Météo-France Seasonal Forecast Bulletin

APRIL - MAY - JUNE 2021

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General synthesis : AMJ 2021

Good agreement between models in the tropics and globally in mid latitudes, in regions with strong signal. This is mainly linked to the impact of La Niña on global climate. On the North Atlantic, week signal in PV and FC, but the zonal regime weather seems to emerge.

A) Oceanic forecast :

- **ENSO : weakening La Niña, evolution toward neutral phase.**
- **IOD** : close to normal

B) Drivers :

- La Niña impacts still present

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 : Zonal regime weather is more likely than normal

D) Most likely conditions :

- In the tropics, increased rainfall over the Maritime Continent and over northern South America. Precipitation in deficit on the western United States as well as the East of Middle East.

- **over Europe** : warm scenario on the East of the domain, normal on Western Europe. Wet scenario over Scandinavia and dry in southern Europe.

Next bulletin : scheduled on April 23th

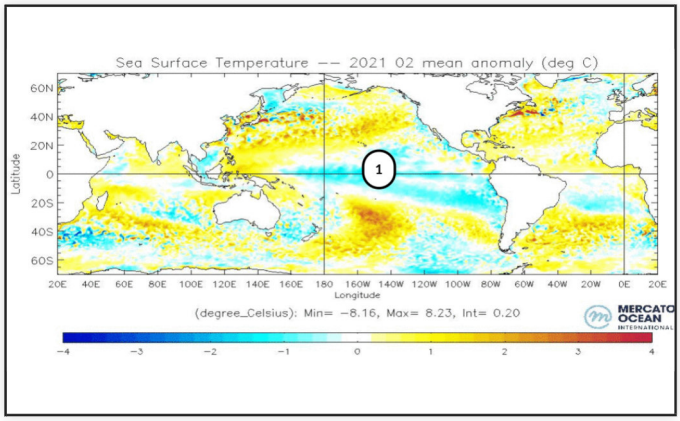
Oceanic analysis of February 2021 : SST anomalies

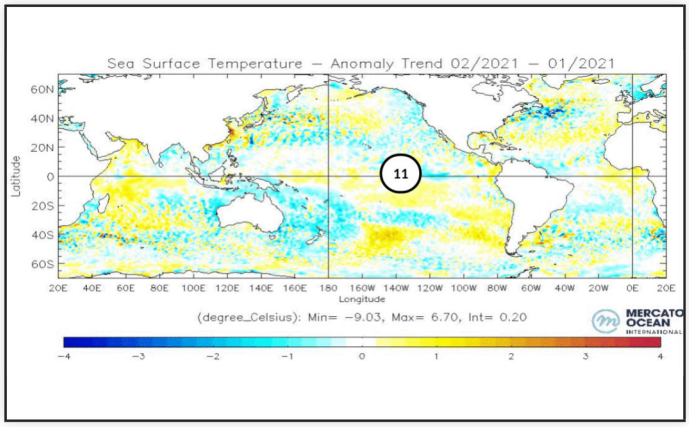
Current ENSO situation : La Niña

In the Pacific Ocean : The cold anomaly in Central Pacific is still very marked, despite a slight warming during the month of February. Strong persistant contrast between this cold anomaly and the warm anomalies in Northern and Southern Pacific.

In the Indian Ocean : Little change except warming in the southwest part of the basin which present a positive anomalie (neutral elsewhere). The Indian Ocean Dipole looks neutral (see DMI in next slides).

In the Atlantic Ocean : in the Northern hemisphere, the east/west contrat faded in February. In the Northern tropics, a sligth positive anomalie is maintened despite cooling.



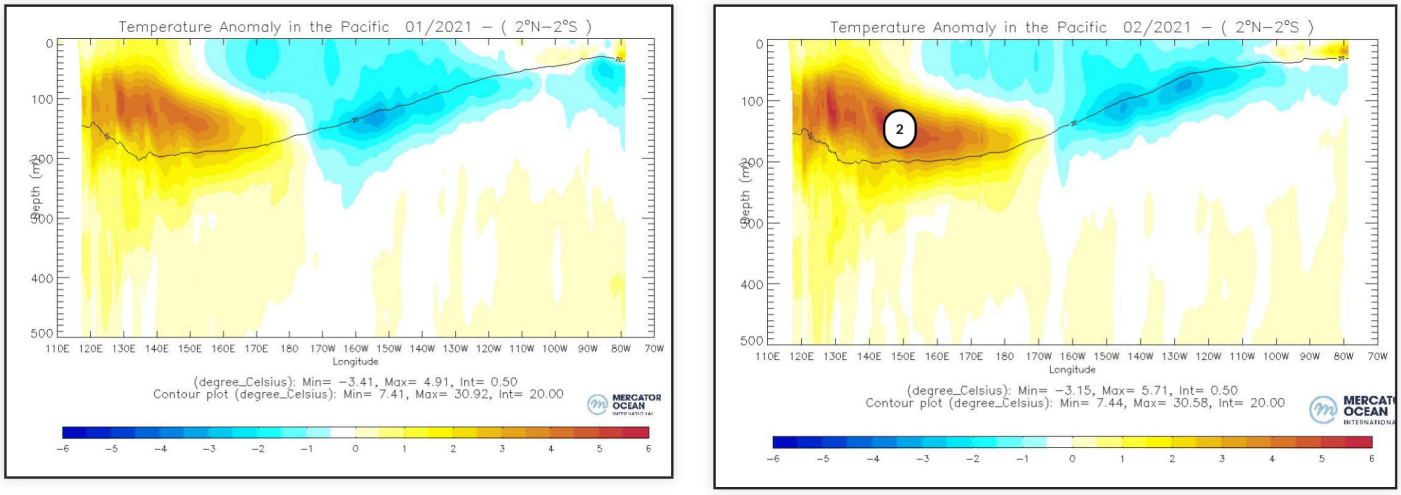


SST Anomalies and trend with the previous month (c) Mercator-Ocean

1 - La Nina cold anomaly
11 - weak warming in Nino3.4 box

Oceanic analysis of February 2021 : Pacific vertical section

In subsurface, almost stationary situation. On the western part of the basin, the hot reservoir continued to strengthen. On the eastern part close to surface, conditions has become neutral.

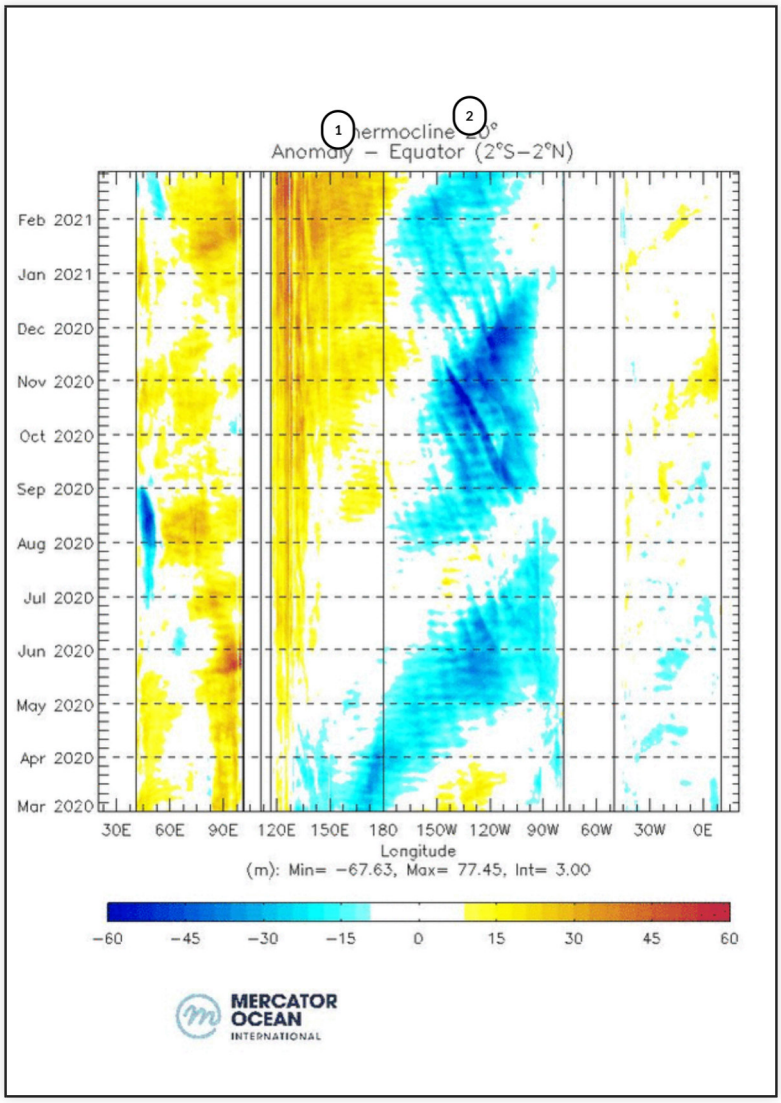


Ocean temperature anomalies in the first 500 meters of the equatorial Pacific basin, monthly average. (c) Mercator-Ocean

2 - strengthened warm anomaly

Oceanic analysis of February 2021 : Hovmüller diagram of the 20°C isotherm

Persistent strong subsurface contrast in the Pacific, the positive anomly in the West is stronger than in January.



