

Météo-France Seasonal Forecast Bulletin

MARCH - APRIL - MAY 2023

Table of Content

1. General synthesis	
1. MAM 2023	3
2. Oceanic analysis of January 2023	
1. SST anomalies	4
2. Pacific vertical section	5
3. Hovmöller diagram of the 20°C isotherm	6
4. Pacific Ocean - Nino3.4 index history	7
5. Indian Ocean - DMI index history	8
3. Oceanic forecast	

General synthesis : MAM 2023

La Niña fades next quarter, while in the Indian Ocean conditions remain neutral.

However the atmospheric response looks like La Niña with teleconnections clearly visible in the Pacific

A) Oceanic forecast :

- ENSO : end of La Niña during the quarter.
- IOD : neutral conditions.
- Tropical Atlantic : weak positive anomaly

B) Drivers :

- weakening "La Niña".
- major sudden stratospheric warming has occurred mid-february

C) Atmospheric circulation :

Related to La Niña, the negative phase of the PNA remains in place around Alaska.

D) Most likely conditions :

Temperatures : Warmer than normal conditions are expected with higher probability in south-eastern Europe.

Precipitations : Drier than normal conditions are expected over south-eastern Europe. No scenario elsewhere.

Next bulletin : scheduled on March 22st

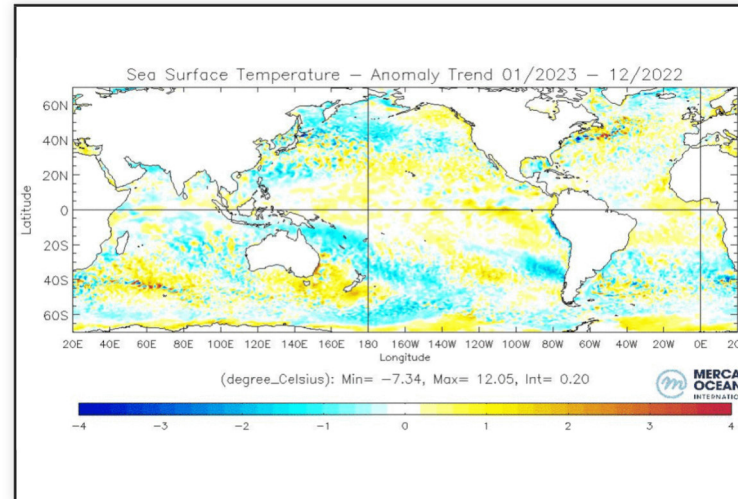
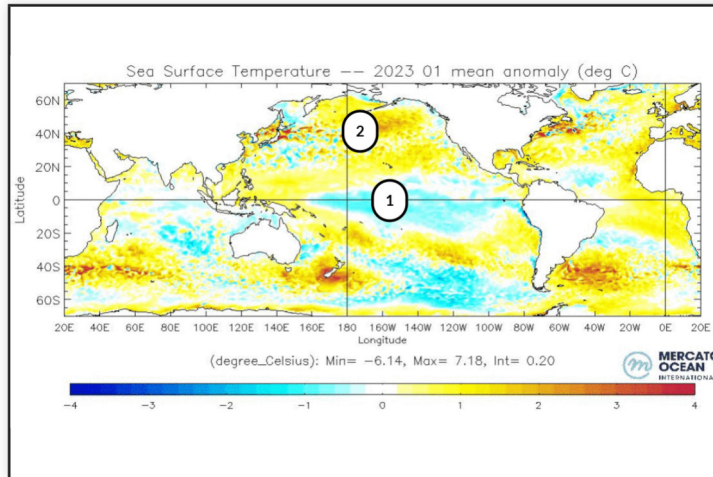
Oceanic analysis of January 2023 : SST anomalies

Current ENSO situation : moderate La Niña

In the Pacific Ocean : Attenuation of the negative phase of ENSO, "La Niña" with a noticeable warming along the equator. In the northern hemisphere, the PDO- pattern is also visible with a warm anomaly around the 40th North in the center of the basin and a cold anomaly near the American coasts.

In the Indian Ocean : No east/west contrast

In the Atlantic Ocean : Little warming along the equator. No significant change in the northern hemisphere.

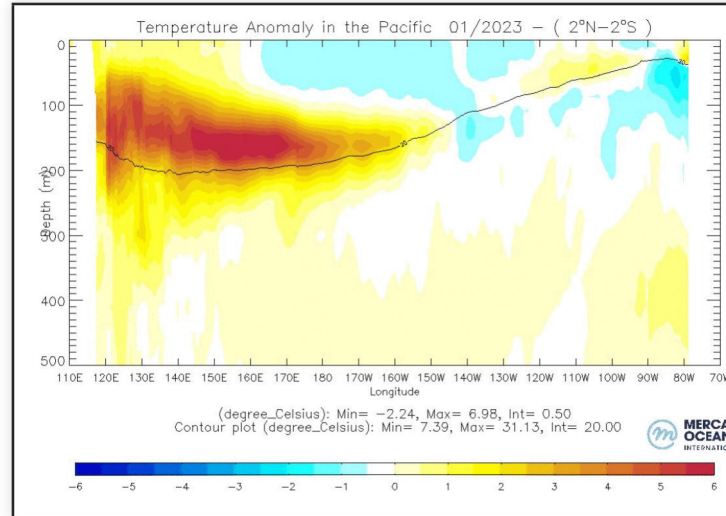
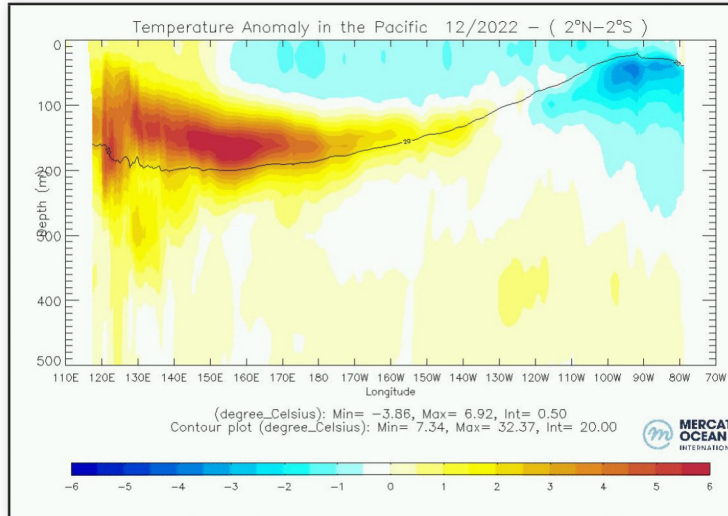


SST Anomalies and trend with the previous month (c) Mercator-Ocean

- 1 - La Niña pattern
- 2 - Warm anomalies everywhere in mid-latitudes

Oceanic analysis of January 2023 : Pacific vertical section

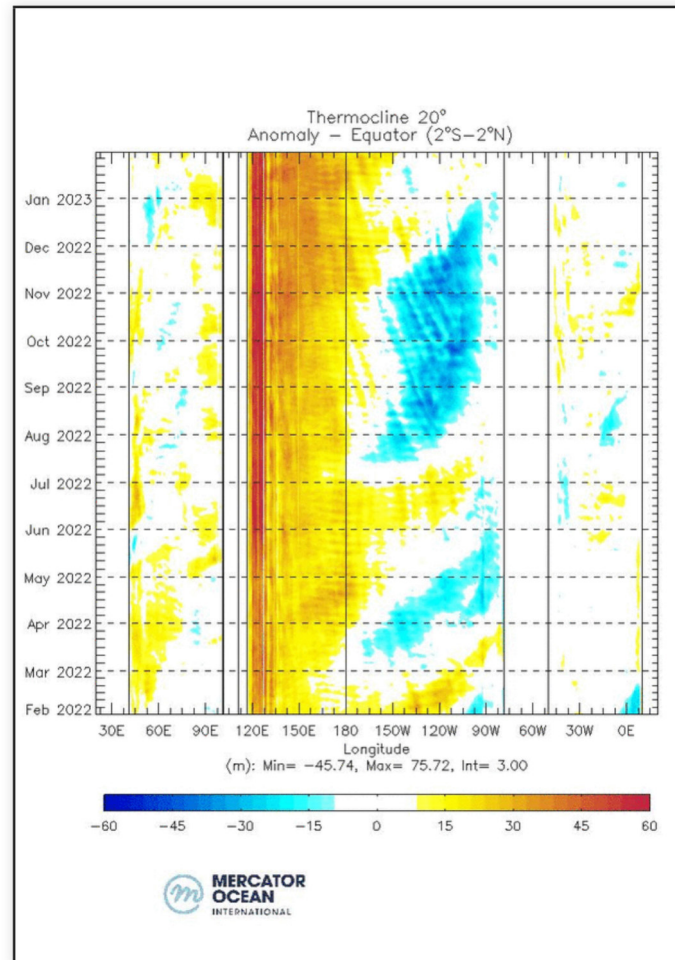
No Kelvin wave propagation. Near the surface the cold anomaly has resolved.



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

Oceanic analysis of January 2023 : Hovmöller diagram of the 20°C isotherm

Same comment as before.

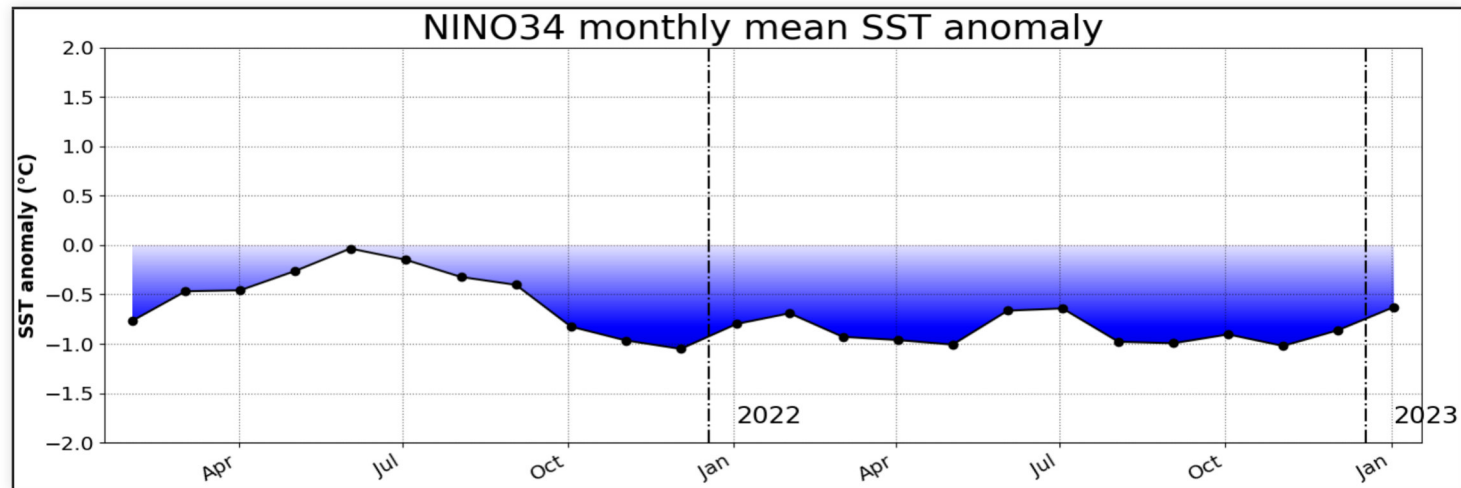


Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 °C isotherm) (c) Mercator-Ocean

