

Météo-France Seasonal Forecast Bulletin

FEBRUARY - MARCH - APRIL 2021

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General synthesis : FMA 2021

The models are very constrained by the ongoing La Nina event. The forecasts at global scale are very close. However in the North Atlantic/Europe zone the models diverge strongly.

A) Oceanic forecast :

- ENSO : ongoing La Niña beginning to subside, will return to low level during the quarter.
- IOD : a temporary positive episode should occur during the period.

B) Drivers :

- SSW

C) Atmospheric circulation :

- classical response to "La Niña" in the tropics (upward motion anomaly over the Eastern Indian Ocean and Maritime Continent, downward motion anomaly over Central Pacific). Very marked negative PNA teleconnection to North America.
- over the North Atlantic and Europe : The models differ on the position of a geopotential low.

D) Most likely conditions :

- In the tropics, increased rainfall over the Maritime Continent, Southeast Asia and Australia as well as over northern South America. Precipitation in deficit over Mexico, the southern United States and the rest of South America as well as the Middle East. Excess precipitation over Canada and Siberia.
- **over Europe** : Warm and dry signal on the extreme southeastern part, no scenario elsewhere.

Next bulletin : scheduled on February 18th

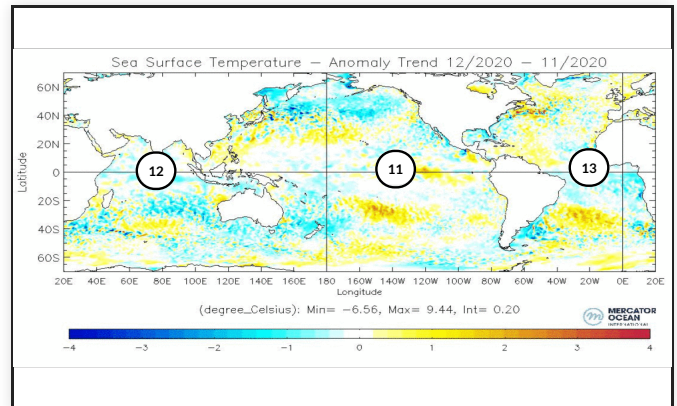
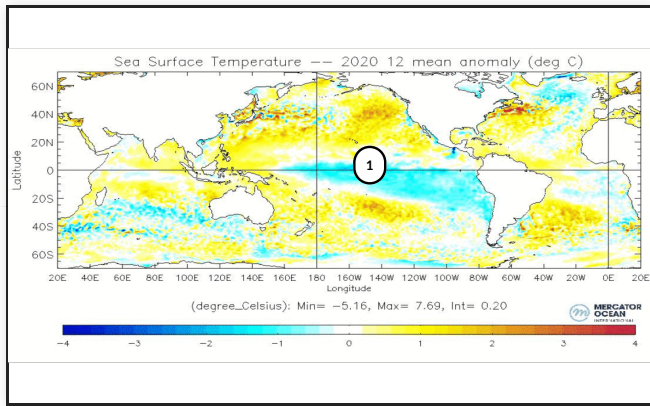
Oceanic analysis of December 2020 : SST anomalies

Current ENSO situation : La Nina conditions

During the month of December, there is an almost general attenuation of the warm anomalies of the oceans.

In the Pacific : The cold anomaly centered in the nino3.4 box is very marked. During the month of December the temperature started to warm up slightly.

The Indian Ocean and the Atlantic Ocean experienced a cooling along the equator which attenuated the pre-existing warm anomalies. Temperatures in these areas have returned to near normal.

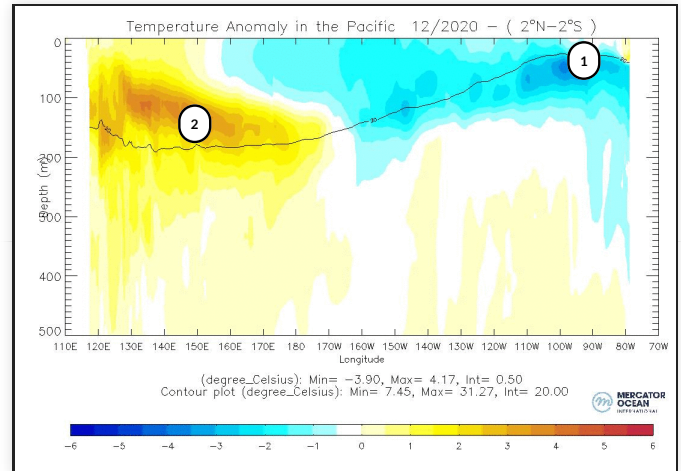
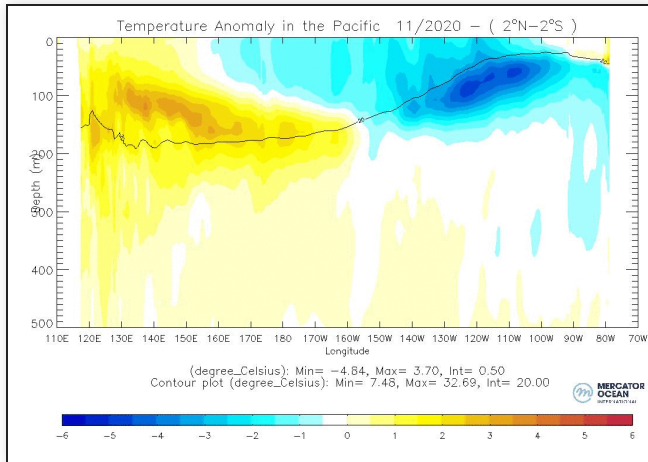


SST Anomalies and trend with the previous month (c) Mercator-Ocean

- 1 - La Nina cold anomaly
- 11 - weak warming in Nino3.4 box
- 12 - Cooling of the Equatorial Indian Ocean
- 13 - Cooling of the Equatorial Atlantic Ocean

Oceanic analysis of December 2020 : Pacific vertical section

In subsurface, the cold Kelvin wave reached the coasts of America and partially dissipated. On the west of the basin, the hot reservoir has strengthened.

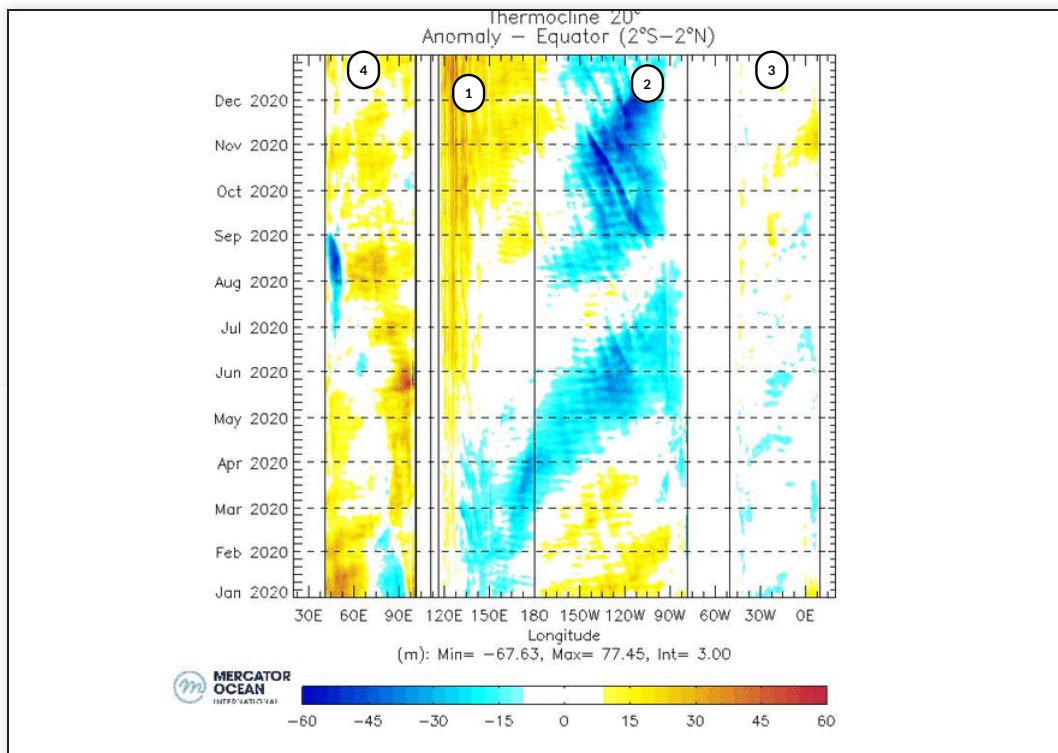


Ocean temperature anomalies in the first 500 meters of the equatorial Pacific basin, monthly average. (c) Mercator-Ocean

- 1 - Cold Kelvin wave reached the coast
- 2 - strengthened warm anomaly

Oceanic analysis of December 2020 : Hovmöller diagram of the 20°C isotherm

The strong subsurface contrast in the Pacific. Beginning of attenuation of the cold anomaly in the eastern part of the basin.



Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 °C isotherm) (c) Mercator-Ocean

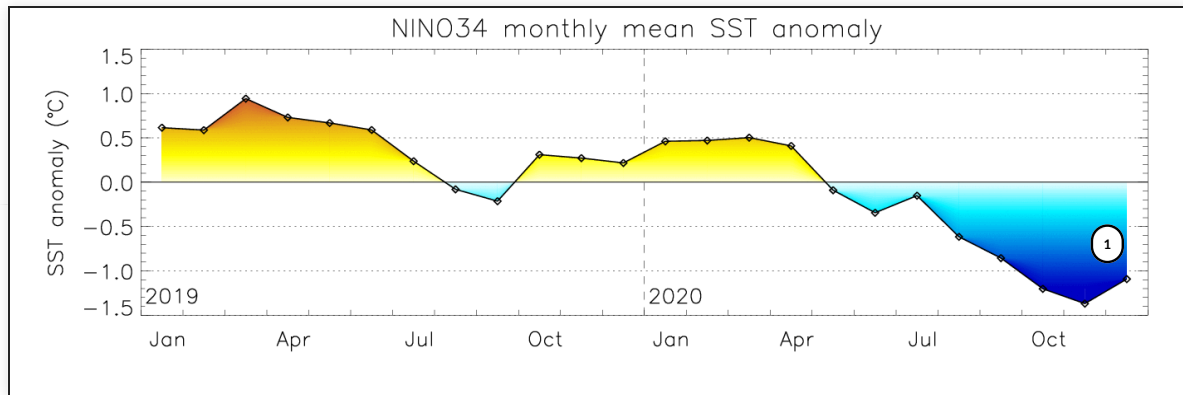
- 1 - Warm anomalie in the west part
- 2 - Cold anomalies in the east part of the Pacific started to decrease
- 3 - neutral in the Atlantic Ocean
- 4 - weakly positive in the Indian Ocean

Oceanic analysis of December 2020 : Pacific Ocean - Nino3.4 index history

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -1.1 °C

(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png)

The cold anomaly in the Nino3.4 box started to rise last month.



