Météo-France Seasonal Forecast Bulletin

SEPTEMBER - OCTOBER - NOVEMBER 2022

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General synthesis : SON 2022

In the Pacific Ocean, the "La Niña" phenomenon is expected to continue in the coming months. Moreover the negative phase of the IOD is developing rapidly. These two phenomena will largely impact the climatic conditions of equatorial and tropical regions. There seems to be teleconnections to the mid-latitudes, unless they are not clearly detected by SF200. They may provide some predictability over North America, but also over North Atlantic and Europe. However, there are discrepancies between models on the positioning of some anomalies (Z500 for example) and on their impacts in T and RR.

A) Oceanic forecast :

- ENSO : weak La Niña.

- IOD : strongly negative

- Equatorial Atlantic : neutral or warm anomaly (uncertainty)

B) Drivers :

- "La Niña" and negative IOD

C) Atmospheric circulation :

A positive anomaly of Z500 extends accross North Atlantic up to Europe, with some differences between models. In MSLP, it corresponds to a positive anomaly centred avec the Atlantic, covering partially Europe. No leading regimes detected in MF and ECMWF models.

D) Most likely conditions :

The warm tercile is the most likely over Europe.

A lot of uncertainty. The dry tercile is most likely over the Iberian Peninsula and Middle East. No scenario elsewhere

Next bulletin : scheduled on September 22th

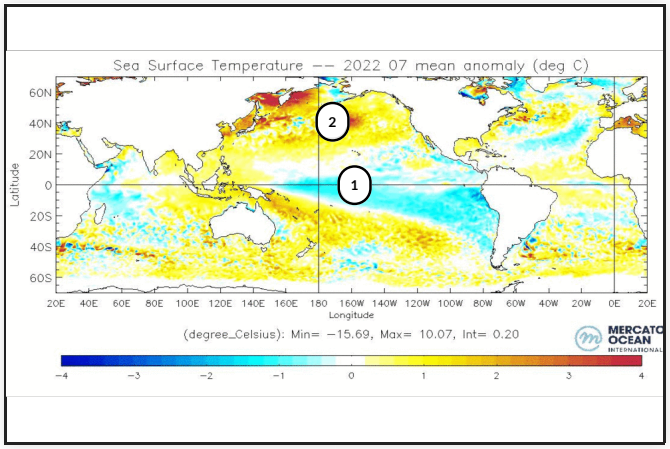
Oceanic analysis of July 2022 : SST anomalies

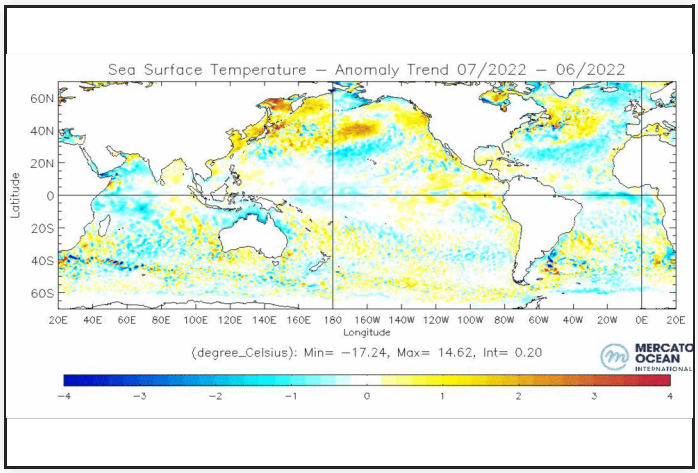
Current ENSO situation : moderate La Niña

In the Pacific Ocean : in the tropics, large pattern of negative anomalies corresponding to La Niña, associated to positive anomalies around the Maritime Continent. Mid-latitudes of the northern hemisphere are entirely covered by positive anomalies, of high intensity in the center (east of the dateline).

In the Indian Ocean : the East/West gradient has become stronger, corresponding to reinforcement of the negative IOD

In the Atlantic Ocean : cooling trend along the equator, leading to slightly cold anomaly. North and South of the equator, slightly warm anomalies. Quite strong modification of the anomaly pattern in mid-latitudes of the north hemisphere. A warm anomaly is now present from the European coast to USA coast, surounded (north and south) by cold anomalies.



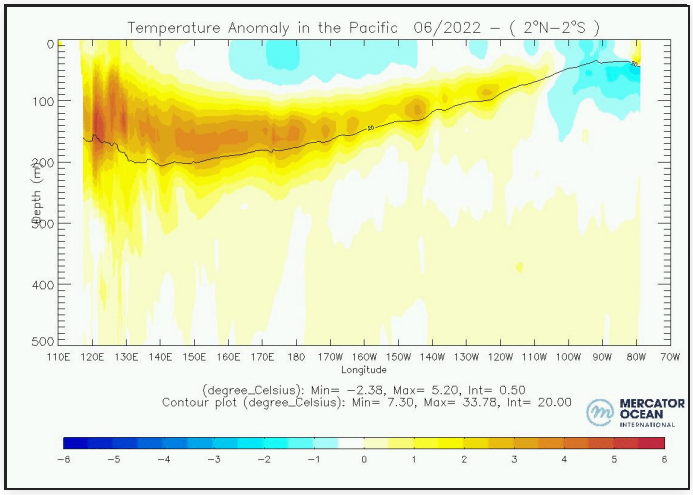


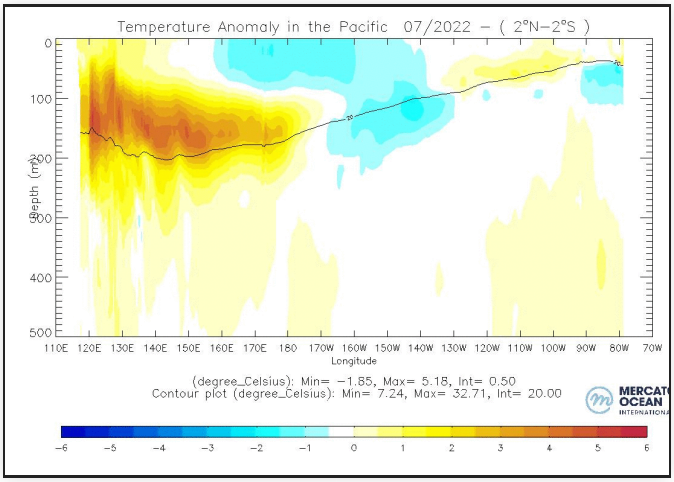
SST Anomalies and trend with the previous month (c) Mercator-Ocean

1 - La Niña pattern
2 - Warm anomalies everywhere in mid-latitudes, with areas of very positive anomalies.

Oceanic analysis of July 2022 : Pacific vertical section

The warm subsurface anomaly (kelvin wave) that was crossing the basin eastwardly had reached the eastern side, leading to a temporal warming in surface. In August, there is still a strong warm anomaly in the west side in subsurface.

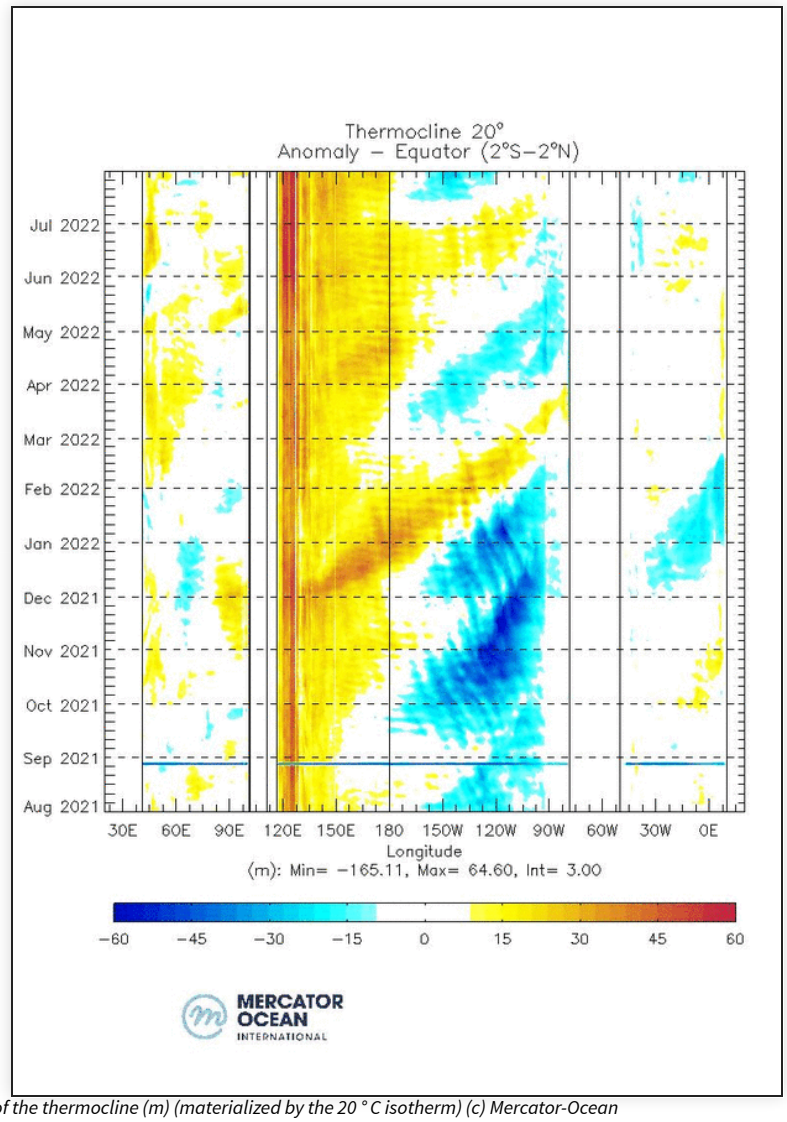




Ocean temperature anomalies in the first 500 meters of the equatorial Pacific basin, monthly average. (c) Mercator-Ocean

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

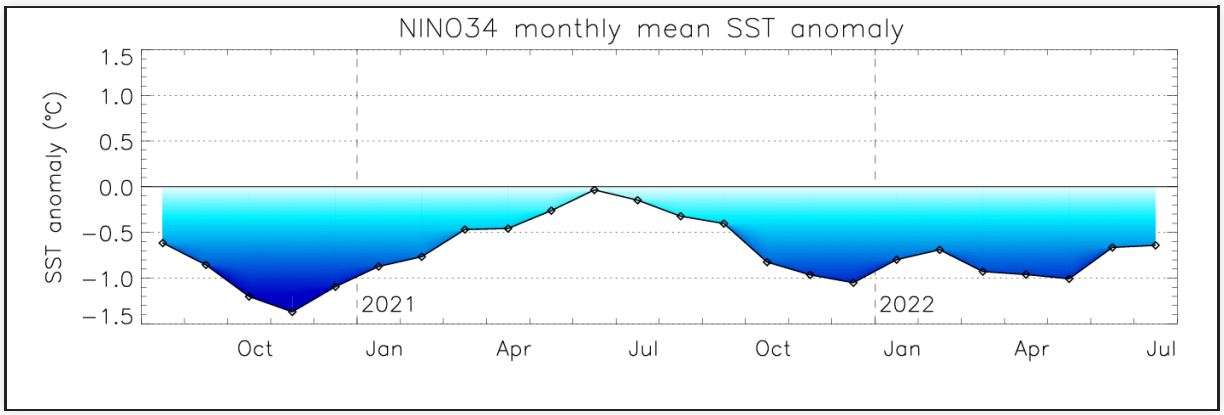
In the Pacific Ocean, the warm Kelvin wave has now disappeared. In August, return to a east-west dipole of anomaly.



