Météo-France Seasonal Forecast Bulletin

NOVEMBER -DECEMBER - JANUARY 2021/22

Table of Content

General synthesis : NDJ 2021/22

A new "La Nina" event is developping during the next quarter, while the negative phase of the IOD decreases. On the equatorial Atlantic, the strong positive SST anomaly is weakening and coming back to neutral conditions. The impacts of these forcings in terms of large scale circulation (see VP/SF 200 hPa or MSLP) are visible in all the models in the tropics. In the Northern Hemisphere, teleconnections are also well planned, both in the Pacific and in the Atlantic

A) Oceanic forecast :

- ENSO : new La Niña event

- IOD : weakening negative phase

- Equatorial Atlantic : decreasing positive anomaly

B) Drivers :

Except oceanic forcings listed above, another driver is identified : the QBO eastern phase, which increases the possibility of a SSW.

C) Atmospheric circulation :

- over the North Atlantic and Europe : despite the great teleconnections, the Atlantic ridge regime is not forecasted by all the models. On the other hand, positive Z500 and MLSP anomalies on the East of the Mediterranean Basin are predicted by models.

D) Most likely conditions :

- over Europe and the Mediterranean Basin :

Warm tercile privileged over the Mediterranean Basin, North of Africa and Middle East .

Dry tercile is privileged in the South-Eastern part of the domain.

Warm and wet tercile is privileged in the North-East of the domain.

Next bulletin : scheduled on November 19th

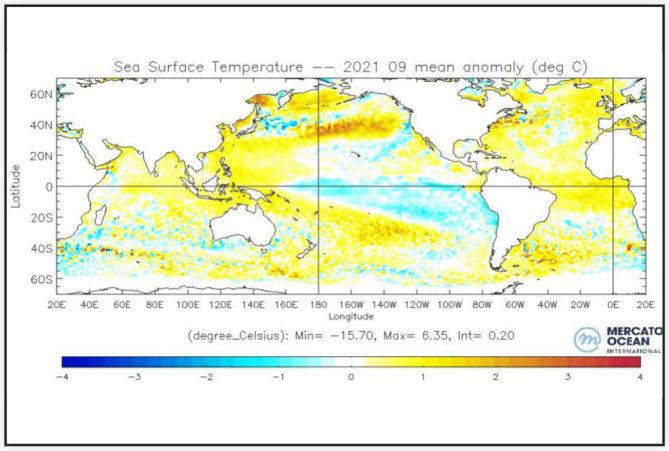
Oceanic analysis of September 2021 : SST anomalies

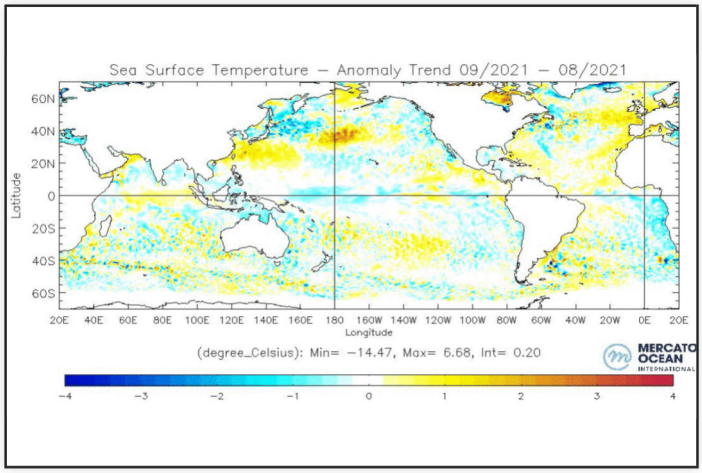
Current ENSO situation : neutral conditions

In the Pacific Ocean : the cold anomaly over the Central Pacific is expanding but remains weak. Over the North Pacific, the warm anomaly is strengthening again in its central part.

In the Indian Ocean : slight warm anomalies from India to the Maritime Continent, and near normal to the west.

In the Atlantic Ocean : the strong positive anomaly along the equator is weakening. In the Northern hemisphere, the East-West contrast attenuates and leads to a warm anomaly over the whole of the North Atlantic

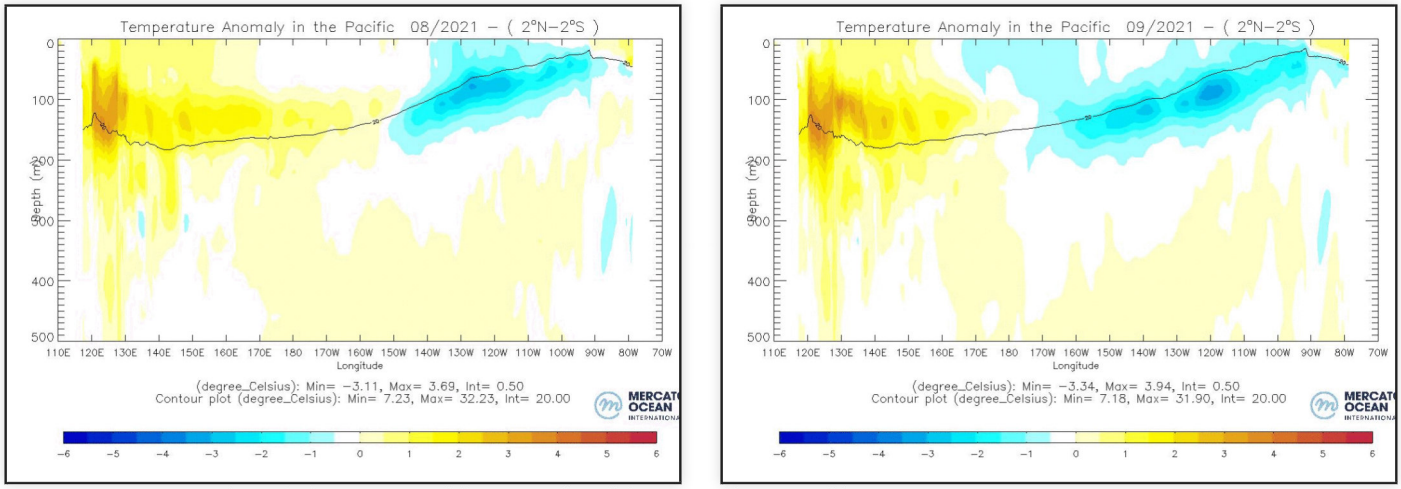




SST Anomalies and trend with the previous month (c) Mercator-Ocean

Oceanic analysis of September 2021 : Pacific vertical section

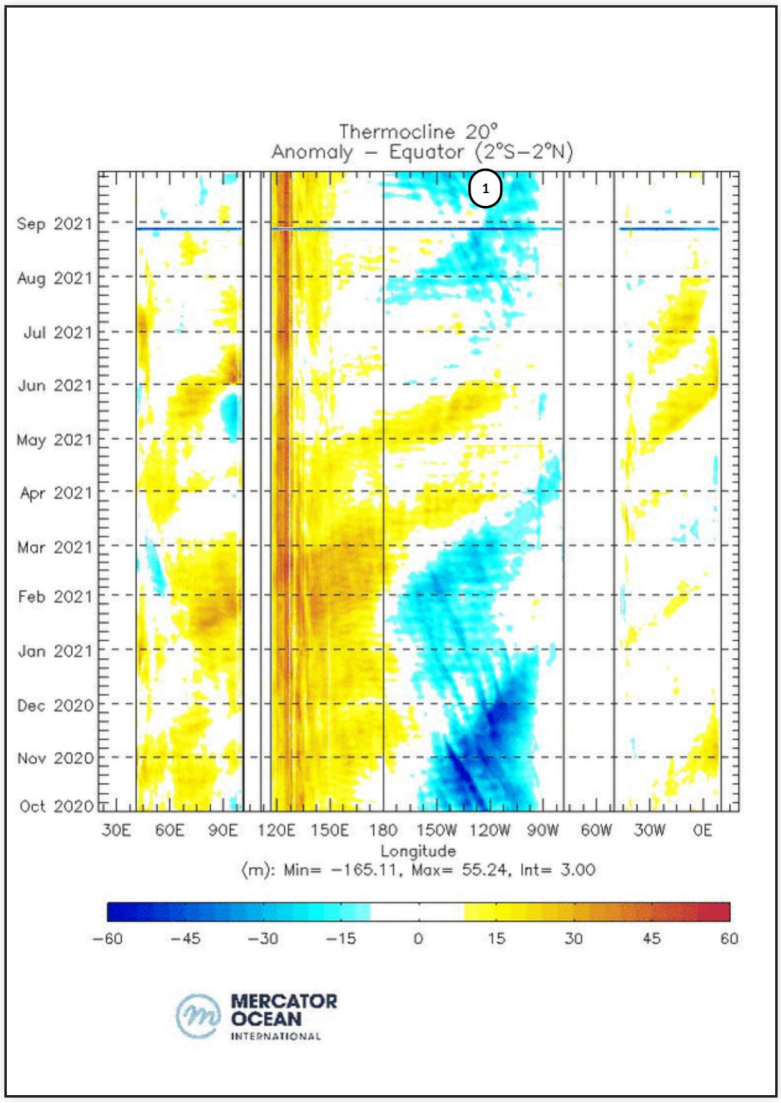
In subsurface, the cold anomaly extends towards the center of the basin.



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

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

In the Pacific Ocean, the East-West contrast seems to be setting up.



