

Météo-France Seasonal Forecast Bulletin

MARCH - APRIL - MAY 2022

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General synthesis : MAM 2022

In the Pacific, the La Nina phenomenon is still present during this quarter, and would continue to strongly impact large scale circulation around the Pacific Ocean. In the Equatorial Atlantic, an east-west gradient. should appear and generate modifications of Hadley-Walker circulation. Mid-latitude teleconnections are well established, particularly in the Northern Hemisphere. The forecasts of all the models show very good consistency, including in Europe.

A) Oceanic forecast :

- ENSO : moderate La Niña
- IOD : neutral
- Equatorial Atlantic : east-west gradient

B) Drivers :

- La Nina impacts
- strong polar vortex at the beginning of the period

C) Atmospheric circulation :

The expected atmospheric circulation is well represented by the C3S multi-model : a NAO+ pattern shifted northward and with a positive anomaly more developed over Europe. So the mean circulation should be dominated by a negative anomaly over Greenland and a positive anomaly over the North Atlantic extending largely over Europe.

D) Most likely conditions :

over Europe and the Mediterranean Basin, the warm tercile is privileged over almost whole Europe and north-west Russia, with good confidence.

Privileged dry tercile from Iberian Peninsula and France to the Balkans. Privileged wet tercile in northern Europe. No scenario elsewhere.

Next bulletin : scheduled on March 21th

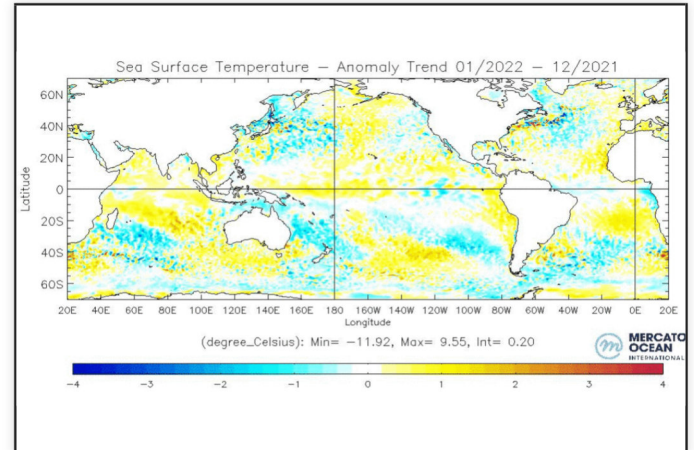
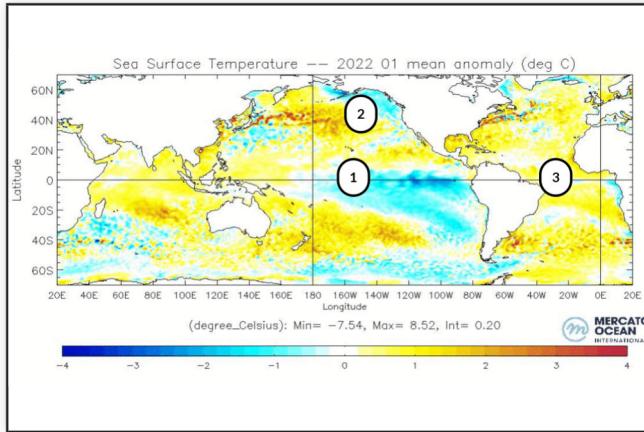
Oceanic analysis of January 2022 : SST anomalies

Current ENSO situation : moderate La Niña

In the Pacific Ocean : the cold anomaly in the Central East Pacific, characteristic of La Niña, resists despite a slight warming along the equator in the western part. Over the North Pacific, the PDO- pattern strengthens slightly.

In the Indian Ocean : widespread warming throughout the basin, except between Indonesia and Australia. Weak gradient between west (neutral) and east (positive anomaly).

In the Atlantic Ocean : neutral conditions along the equator, except trace of upwelling in the Gulf of Guinea. Warm anomalies in the north and south tropics. In the North Atlantic Ocean, despite a cooling trend in the western part, generalised warm anomalies.

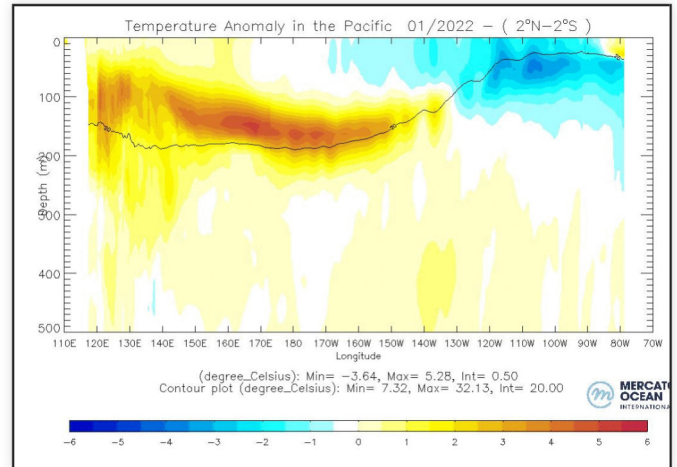
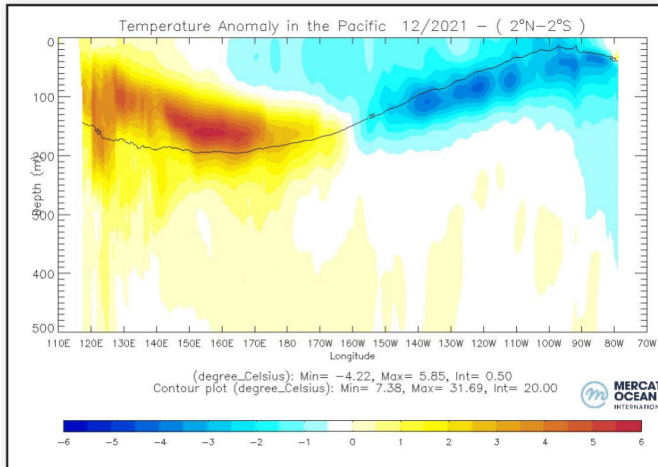


SST Anomalies and trend with the previous month (c) Mercator-Ocean

- 1 - La Niña pattern
- 2 - Negative PDO pattern
- 3 - Slight positive anomalies on both sides of the equator, neutral conditions along the equator

Oceanic analysis of January 2022 : Pacific vertical section

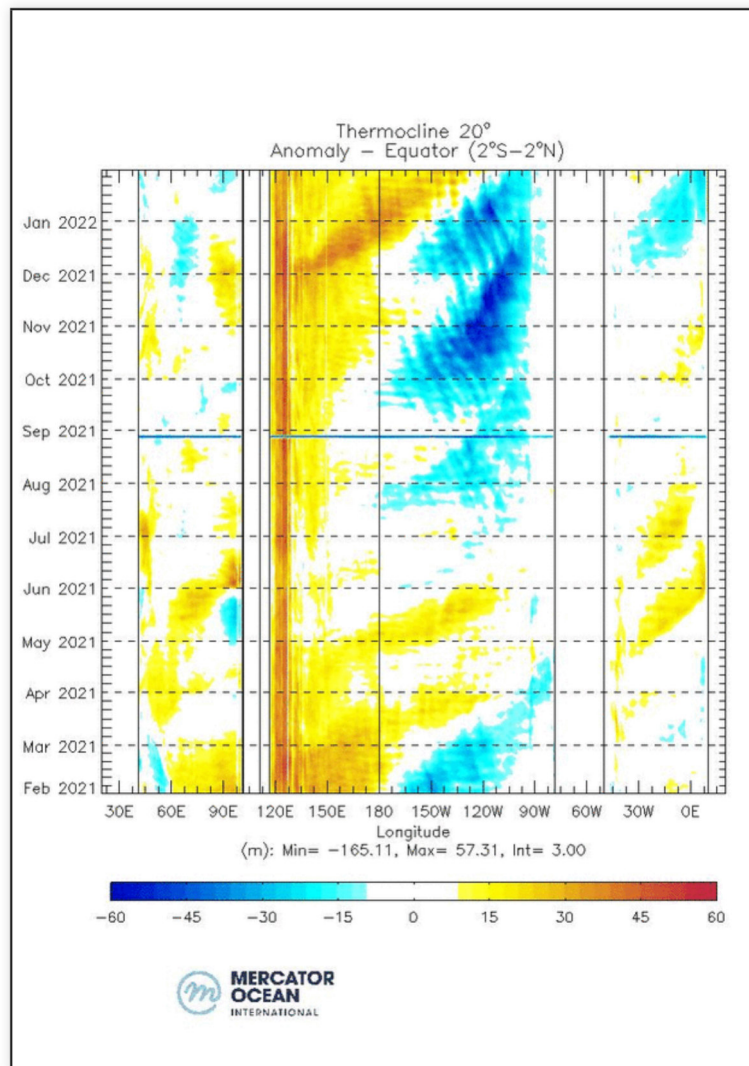
Propagation of the sub-surface warm anomaly from the west to the east. In January the cold anomaly is significantly reduced but still strong in subsurface and extended to a large area at the Ocean surface.



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

Oceanic analysis of January 2022 : Hovmüller diagram of the 20°C isotherm

In the Pacific Ocean, nice kelvin wave propagating from the warm pool (beginning of December) to Central Pacific (end of January). This is an indication of the end of la Niña in the next months.