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

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

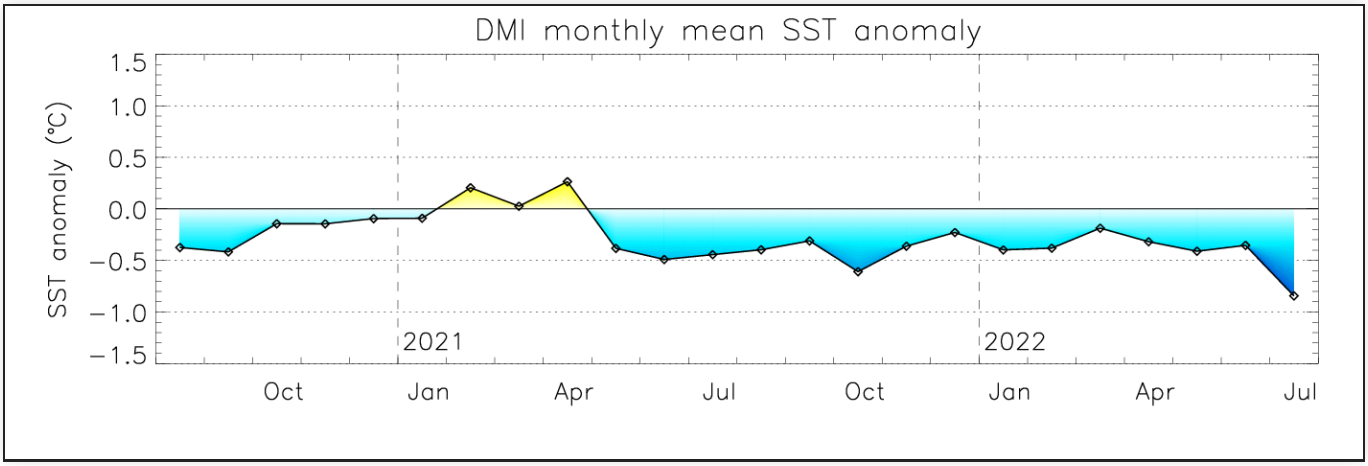
Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : -0.6°C
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png)



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

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

DMI Index issued from Mercator Ocean PSYV4R2 analysis : -0.8°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

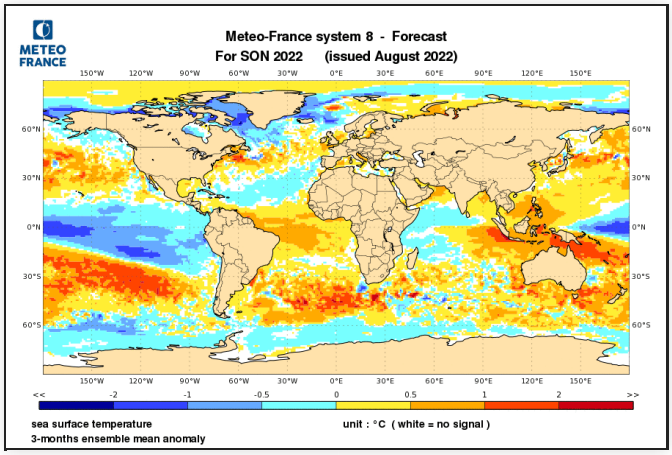
Oceanic forecast : SST anomaly

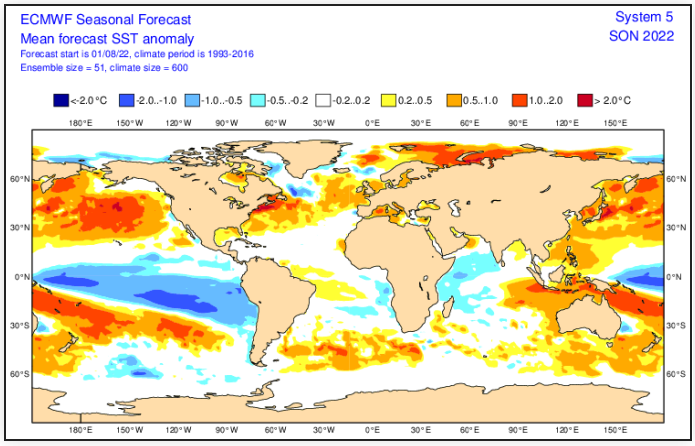
Good agreement between MF-S8 and ECMWF-SEAS5 in the main anomaly patterns.

In the Pacific Ocean : Persistence of the two main patterns, La Niña and the generelazised positive anomaly in the Northern Pacific.

In the Indian Ocean : The East/West gradient is clearly accentuated (negative IOD).

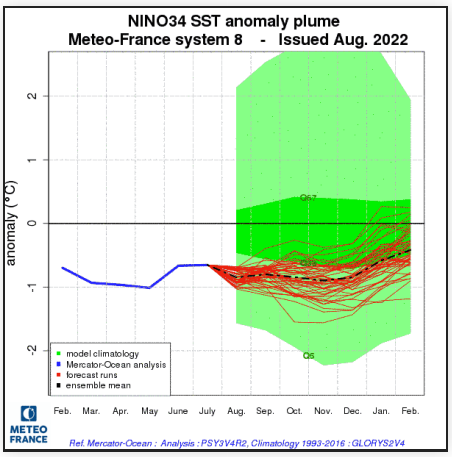
In the Atlantic Ocean : The warm anomaly along the equator is strong with MF-S8, quite neutral with ECMWF-SEAS5 (the most represented scenario within C3S models). In the North Atlantic, the warm anomaly is weakening. The western half of the Mediterranean sea remains warmer than normal.

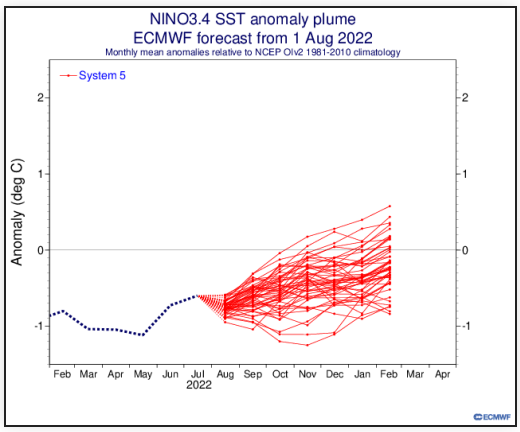




Oceanic forecast : NINO3.4 Plume diagrams

Little evolution in the coming months with MF-S8, a slight positive trend with ECMWF-SEAS5 (with more spread)

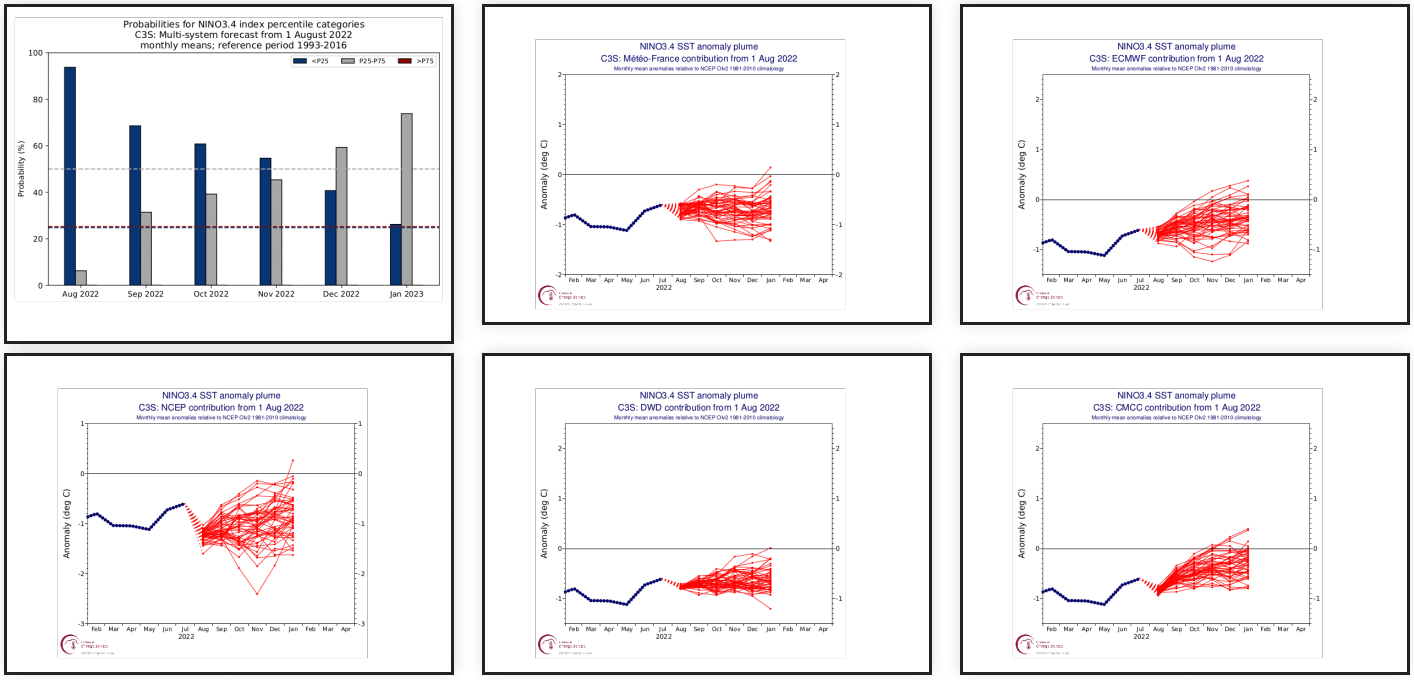




Oceanic forecast : C3S Nino3.4 re-scaled plume diagrams

For the coming months, all the models forecast the persistence of La Niña at its current intensity or slightly weaker than now.