Oceanic analysis of January 2023 : Pacific Ocean - Nino3.4 index history

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -0.6°C

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

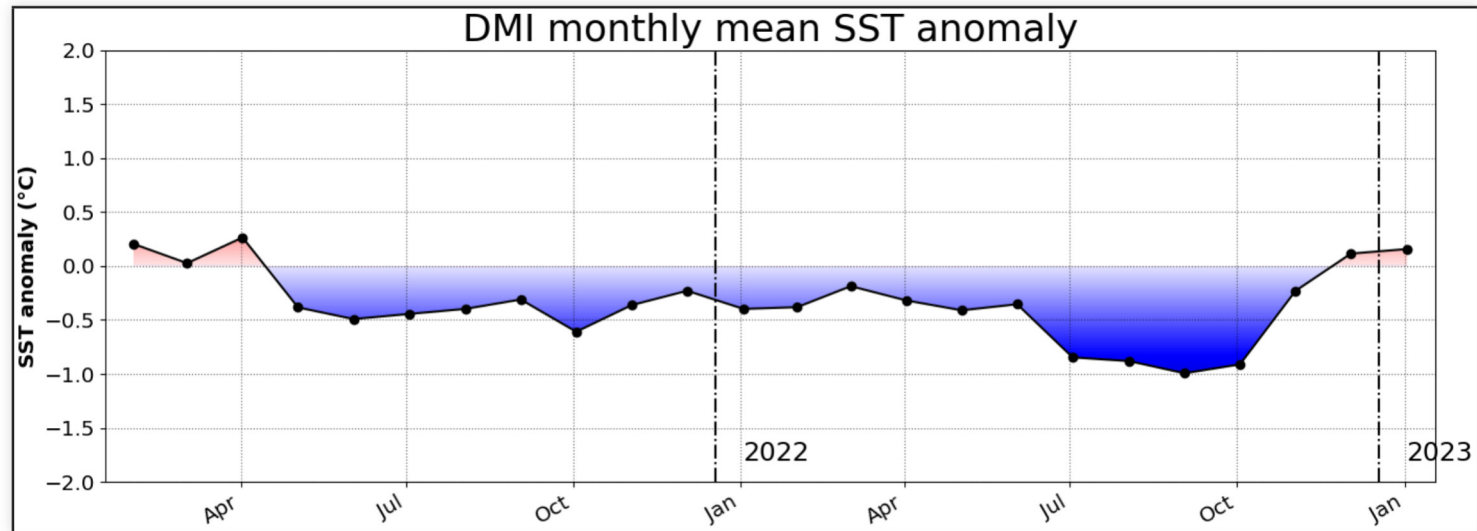


Evolution of SST in the NINO3.4 box (c) Mercator-Ocean

Oceanic analysis of January 2023 : Indien Ocean - DMI index history

DMI Index issued from Mercator Ocean PSYV4R2 analysis : $+0.1^{\circ}\text{C}$

(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

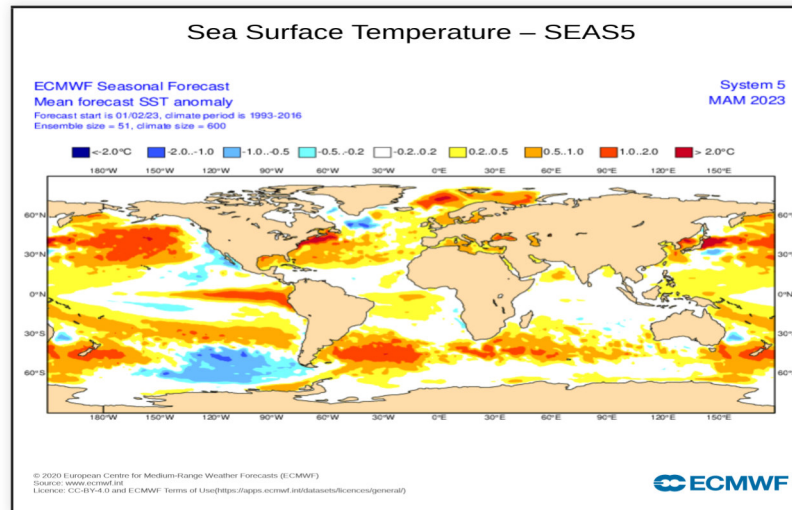
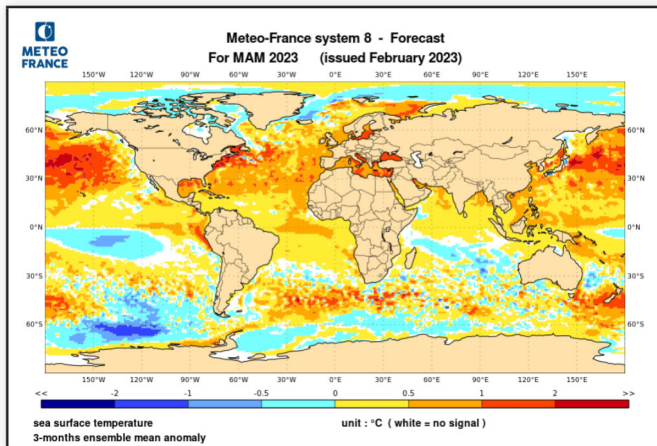
Oceanic forecast : SST anomaly

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

In the Pacific Ocean : The cold anomaly in the Equatorial Pacific has almost disappeared. The negative phase of ENSO is over. On the other hand, there is still a strong warm anomaly in the Northern Hemisphere and a small cold anomaly near the American coasts, a pattern of the PDO- still in place.

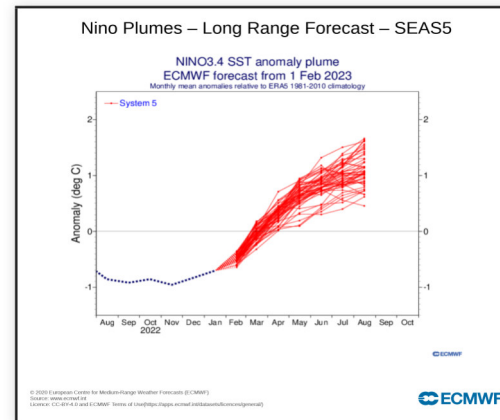
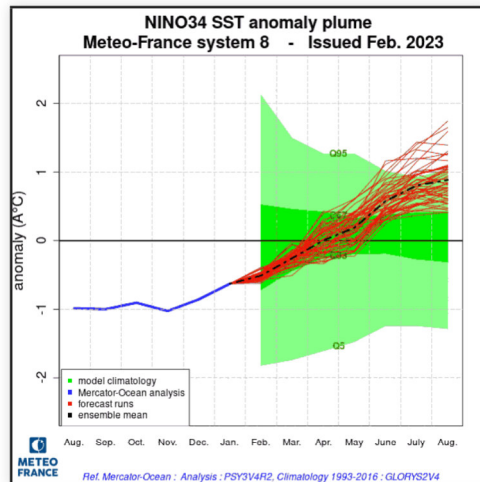
In the Indian Ocean : neutral conditions.

In the Atlantic Ocean : Small positive anomaly in the equatorial zone. In the northern hemisphere, the warm anomaly is preponderant for both models, but more marked with MF8. A cold anomaly is marked south of Greenland, stronger with ECMWF.



Oceanic forecast : NINO3.4 Plume diagrams

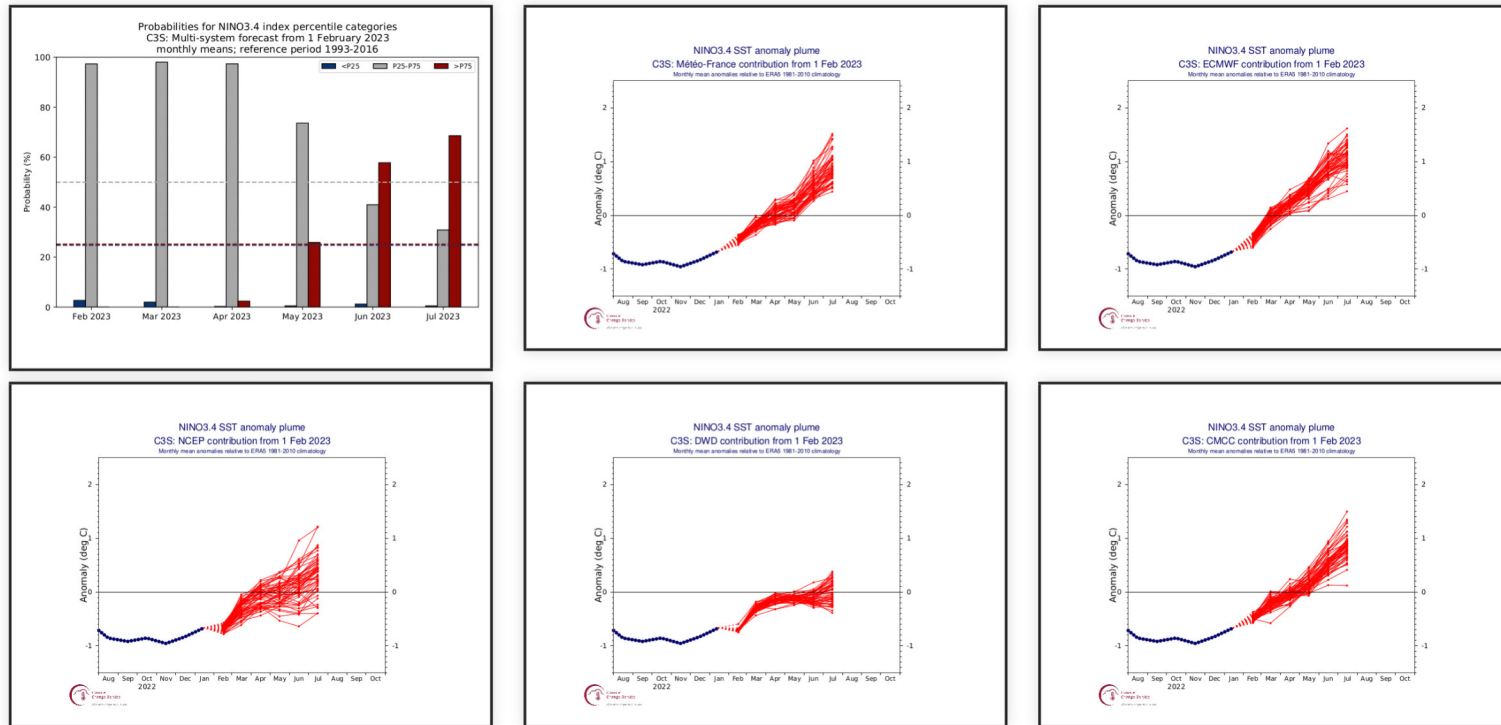
Both models agree on a return to positive values at the end of the period.



