

VERIFICATION BULLETIN

DECEMBER - JANUARY - FEBRUARY 2022-23

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. Winter 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 DJF 2022-2023	18

Introduction : Objective

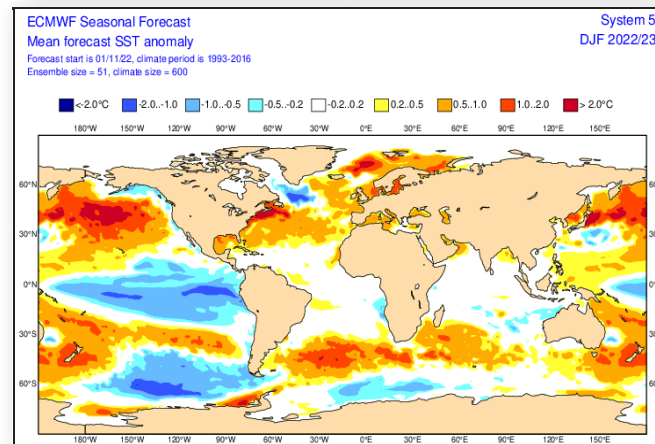
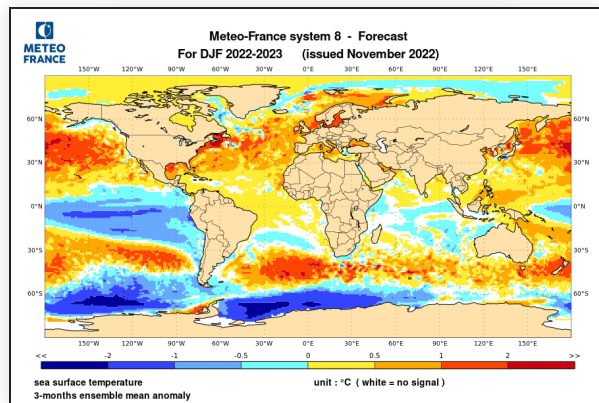
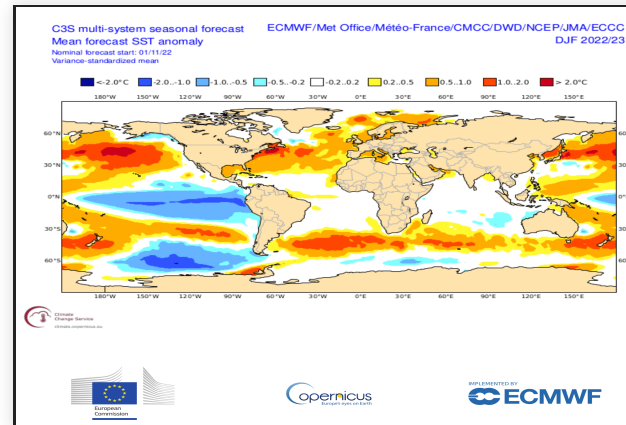
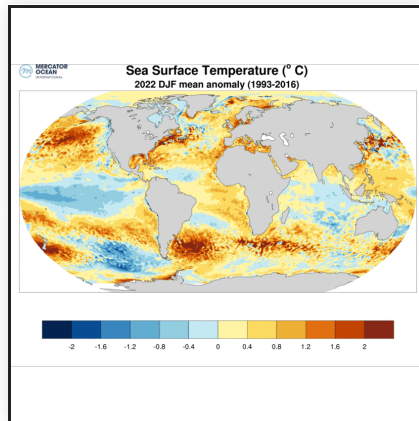
- The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean 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 "la Niña" pattern is still present and well seen by the models, even if they are too cold near the South American coast. The PDO- pattern is also well predicted by the models in the Northern Hemisphere.

In the Indian Ocean, the signal is weak in the analysis as for the models.

In the South Atlantic and up to the Equator, along the African coast, a warm anomaly is clearly visible in the analysis. It is predicted, but in an attenuated way, only by MF S8. Further north, differences in the location of anomalies are observed.

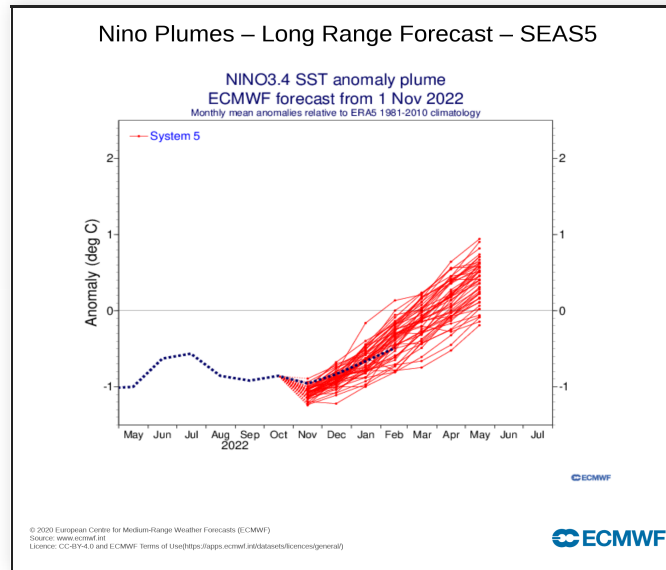
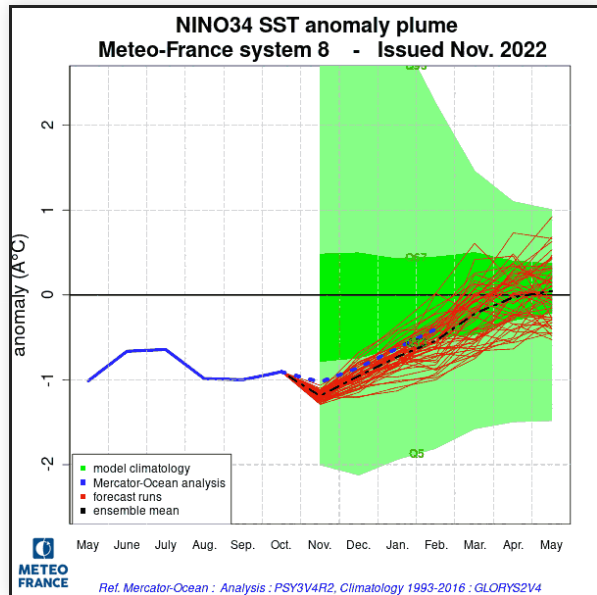


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and SEAS5 (bottom right)