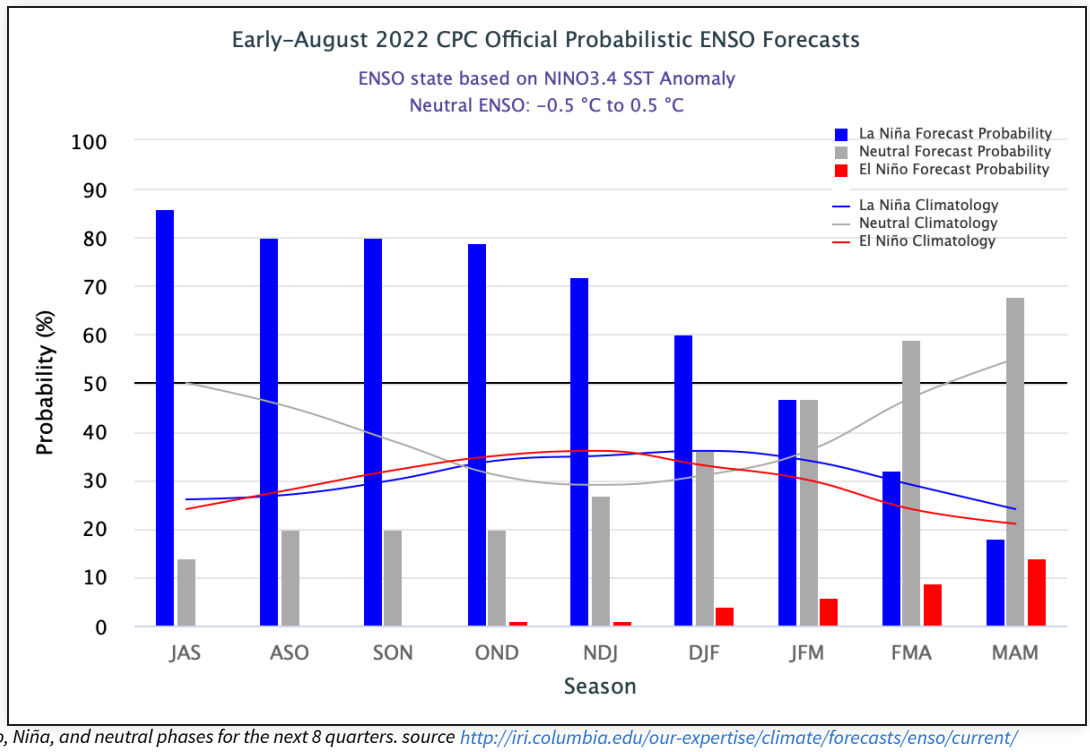
The most likely phase for the next three months : Weak La Niña



C3S multi-system probabilty 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

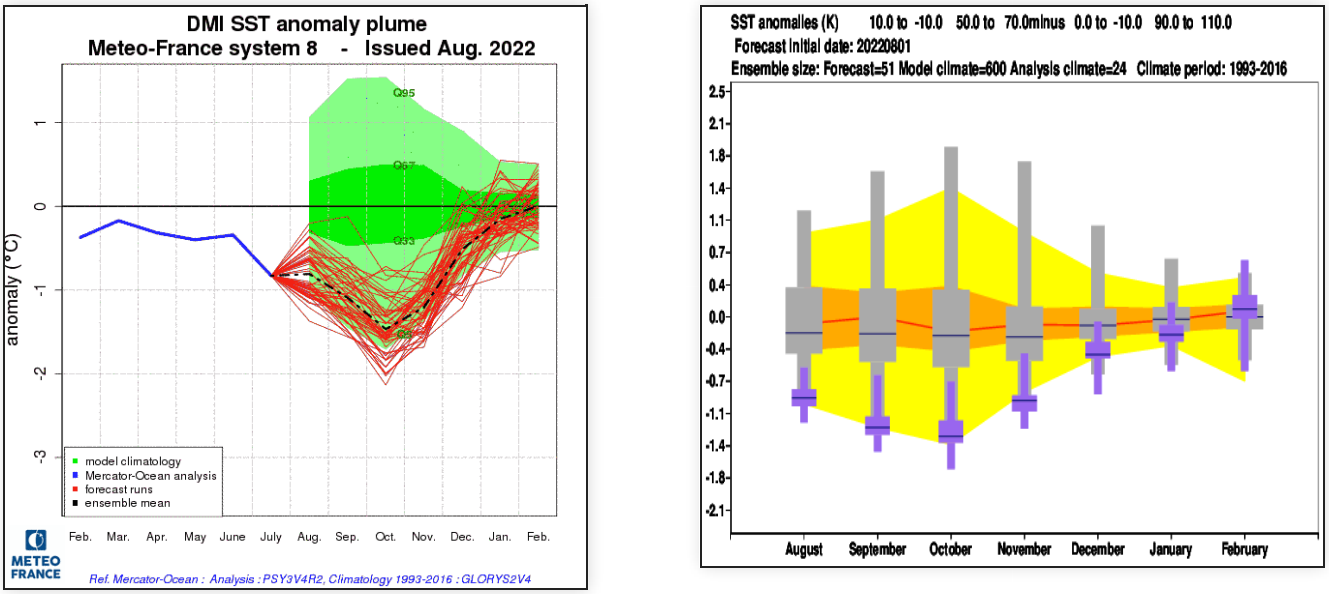
IRI forecast : about 80% chance of "La Nina" and 20% of neutral condition for SON.



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

Very negative DMI expected for the next few months, for both models.

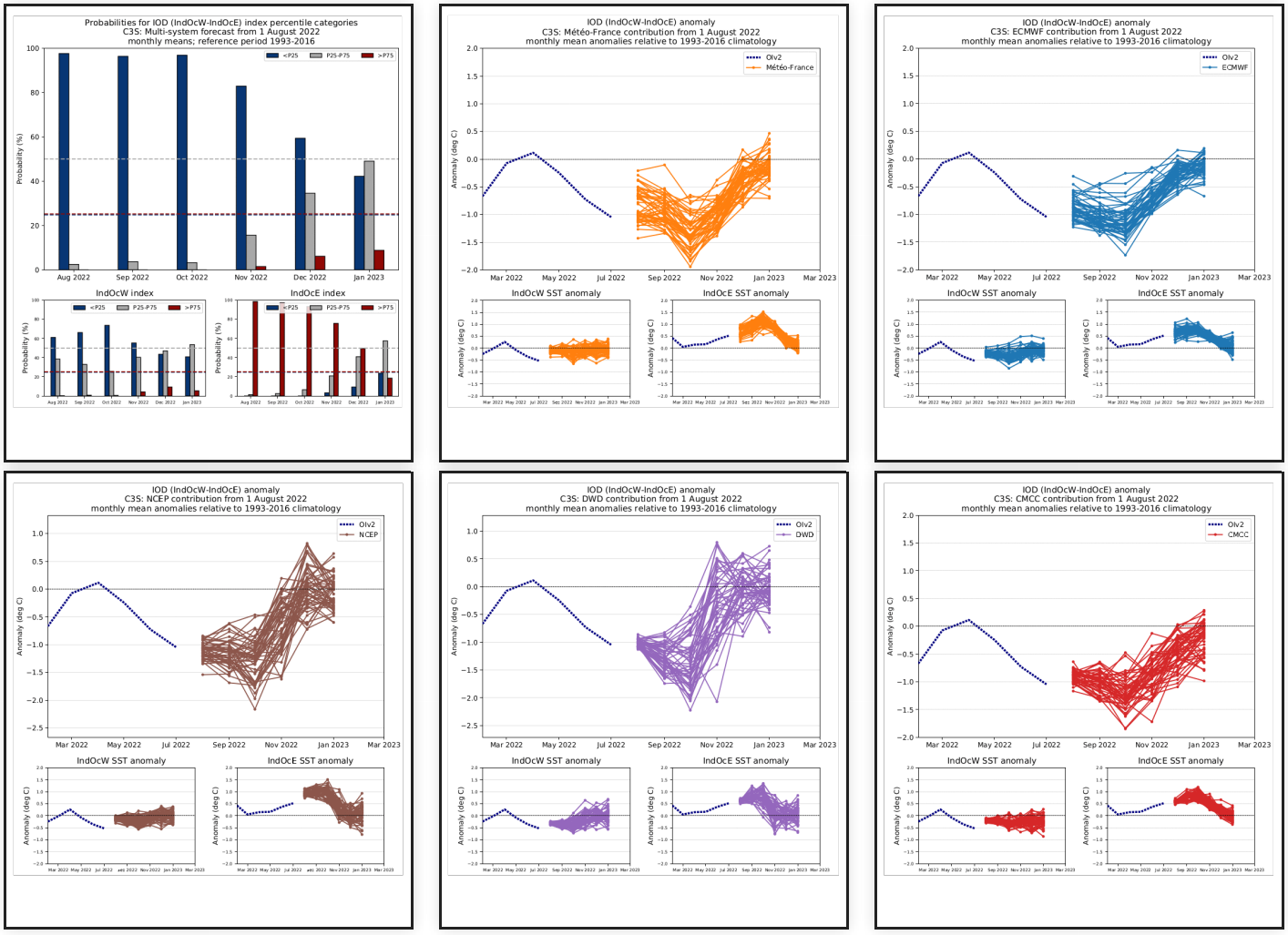


DMI index : analysis, forecasts and model climatology with MF-S8 on the left and ECM-SEAS5 on the right

Oceanic forecast : C3S IOD re-scaled plume diagrams

Good agreement between C3S models on a marked warming in the east box, responsible for a negative IOD .