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

Neutral conditions for all models next quarter

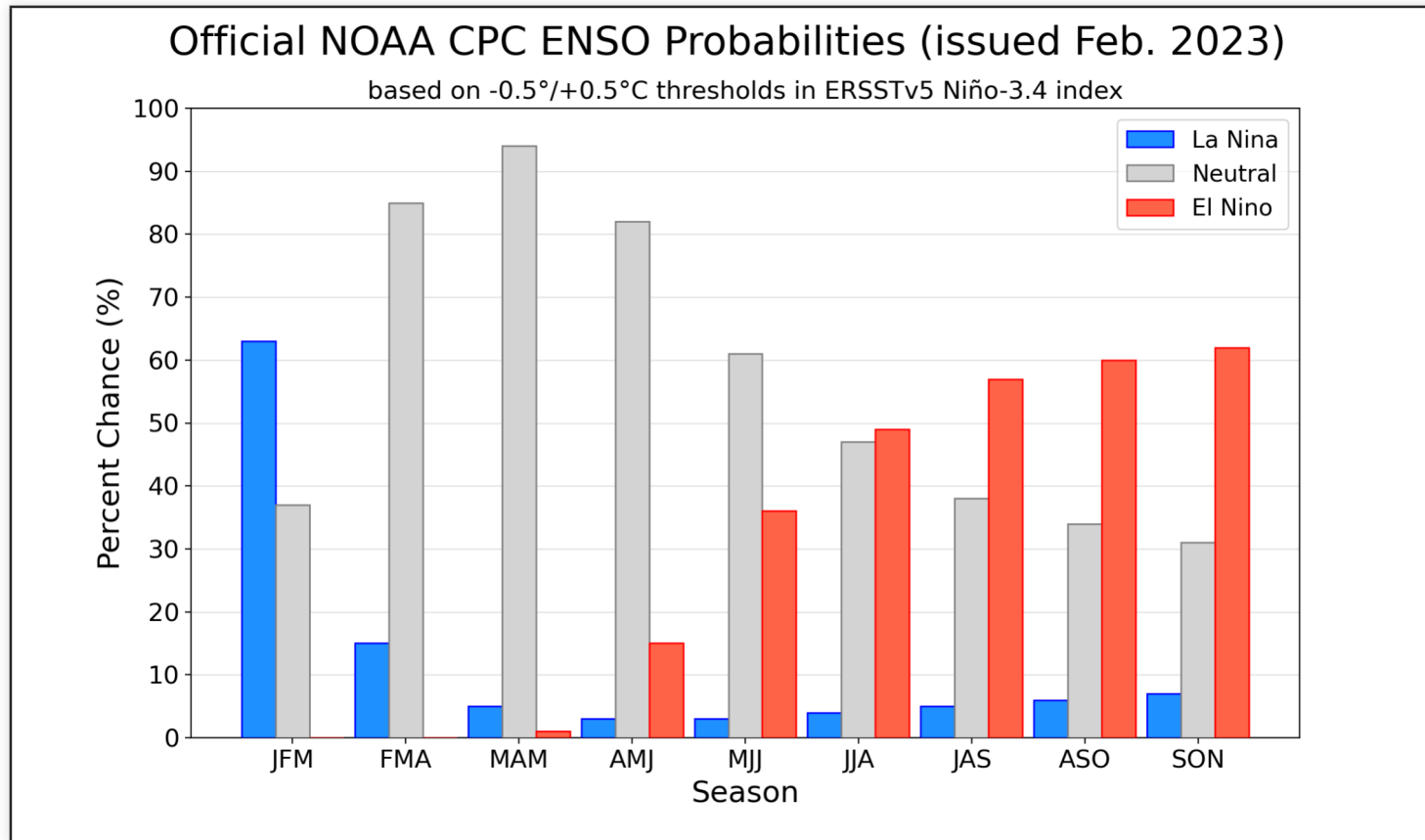
The most likely phase for the next three months : Neutral



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 : Synthesis from IRI

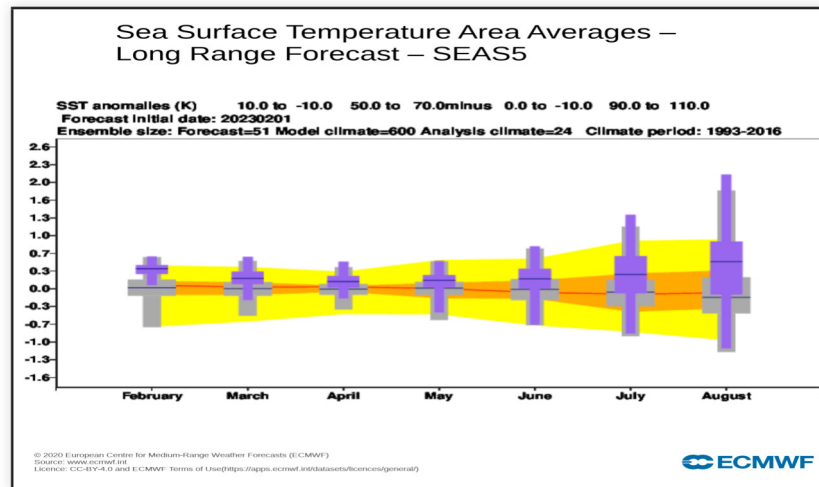
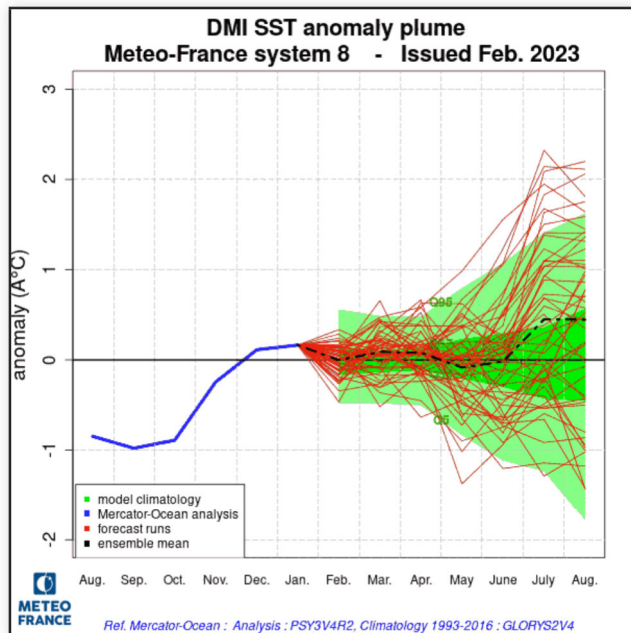
IRI forecast : above 90 % of neutral condition for MAM.



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

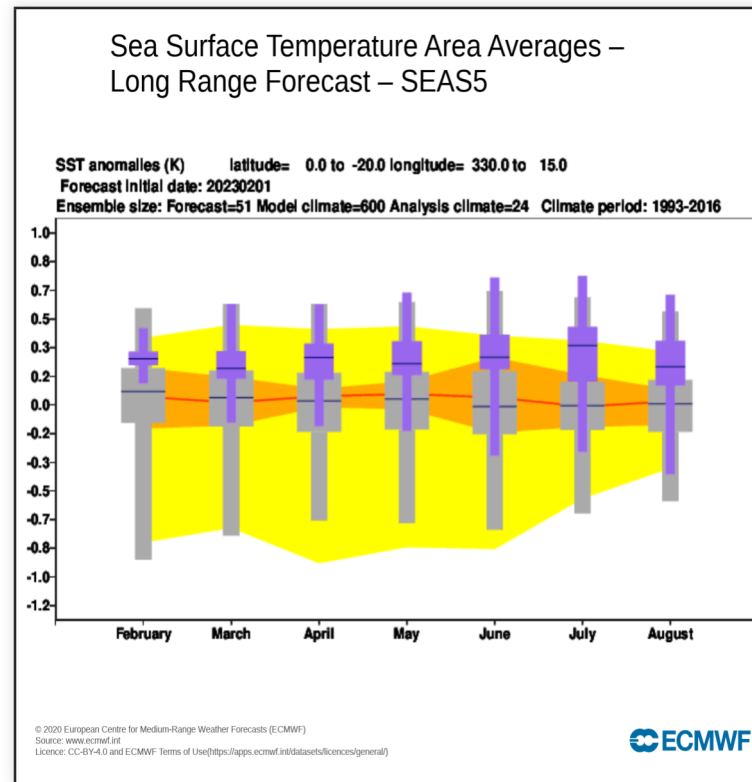
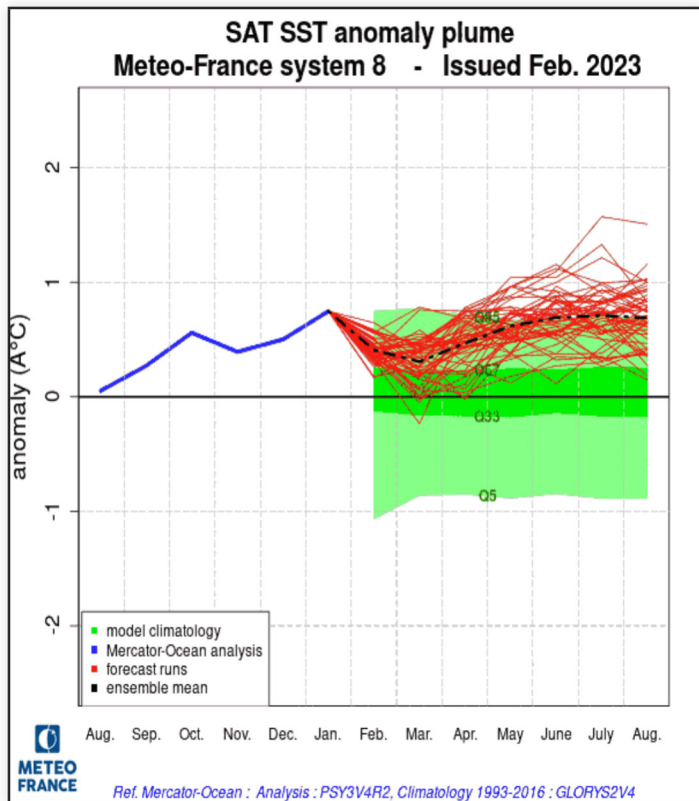
Neutral conditions for both models, with a significant spread.



