Météo-France Seasonal Forecast Bulletin

DECEMBRE - JANUARY - FEBRUARY 2020/2021

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General synthesis : DJF 2020/2021

The models are very constrained by the ongoing La Nina event. The forecasts are extremely close, both geographically and in their temporal evolution.

A) Oceanic forecast :

- **ENSO : ongoing moderate La Niña.** The phenomenon should reach a peak towards the end of the year and start to decrease from February.

- **IOD** : neutral situation during next quarter.

B) Drivers :

- West QBO with an east shift at the end of the quarter.
- Slightly reinforced polar vortex.

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).

- over the North Atlantic and Europe : all the models predict high field values from Unite States to Europe. They are less in agreement with the positioning of low values further north around Iceland.

D) Most likely conditions :

- Wet conditions from India and Southeast Asia to the Maritime Continent and Australia, as well as over northern South America. Dry conditions elsewhere in the tropics.

- over Europe : weak warm signal on the east. Drier than normal in Mediterranean area. Wet expected over Scandinavia

Next bulletin : scheduled on December 18th

Oceanic analysis of October 2020 : SST anomalies

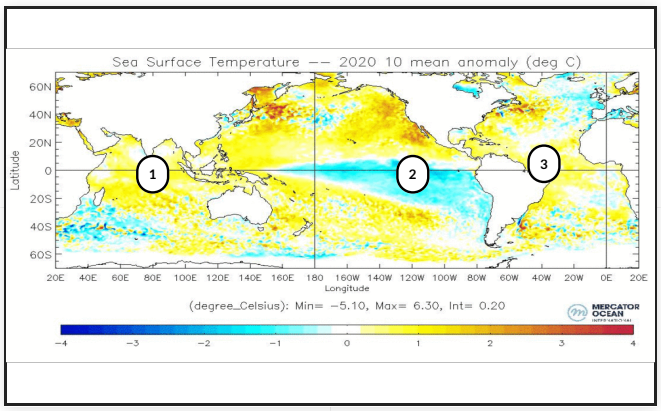
Current ENSO situation : La Nina conditions

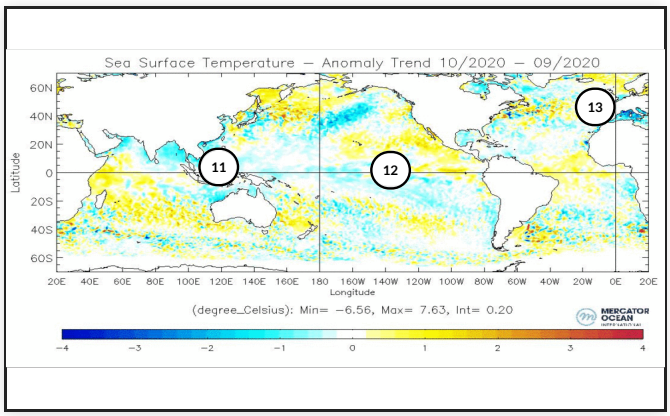
In the Pacific : Cooling along the equator continued in October, especially in the central part of the basin. The La Nina event is now well established.

Net cooling from Asia to Australia during the month, anomalies remain positive in October.

The Indian Ocean is still warmer than normal except in the southwest part.

In the Atlantic : positive anomalies in the tropics. In the North Atlantic, the western part is warmer than normal while the vicinity of Europe shows quite marked cold anomalies



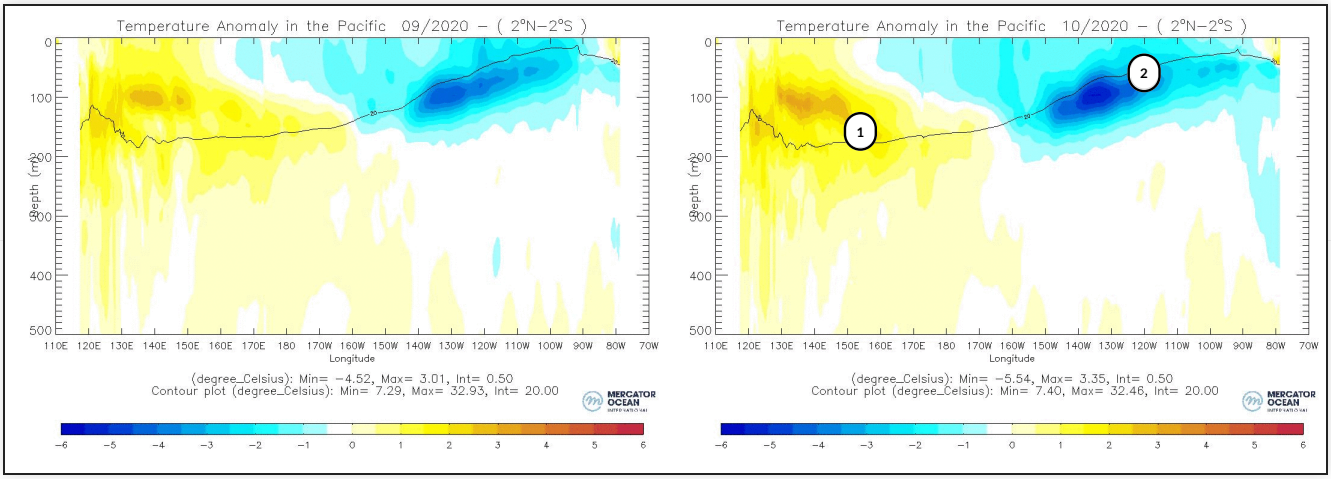


SST Anomalies and trend with the previous month (c) Mercator-Ocean

1 - warm Indian Ocean
2 - LA Nina cold anomaly
3 - warmer than normal
11 - cooling
12 - Cooling in Nino3.4 box
13 - cooling in the vicinity of Europe

Oceanic analysis of October 2020 : Pacific vertical section

In subsurface, strong cooling continuation in the eastern and central part. Significant warming in the western part. The strong east-west contrast has further strengthened



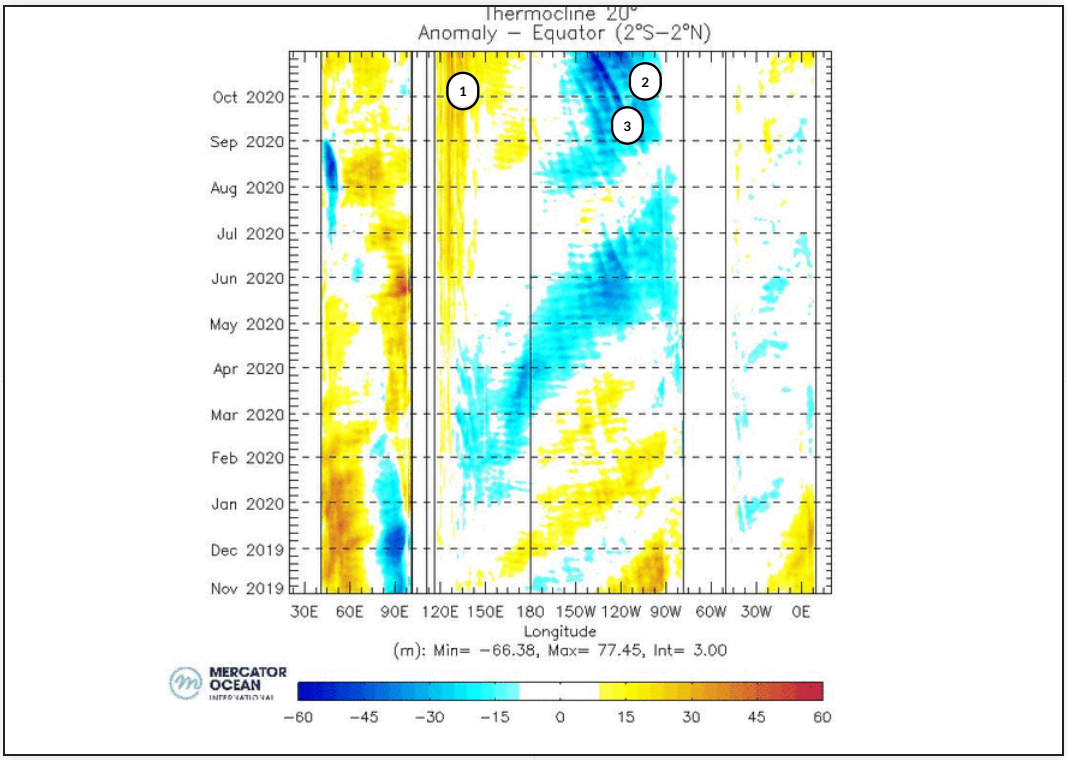
Ocean temperature anomalies in the first 500 meters of the equatorial Pacific basin, monthly average. (c) Mercator-Ocean

1 - warming in the West
2 - Cooling in the East

Oceanic analysis of October 2020 : Hovmüller diagram of the 20°C isotherm

The strong subsurface contrast is clearly visible and has little changed in October.

Note the reflection of the spring/summer Kelvin wave as a beautiful Rosby wave.



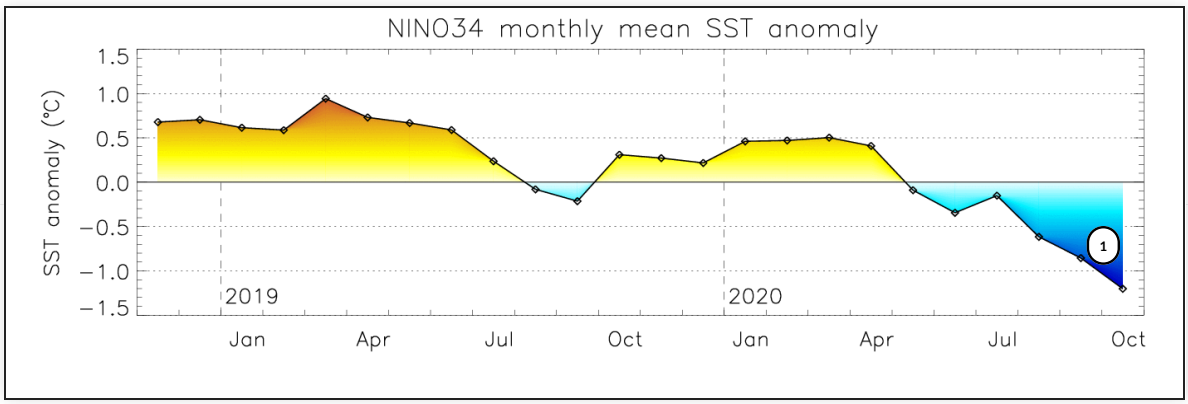
Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 ° C isotherm) (c) Mercator-Ocean

1 - Warm anomalie in the west part
2 - Cold anomalies in the east part of the Pacific
3 - Beautiful Rosby wave

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

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -1.2 °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 clearly increased during the last month.



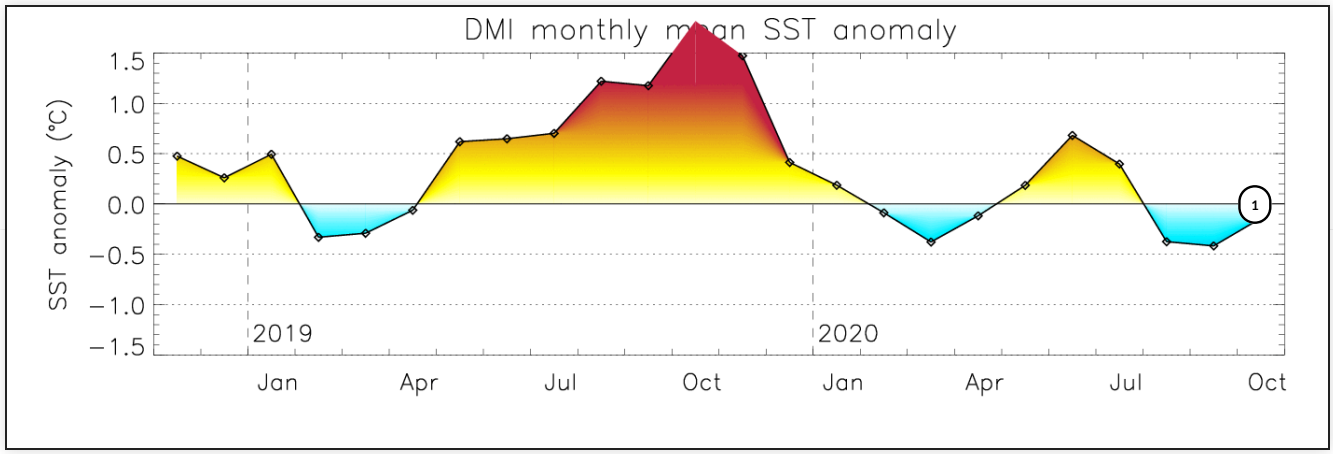
Evolution of SST in the NINO3.4 box (c) Mercator-Ocean

1 - The cold anomaly gets strong

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

DMI Index issued from Mercator Ocean PSYV4R2 analysis : -0.2°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

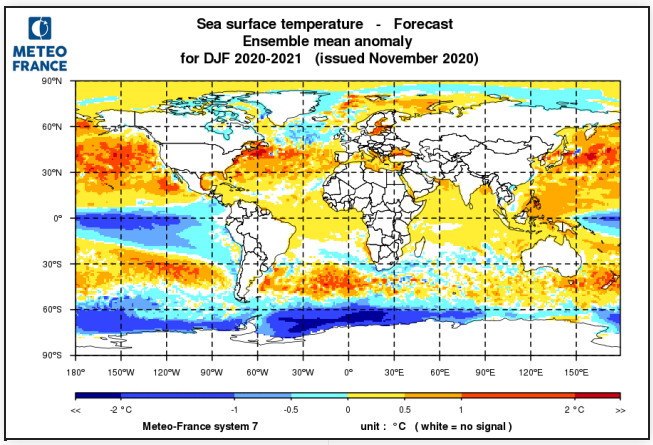
Oceanic forecast : SST anomaly

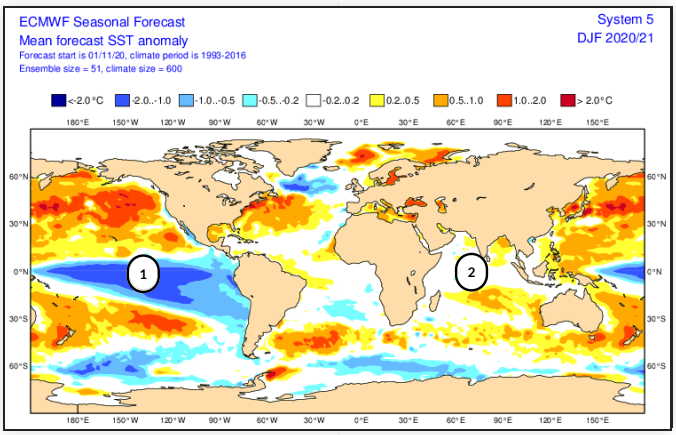
Very good agreement between MF-S7 and ECMWF-SEAS5. Same anomaly patterns, little differences in the Indian Ocean.