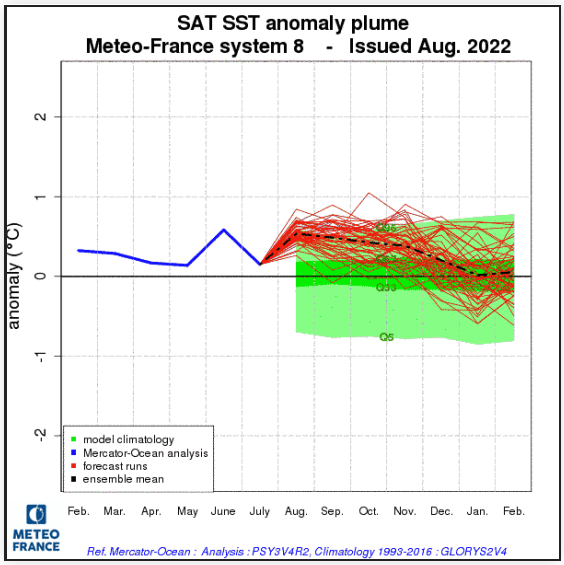
Expected Phase for the next three months : negative.

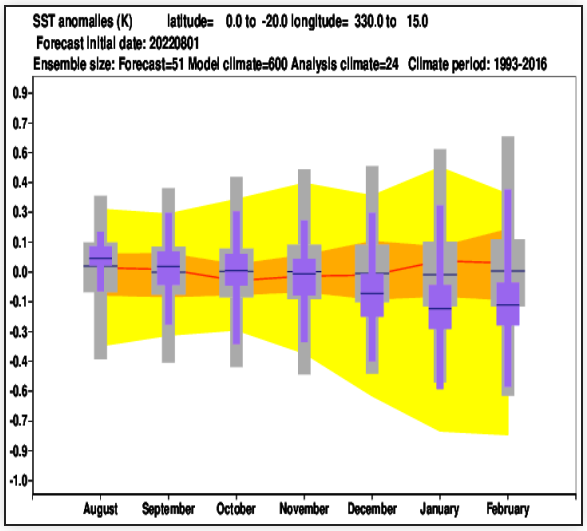


C3S multi-system probabilty forecast (top left figure) and C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010.

Oceanic forecast : Atlantic ocean - SAT evolution

MF-S8 predicts warmer than normal conditions, whereas ECMWF-SEAS5 predicts neutral conditions.





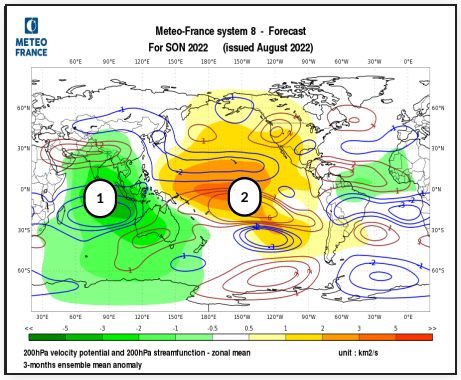
Anomaly on the SAT box : analysis, forecasts and model climatology with MF-S8 on the left and SEAS5 on the right

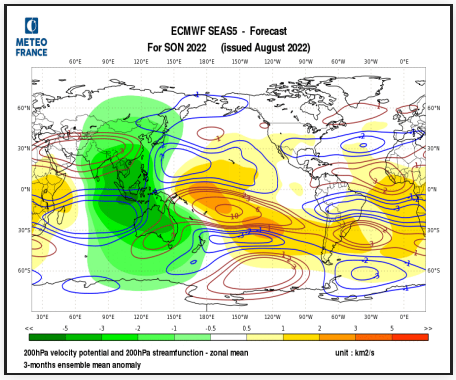
Atmospheric circulation forecasts : velocity potentiel and stream function at 200hPa

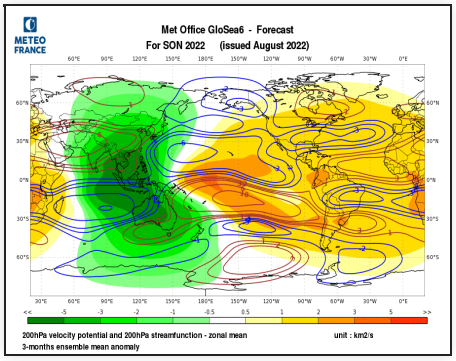
Very good agreement between models for the main patterns (linked to La Niña and negative IOD).

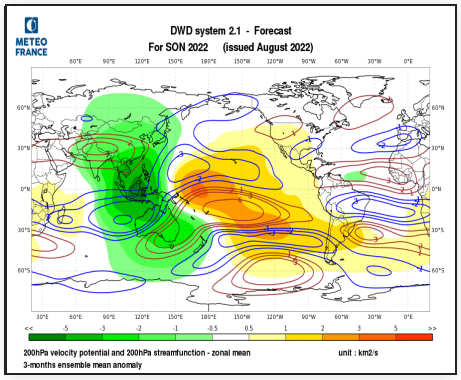
Velocity Potential : Strong dipole over Indian and Pacific Oceans: a downward motion anomaly centered over the western Central Pacific (linked to La Niña); a strong upward motion anomaly centered over the eastern Indian Ocean (linked to La Niña combined with a negative IOD), and downward motion anomaly over East Africa (not for all the models). No agreement over the Atlantic, in link with different scenarios in SST. We priviledge a scenario close to ECMWF-SEAS5 (see SST forecast).

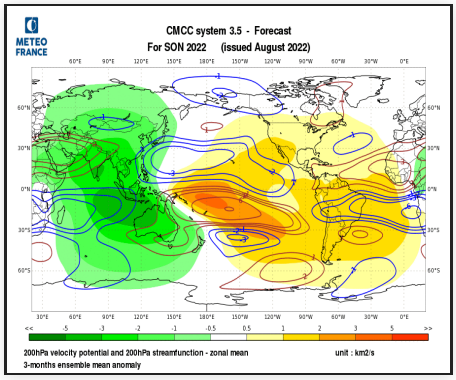
Streamfunction : Strong quadripole in the Indian and Pacific oceans, in link with La Niña and the IOD. Over the western Pacific, teleconnections to North America are even visible with some models (MF-S8 for instance). The dipole over the Indian Ocean extends up to the Arabian Peninsula and East Africa. Over the Atlantic, despite differences in VP200, there is quite a good agreement for a dipole over both sides of the equator, and on cyclonic anomaly circulation extending on the Iberian peninsula.

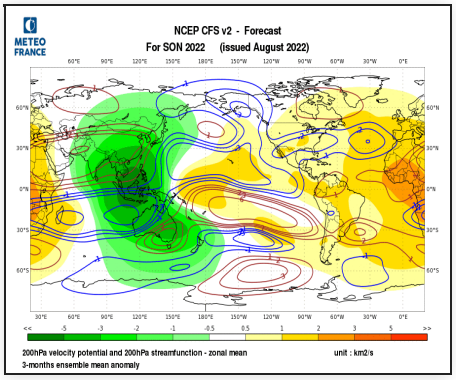










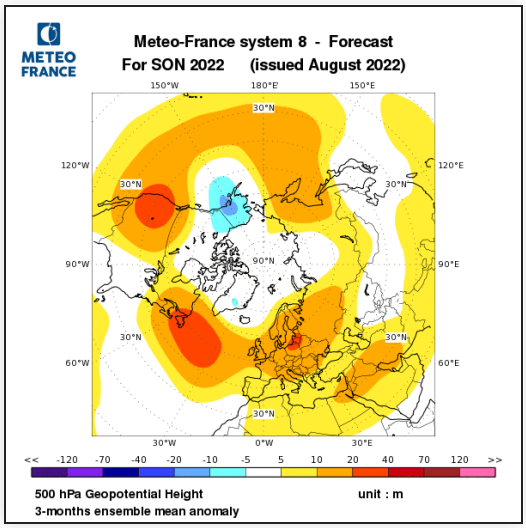


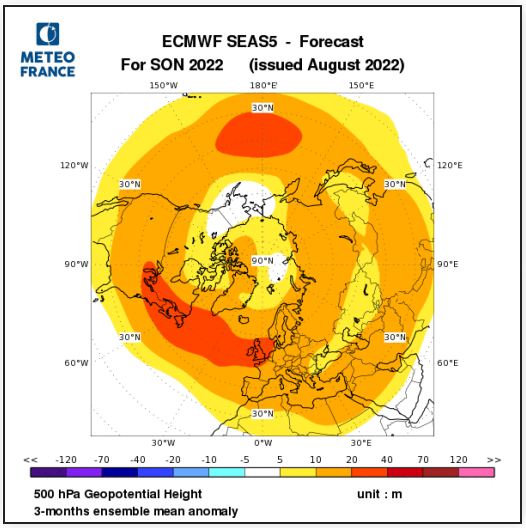
MF8,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

1 - VP : upward motion anomaly related to La Nina and the SST anomaly gradient in the Indian Ocean
2 - VP : downward motion anomaly related to La Nina

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Quite good agreement in terms of large scale circulation patterns. Over North America, the PNA- pattern is visible in the 2 models, even if the main poles are not exactly at the same place. Large positive anomaly over the Atlantic and Europe (positive NAO), another one over middle east up to China.