DMI index : analysis, forecasts and model climatology with MF-S8 on the left and ECM-SEAS5 on the right

Oceanic forecast : Atlantic ocean - SAT evolution

Both models forecast a positive anomaly, in the warm tercile.

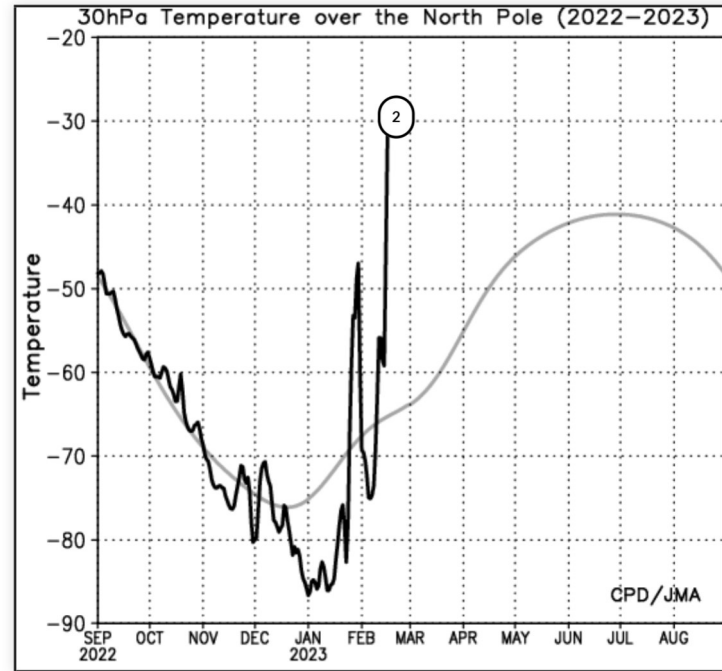
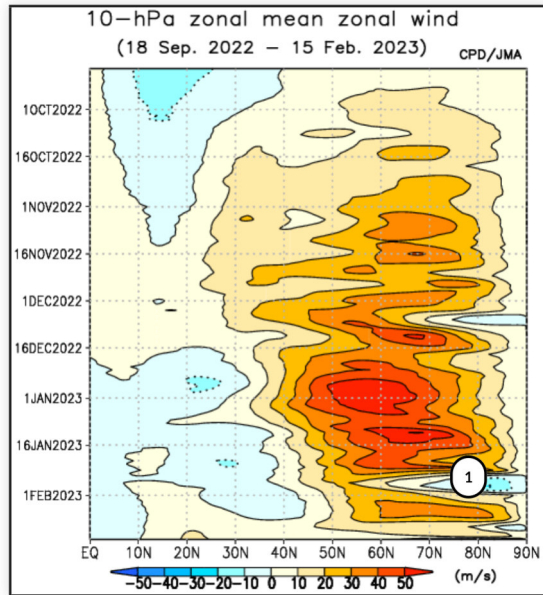


Anomaly on the SAT box : analysis, forecasts and model climatology with MF-S8 on the left and SEAS5 on the right

Drivers : SSW

Minor SSW observed at the end of January and major SSW mid-February.

The effect of the last SSW on the zonal wind in the stratosphere is not yet visible on the left map.

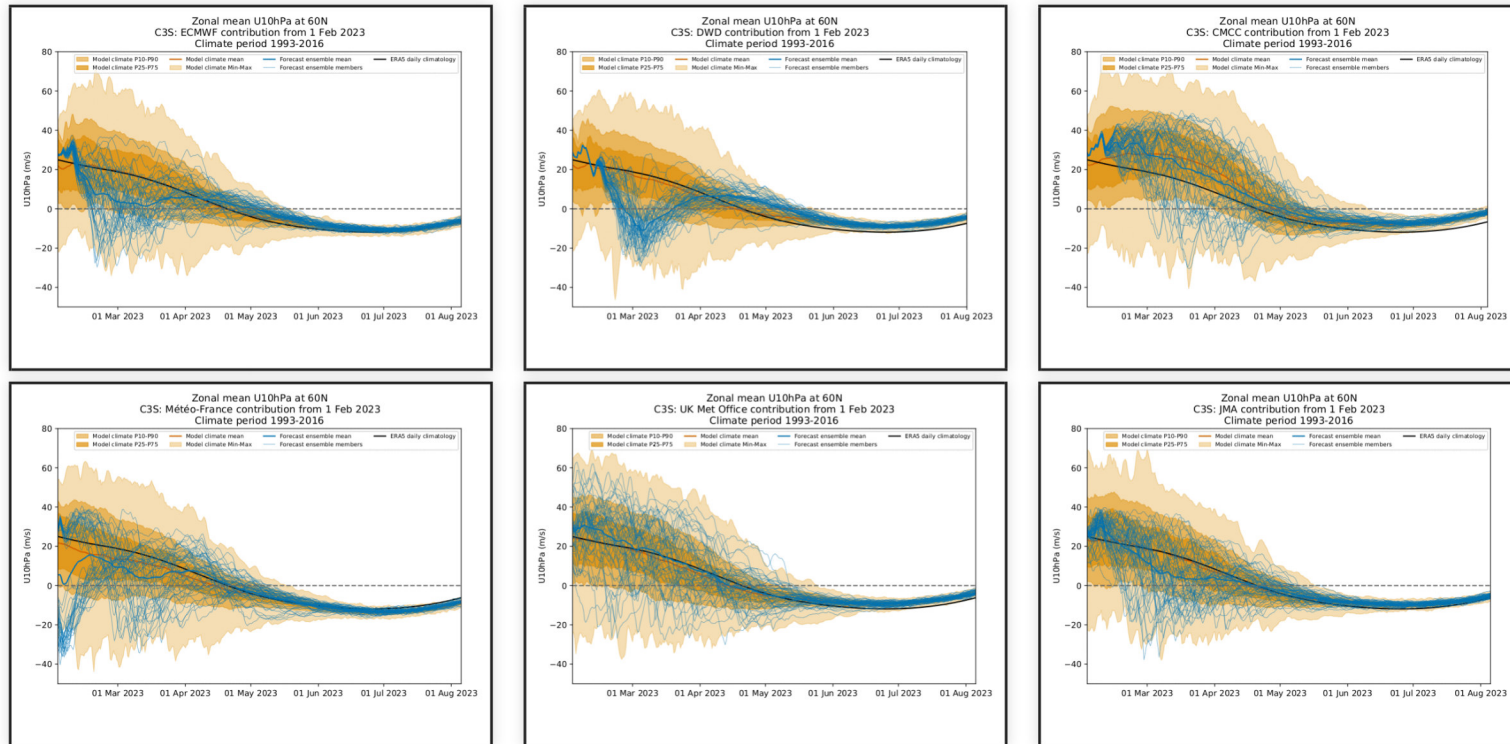


10 hPa zonal wind Hovmuller diagram and 30 hPa temperature histogram. (c) Tokyo Climat Center JMA

- 1 - minor SSW
- 2 - Major SSW

Drivers : polar vortex (U010 plumes)

The effect of SSW is clear visible with ECMWF and DWD.



ECMWF-SEAS5, DWD, CMCC, MF-S8, UKMO, and JMA 010hPa zonal mean of u component of wind at 60°N.

Drivers : Summary

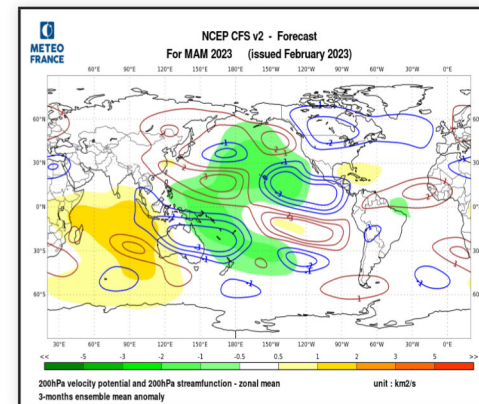
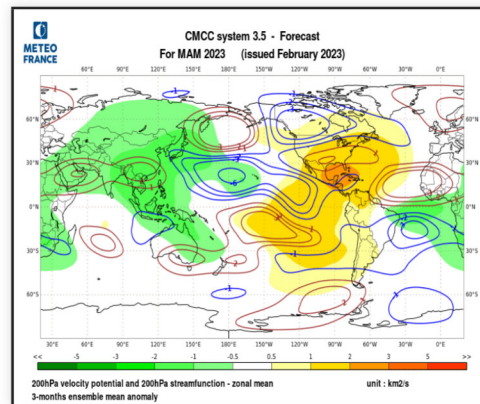
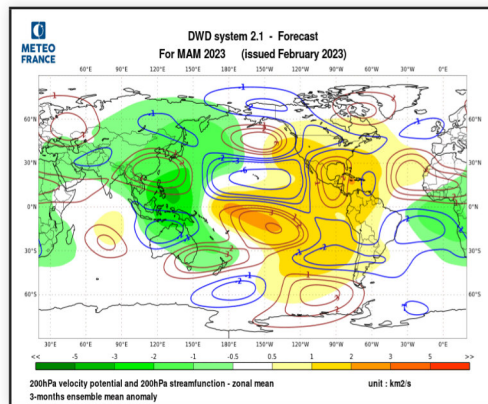
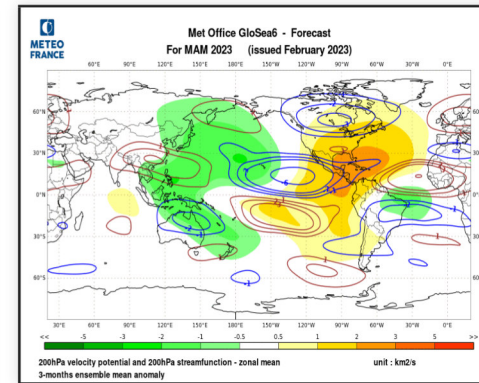
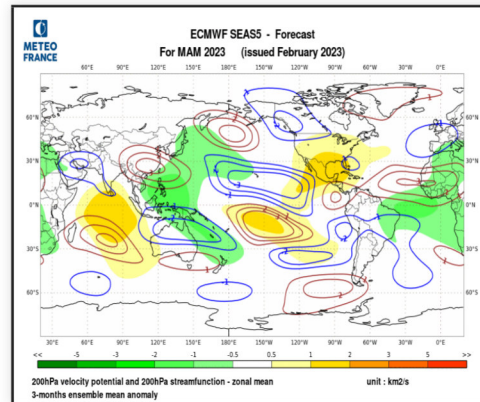
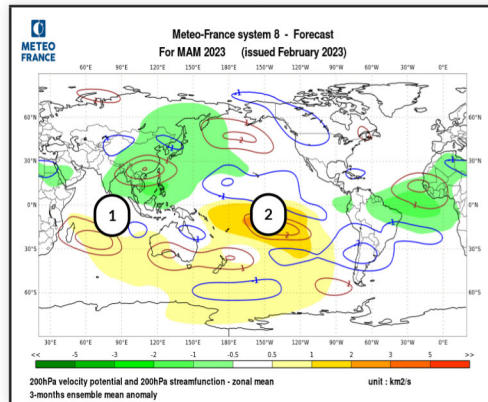
- Sudden Stratospheric Warming (SSW) : favored negative phase of NAO several weeks after.