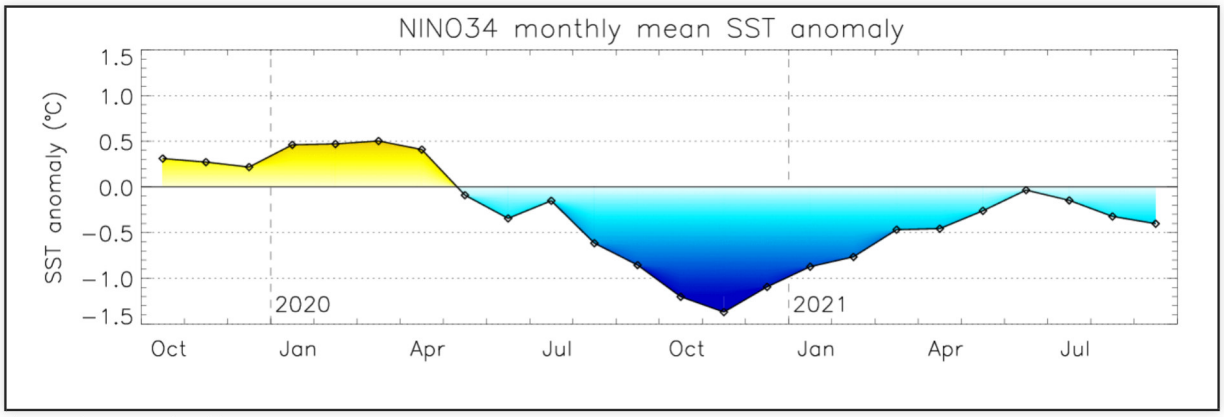
Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 ° C isotherm) (c) Mercator-Ocean

1 - Reemergence of the thermocline on the eastern Pacific

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

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : near - 0.5°C
(see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png)

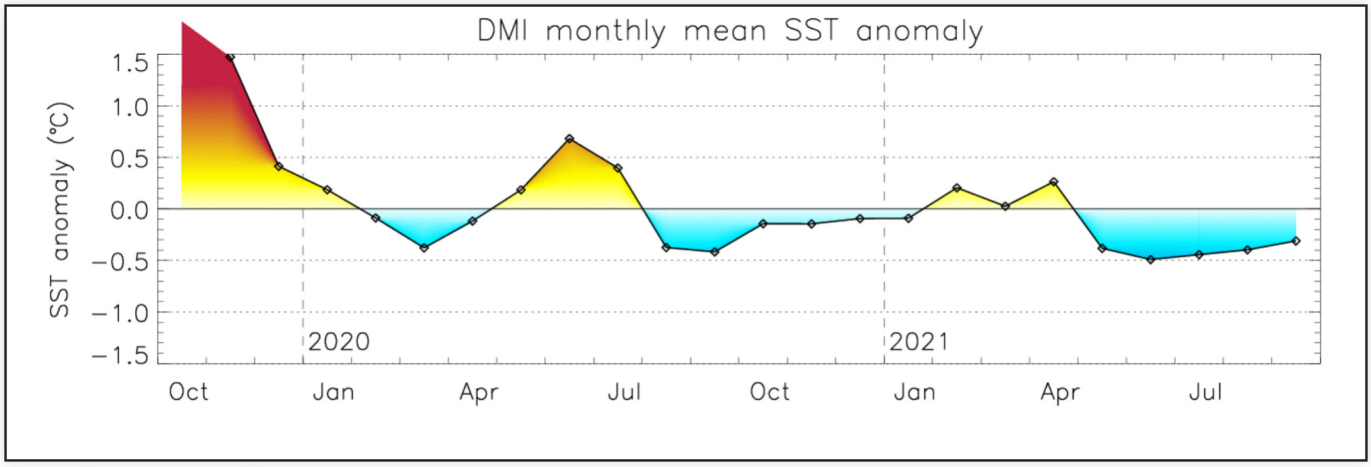
Slow decline in the index.



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

Oceanic analysis of September 2021 : Indien Ocean - DMI index history

DMI Index issued from Mercator Ocean PSYV4R2 analysis : -0.5 °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

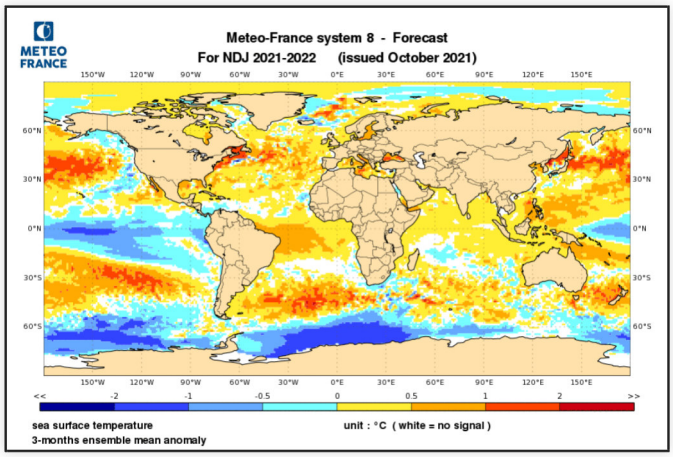
Oceanic forecast : SST anomaly

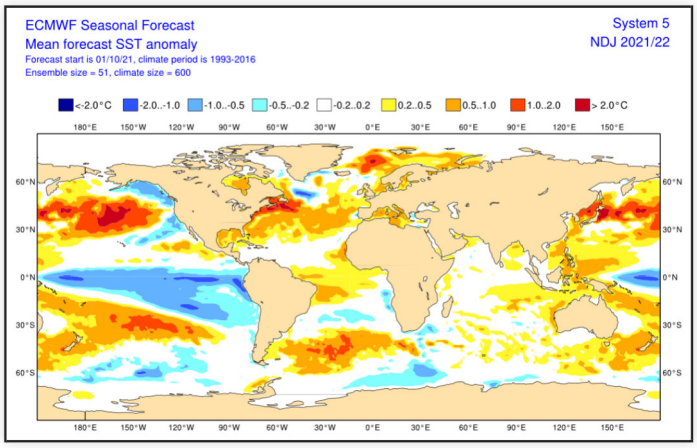
Good agreement between MF-S8 and ECMWF-SEAS5 in all oceans.

In the Pacific Ocean : the cold anomaly pattern confirms the setting up of a "la Niña" phenomenon. Good agreement on the warm anomaly patterns in mid-latitudes (Northern and Southern hemisphere).

In the Indian Ocean : No more marked contrast between the east and west of the basin.

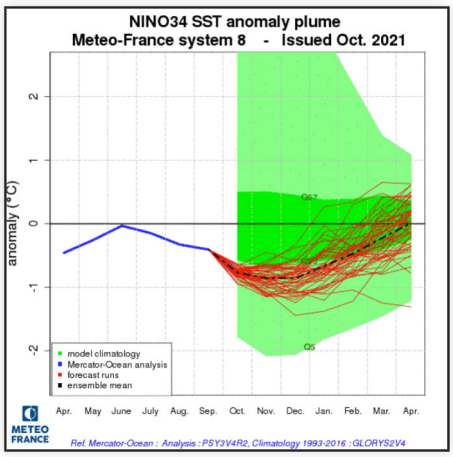
In the Atlantic Ocean : The large and strong warm anomaly along the equator is weakening. In mid-latitudes, the eastern part of the basin, from Europe to North Africa, is warming.

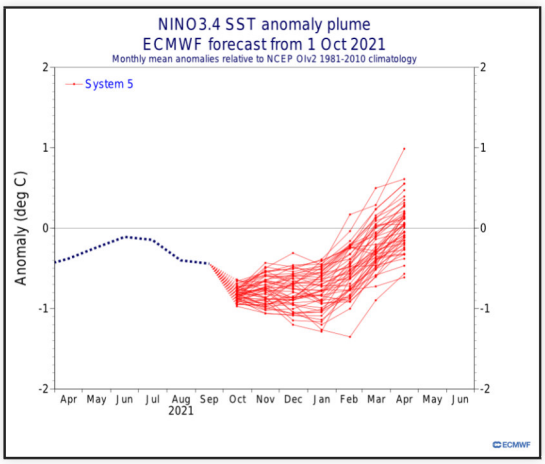




Oceanic forecast : NINO3.4 Plume diagrams

ECMWF-SEAS5 and MF-S8 : the two models are very close. They both forecast a cooling trend in the next months and "La Niña" conditions.



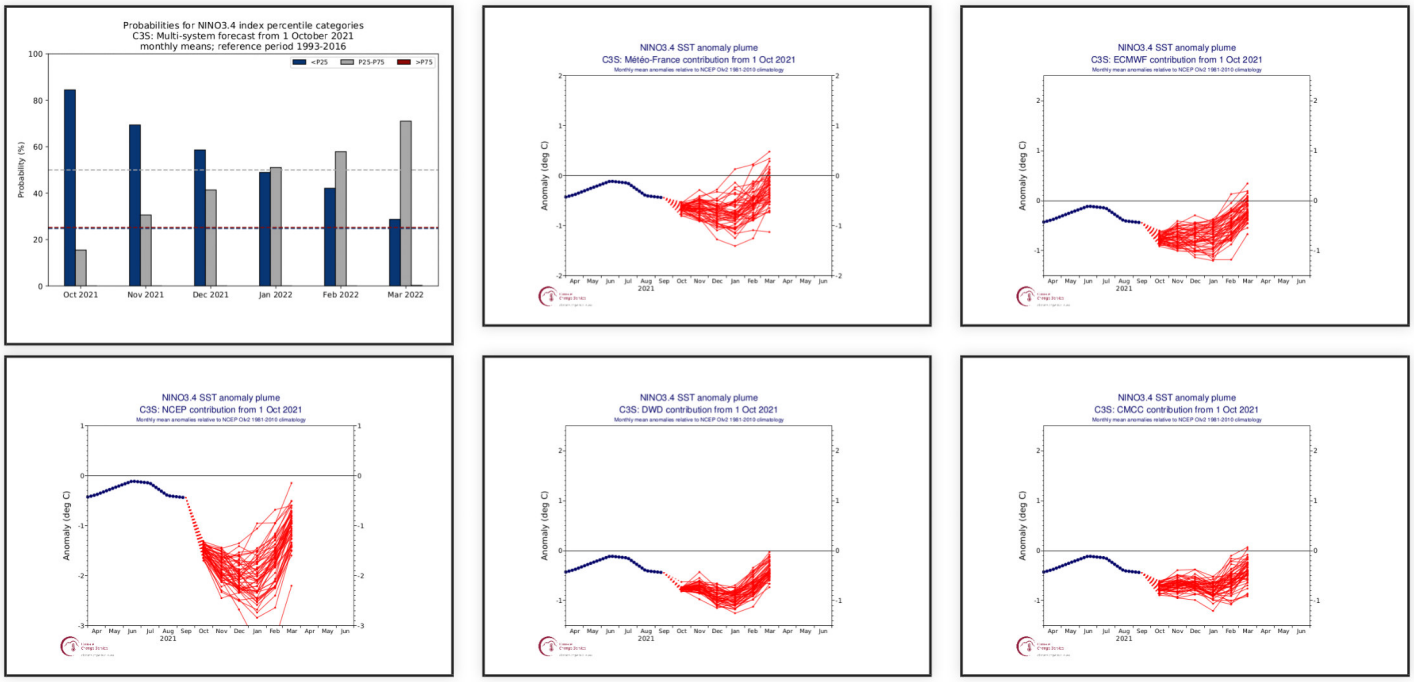


Oceanic forecast : C3S Nino3.4 re-scaled plume diagrams

All the models agree on negative conditions. Only one model (NCEP) seems to evolve toward a moderate to strong La Nina event.