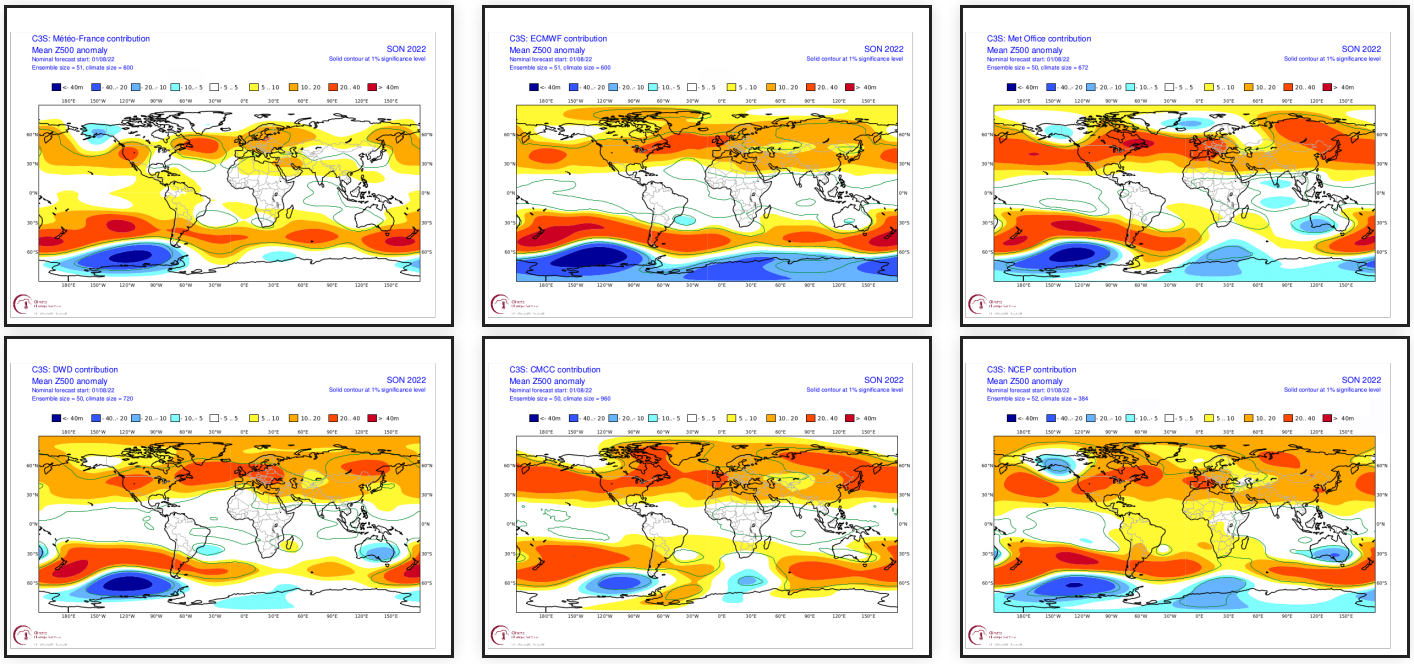




polar projection of MF8 and SEAS5 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in C3S models

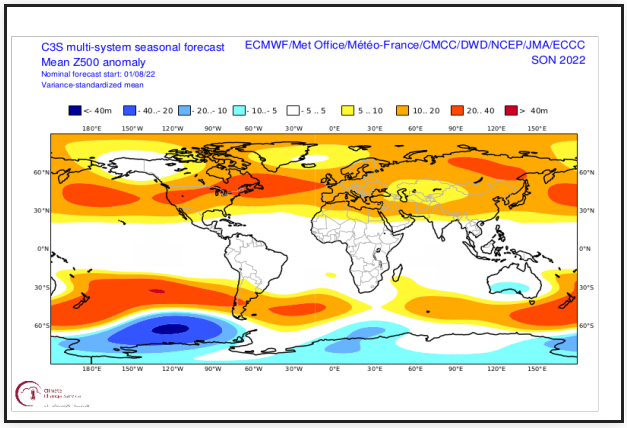
All models predict a PNA- pattern over western North America. Similarly, around the North Atlantic, there are positive anomalies up to Europe in all models, projecting (more or less) on a positive phase of NAO.



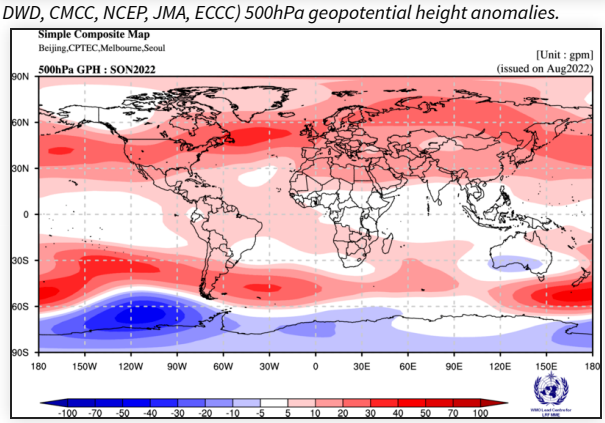
MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies multi-systems

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



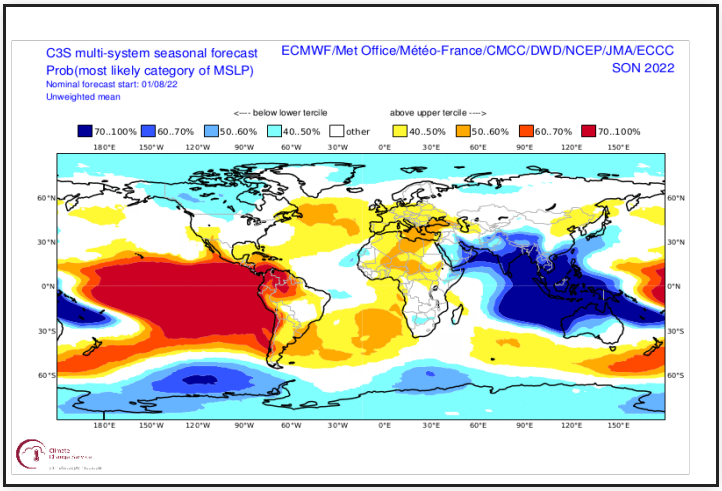
C3S multi-models (MF-S8, ECMWF-SEAS5, UKMO, DWD, CMCC, NCEP, JMA, ECCC) 500hPa geopotential height anomalies.



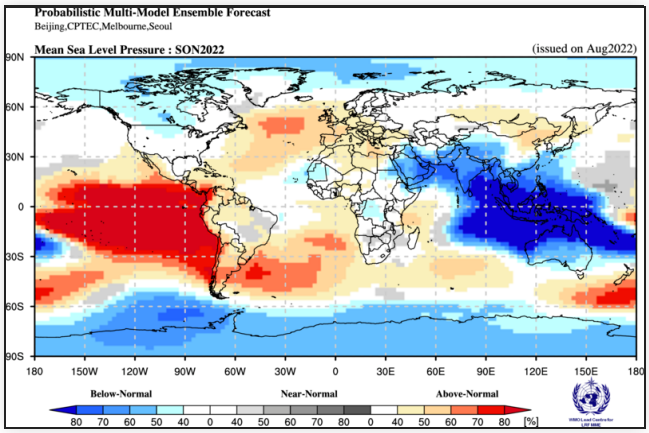
Others models of WMO multi-models 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : MSLP probabilites multi-systems

Good agreement between multi-model combinations.



C3S multi-models MSLP terciles probability.

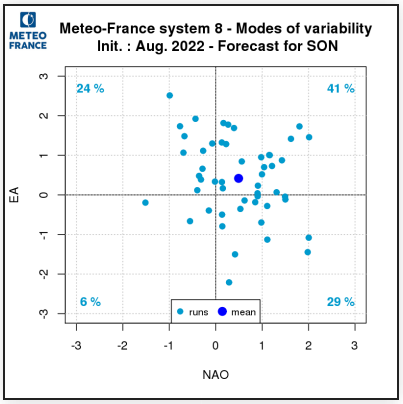


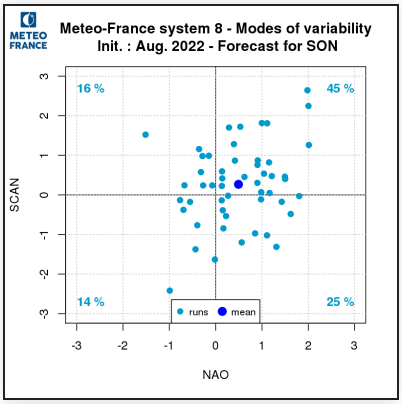
Others models of WMO multi-models MSLP terciles probability.

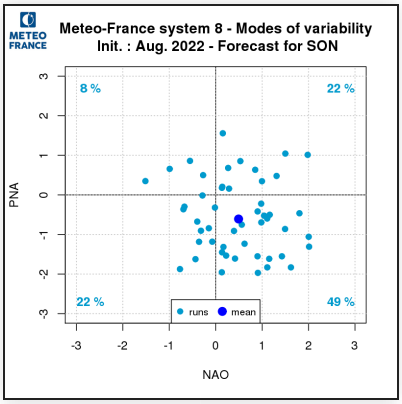
Modes of variability : forecast

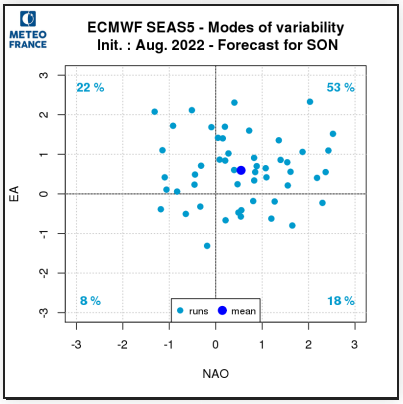
Good agreement between the two models :

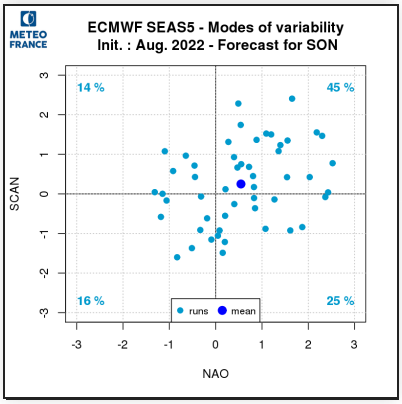
Still good confidence in PNA- and NAO+, but no signal for SCAN. Concerning EA, they both forecast high probabilities for a positive phase, unless it is not obvious when looking at Z500 anomaly fields.