Oceans : ENSO

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

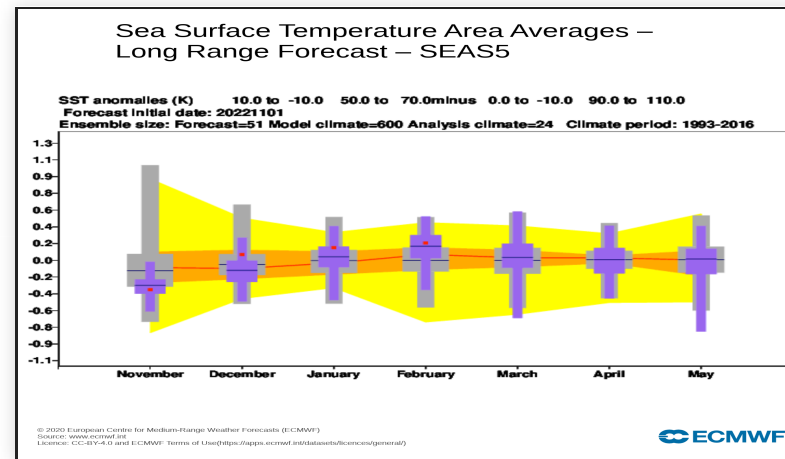
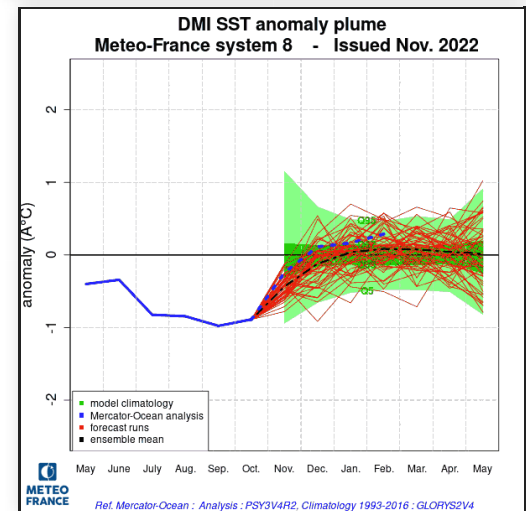
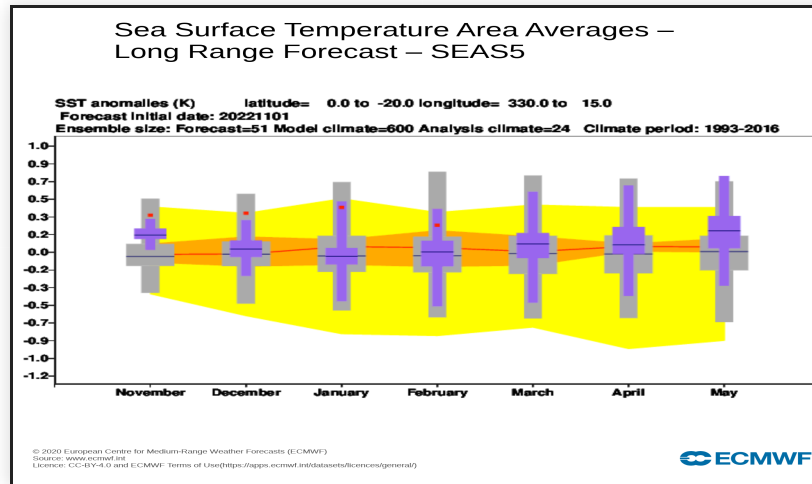
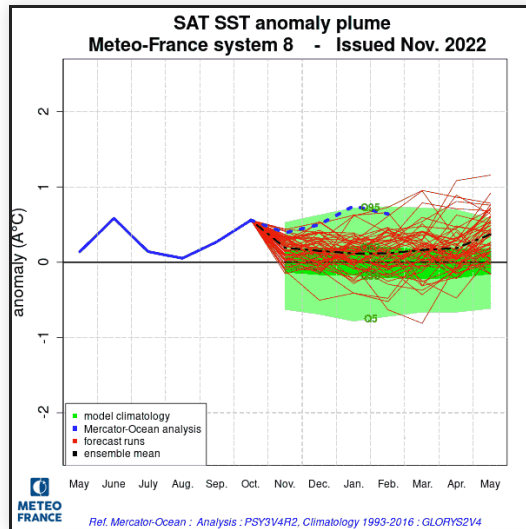
Very good forecast for both models.



Oceans : tropical Atlantic and Indian Ocean index

SAT : Both models expected to remain in the normal tercile, while a marked positive anomaly persists.

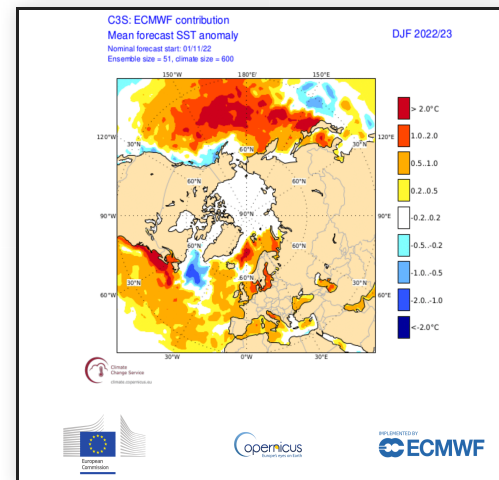
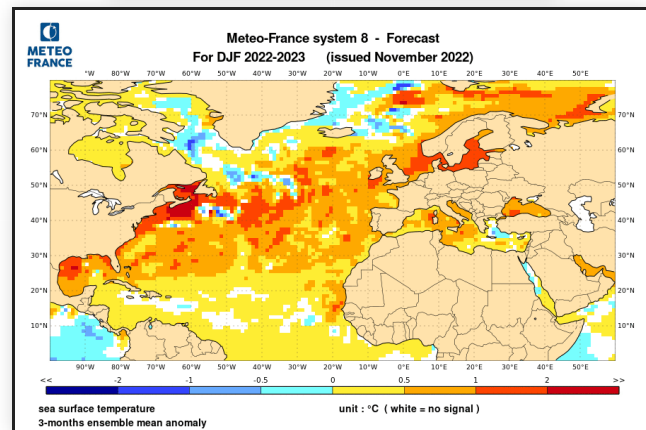
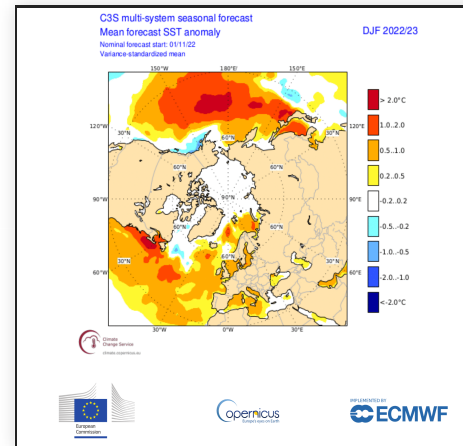
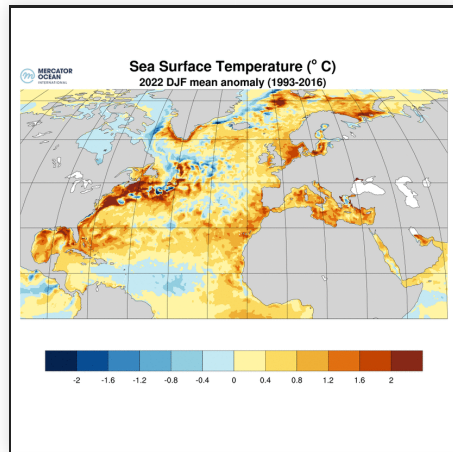
DMI : The trends suggested by both models are good, although they are slow to return to a positive DMI.



Oceans : North Atlantic SST

ECMWF is closer to the analysis than MF-S8 on the path of the positive anomaly in the North Atlantic. MF-S8 keeps it too far north.

In the Mediterranean, the warm anomaly is generalized in the analysis, while the models confined it to the west of the basin.

