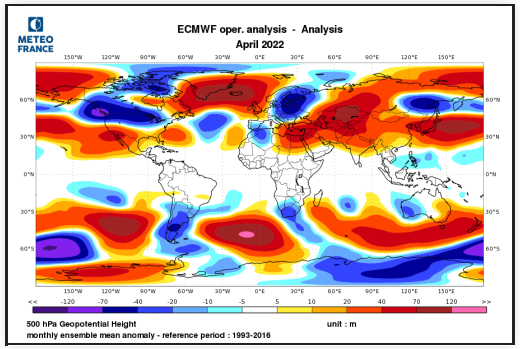


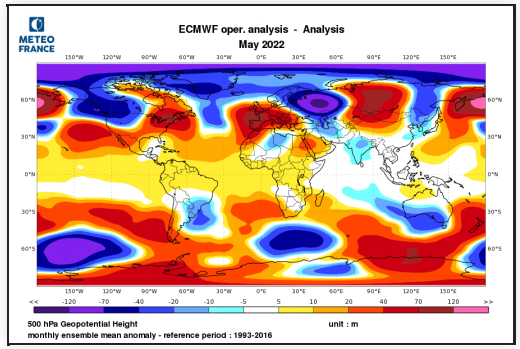
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

Atmospheric circulation : Variability within the quarter

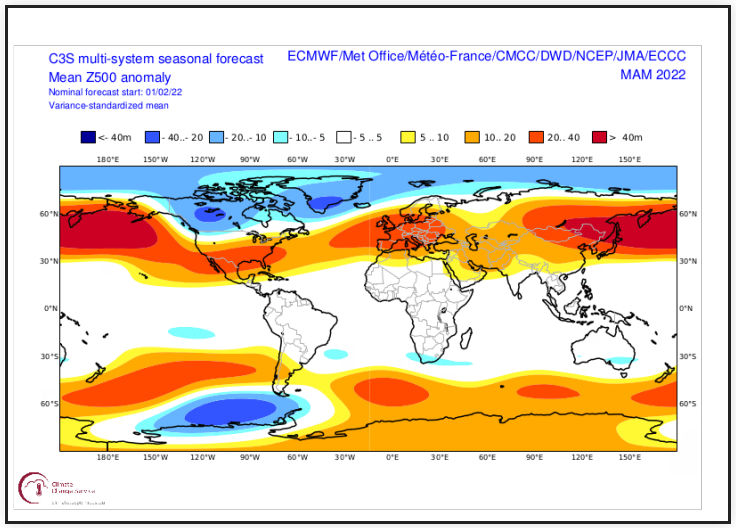
Important intra-seasonal variaibility over north Atlantic and Eurasia. Nevertheless the averaged circulation on a very large scale over the quarter was rather well predicted by the multi-model.

