

Météo-France Seasonal Forecast Bulletin

JANUARY - FEBRUARY - MARCH 2022

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General synthesis : JFM 2022

The "La Nina" event should reach a "moderate" state this winter. 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, models forecast teleconnections both in the Pacific, in the Atlantic and Indian Ocean. This may explain the similarities between the models from the North Atlantic to Europe.

A) Oceanic forecast :

- ENSO : moderate La Niña
- IOD : neutral to positive
- Equatorial Atlantic : positive anomaly concerns the west side

B) Drivers :

- Eastern phase of QBO
- One one models (DWD) suggest a temporary weakening of the polar vortex a the end of december, that could favour a SSW event and negative AO/NAO. This is not confirmed by the last monthly forecasts (GFS, ECMWF)

C) Atmospheric circulation :

The mean JFM circulation (in Z500) is quite well summarized by C3S multi-model forecast, with a stronger zonal gradient over Atlantic (like NAO+ regime) and a positive anomaly centred over Central Europe (like Blocking regime).

D) Most likely conditions :

- **over Europe and the Mediterranean Basin :**

Warm tercile privileged from British Island to Scandinavia. No preferred scenario elsewhere.

Dry tercile is privileged on most European countries . And wet tercile around Scandinavia

Next bulletin : scheduled on January 21th

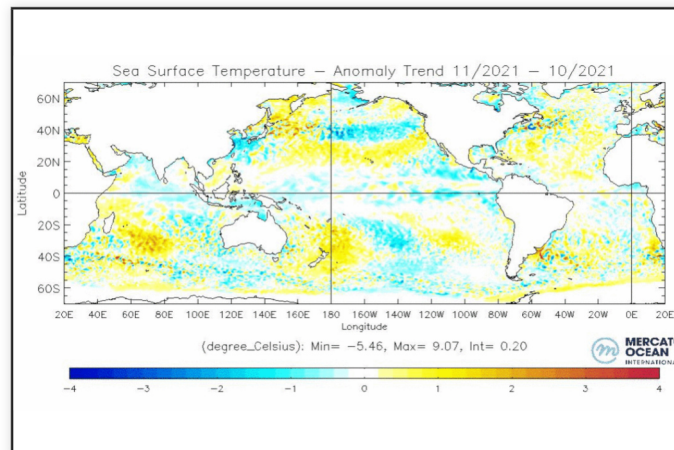
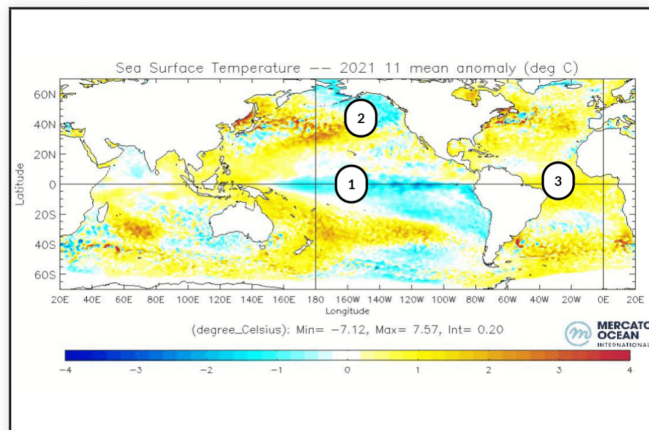
Oceanic analysis of November 2021 : SST anomalies

Current ENSO situation : weak La Niña

In the Pacific Ocean : the cold anomaly in the Central and East Pacific remained marked, the La Niña is well established. Over the North Pacific, the warm anomalies attenuates a little in the center. The anomalies structure look like the PDO- pattern

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 hasn't clearly evolved in November. The North Atlantic Ocean is globally warmer than normal