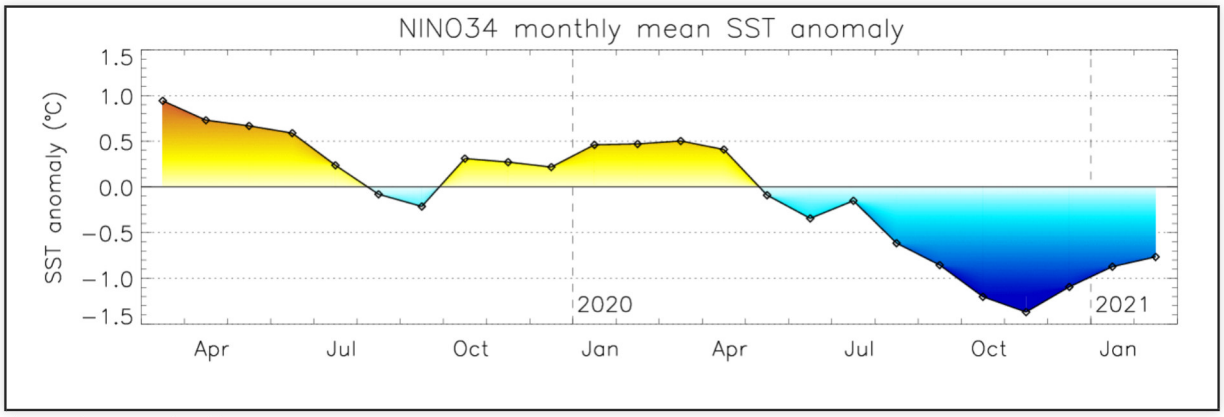
Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 ° C isotherm) (c) Mercator-Ocean

1 - Warm anomalie in the west part
2 - Cold anomalies in the east part of the Pacific started to decrease

Oceanic analysis of February 2021 : Pacific Ocean - Nino3.4 index history

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -0.9 °C
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png)

Continued reduction of the negative anomaly, as foreseen last month.

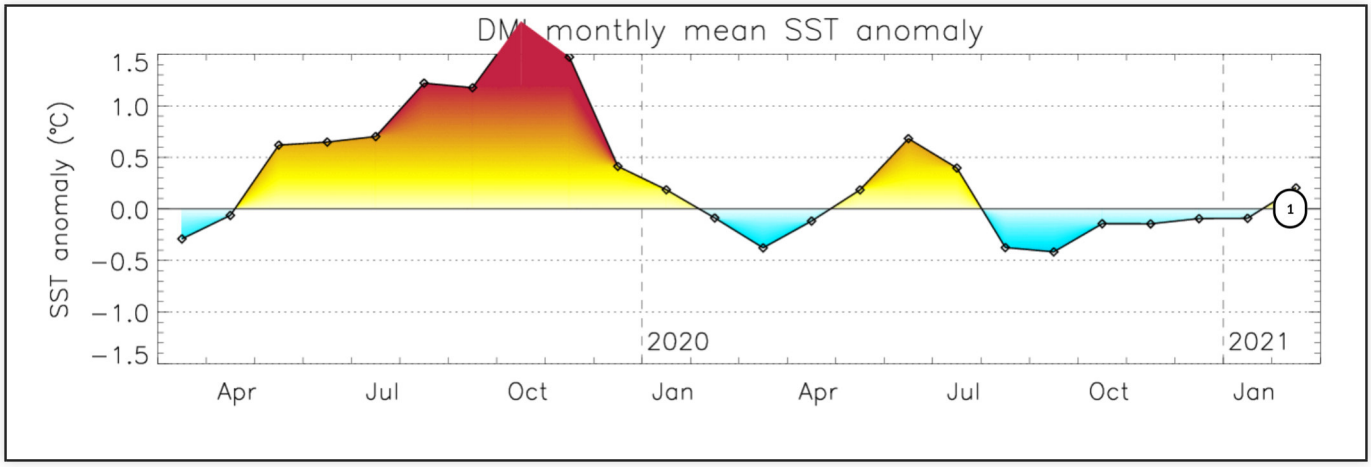


Evolution of SST in the NINO3.4 box (c) Mercator Ocean

Oceanic analysis of February 2021 : 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

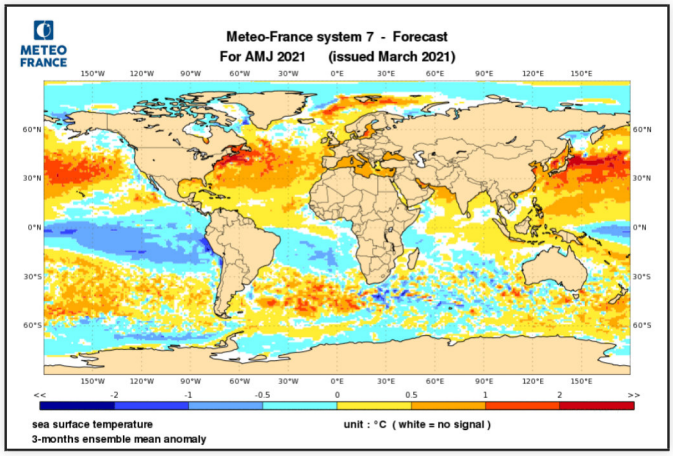
Oceanic forecast : SST anomaly

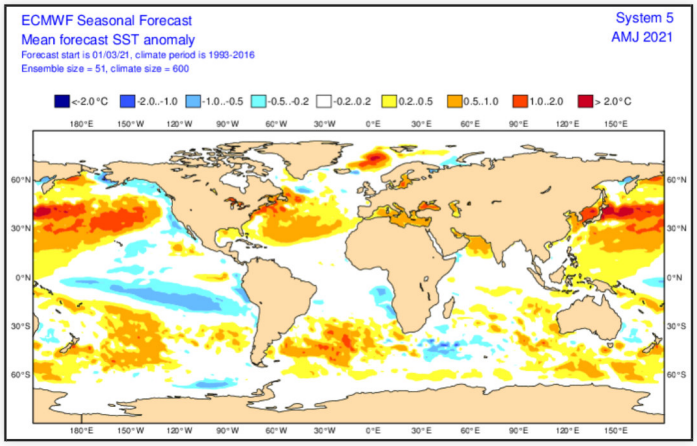
In the Pacific, good agreement between MF-S7 and ECMWF-SEAS5. But some differences in the other basins.

In the Pacific Ocean : the cold anomaly pattern associated to La Niña is still present in the forecasts. Its intensity is a little bit stronger in MF-S7 than in ECMWF-SEAS5, but its extension to the South-East (up to South America) is similar in both models. Good agreement on the warm anomaly patterns in mid-latitudes (Northern and Southern hemisphere)

In the Indian Ocean : Low temperatures anomalies excepted positive anomalies in Arabian Sea.

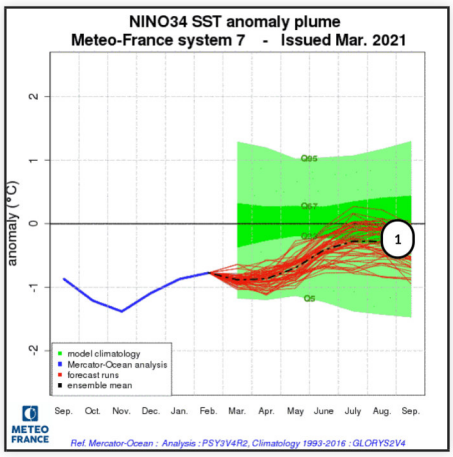
In the Atlantic Ocean : the anomaly pattern foreseen by ECMWF-SEAS5 is shared by all C3S models, except MF-S7 (which seems to warm in Northen tropics).

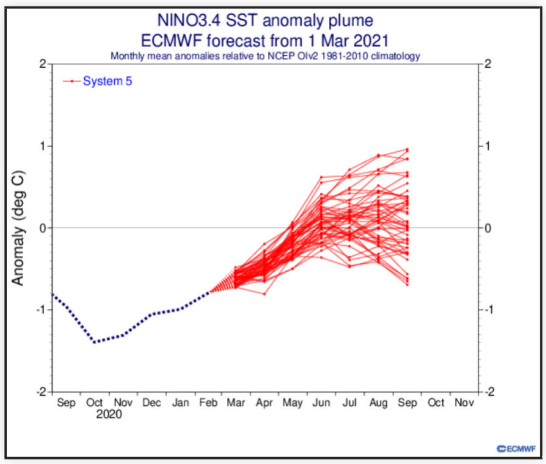




Oceanic forecast : NINO3.4 Plume diagrams

ECMWF-SEAS5 and MF-S7 : both models predict a gradual attenuation of the cold anomaly over the next months. The ascent is a little more straightforward with ECMWF-SEAS5 than with MF-S7.