Major SSW observed mid-february increased the probability of negative phase of NAO at the beginning of the next quarter.

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

Velocity Potential : The dipole related to the "la Niña" phase is still well visible for all models but of variable intensity. DWD which predict a slower warming have a strong and wider signal.

Streamfunction : The dipole over the Pacific is seen by all models, as well as teleconnections to North America (PNA- pattern), in connection with "la Niña", while over the Maritime Continent, the dipole is more or less present depending on the model. There is also a dipole over the Atlantic but not teleconnections to Europe with models except with Met-Office.



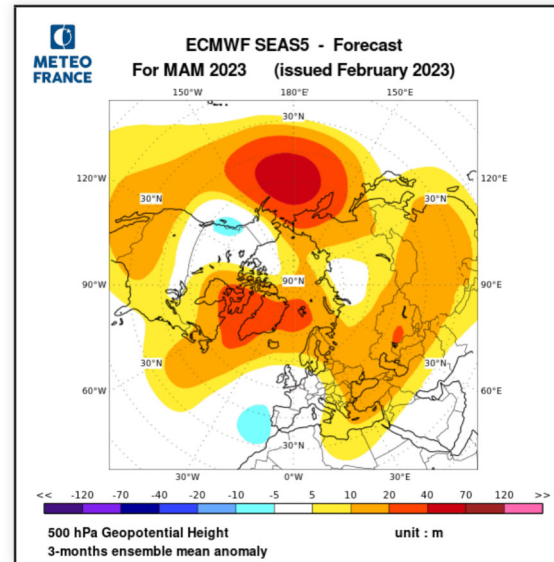
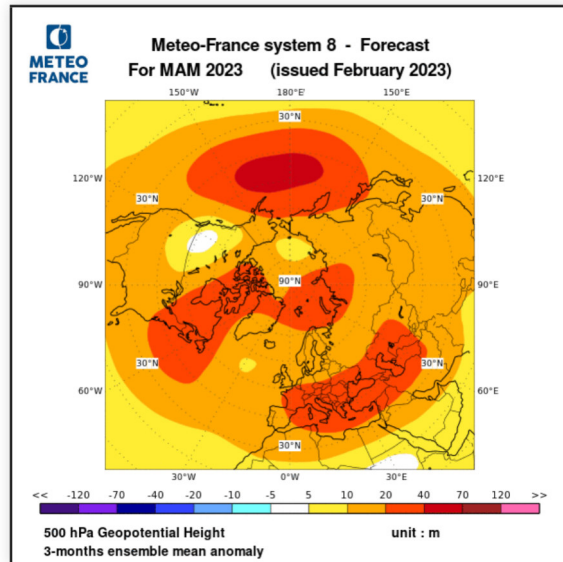
MFR, SEASS, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green: ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

- 1 - VP : weakening upward motion anomaly
- 2 - VP : downward motion anomaly related to La Nina

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Both models agree on the PNA- pattern over Pacific and North American continent..

There are strong differences elsewhere: notably in western Europe or Siberia where the anomalies are opposite.

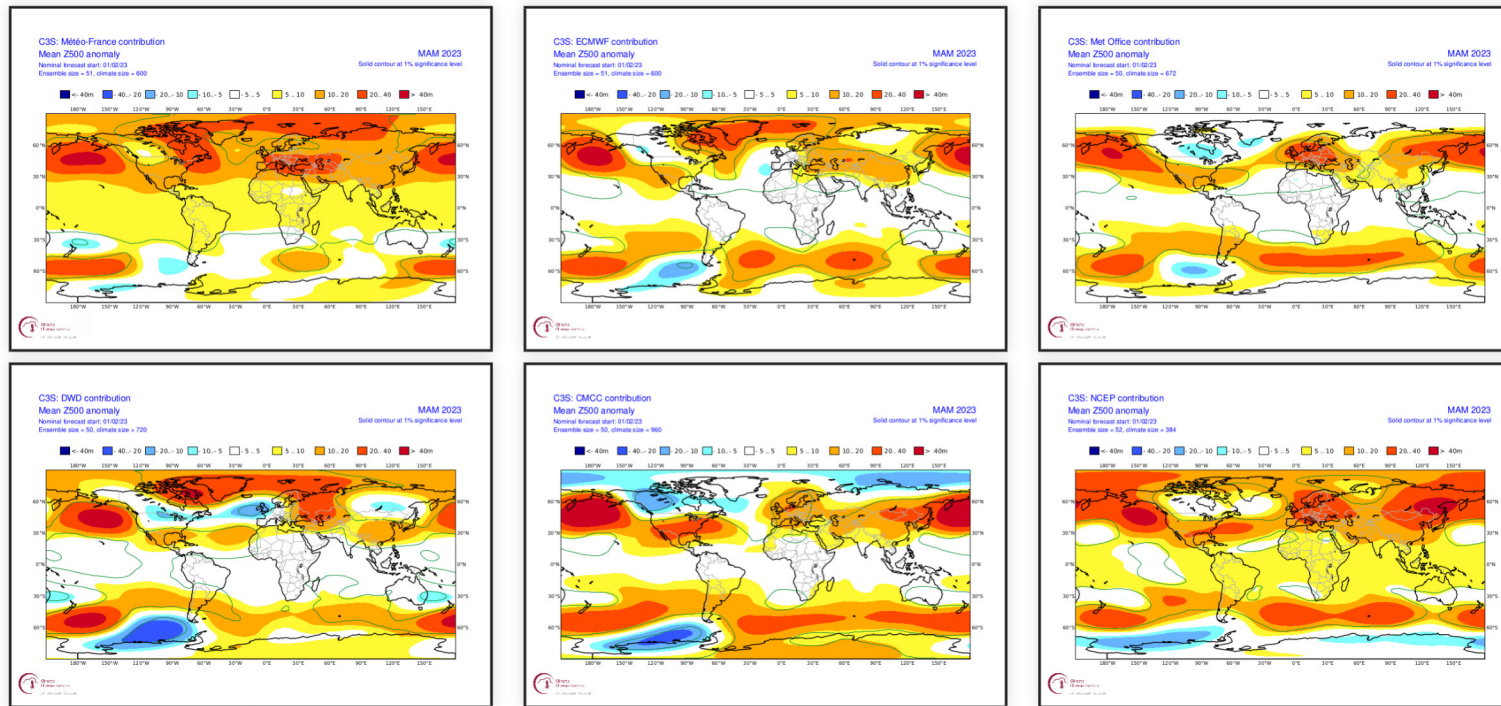


polar projection of MF8 and SEAS5 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in C3S models

Very good agreement between the models for the PNA- pattern, even if the cold anomaly is less marked with MF8.

Over Europe and the Atlantic dispersion is quite strong, specially from Greenland to western europe

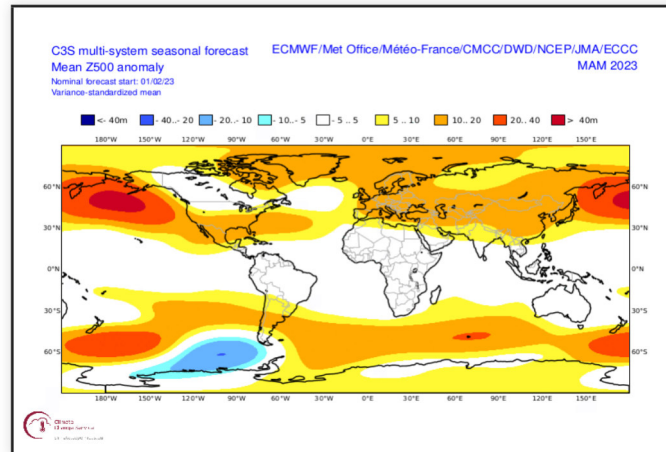


MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

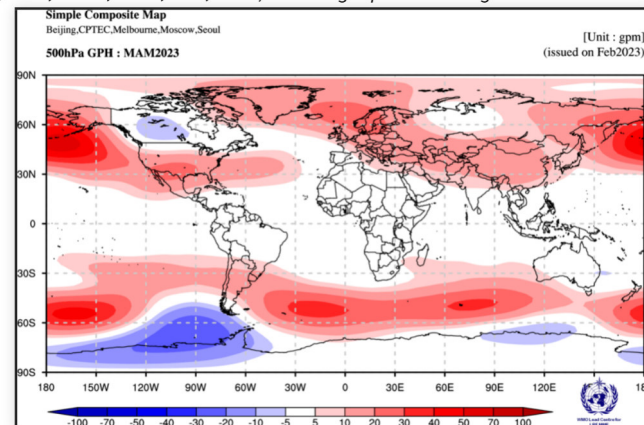
Atmospheric circulation forecasts : Z500 anomalies multi-systems

Both multi-models agree on the main anomalies in Z500, both in the southern and northern hemispheres.

Negative PNA over North America, positive anomalies from Greenland to Scandinavia to Central Asia and relative negative anomalies from Quebec to West European coasts



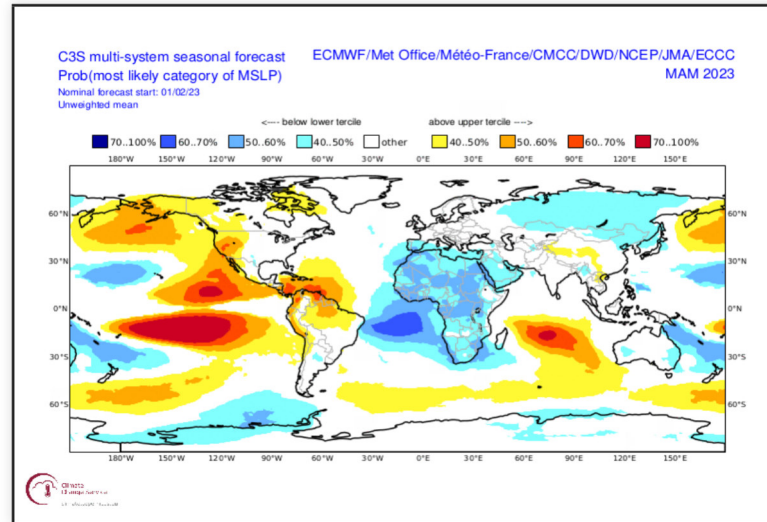
C3S multi-models (MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC, NCEP, JMA, ECCC) 500hPa geopotential height anomalies.