In the Pacific Ocean : The ongoing La Nina phenomenon will continue beyond the next quarter. The strong anomalies in the north hemisphere and around 30°S will get even stronger.

In the Indian Ocean : No west/east contrast, near neutral IOD. neutral values.

In the Atlantic Ocean : MF-S7 is a little warmer in the equatorial zone. Dipole marked near Newfoundland

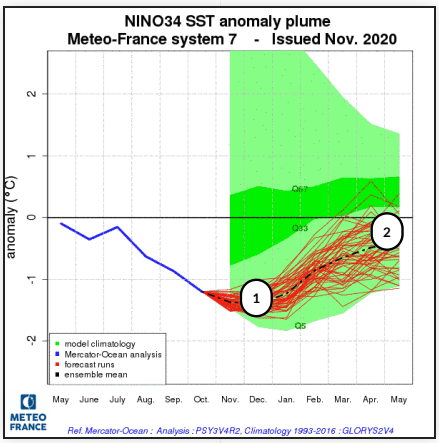


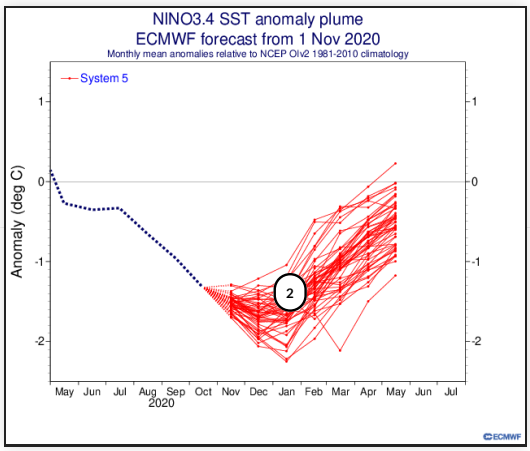


1 - Very similar forecast for La Nina
2 - Little difference in the Indian Ocean

Oceanic forecast : NINO3.4 Plume diagrams

Good consistency of the two models on a strengthening of La Nina event, peaking at the end of the year.



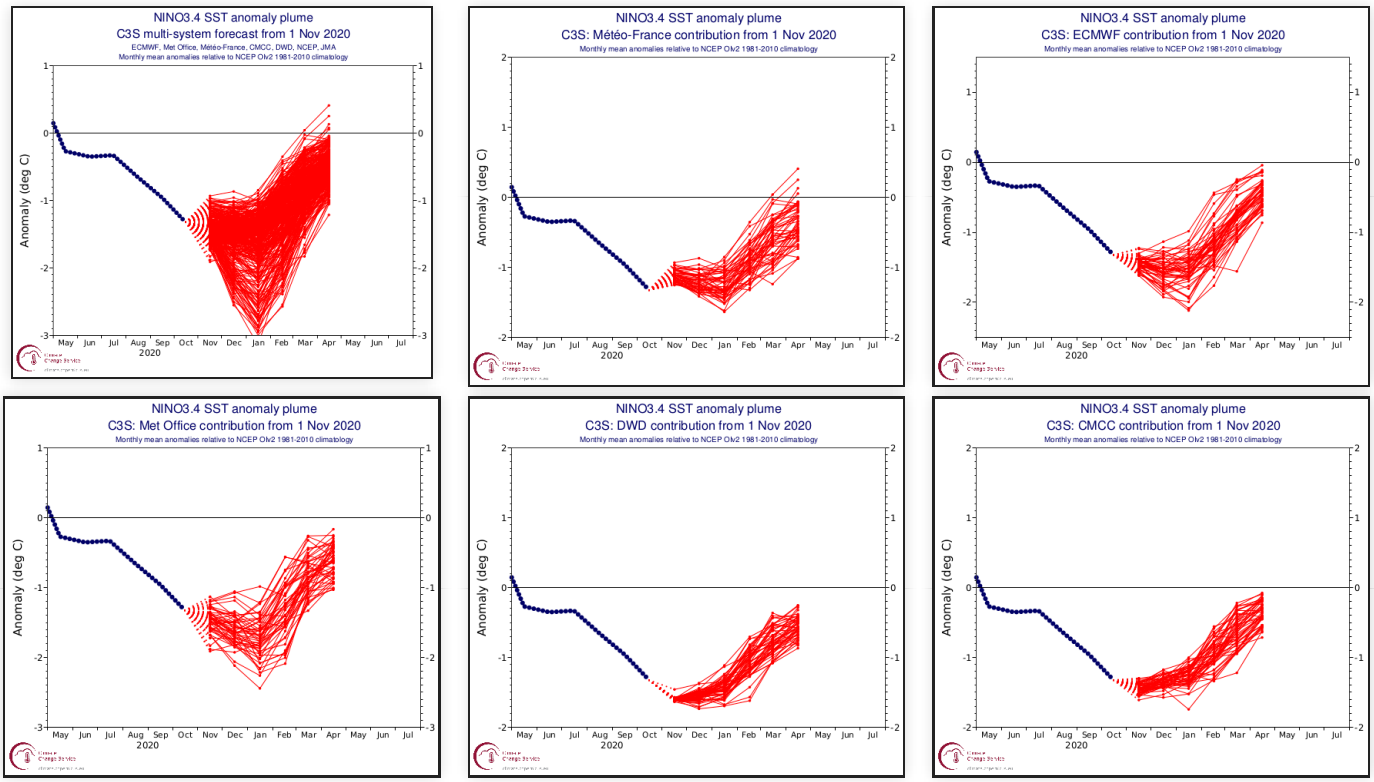


1 - Little dispersion of runs (values around -1.4°C)
2 - Return to neutrality expected in the spring.
2 - same signal with a little more spread

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

Very good agreement between the models whose simulations are moreover weakly dispersed.The anomaly in the NINO3.4 box predicted between -1 and -1.5 ° C until January should start to weaken from February.

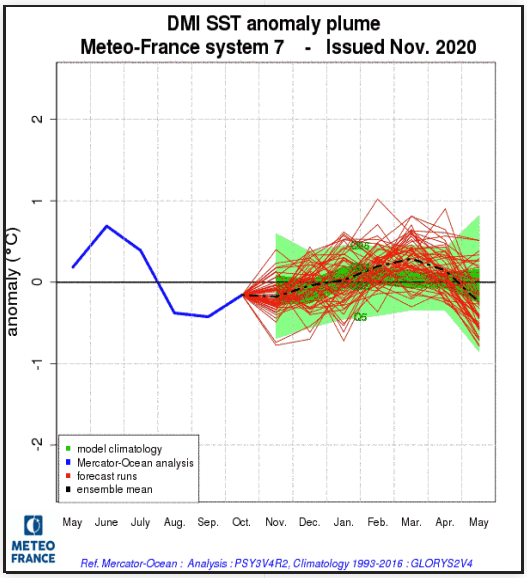
Expected Phase for the next three months : moderate La Niña

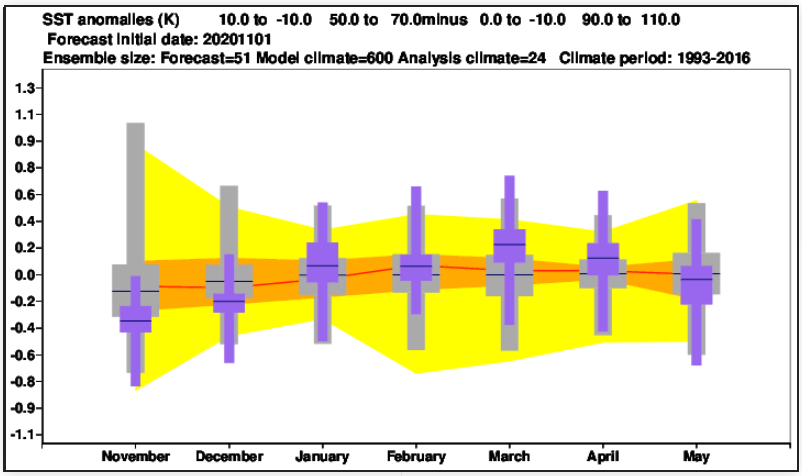


C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010.

Oceanic forecast : Indian ocean - DMI evolution

DMI index around neutrality during the next quarter

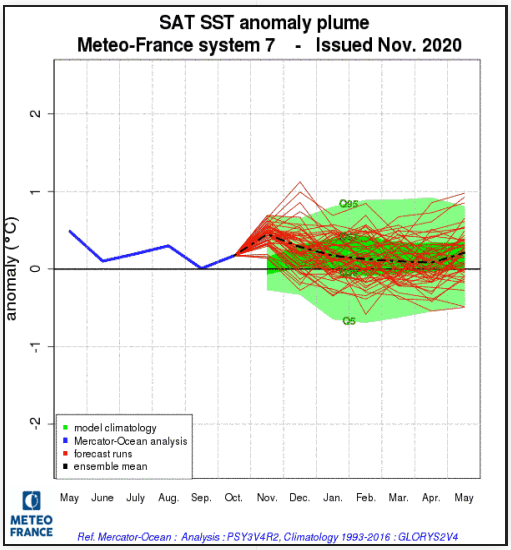


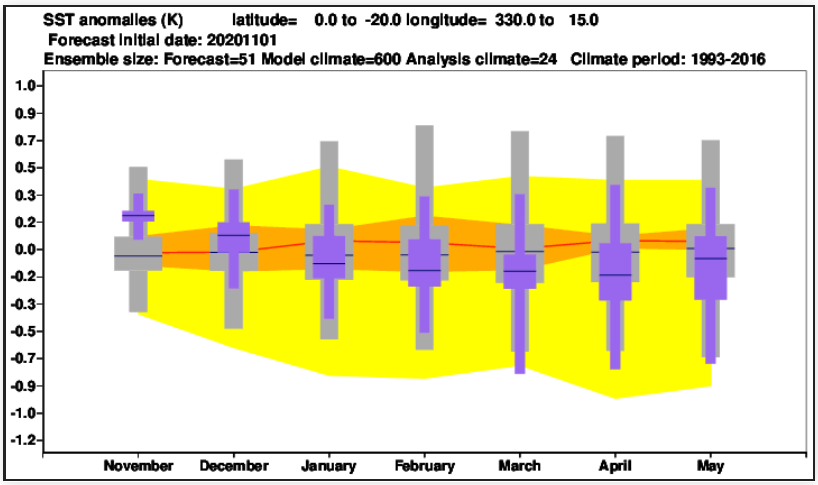


DMI index : analysis, forecasts and model climatology with MF7 on the right and SEAS5 on the left

Oceanic forecast : Atlantic ocean - SAT evolution

Return to neutrality expected during the next quarter.

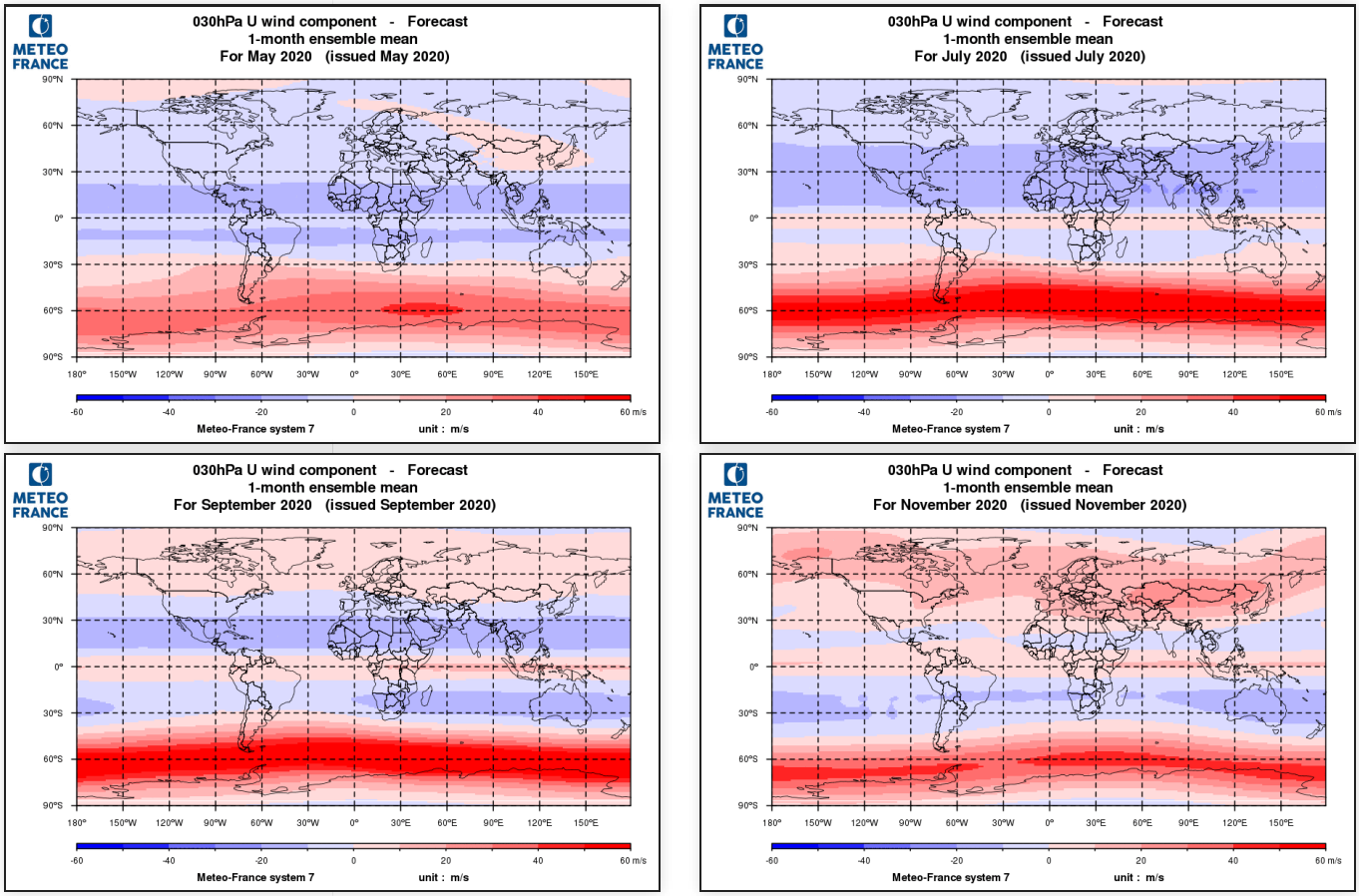




Anomaly on the SAT box : analysis, forecasts and model climatology with MF7 on the right and SEAS5 on the left