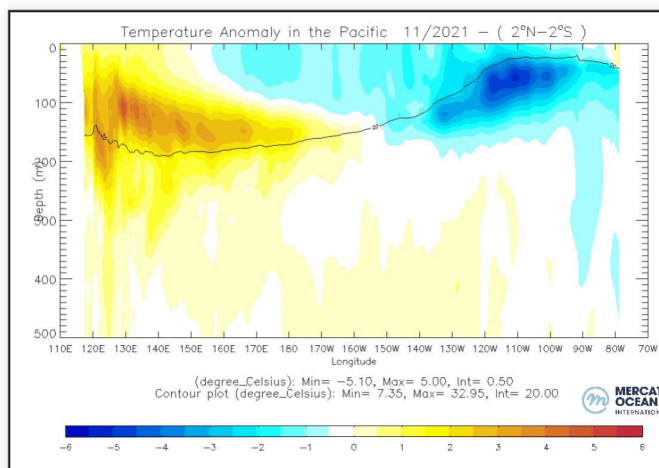
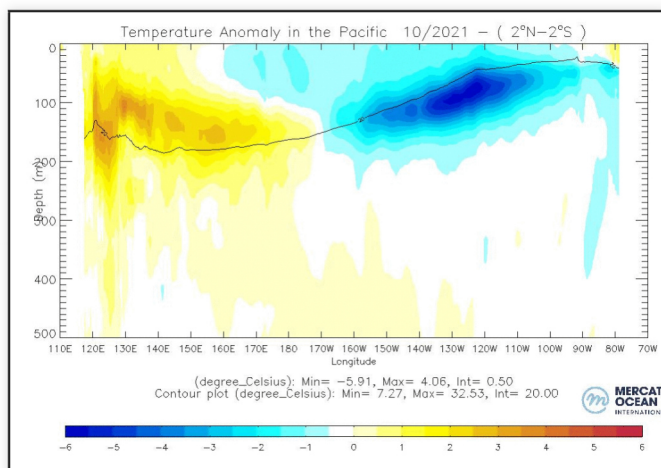


SST Anomalies and trend with the previous month (c) Mercator-Ocean

- 1 - La Niña pattern
- 2 - Negative PDO pattern
- 3 - Persistence of the strong warm anomaly

Oceanic analysis of November 2021 : Pacific vertical section

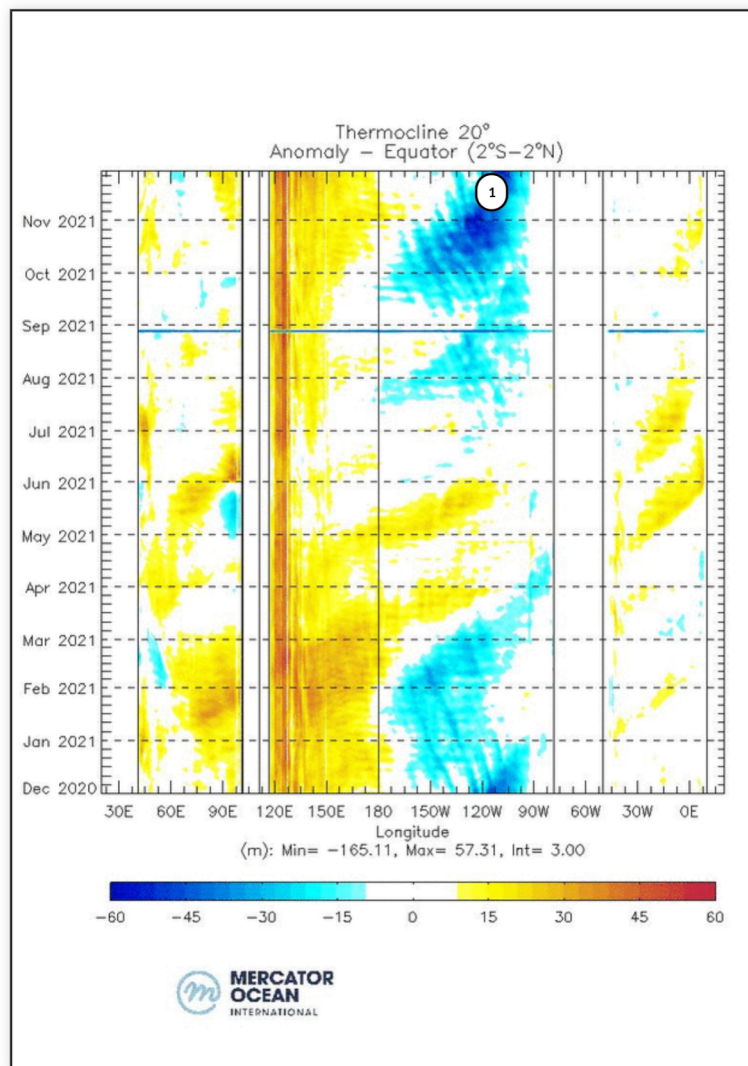
In subsurface, strong reinforcement of the cold anomaly in the Eastern part. The cooling is also visible in surface, though less intense.