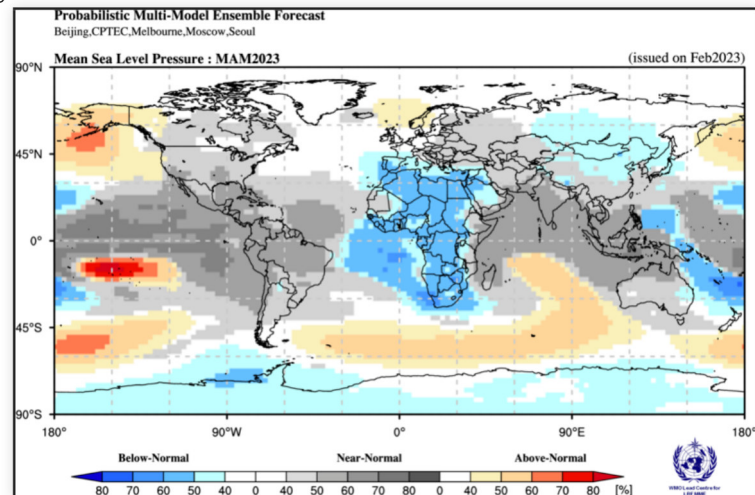
Others models of WMO multi-models 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : MSLP probabilities multi-systems

Good agreement between multi-models.



C3S multi-models MSLP terciles probability.



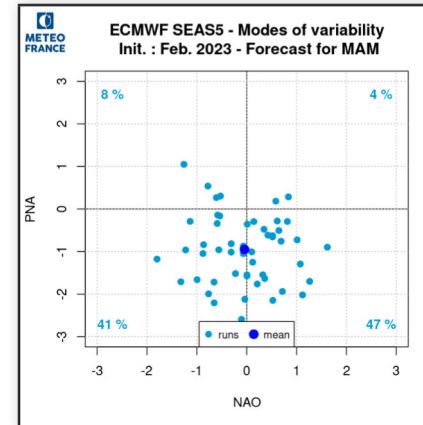
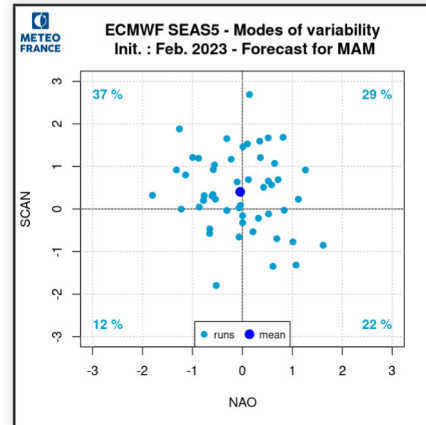
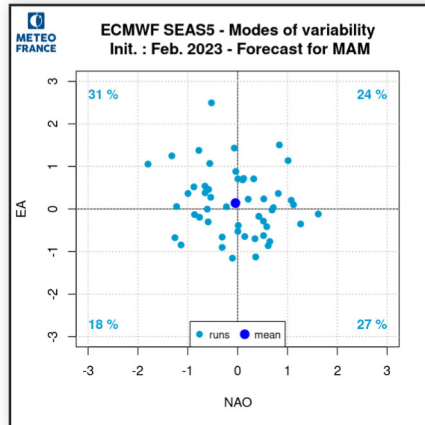
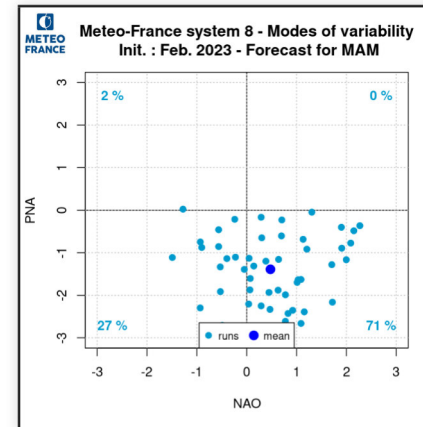
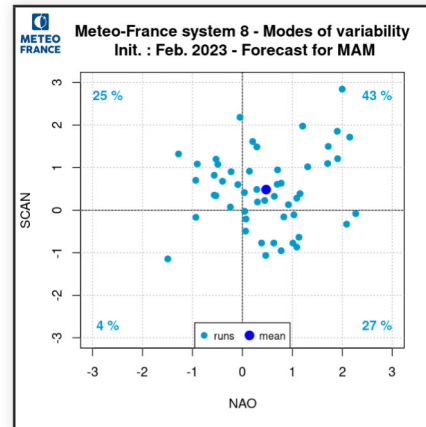
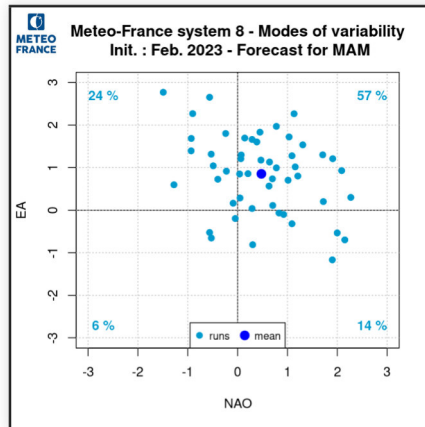
Others models of WMO multi-models MSLP terciles probability.

Modes of variability : forecast

Dispersion is lower with the ECMWF model. Both models agree on a PNA-.

Both models also provide a SCAN+ mode and a NAO+ mode.

EA is close to zero on average.

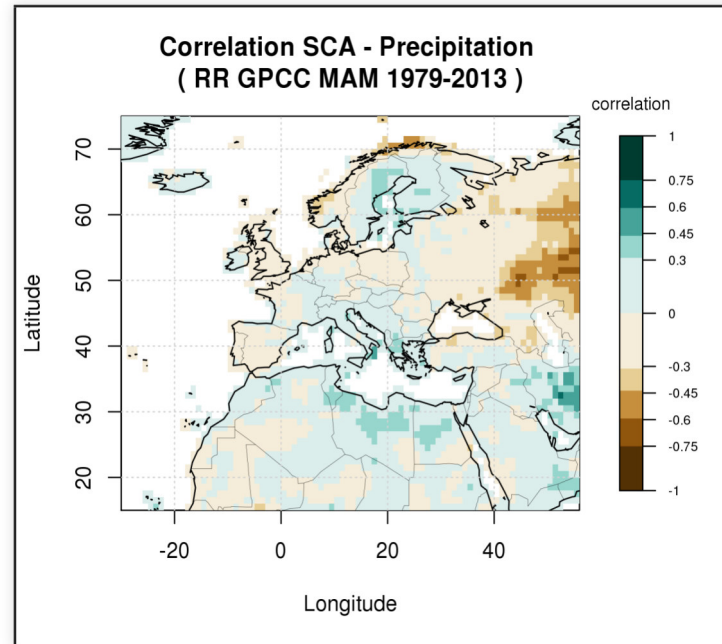
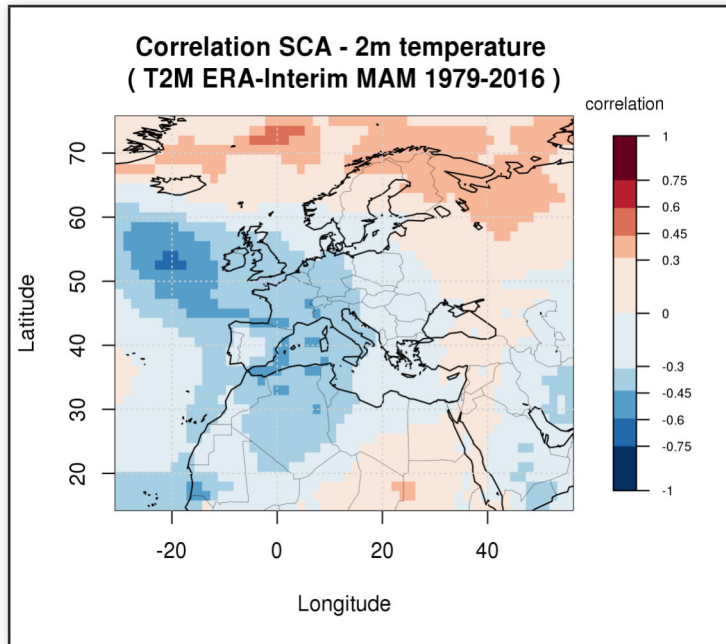


See the modes of variability patterns

Modes of variability : SCA impacts

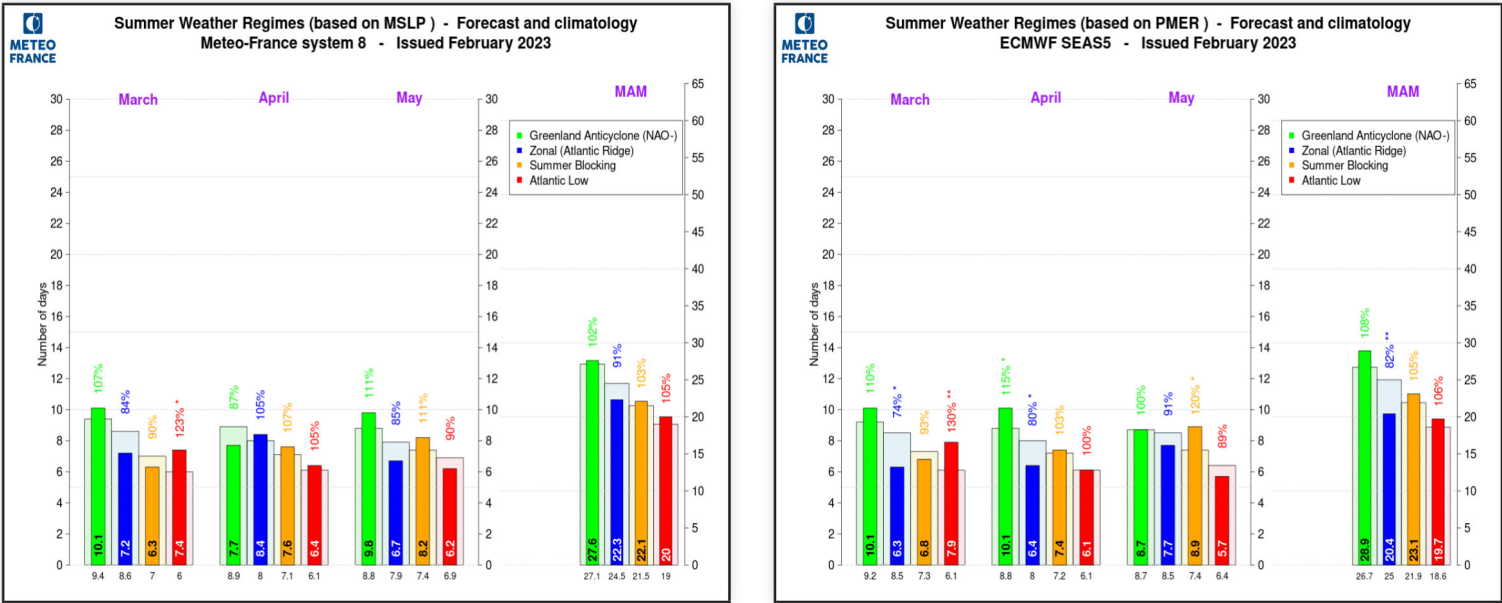
Blocking regim favors colder than normal conditions over western Europe and warmer from Scandinavia to Russia.

