

Météo-France Seasonal Forecast Bulletin

OCTOBER - NOVEMBER - DECEMBER 2023

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General synthesis : OND 2023

The El Niño phenomenon reaches its maximum towards the end of the year. Positive phase of IOD reaches its maximum during next months, with an atmospheric response taking shape.

A) Oceanic forecast :

- ENSO : El Niño conditions.
- IOD : positive phase
- Equatorial and tropical Atlantic, Northeastern Atlantic : positive anomaly

B) Drivers :

El Niño and IOD with a probable influence over North Atlantic and Middle-East

C) Atmospheric circulation :

El Niño conditions and positive phase of IOD are now having an impact on atmospheric circulation, with downward motion anomalies over the Indian Ocean and upward motion anomalies over the Pacific Ocean. Teleconnections seems to appear from South America to North Atlantic. They favor the positive phase of East-Atlantic mode.

D) Most likely conditions :

Temperatures : Warmer-than-normal scenario likely to very likely across Europe.

Precipitations : Wetter than normal over western Europe

Next bulletin : scheduled on October 19 st

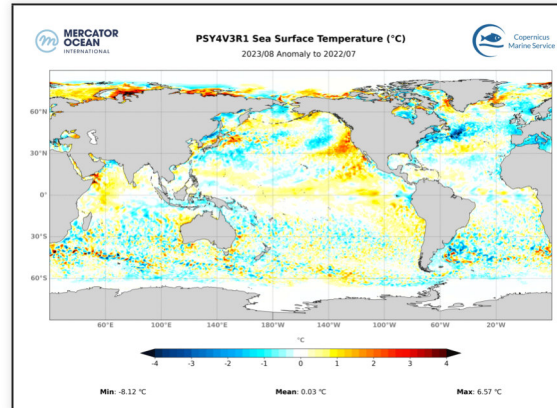
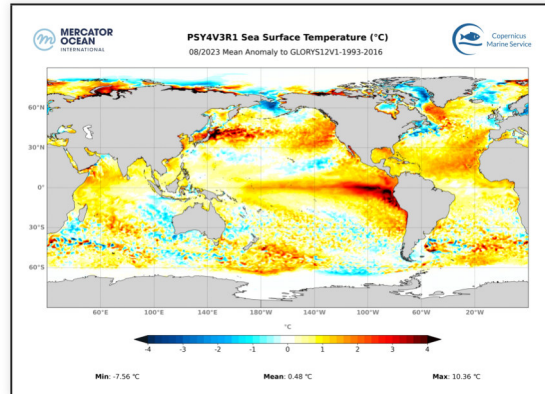
Oceanic analysis of August 2023 : SST anomalies

Current ENSO situation : positive phase

In the Pacific Ocean : Little change in equatorial zones : slight warming in central and west part and slight cooling in the eastern part which remains excessively hot. In the Northern Hemisphere, the PDO- remains although we observe a warming near american's coast and and a cooling in some part of north Pacific.

In the Indian Ocean : A contrast appeared last month between the west (hot) and the east (cold).

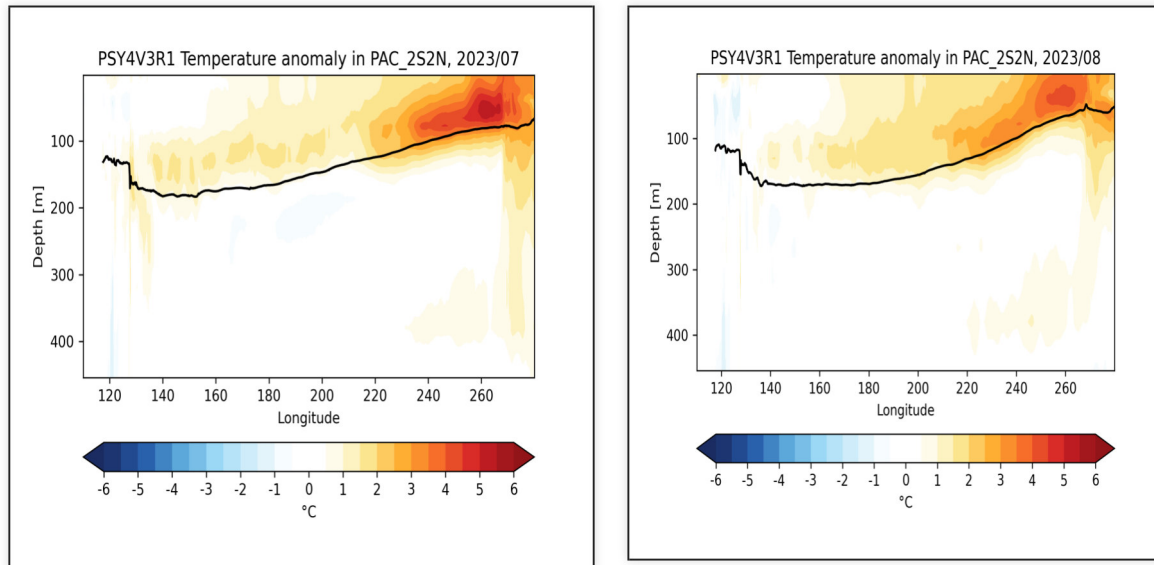
In the Atlantic Ocean : In the equatorial zone, SST is once again neutral. Conversely, in the Northern Hemisphere, the positive anomaly over the eastern basin persists, although weakening off the European coast.



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

Oceanic analysis of August 2023 : Pacific vertical section

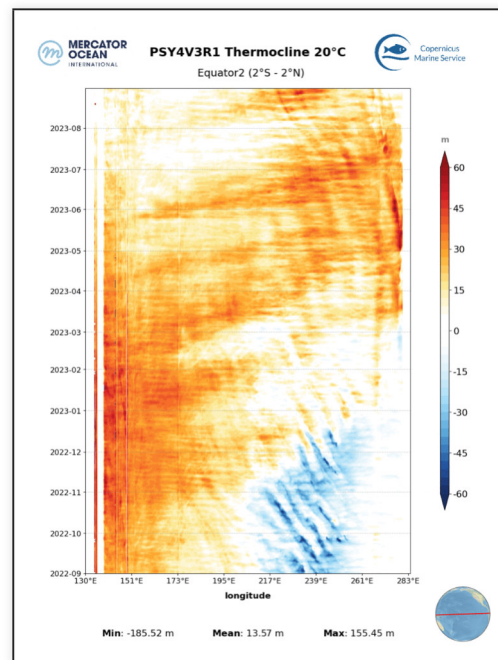
The warm subsurface anomaly mainly concerns east of the basin.



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

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

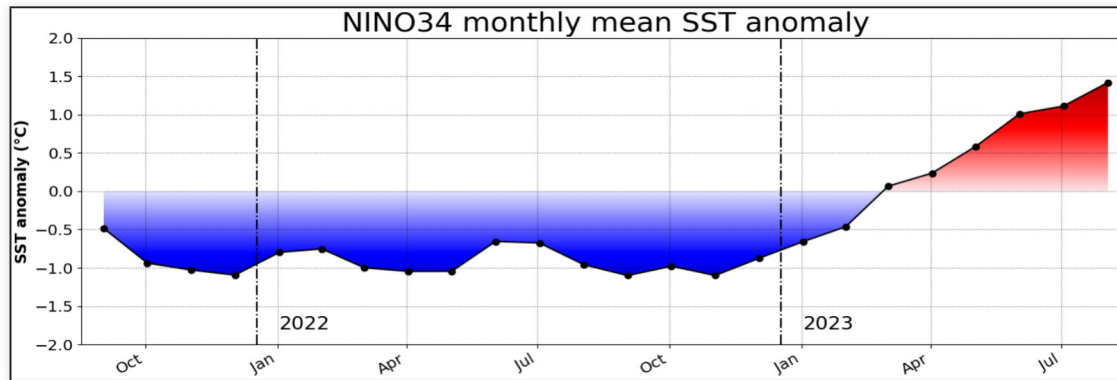
The 20°C thermocline remains deeper than normal on the centre-east of the Pacific and returns close to climatology far east.