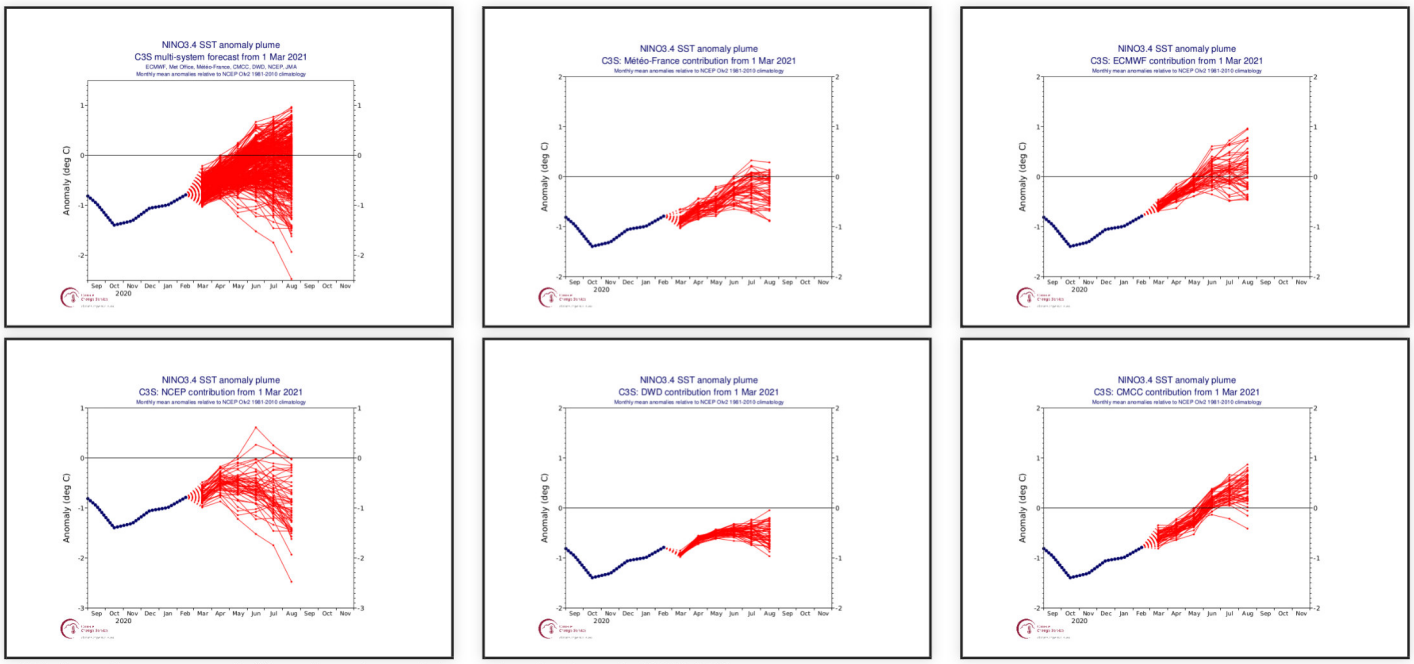


1 - Return to neutrality expected in the summer.

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

C3S models : most models agree on the gradual warming scenario, slower with DWD and MF7 wich remains negative at the end of the quarter. Note that NCEP remains on lowers values and even trends to cool again during the summer.

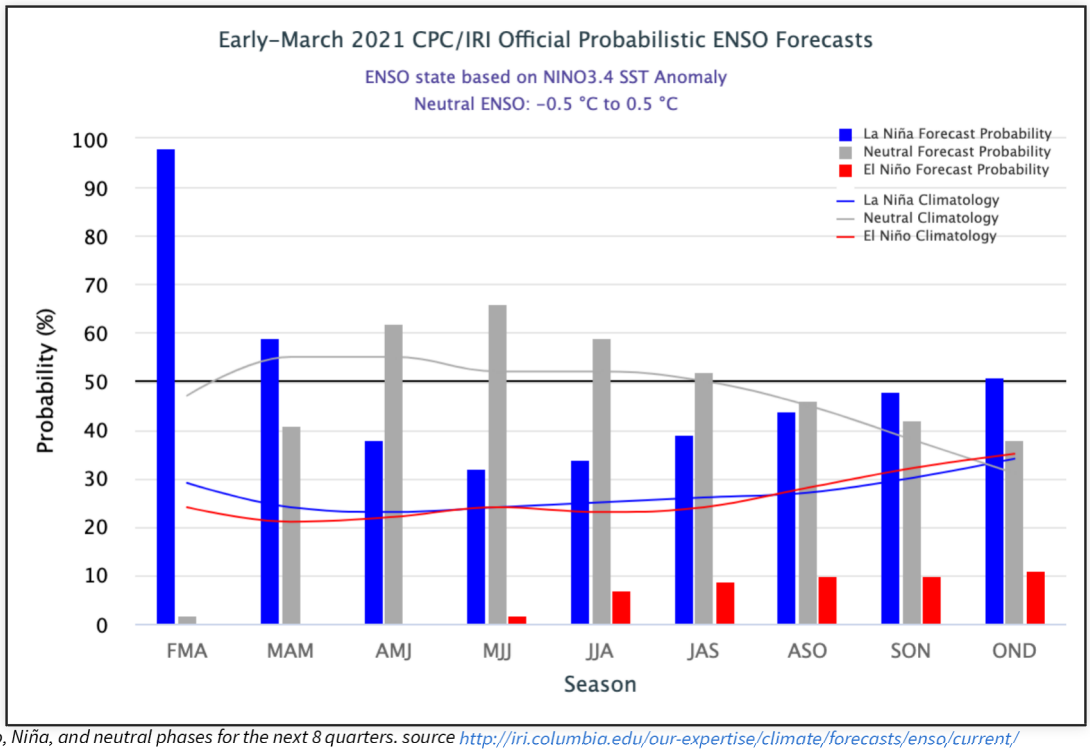
Expected Phase for the next three months : mitigation of the La Nina phenomenon and probable return to neutral during AMJ quarter.



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

Oceanic forecast : Synthesis from IRI

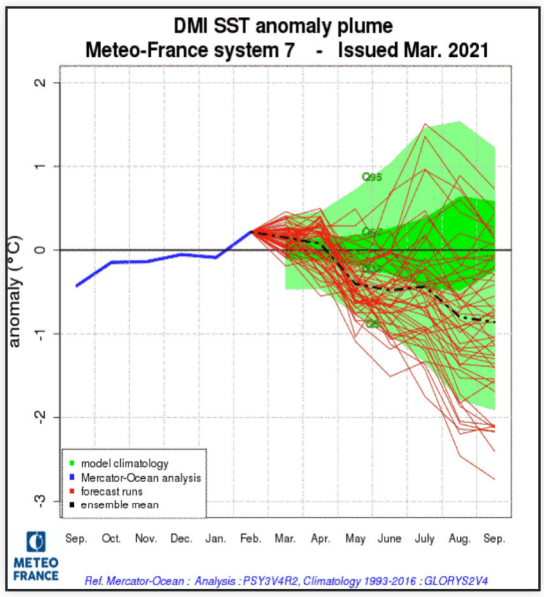
Neutral conditions are the more likely for the next quarter.

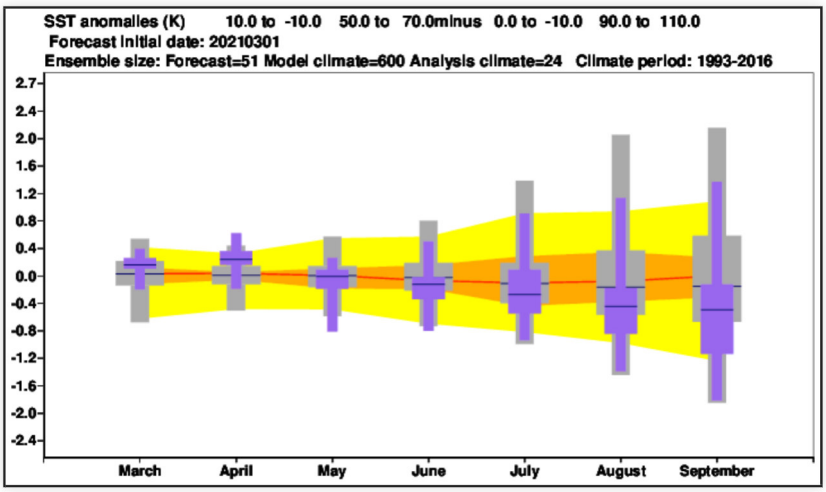


Probability of Niño, Niña, and neutral phases for the next 8 quarters. source http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

Oceanic forecast : Indian ocean - DMI evolution

It becomes negative at the end of the period but the dispersion is strong. On the quarter it is close to neutrality.





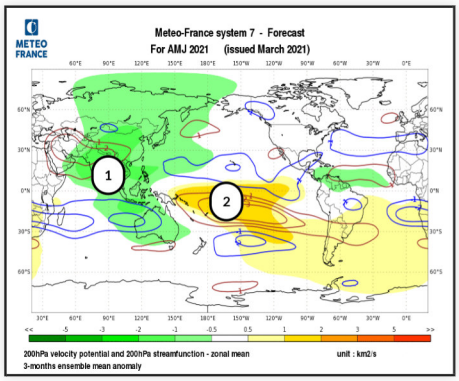
DMI index : analysis, forecasts and model climatology with MF7 on the right and SEAS5 on the left

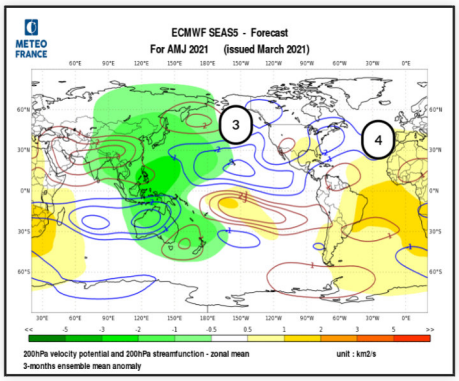
Atmospheric circulation forecasts : velocity potentiel and stream function at 200hPa

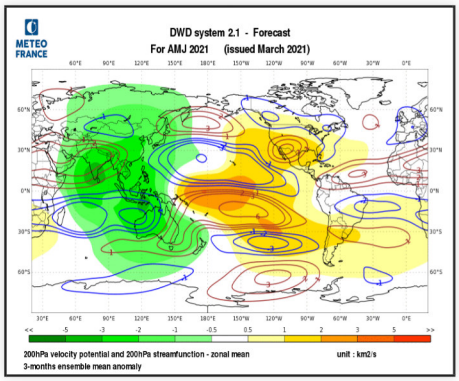
Good agreement between models in the tropics and globally in mid latitudes. On the North Atlantic week signal in PV and FC

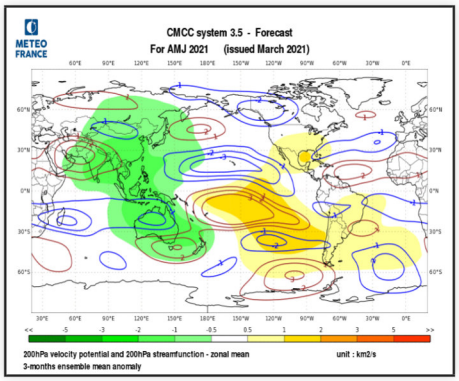
Velocity Potential : In connection with the La Nina situation, the models foreseen a strong dipole in the Pacific-Indian zone, with upward motion anomaly over the Maritime Continent extending to the Eastern Indian Ocean and large downward motion anomalies over the Pacific. Secondary anomalies are visible in a majority of models : a dipole +/- over north of South America/The Caribbean, a negative anomaly over Africa and South Atlantic.