Evolution of SST in the NINO3.4 box (c) Mercator-Ocean

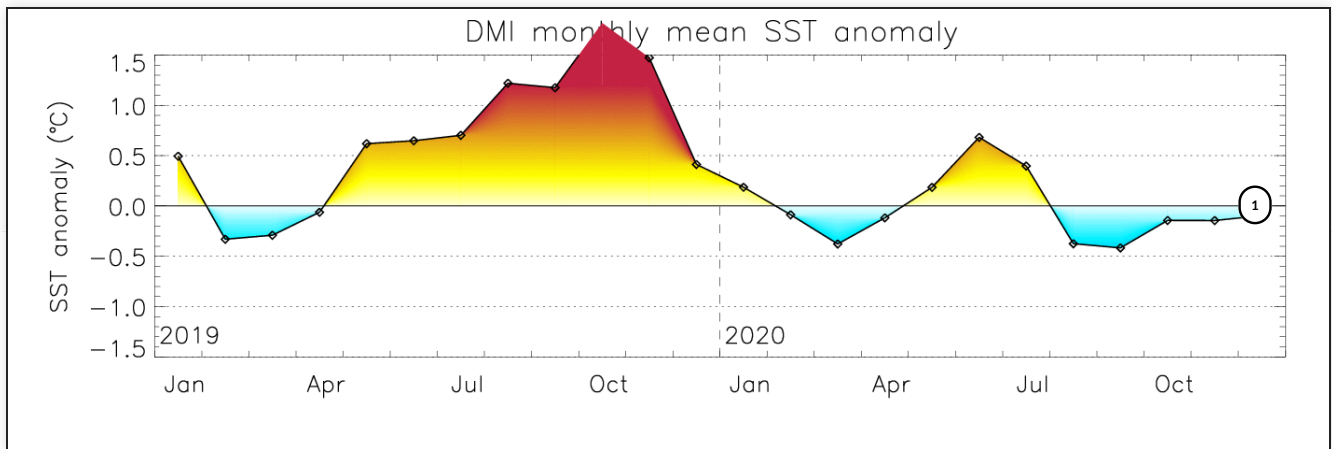
1 - start of index rise

Oceanic analysis of December 2020 : Indien Ocean - DMI index history

DMI Index issued from Mercator Ocean PSYV4R2 analysis : -0.1°C

(see BOM site for weekly values : <http://www.bom.gov.au/climate/enso/monitoring/iod1.png>)

Near neutral conditions



Evolution of SST in the DMI box (c) Mercator-Ocean

1 - Near neutral conditions

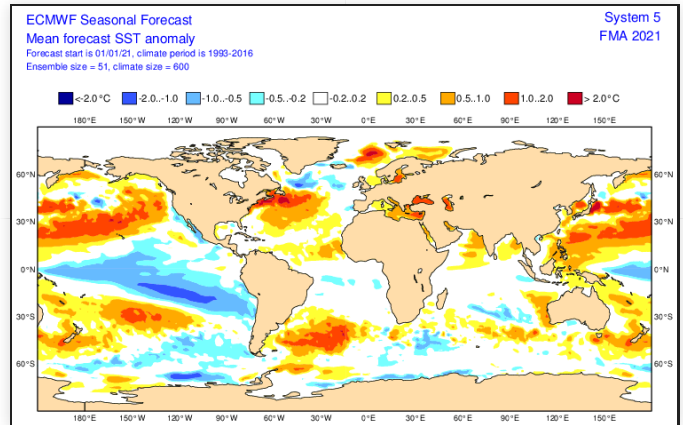
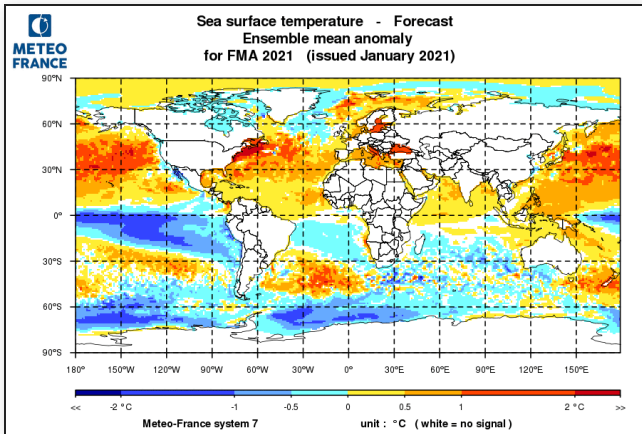
Oceanic forecast : SST anomaly

Good agreement between MF-S7 and ECMWF-SEAS5.

In the Pacific Ocean : The ongoing La Nina phenomenon will continue beyond the next quarter. The cold anomaly predicted by MF-S7 along the equator, is a little stronger than that of ECMWF-SEAS5. On the other hand, SEAS55 is cooler north of the equator.

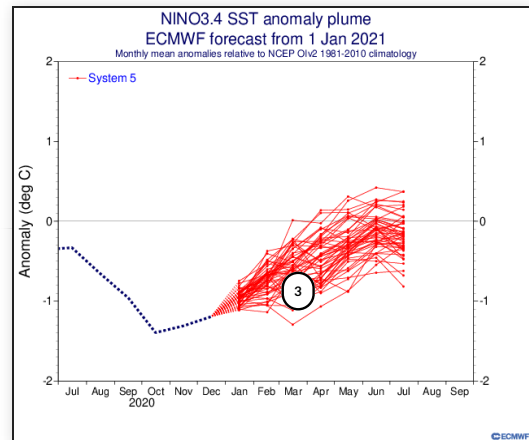
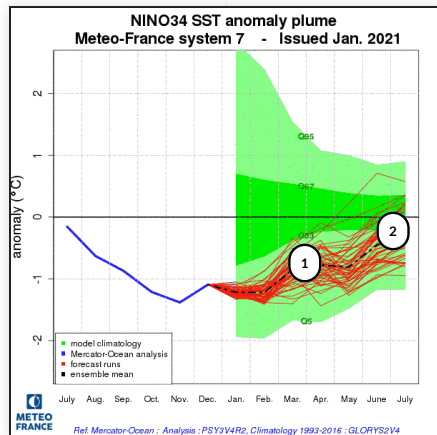
In the Indian Ocean : neutral values. In this context, the small cold anomaly predicted by the two models in the vicinity of Sumatra, could influence the DMI index.

In the Atlantic Ocean : Dipole marked near Newfoundland



Oceanic forecast : NINO3.4 Plume diagrams

Both models predict a gradual attenuation of the cold anomaly over the next months. The ascent is more straightforward with ECMWF and more chaotic with MF which provides for successive breaks in warming. The latest weekly observations do seem to mark a plateau.

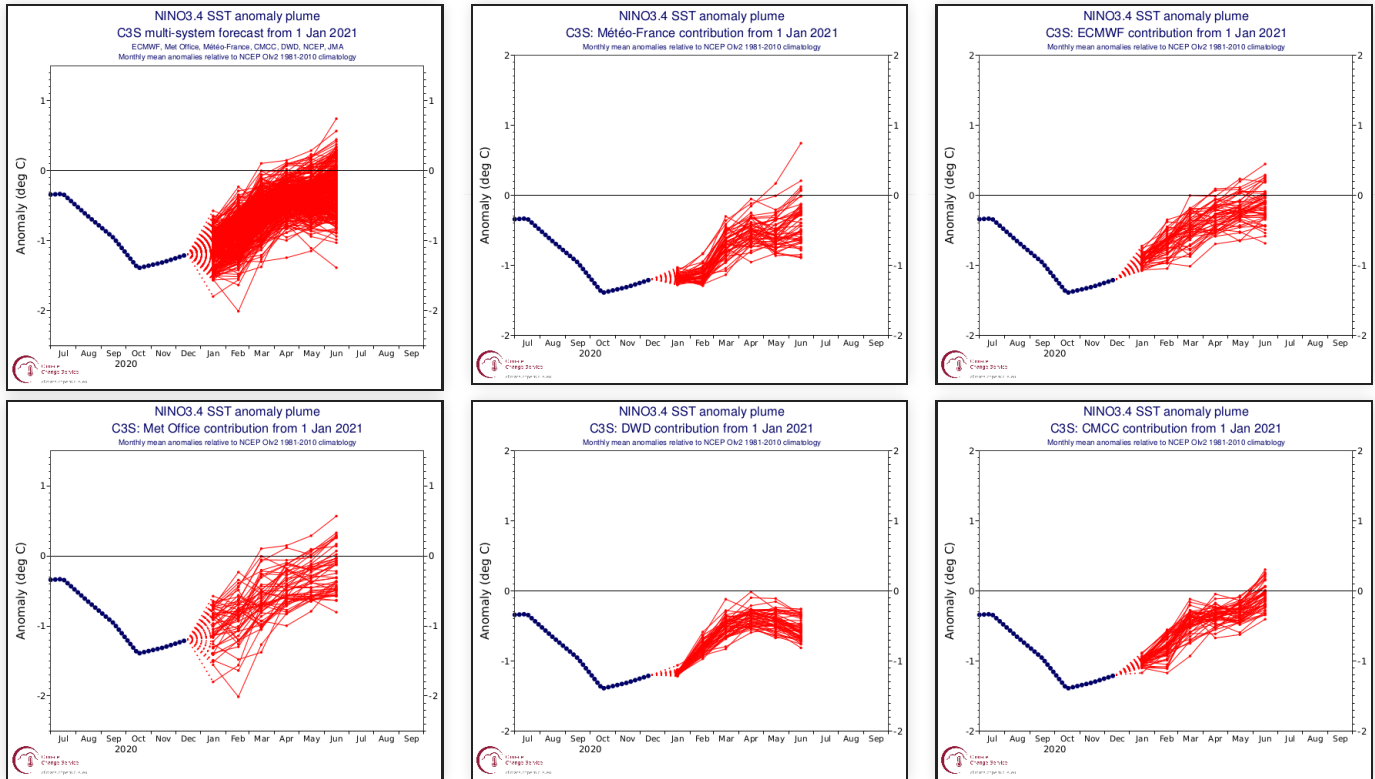


- 1 - break in warming
- 2 - Return to neutrality expected in the summer.
- 3 - continuous ascent

Oceanic forecast : C3S Nino3.4 re-scaled plume diagrams

The models agree on the gradual warming scenario. Only the DWD has a divergent option at the end of the period. The dispersion is generally low, except for the UKMO model.