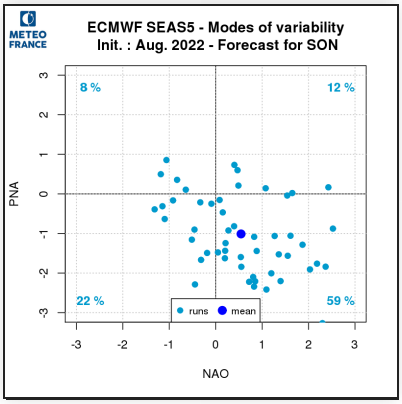








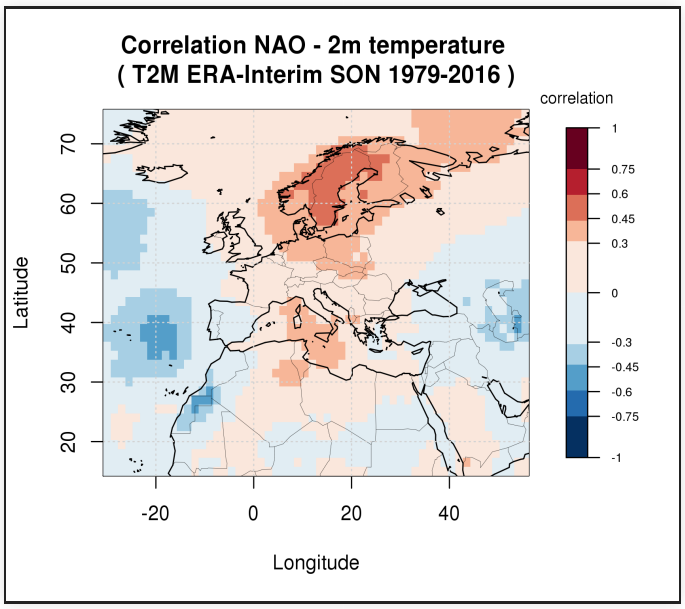


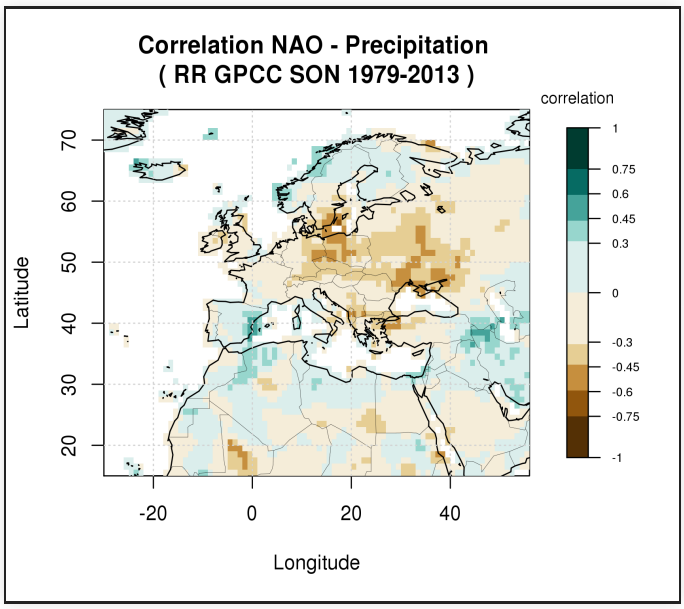


See the modes of variability patterns

Modes of variability : NAO impacts

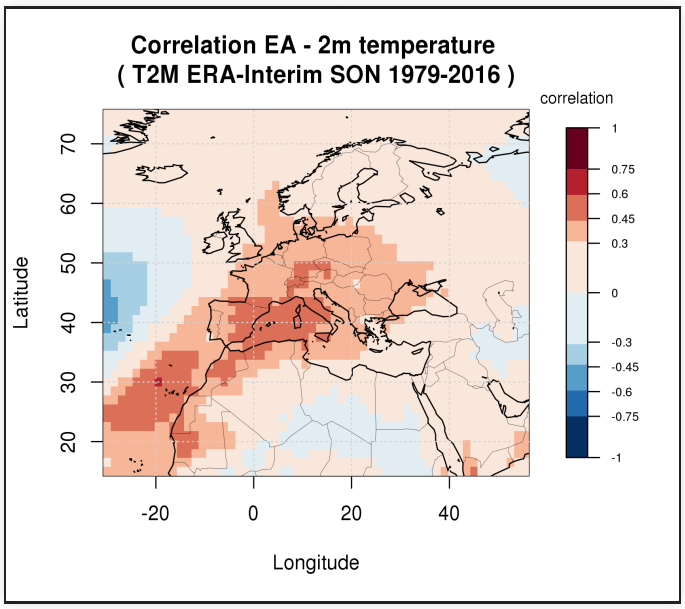
Positive phase of the NAO next quarter

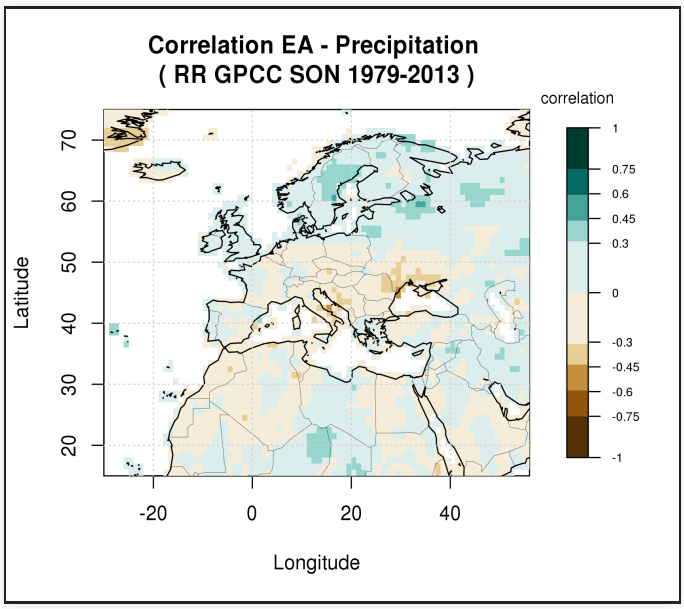




Modes of variability : EA impacts

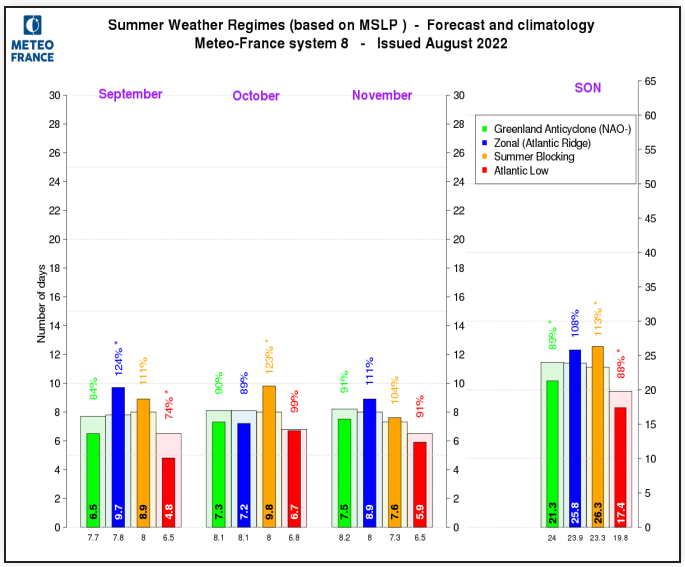
Positive EA is expected next quarter. This mode has a strong influence in particular on the temperature on the south of Europe.

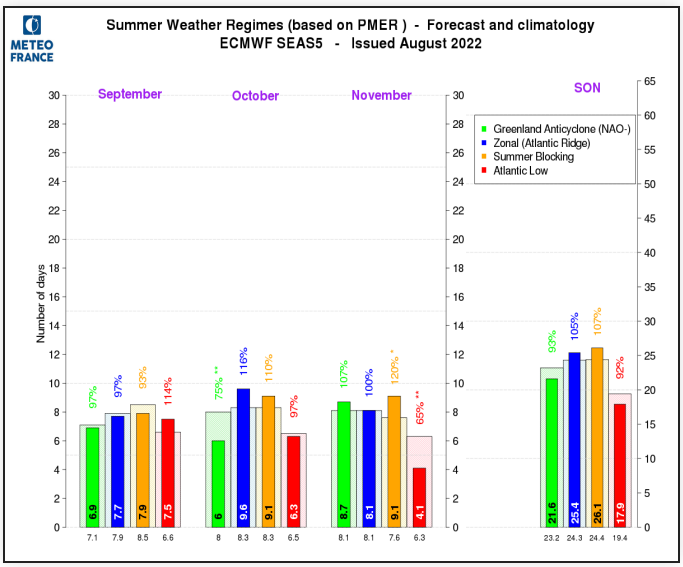




Weather regimes : summer MSLP

Two regimes are dominant, zonal and summer blocking, but with small departure from their climatology.