Because of the SST pattern in the Pacific, and despite the Nino3.4 probability forecast emphasises a neutral phase (see barplots on top left),

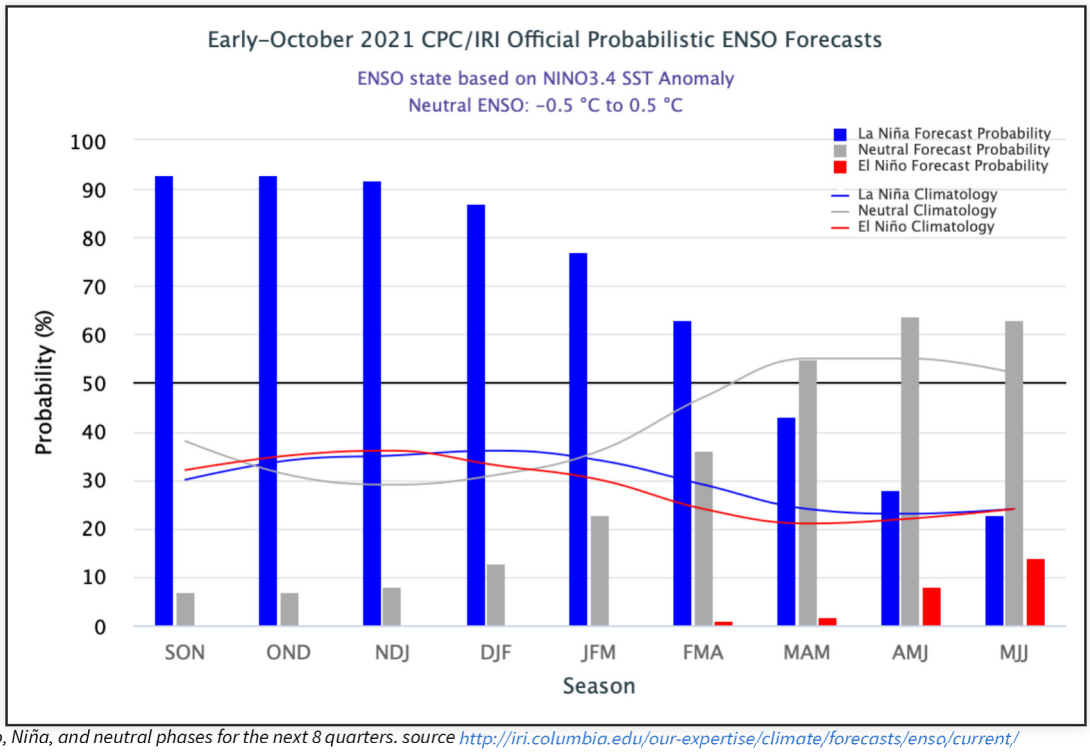
The most likely phase for the next three months : weak La Niña.



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

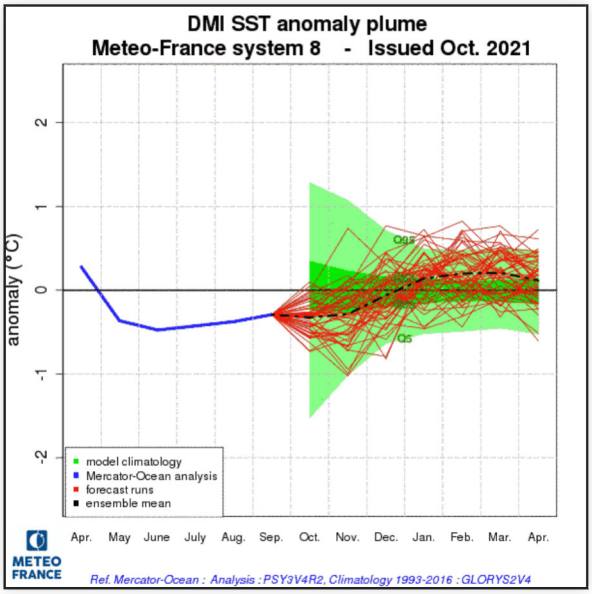
For IRI, "La Nina" is the most likely phase for the next quarter

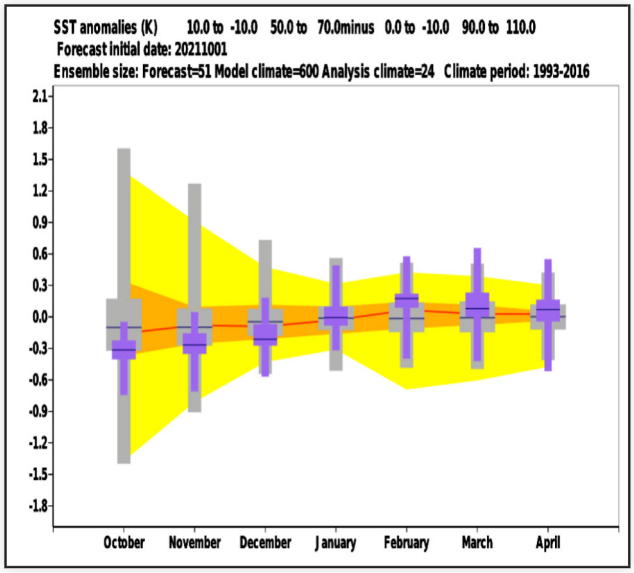


Probability of Niño, Niña, and neutral phases for the next 8 quarters. source http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

Oceanic forecast : Indian ocean - DMI evolution

Good agreement for a gradual return to normal conditions at the end of the quarter.



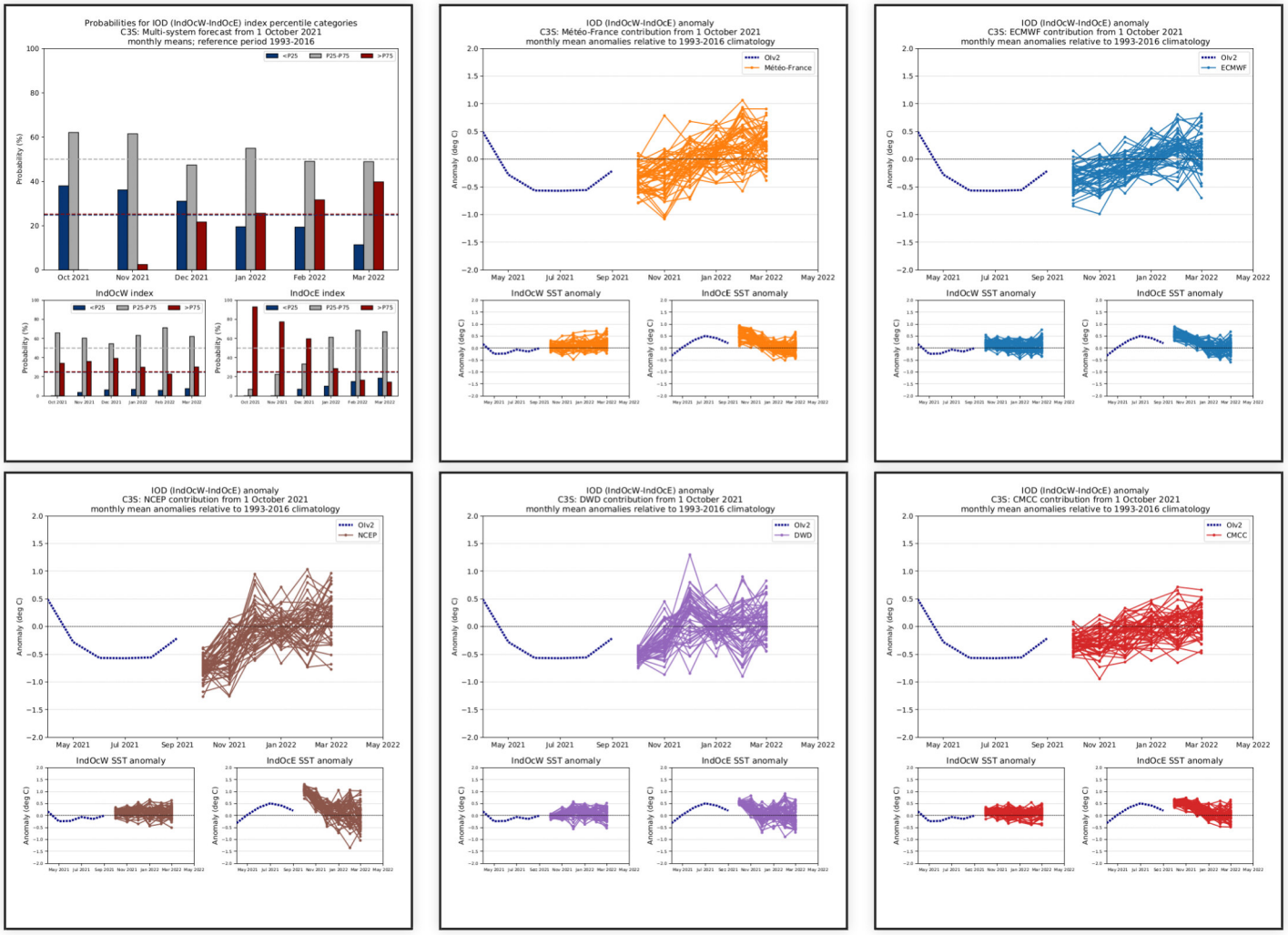


DMI index : analysis, forecasts and model climatology with MF-S7 on the left and ECM-SEAS5 on the right

Oceanic forecast : C3S IOD re-scaled plume diagrams

Good agreement between C3S models for a gradual return to normal values of the Indian Ocean Dipole.

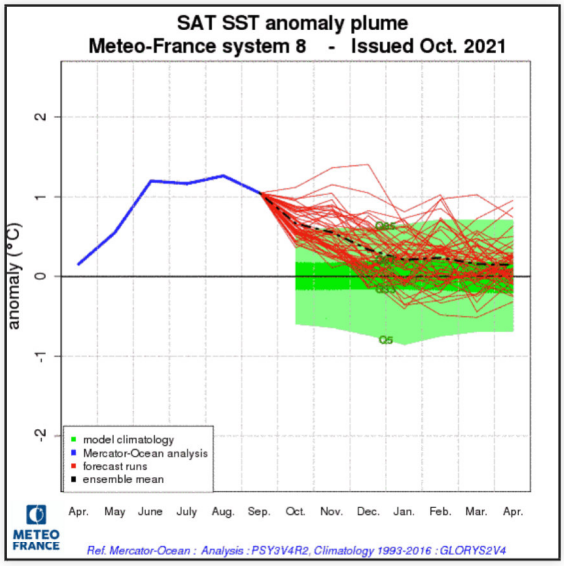
Expected Phase for the next three months : negative with return to neutral values.

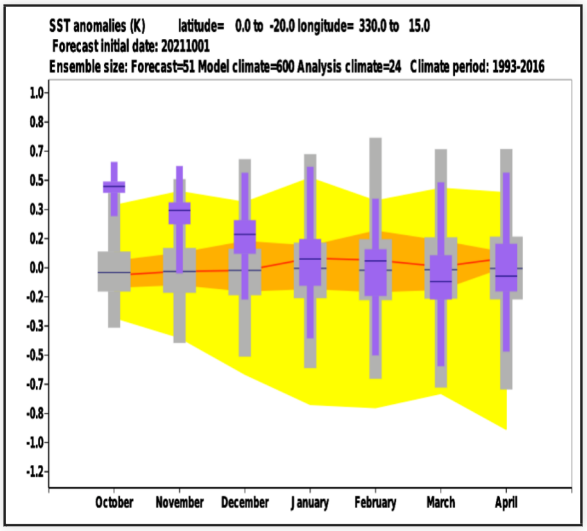


C3S multi-system probabilty forecast (top left figure) and C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010.