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

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

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : close to +1.4°C
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png)

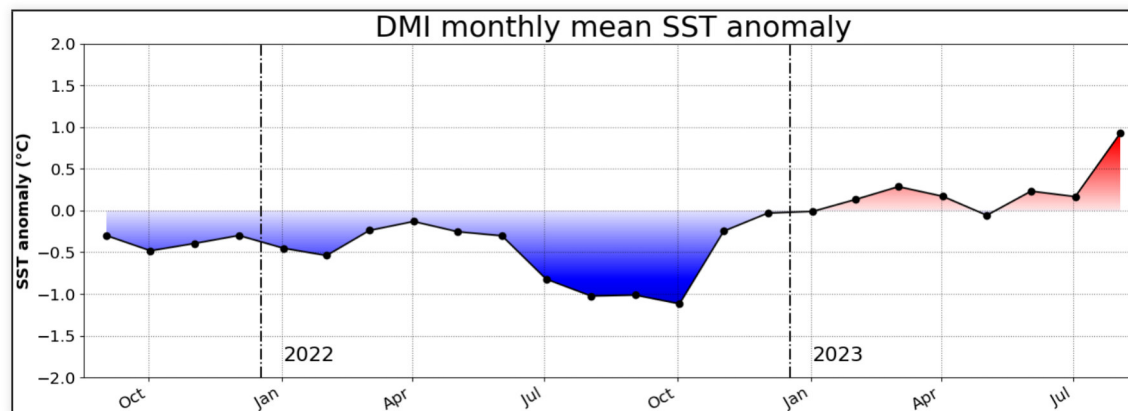


Evolution of SST in the NINO3.4 box (c) Mercator-Ocean

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

DMI Index issued from Mercator Ocean PSYV4R2 analysis : +0.9°C

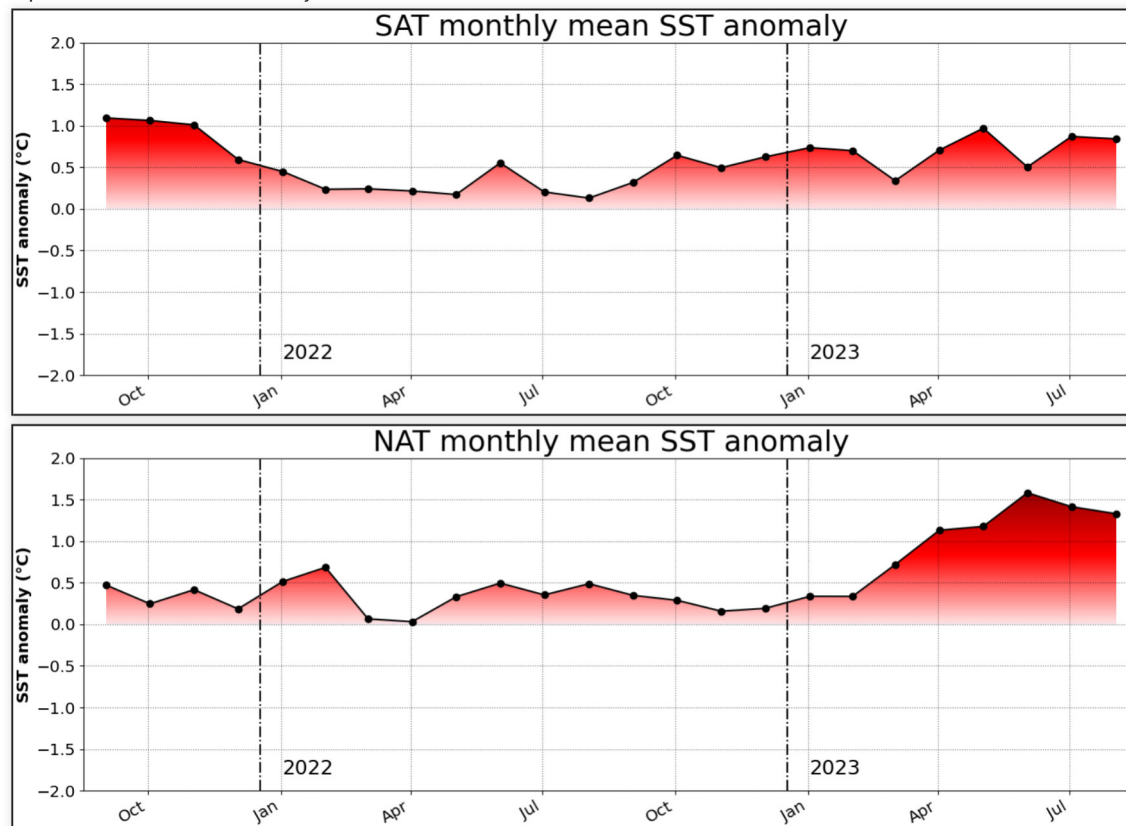
(see BOM site for weekly values : <http://www.bom.gov.au/climate/enso/monitoring/iod1.png>)



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

Oceanic analysis of August 2023 : Atlantic Ocean : SAT and NAT index

Tropical Atlantic remains excessively hot.



Evolution of SST in the SAT and NAT box (c) Mercator-Ocean

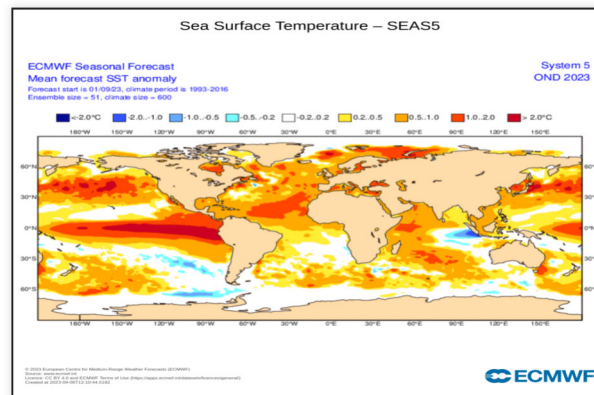
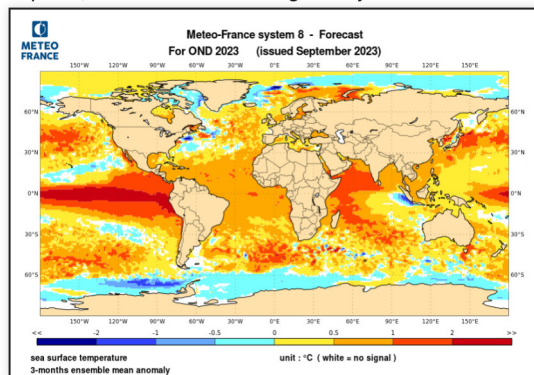
Oceanic forecast : SST anomaly

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

In the Pacific Ocean : In the equatorial zone, the positive anomaly continues to extend westwards this quarter. In the Northern Hemisphere, the PDO- pattern remains in place.

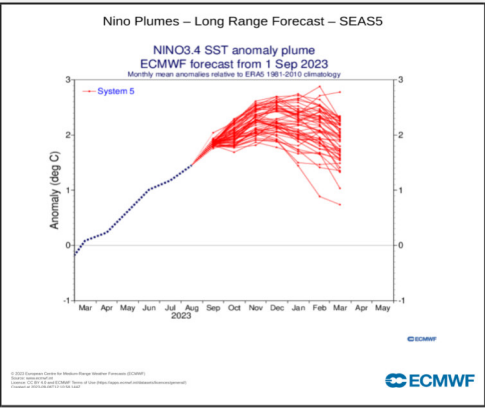
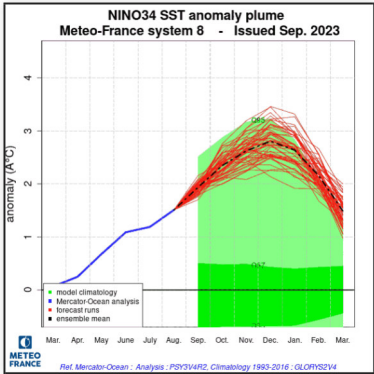
In the Indian Ocean : The positive anomaly (near the African coast) and the negative one (near the Maritime Continent) are well established for both models.

In the Atlantic Ocean : A positive anomaly stretches from the Caribbean to Equatorial Africa and Europe. MF-S8 is warmer near the Equator, while ECMWF-SEAS5 is generally warmer in North Atlantic.