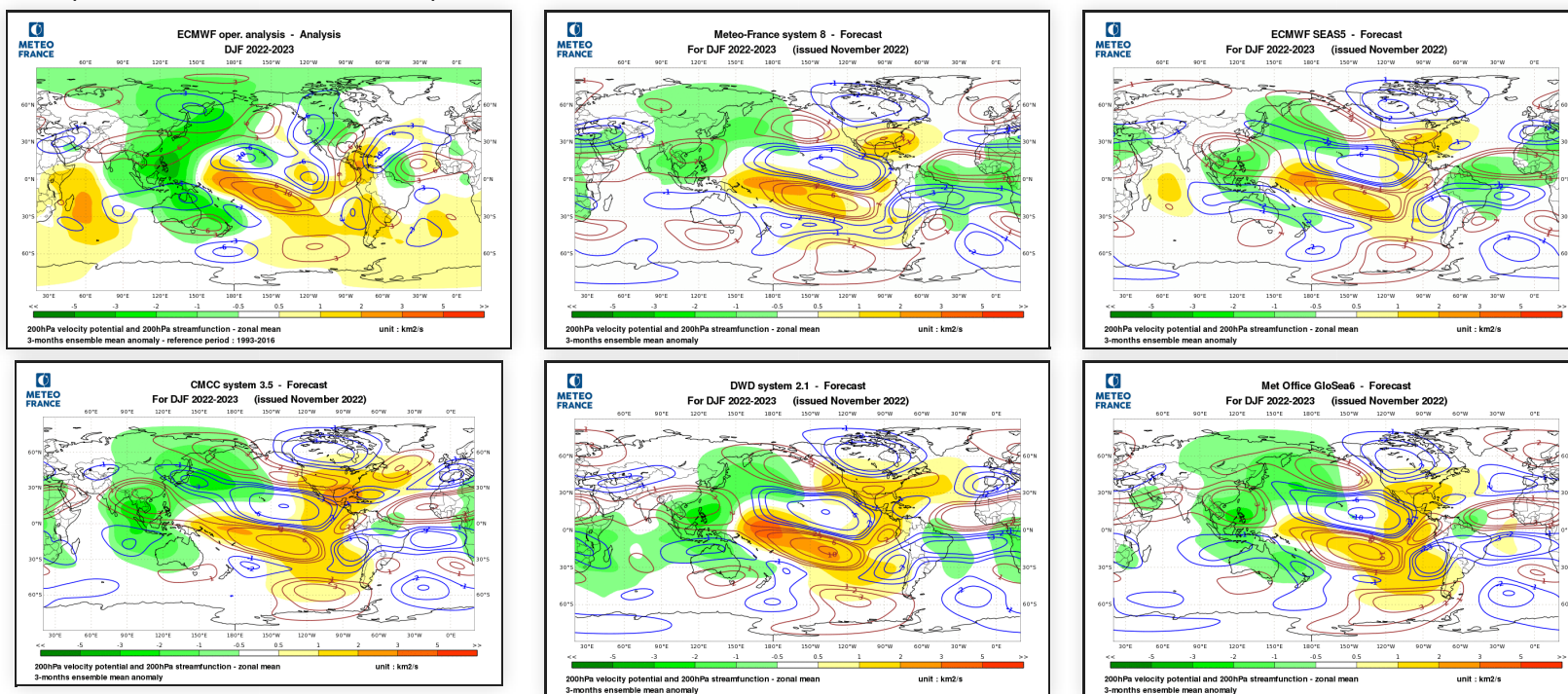


SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S8 (bottom left) and ECMWF SEAS5 (bottom right)

Atmospheric circulation : Global teleconnection

VP : The dipole of downward motion anomaly over the Pacific Ocean and upward motion anomaly over the Maritime Continent, linked to "La Niña" is well predicted by all models. On the other hand, the downward motion anomaly over the western Indian Ocean, linked to the negative phase of the recent IOD is less well seen (except with ECMWF).

SF :The dipoles on the Pacific and Atlantic Oceans are seen by the models. On the other hand, the teleconnections towards North America, well marked for all models, are much less visible in the analysis. Over Europe, the anticyclonic curve centered on Northern Europe is found over Southern Europe and the Balkans.

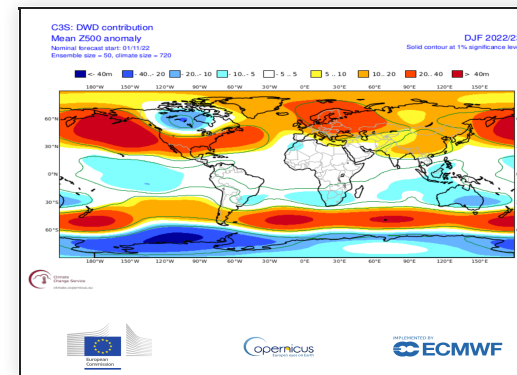
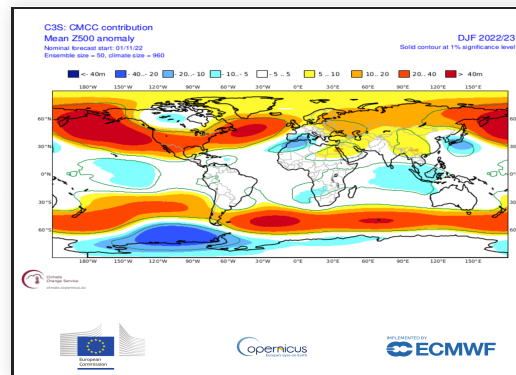
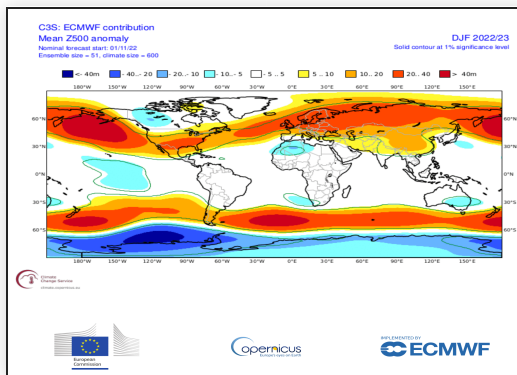
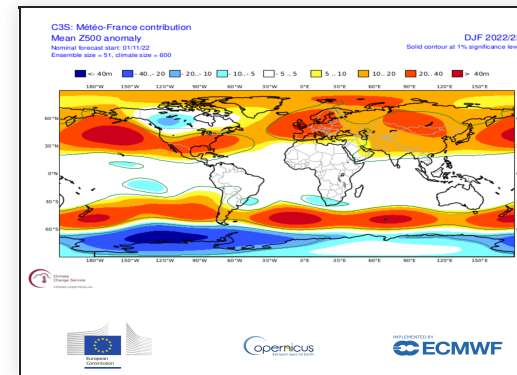
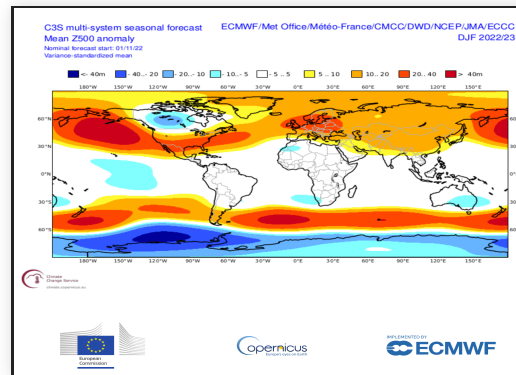
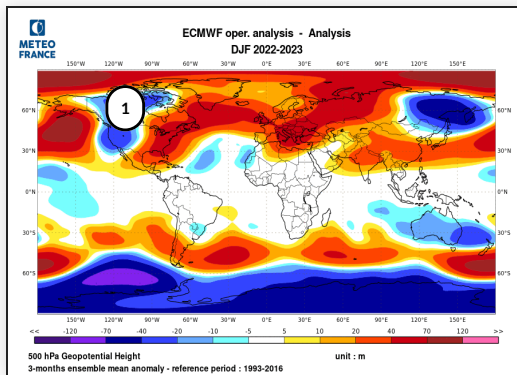