Little impact on precipitation.



Weather regimes : summer MSLP

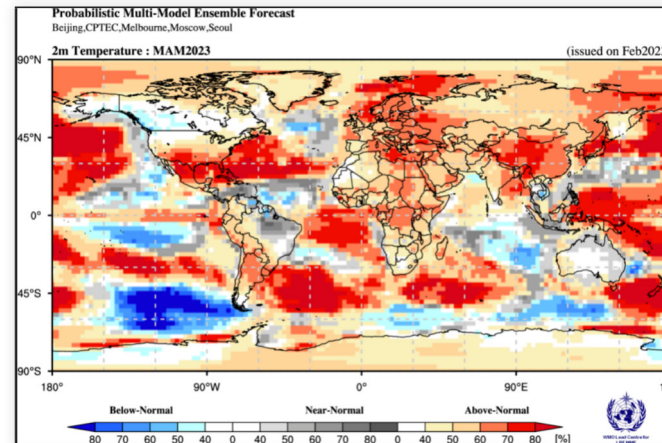
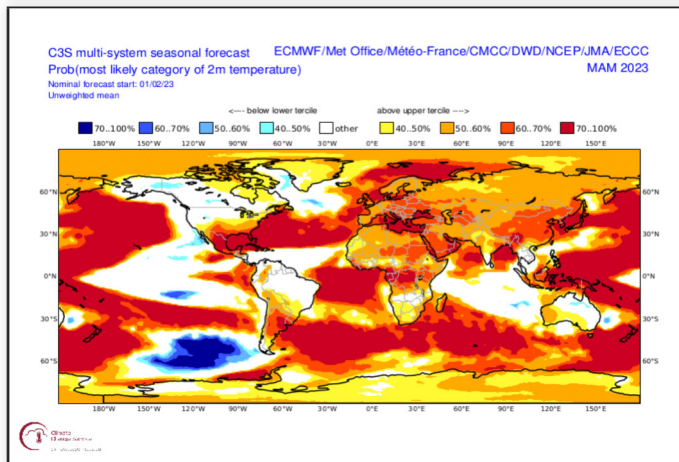
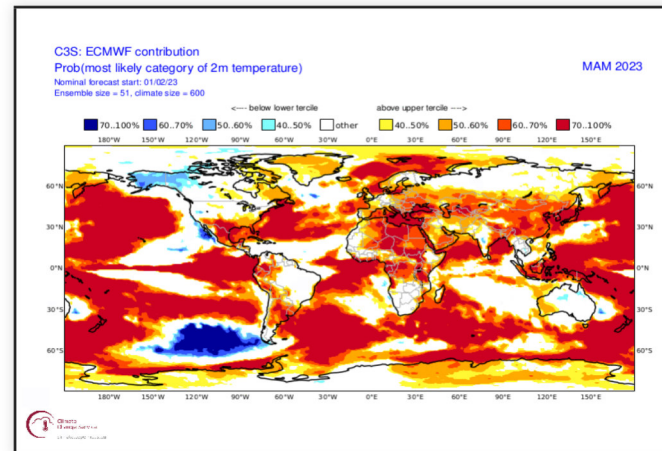
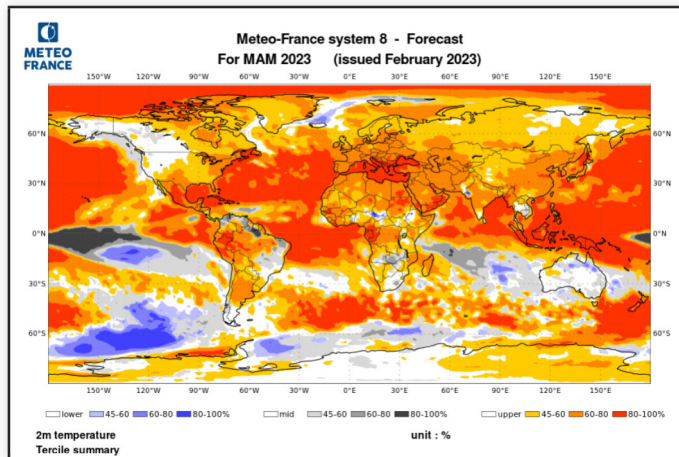
The results do not deviate significantly from the models' climatology except zonal regim less likely for SEAS5



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).

Forecast of climatic parameters : Temperature probabilities

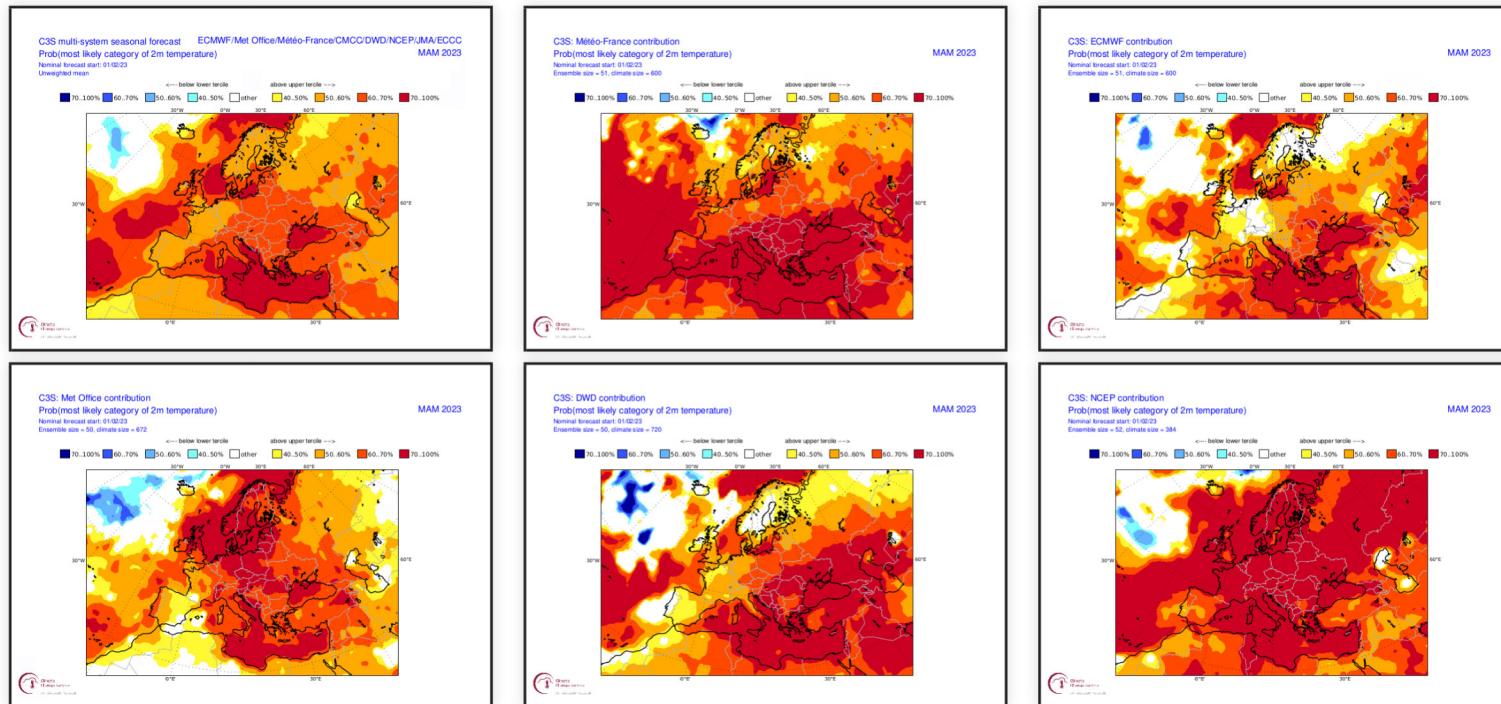
The models agree on the main anomalies, except over eastern Canada, warmer with MF8 in connection with the positive anomaly in Z500 over this area.