Oceanic forecast : NINO3.4 Plume diagrams

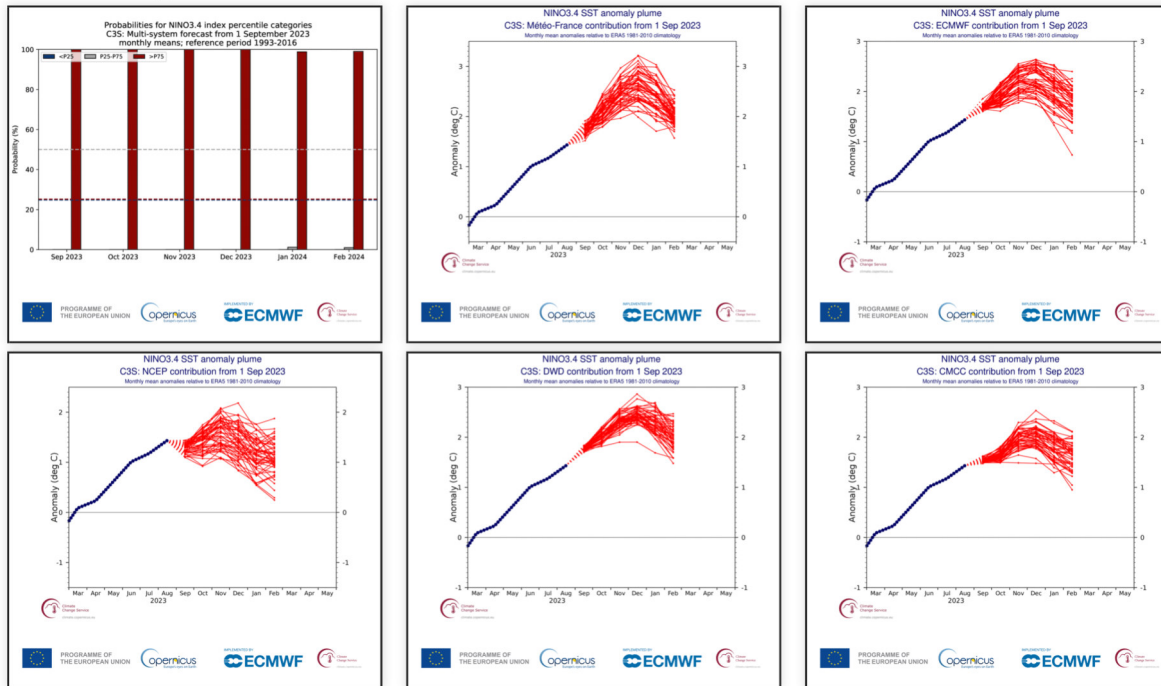
The index reaches its maximum towards the end of the year.



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

Three models (MF8, ECMWF, DWD) forecast a rapid increase in the Nino3.4 index (around +2°C by the end of the quarter). The NCEP and CMCC models heat up much slower.

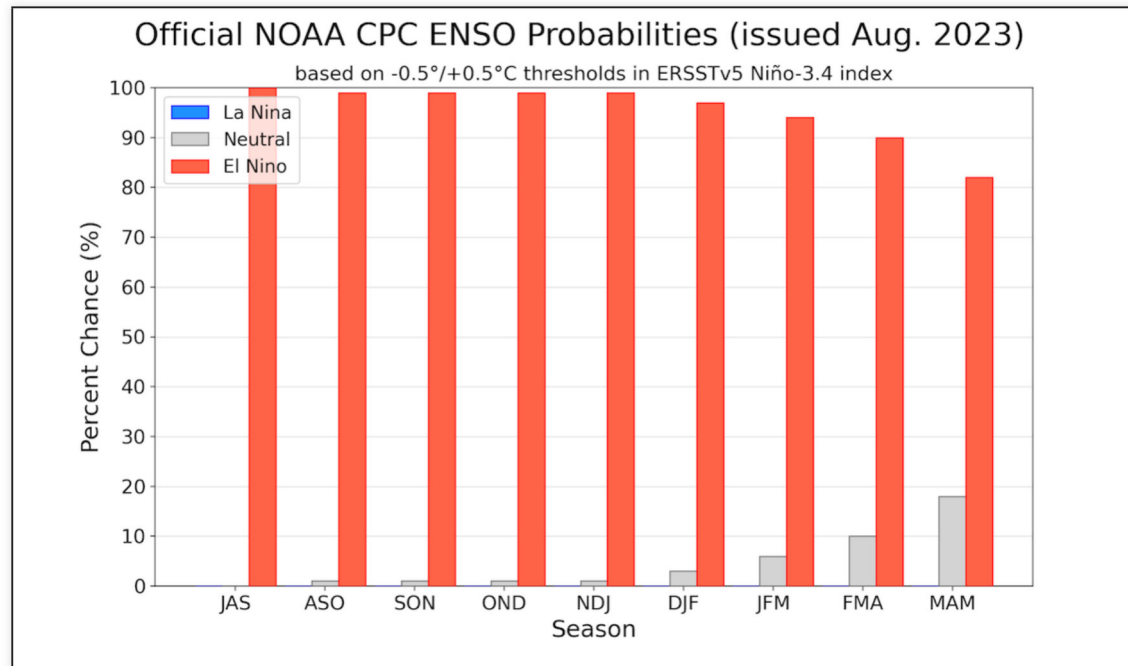
The most likely phase for the next three months : Positive phase



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

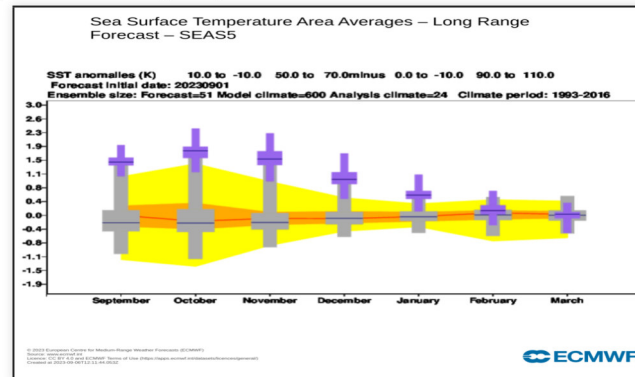
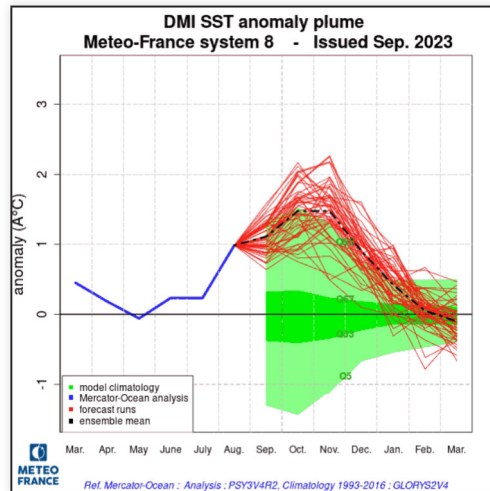
IRI forecast : near 100% probability of El Niño conditions for OND.



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

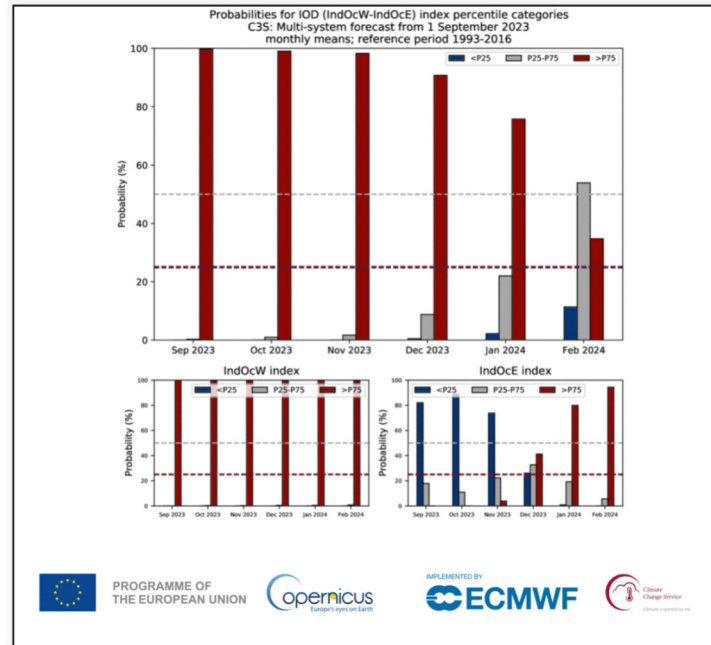
Both models forecast a rapid rise in the DMI index, reaching a maximum during this quatern.



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

Oceanic forecast : C3S IOD re-scaled plume diagrams

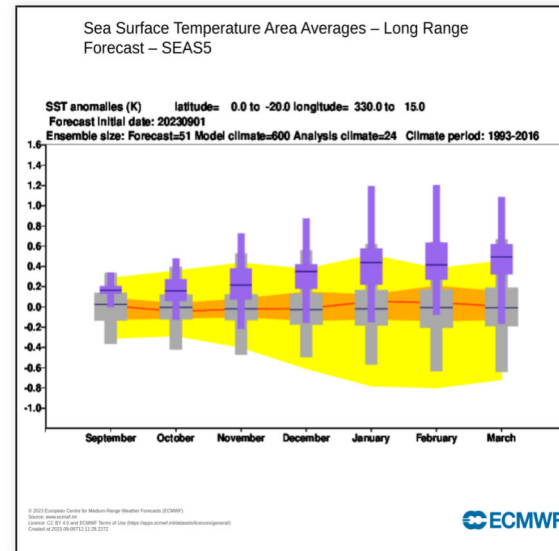
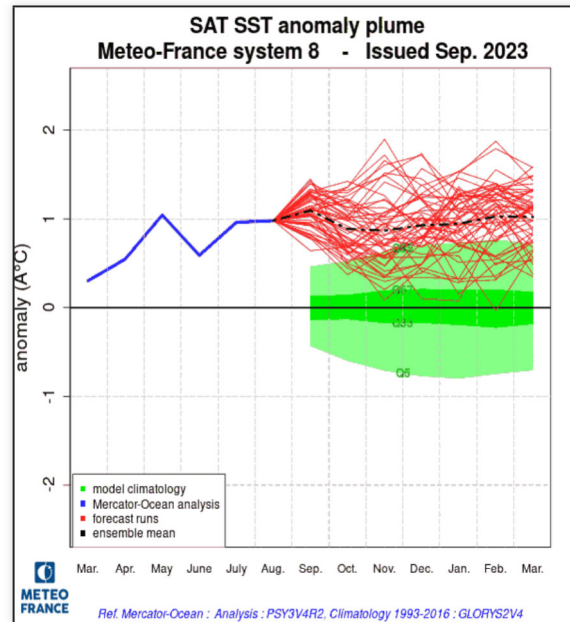
Expected Phase for the next three months : the positive phase is the most likely.