Oceanic forecast : Atlantic ocean - SAT evolution

The index remains high for both models, but it drops sharply to approach neutral conditions at the end of the quarter.



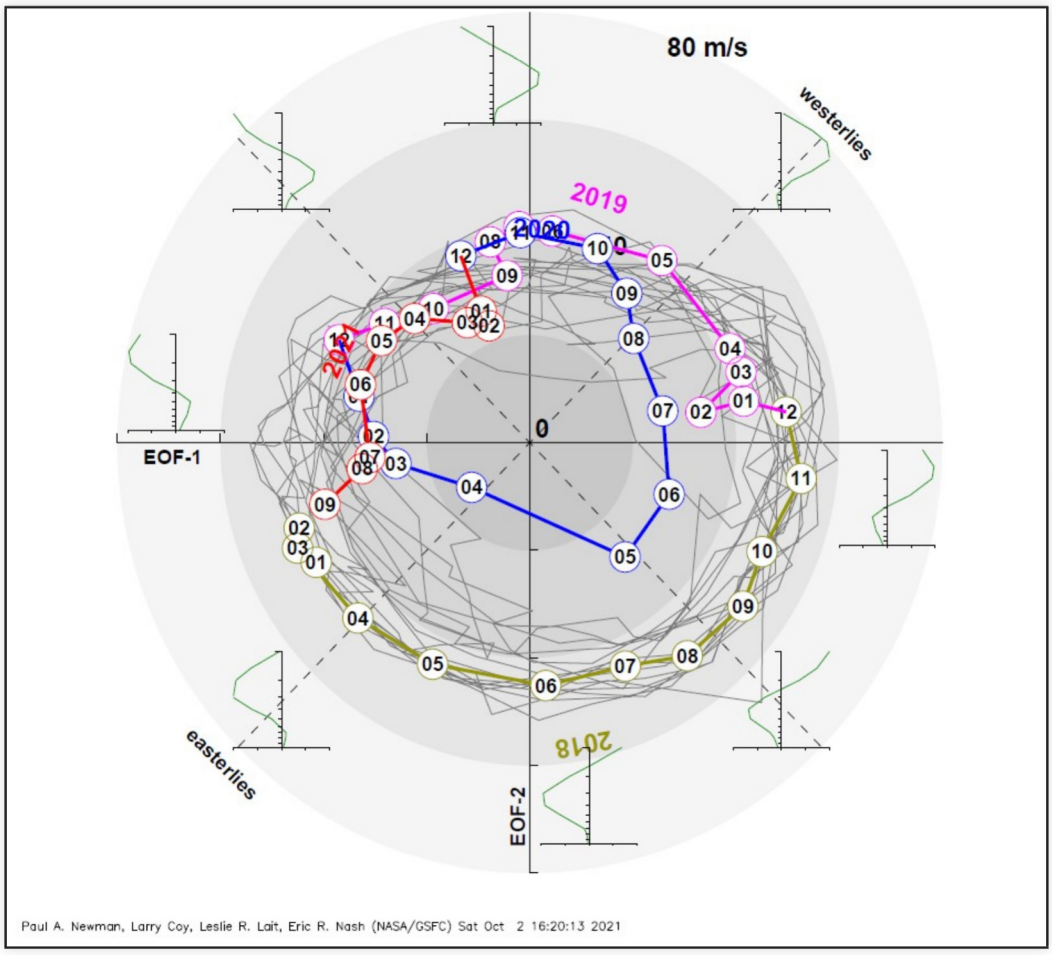


Anomaly on the SAT box : analysis, forecasts and model climatology with MF7 on the left and SEAS5 on the right

Drivers : QBO analysis

The oscillation of the QBO was largely disturbed during the year 2020. It seems to have resumed a more usual rhythm. It has entered an eastern phase since this summer.

This increases the probability of an SSW.



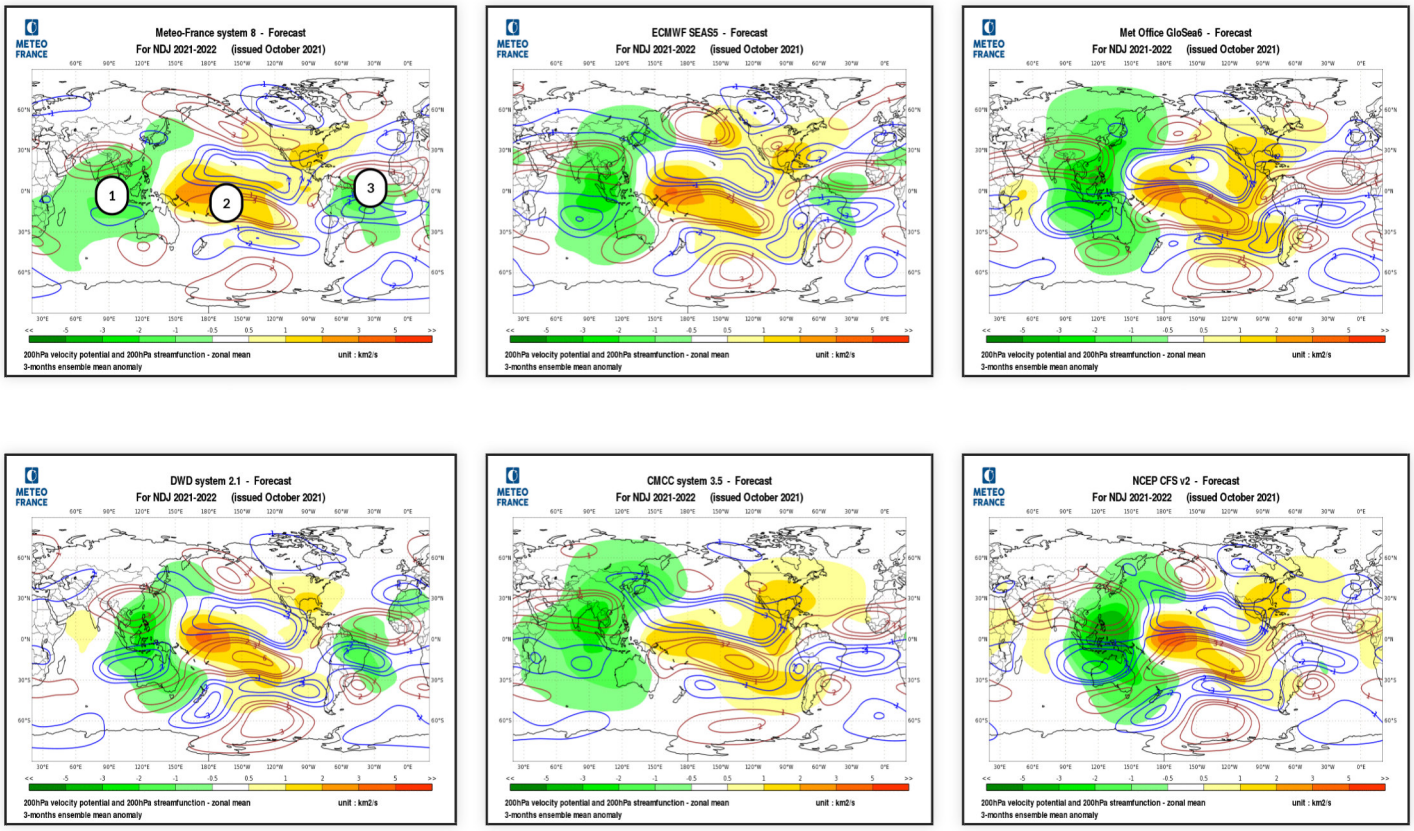
MF-S7 analysis of the zonal component of the wind at 030hPa in May, July, September and November

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

Good agreement between models.

Velocity Potential : clear dipole pattern in the models corresponding to a "La Nina" response : a downward motion anomaly over the Central/East Pacific and an upward motion anomaly over the Maritime Continent extending to the east of the Indian basin. Over Africa and equatorial Atlantic, weak signals : perhaps a negative anomaly (upward anomaly motion) over Atlantic, due to the strong positive SST anomaly, and downward motion on the west of Indian bain and eastern Africa because of the negative phase of IOD.

Streamfunction : clear dipoles on both sides of the equator over each basin. Teleconnexions toward mid-latitudes are clearly predicted by all the models, both in the Pacific Ocean (anticylonic circulation on the northt of the basin) and in the Atlantic Ocean. (cyclonic circulation from Spain to Caribean Isles and anticyclonic circulation south of Greenland).



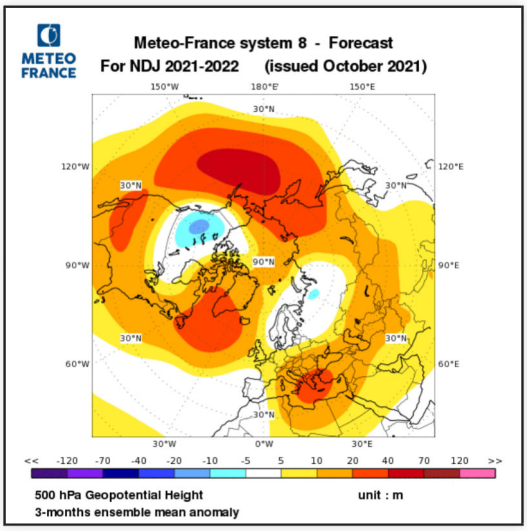
MF8,SEAS5, UKMO, DWD, CMCC and NCEP 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

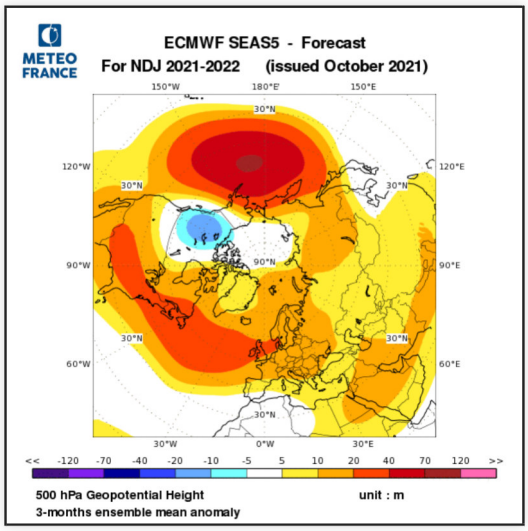
1 - VP : large area of upward motion anomaly
2 - VP : downward motion anomaly related to La Nina and negative IOD
3 - VP : upward motion anomaly in MF-S8 linked to warm SST anomalies

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Postive anomalies are dominant, due to the positive trend induced by global warming.