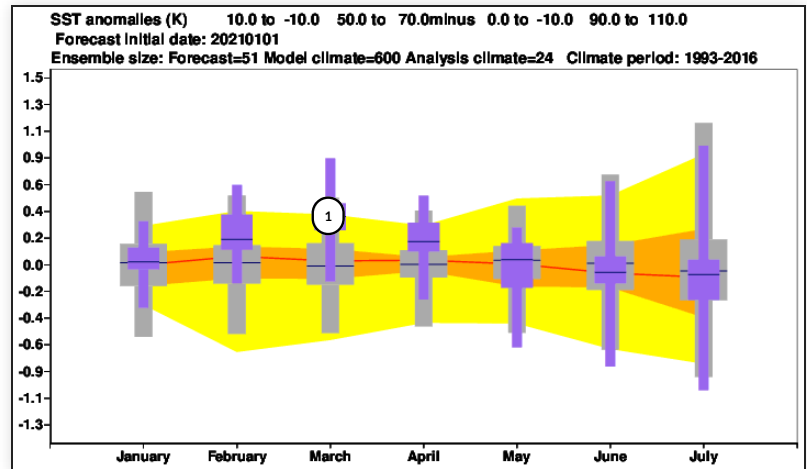
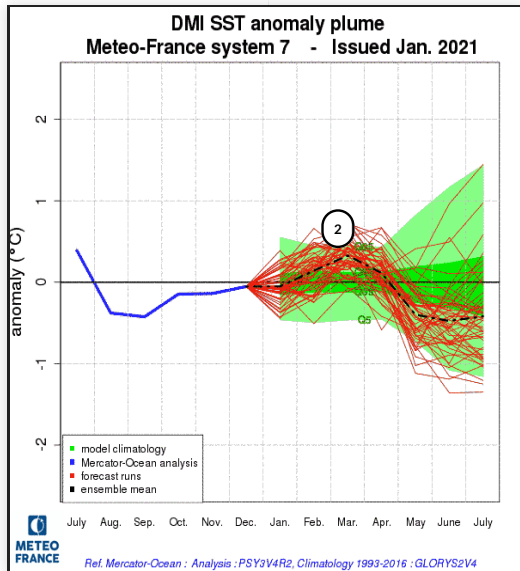
Expected Phase for the next three months : Mitigation of the La Nina phenomenon which returns to a weak level



C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010.

Oceanic forecast : Indian ocean - DMI evolution

Both models predict a small hot surge for the next quarter, which is atypical in this period of low variability.

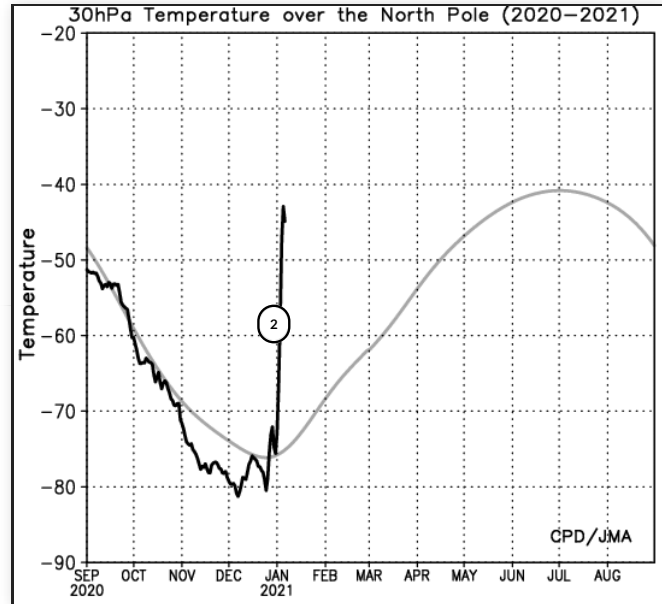
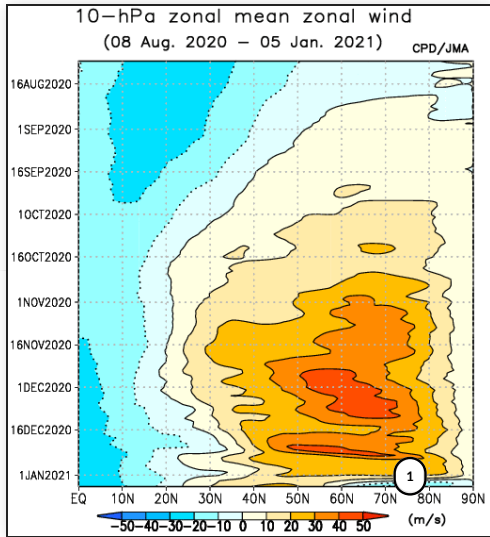


DMI index : analysis, forecasts and model climatology with MF7 on the right and SEAS5 on the left

- 1 - Average runs in the upper tercile
- 2 - some runs are in the extremes

Drivers : SSW

Spectacular SSW with a rise in temperature to 30hPa of over 30 °C in a very few days. This should promote the NAO- weather regime in the coming weeks until early February but this sub-seasonal effect does not generally last beyond that.

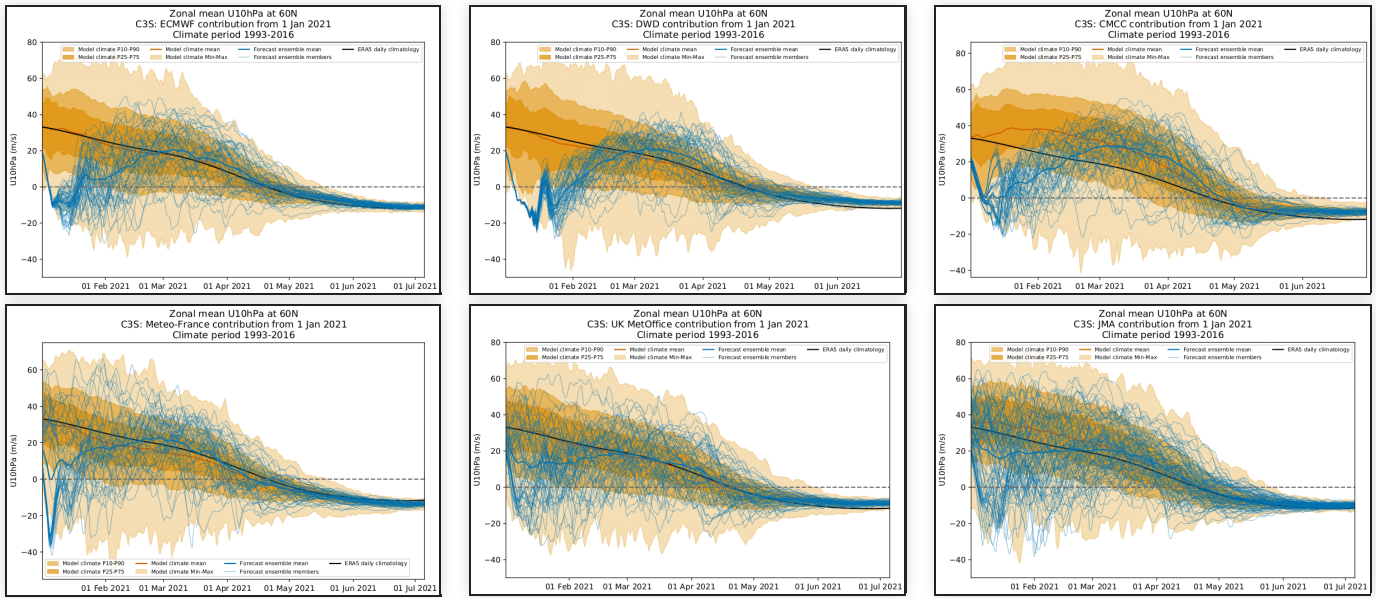


10 hPa zonal wind Hovmuller diagram and 30 hPa temperature histogram. (c) Tokyo Climat Center JMA

- 1 - zonal wind reversal in the first days of January
- 2 - spectacular rise in temperatures of around 30 °C

Drivers : U010 plumes

Depending on the initialization date of the model runs, the sudden inversion of the wind in the stratosphere is taken into account or not. For ECMWF, DWD and CMCC, the late initialization enable the wind shift to be well predict by all the runs. For MF-S7 only part of the runs produced the wind reversal. For UKMO and JMA, a large majority of the runs launched early do not anticipate at all the change in direction.



ECMWF-SEAS5, DWD, CMCC, MF-S7, UKMO, and JMA 010hPa zonal mean of u component of wind at 60°N.

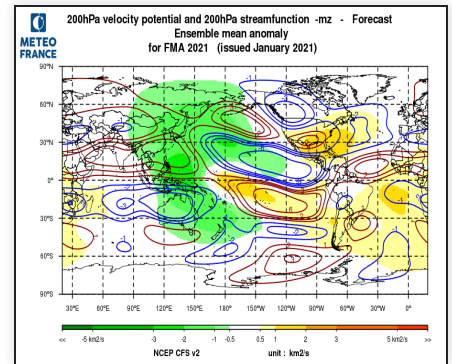
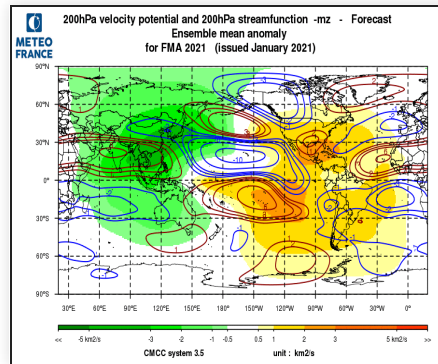
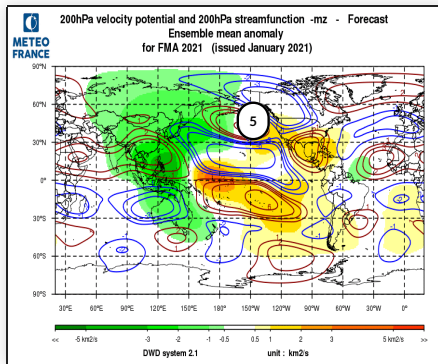
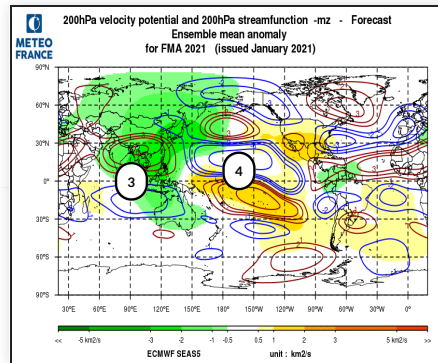
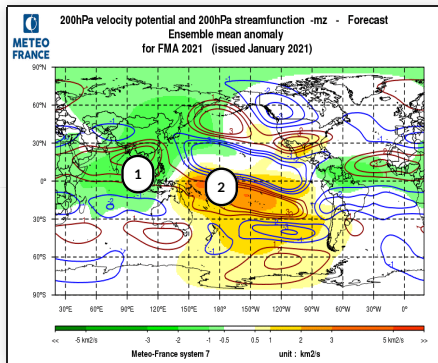
Atmospheric circulation forecasts : velocity potentiel and stream function at 200hPa

UKMO is not available this month.

good agreement between the models on the Pacific and the areas directly under the influence: the Indian Ocean and America. On the North Atlantic, SEAS5, CMCC and DWD are in fairly good agreement but diverge from MF and NCEP.

Velocity Potential : In connection with the La Nina situation, the models foreseen a strong dipole in the Pacific-Indian zone, with upward motion anomaly over the Maritime Continent extending more or less towards the Indian Ocean and downward motion anomalies over the Pacific.