C3S multi-system probability forecast for IOD, west box and east box Index

Oceanic forecast : Atlantic ocean - SAT evolution

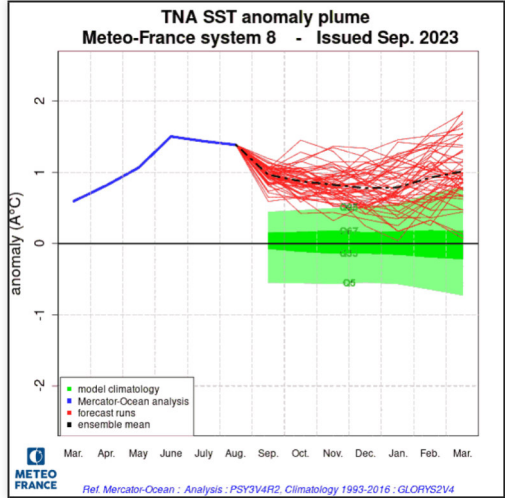
Both models show positive anomaly, much marked with MF8.



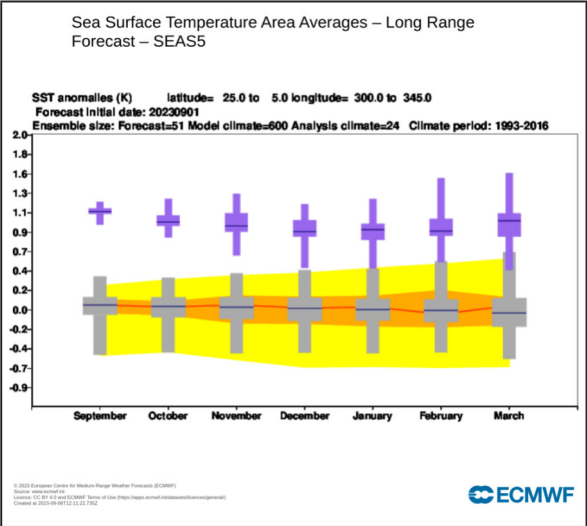
Anomaly on the SAT box : analysis, forecasts and model climatology with MF-S8 on the left and SEAS5 on the right

Oceanic forecast : Atlantic ocean - TNA evolution

Warm anomalies remain high

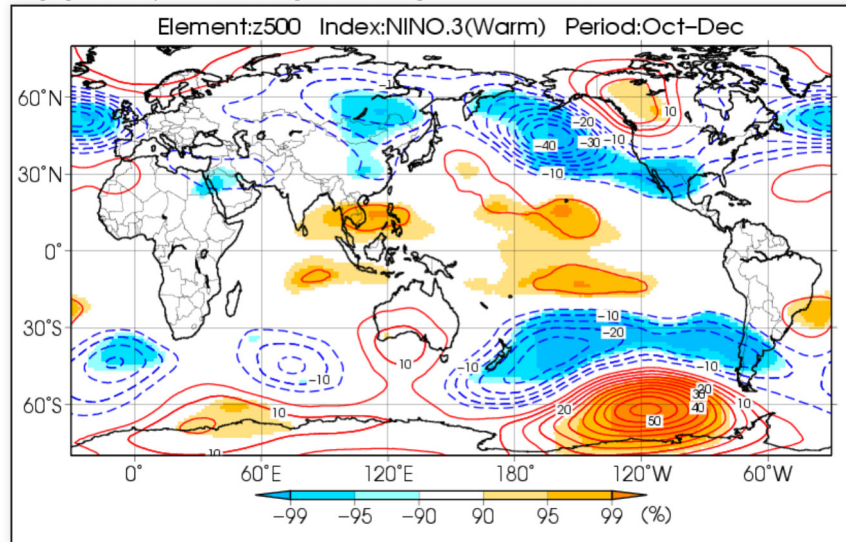


legende

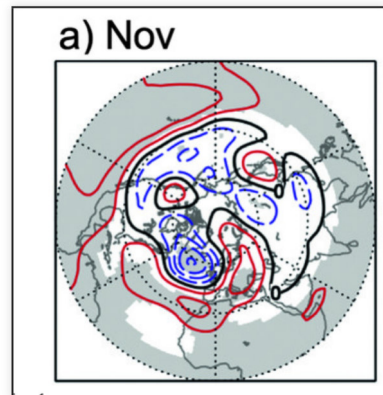


Drivers : Pacific SST _ Statistical effect of El Niño

At the end of the year, during an El Niño episode, we more frequently observe a negative geopotential anomaly over the eastern North Atlantic (see following figure : composite field or regression during El Niño conditions).



Composite field of Geopotential at 500Hpa for El Niño years between 1959 and 2013

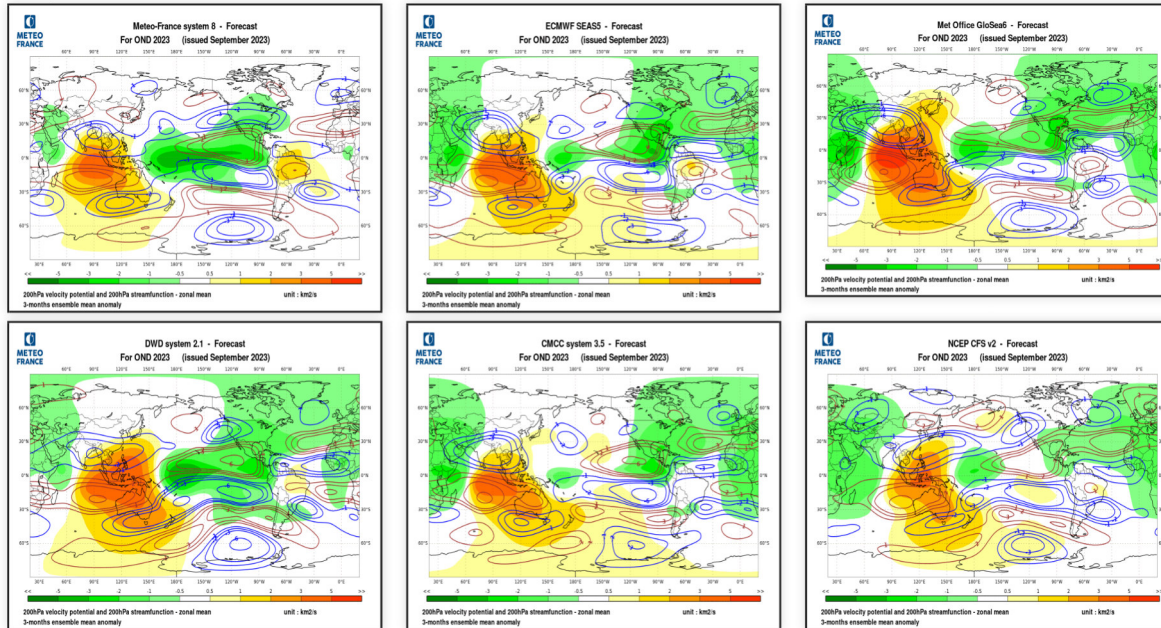


Regression of Z200 in Nov and mean Nino-3.4 index in Sep-Nov. contour interval is 10m. shading indicates statistic significance at the 95 % level. source : <https://journals.ametsoc.org/view/journals/bams/99/7/bams-d-17-0020.1.xml>

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

Velocity Potential : The dipole downward motion anomaly over the eastern Indian Ocean / upward motion anomalies over the Pacific is highlighted by most models, in linked with El Niño and IOD + . Incertainty about the location of main upwards motion over the Pacific (located west with MF8 and NCEP or east with SEAS5 or CMCC). Most of models suggests downdraft motion over South America and updraft motion over Atlantic (linked to warm anomalies of SST).