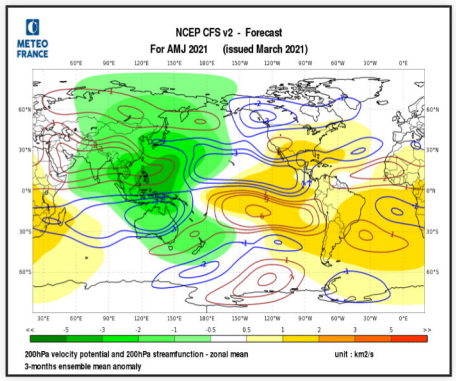
Streamfunction : quadripole over Indian and Pacific oceans, in relation to La Niña. Teleconnection of negative PNA. On the Atlantic models suggests a dipole in the tropics with negative anomaly from the Gulf of Mexico to the Acores.











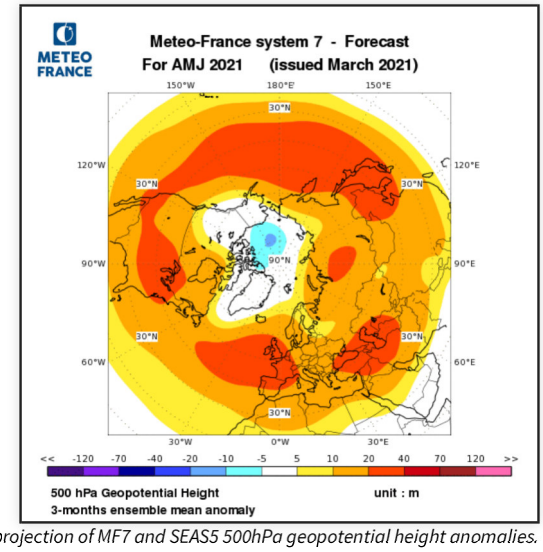
MF7,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

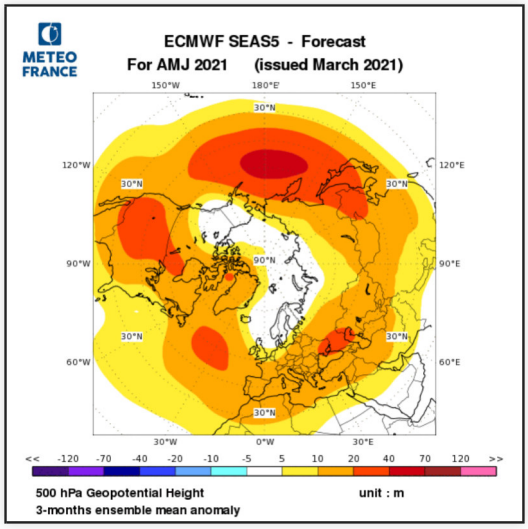
1 - VP : large area of upward motion anomaly
2 - VP : large downward motion anomaly
3 - SF : pattern of negative PNA
4 - SF : cyclonic circulation anomalies at 200hPa

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Good agreement for the negative PNA.

Over Eurasia, the two models have a similar scenario of positive Z500 anomaly, despite differences in the anomaly pattern. These postive anomalies at temperatures latitudes are partly due to climate change.



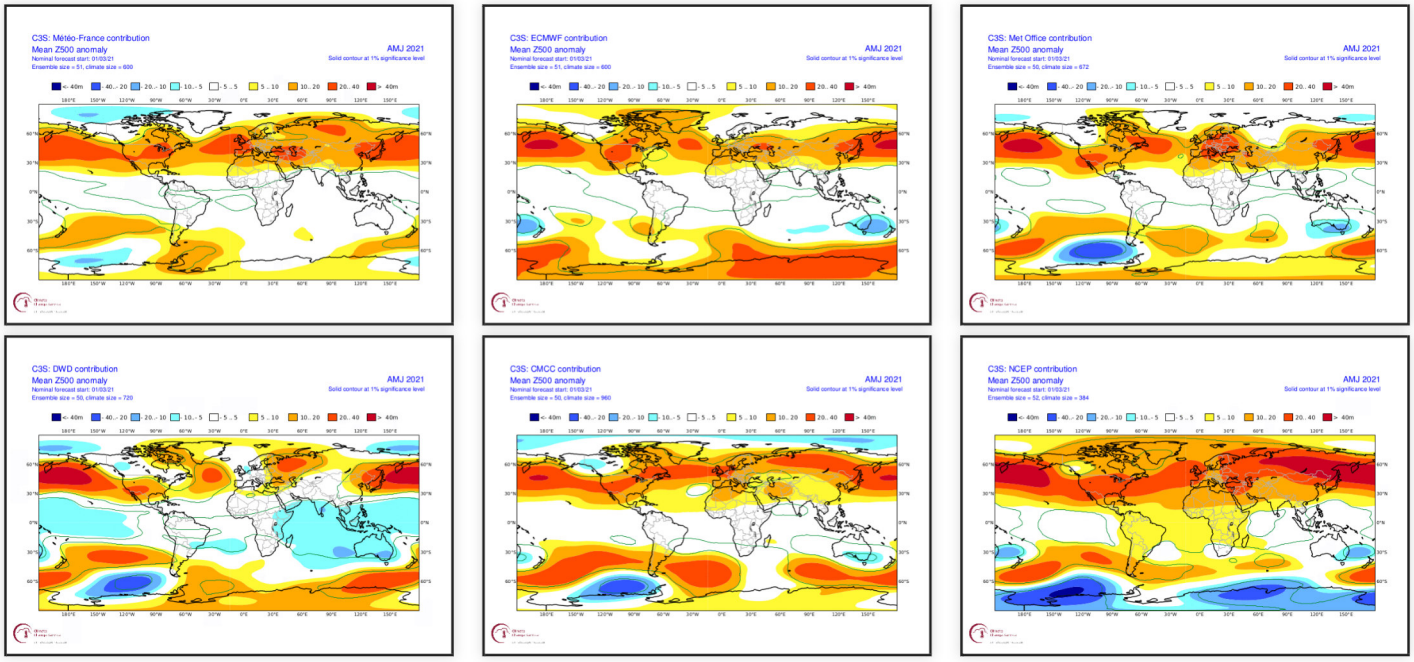


polar projection of MF7 and SEAS5 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in C3S models

All C3S models agree on a marked negative PNA, as already seen on PV-FC200.

Over North Atlantic and Europe, there are noticable differences between models. They tend to agree on a positive anomaly stretching for USA to Europe, and Eastwardly to Asia. Over Europe the anomaly pattern differs from one model to another but the positive anomaly is the most probable.

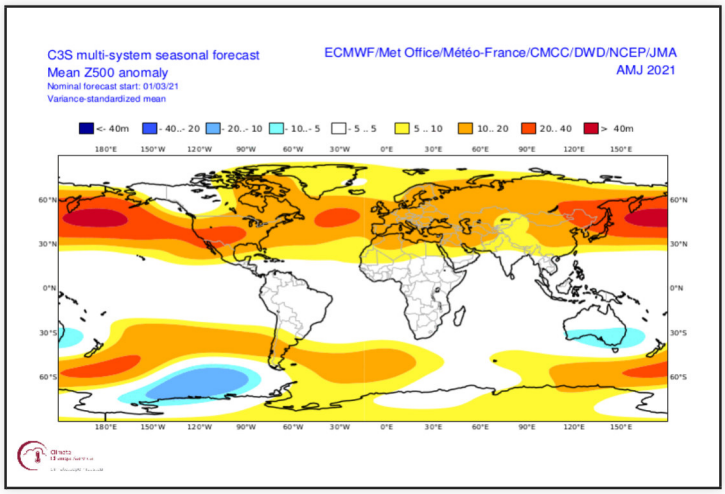


MF-S7, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

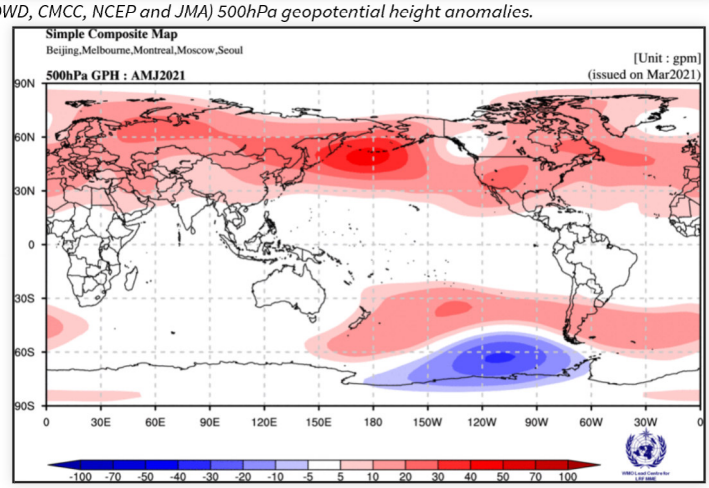
Atmospheric circulation forecasts : Z500 anomalies multi-systems

The two multi-models charts look similar for North Atlantic and Eurasia.