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

Oceanic analysis of November 2021 : Hovmöller diagram of the 20°C isotherm

In the Pacific Ocean, the East-West contrast is now well settled, typical of La Niña.



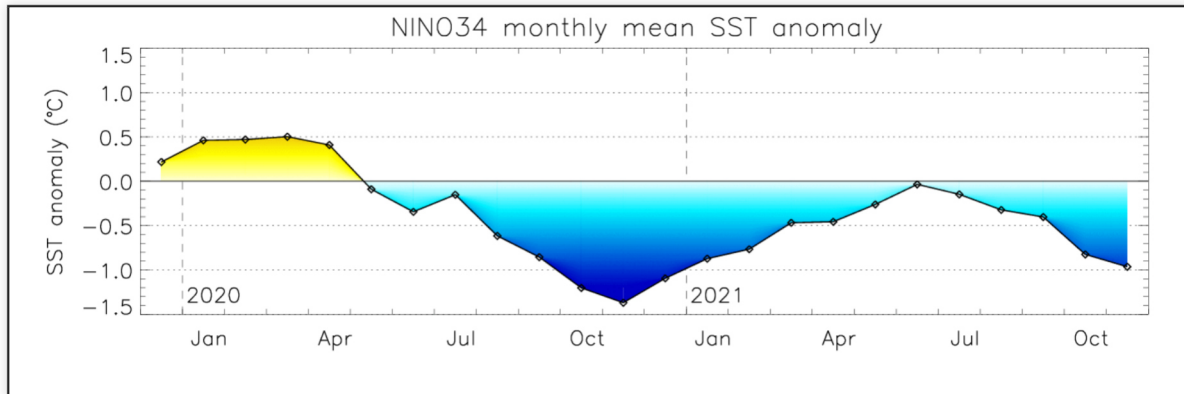
Evolution of the anomalies of depth of the thermocline (m) (materialized by the 20 °C isotherm) (c) Mercator-Ocean