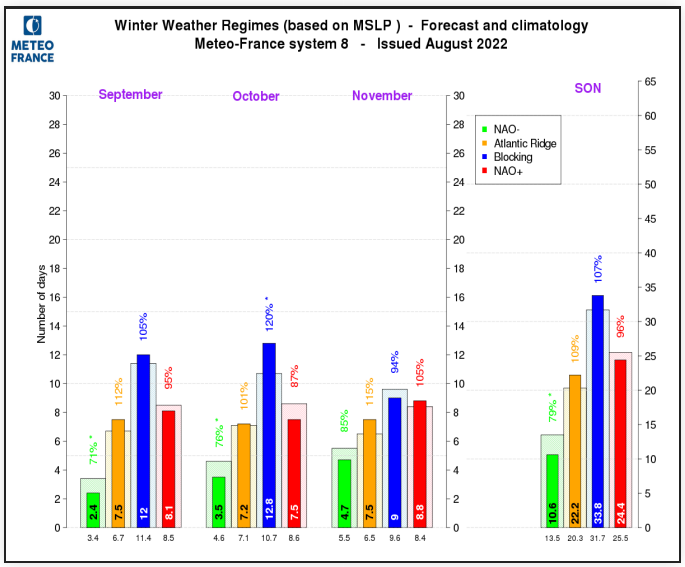


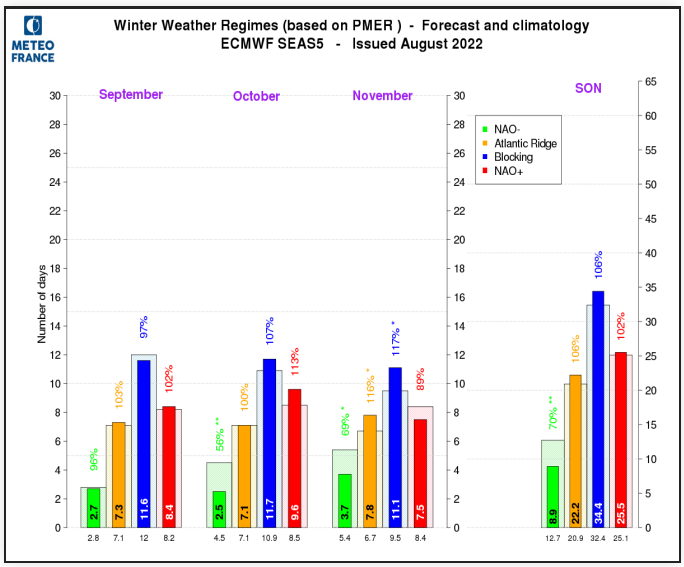


Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S8 (left) and SEAS5 (right).

Weather regimes : winter MSLP

Blocking and Atlantic Ridge regimes favoured, but not signicantly. Note that NAO+ frequency is close to its climatology.



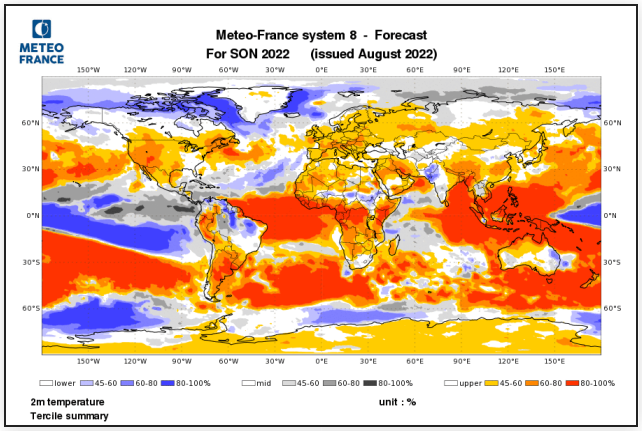


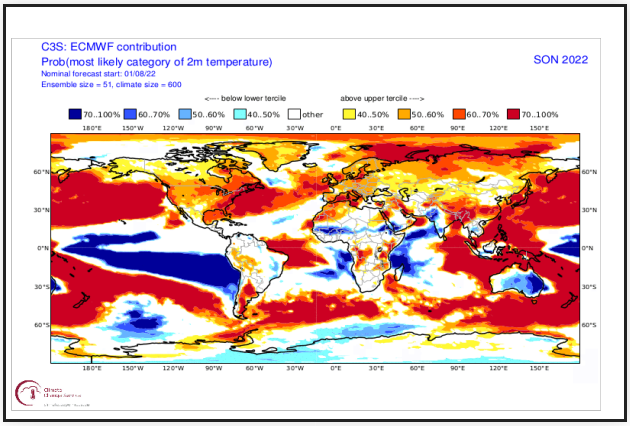
Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S8 (left) and SEAS5 (right).

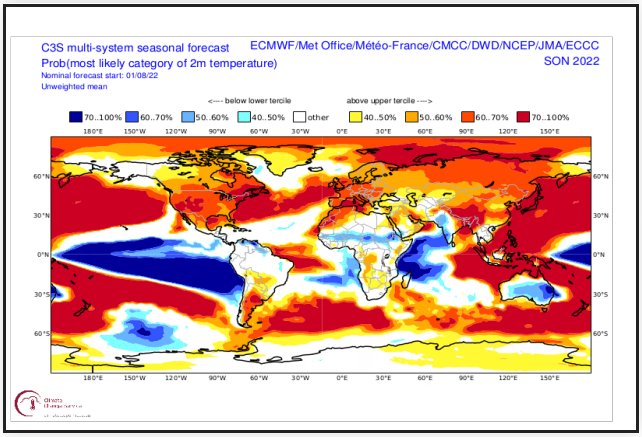
Forecast of climatic parameters : Temperature probabilities

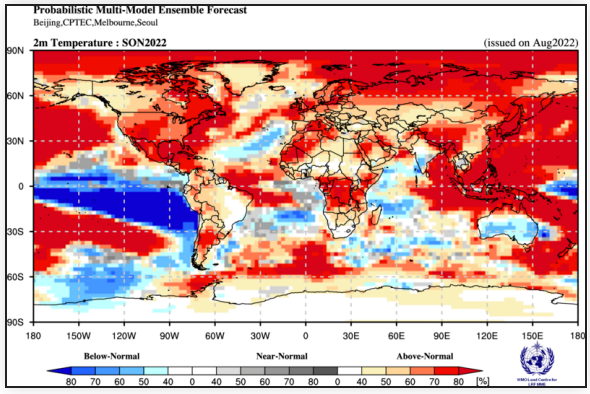
Good agreement between models, both in the intertropics and in the mid-latitudes.

In MF-S8, the probabilities for the warm scenario are higher than the other models in the tropical Atlantic and over Africa