Almost all C3S models agree on a "NAO+" scenario.



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

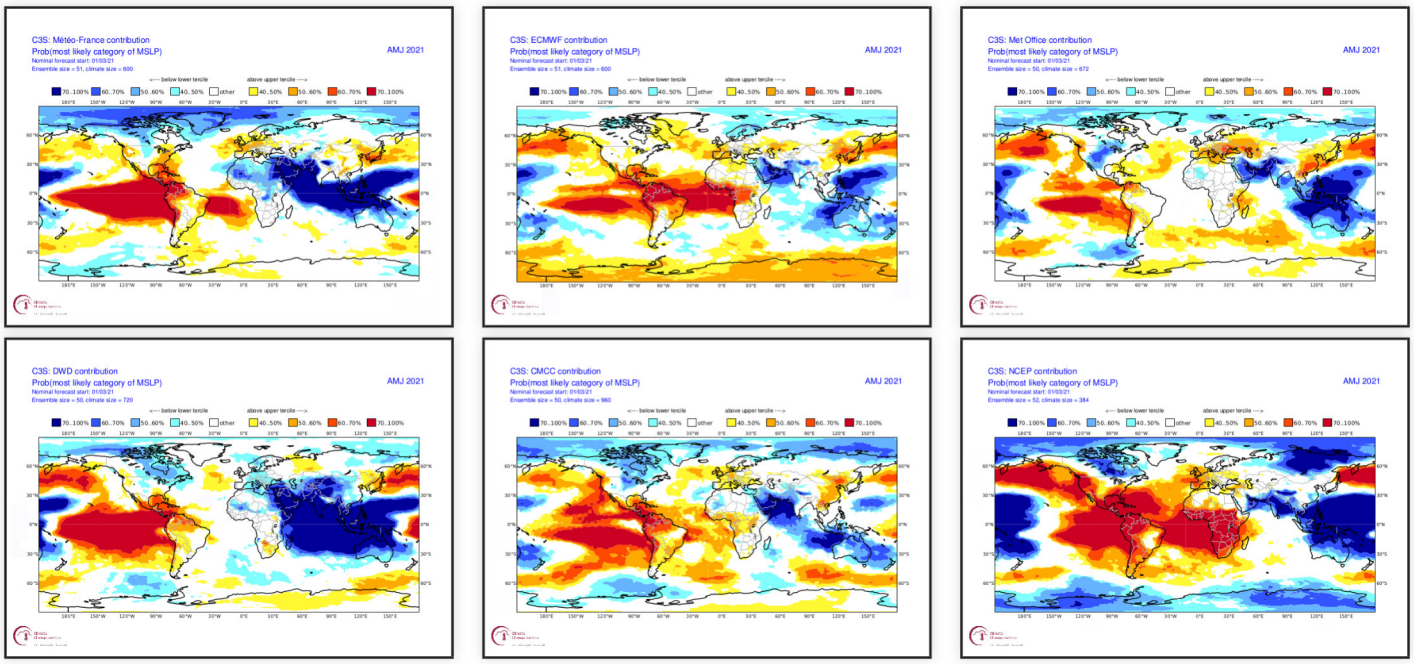


Others models of WMO multi-models 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : MSLP probabilities

Strong dipole between the Indian Ocean and the Pacific is the tropics, in links with the VP200 anomalies.

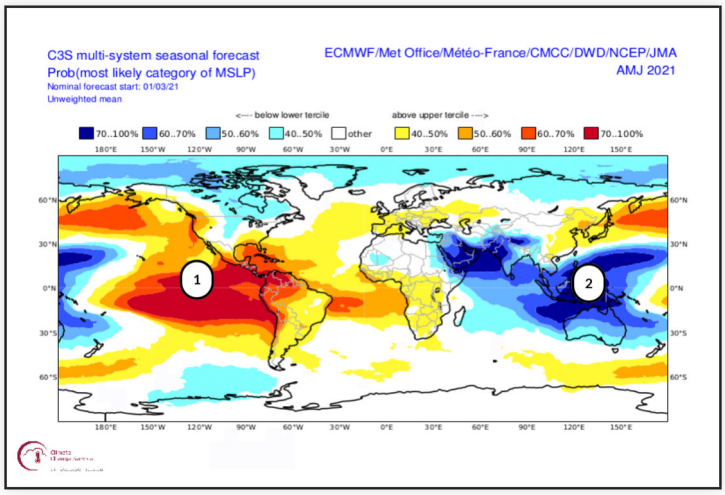
Most models forecast a positive anomaly accross North Atlantic extending to the soutwest of Europe. And a negative anomaly over Scandinavia.



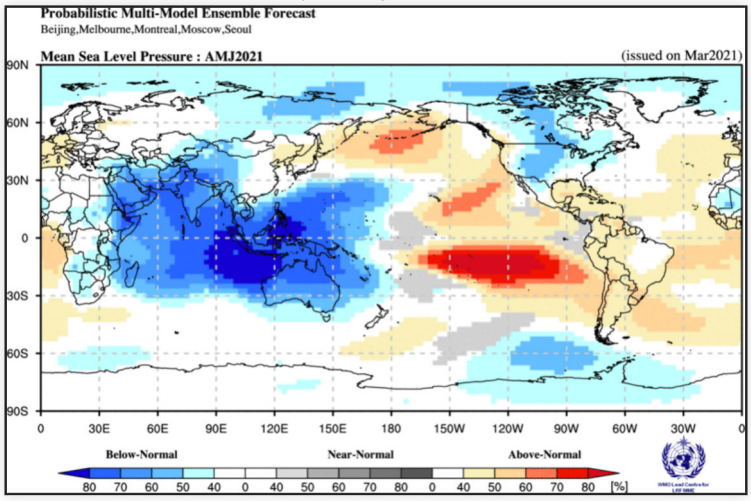
MF-S7, SEAS5, UKMO, DWD, CMCC and NCEP models probability maps.

Atmospheric circulation forecasts : MSLP probabilites multi-systems

Fairly good agreement between the two multi-models. High field likely over Europe, especially on the Atlantic side. Fairly strong probability also in the Middle East



C3S multi-models (MF-S7, SEAS5, UKMO, DWD, CMCC and NCEP) MSLP terciles probability.



Others models of WMO multi-models MSLP terciles probability.

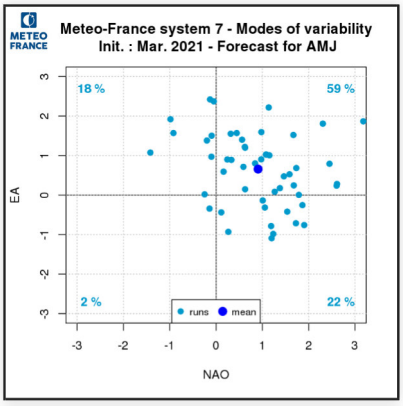
1 - High probable values related with La Nina situation
2 - low probable values related to La Nina

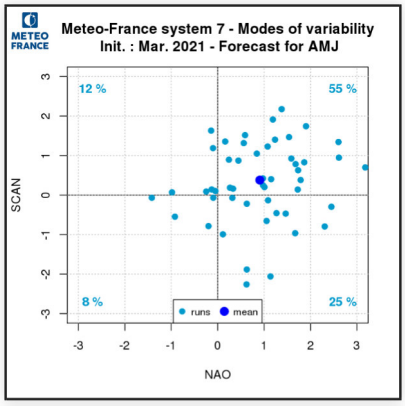
Modes of variability : forecast

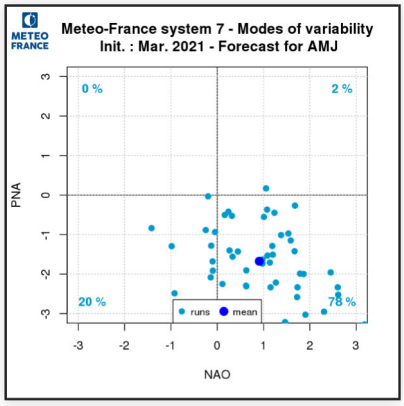
Unsurprisingly, all the individual members of each ensemble, except one, forecast negative PNA.

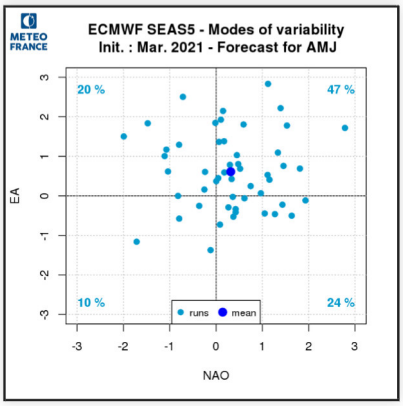
A positive NAO is probable (more than 70% of the ensemble, for the two models).