Streamfunction : Magnificent teleconnection of negative PNA type. MF-S7 diverge from the others over north Atlantic.

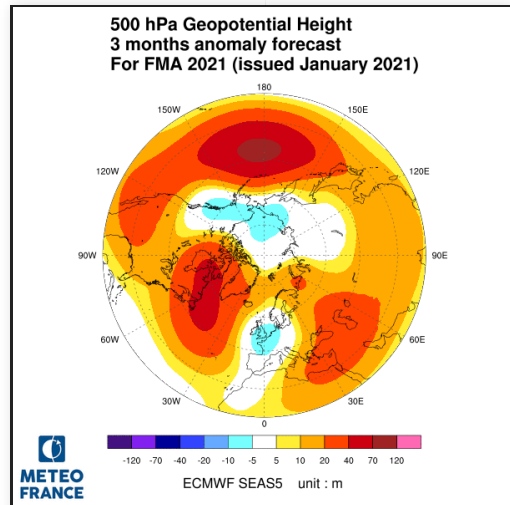
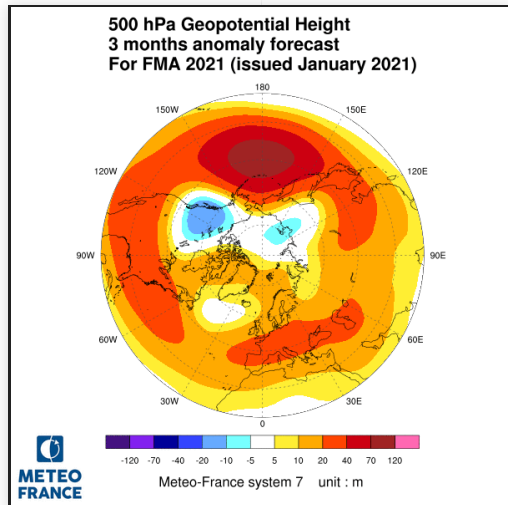


MF7, SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

- 1 - VP : large area of upward motion anomaly
- 2 - VP : large downward motion anomaly
- 3 - SF : anticyclonic circulation anomalies at 200hPa on each side of the equator
- 4 - SF : cyclonic circulation anomalies at 200hPa on each side of the equator
- 5 - Beautiful PNA teleconnection

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Total disagreement on the North Atlantic area and Western Europe. Good agreement for the PNA

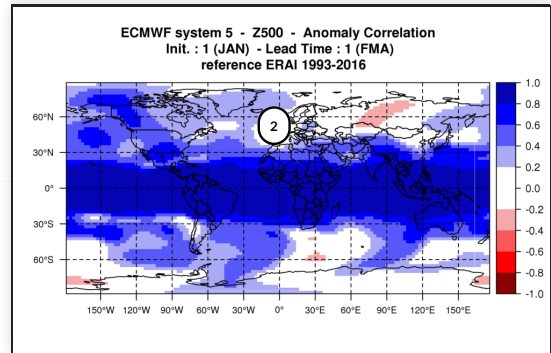
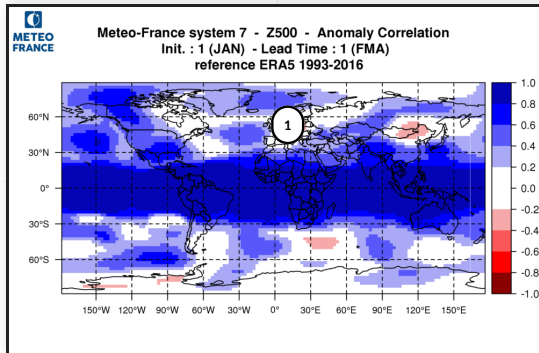
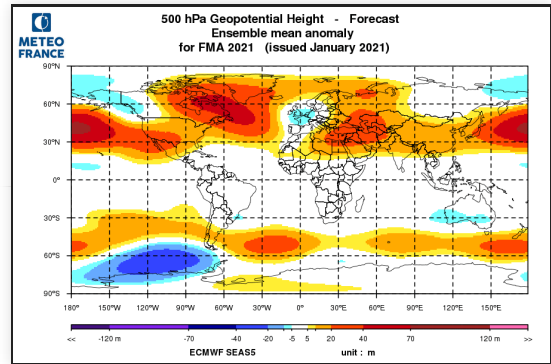
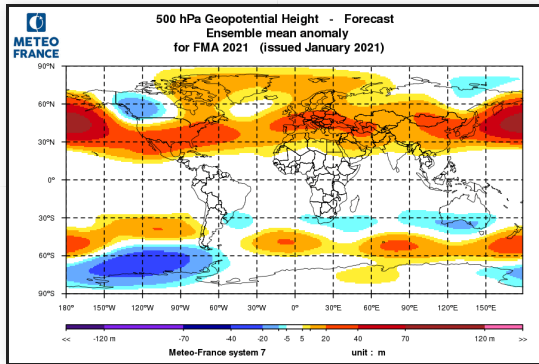


polar projection of MF7 and SEAS5 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 scores

The scores for the two models are not good in Europe, they are better in the Atlantic, especially for MF7. They do not make it possible to separate the contrary options of the models.

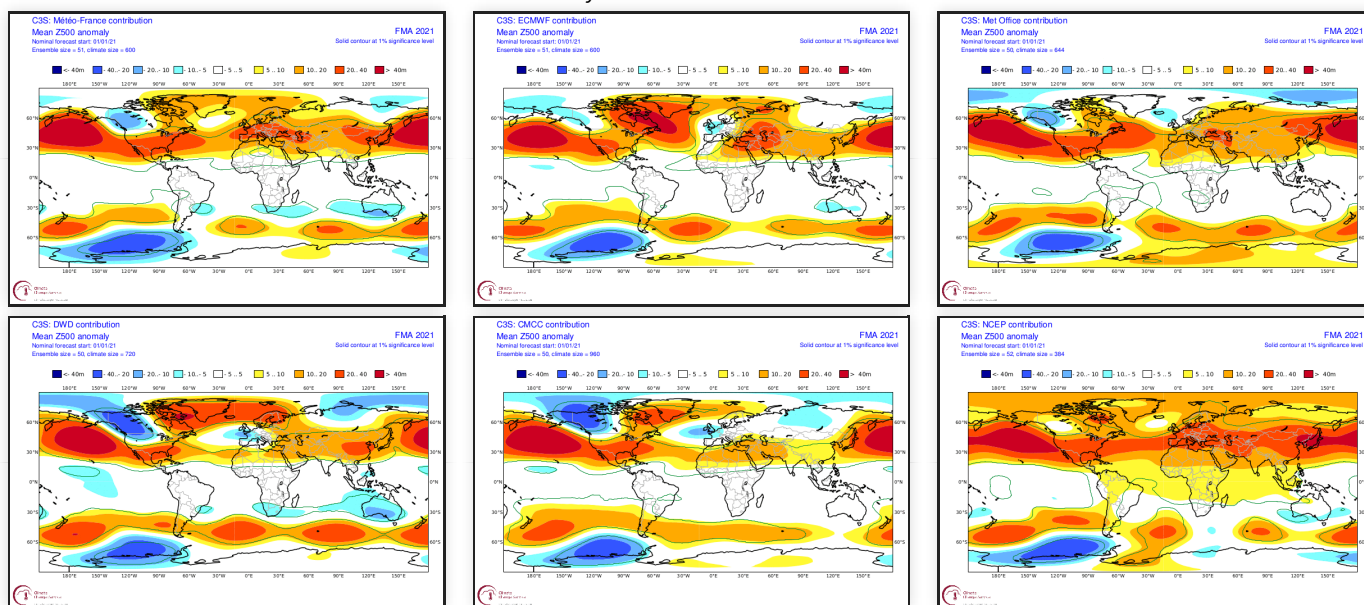
Very good scores for the PNA.



- 1 - Bad score on Europe especially on Central Europe
- 2 - Bad score on Western Europe

Atmospheric circulation forecasts : Z500 anomalies in C3S models

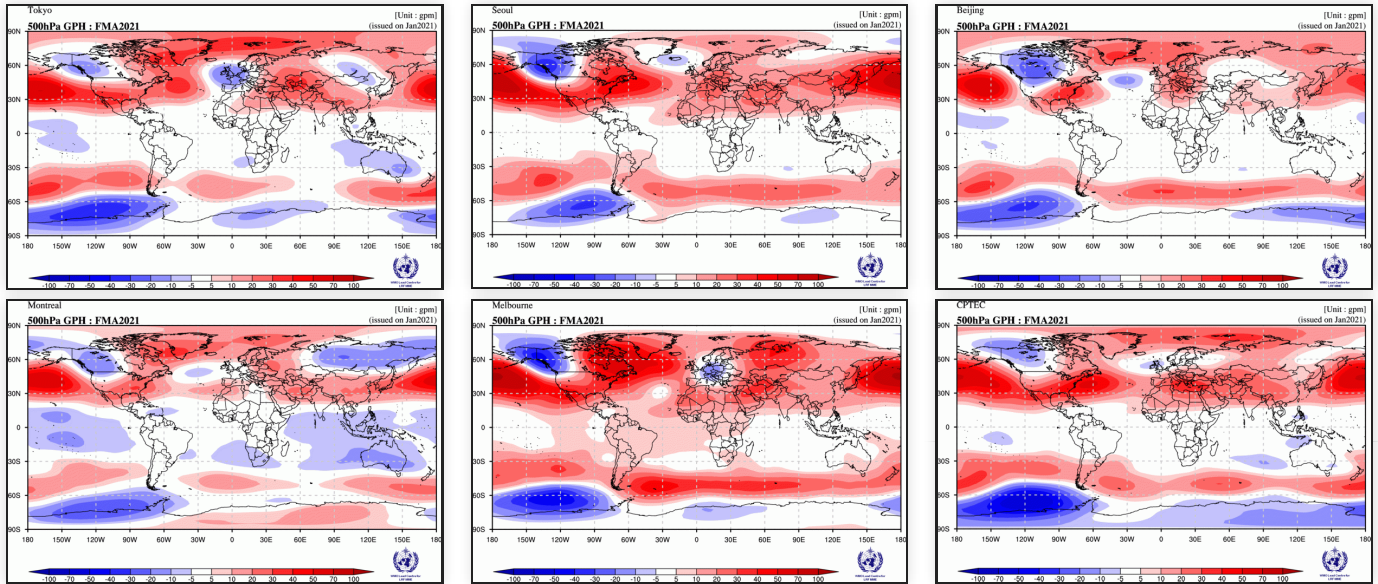
All C3S models opt for a marked negative PNA. Total divergency over Europe between on the one hand ECMWF, DWD and CMCC which forecast negative anomalies centered on Western Europe and MF, UKMO and NCEP on the other hand which forecast high values on the continent and low values on the Atlantic in the vicinity of Iceland.



MF-S7, SEASS, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in models but C3S

The other seasonal forecast models do not help us to identify a majority option for Europe/North Atlantic. A low value zone is still present but all locations seem possible.