The anomaly pattern is globally in phase over Pacific. On the other hand, over Europe and Asia, the anomaly structures are different, especially around Scandinavia.





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

Atmospheric circulation forecasts : Z500 anomalies in C3S models

Two large-scale structures are present in most models: the positive anomaly in the north-east Pacific and the positive anomaly in southern Greenland and over the Middle-East.
Cold anomaly near Alaska is predicted by all models. Near europe, models disagree(for example, over Scandinavia)

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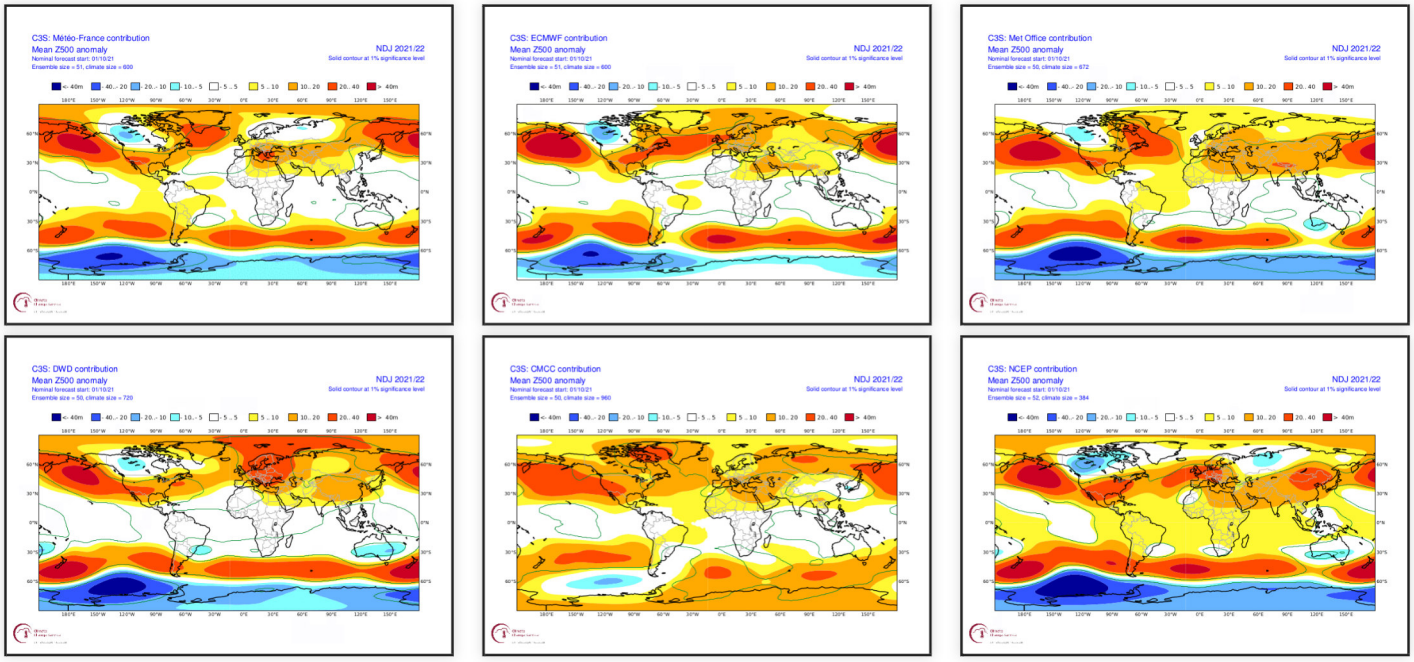
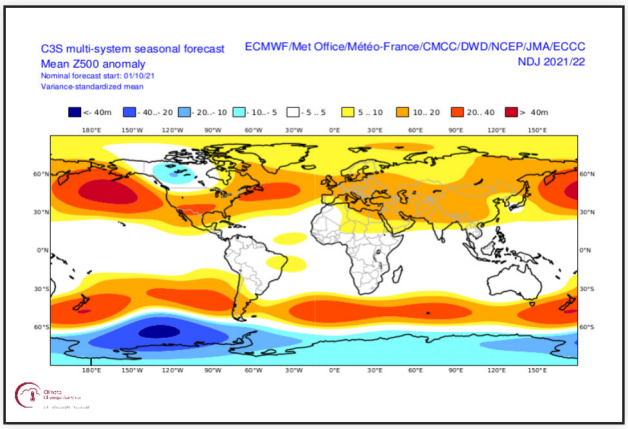


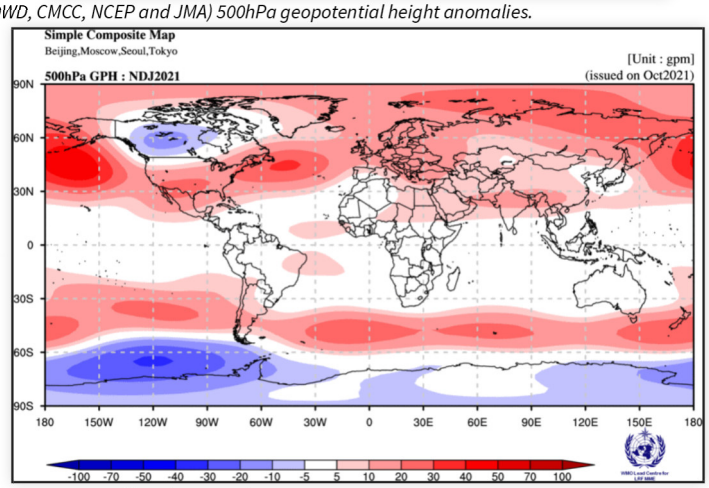
MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies multi-systems

Over North America, a typical PNA- pattern is visible in both multi-model charts. On the Atlantic a positive anomaly is present from off Quebec to Europe, stronger near Quebec.



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

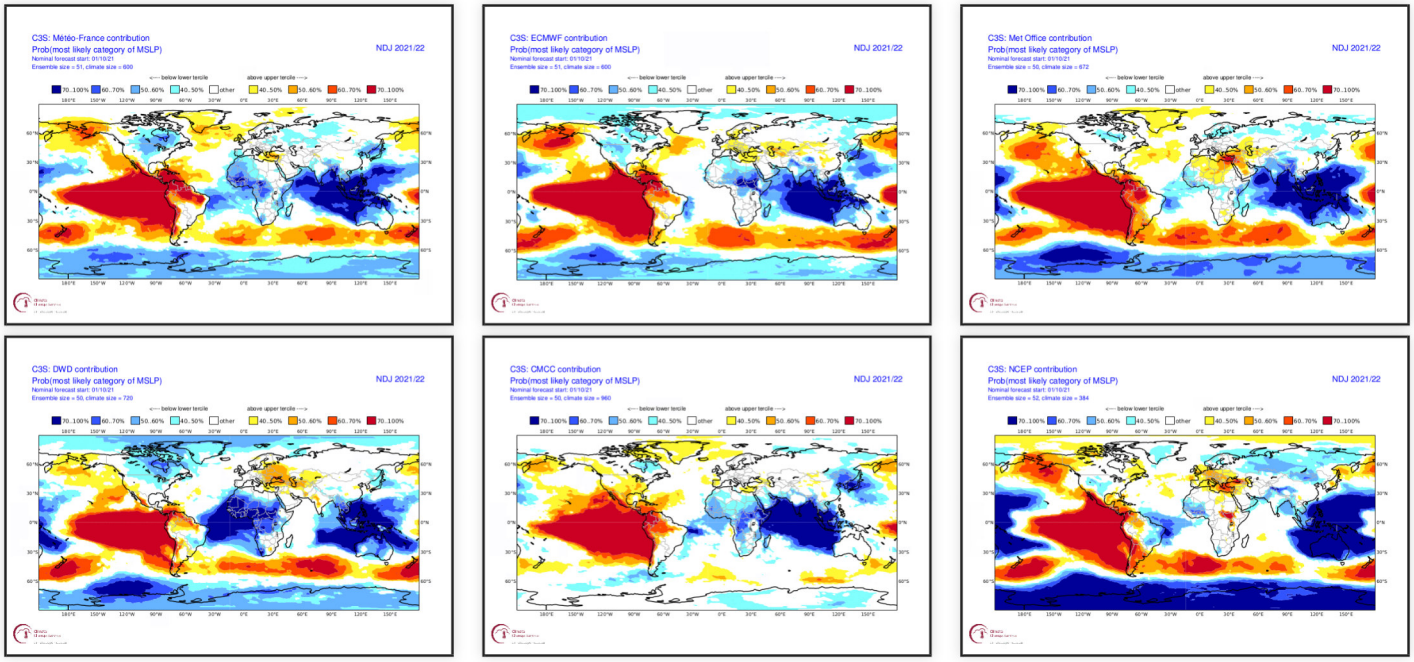


Others models of WMO multi-models 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : MSLP probabilities

Between the Tropics, the signals are clear on the Pacific and the Maritime Continent, in connection with the phenomenon "La Niña". A majority of the models foresee a negative anomaly on West Africa.

In mid-latitudes, most of the models predict the dipole over North America. Over Europe, the signals are weak and models do not agree on the positioning of the positive anomaly, except over the eastern Mediterranean basin.

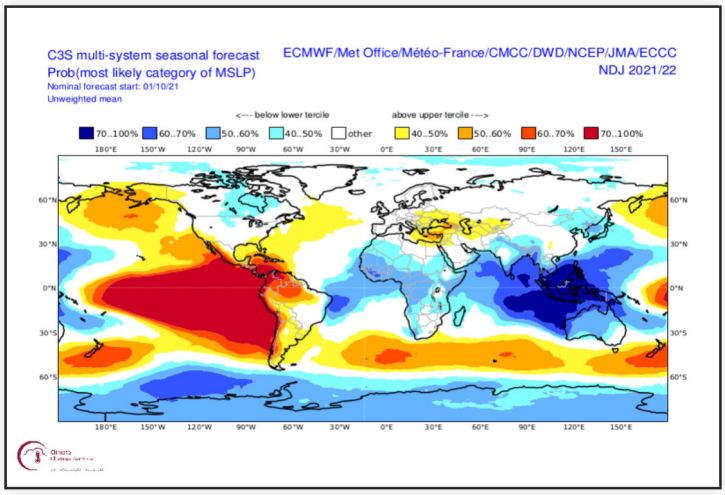


MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP models probability maps.