1 - Reemergence of the thermocline on the eastern Pacific

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

Nino3.4 index issued from Mercator Ocean PSYV4R2 analysis : near - 1.0°C

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

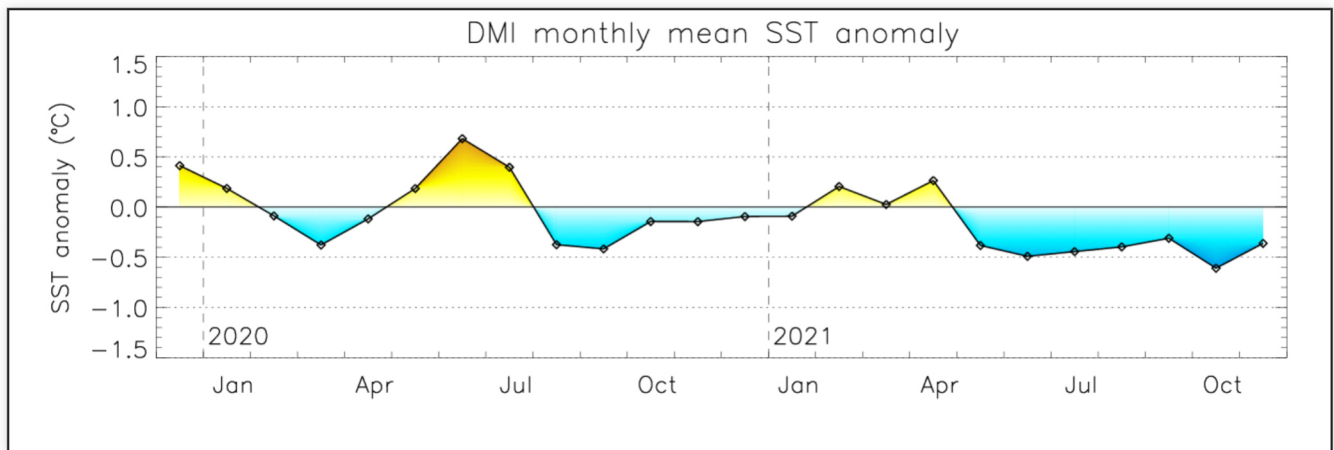


Evolution of SST in the NINO3.4 box (c) Mercator-Ocean

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

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

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



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

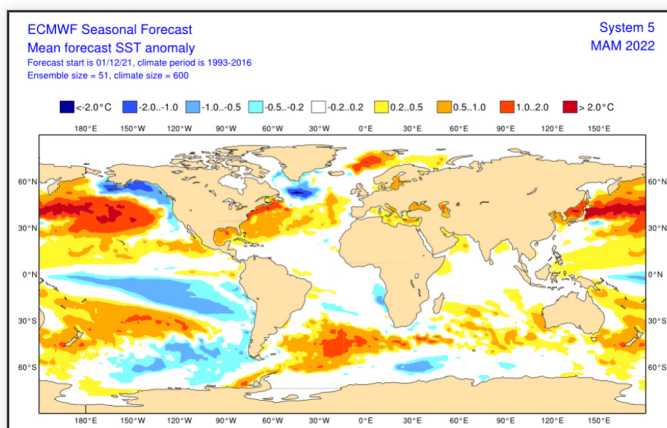
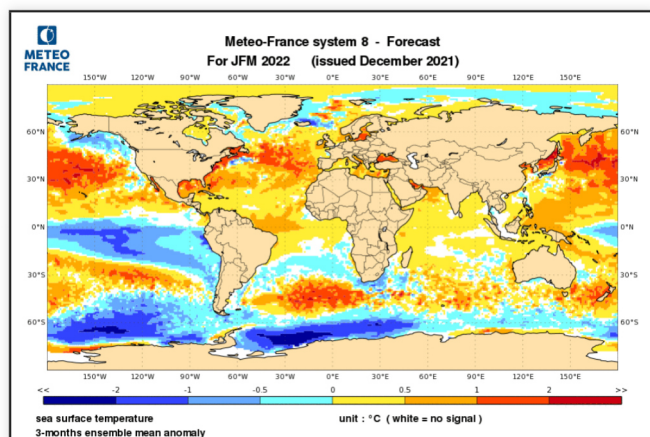
Oceanic forecast : SST anomaly

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

In the Pacific Ocean : the spatial extension of the cold anomaly pattern is typical of a "la Niña" phenomenon. Good agreement on the anomaly patterns in mid-latitudes (Northern and Southern hemisphere), with a nice PDO- shape.

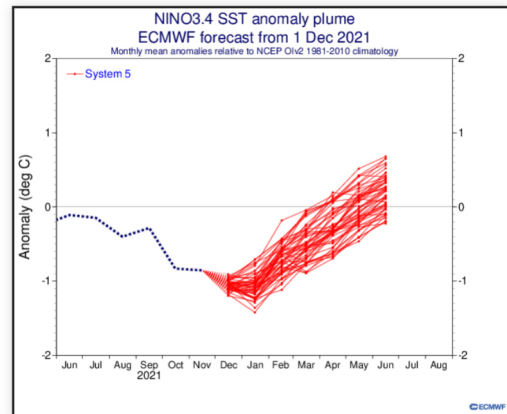
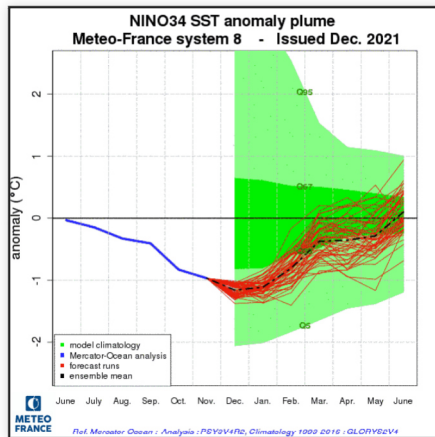
In the Indian Ocean : No more marked contrast between the east and west of the basin.

In the Atlantic Ocean : The large and strong warm anomaly along the equator is weakening and would mainly concern the western side. In mid-latitudes in the Northern hemisphere, large area of warm anomaly from America to Europe, it seems that the intensity of the anomaly is stronger than in the analysis.