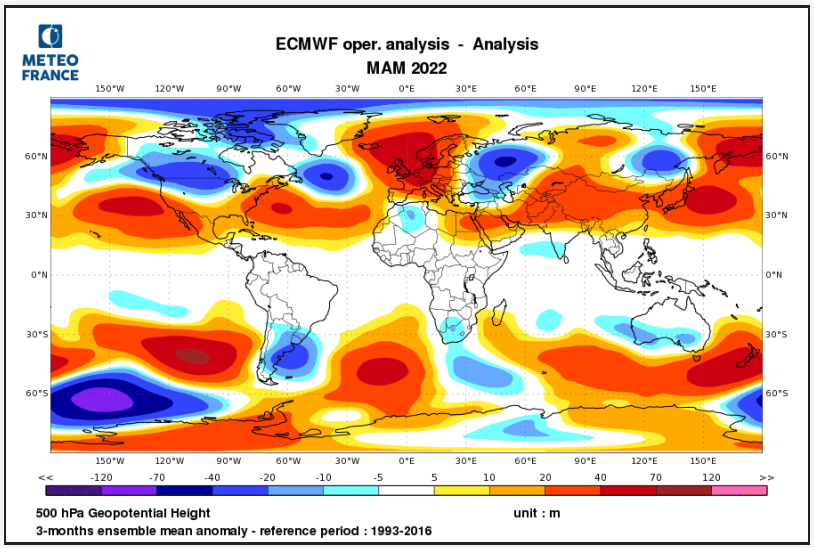






ECMWF analysis : January, February and March 500 geopotential height anomalies

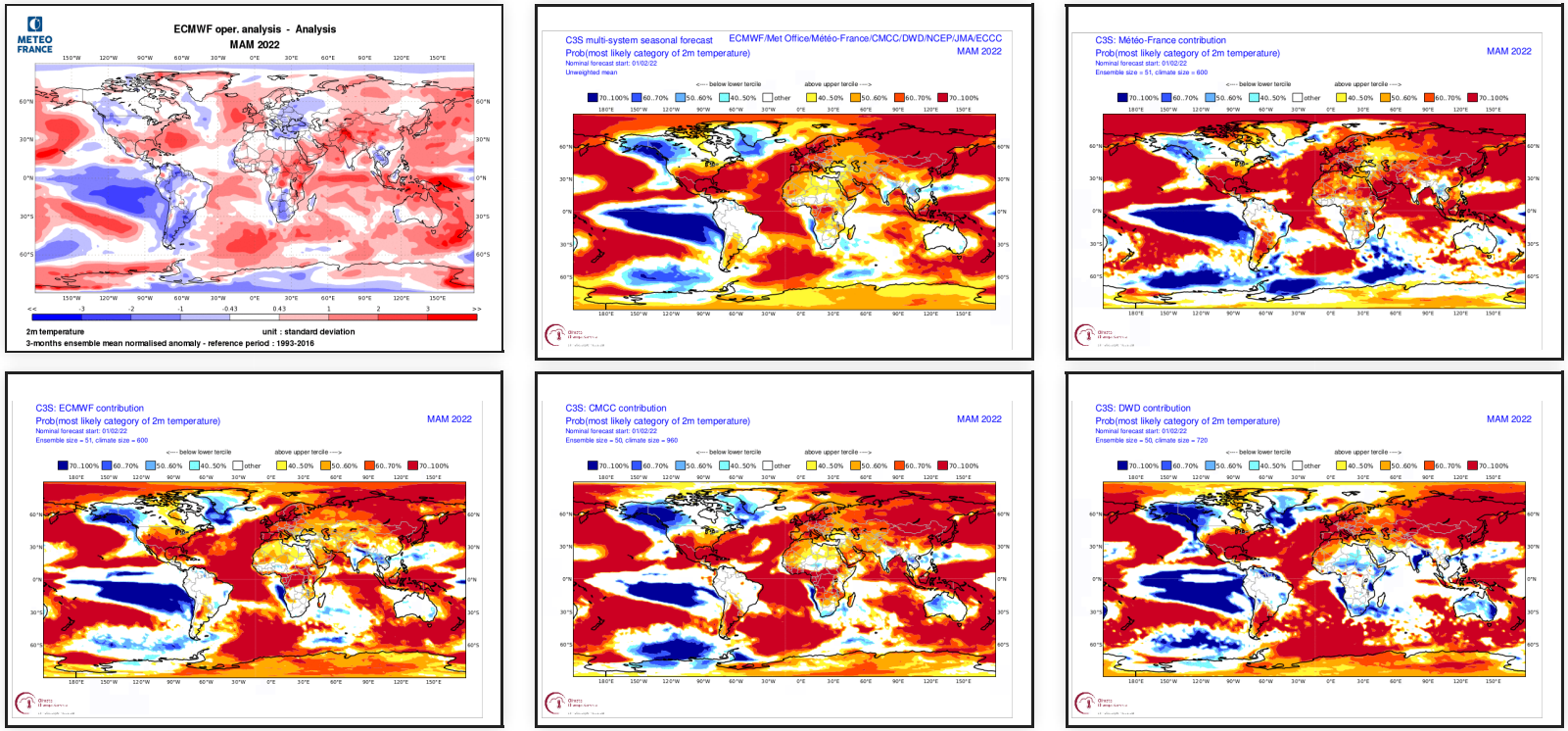




C3S multi-sytem forecast and ECMWF analysis 500 geopotential height anomalies for JFM

Climatic parameters : temperature on the globe

Inland, looking at C3S multi-model in the north hemisphere, the areas with the strongest probabilities (Canada, USA, east Russia) were globally well forecasted.