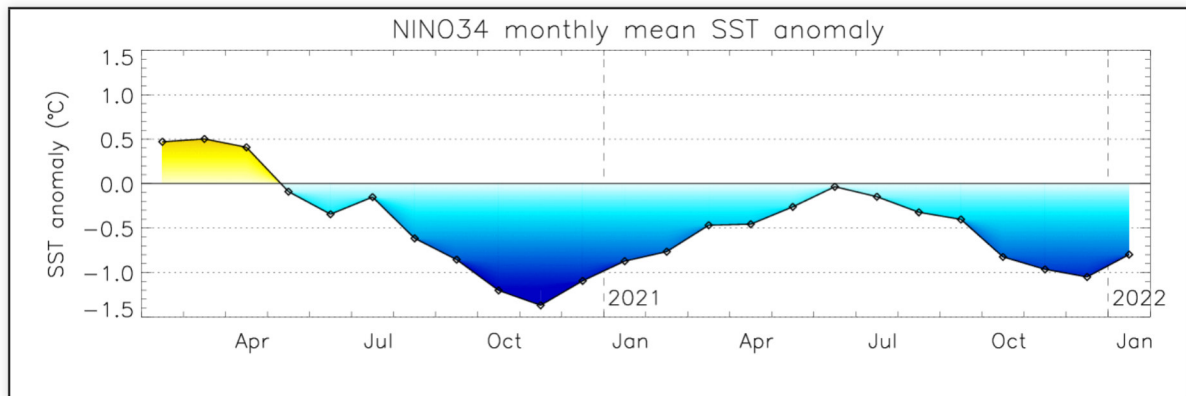


Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 °C isotherm) (c) Mercator-Ocean

Oceanic analysis of January 2022 : Pacific Ocean - Nino3.4 index history

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -0.8°C

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

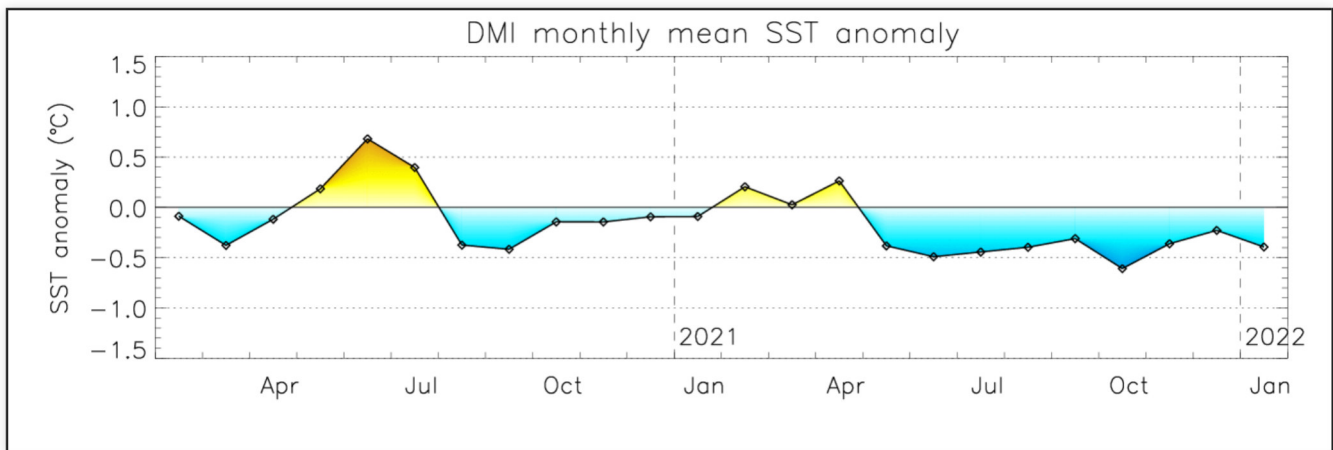


Evolution of SST in the NINO3.4 box (c) Mercator-Ocean

Oceanic analysis of January 2022 : Indien Ocean - DMI index history

DMI Index issued from Mercator Ocean PSYV4R2 analysis : -0.4°C

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



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

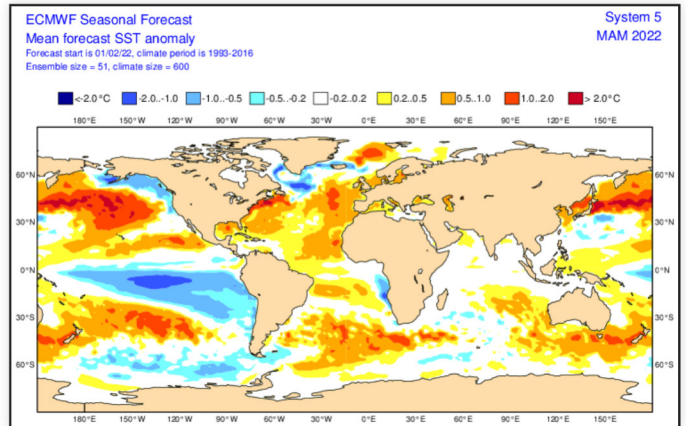
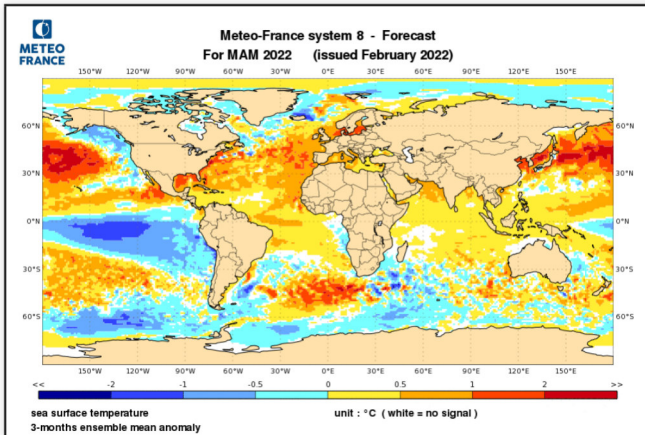
Oceanic forecast : SST anomaly

Very good agreement between MF-S8 and ECMWF-SEAS5 in the main anomaly patterns.

In the Pacific Ocean : On the Central East Pacific Ocean, there is still a large cold anomaly pattern typical of "la Niña" but of weaker intensity than in the January analysis. Good agreement on the anomaly patterns in mid-latitudes (especially the PDO- pattern in the north hemisphere)

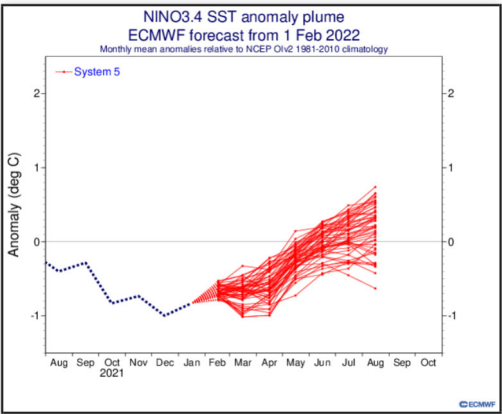
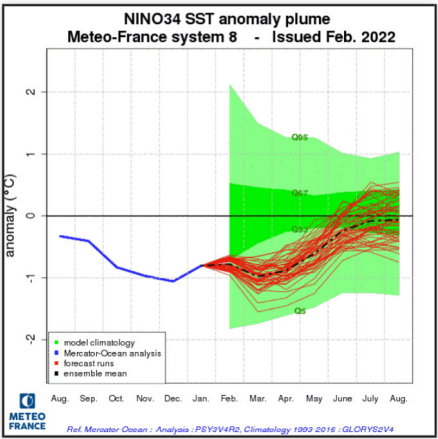
In the Indian Ocean : normal or slightly above normal conditions.

In the Atlantic Ocean : east-west gradient along the equator and positive anomalies on north and south tropics. In the northern hemisphere, formation of a north-west / south-east gradient with positive anomalies on the European coasts and the Mediterranean sea.



Oceanic forecast : NINO3.4 Plume diagrams

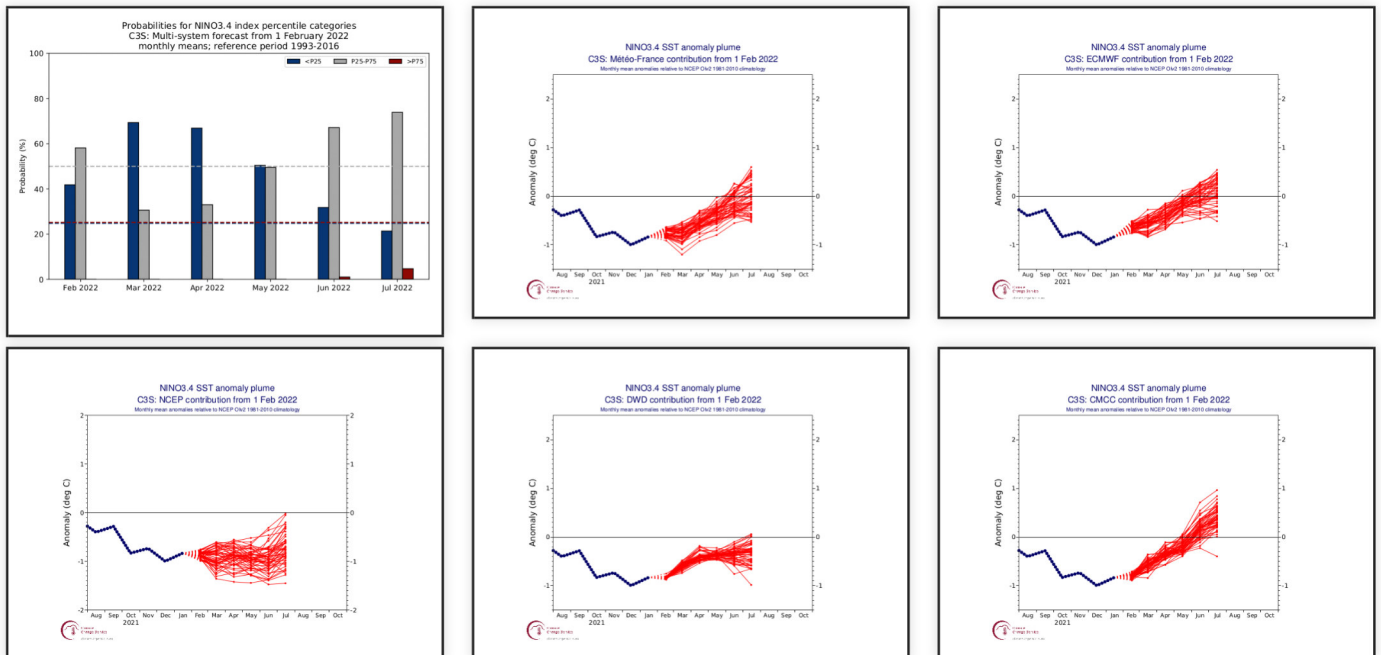
ECMWF-SEAS5 and MF-S8 both forecast progressive return to neutral condition for next summer.