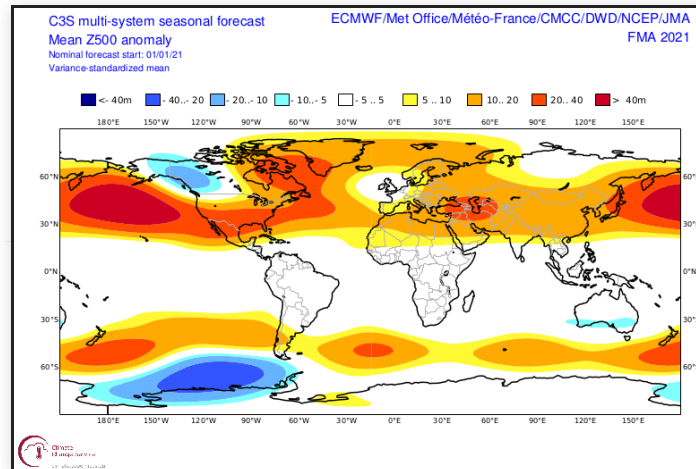


Tokyo, Seoul, Beijing, Montréal, Melbourne and CPTC 500hPa geopotential height anomalies.

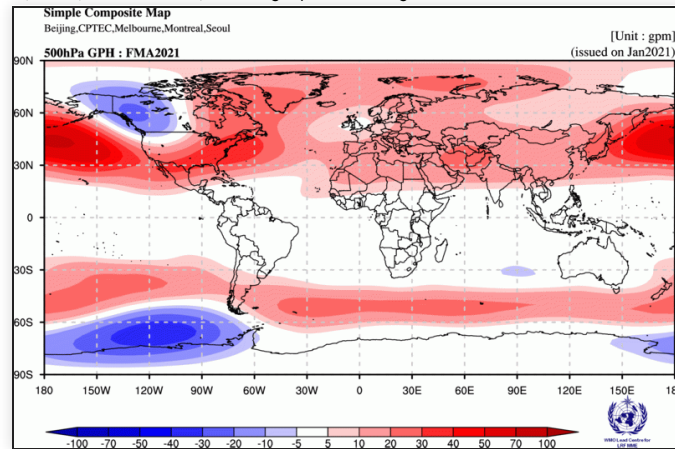
Atmospheric circulation forecasts : Z500 anomalies multi-systems

The two multi-models seem very close but for Europe/North Atlantic, the overall average includes very different options. The great climatic variability of spring further reinforces the uncertainty.

In the end we are not able to choose an option for atmospheric circulation over Europe/North Atlantic.



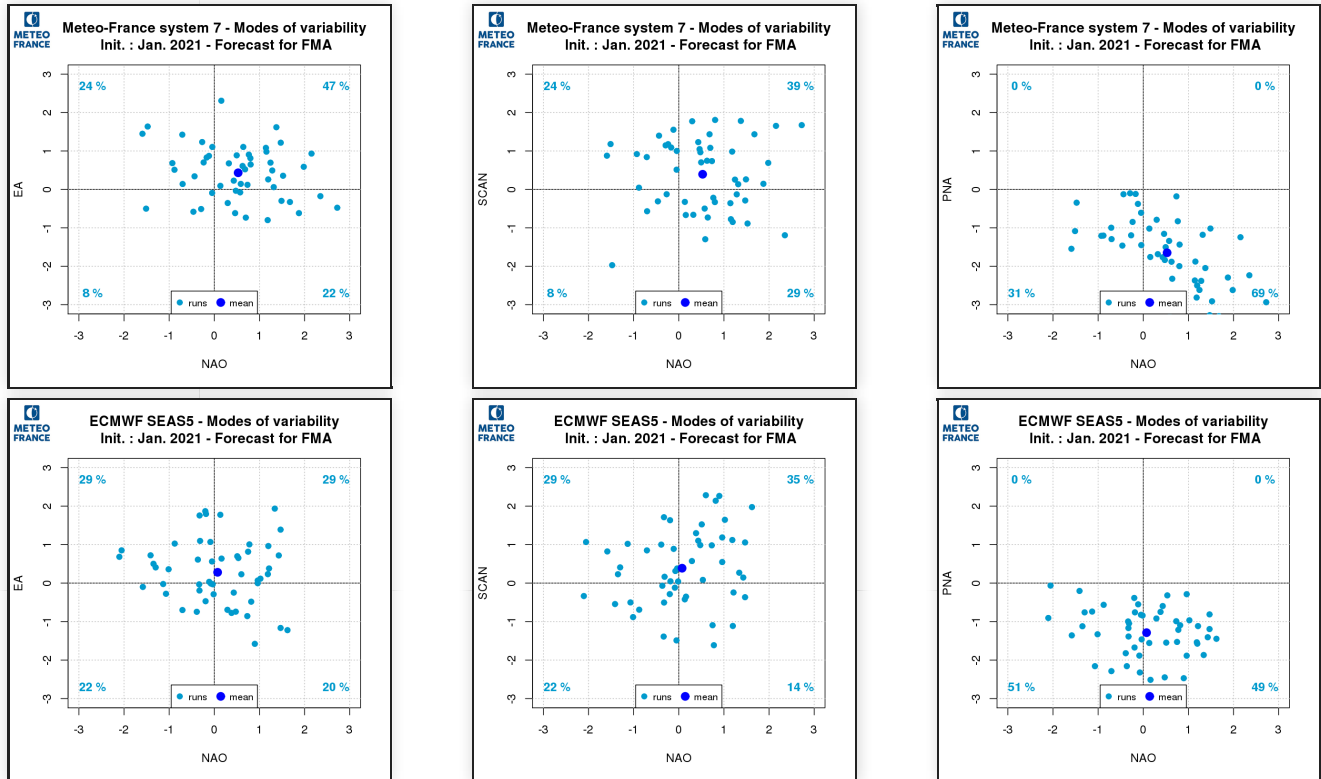
C3S multi-models (MF-S7, SEAS5, UKMO, DWD, CMCC, NCEP and JMA) 500hPa geopotential height anomalies.



Others models of WMO multi-models 500hPa geopotential height anomalies.

Modes of variability : forecast

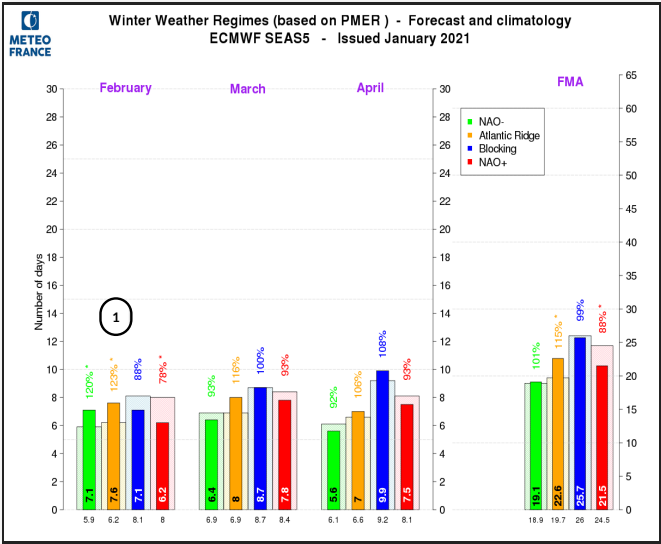
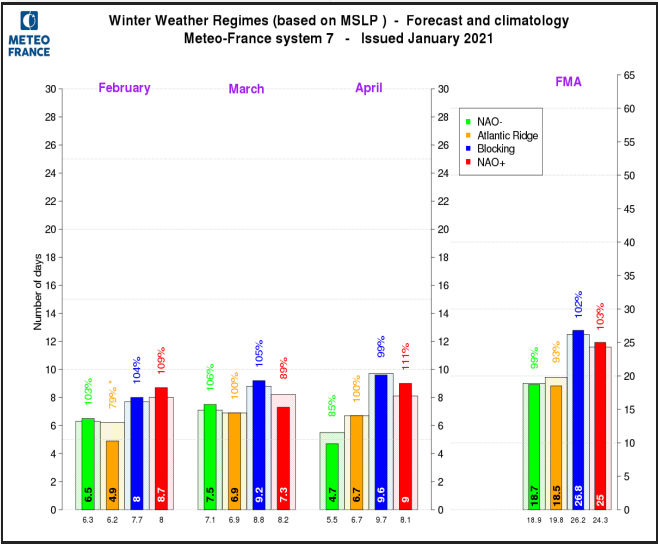
Unsurprisingly, all the runs create negative PNA. The divergent scenarios in Z500 impact the NAO mode which is positive with MF-S7 and neutral with ECMWF-SEAS5. Weak positive EA and SCAN modes tendency in both models.



[see the modes of variability patterns](#)

Weather regimes : winter MSLP

SEAS5's February regimes take into account the impacts of SSW with more NAO- (Atlantic Ridge is also favored). For the next two months when the impact of the SSW should have subsided, SEAS5 returns to climatological values. MF-S7, which did not take SSW well into account, has no trend for the quarter.

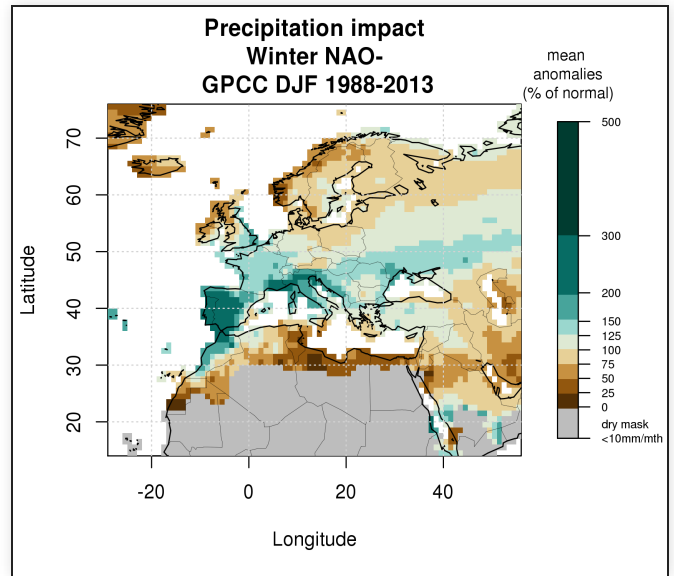
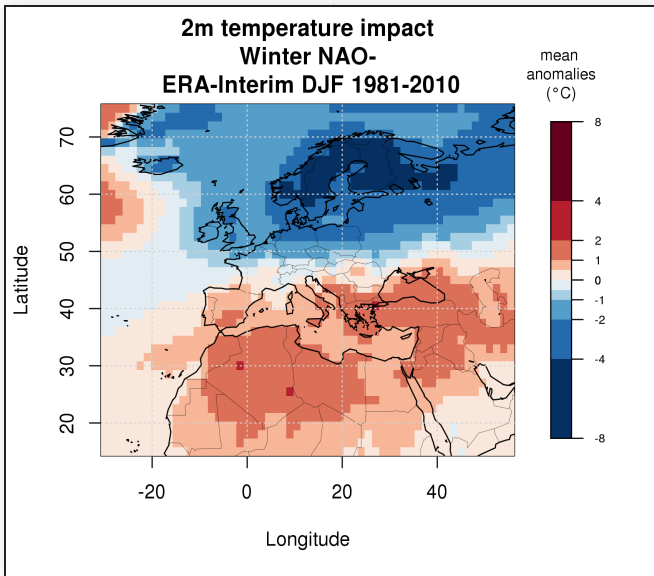


Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S7 (left) and SEAS5 (right).