Drivers : QBO analysis

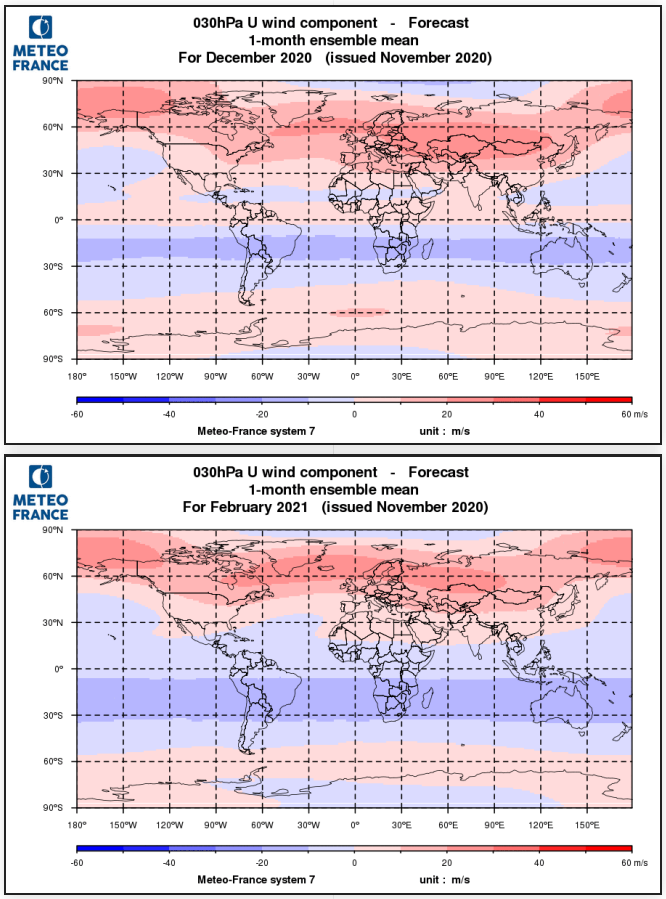
The regularity of the QBO oscillation seems to be disturbed again this year (see NASA article about 2016 QBO irregularity), perhaps in connection with the ongoing La Nina event (see JMSJ article about 1987 short easterly phase). The eastern phase started in November 2019, ended prematurely this summer. The western phase has since strengthened (it probably contributed to intensify the hurricane season which reached an exceptional level).

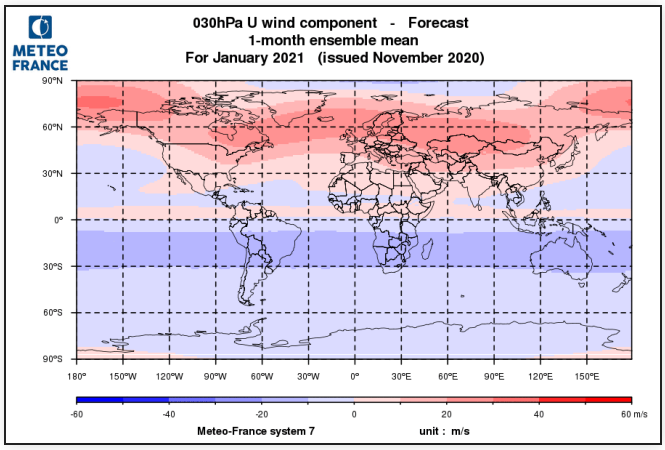


MF-S7 analysis of the zonal component of the wind at 030hPa in May, July, September and November

Drivers : QBO forecast

MF-S7 suggest an atypical scenario, with a rapid weakening of the westerly phase and a return to easterly winds at the end of the term.

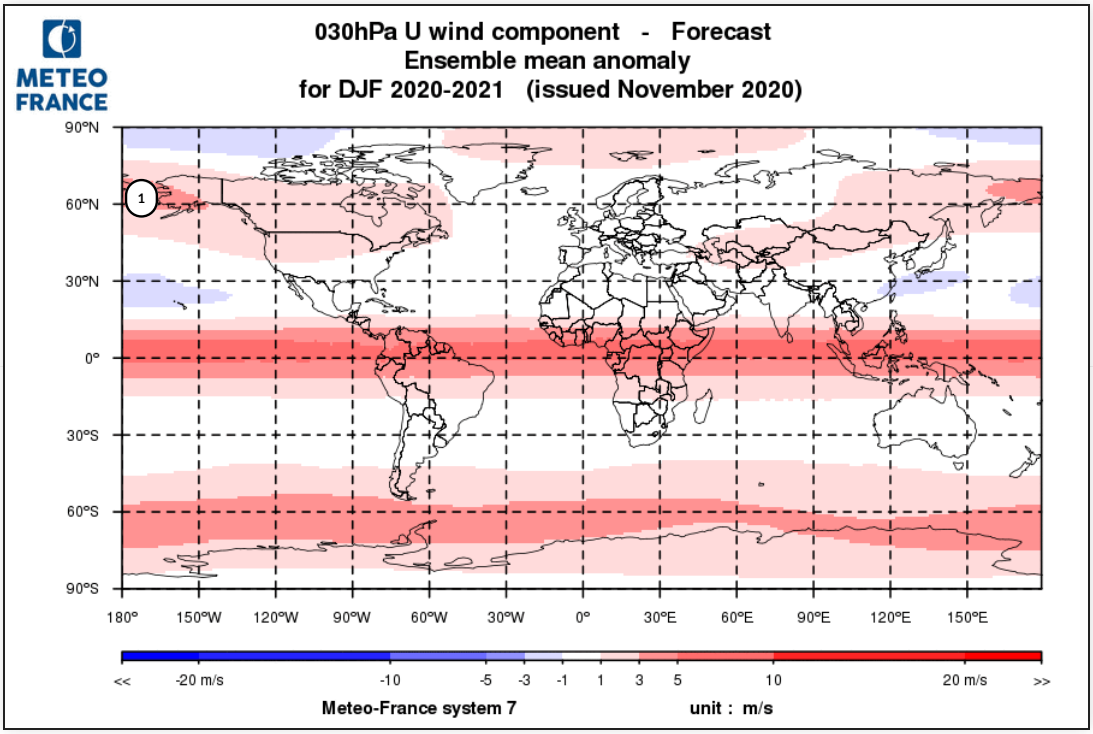




MF-S7 forecast of the zonal component of the wind at 030hPa for December, January and February

Drivers : vortex polaire

MF-S7 predicts a gradual strengthening of the polar vortex over the months. The DJF quarterly average is slightly strengthened mainly from Asia to America.

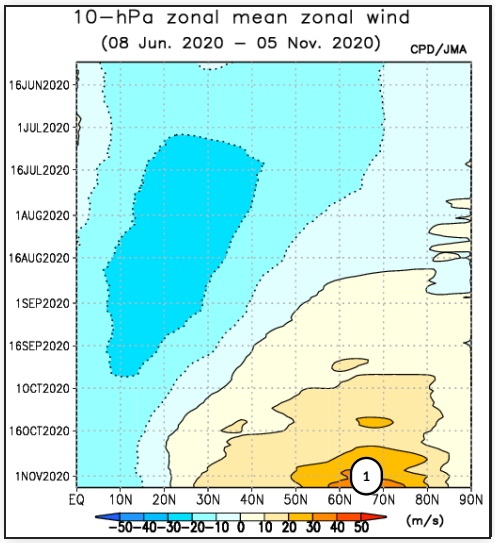


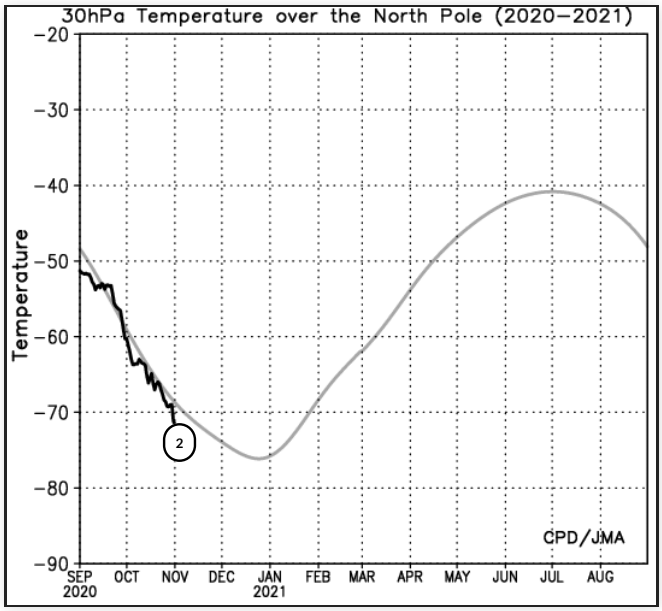
10 hPa zonal wind Hovmuller diagram and 30 hPa temperature histogram. (c) Tokyo Climat Center JMA

1 - westerly wind stronger than usual

Drivers : SSW

The negative anomaly of temperature observed at the beginning of November is consistant with a reinforced polar vortex.



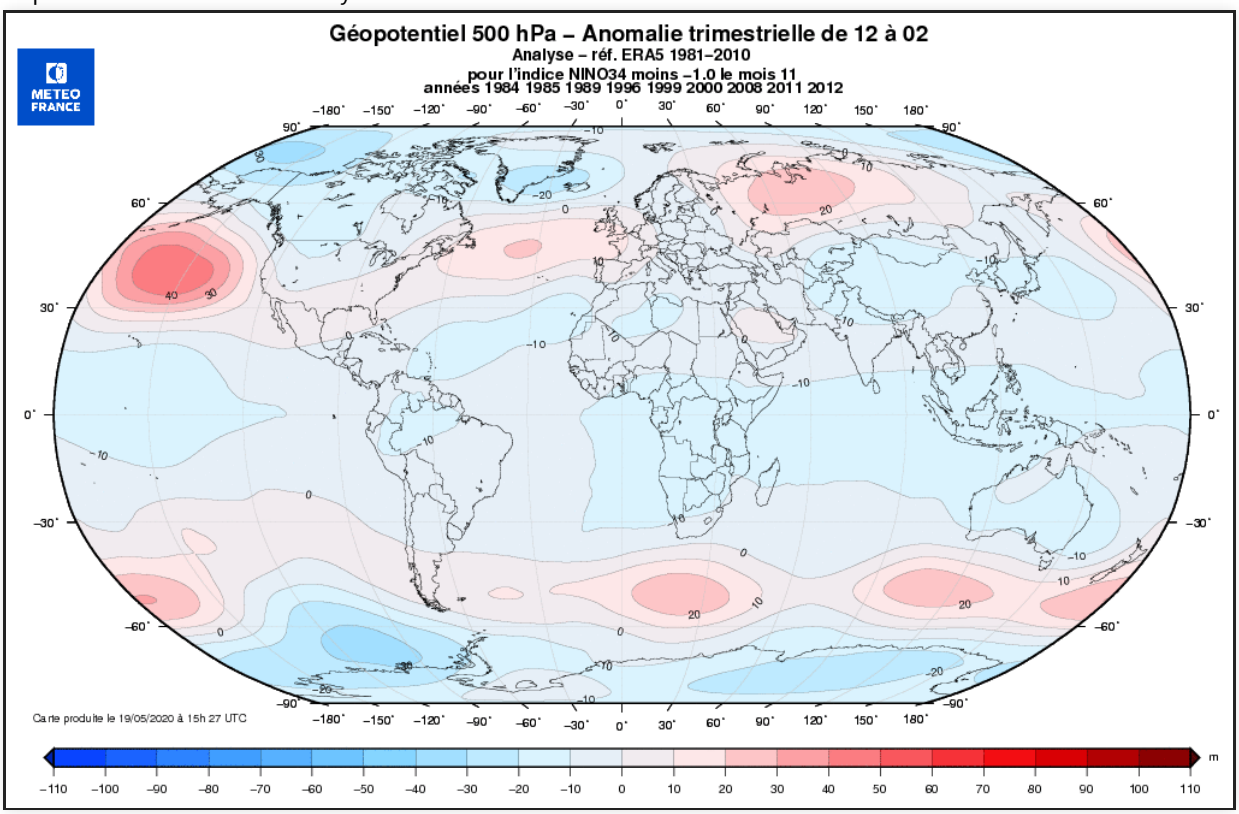


10 hPa zonal wind Hovmuller diagram and 30 hPa temperature histogram. (c) Tokyo Climat Center JMA

1 - Zonal wind stronger than climatology.
2 - Temperature negative anomaly

Drivers : Pacific SST : Statistical effect of La Nina

The composite field of Z500 for La Nina years is shown below.