Oceanic forecast : NINO3.4 Plume diagrams

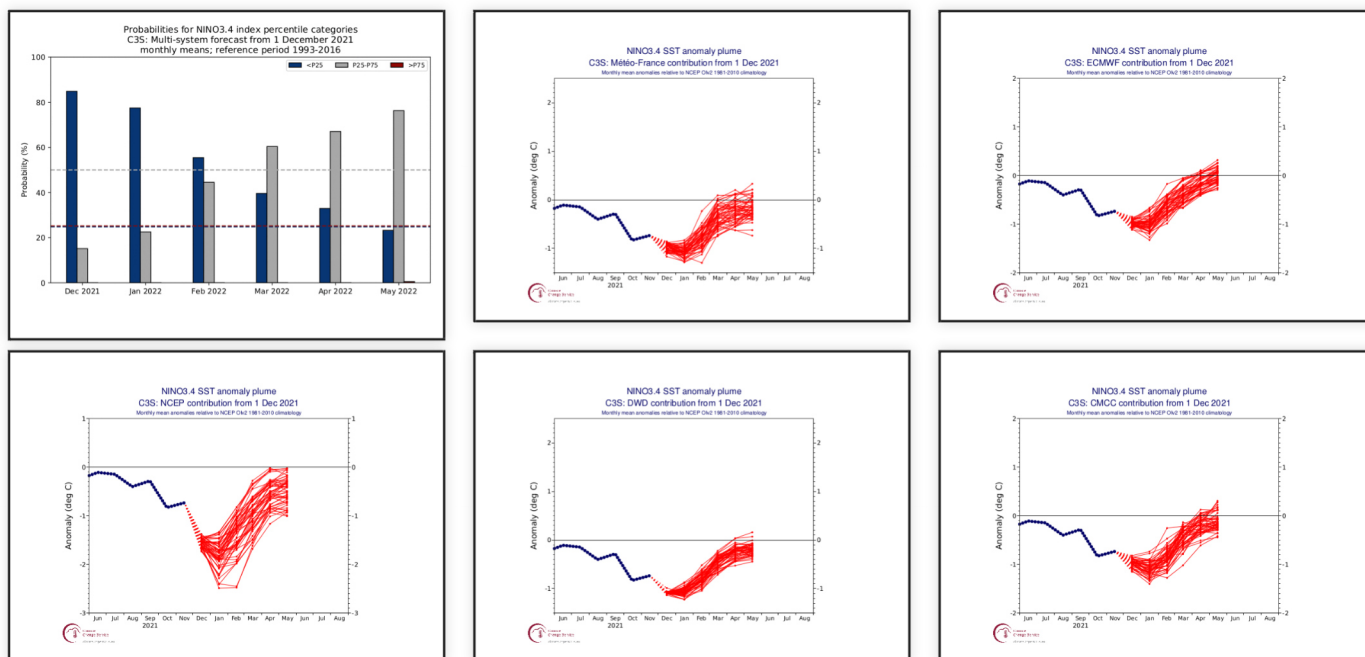
ECMWF-SEAS5 and MF-S8 : the two models are very close. They both forecast a maximum of "La Niña" in the coming months, reaching the state "moderate" (below -1°C)



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

Good agreement between models, the maximum of Nino3.4 is expected to slightly exceed -1°C , so we should have a "moderate" La Niña. Like last month, the NCEP model is very different from the others : its forecast last month was clearly wrong (to strong cooling in December), we decide not to taking it into account.