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

Rather good agreement between models, all the models (except NCEP) agree on a progressive return to neutral conditions. So we should have "weak" La Niña conditions during the next three months.

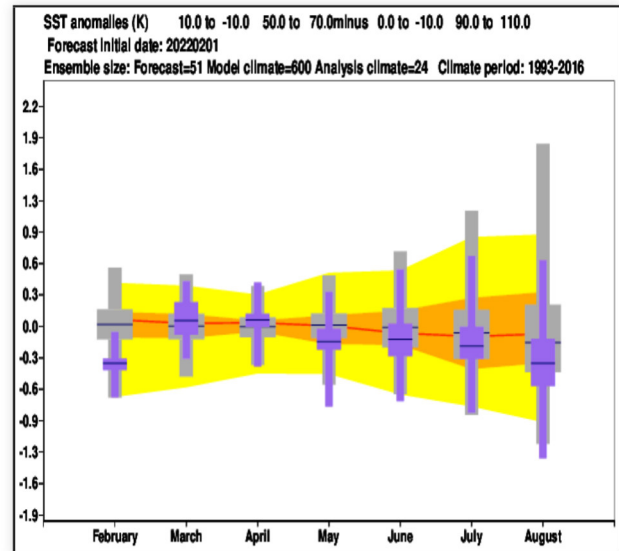
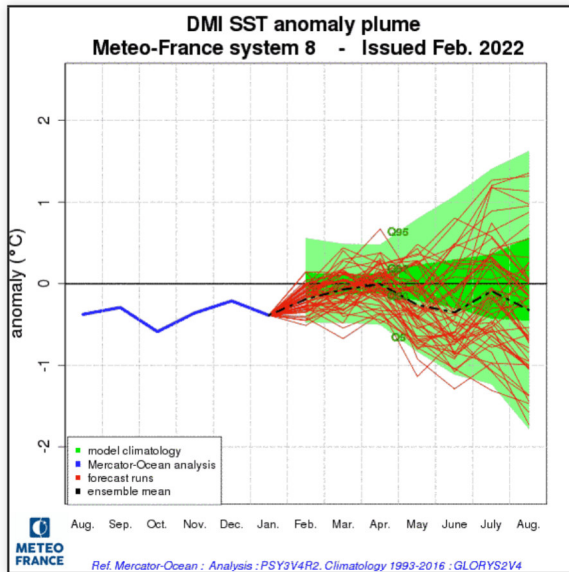
The most likely phase for the next three months : weak La Niña.



C3S multi-system probability forecast (top left figure) and C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010.

Oceanic forecast : Indian ocean - DMI evolution

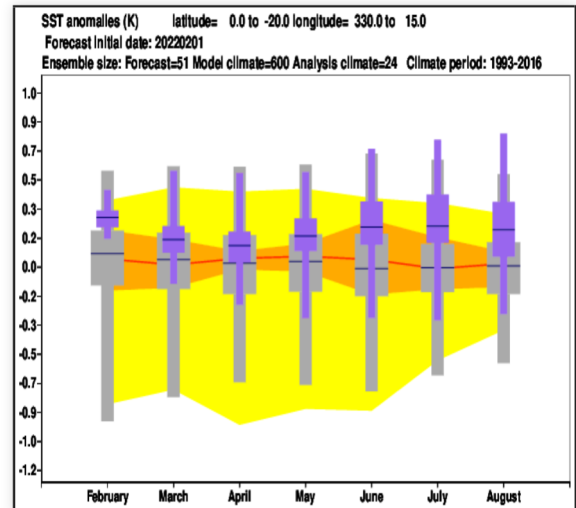
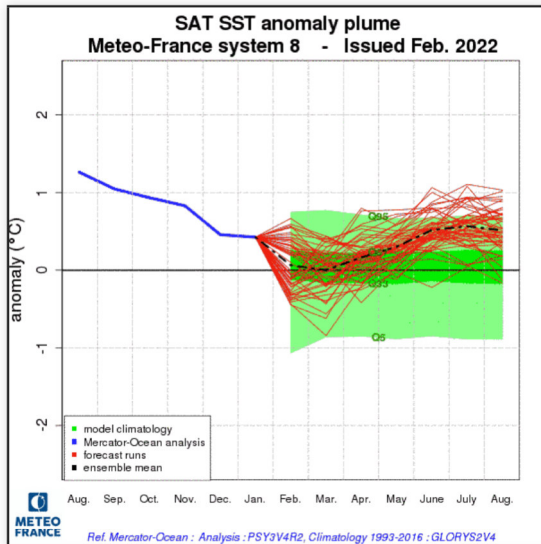
Neutral conditions forecast for the next quarter.



DMI index : analysis, forecasts and model climatology with MF-S7 on the left and ECM-SEAS5 on the right

Oceanic forecast : Atlantic ocean - SAT evolution

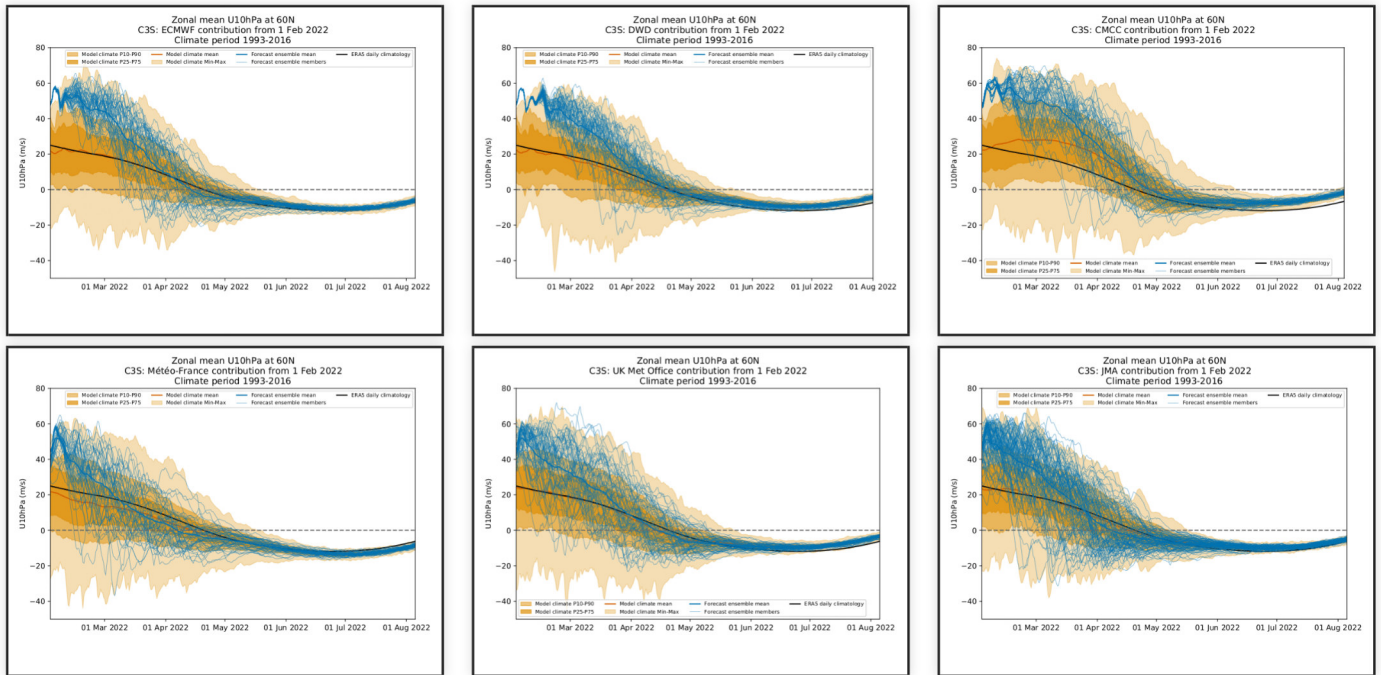
The two models forecast warmer than normal conditions.



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

Drivers : polar vortex (U010 plumes)

Strong polar vortex at the beginning of the simulations. Low probability of a weaker vortex than normal in late winter.



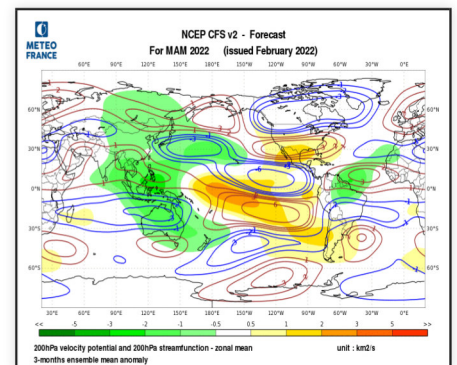
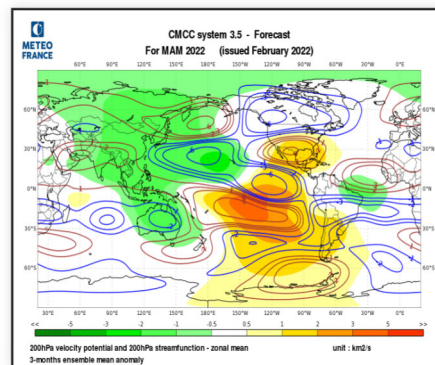
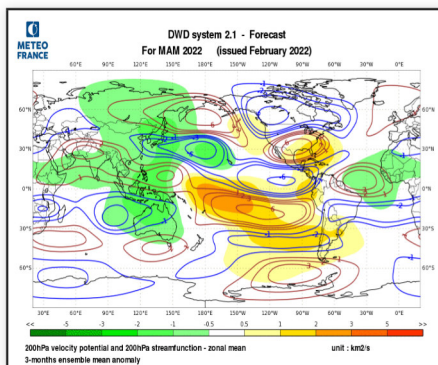
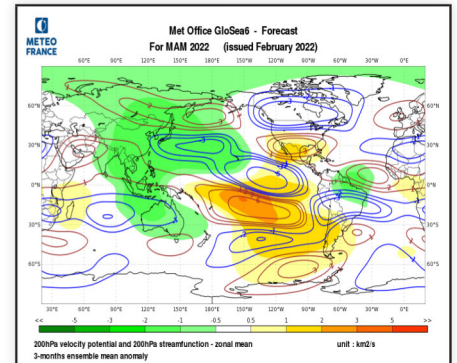
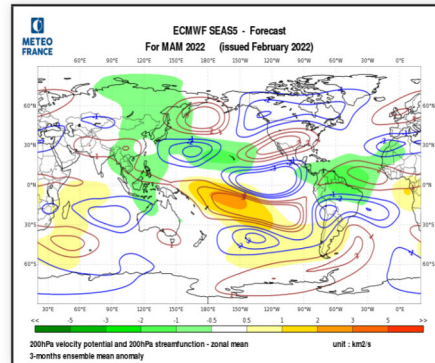
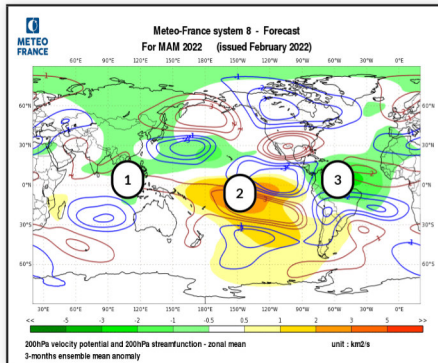
ECMWF-SEAS5, DWD, CMCC, MF-S7, UKMO, and JMA 010hPa zonal mean of u component of wind at 60°N.