Composite field of Geopotential at 500Hpa for La Nina years between 1980 and 2019

Drivers : Summary

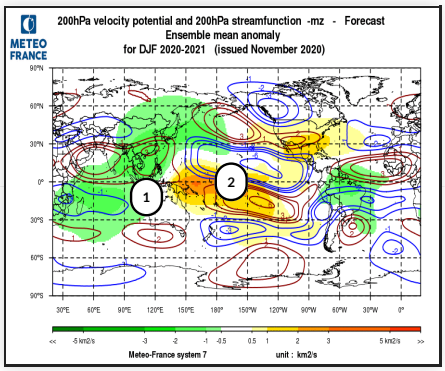
- strengthening of the polar vortex linked with the ongoing westerly phase of QBO
- In winter La Nina conditions favor the Atlantic Ridge regime

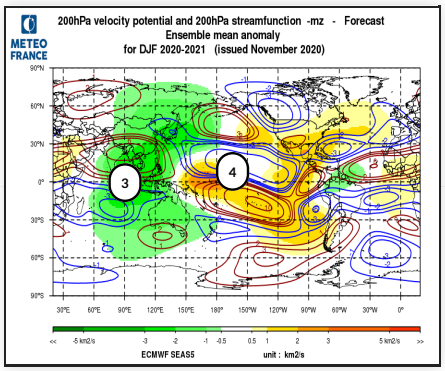
Atmospheric circulation forecasts : velocity potentiel and stream function at 200hPa

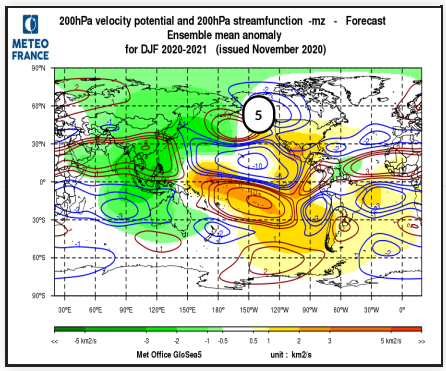
Good agreement between the models in both PV and FC.

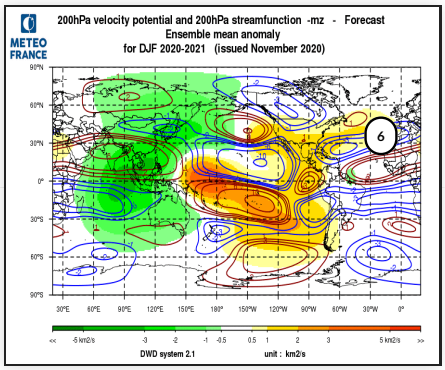
Velocity Potential : the models foreseen a principle dipole in the Pacific-Indian zone, and a secondary dipole in the America-Atlantic-Africa zone.

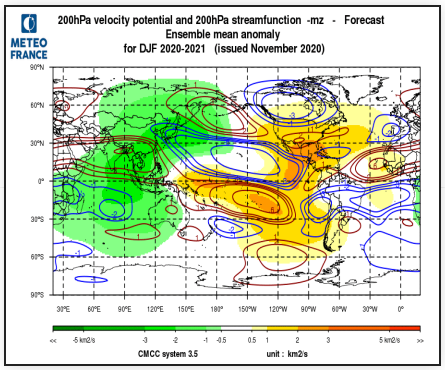
Streamfunction : The models agree remarkably well both in the tropics and for teleconnections to mid-latitudes, both in the Pacific and in the Atlantic.

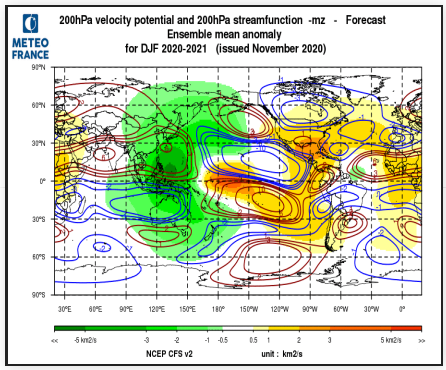










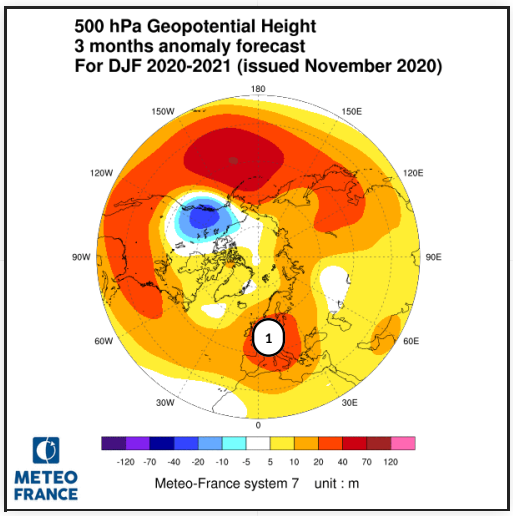


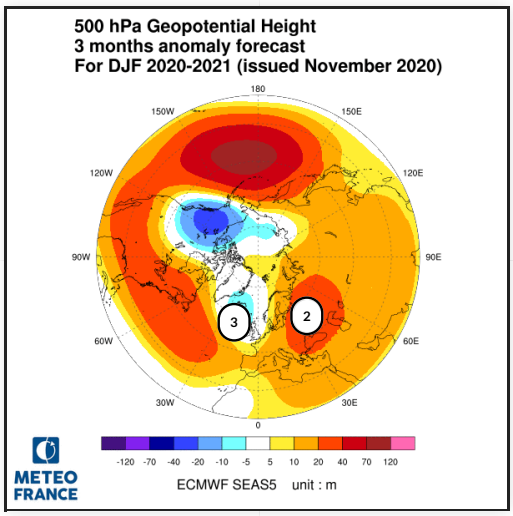
MF7,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

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 - teleconnections to North America.
6 - teleconnection to the Atlantic

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Very good consistency overs the Pacific and North America. Both models opt for a high value belt from America to Europe and a lower field to Greenland (NAO+), however SEAS5 is much hollow with lower values from Iceland to the British Isles and the high values shifted to Eastern Europe.



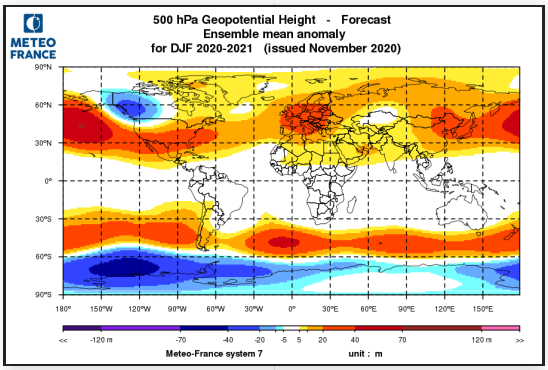


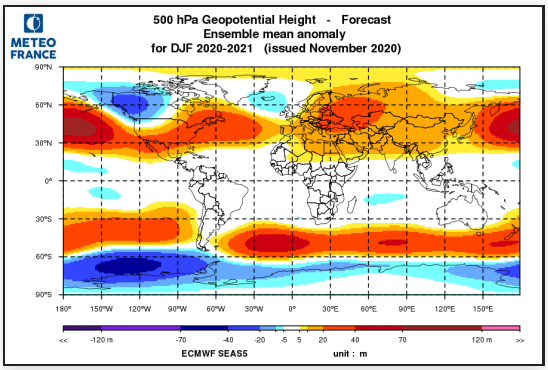
polar projection of MF7 and SEAS5 500hPa geopotential height anomalies.

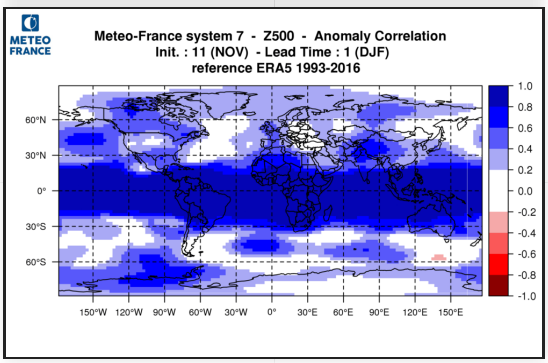
1 - Positive anomaly centered on Western Europe
2 - Positive anomaly in Eastern Europe
3 - NAO+ type pattern

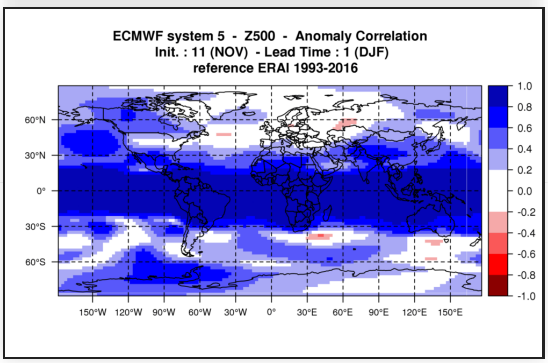
Atmospheric circulation forecasts : Z500 scores

MF-S7 scores are better than SEAS5 for Europe and north pole



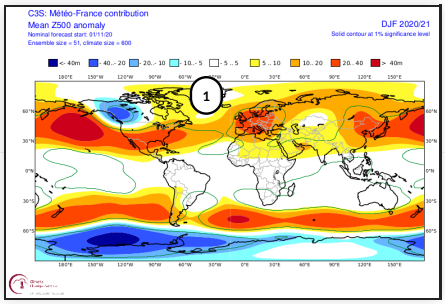


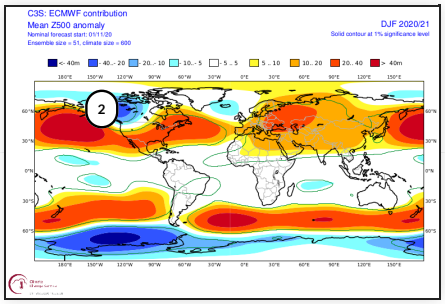


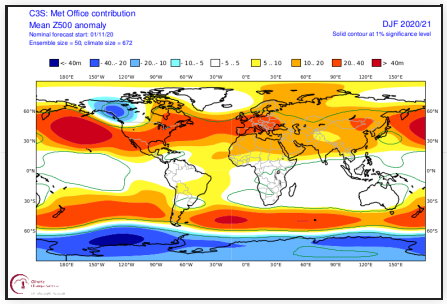


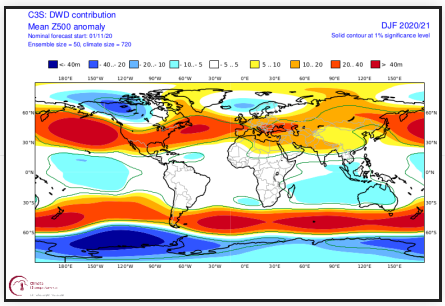
Atmospheric circulation forecasts : Z500 anomalies in C3S models

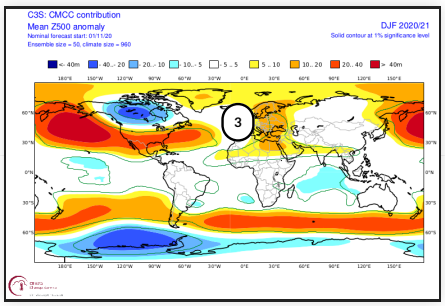
Good agreement between the models all over the globe. In the northern hemisphere, almost all models agree for high values of Z500 from the Northern Pacific to United States and Europe, and low values further north. The PNA- structure is very marked. The precise positioning and the value of the minimum near Iceland can vary from a model to another. It is generally quite north, close to the NAO mode of variability pattern, or a NAO+ weather regime structure slightly shifted to the north.

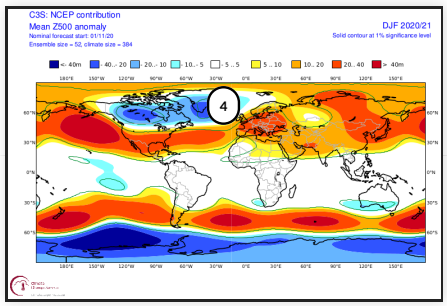










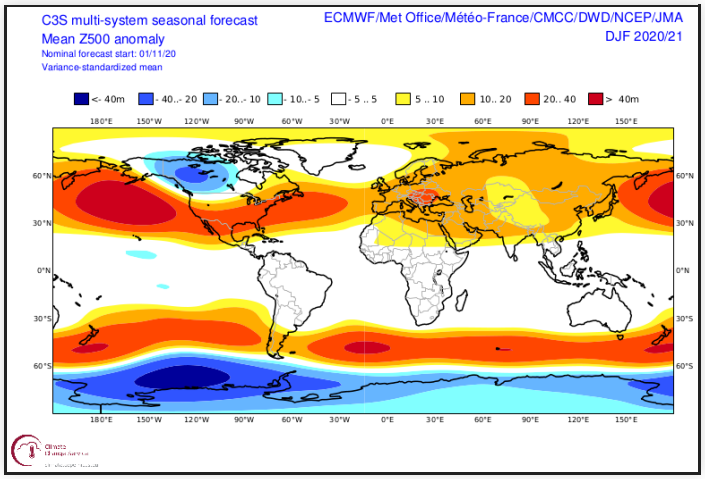


MF-S7, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

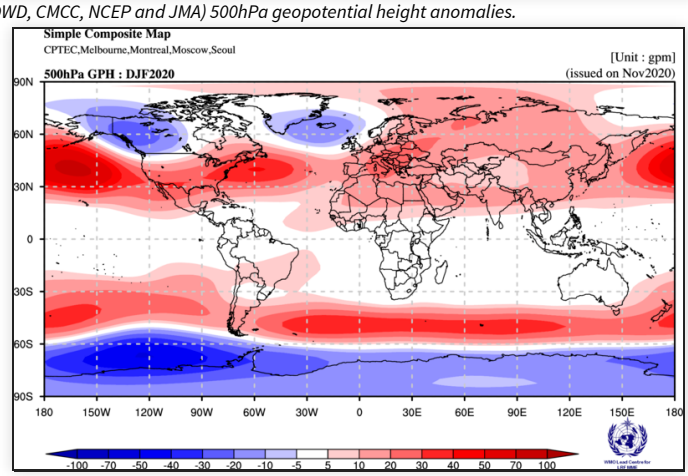
1 - MF-S7 has a little hollow minium
2 - classical scheme of PNA-
3 - with CMCC the high value belt is interrupted
4 - NCEP has the lowest minium

Atmospheric circulation forecasts : Z500 anomalies multi-systems

The two multi-models are very close. The low mean values predicted over the Atlantic near Iceland is more marked in the non-C3S multi-model.