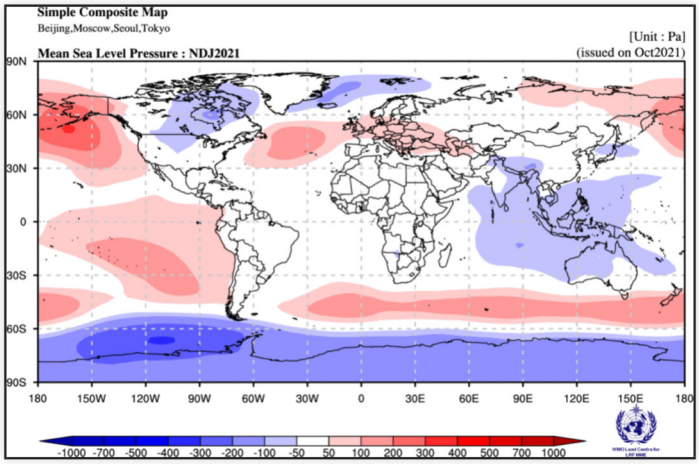
Atmospheric circulation forecasts : MSLP probabilites multi-systems

Very good agreement between the two multi-models in the tropical zone.

In the Northern hemisphere over mid-latitude, good agreement over North America. In North Atlantic, the models agree for a positive anomaly south of Greenland



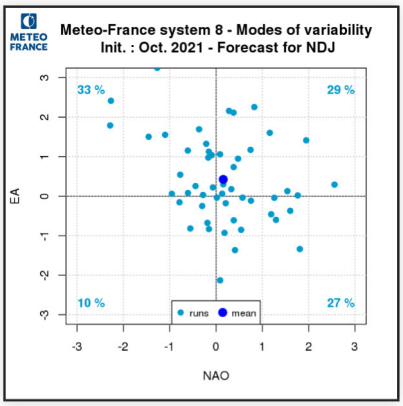
C3S multi-models MSLP terciles probability.

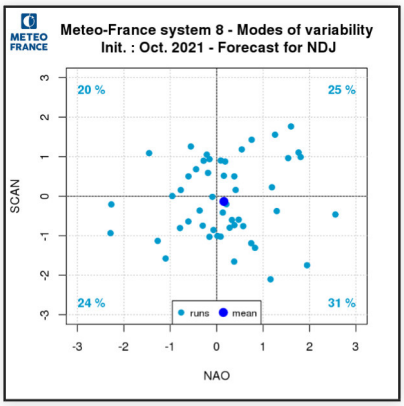


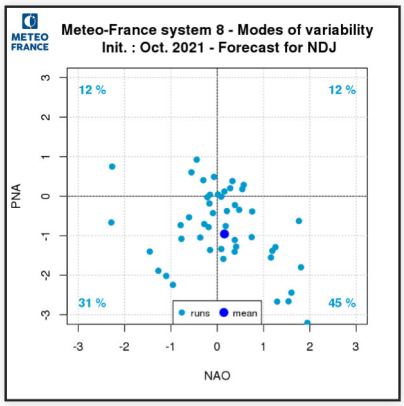
Others models of WMO multi-models MSLP terciles probability.

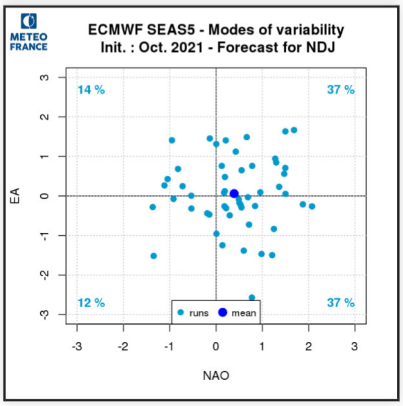
Modes of variability : forecast

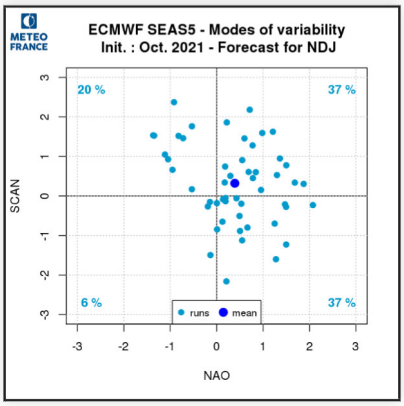
Good confidence in a negative PNA. Positive EA, SCAN et NAO are very weak.

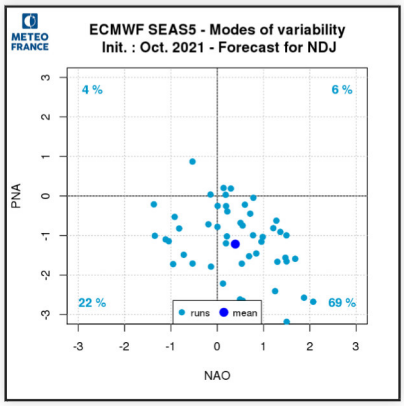








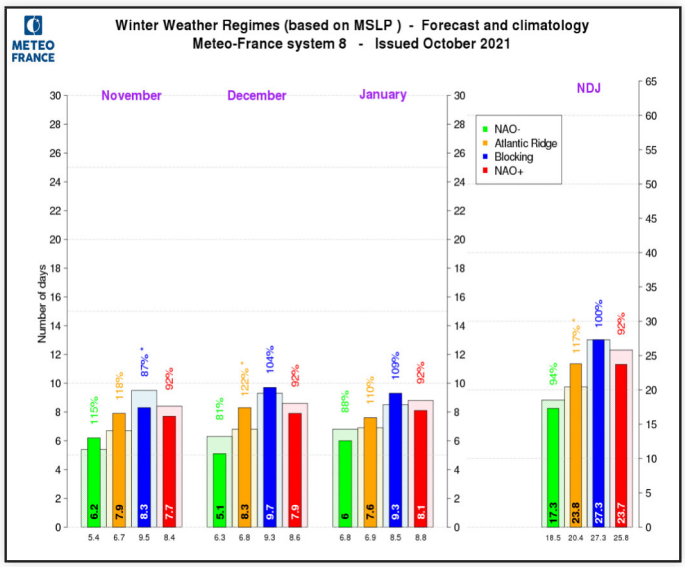


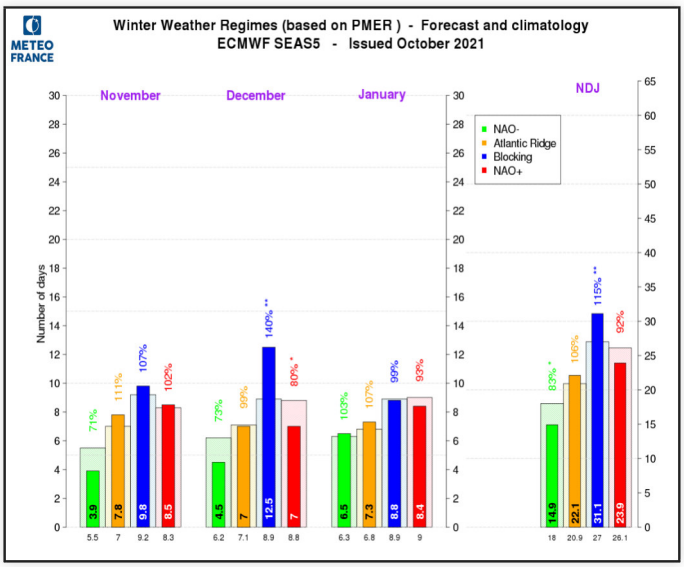


See the modes of variability patterns

Weather regimes : winter MSLP

No clear consensus between the two models. The Atlantic Ridge is more represented compared to climatology with MF-S8. For ECMWF-S5, the more frequent signal concerns the Blocking,especially due to december.

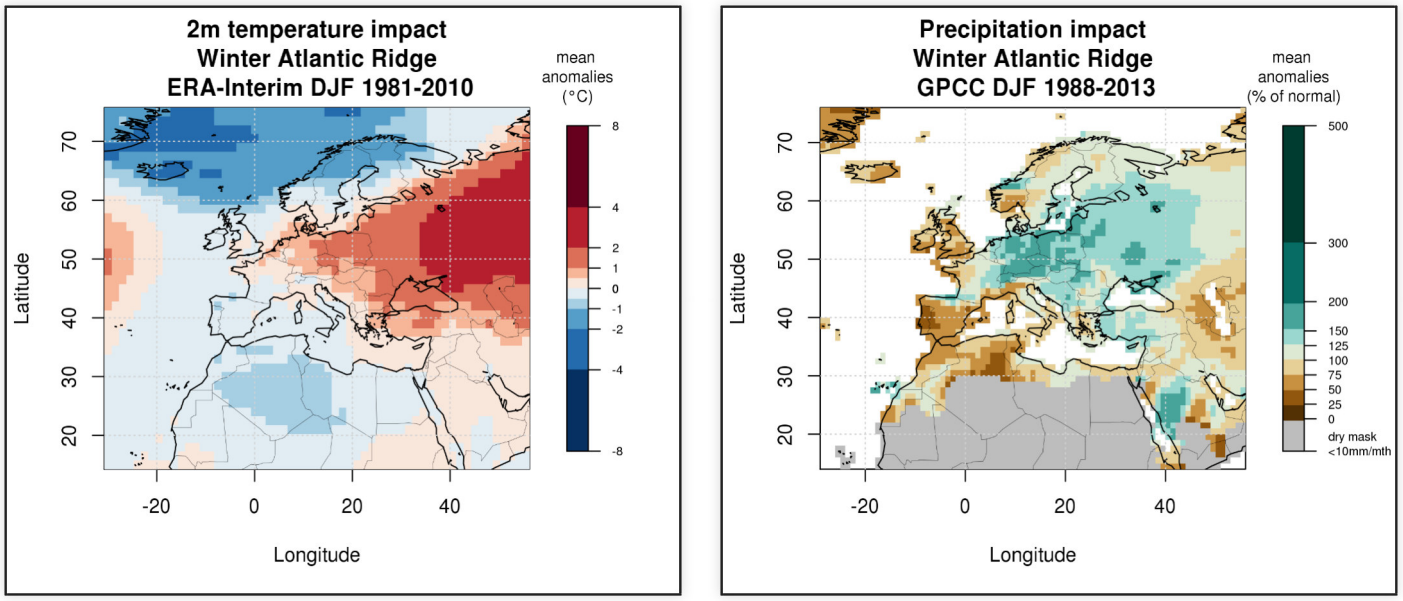




Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF-S8 (left) and SEAS5 (right).