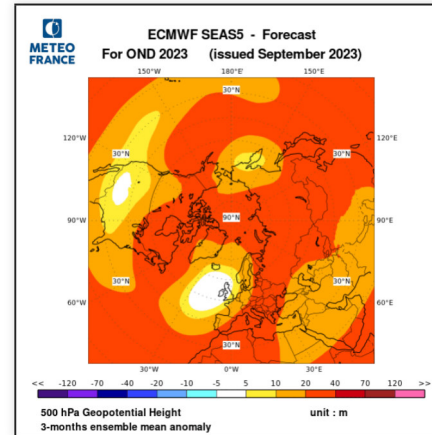
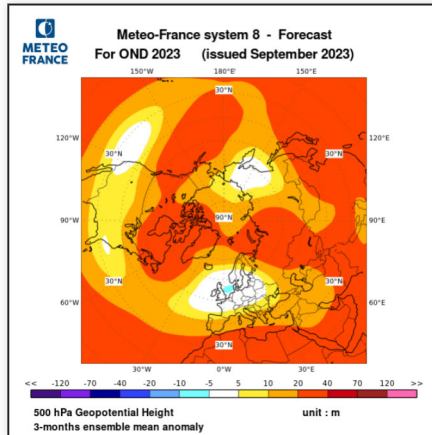
Streamfunction : Indian and Pacific Ocean dipoles are being set up. Teleconnections are clearly visible in the Southern Hemisphere. In the Northern Hemisphere no teleconnections to north america unlike the north atlantic where structures appears from the north of south america (cyclonic curvature from south of Carabbean to Gulf of Guinea, anticyclonic curvature off the coast of Morocco) Note also cyclonic curvature is positioned over the Middle East linked with possiff IOD.



MF8, SEAS5, UKMO, UWU, 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).

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

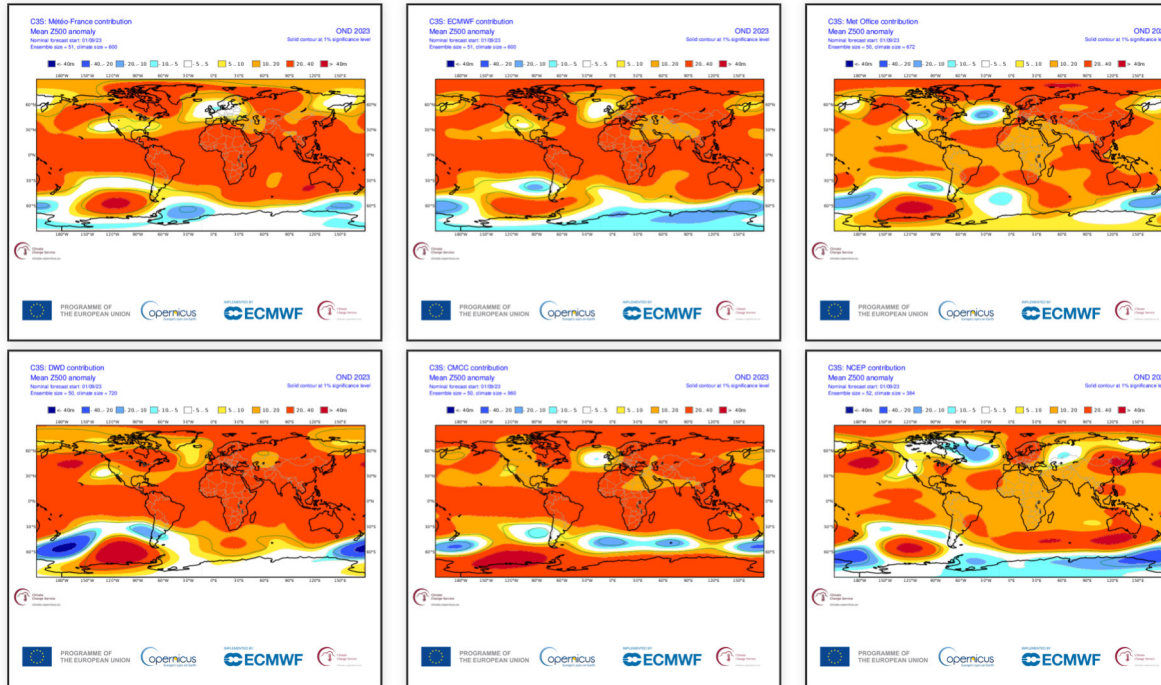
Similarity between models. The Atlantic minimum is positionned further east with MF8.



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

Atmospheric circulation forecasts : Z500 anomalies in C3S models

Most of models suggests relative weakness from United States to Atlantic. In addition they highlight stronger anomalies in the North Pacific and from Greenland to Scandinavia.

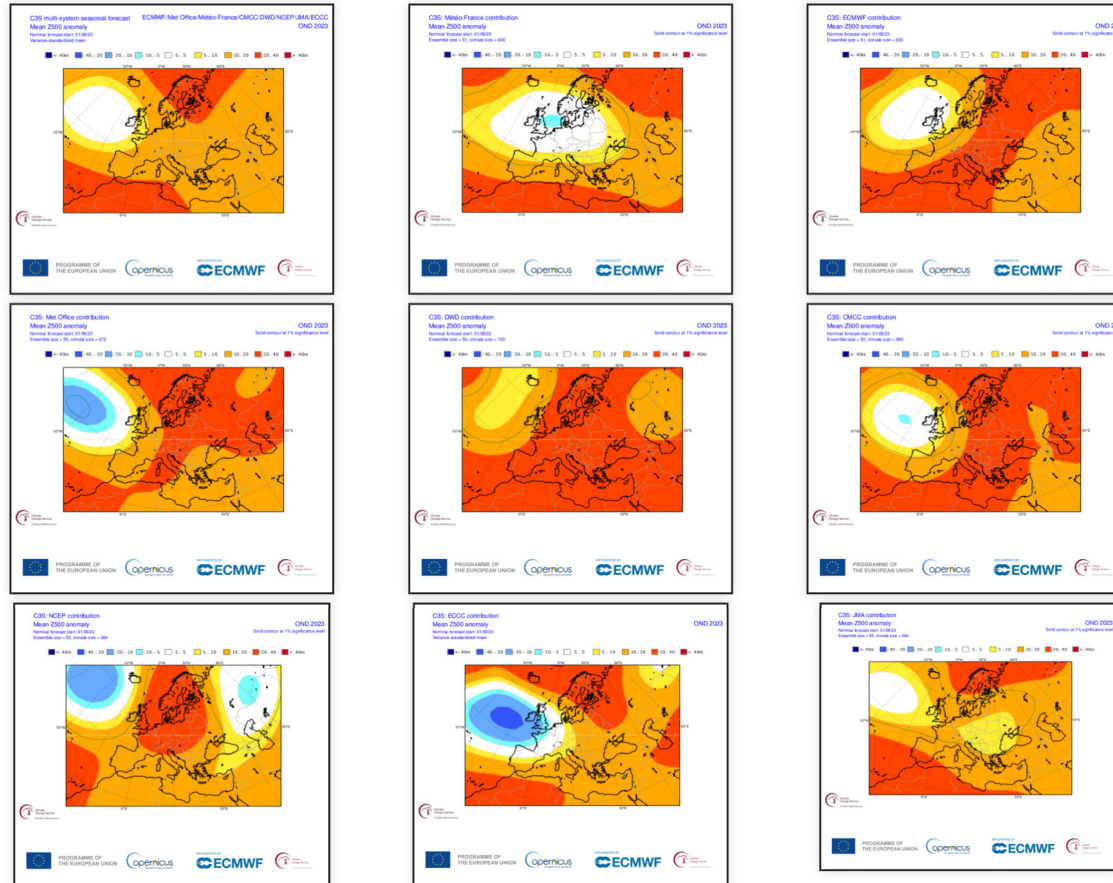


MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in C3S models

There is a negative anomaly on the Atlantic and a positive anomaly more marked around Scandinavia and North Africa.

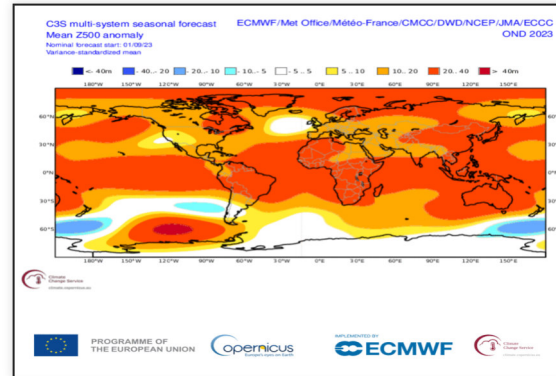
The uncertainty concerns the positioning of the negative anomaly on the Atlantic.



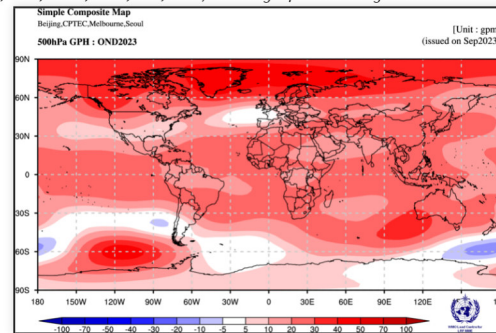
multi-models 500hPa geopotential height anomalies

Atmospheric circulation forecasts : Z500 anomalies multi-systems

In the northern hemisphere, the two multi-models show a positive anomaly from Greenland to Scandinavia and a weakness in the center-east of the North Atlantic basin.