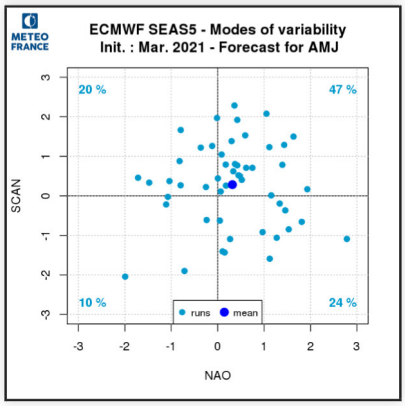
Positive EA and positive SCAN are the most likely

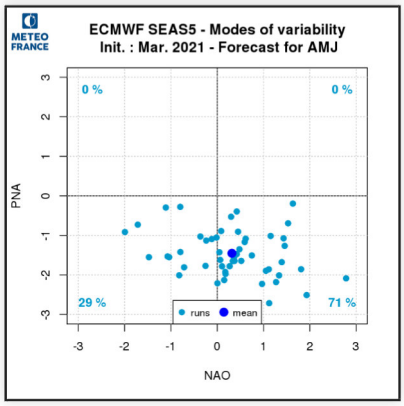








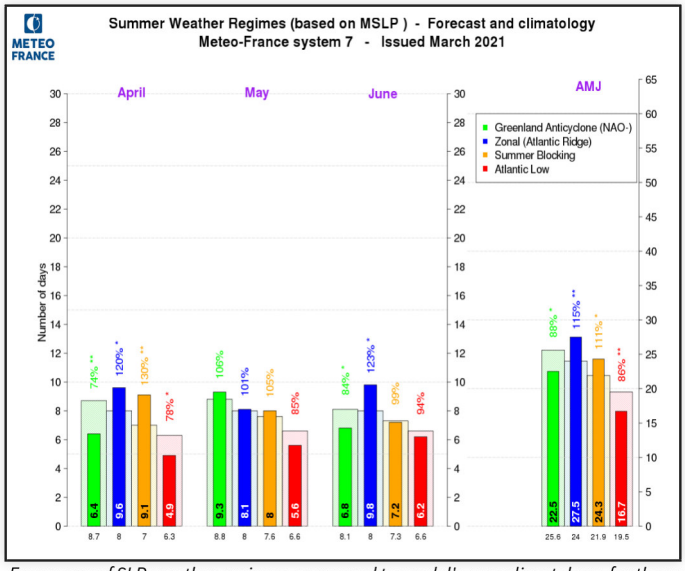


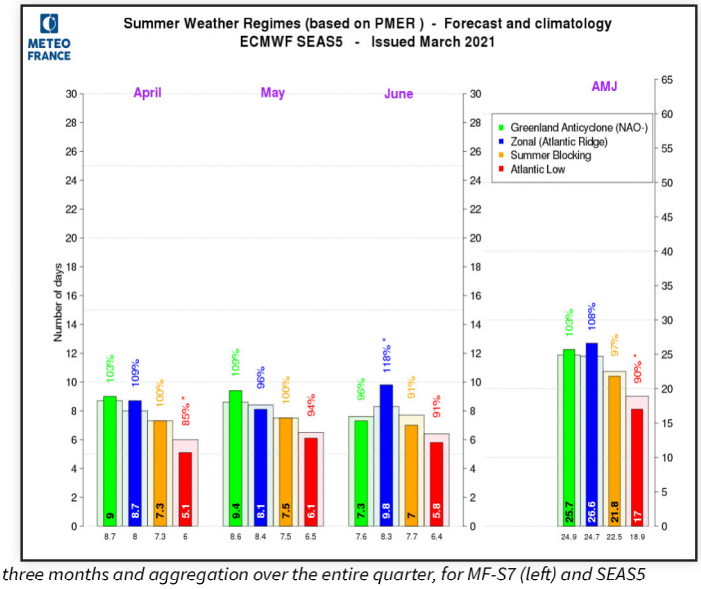


See the modes of variability patterns

Weather regimes : summer MSLP

Both models foreseen higher frequencies for the Zonal regime and lower frequency of Atlantic Low(consistent with the 3-month mean of MSLP).

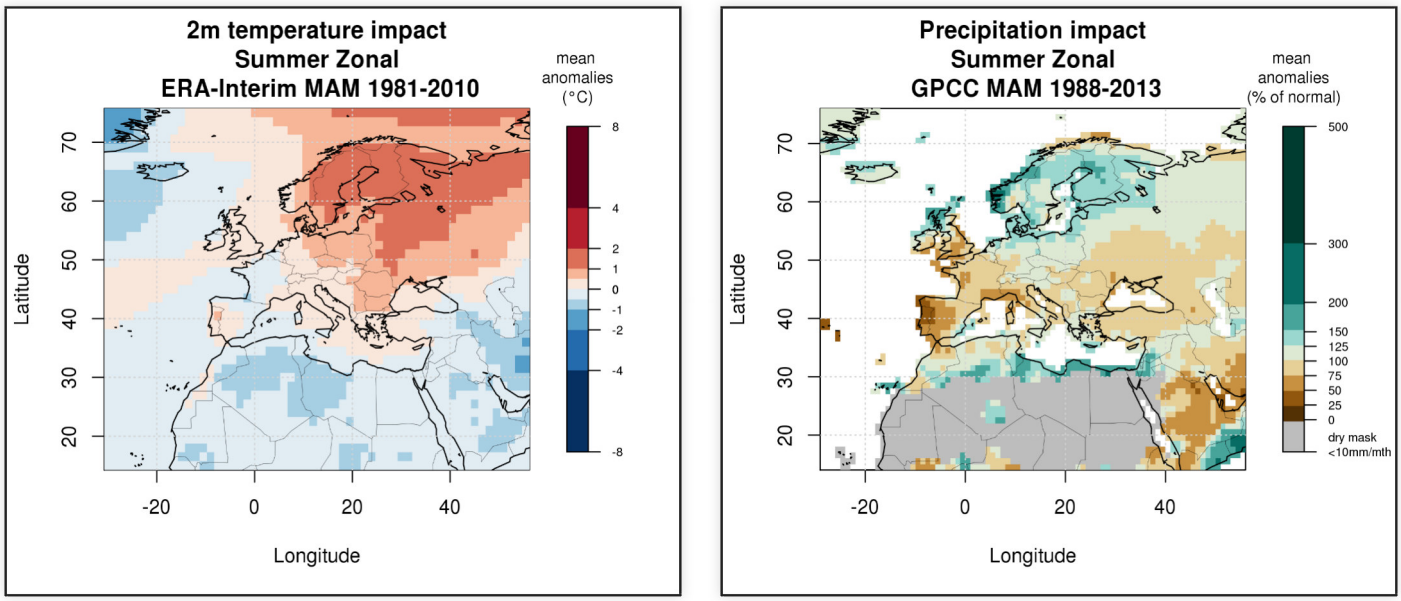




Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S7 (left) and SEAS5 (right).

Weather regimes : Impacts

Summer Zonal weather regime is favored



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

Forecast of climatic parameters : Temperature probabilities

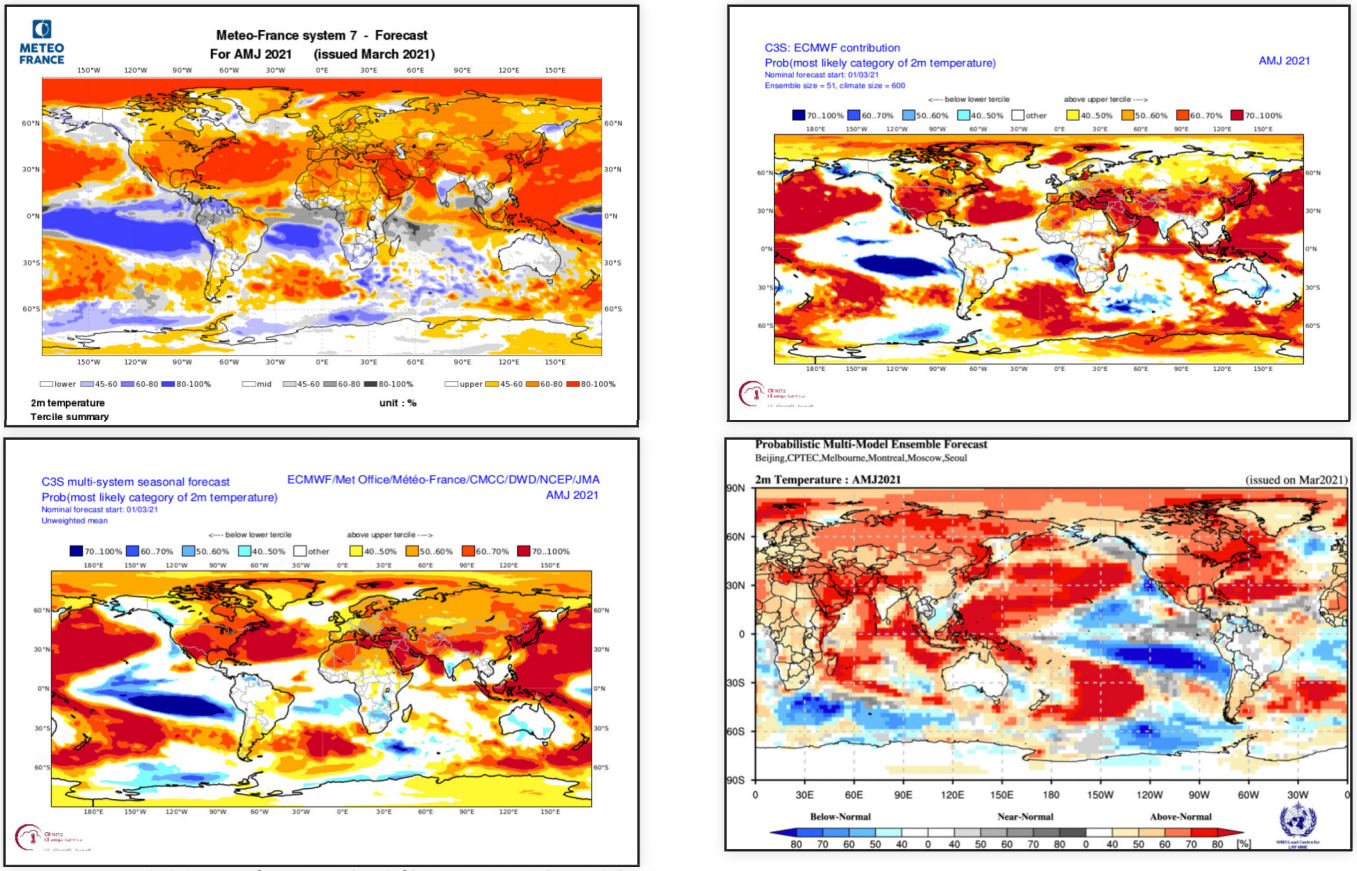
In a situation constrained by the La Niña in the Pacific and around.