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

Very good agreement between models, both for Velocity Potential and Streamfunction.

Velocity Potential : in the Pacific and around, dipole pattern consequence of "La Nina", with a downward motion anomaly over the Centra Pacific and an upward motion anomaly from the Maritime Continent extending to the Asian Pacific Coasts. In the Atlantic, upward motion anomaly centred over the North-East coast of South America and little downward motion anomaly over the Gulf of Guinea : this is consistent with SST anomalies.

Streamfunction : clear dipole on both sides of the equator over Pacific Ocean with teleconnexions toward mid-latitudes (negative PNA). A dipole is also visible in the Indian Ocean. In the Atlantic Ocean, the dipole over the equatorial zone is well marked. Over the Mediterranean Basin and Europe, good agreement (this is not common) : it could be link to the coincidence between a teleconnexion from the tropical Atlantic and a teleconnexion from the Indian Ocean.

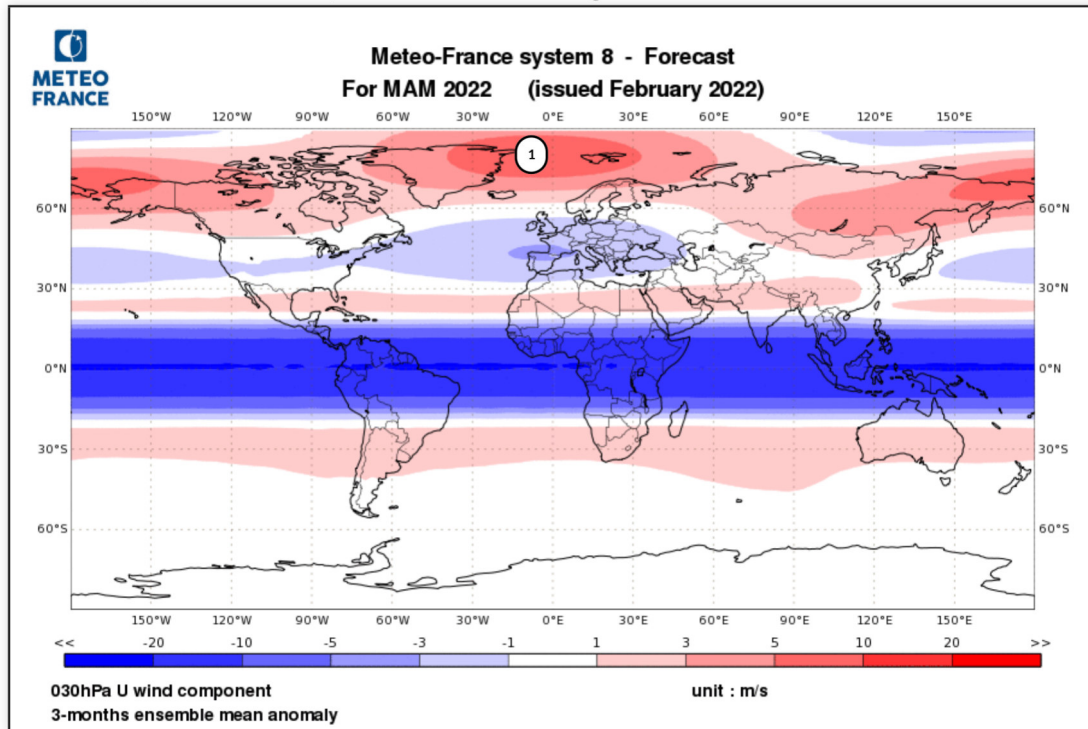


MF8,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

- 1 - VP : upward motion anomaly related to La Nina
- 2 - VP : downward motion anomaly related to La Nina
- 3 - VP : upward motion anomaly linked to the west-east SST gradient along the equator

Atmospheric circulation forecasts : polar vortex

30 hPa zonal wind anomaly shows enhanced polar vortex for the coming 3 months. This should favour AO+ and NAO+ modes.

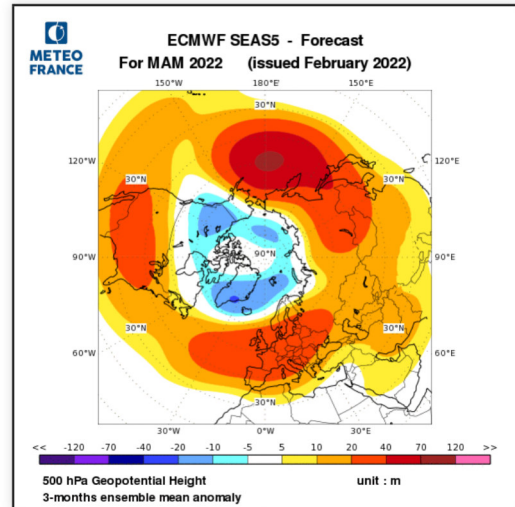
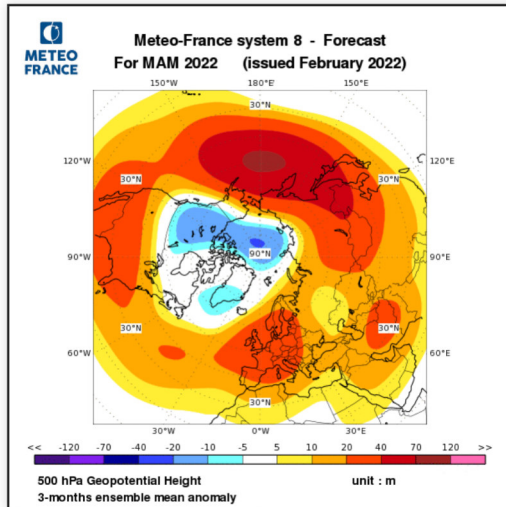


1 - enhanced polar vortex

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Very good agreement between the 2 models :

- firstly around the Pacific with a PNA- pattern, up to the Gulf of Mexico with a positive anomaly.
- secondly from Western Canada to Greenland and Europe, where they both predict a NAO+ circulation.



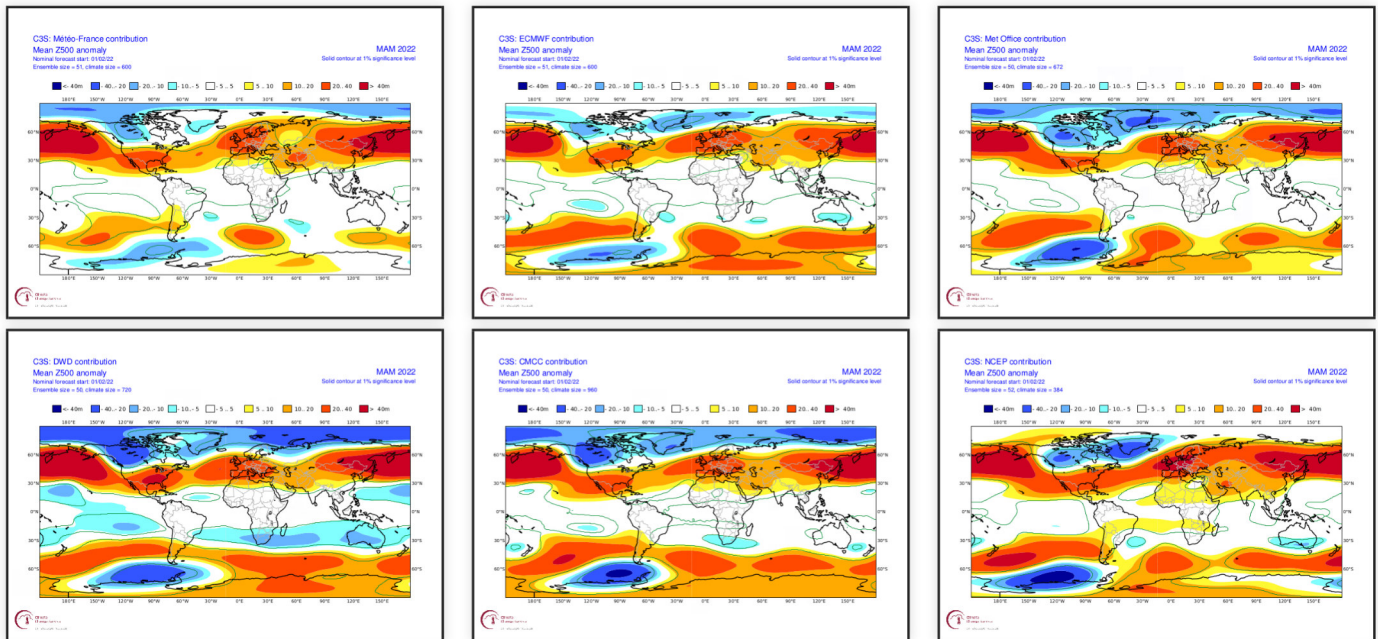
polar projection of MF8 and SEAS5 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in C3S models

All the C3S models are in agreement in the north hemisphere circulation.