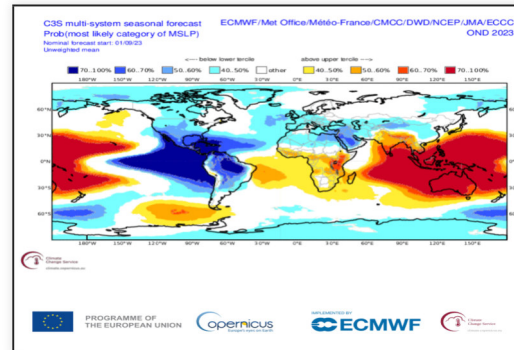
C3S multi-models (MF-S8, ECMWF-SEASS, UKMO, DWD, CMCC, NCEP, JMA, ECCC) 500hPa geopotential height anomalies.



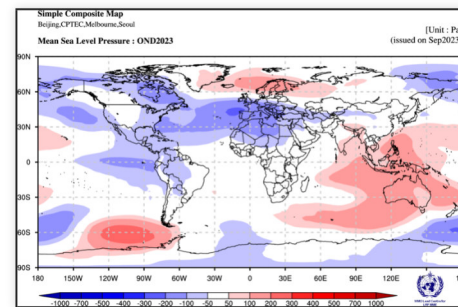
Others models of WMO multi-models 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : MSLP probabilities multi-systems

Both multi-models agree on the MSLP anomalies between the tropics. Over Europe, they forecast probable negative anomaly from East Atlantic to south Europe. The probable positive anomaly over northern Europe forecasted by WMO multi-models is not anticipated by C3S multi-models.



C3S multi-models MSLP terciles probability.

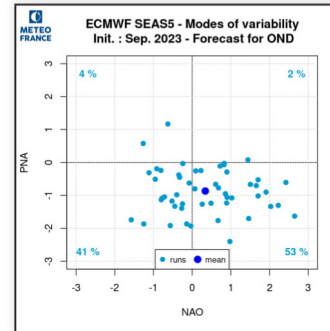
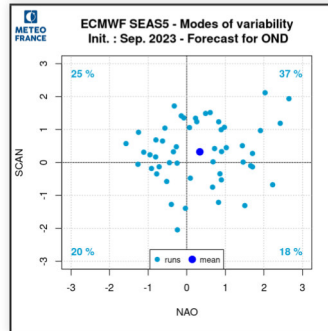
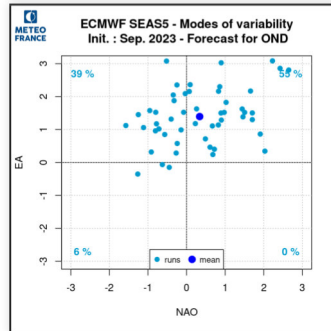
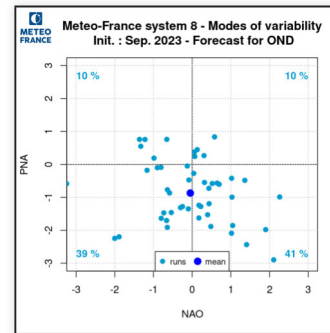
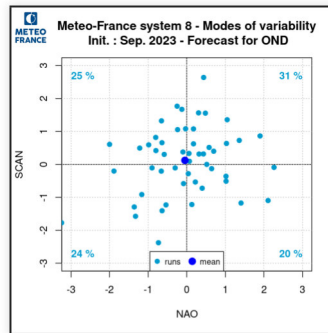
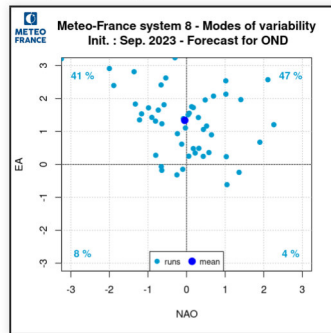


Others models of WMO multi-models MSLP terciles probability.

Modes of variability : forecast

EA+ and PNA- modes, and to a lesser extent NAO+ mode, are preferred.

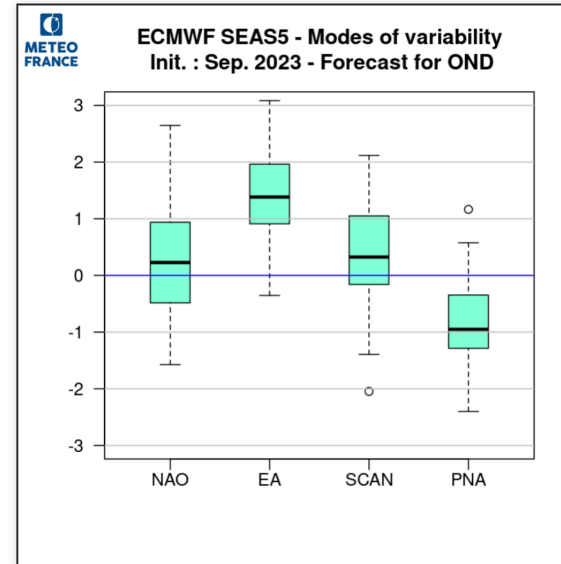
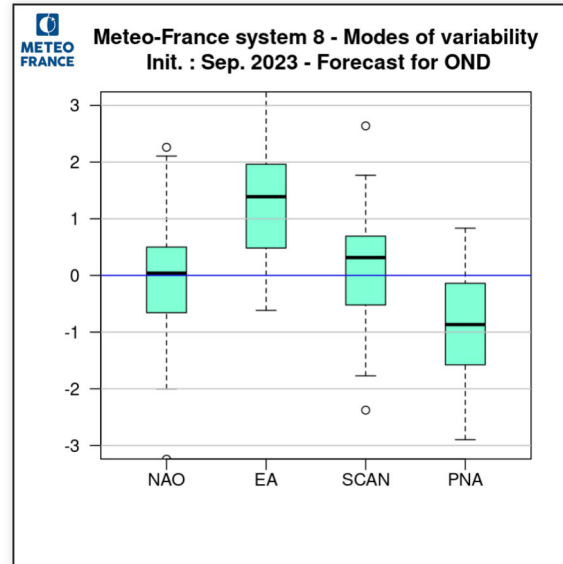
Weak positive signal for SCAN.



[See the modes of variability patterns](#)

Modes of variability : forecast

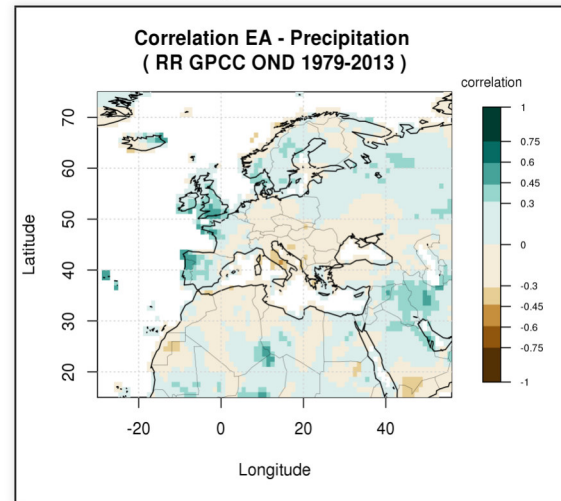
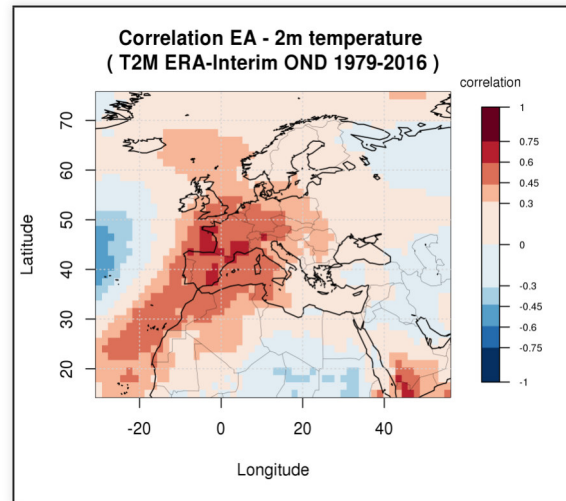
On the Atlantic and Europe the atmospheric circulation is strongly influenced by the positive phase of EA mode.