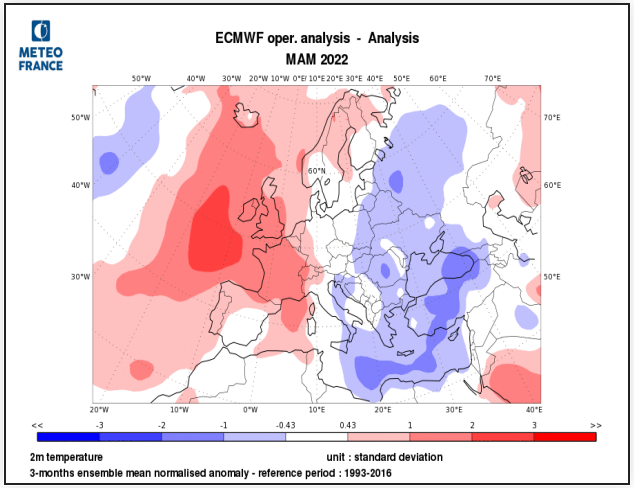


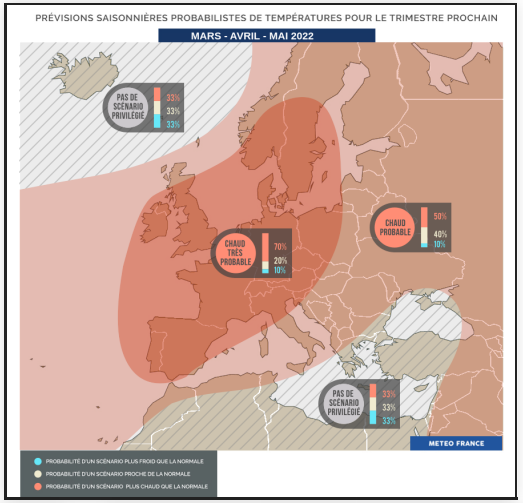
ECMWF analysis top left, forecast for multi-model top center and forecast for MF-S8 top right, ECMWF-SEAS5, CMCC, DWD on the bottom line.

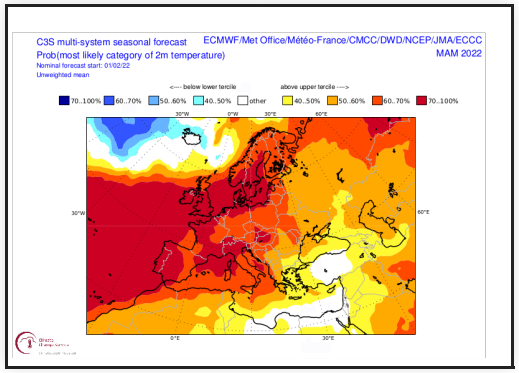
Climatic parameters : temperature over Europe

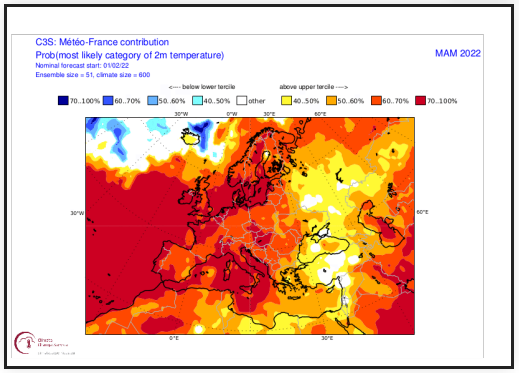
In the area with highest probabilities for the warm scenario (over western Europe), we observed warmer than normal conditions.