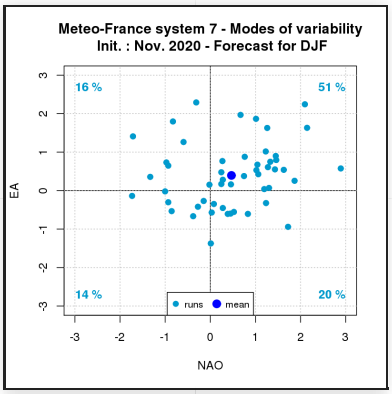
C3S multi-models (MF-S7, SEAS5, UKMO, DWD, CMCC, NCEP and JMA) 500hPa geopotential height anomalies.

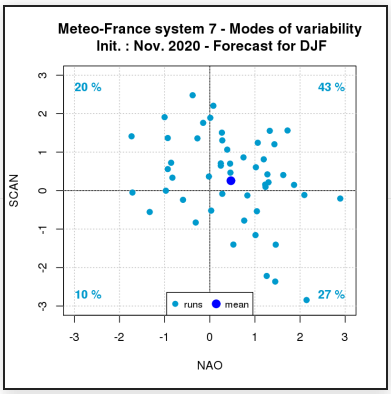


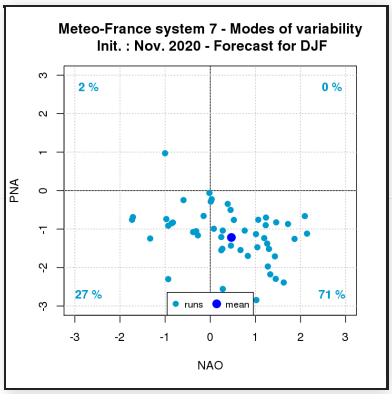
Others models of WMO multi-models 500hPa geopotential height anomalies.

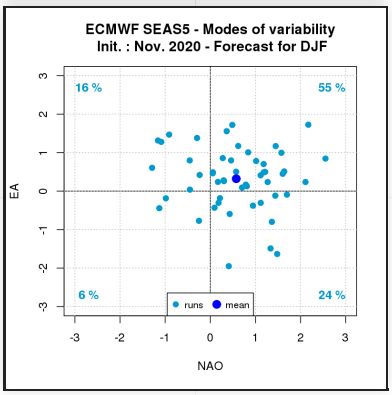
Modes of variability : forecast

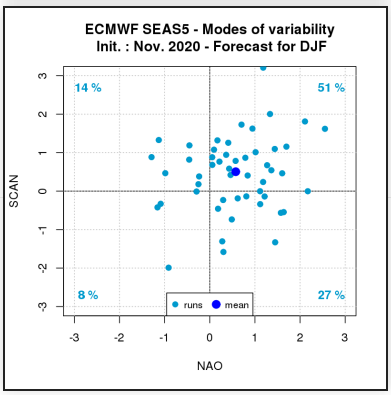
The two models are very close. Totally strong negative PNA. Majority NAO + EA + and SCAN +.

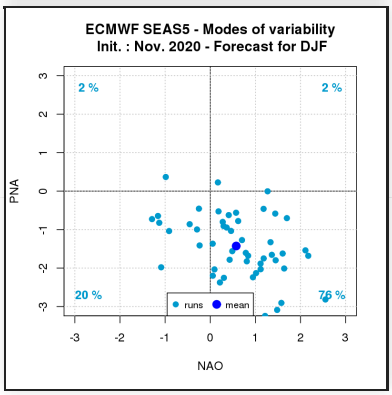








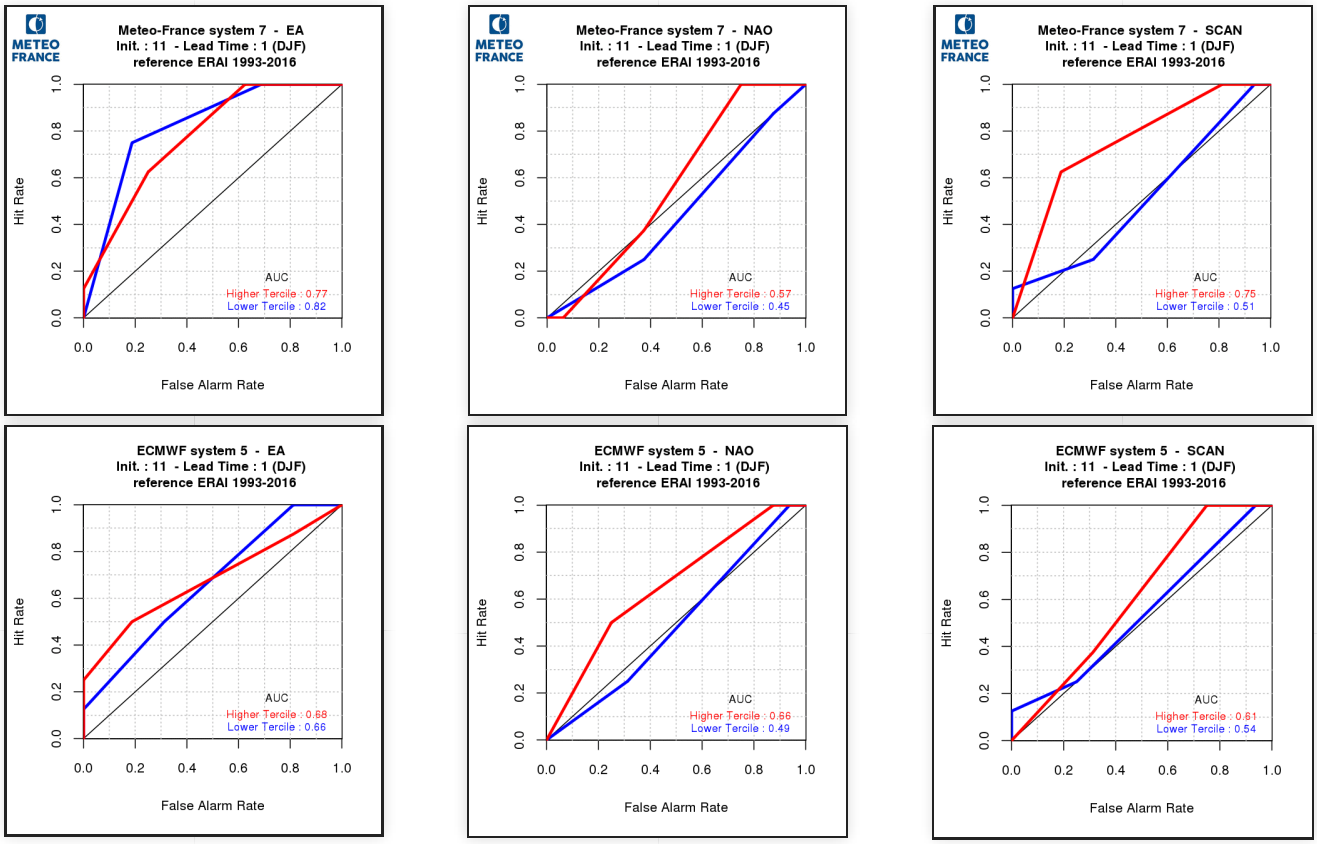




see the modes of variability patterns

Modes of variability : scores

There is a bit of a signal on the modes of variability for the DJF Quarter. MF-S7 is slightly better than SEAS5 except for NAO mode

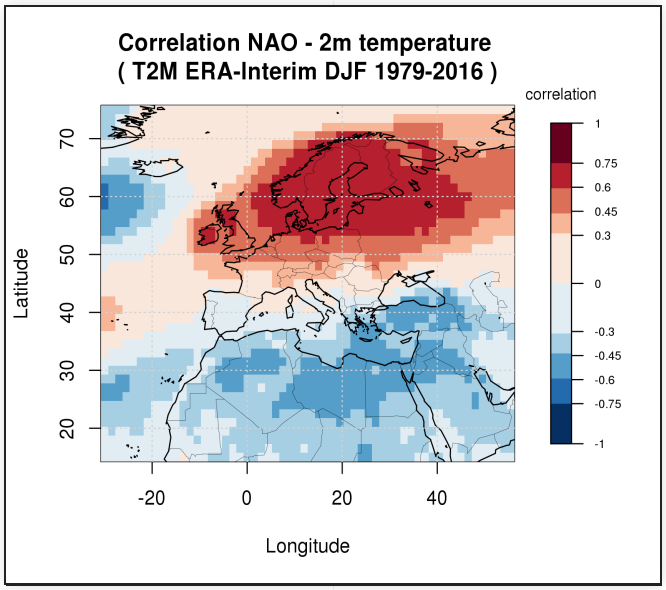


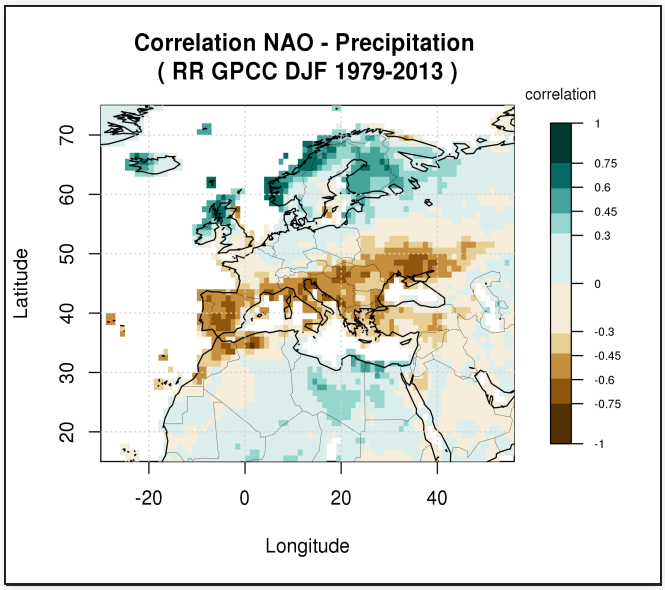
ROC score for EA, NAO and SCAN mode for MF7 (on top) and SEAS5 (below)

see the modes of variability patterns

Modes of variability : NAO impacts

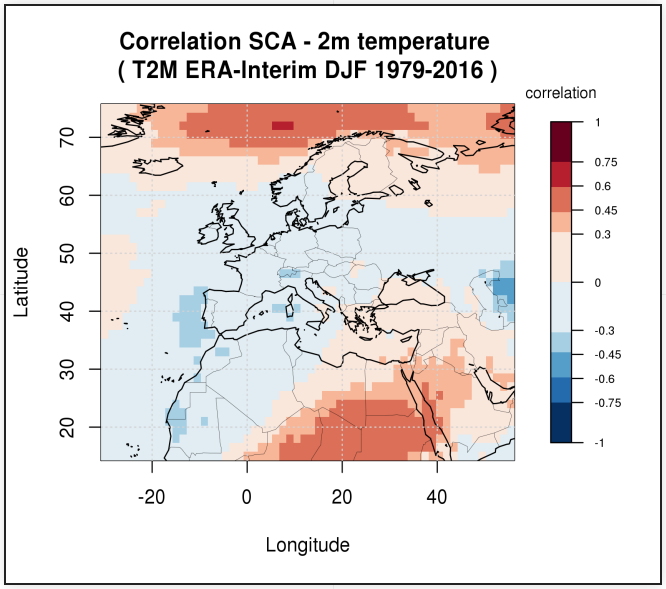
NAO mode has a strong impact on Europe for this 3-month period

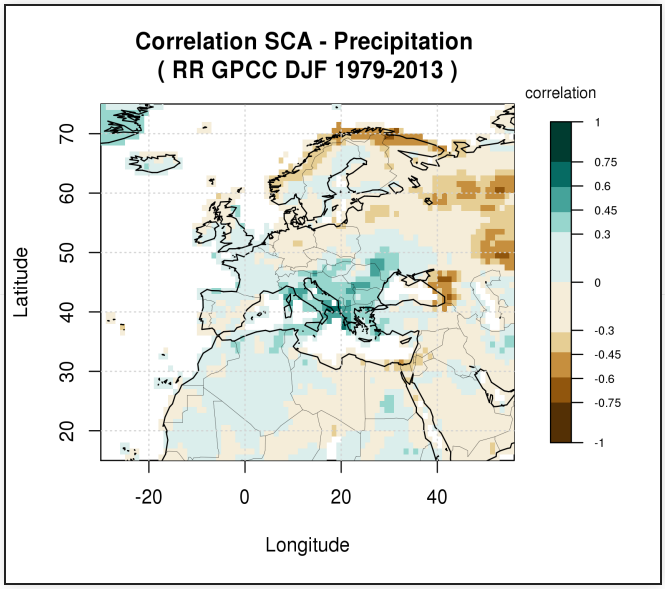




Modes of variability : SCA impacts

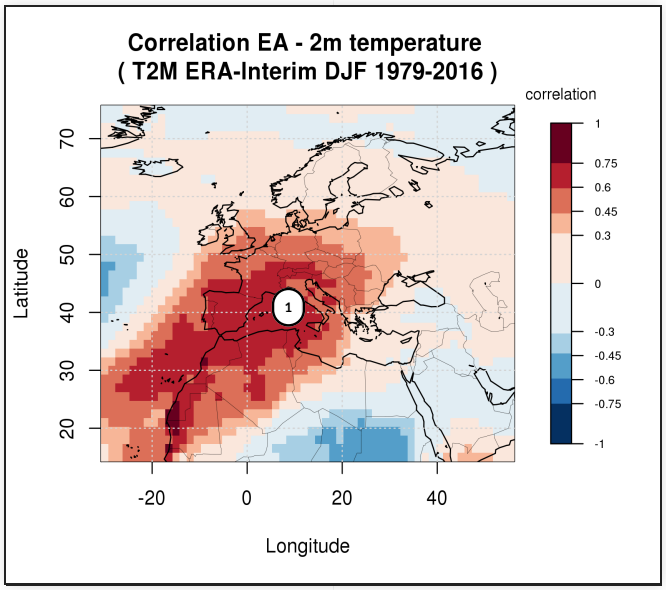
The SCAN has a weak influence on temperature on Western Europe (the opposite of NAO and EA). The influence is stronger for precipitation over south-eastern Europe (again opposed to NAO+ and EA+)

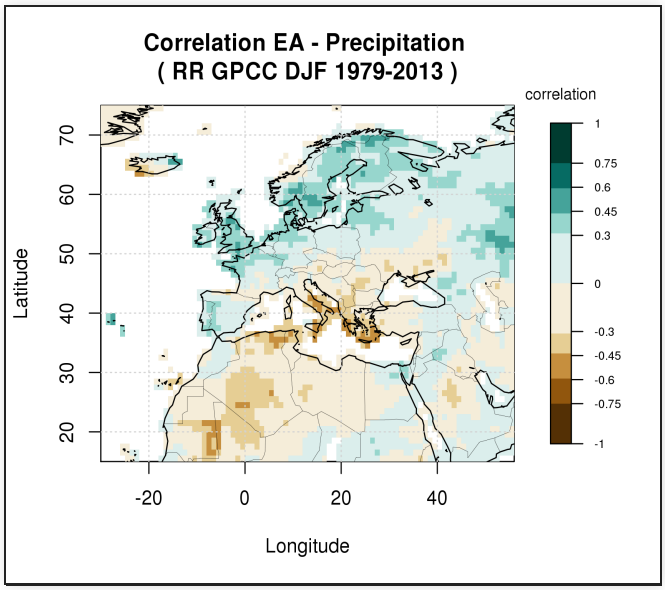




Modes of variability : EA impacts

EA mode has a strong influence in particular on the temperature for Western Europe.