MF-S8 and ECMWF-SAES-S5 boxplot of modes of variability

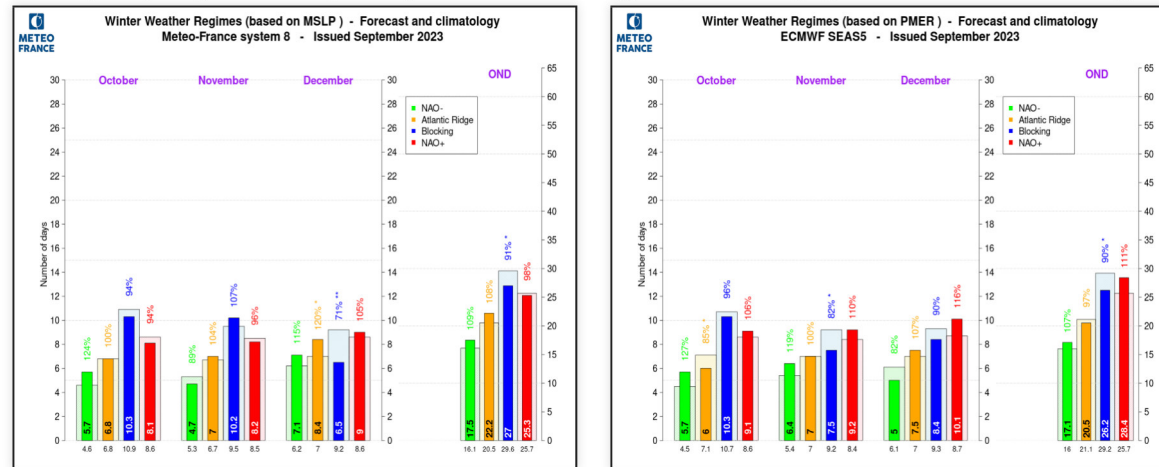
Modes of variability : EA impacts

Positive EA is expected next quarter. This mode has a strong influence in particular on the temperature on the south-western Europe.



Weather regimes : winter MSLP

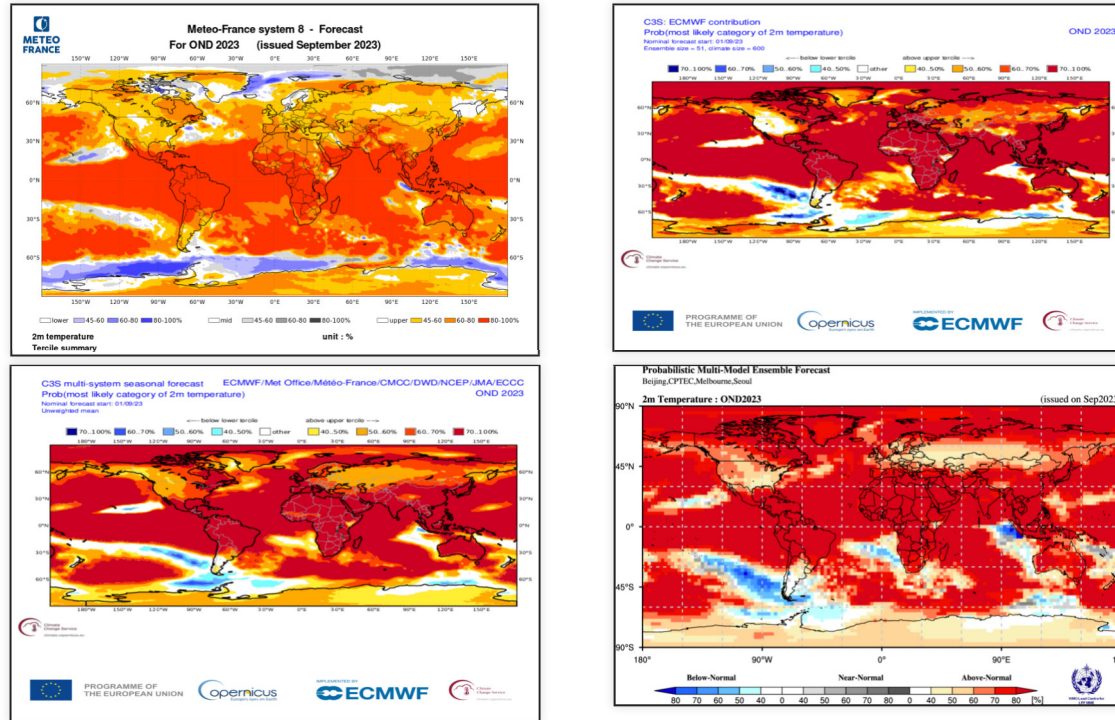
For the quarter, no regime deviate significantly from models' climatology except for Blocking regimed forecasted below climatology.



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

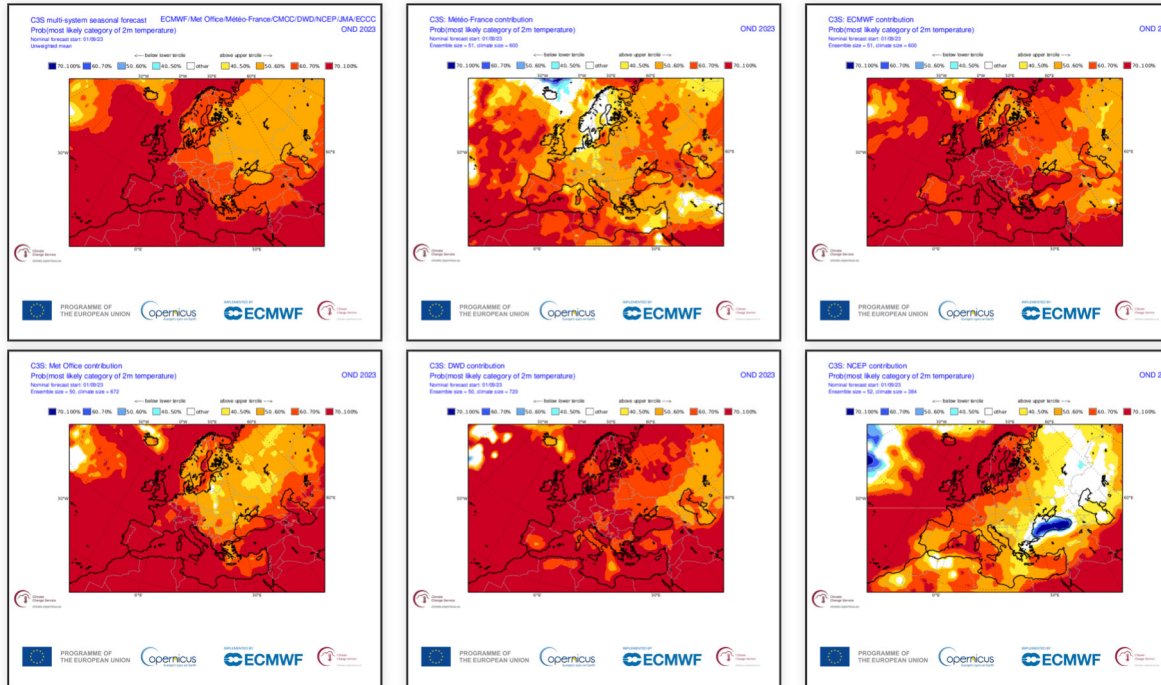
The probability of a warmer-than-normal signal is almost universal across the globe, with the exception of the eastern Indian Ocean and some areas on the Pacific.



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

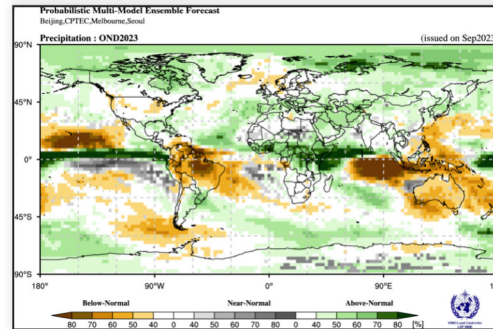
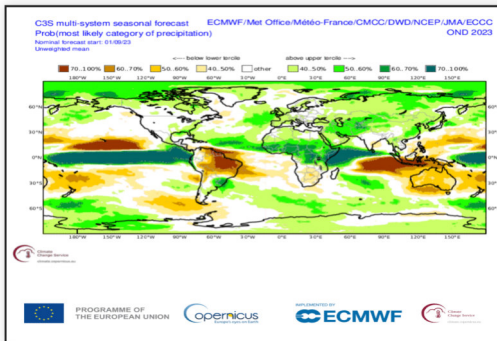
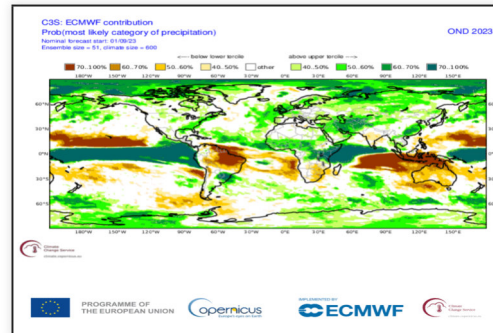
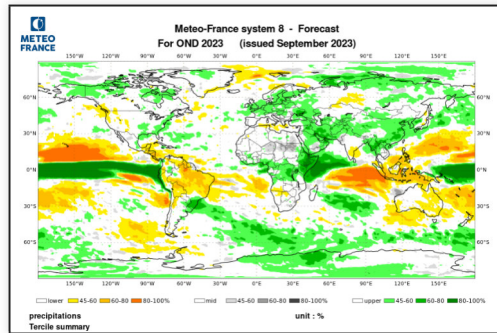
The probability of being in the warm tercile exceeds 50% over the entire zone, and even 70% over Western Europe and the Mediterranean Basin.