From North-East America to North Atlantic and Europe, all the C3S models agree for a NAO+ pattern.

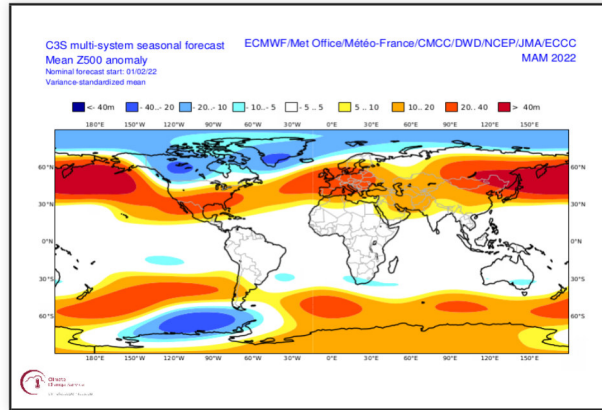
The main noticeable difference is located over west Russia : a relative low is visible in all the models, but the 3-month mean differs from one model to another.



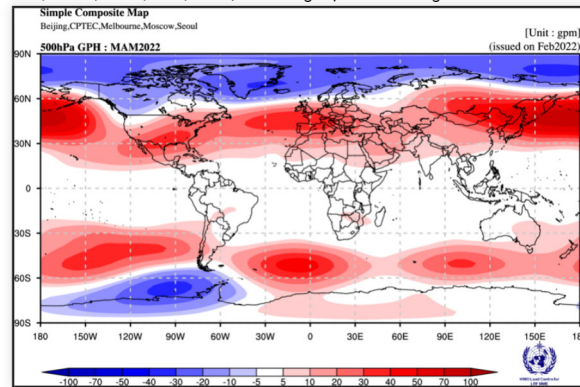
MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies multi-systems

Very good agreement between the two multi-models.



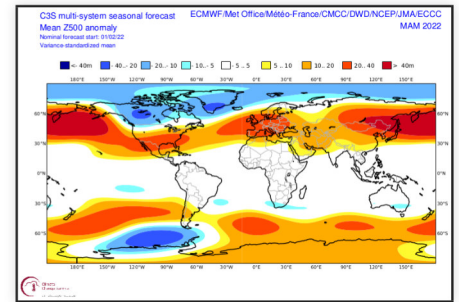
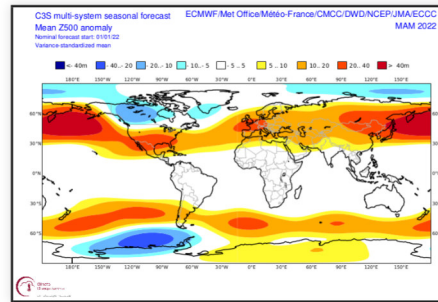
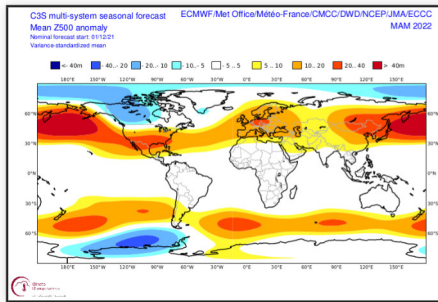
C3S multi-models (MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC, NCEP, JMA, ECC) 500hPa geopotential height anomalies.



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

Atmospheric circulation forecasts : Forecast stability

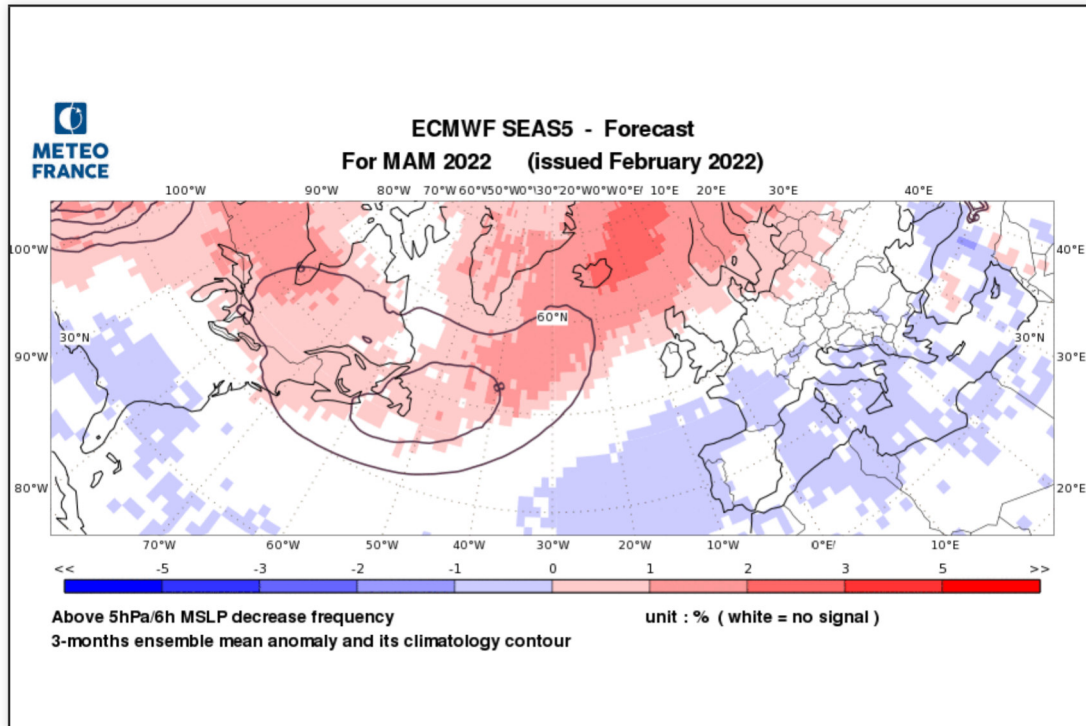
Very good stability with the C3S multi-models, even over Europe.



Successive forecasts of the C3S multi-model for the coming quarter

Atmospheric circulation forecasts : Strong MSLP decrease

Significant reduction of frequencies over most of European countries and around the Mediterranean basin, except Scandinavia : consistent with NAO+



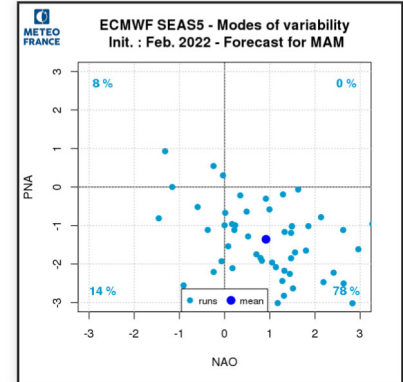
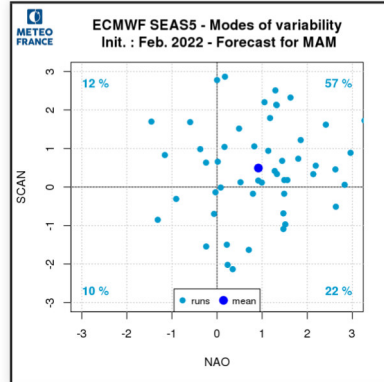
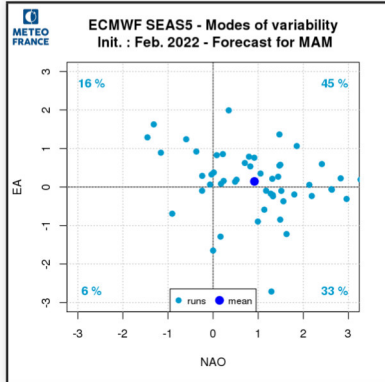
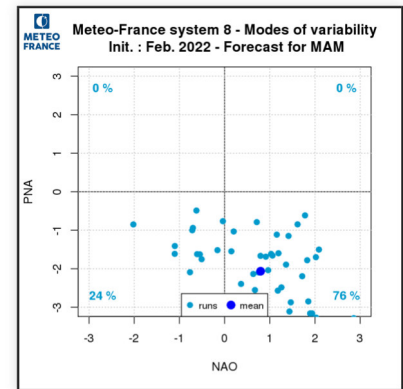
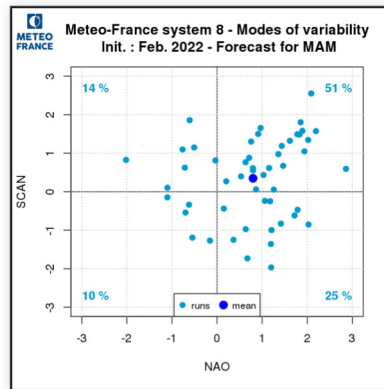
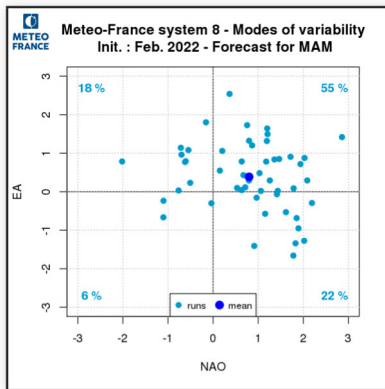
Frequency of more than 5hPa/6h MSLP decrease in MF-S7 (left) and ECMWF-SEAS5 (right)

Modes of variability : forecast

High confidence in a negative PNA.

Strong signal for NAO+ and SCAN+ : probability greater than 75% for both models.