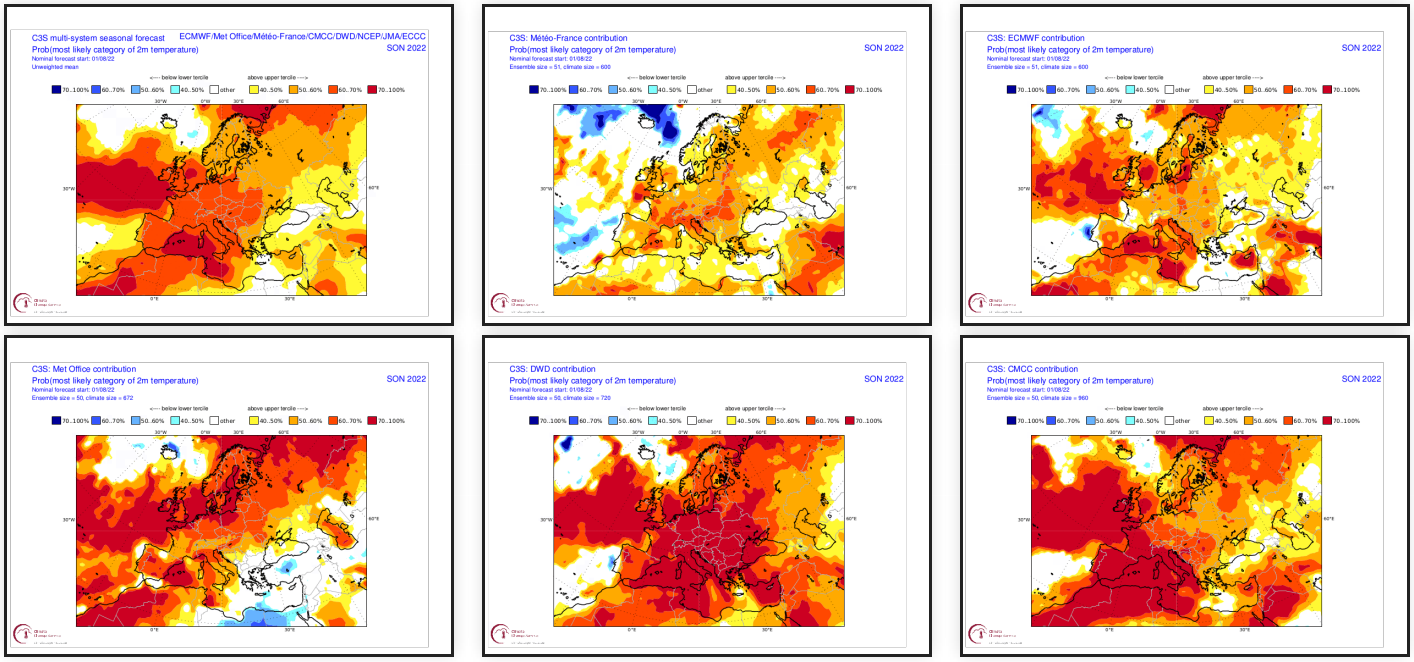




2m temperature probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

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

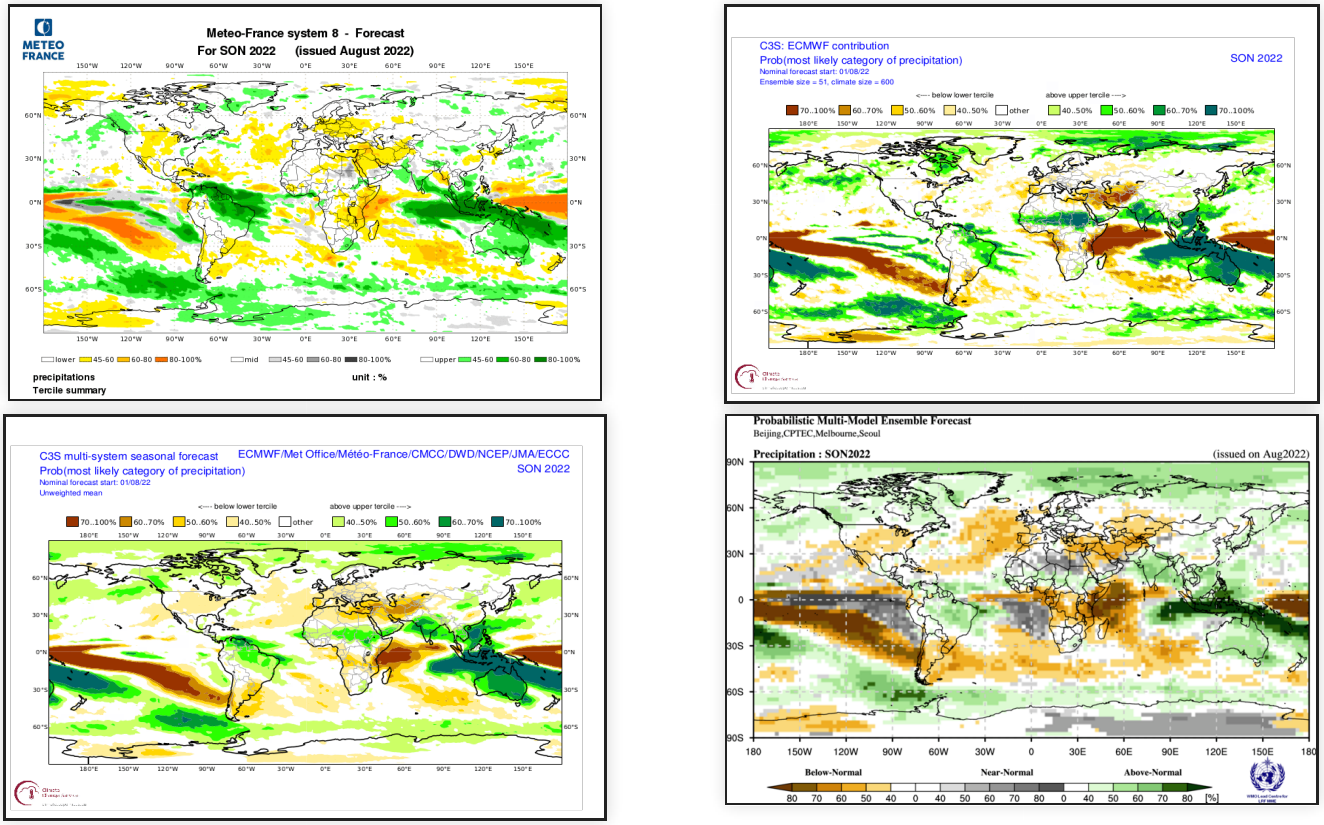
Over Western Europe and western North Africa, the probability of being in the upper tercile is high (>60%) in most of the models, in connection with the predominence of anticyclonic conditions. Conversely, due to a relative low in geopotential over the eastern part of the Mediterranean basin, the warm signal is weaker (or even absent) in this region.



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

Forecast of climatic parameters : Precipitation

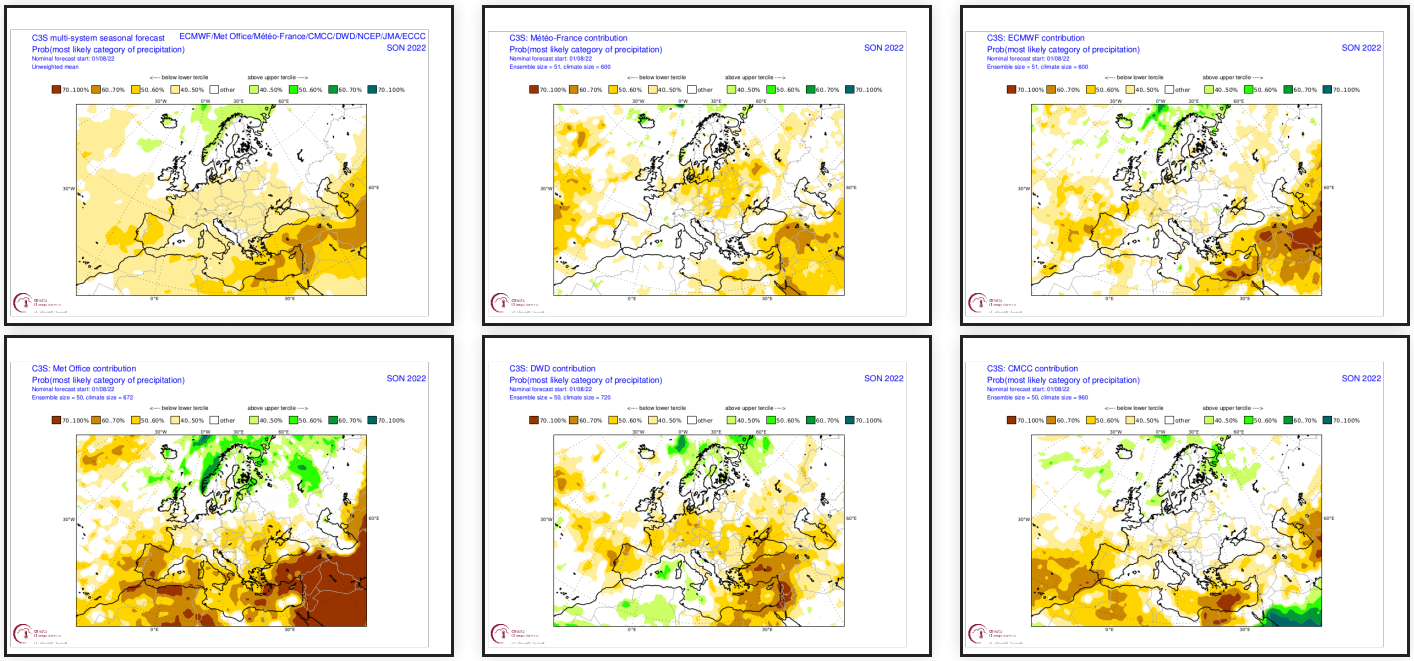
Strong and concordant signal in the tropics, except in the Atlantic and over western Africa.
In mid-latitudes, weak signal but in good agreement over North America. The stronger signal concerns Middle East : relatively high probabilities for dry conditions, consistent with the teleconnexion from IOD.



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

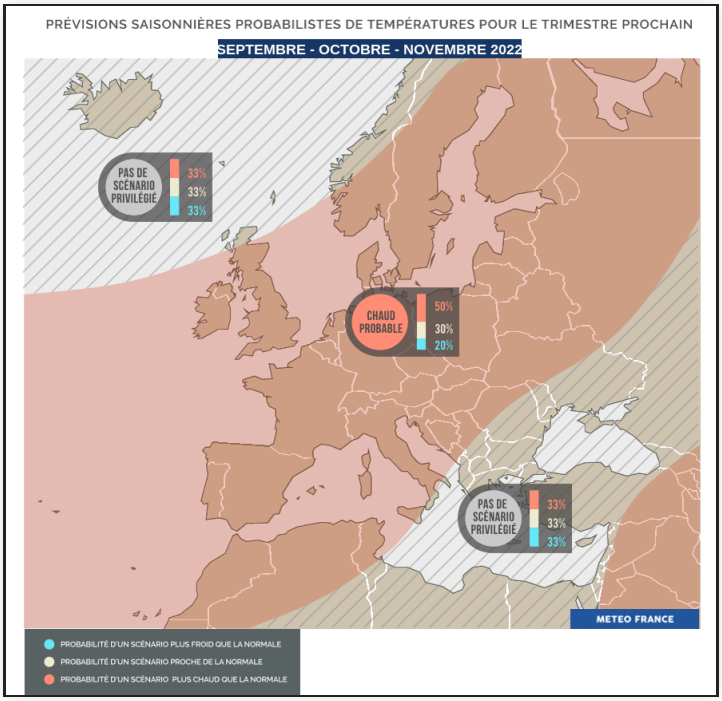
Only the dry signal over the Near East has a good consensus between the models.
Elsewhere, the models sometimes show significant differences. However, three of the main models (MF-S8, ECMWF-SAE5 and DWD) show a significant dry signal from France to Central Europe (impact of the NAO+ mode of variability).



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

Synthesis map for Europe : Temperature

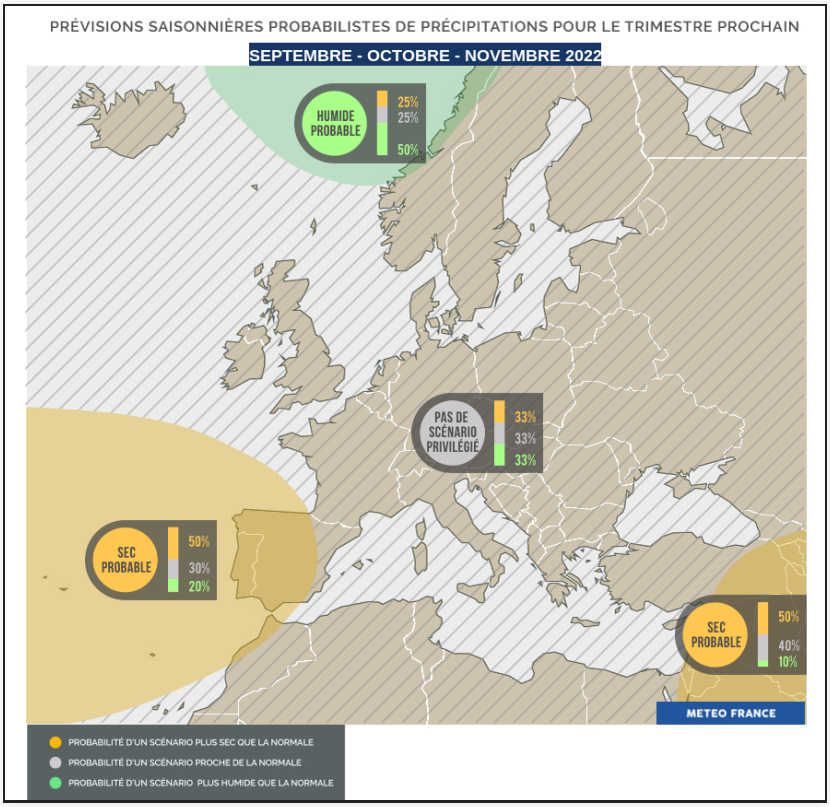
Almost all models priviledge the warm tercile over Europe. This is consistent with more anticyclonic conditions than usual (the disturbed flow is shifted north), but it also includes the effect of climate warming. In the south eastern part of the domain (including eastern Mediterranean sea), there seems to be be more uncertainties.



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

Synthesis map for Europe : Precipitation

No clear agreement between models for precipitations, which explains the lack of signal in a large part of the domain. We choose to keep a dry signal over the Iberian peninsula (positive anomalies in MSLP) and over Middle East (positive Z500 and MSLP anomalies, in link with IOD teleconnexion).and a wet signal over the Norway's coasts (north shift of the disturbed flow)



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