- North America : strong signal in link with La Niña.

- South America : close to normal

- North of Africa and Middle East : consistent signal of warmer than normal

- Asia : warmer than normal with the exception of extreme south.

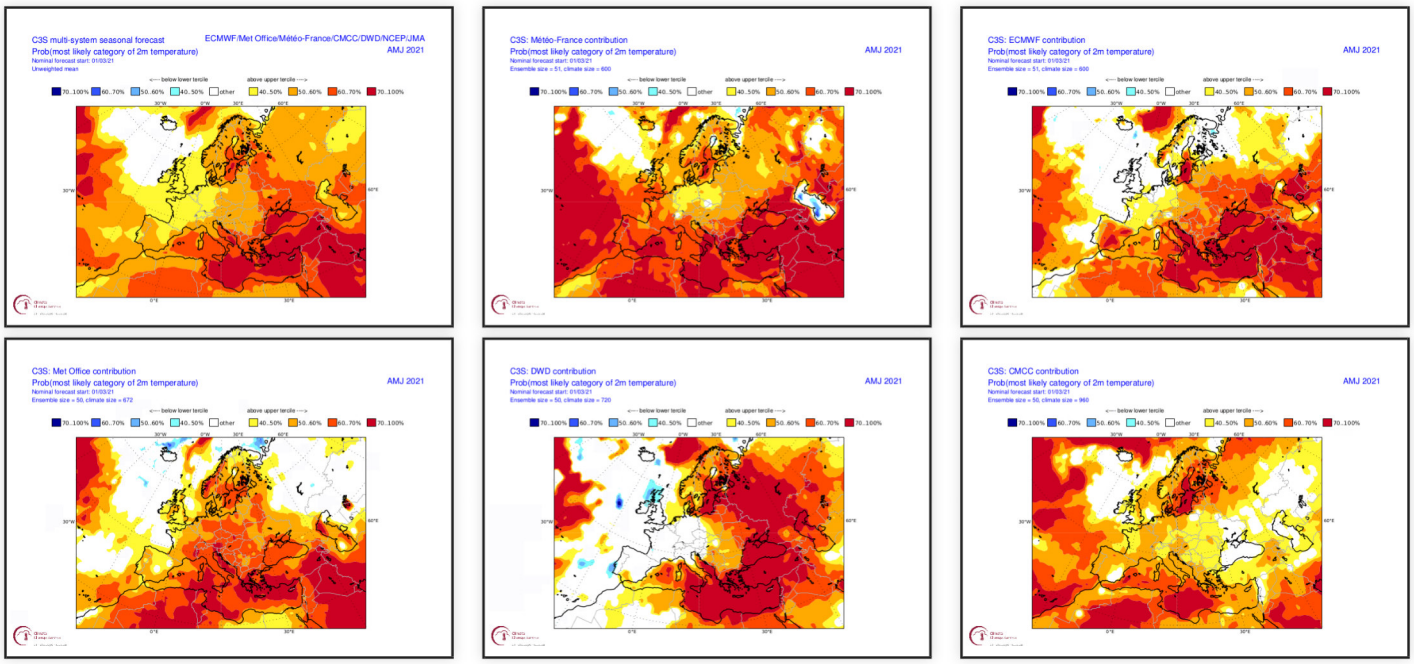


2m temperature probability map from MF-S7 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

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

The "warmer than normal" scenario seems the most probable in the Eastern part of Europe.

Whereas in Western Europe, models are more divergent : two of them (DWD and to a lesser extend ECMWF) priviledge a "normal" scenario, linked to the circulation more meridional (see Z500 anomalies)

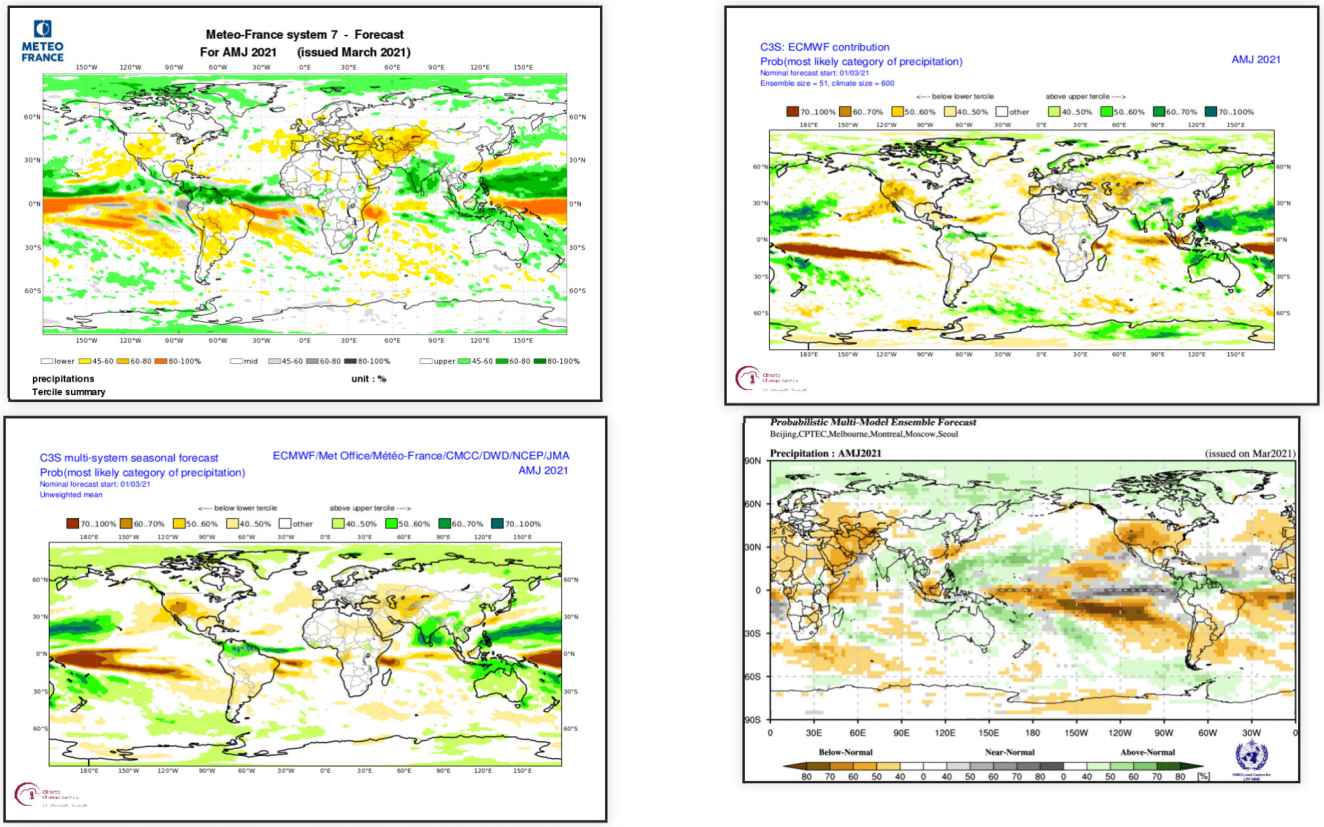


C3S multi-models probability map (top left) and MF-S7, ECMWF-SEAS5, UKMO , DWD, CMCC models.

Forecast of climatic parameters : Precipitation

Thanks to La Niña, models are remarkably consistent in the tropics and up to mid-latitudes over North and South America, but also over South Asia (wet pattern).

Over Middle East, a "drier than normal" pattern is clearly foreseen by the models, consistent with Z500 anomaly charts.