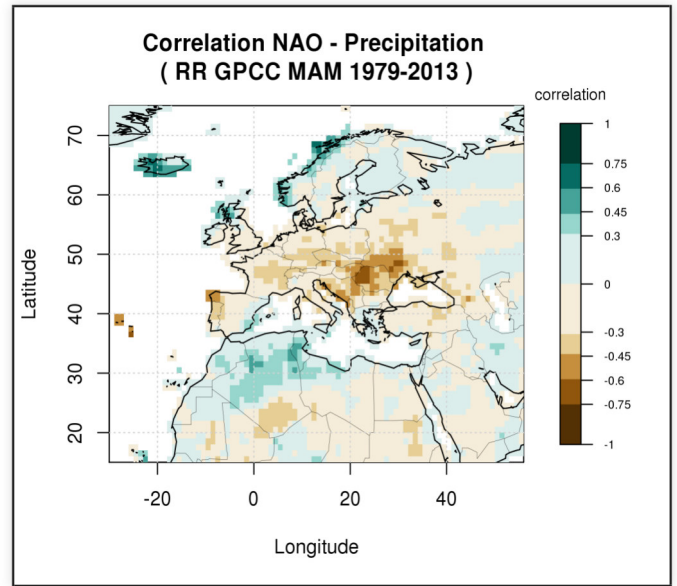
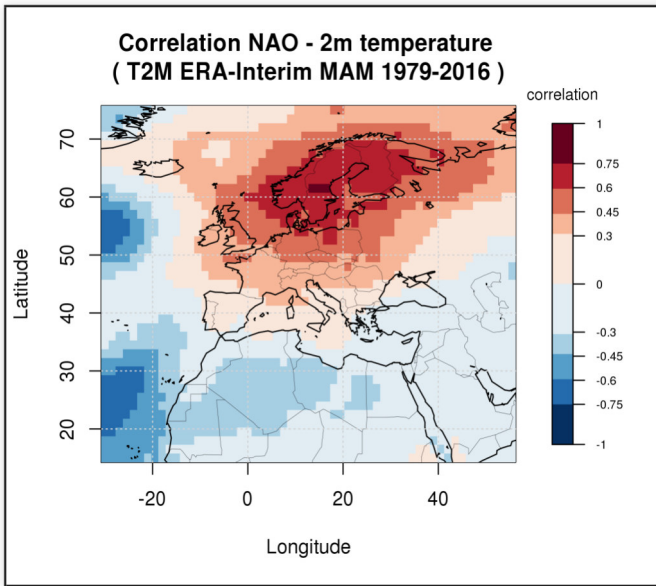
No clear signal for EA.



[See the modes of variability patterns](#)

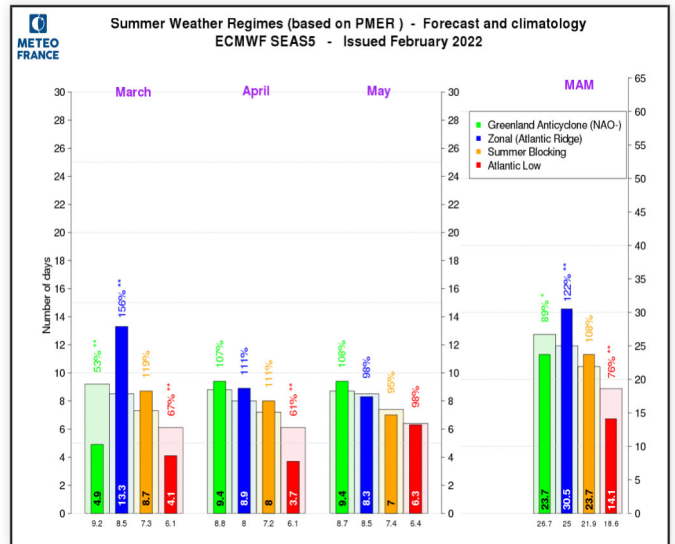
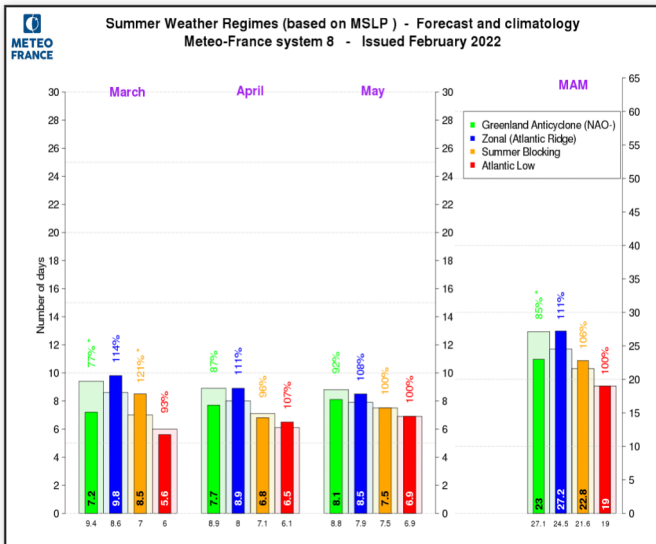
Modes of variability : NAO impacts

The NAO phase is the dominant mode



Weather regimes : summer MSLP

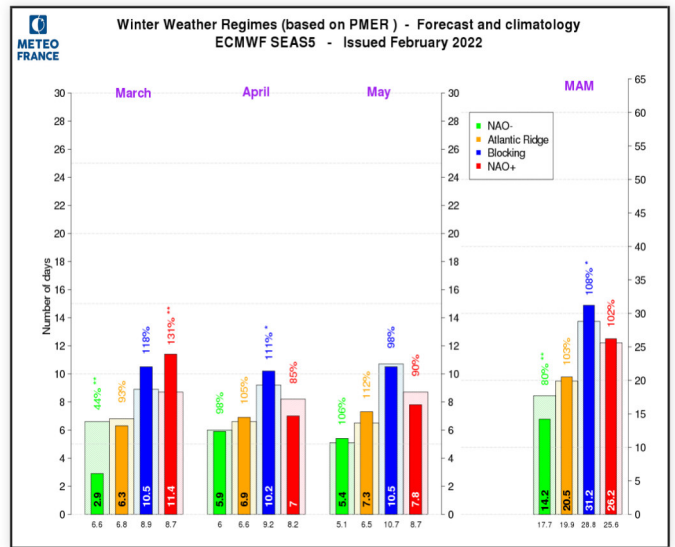
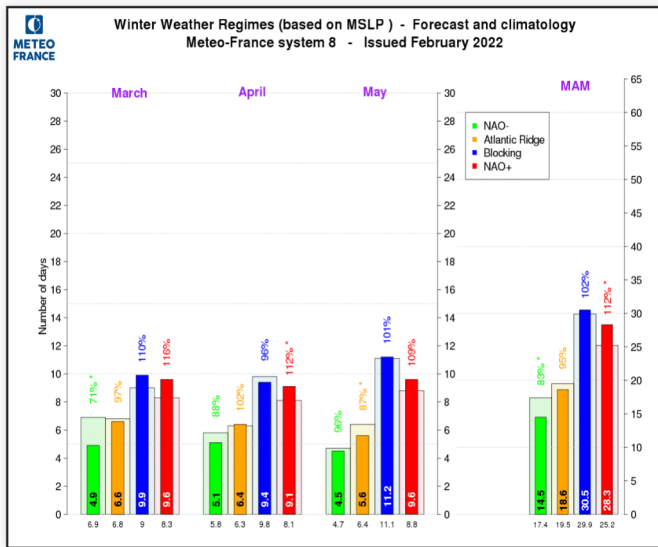
Good agreement between models for a positive anomaly of Zonal regimes all along the 3-month period.



Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S8 (left) and SEAS5 (right).

Weather regimes : winter MSLP

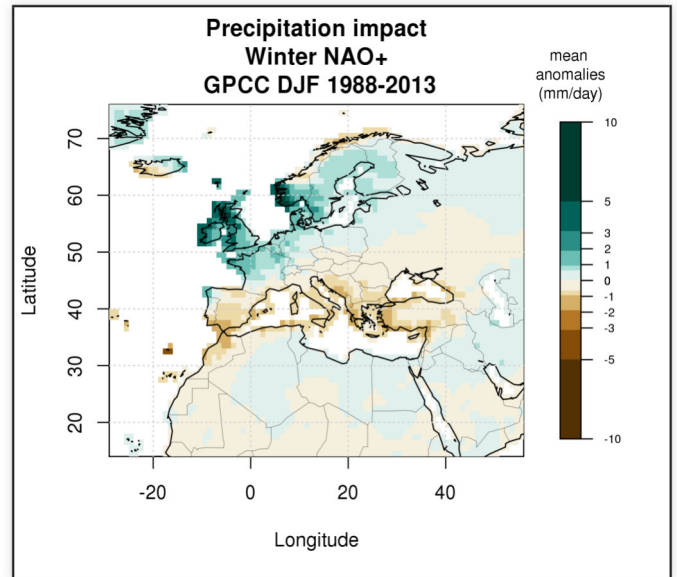
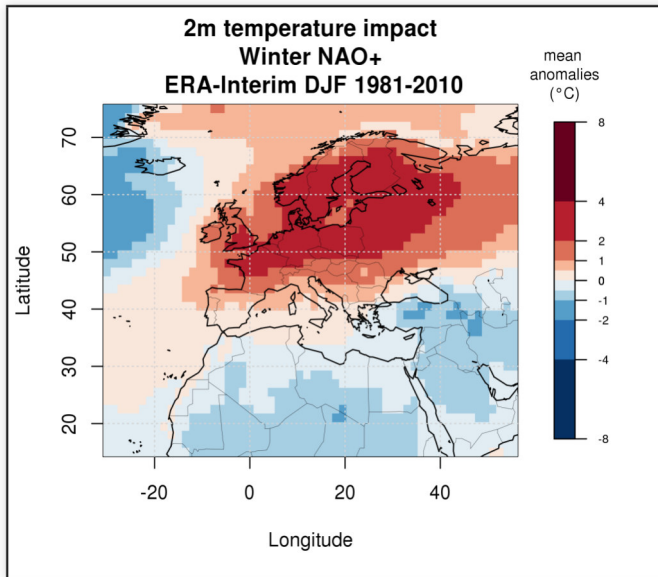
NAO+ regimes favoured.



Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S8 (left) and SEAS5 (right).

Weather regimes : Impacts

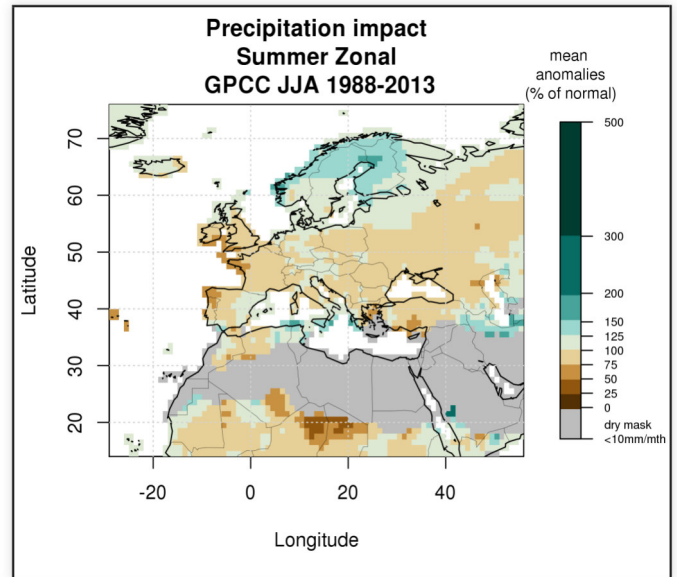
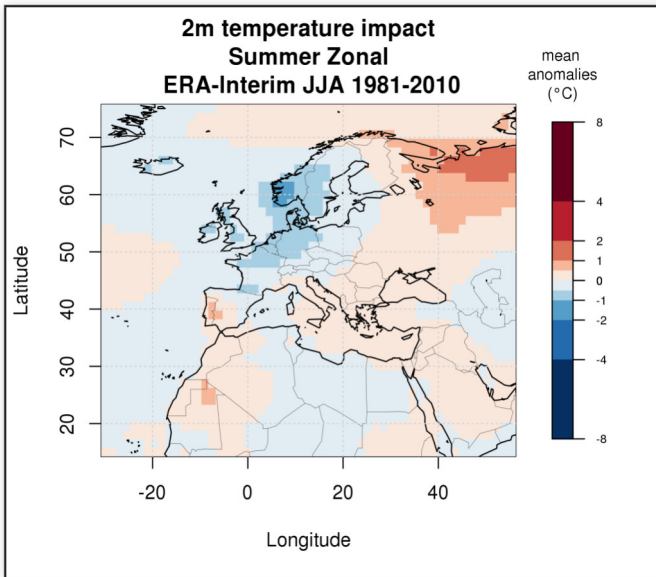
This regime is dominant in ECMWF-SEAS5 forecast.



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

Weather regimes : Impacts

Summer Zonal weather regime is favored. Over western Europe it is favourable to dry conditions and cool temperature.

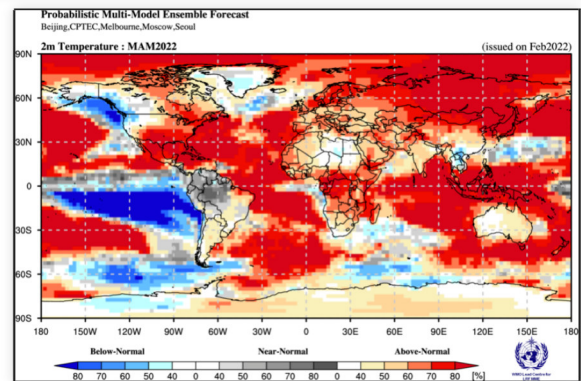
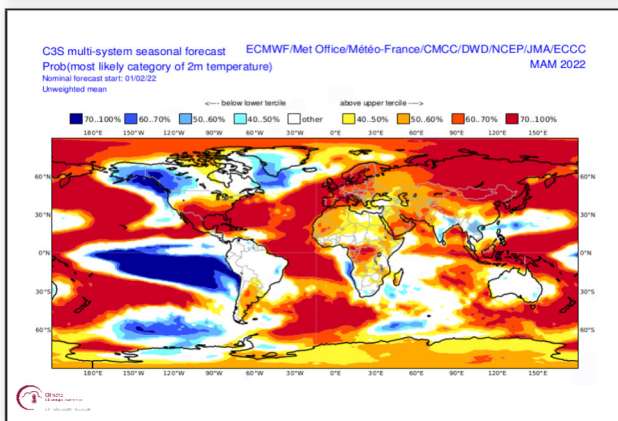
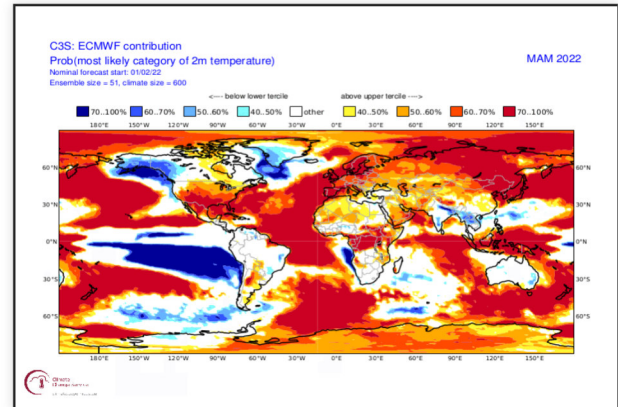
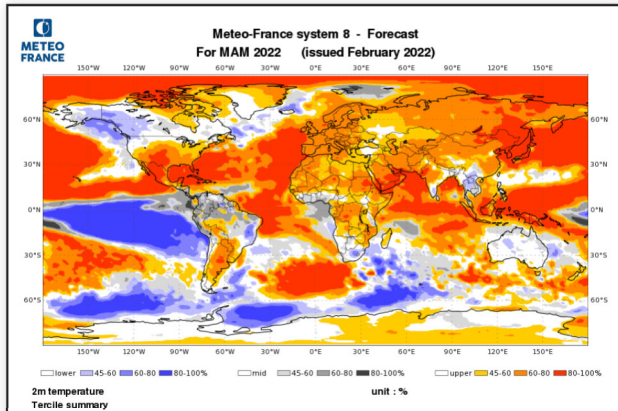


Impact of Summer Blocking weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)

Forecast of climatic parameters : Temperature probabilities

Very good agreement between models.

MF-S8 could be considered as representative of the models. Except for the northern part of Africa, the Arabian peninsula and for Asia, where the probabilities for the warmest tercile are significantly higher than most of the models.

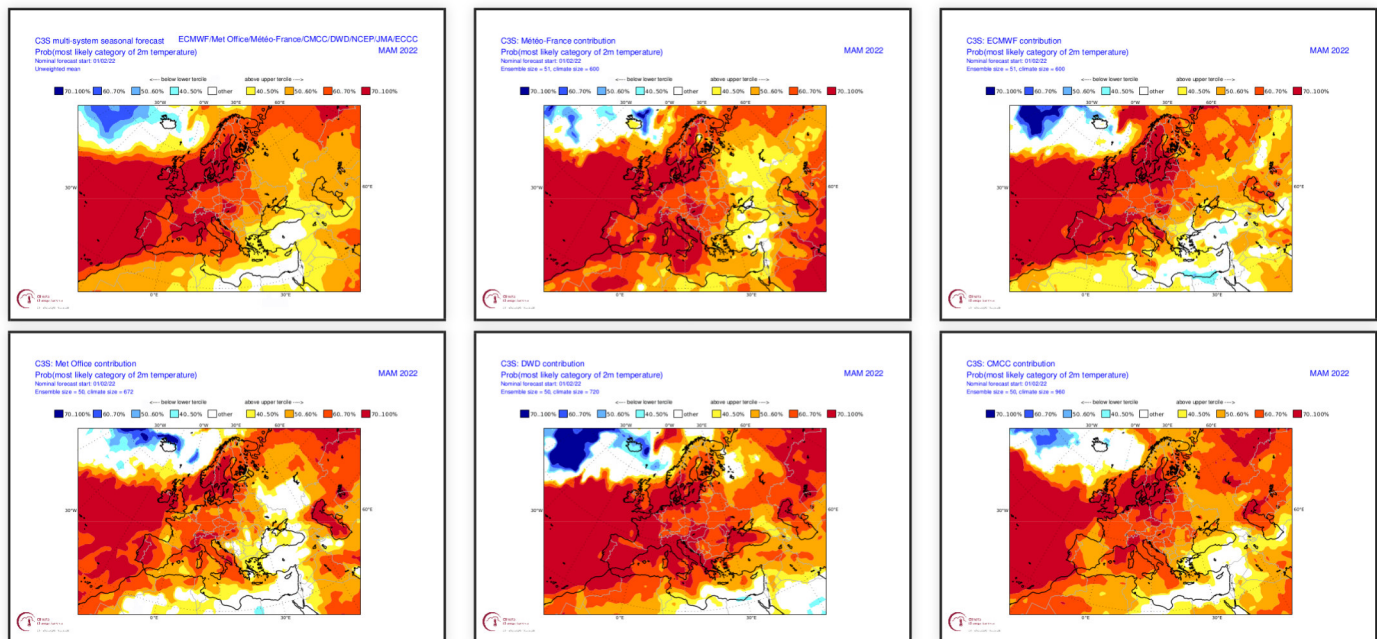


2m temperature probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

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

According to the NAO+ circulation, a warmer than normal signal is the most probable from Europe to Russia. No clear signal over the eastern part of the Mediterranean basin.

Note the high values of probability over most of the European continent.