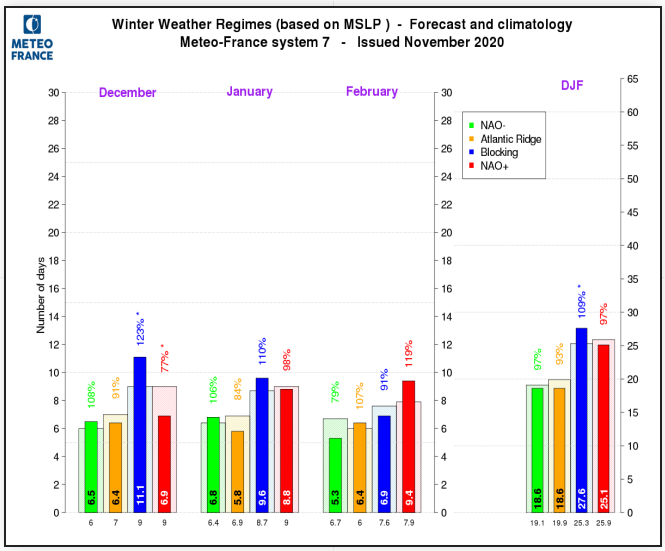


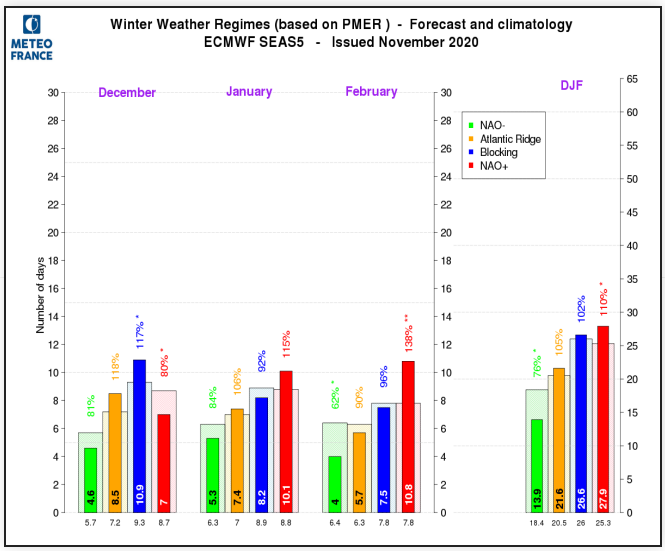
1 - high correlation with the temperature anomaly

Weather regimes : winter MSLP

The temporal evolution of the two models is identical with blocking favored at the start of the quarter and then gradually more NAO +. SEAS5 switches more frankly towards NAO + (see the field of Z500) from where a quarterly average favoring the NAO + to the detriment of NAO-

Note: the positioning of the high values for the blocking is different in the mode and speed patterns, which may explain the apparently contradictory frequency differences.

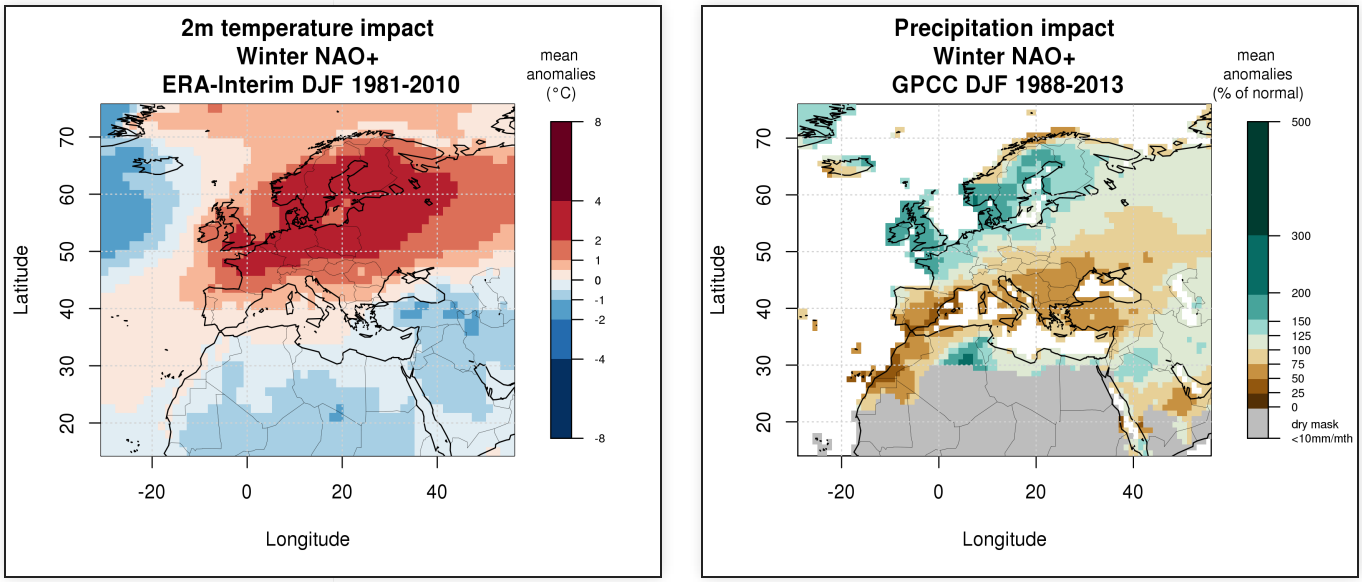




Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S7 (left) and SEAS5 (right).

Weather regimes : Impacts

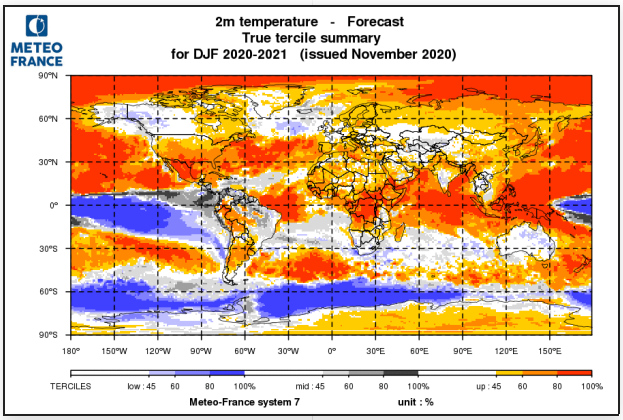
NAO+ weather regime should be favored

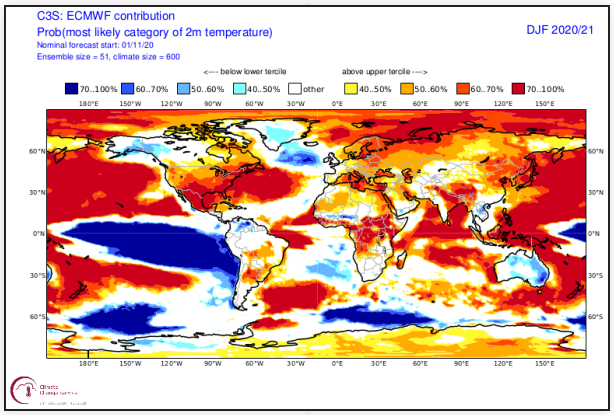


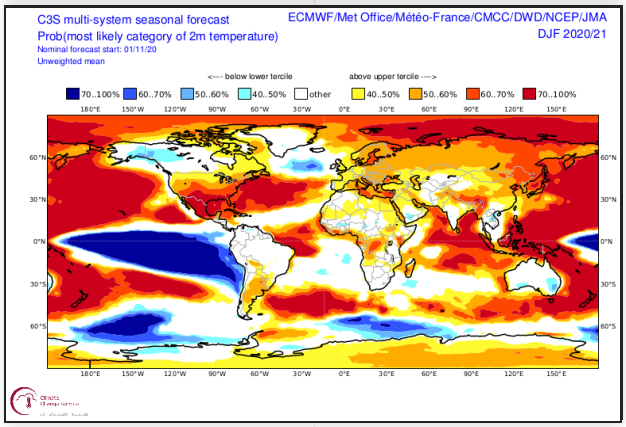
Impact of Summer Blocking weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)

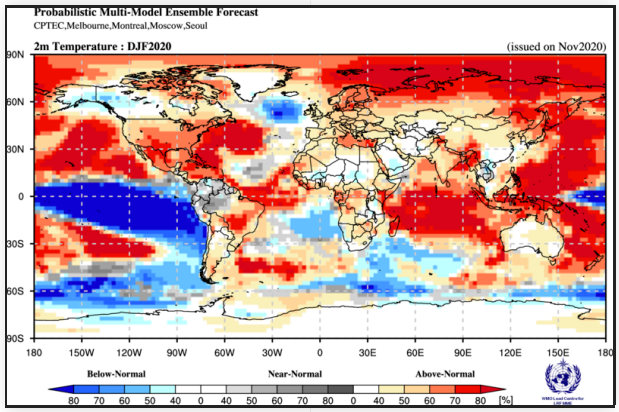
Forecast of climatic parameters : Temperature probabilities

The models are very constrained by the La Nina situation. They give extremely consistent temperature forecasts.





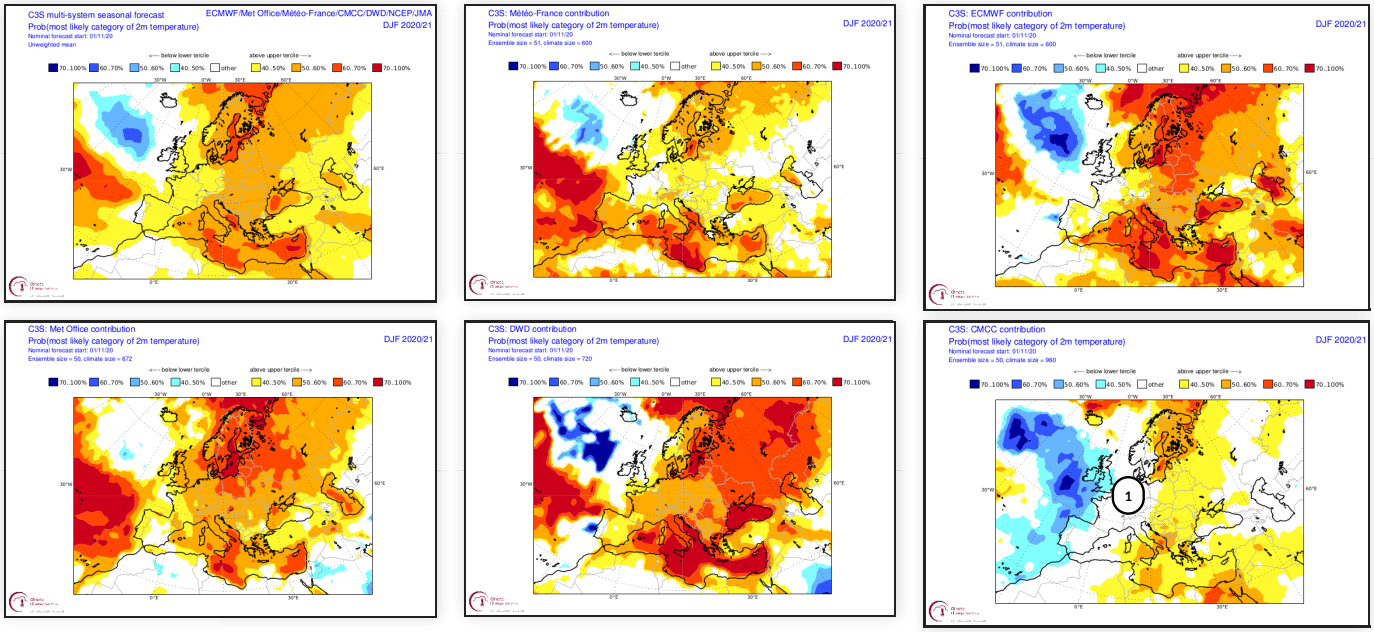




2m temperature probability map from MF-S7 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

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

A warm signal dominates on Mediterranean area and on Scandinavia. In eastern Europe the warm signal is less unanimous. Over Western Europe, no signal or weak tendency towards mild.