Weather regimes : Impacts

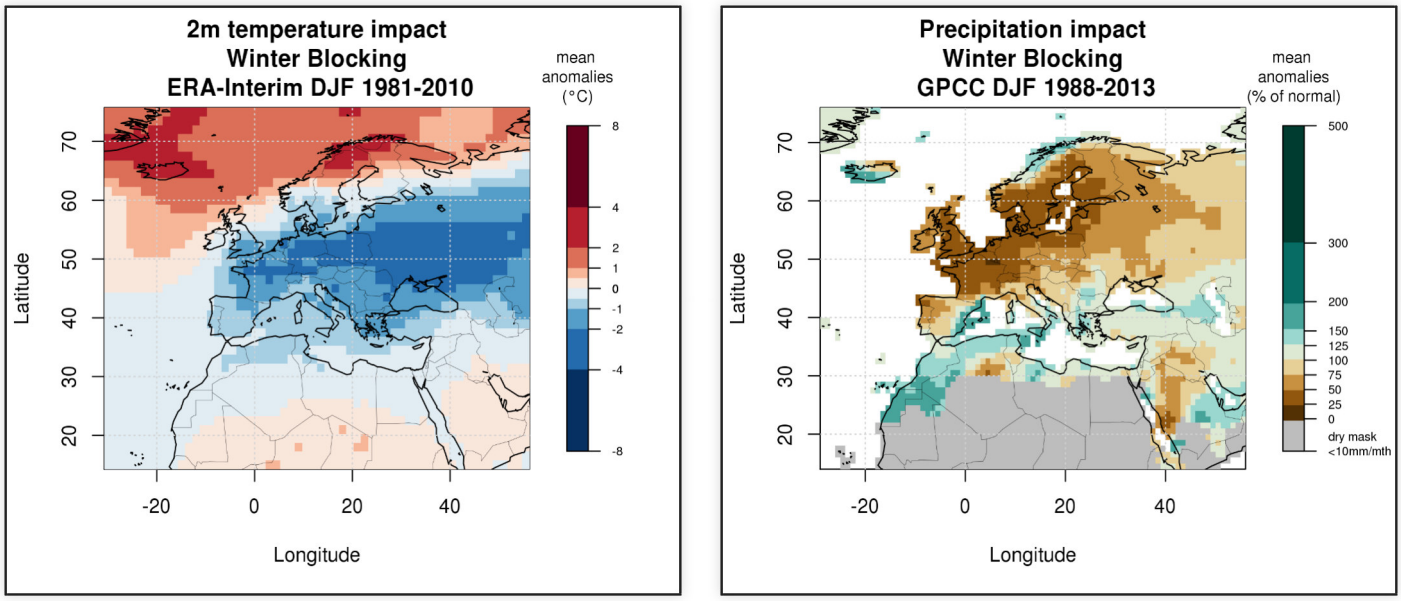
The Atlantic Ridge weather regime should be favored, according to MF-S8, over the quarter.



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

Weather regimes : Impacts

Winter Blocking weather regime should be favored according to ECMWF-S5, over the quarter.



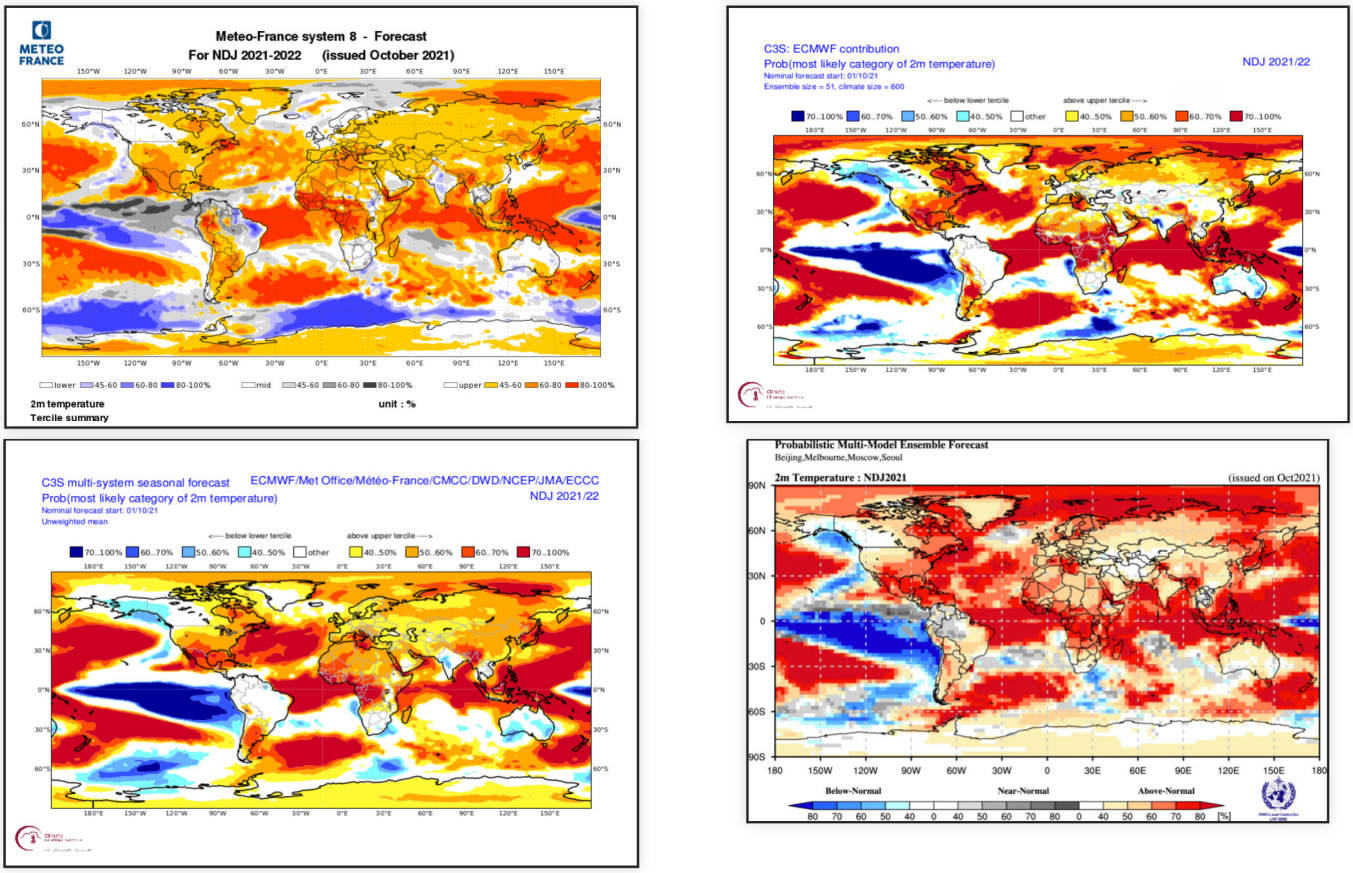
Impact of Summer Blocking weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)

Forecast of climatic parameters : Temperature probabilities

In the tropics, high probability of a warm signal over the Maritime Continent and Equatorial Africa. Anear normal signal is probable in Brazil, South Africa and Australia.

Over North America, good agreement for a fresh signal from Alaska to the Western Canada and a warm one from Quebec to Mexico.

On Eurasia a weaker warm signal emerge, excepted on the Mediterranean Sea.



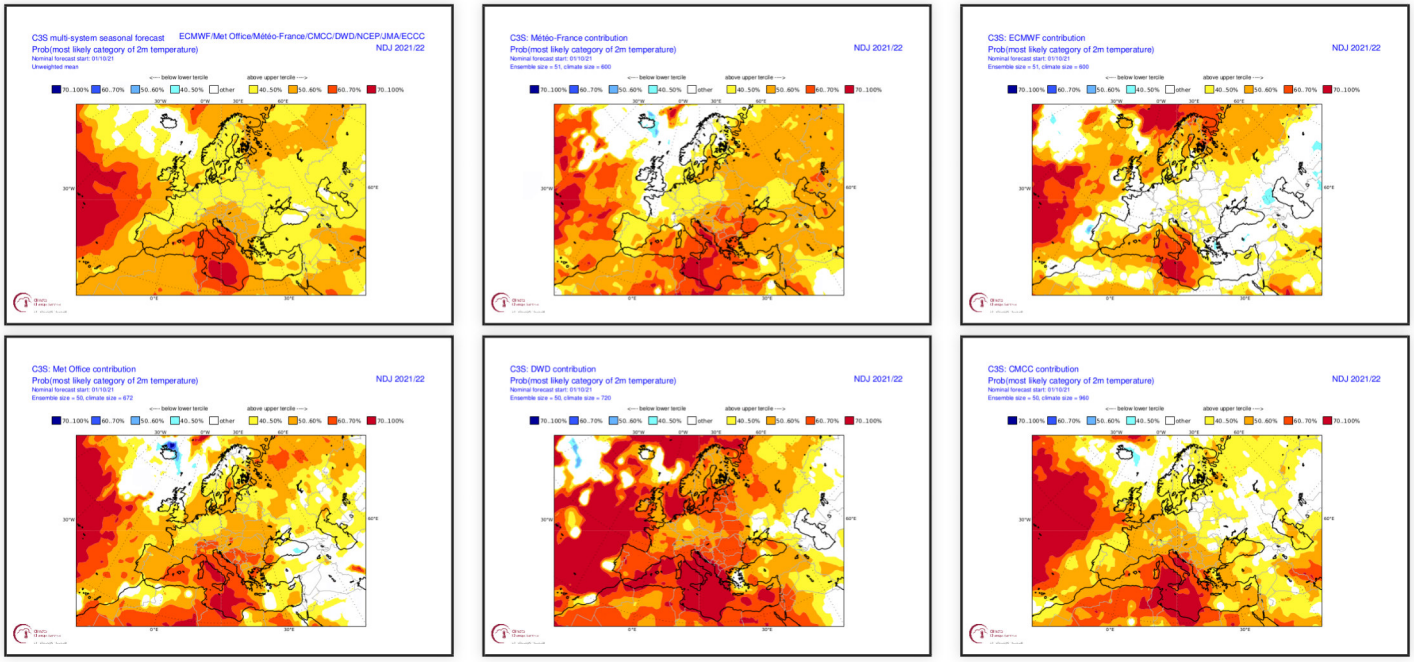
2m temperature probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

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

The impacts of Atlantic Ridge (MF-S8) and Blocking (ECMWF-S5) regimes are hardly noticeable.

The only agreement between the models: a warmer-than-normal scenario very likely over the central part of the Mediterranean basin and an overall warmer-than-normal trend. This phenomenon may be linked to the positive Z500 and MLSP anomalies which could generate southern winds and a warm trend over the central Mediterranean basin.

A warmer than normal signal is possible over the north of the domain, according to several models and to the mutli-models map.