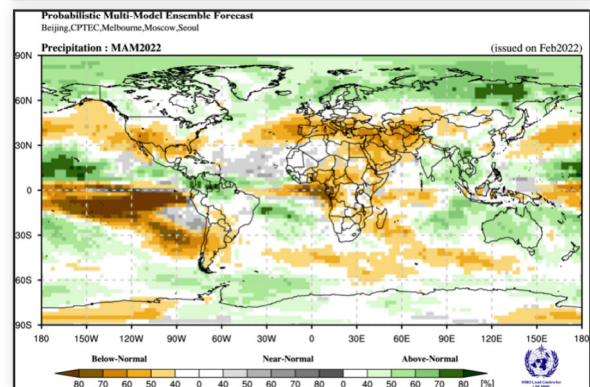
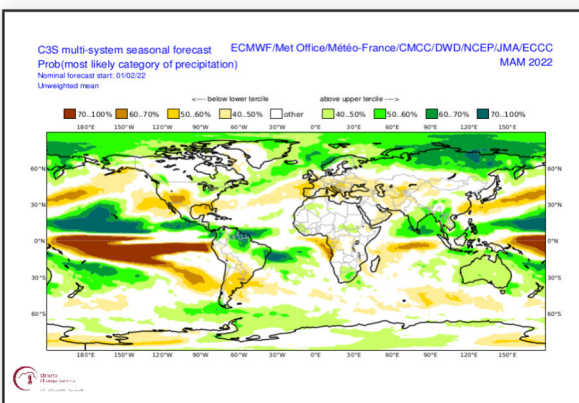
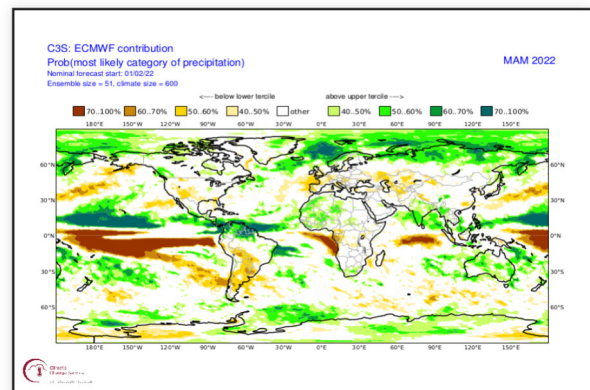
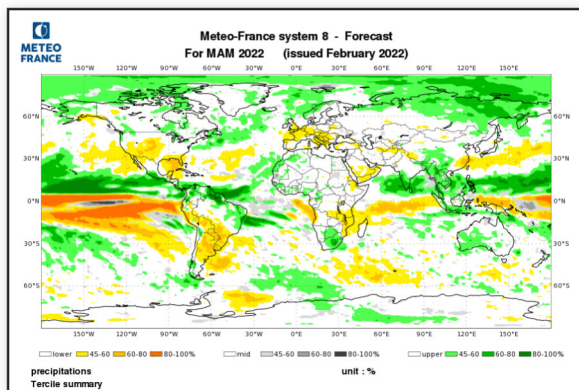


C3S multi-models probability map (top left) and MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC models.

Forecast of climatic parameters : Precipitation

Again very good agreement between models.

Classical effects of La Niña over the American continent, Africa, around the Maritime Continent. Consistent signal over Europe and north of Russia.

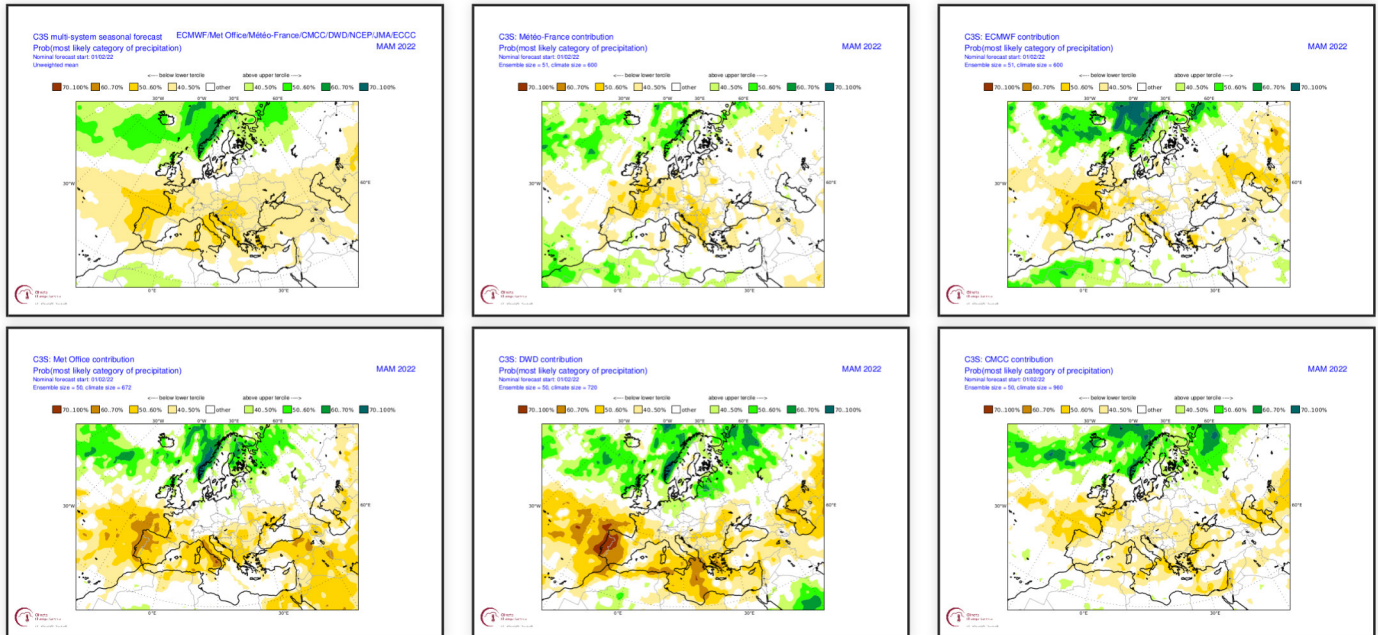


precipitation probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

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

All the models forecast conditions consistent with the impacts of the NAO+ circulation :

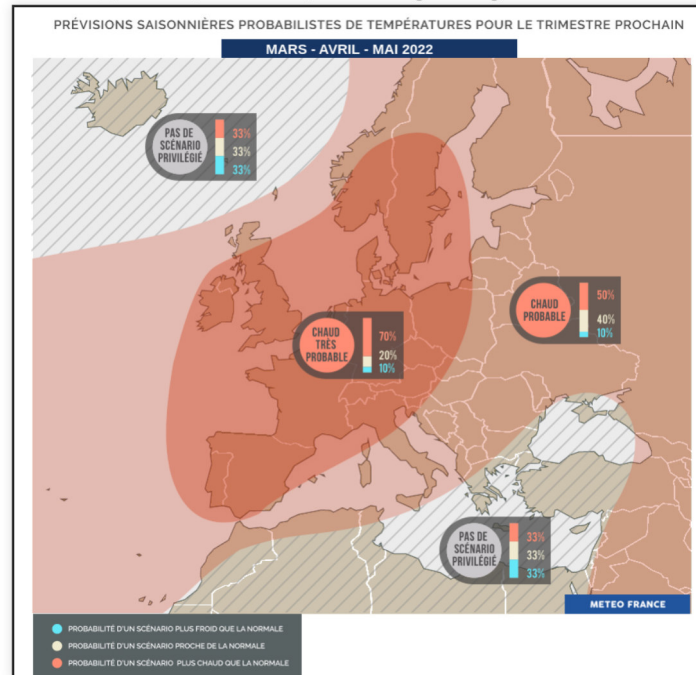
- a drier than normal signal over Southern Europe and Central Europe.
- a wetter than normal signal from Ireland to Scandinavia.



C3S multi-models probability map (top left) and MF-S8, SEAS5, UKMO, DWD, CMCC models.

Synthesis map for Europe : Temperature

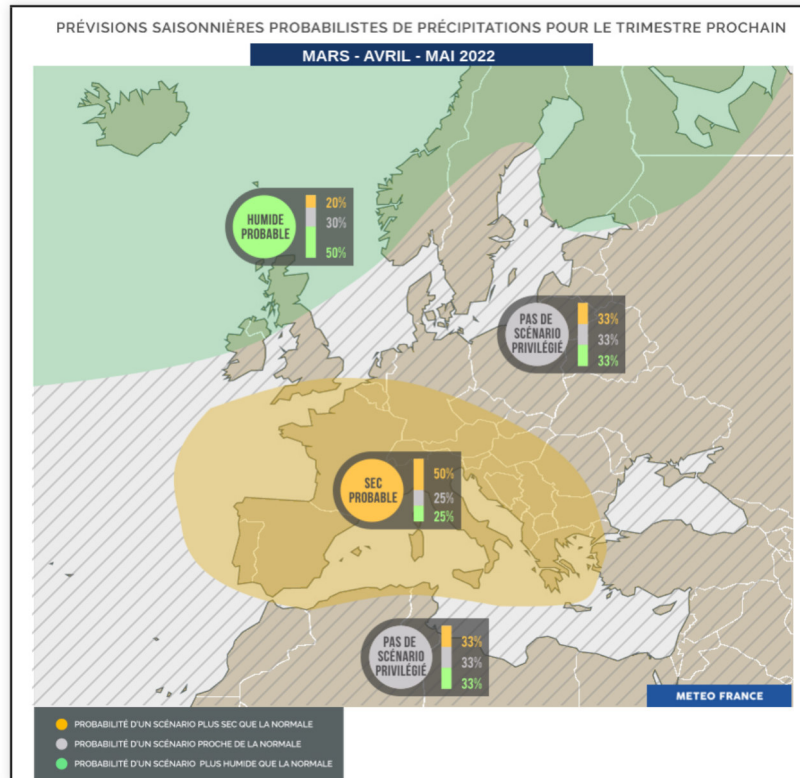
There is a good confidence in the mean circulation : positive NAO, with a strong jet crossing the north Atlantic and anticyclonic conditions dominating over most of Europe. Consistent with this analysis, the different models suggest a more strong probabilities of warmer than normal conditions over Europe, especially over western countries. The unusual high value for the higher tercile is due to the excellent agreement between models, probalby induced by the strong forcings identified.



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

Synthesis map for Europe : Precipitation

The expected circulation favors a north-south contrast over Europe: wetter than normal over northern Europe and drier than normal over southern Europe. This pattern is found in all the models.



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