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

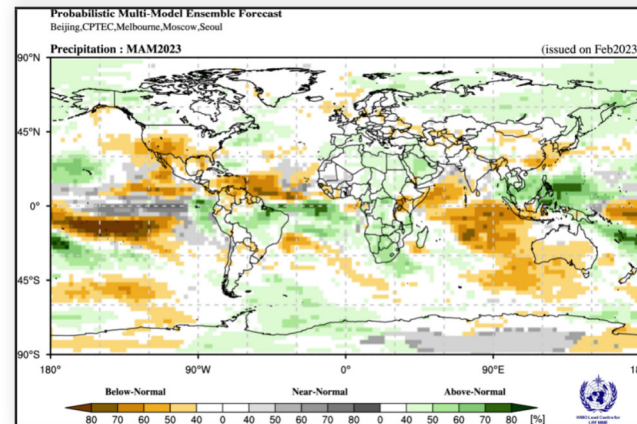
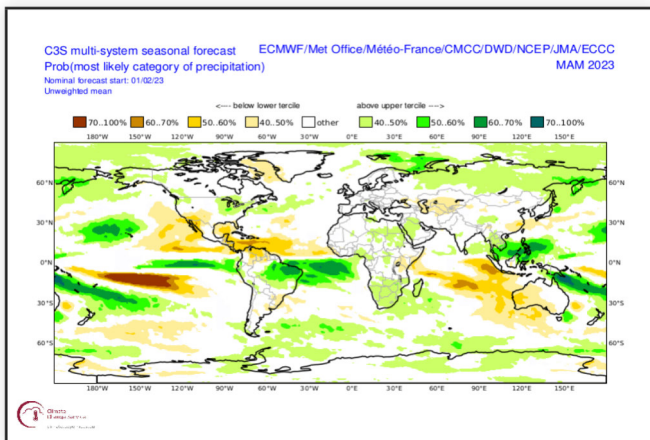
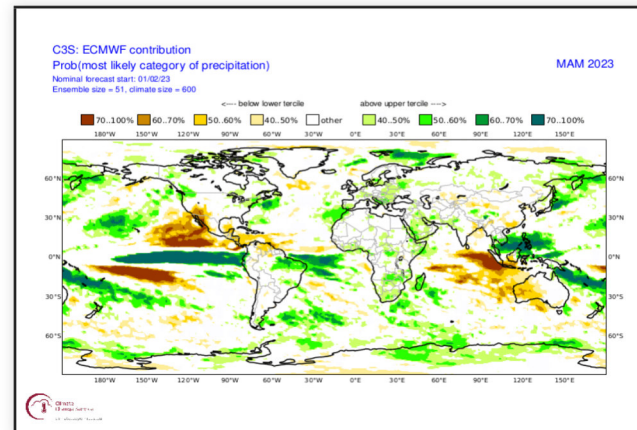
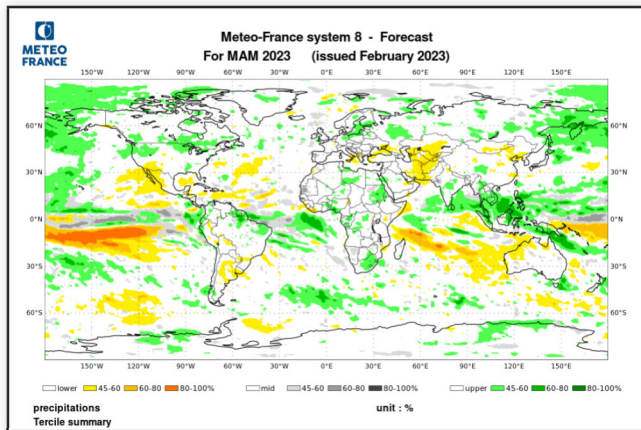
A warm signal is widely preferred on Europe with higher probability on the south-east where the positive geopotential anomaly is stronger relative to its climatology.



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

Forecast of climatic parameters : Precipitation

Little signal at temperate latitudes except from the dipole over North America (linked to PNA-) and a privileged wet scenario towards Siberia.

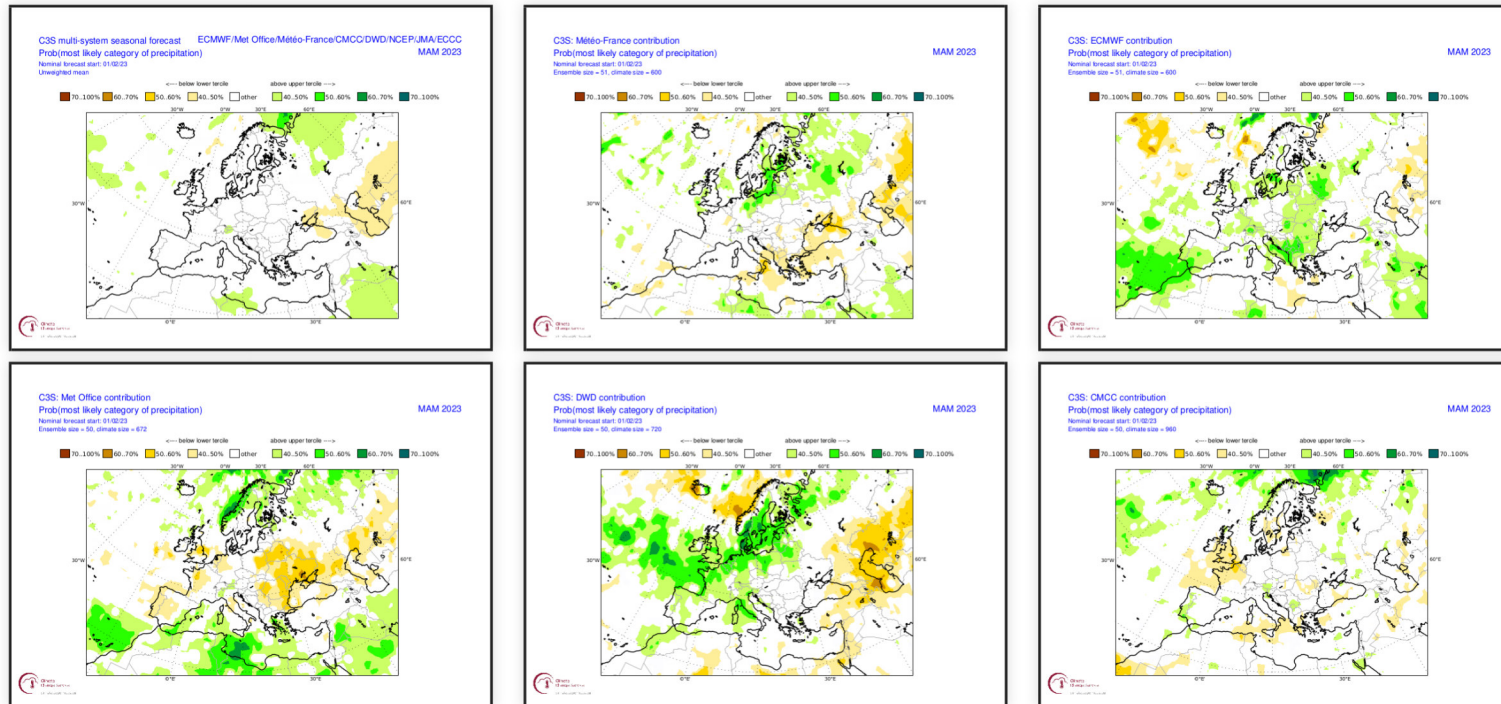


precipitation probability map from MF-S8 (top left), ECMWF-SEASS (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

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

Dispersion of the models.

The suggested dry signal from Central Asia towards the Black Sea is consistent with the favored positive geopotential anomaly.

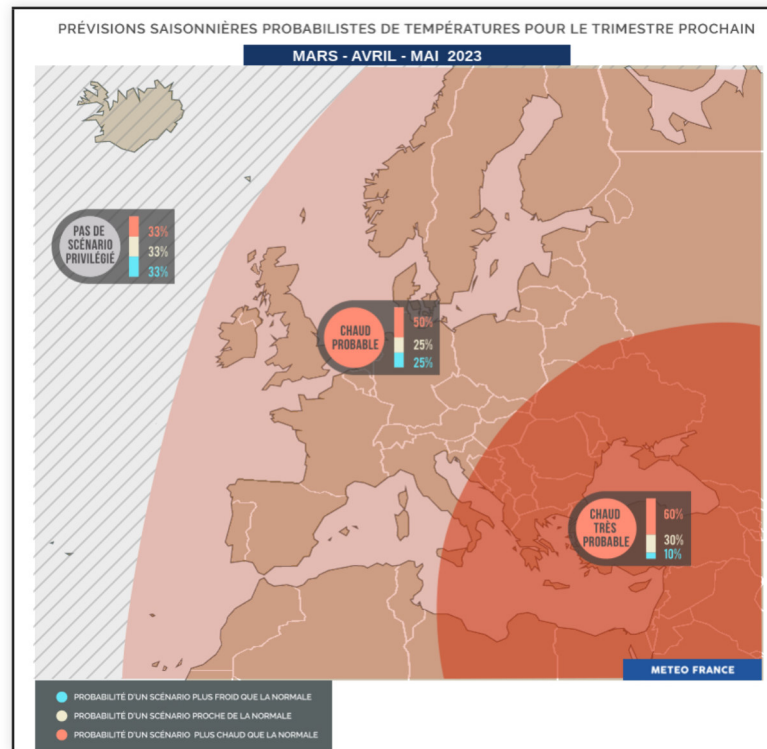


C3S multi-models probability map (top left) and MF-S8, SLAS5, UKMO, DWD, CMCC models.

Synthesis map for Europe : Temperature

No dominate scenario emerge.

The warm signal is mainly related to climate change and also to the higher probability of positive anomaly of geopotentials towards south-eastern Europe.

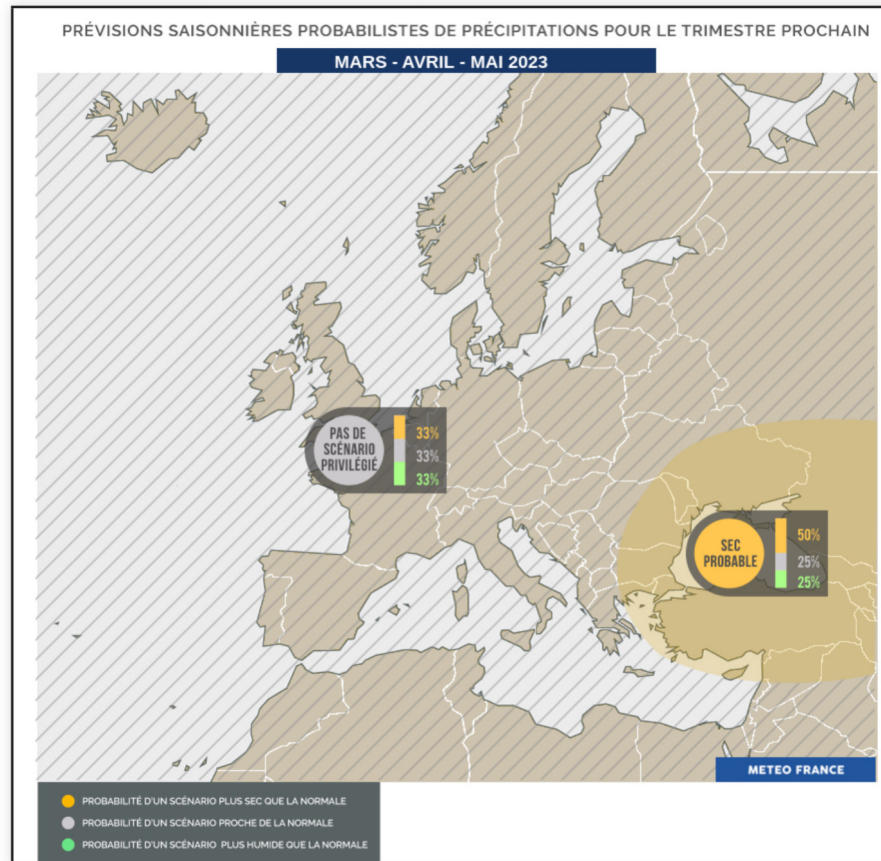


Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS

Synthesis map for Europe : Precipitation

Little signal from the models.

The preferred dry scenario is linked to the expected positive geopotential anomaly and also by a weak signal suggested by the models



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