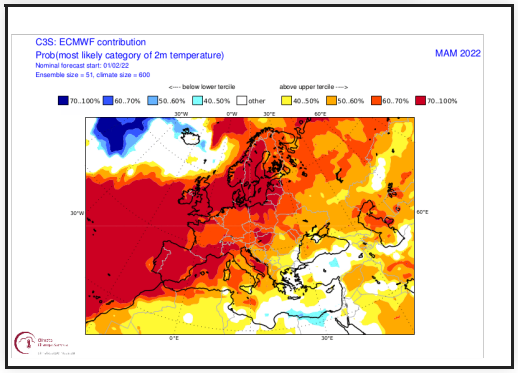
The cold pattern over eastern Europe wasn't predicted by the models in connection with the meridian circulation not anticipated.







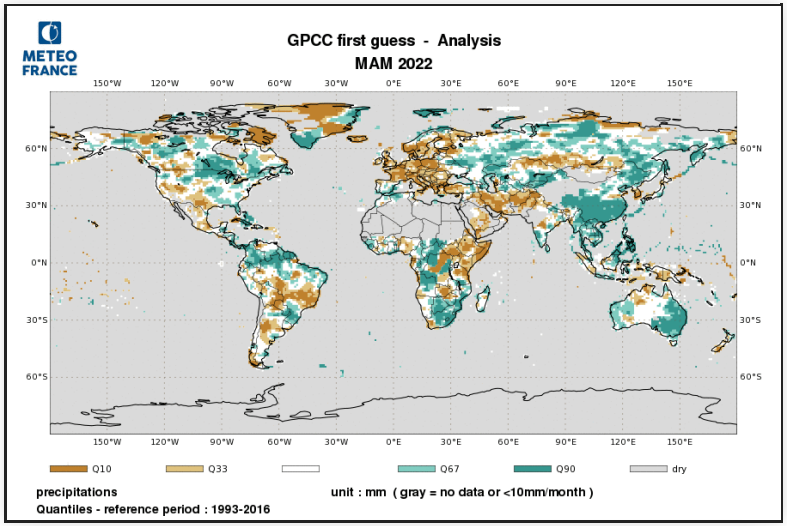


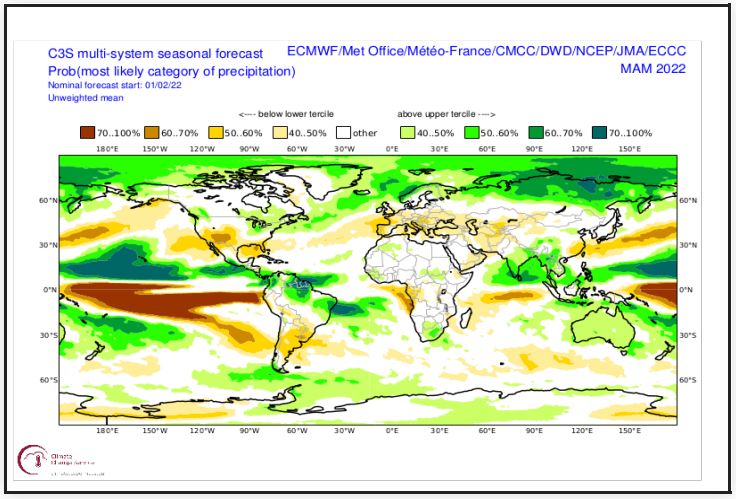


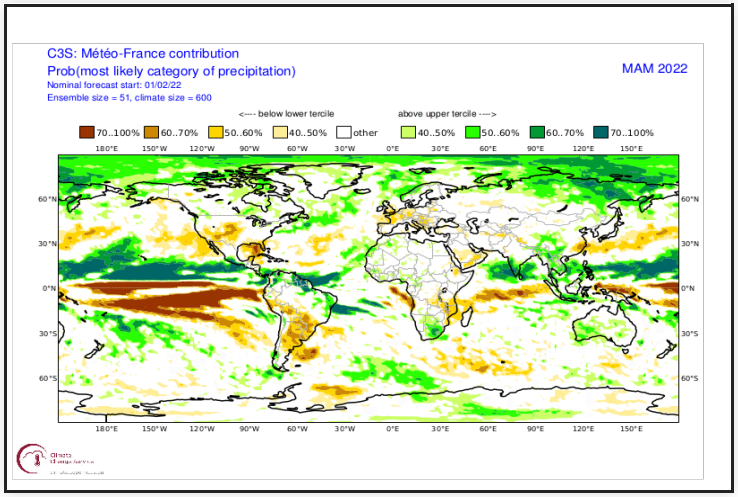
ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system , MF-S8 and SEAS5 on the bottom line.

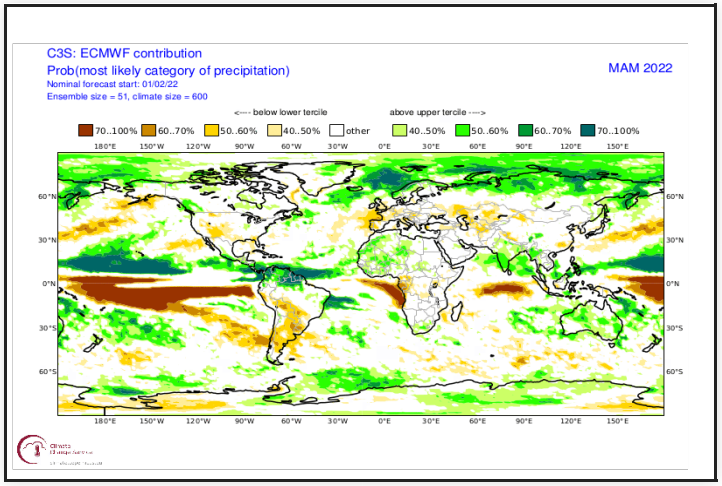
Climatic parameters : Precipitations over the globe

In the North hemisphere, good prediction on North America (wet dipole eastern Canada and dry over western United states), on Europe (dry signal) and over north-east Russia (wet signal)