ECMWF analysis, MF-S8, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

Atmospheric circulation : 500hPa Geopotential height

South hemisphere : the main structures are well predicted

North hemisphere : Analysis and models agree on a PNA-type pattern. Over the North Atlantic, the models predicted a small negative anomaly over Morocco. It is found in the analysis, but it is associated with a second negative anomaly further west. Over Europe, the strongest positive anomaly is centered further south, towards the Balkans. Conversely, the strong negative anomaly observed over Kamchatka is not seen by any model.



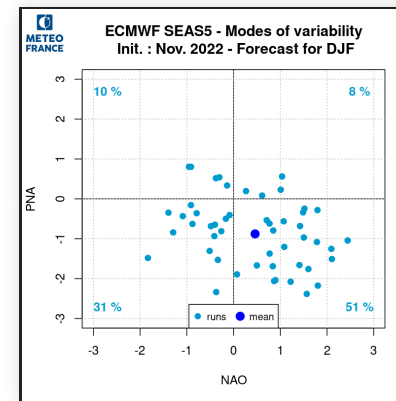
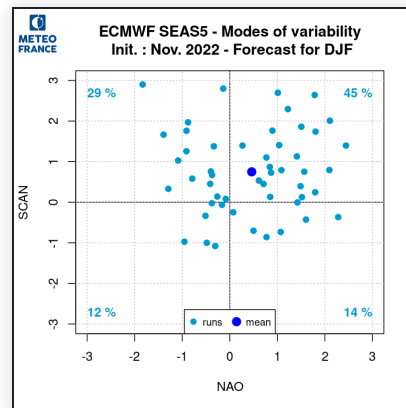
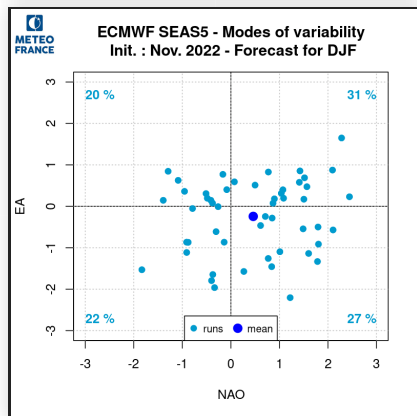
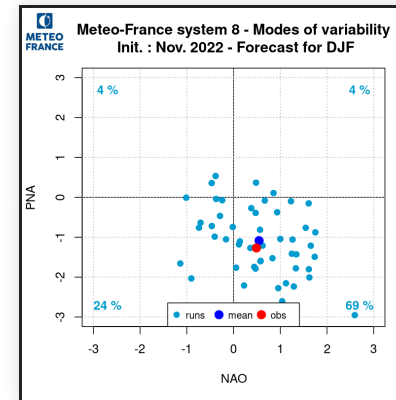
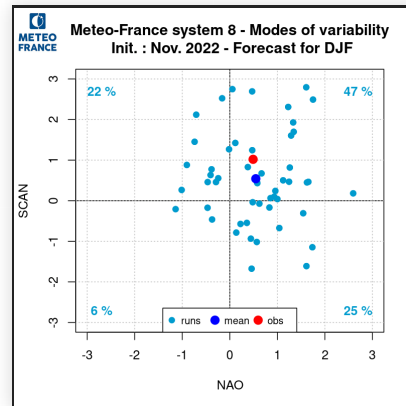
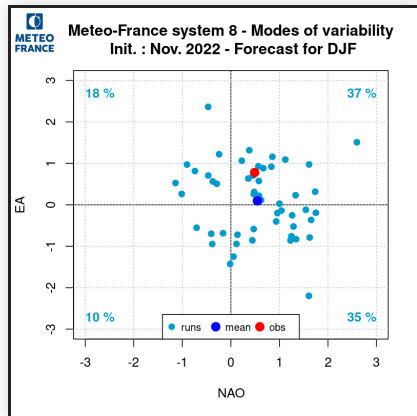
ECMWF analysis, C3S multi-system, MF-S8, ECMWF-SEASS, CMCC and DWD 500hPa geopotential height anomalies.

1 - Look like PNA -

Atmospheric circulation : Modes of variability

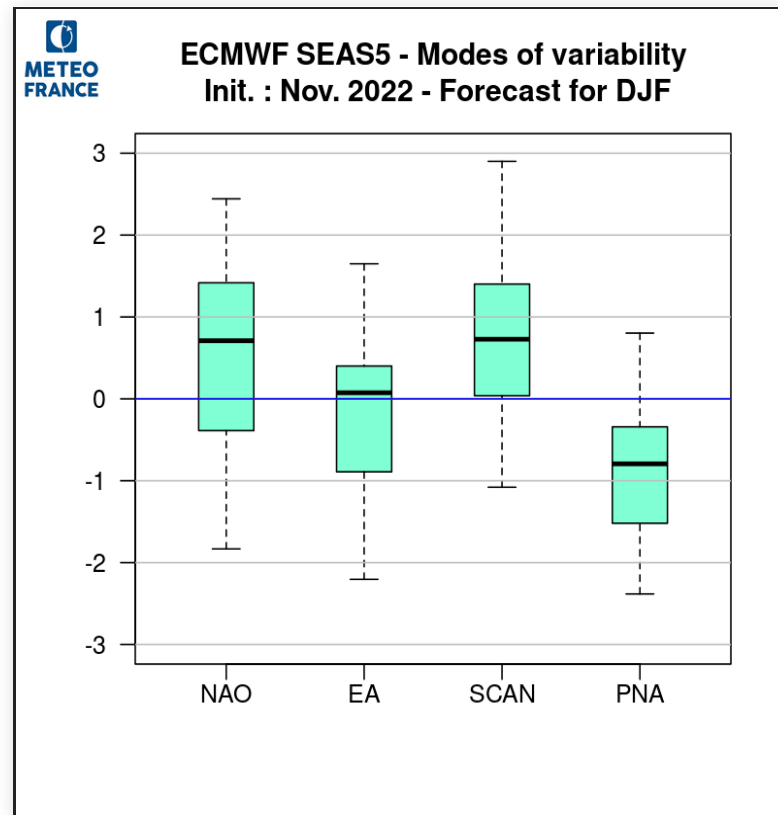
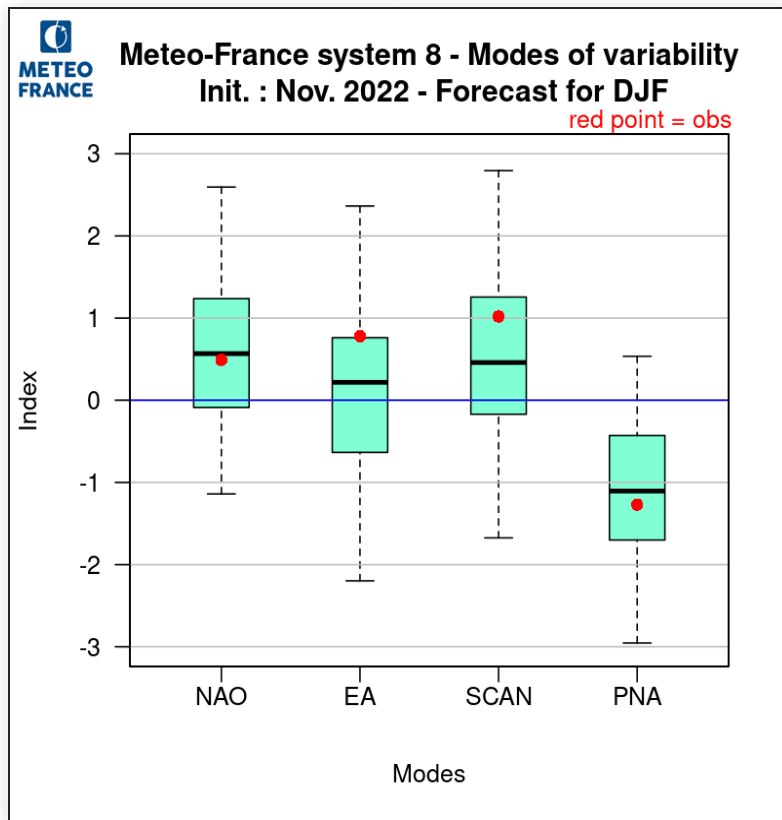
The PNA- and NAO+ modes are well seen by both models.