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

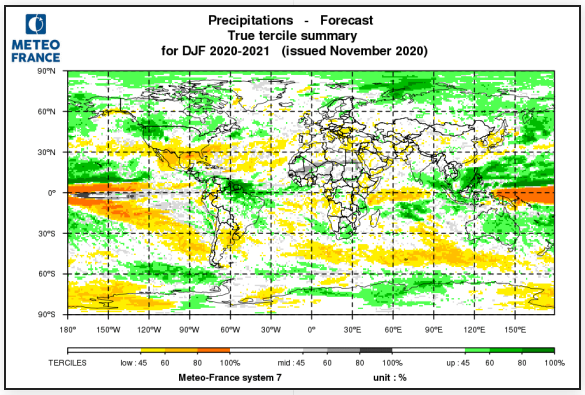
1 - CMCC has the colder forecast

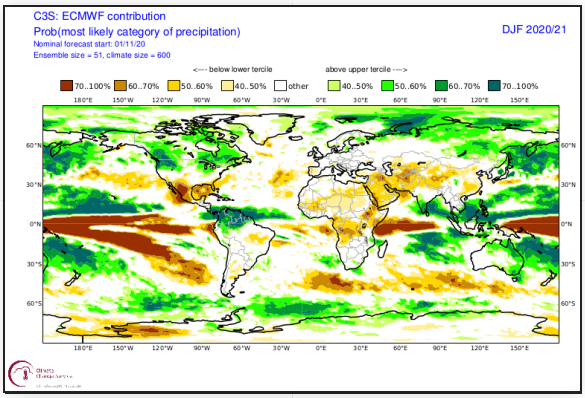
Forecast of climatic parameters : Precipitation

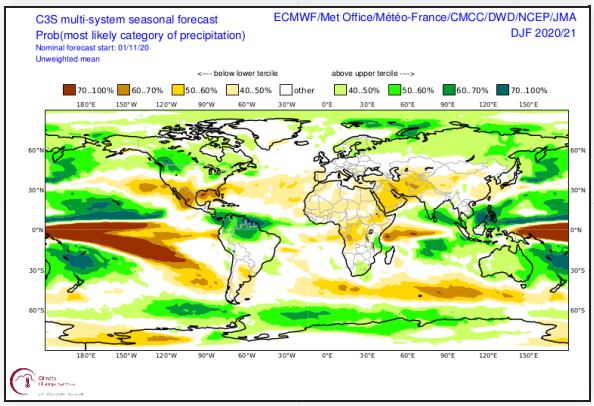
In the tropics, the forecasts remain very similar to those of the previous months. Heavier than normal precipitation is likely from India to Southeast Asia to the Maritime Continent and Australia, as well as over northern South America. Drier than normal elsewhere.

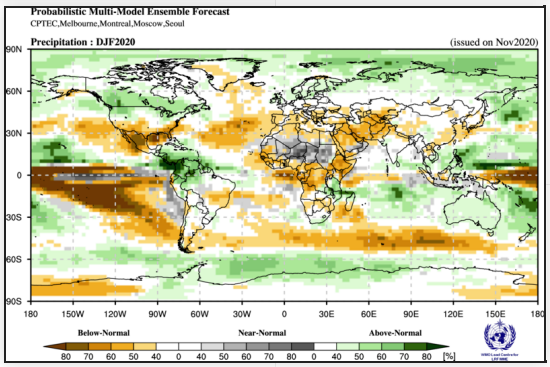
Drier than normal from Mexico to Mediterraneen Sea through the Atlantic.

More rain than normal likely in higher latitudes.





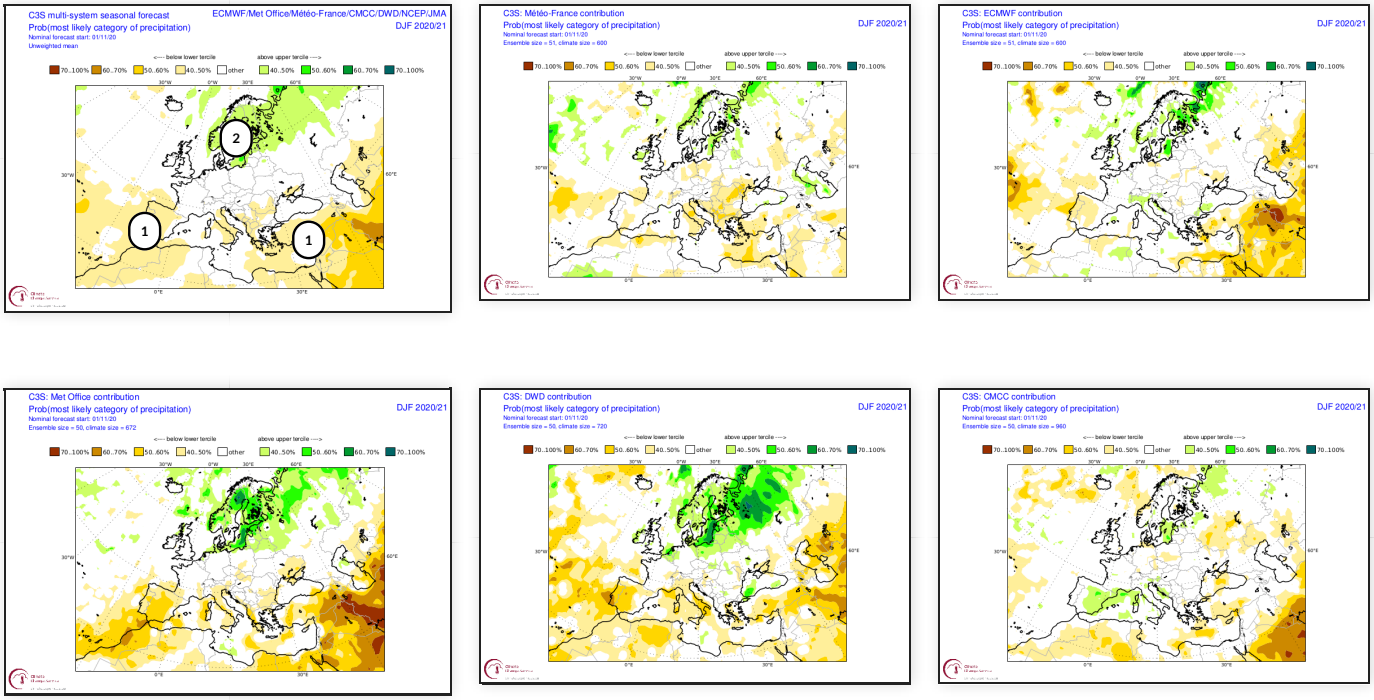




precipitation probability map from MF-S7 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

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

The models forecast increased precipitation over Scandinavia and deficit on the Atlantic side as well as on the Midlle East. This is consistent with the Atlantic regime favored by models.

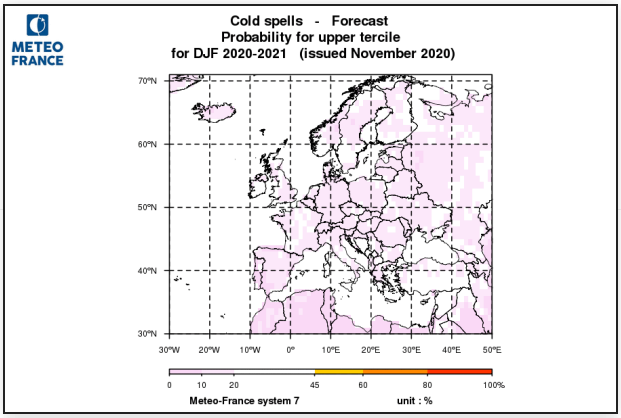


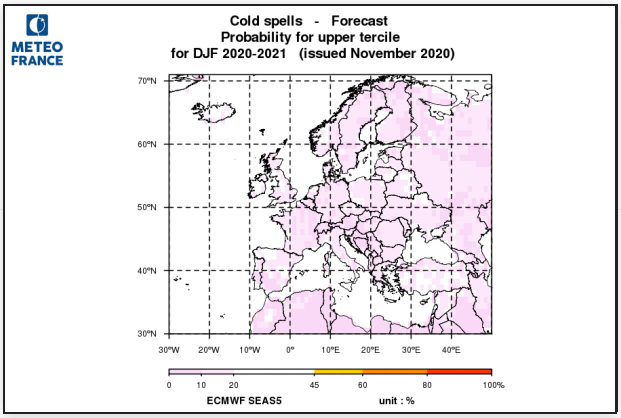
C3S multi-models probability map (top left) and MF-S7, SEAS5, UKMO, DWD, CMCC models.

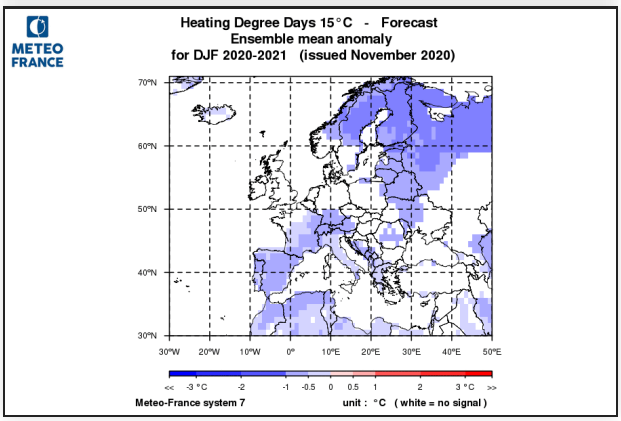
1 - Dry signal linked to high geopotential forecasted
1 - Dry signal linked to high geopotential forecasted
2 - weak wet signal

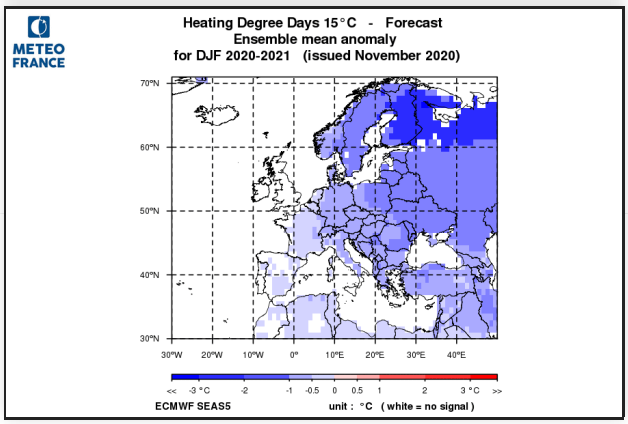
Forecast of climatic parameters : cold spell

The probability of a cold spell is very low in both models. The need for heating is also reduced especially with ECMWF-SEAS5 in eastern Europe.





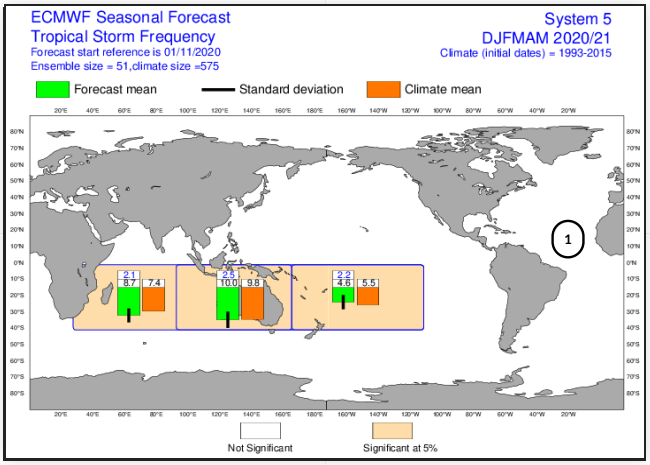


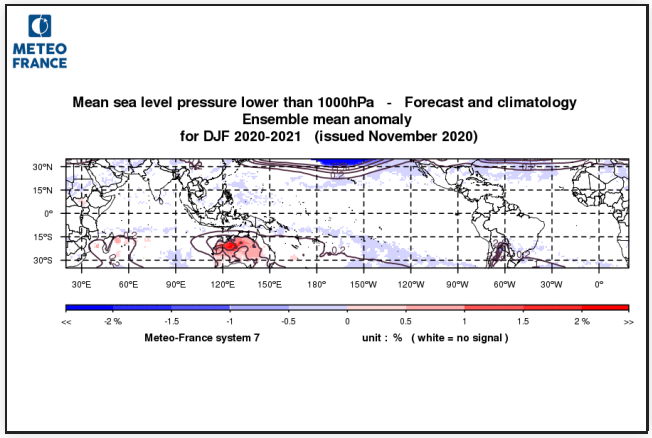


Above, cold wave probability and below, heating degree-days (base 15°C) for MF7 (right) and ECMWF (left)

Forecast of climatic parameters : Tropical Storm Frequency

In the well-established La Nina situation, cyclone risk likely decreases in the central Pacific and likely increases around Australia and in the southwest Indian Ocean

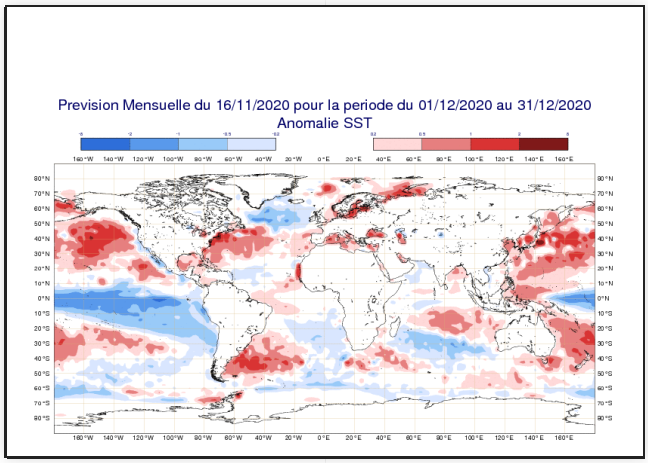


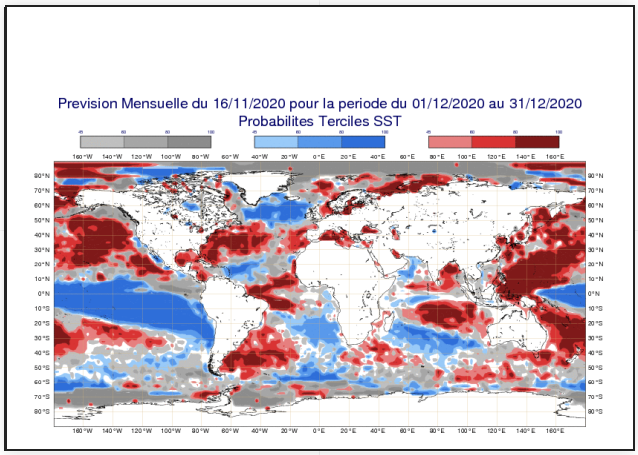


1 - close to normal

Monthly forecast of 20201116 : SST

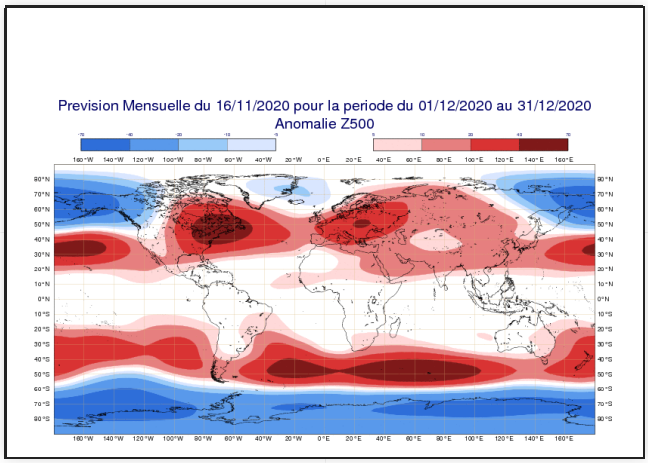
With the ongoing La Nina, the monthly forecast is very consistent with the seasonal forecast.