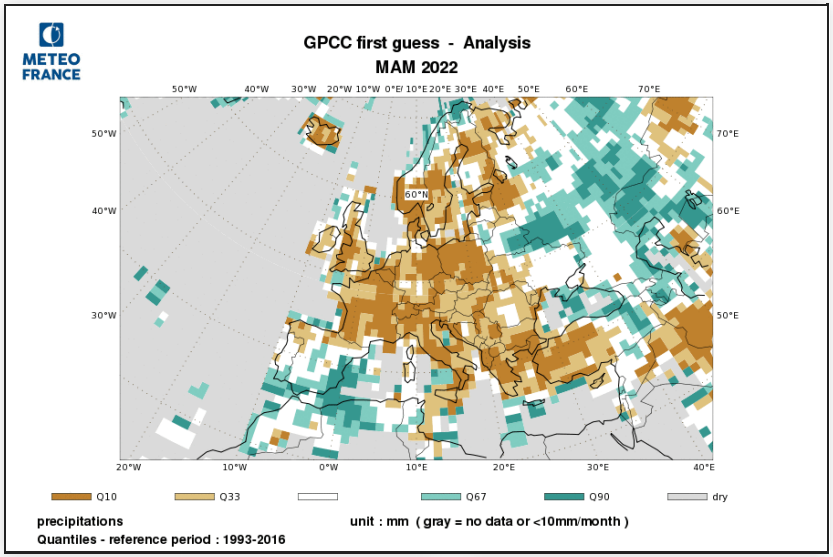


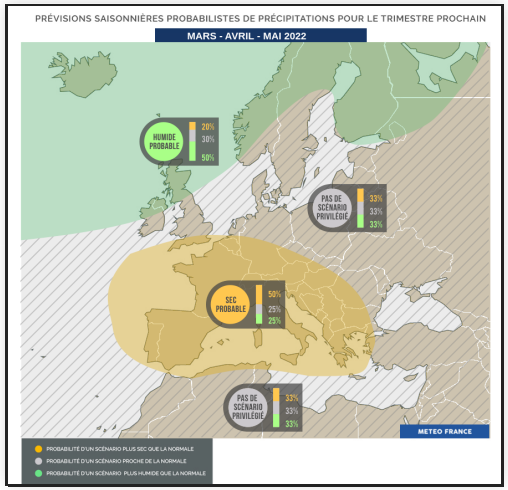
Standardized Precipitation Index analysed by IRI top left, forecast for multi-model top right and MF-S8 and SEAS5 on the bottom line.

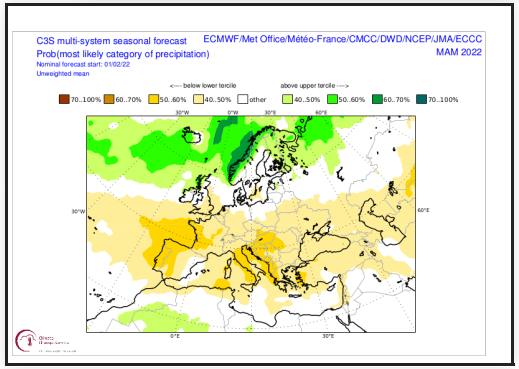
Climatic parameters : Precipitations over Europe

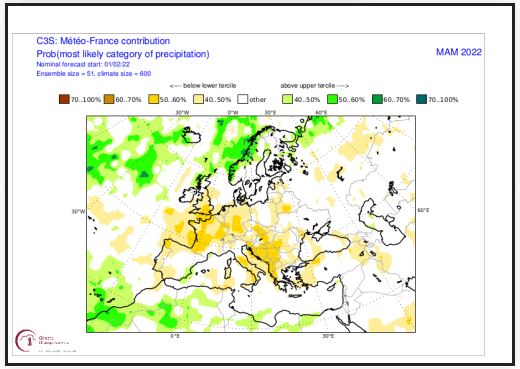
The dry conditions from west to central Europe were globally well predicted.

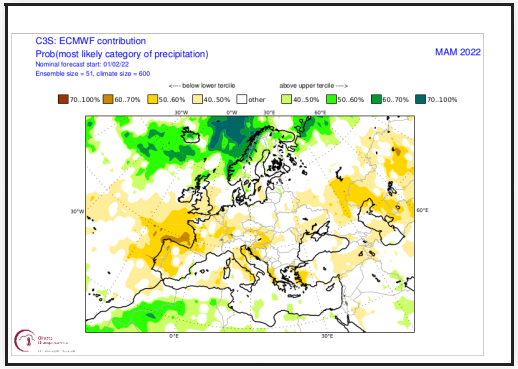
The wet conditions privileged by models over Scandinavia was not really observed.











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 MAM 2022

1) **Oceans :**

Good forecasts of the main patterns in the Pacific Ocean (La Niña and PDO-), but note that the dynamic of ENSO (reinforcement of la Niña) was not forecasted by the models .

In tropical north Atlantic and in tropical north Indian Ocean (for the IOD), some anomaly patterns were not correctly forecasted by models.

2) **Large scale atmospheric circulation :**

VP 200 hPa : over the Pacific and the Indian oceans the main patterns were quite well forecasted. Over the Atlantic and Africa, the anomaly patterns observed were complex, however models were able to forecast the gradients (especially the east-west gradient over the Atlantic).

SF 200 hPa : globally, a good forecast over the north hemisphere. The PNA teleconnexion related to La Niña . The teleconnexion from tropical Atlantic to the iberian peninsula was suggested by the models.

Z500 : good forecast on large scale on the northern hemisphere despite unpredictable synopic structures.

3) **Climatic parameters over Europe :**

Temperatures : Good forecasts of warm anomalies on western Europe. Cold anomalies over eastern Europe were not forecasted.

Precipitations : The dry conditions from west to central Europe were well predicted.