The SCAN+ mode is also correctly predicted, unlike the EA+ mode which is not anticipated.



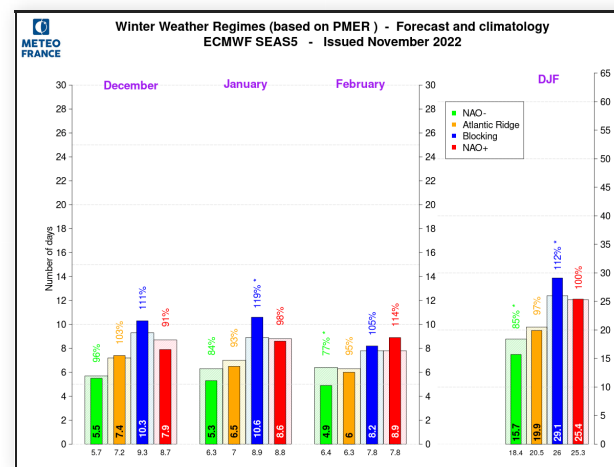
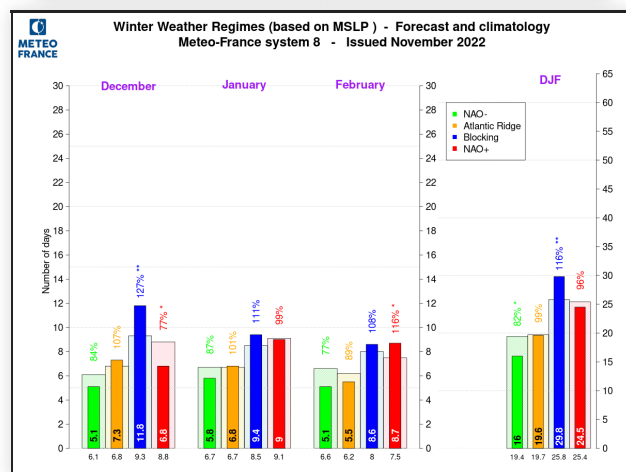
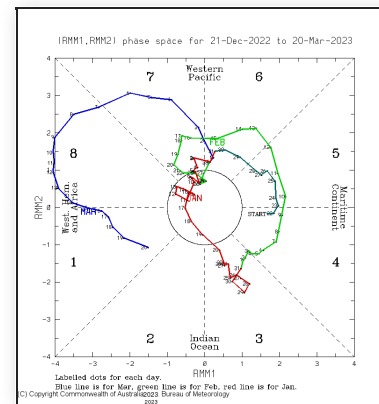
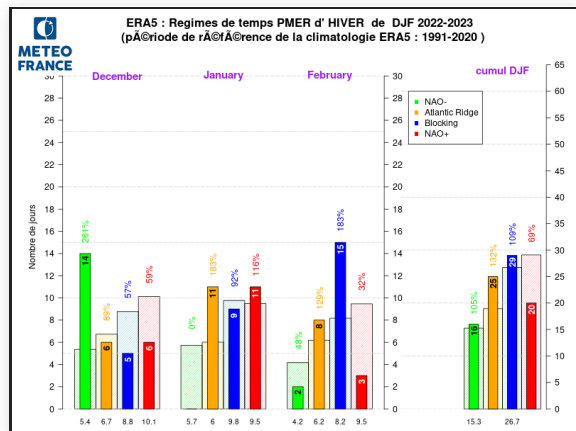
Atmospheric circulation : Modes verification

Same observation as for the previous slide



Atmospheric circulation : Winter SLP weather regimes

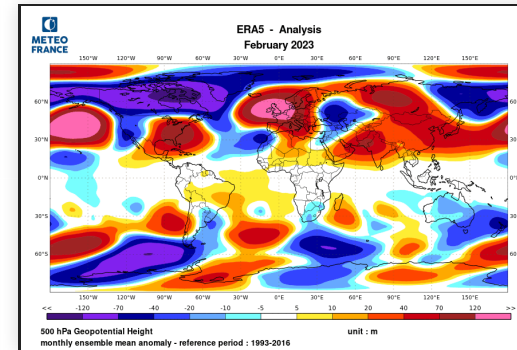
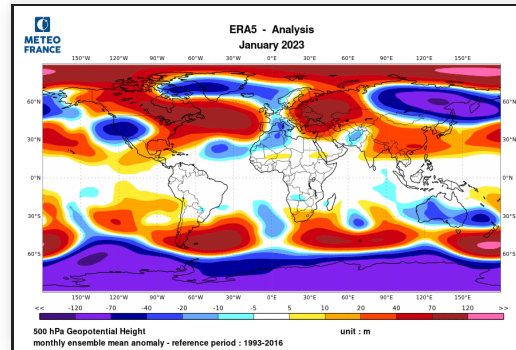
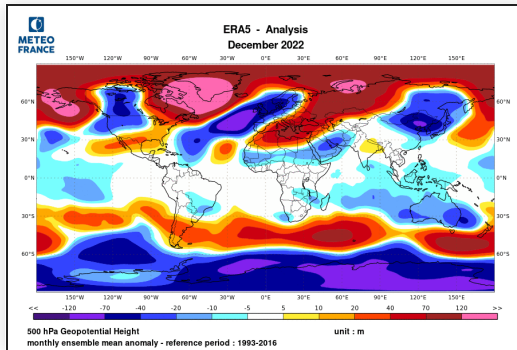
The three months have very different regime distributions. In the end, the Atlantic Ridge regime deviates the most from its climatology, at the expense of the NAO+ mode. But it is the Blocking regime that is the most present, which was predicted by both models.