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

Forecast of climatic parameters : Precipitation

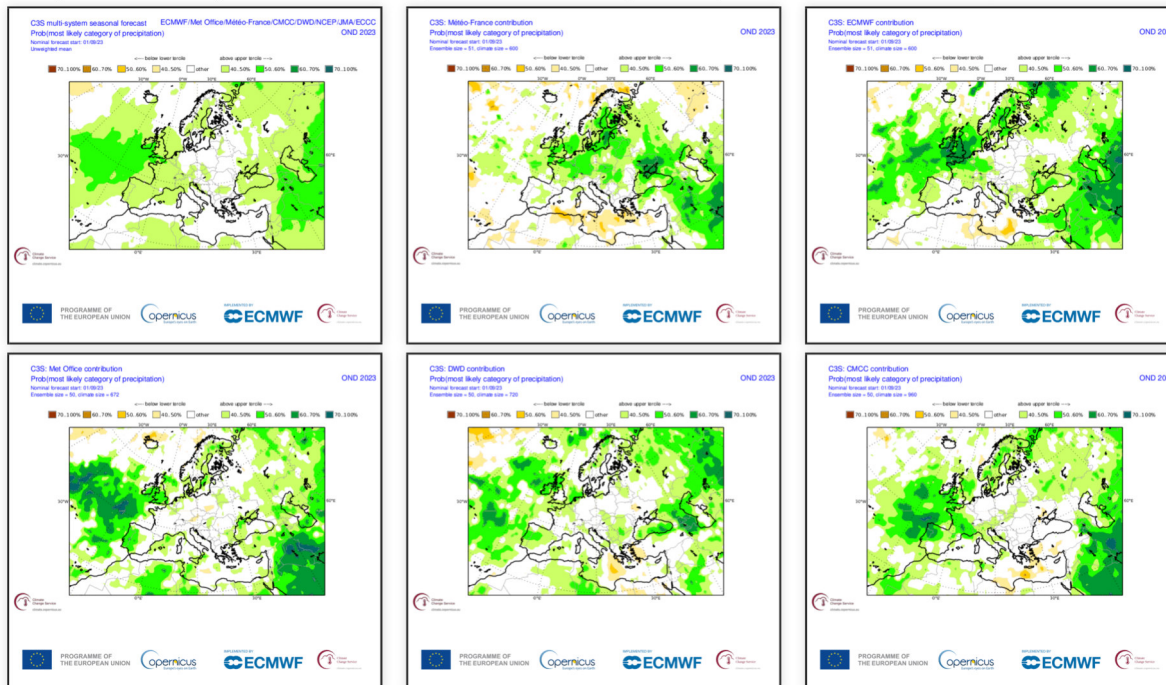
The models agree in the intertropics. The consequences of El Niño are beginning to show (dry signals over Australia, the Maritime Continent and northern Brazil) as well as the influence of positif IOD (wet over east of Africa)
At mid-latitudes of the Northern Hemisphere a wet signal is more probable over Middle East as well as western Europe (in linked with teleconnexion)



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

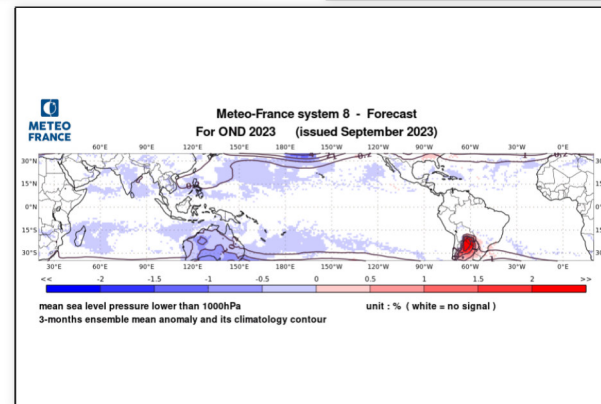
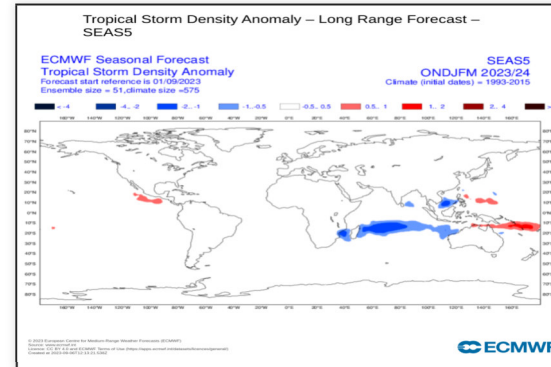
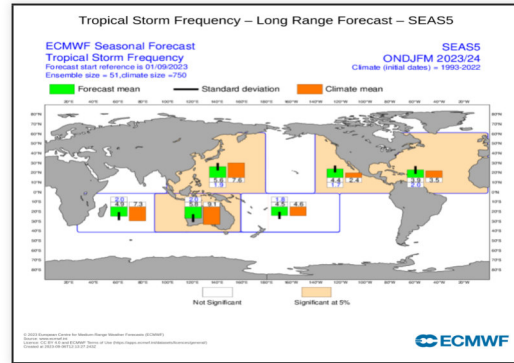
Most models forecast lower geopotential than normal over east of Atlantic, So wetter-than-normal conditions are likely over west of Europe. Moreover the cyclonic circulation anticipated over Middle East (see PV200) favors wet conditions over this area.



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

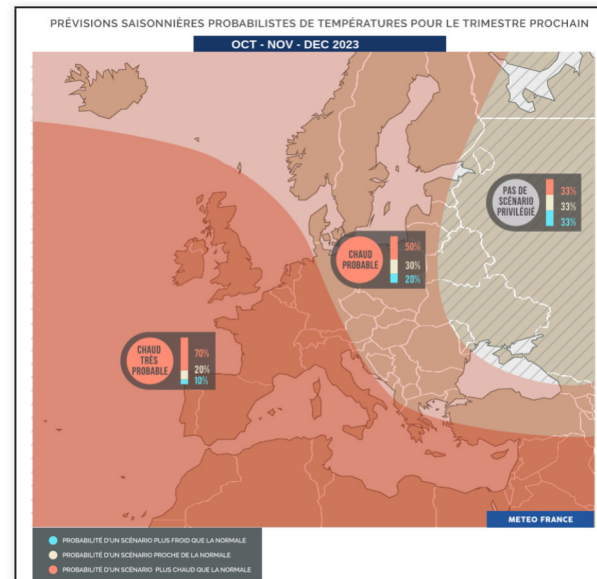
Forecast of climatic parameters : Tropical Storm Frequency

The frequency of tropical storms in the Atlantic is higher than normal.



Synthesis map for Europe : Temperature

A warmer-than-normal scenario is likely, if not very likely, over much of Europe and Mediterranean regions.

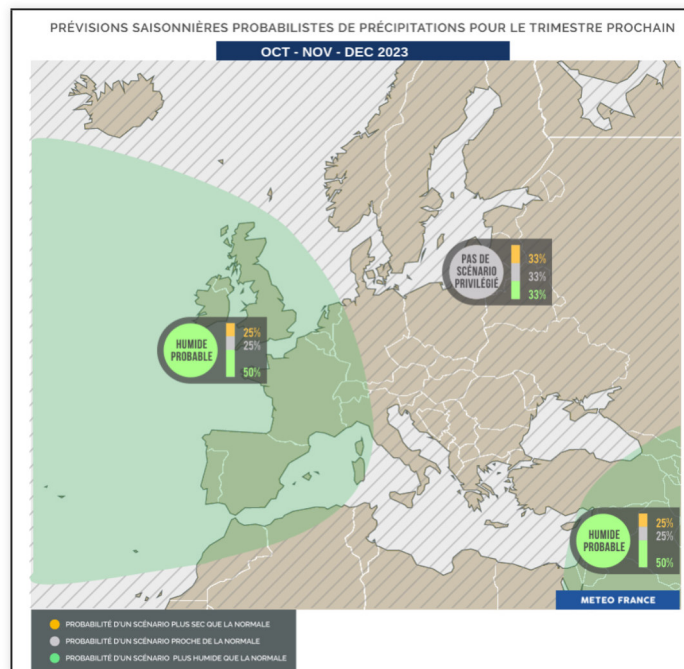


Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS

Synthesis map for Europe : Precipitation

Most models converge on a wetter than normal scenario for the western Europe and Middle East

No scenario is preferred elsewhere.



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