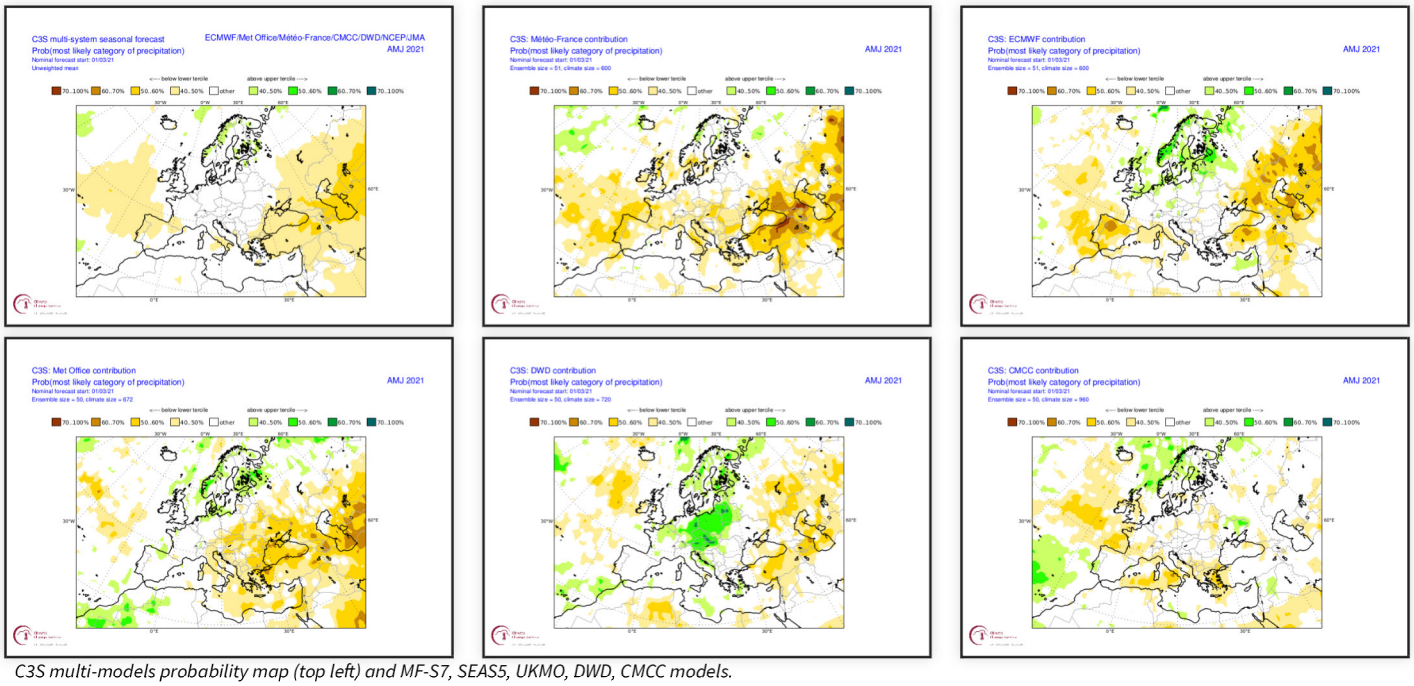


precipitation probability map from MF-S7 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

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

Over Scandinavian countries, "wetter than normal" signal suggested by C3S models : this is consistent with a dominant zonal regime.

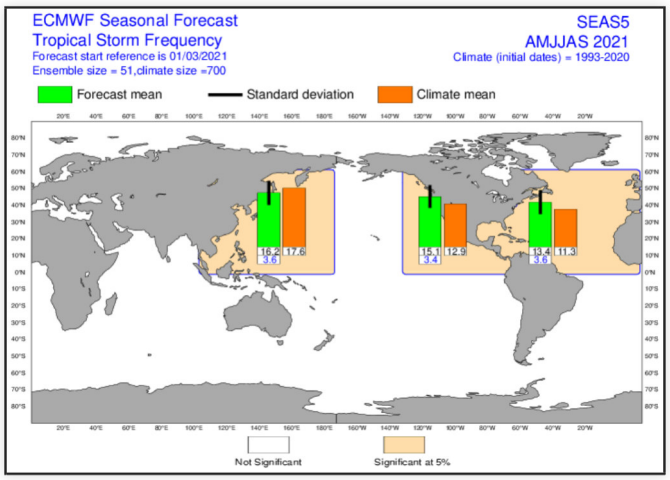
And traces of "dry" signal on Western Europe, along Southern Europe and the Mediterranean sea. The "dry" signal is much stronger in the Middle East.

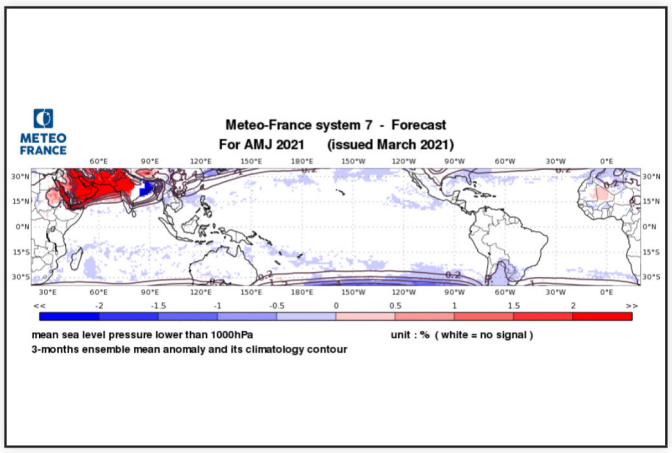


C3S multi-models probability map (top left) and MF-S7, SEAS5, UKMO, DWD, CMCC models.

Forecast of climatic parameters : Tropical Storm Frequency

The cyclone risk is likely to increase in west Pacific and Atlantic





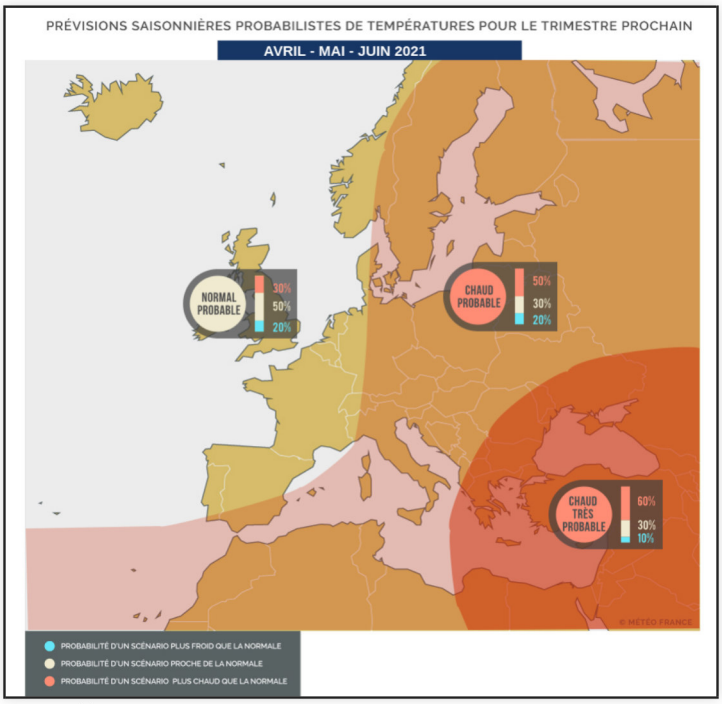
Synthesis map for Europe : Temperature

We take into account the C3S 's scenario of a dominant zonal regime weather, combined with a positive geopotential anomaly on Middle East.

As a result :

- the Eastern part of the domain should experience warmer than normal temperature

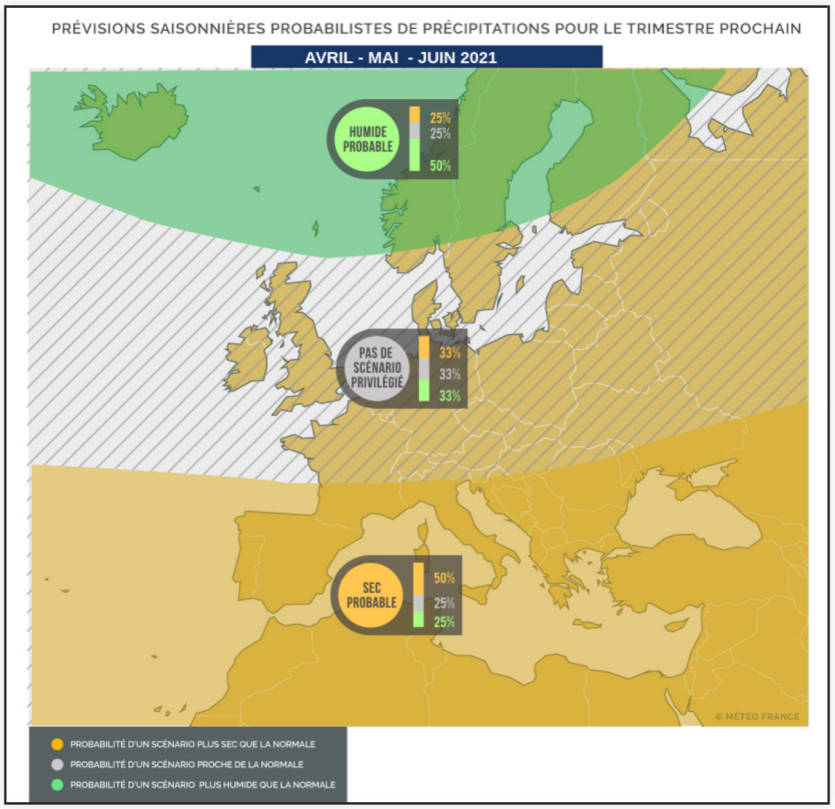
- no scenario elsewhere



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

Synthesis map for Europe : Precipitation

Wetter than normal on Scandinavian countries and driest in southern Europe in connection with zonal regime weather and positive geopotential anomalies.



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