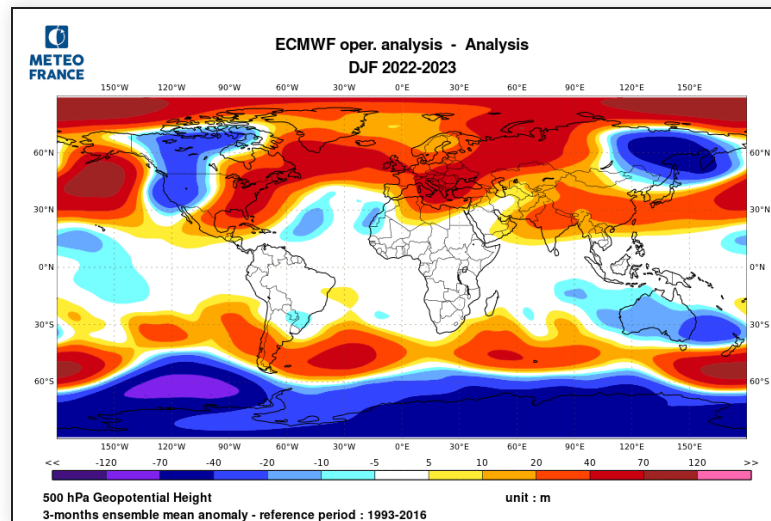
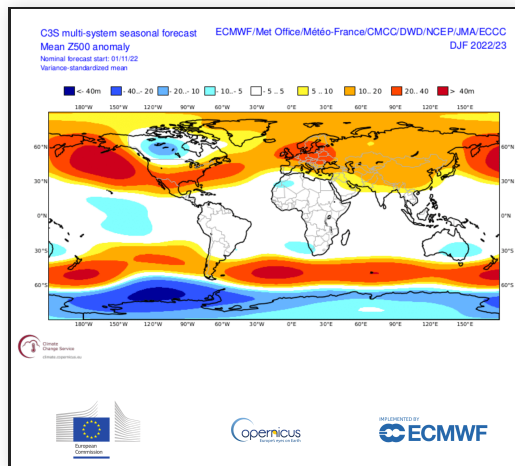
weather regime : ECMWF analysis top left, MF8 and ECMWF forecasts at the bottom. MJO phase top right

Atmospheric circulation : Variability within the quarter

The atmospheric circulation is indeed very changeable from month to month during this quarter, especially from the North Atlantic to Europe.



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

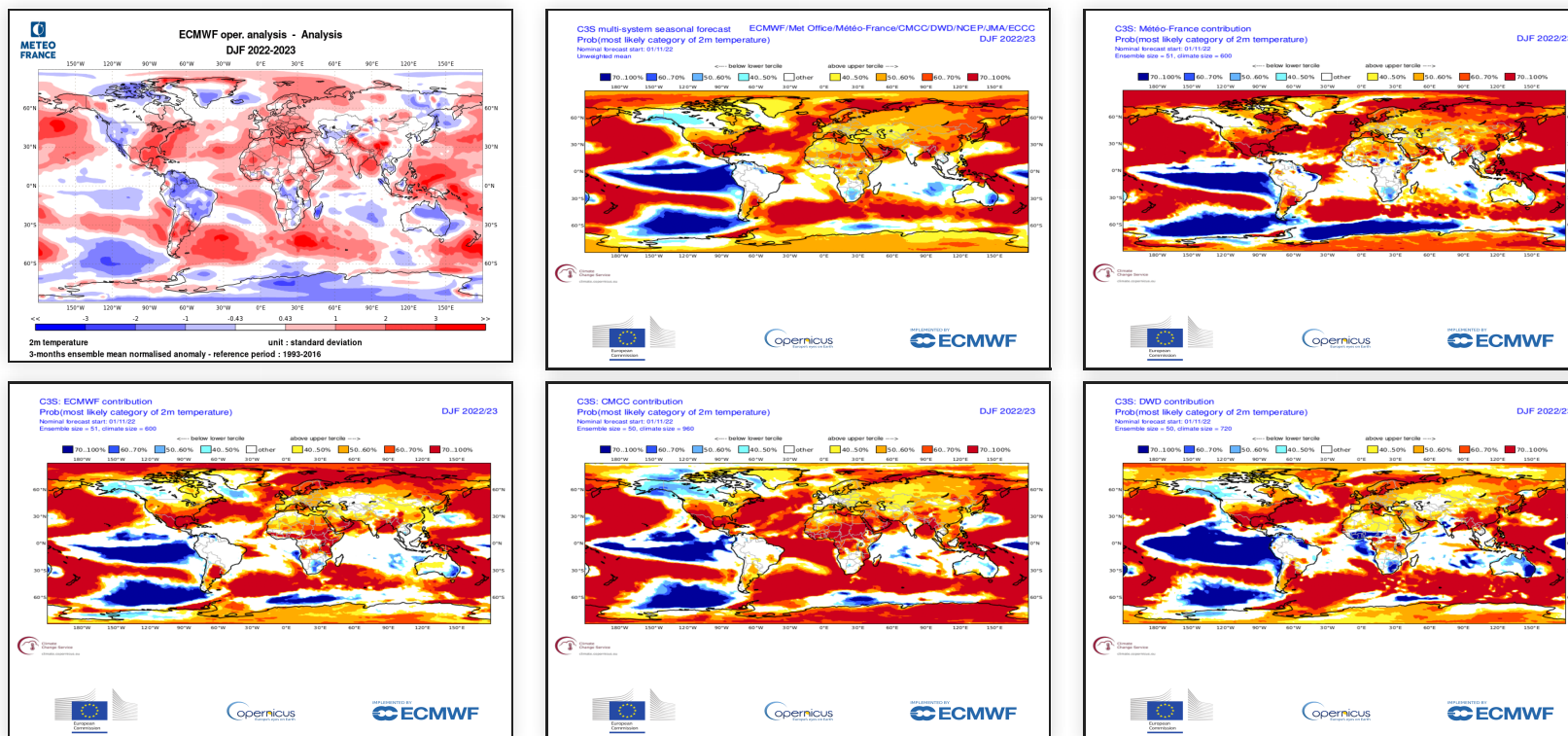


C3S multi-sytem forecast and ECMWF analysis 500 geopotential height anomalies for JFM

Climatic parameters : temperature on the globe

The cold anomaly in South America is more marked than expected. The predicted cold anomaly in Alaska is shifted southward. East of Russia, in connection with the negative anomaly in Z500, the cold temperature anomaly was not expected.