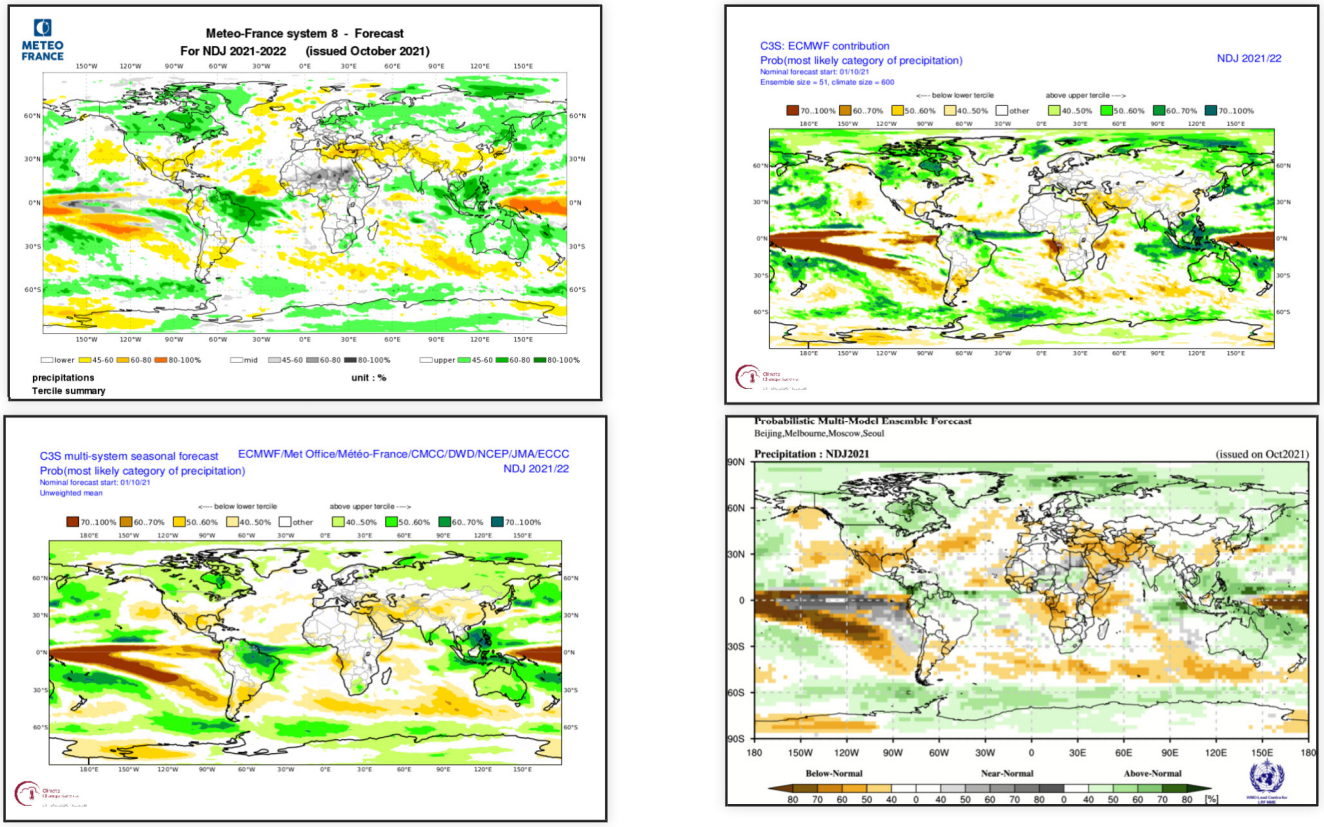


C3S multi-models probability map (top left) and MF-S8, ECMWF-SEAS5, UKMO , DWD, CMCC models.

Forecast of climatic parameters : Precipitation

Models are consistent all over the world (America, Africa, Asia, the Maritime Continent and Australia).

In Europe, the signal is very weak.



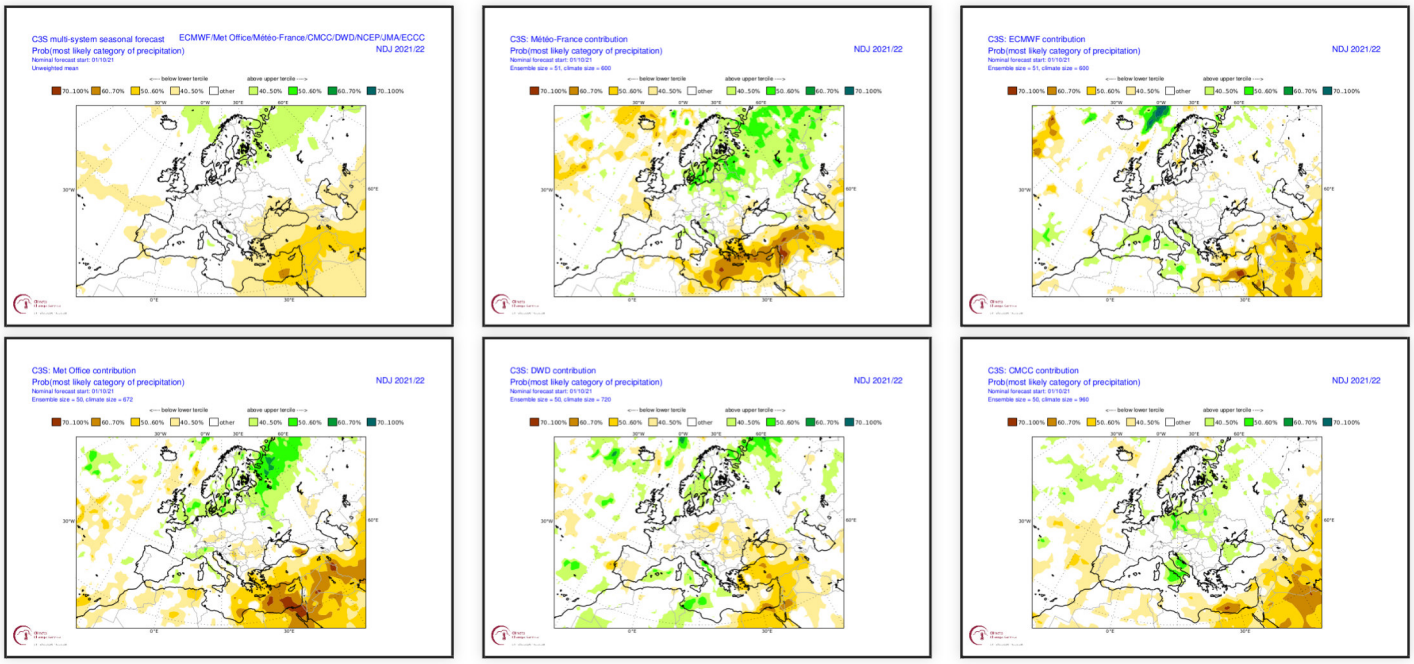
precipitation probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

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

A dry signal is predicted by all the models over the eastern Mediterranean basin, linked with the positive Z500 and MLSP anomalies.

From Scandinavia to Northern Russia, a more humid than normal trend seems to emerge linked with the warmer than normal trend over the same area..

Elsewhere, the signal is very weak.

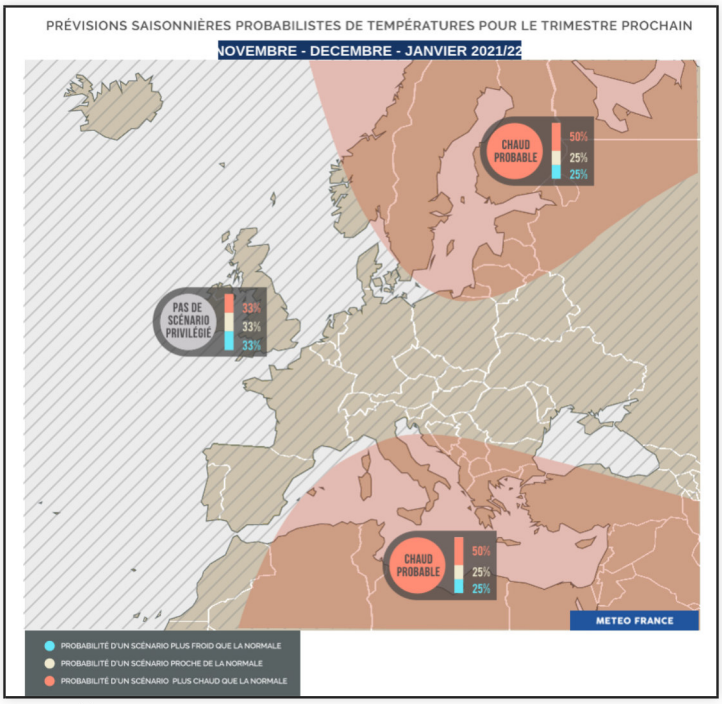


C3S multi-models probability map (top left) and MF-S8, SEAS5, UKMO, DWD, CMCC models.

Synthesis map for Europe : Temperature

As the Atlantic Ridge and the Blocking patterns are difficult to identify, we rely on the multi-model map. The warmer than normal trend from Scandinavia to northern Russia is retained, associated with a wetter trend.

The warm anomaly in the Mediterranean Sea is taken into account.



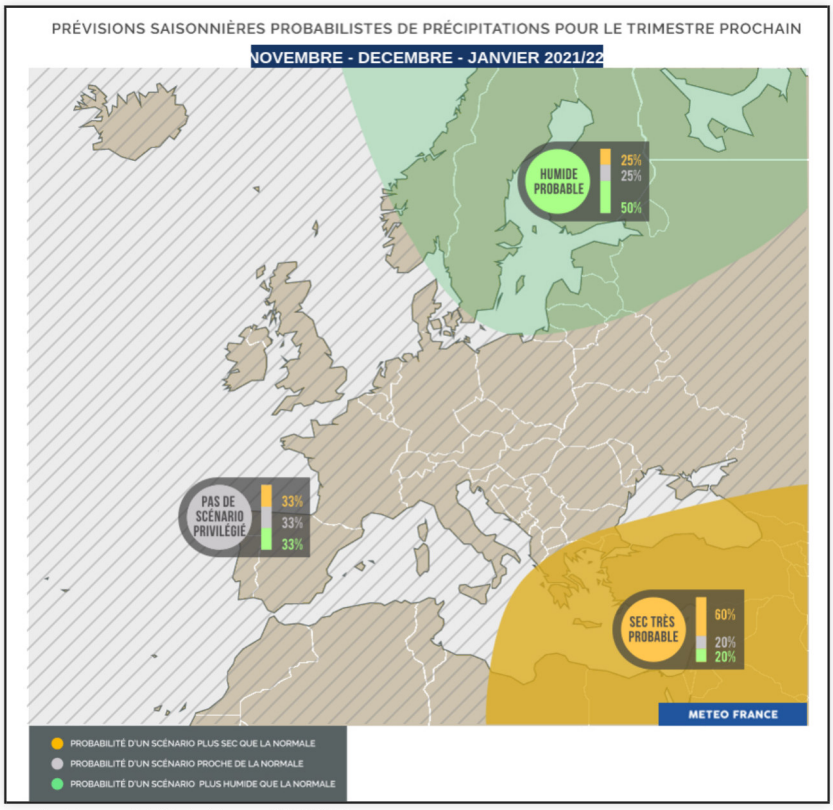
Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS

Synthesis map for Europe : Precipitation

The drier than normal trend from Greece to the Middle East spotted by all models is linked to the positive anomaly in Z500 and MLSP.

Combined with the warmer than normal trend, the wetter than normal trend over Scandinavia and northern Russia is taken into account.

No clear signal elsewere.



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