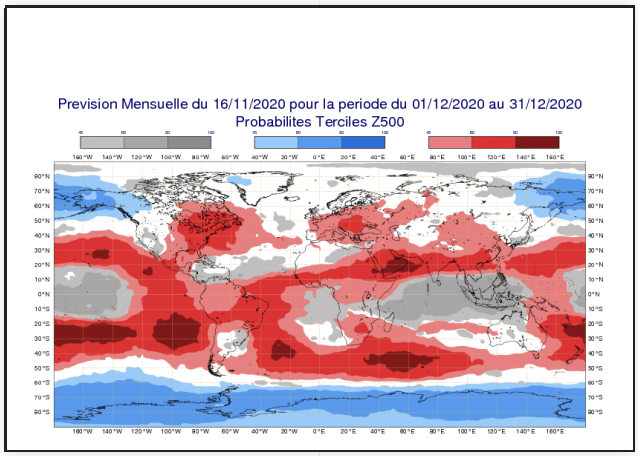




Monthly forecast of 20201116 : Z500

The structure of PNA- is present but less canonical than in the seasonal forecast. Over Europe, the field is very high and the positioning of the minimum over the North Atlantic is rather consistent with the forecast of MF-S7 (NAO+ mode).

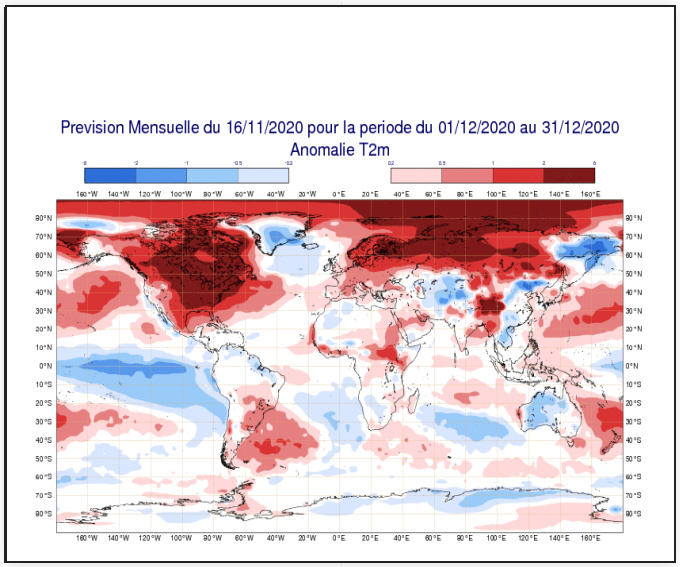


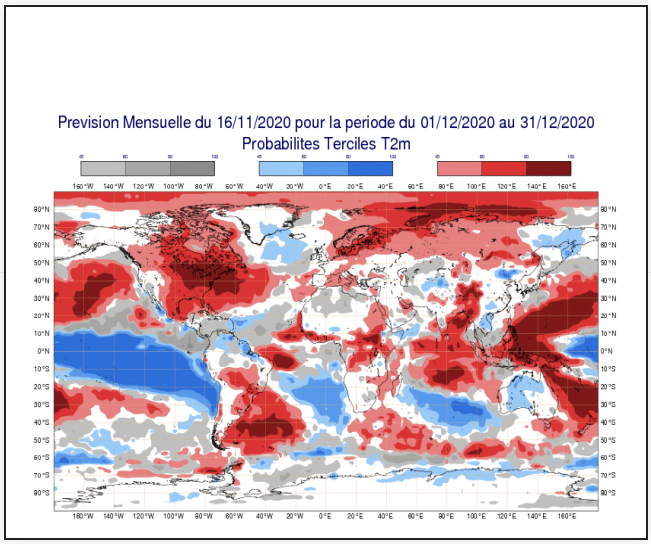


Monthly forecast of 20201116 : temperature

Very strong positive anomaly forecast for NorthAmerica and northern Eurasia compatible with seasonal forecast.

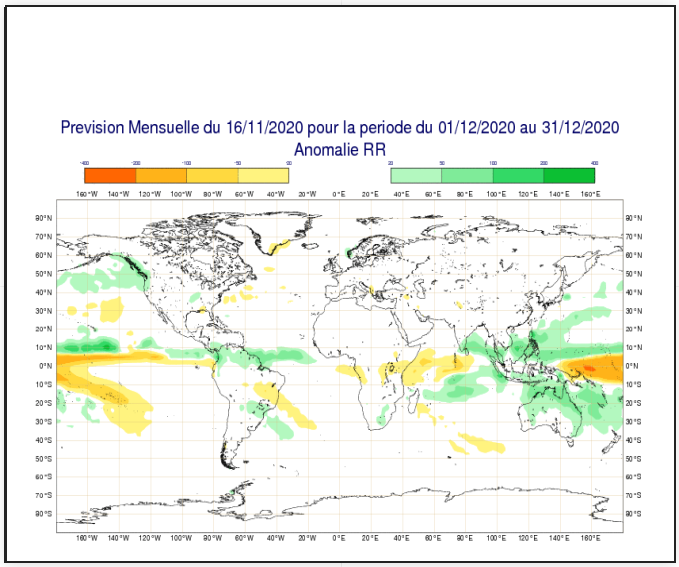
For Europe, very strong positive anomaly on Scandinavia. More moderate anomaly forecast over Central and Eastern Europe. weak anomaly on the Atlantic coast.

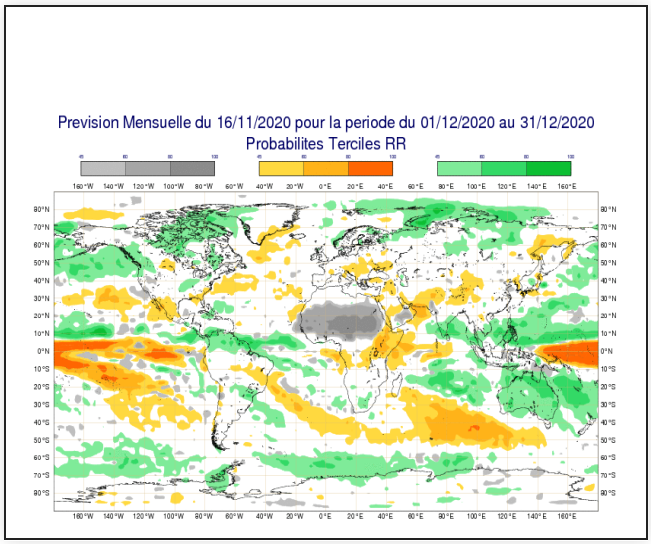




Monthly forecast of 20201116 : precipitation

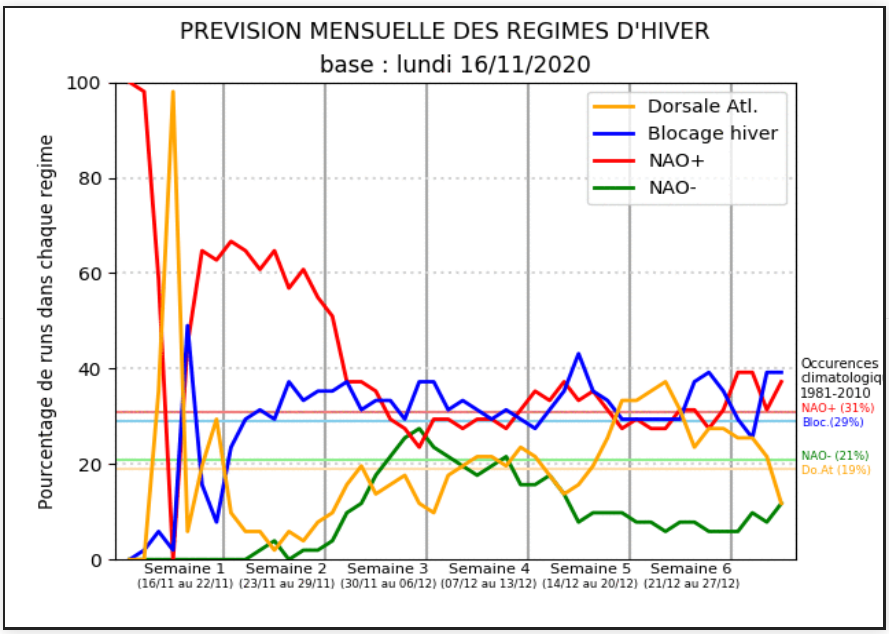
The signal is weak over Europe but nevertheless shows the north (wet) - south (dry) contrast present in the seasonal forecast.





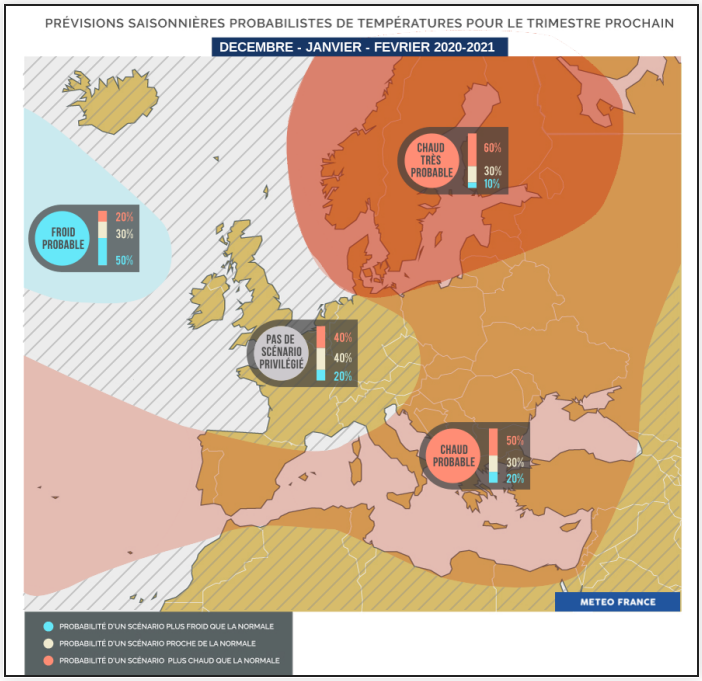
Monthly forecast of 20201116 : winter SLP weather regimes

The dominant mix of Blockage/NAO+ regimes forecast in the seasonal forecast is also forecast in the monthly forecast for the month of December.



Synthesis map for Europe : Temperature

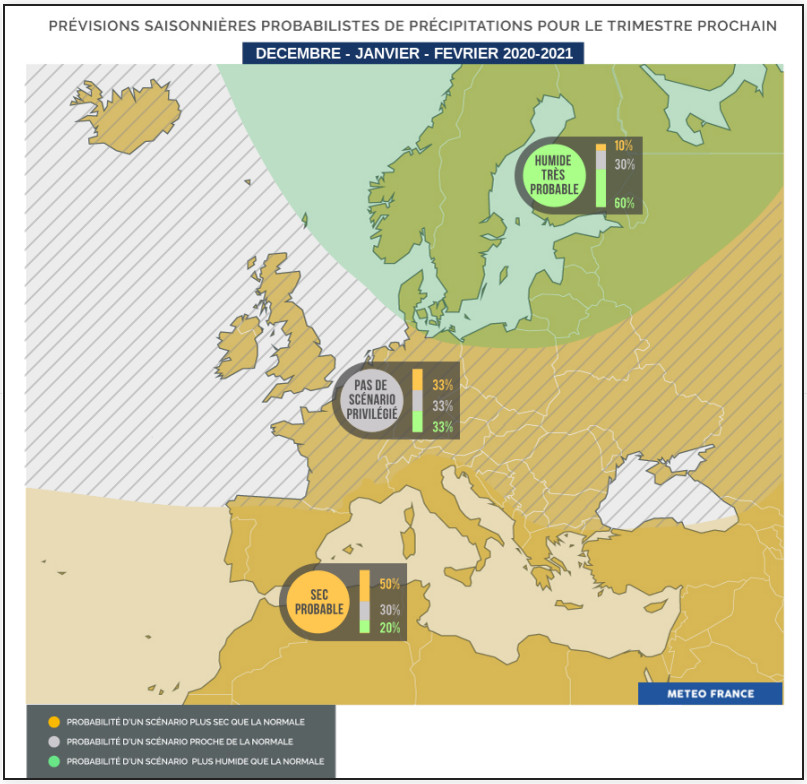
Temperatures are expected to be milder than normal from Scandinavia to Eastern Europe and the Mediterranean. Further west, the oceanic influence is thwarted by high geopotential fields and no dominant scenario emerges for temperatures.



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

Synthesis map for Europe : Precipitation

Oceanic influence is expected to be stronger than normal over and around Scandinavia, bringing additional precipitation. Conversely, the Mediterranean basin should remain mostly away from disturbances, hence precipitation probably below normal. No majority scenario between these two areas.



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