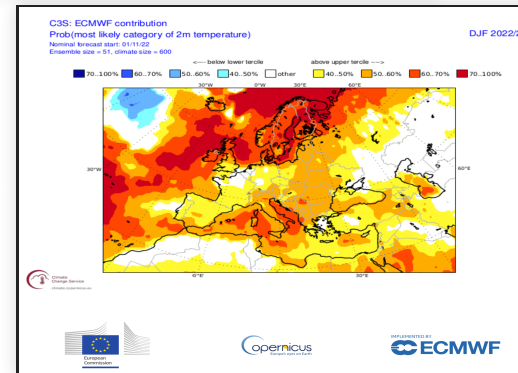
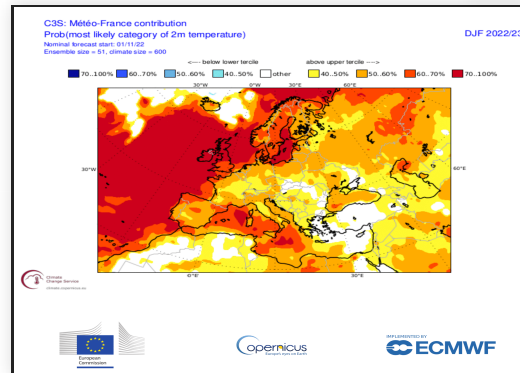
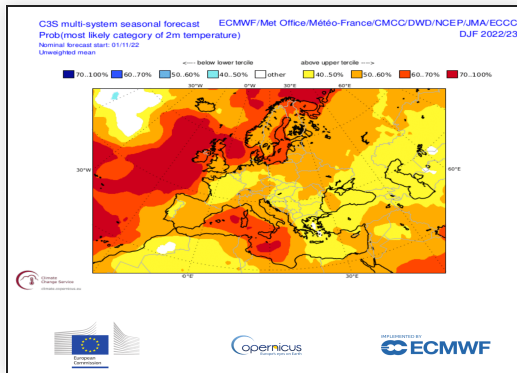
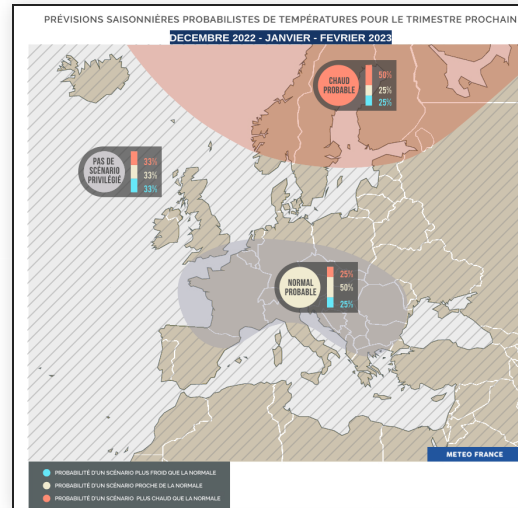
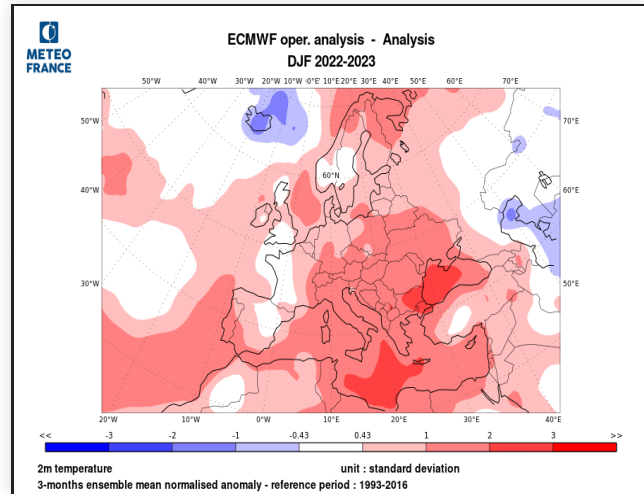
Differences are also visible in Europe.



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 anomaly forecast over northern Europe, linked to the positive anomaly in Z500, is on analysis much more southern, centered over Greece, but still linked to this positive anomaly in Z500 itself shifted.



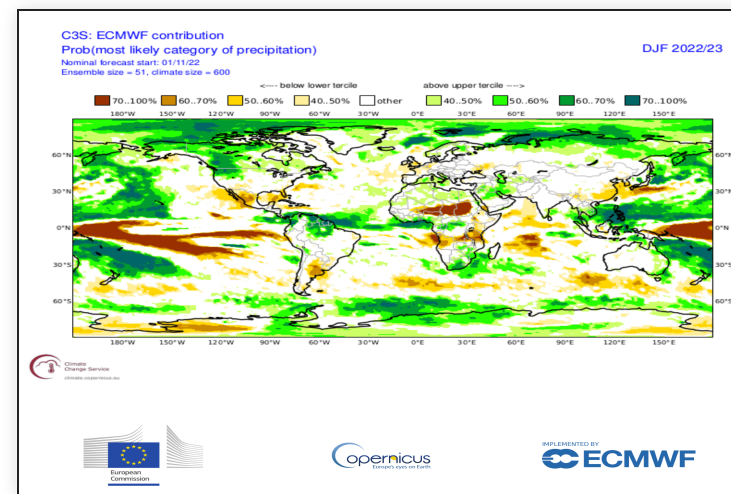
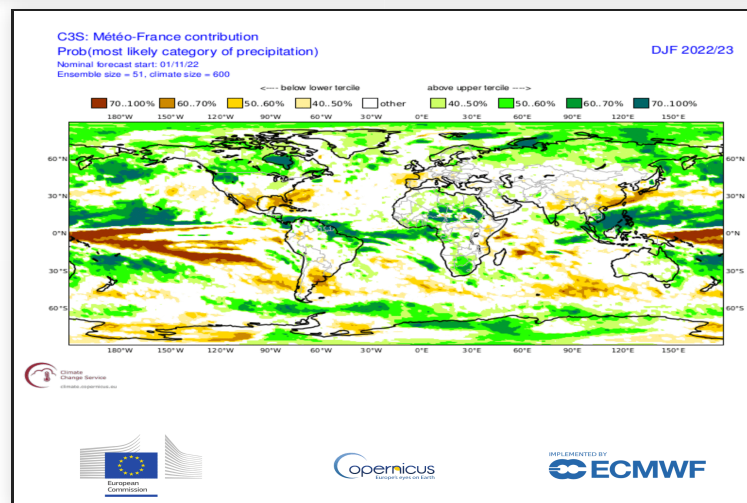
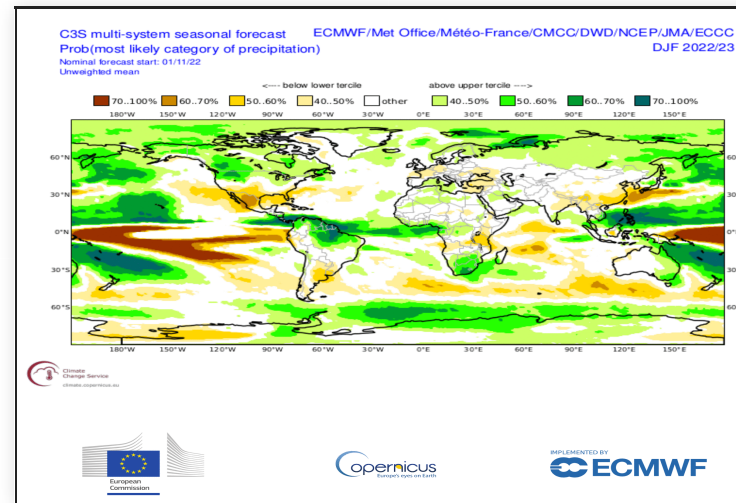
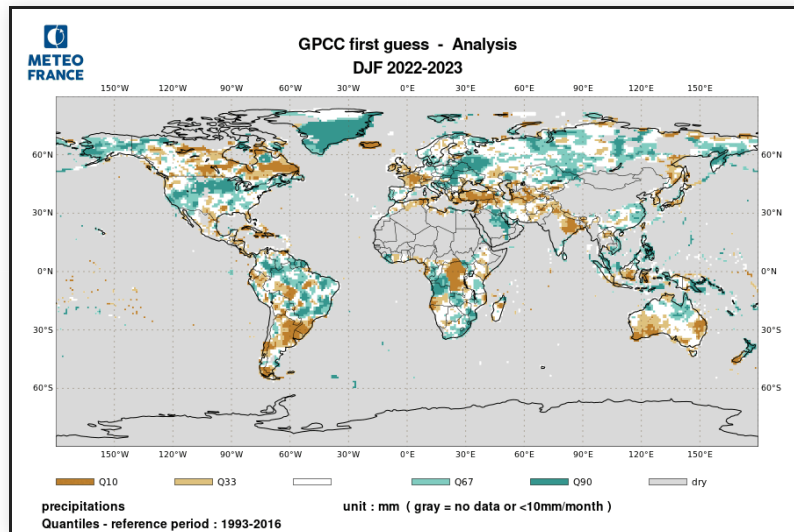
ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system, MF-S8 and SEAS5 on the bottom line.