1 - impact of SSW

Weather regimes : Impacts

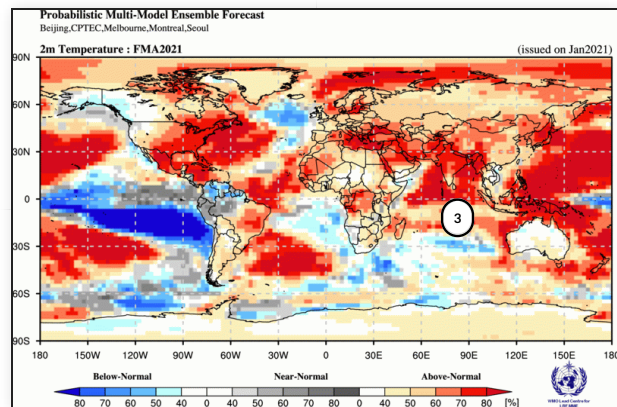
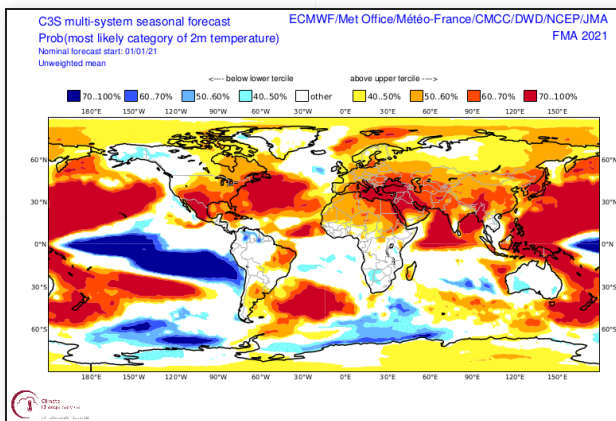
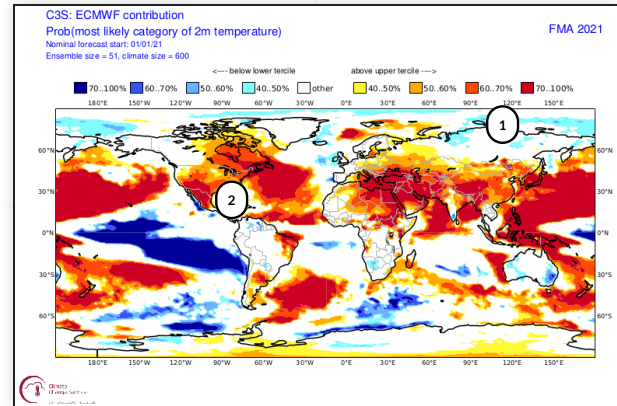
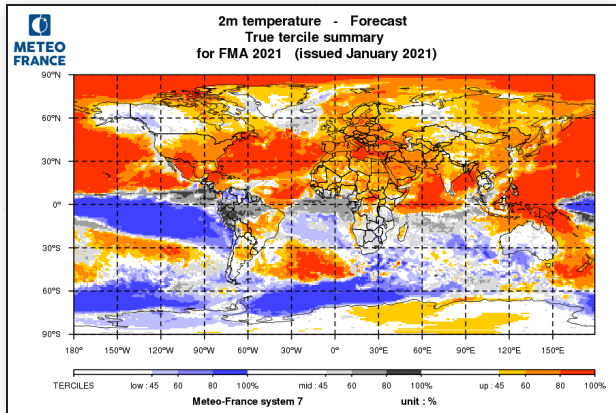
At a sub-seasonal scale, NAO- weather regime should be favored at the beginning of the quarter (closer to DJF than MAM period).



Impact of Summer Blocking weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)

Forecast of climatic parameters : Temperature probabilities

In a situation very constrained by the La Nina phenomenon, the general structures of anomalies on the globe are shared by all the models.

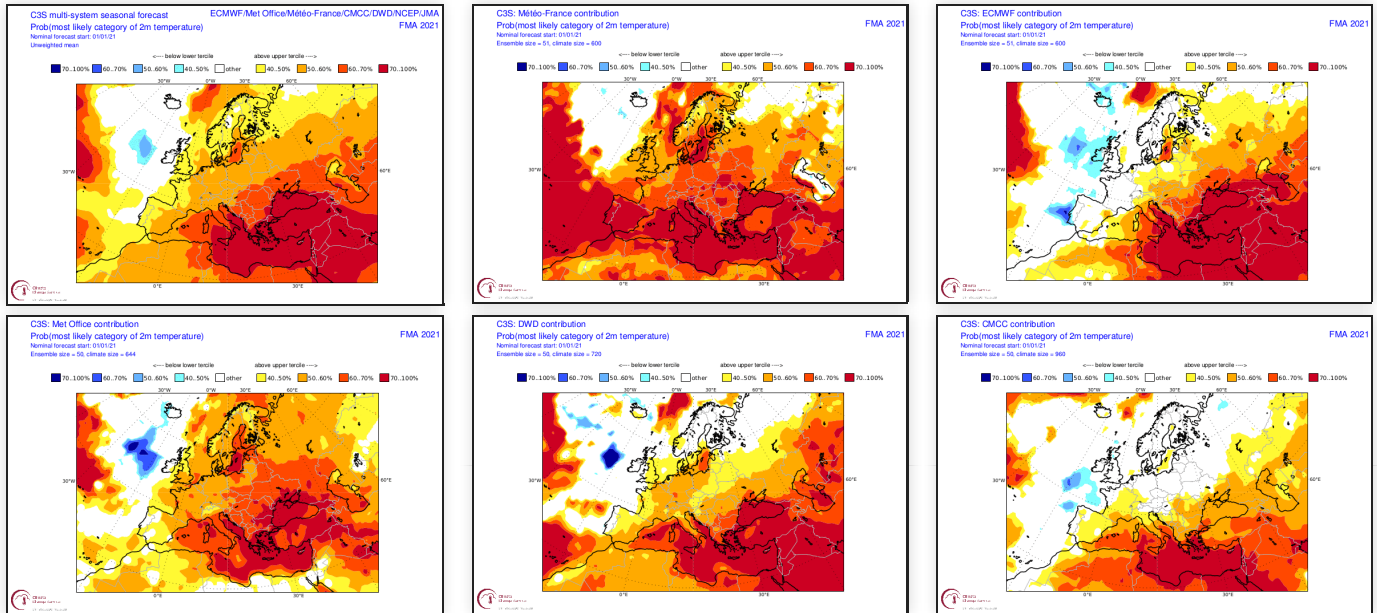


2m temperature probability map from MF-S7 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

- 1 - Most models do not forecasted this cold anomaly
- 2 - SEAS5 has no warm signal in the area
- 3 - C3S does not share this warm signal

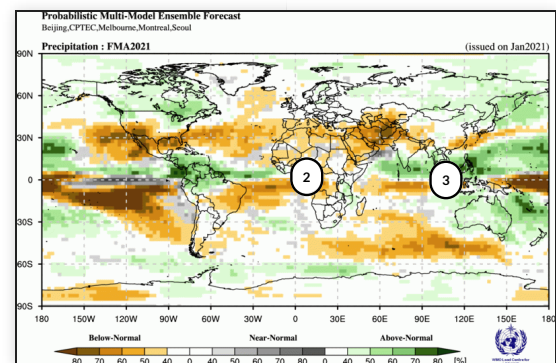
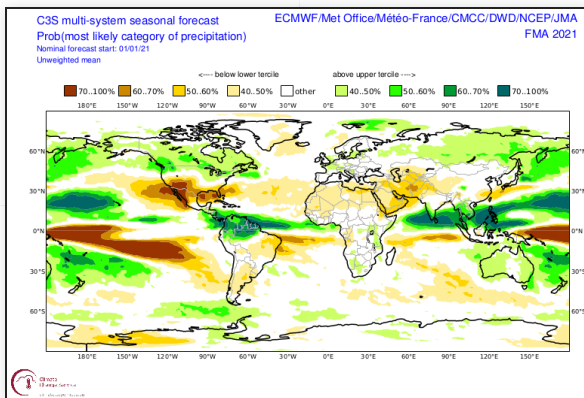
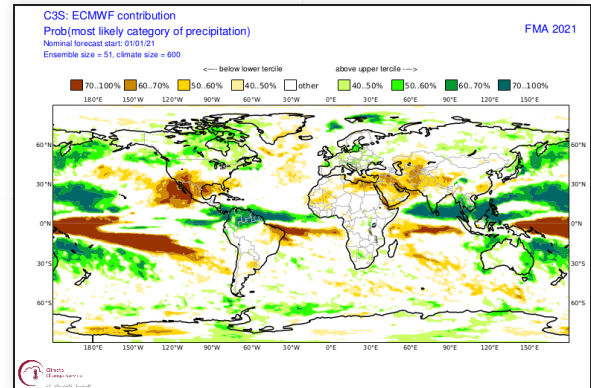
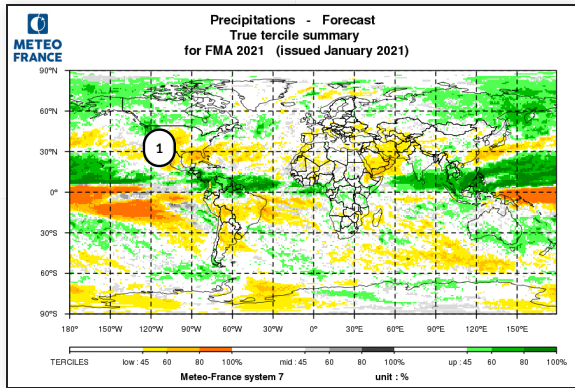
Forecast of climatic parameters : T2M probabilities over Europe in C3S models

Due to the divergences in the forecast of the general situation, the temperature forecasts for Europe show large differences from one model to another.



C3S multi-models probability map (top left) and MF-S7, ECMWF-SEAS5, UKMO (bottom left), DWD, CMCC models.

At the global level, the anomaly structures are very constrained by the La Nina phenomenon and the models are remarkably consistent.