Climatic parameters : Precipitations over the globe

In the intertropical area, the models agree with the analysis on the main anomalies.

Over North America, the differences between the analysis and the models on the PNA- pattern are found in the location of precipitation anomalies.

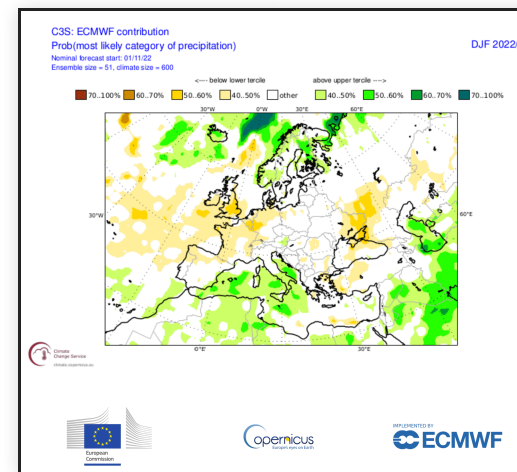
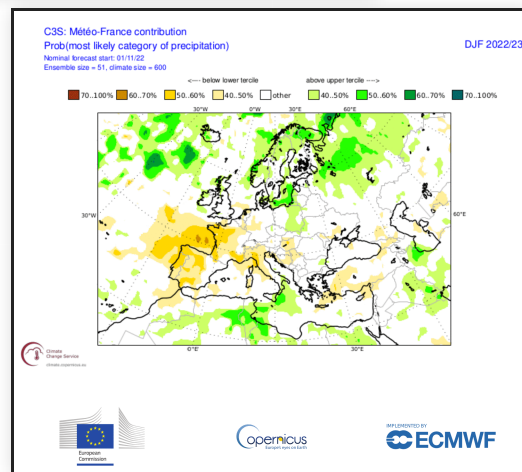
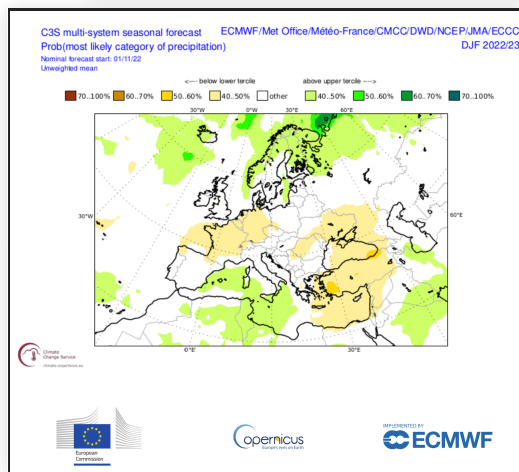
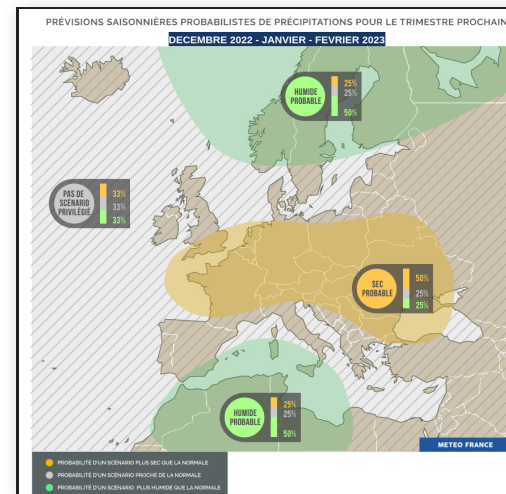
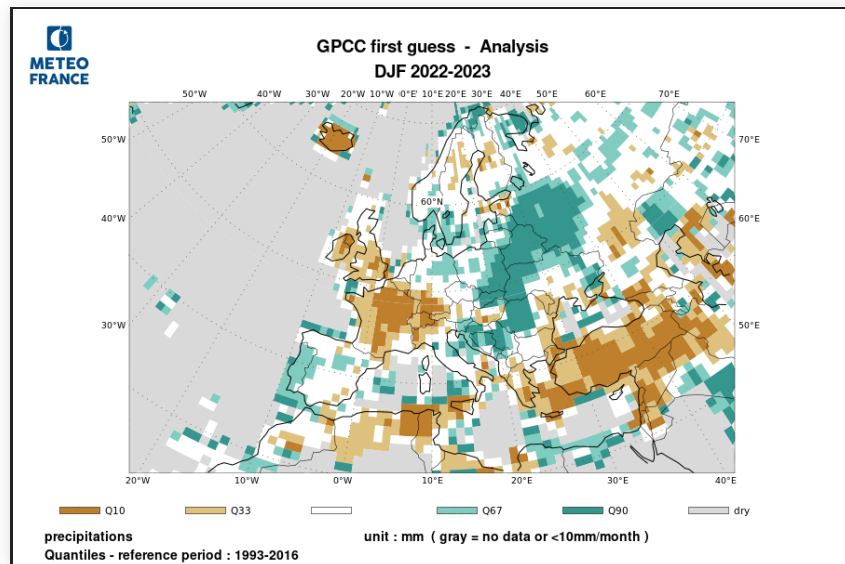
Over Europe, the wet anomaly at the borders of Russia was not expected.



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

With an observed atmospheric circulation far from the forecasts, the dry and wet anomalies forecast are badly positioned. Even if, in the end, the forecasts over France are correct.



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 DJF 2022-2023

1) Oceans :

The main SST anomalies are well predicted, except in the Atlantic Ocean (North and South).

2) Large scale atmospheric circulation :

VP 200 hPa : Forecasts are correct over the Pacific, but less accurate over the Indian Ocean.

SF 200 hPa : The dipoles in the equatorial zones are well planned. On the other hand, the teleconnections, well marked by the models, are much less so in the analysis. As a consequence, significant differences are visible over Europe.

Z500 : The circulation at 500 hPa predicted by the models lacks precision over North America and is not good over Europe.

3) Climatic parameters over Europe :

Temperatures : The warmer-than-normal scenario observed from Italy to the Black Sea has not been predicted correctly.

Precipitations : The forecasts are quite far from the observation, except on France.