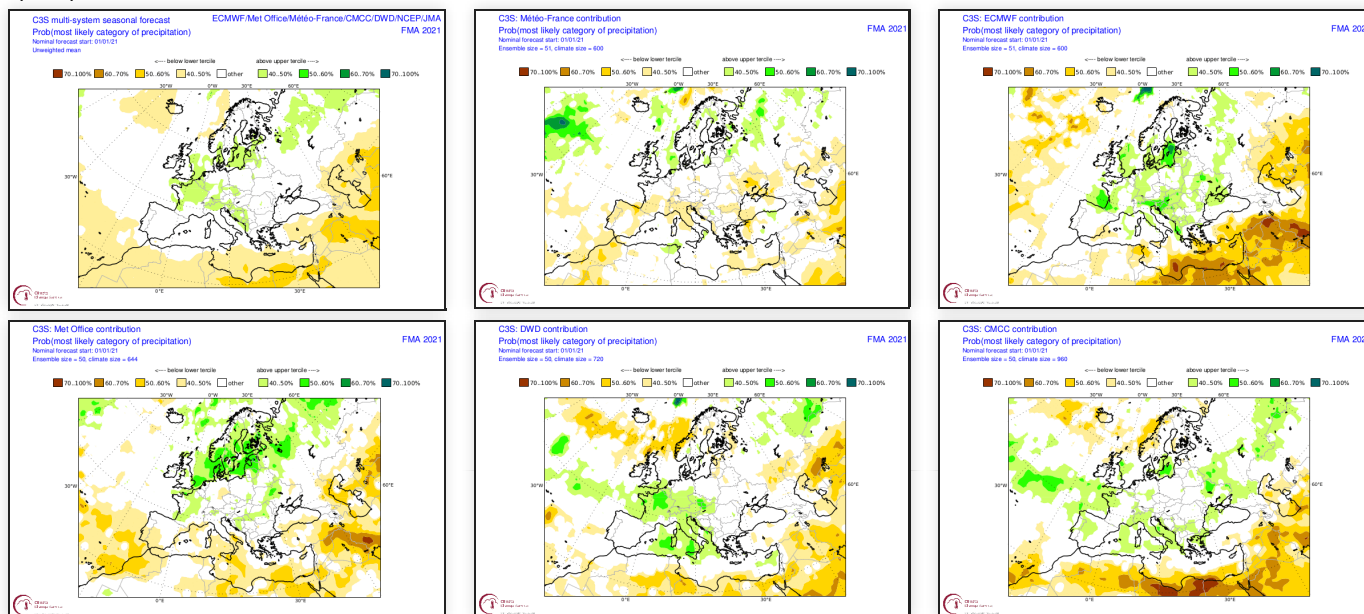


precipitation probability map from MF-S7 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

- 1 - dry anomaly is less marked than in the other C3S models
- 2 - drier than C3S models
- 3 - Drier than C3S models

Forecast of climatic parameters : Precipitation probabilities over Europe in C3S models

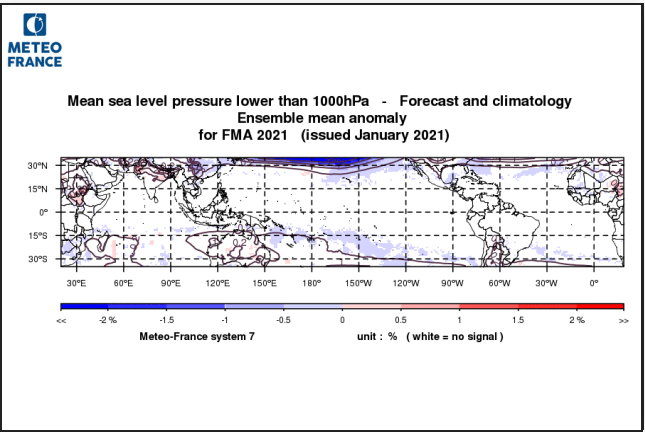
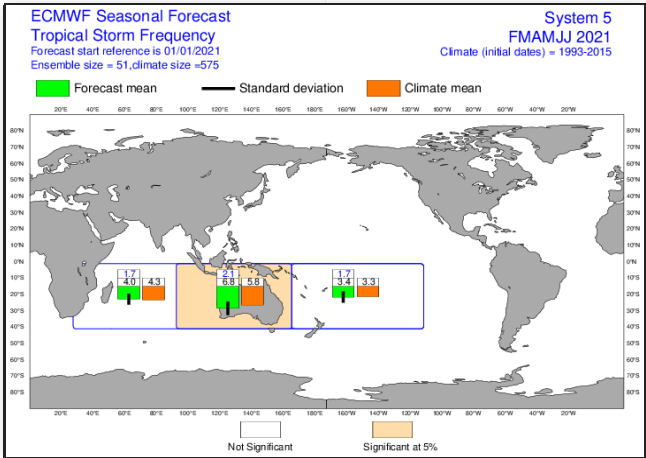
Same remark as for temperature: the divergences in the forecast of the general situation have repercussions on the forecast of precipitation.



C3S multi-models probability map (top left) and MF-ST, SEAS5, UKMO, DWD, CMCC models.

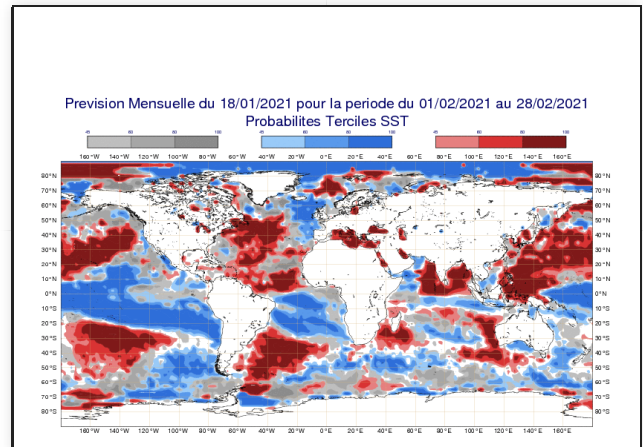
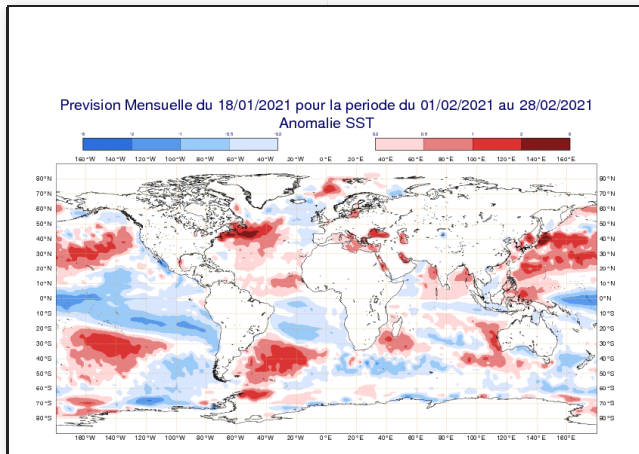
Forecast of climatic parameters : Tropical Storm Frequency

In the well-established La Nina situation, cyclone risk is likely to increase around Australia.



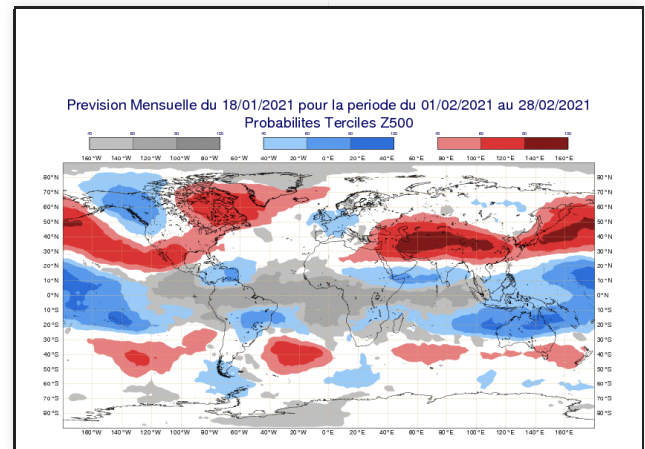
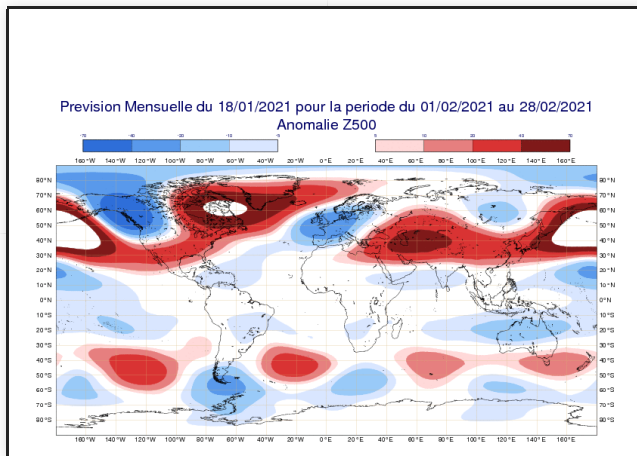
Monthly forecast of 20210118 : SST

The monthly forecast is very consistent with the seasonal forecast.



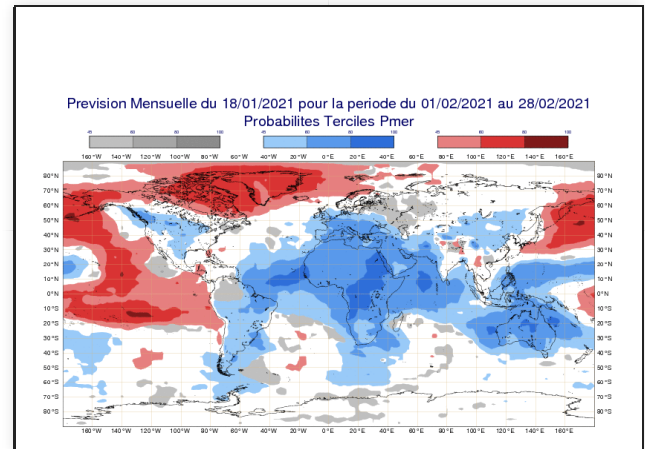
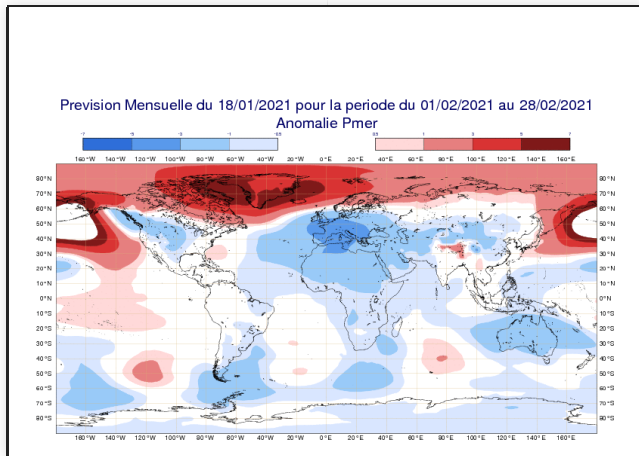
Monthly forecast of 20210118 : Z500

Negative PNA mode is present as in seasonal forecasts. Over Europe, the monthly forecast is rather consistent with the choice of the ECMWF / DWD / CMCC scenario.



Monthly forecast of 20210118 : MSLP

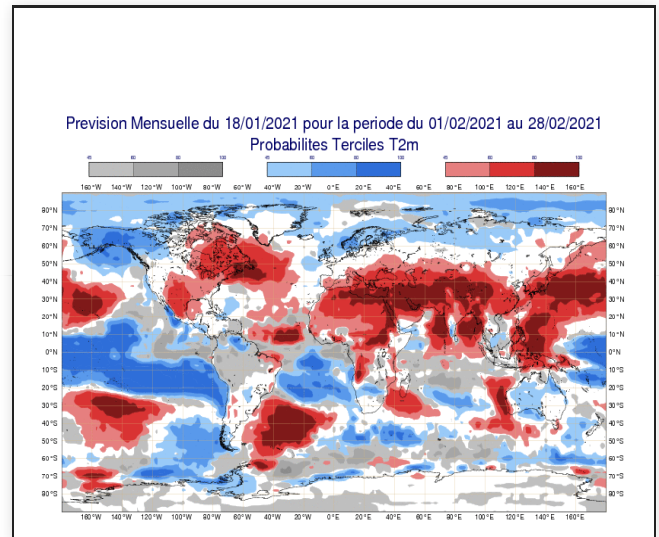
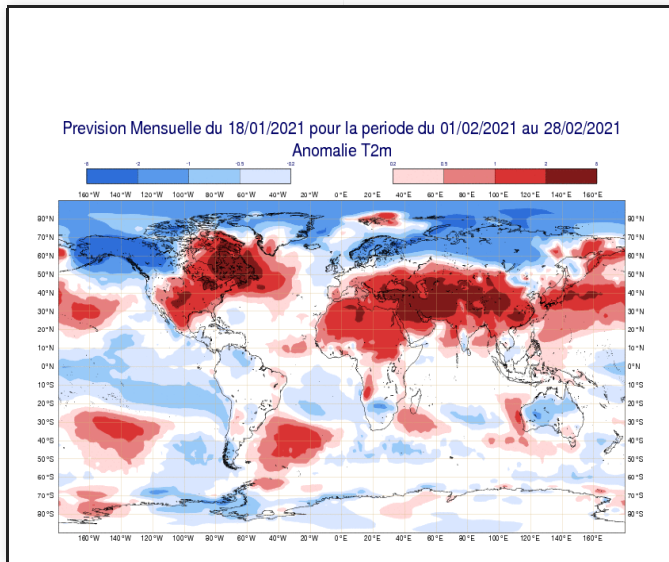
Low values over a large part of Europe.



Monthly forecast of 20210118 : temperature

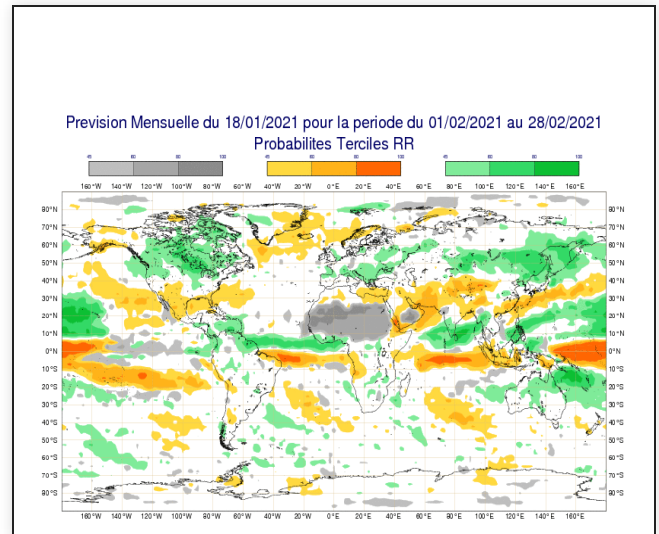
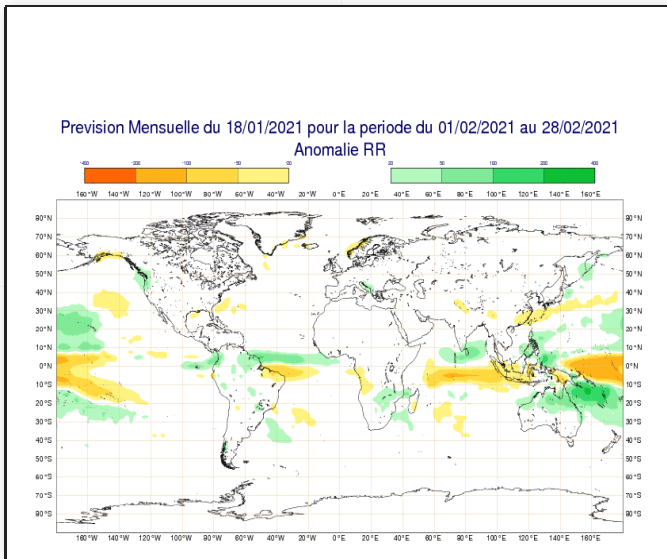
Dipole anomaly forecast for NorthAmerica compatible with seasonal forecast.

On Eurasia, the north-south contrast is characteristic of the NAO- regime. It should not last for the entire quarter.



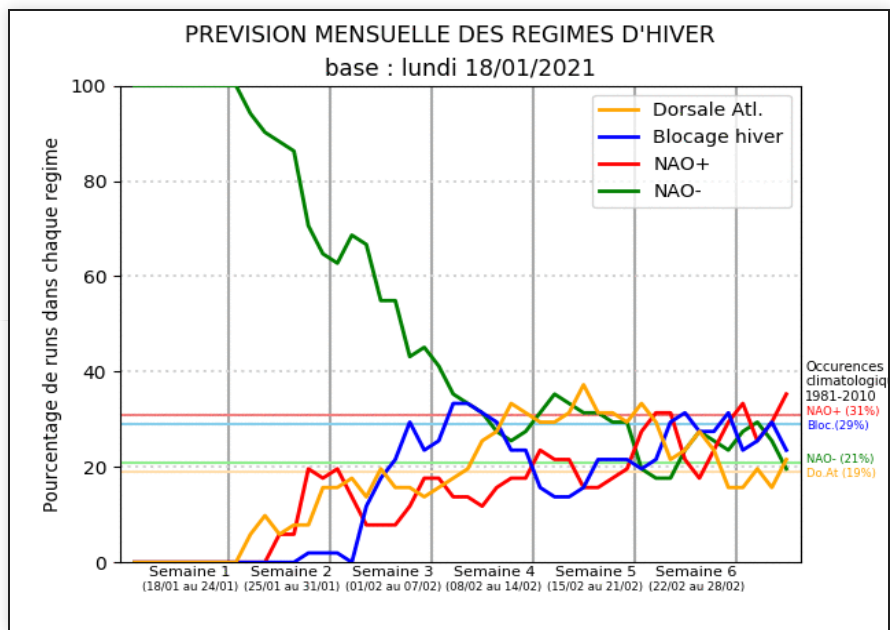
Monthly forecast of 20210118 : precipitation

Forecast very similar to the seasonal forecast on a global scale. No signal over Europe.



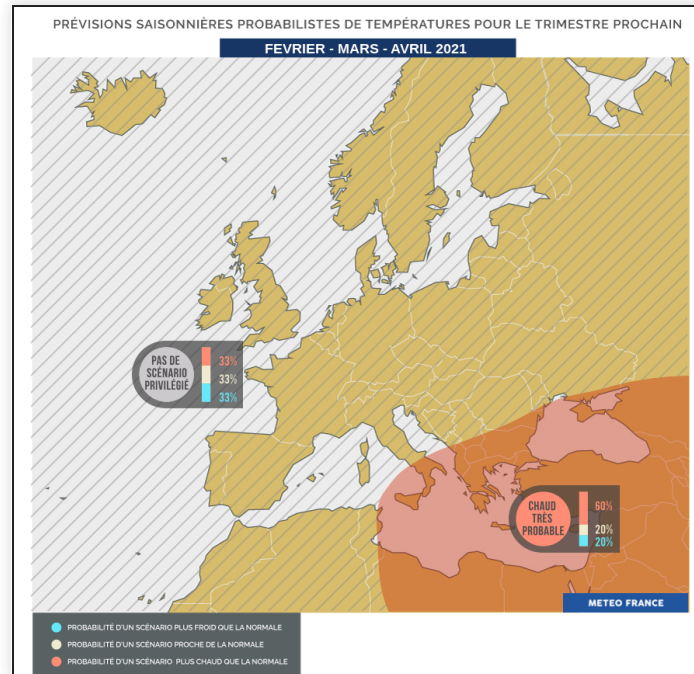
Monthly forecast of 20210118 : winter SLP weather regimes

Due to SSW, the NAO- regime is very dominant at the beginning of the period but decreases rapidly during the month



Synthesis map for Europe : Temperature

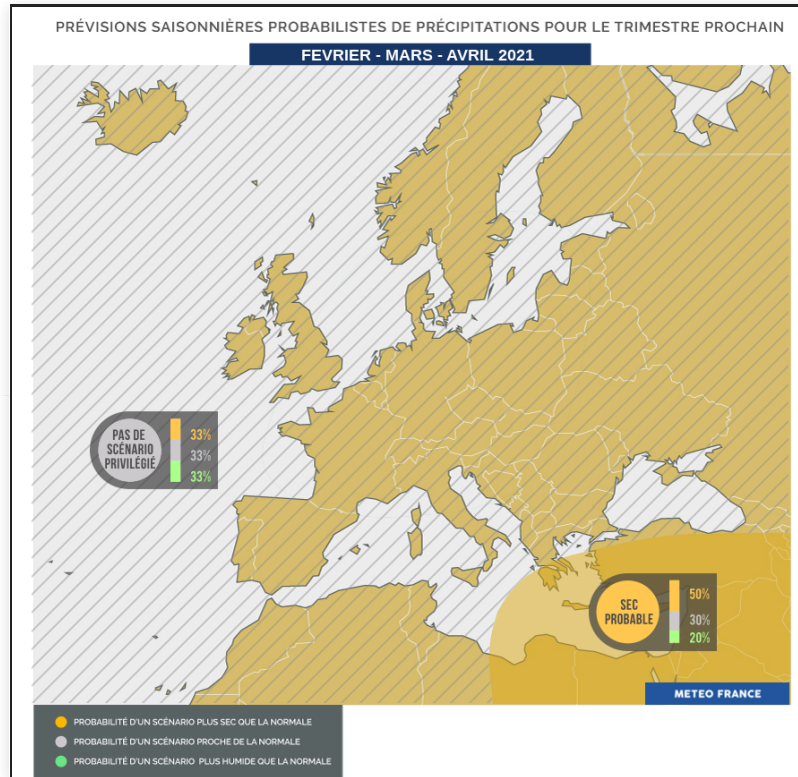
No scenario for Europe except for the extreme south-eastern part of the continent which has majority probabilities for a warmer-than-normal quarter.



Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/AVH

Synthesis map for Europe : Precipitation

No scenario for Europe only the extreme south-eastern part of the area has an enhanced probability of dryness.



Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/AVH