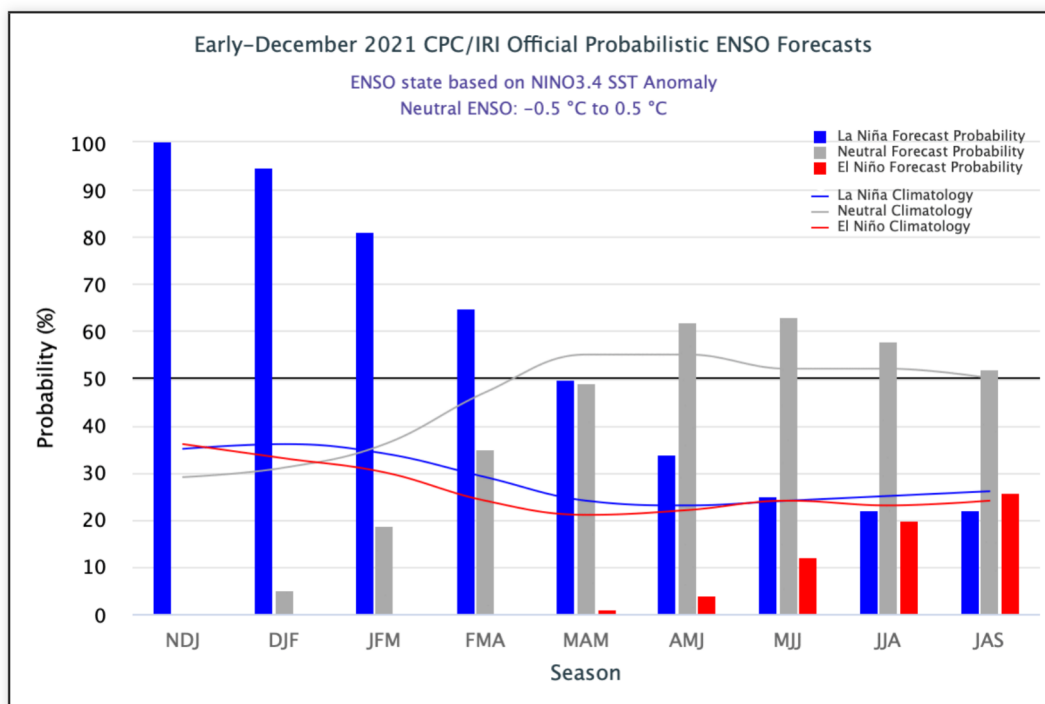
The most likely phase for the next three months : moderate La Niña.



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

Oceanic forecast : Synthesis from IRI

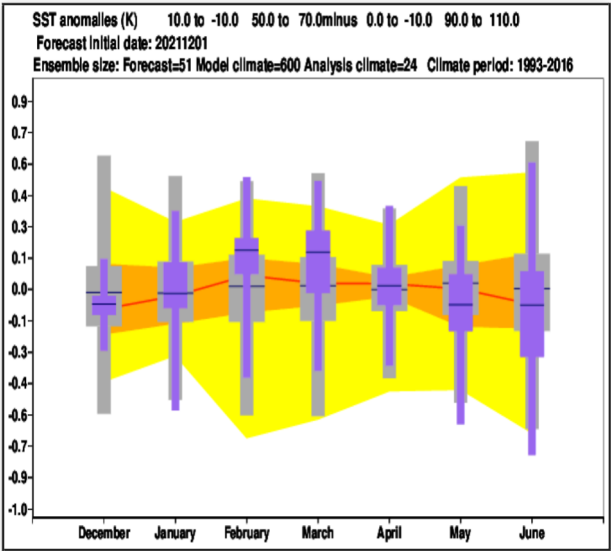
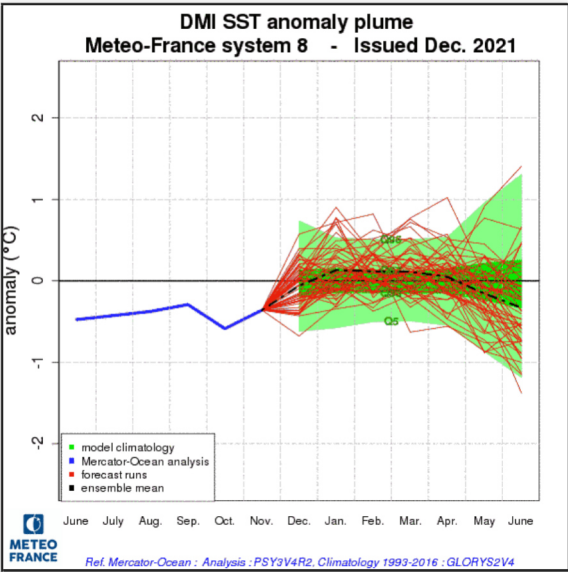
IRI forecast : about 80% chance of "La Nina" for JFM



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 (MF8) or slightly positive at the end of the quarter (SEAS5).

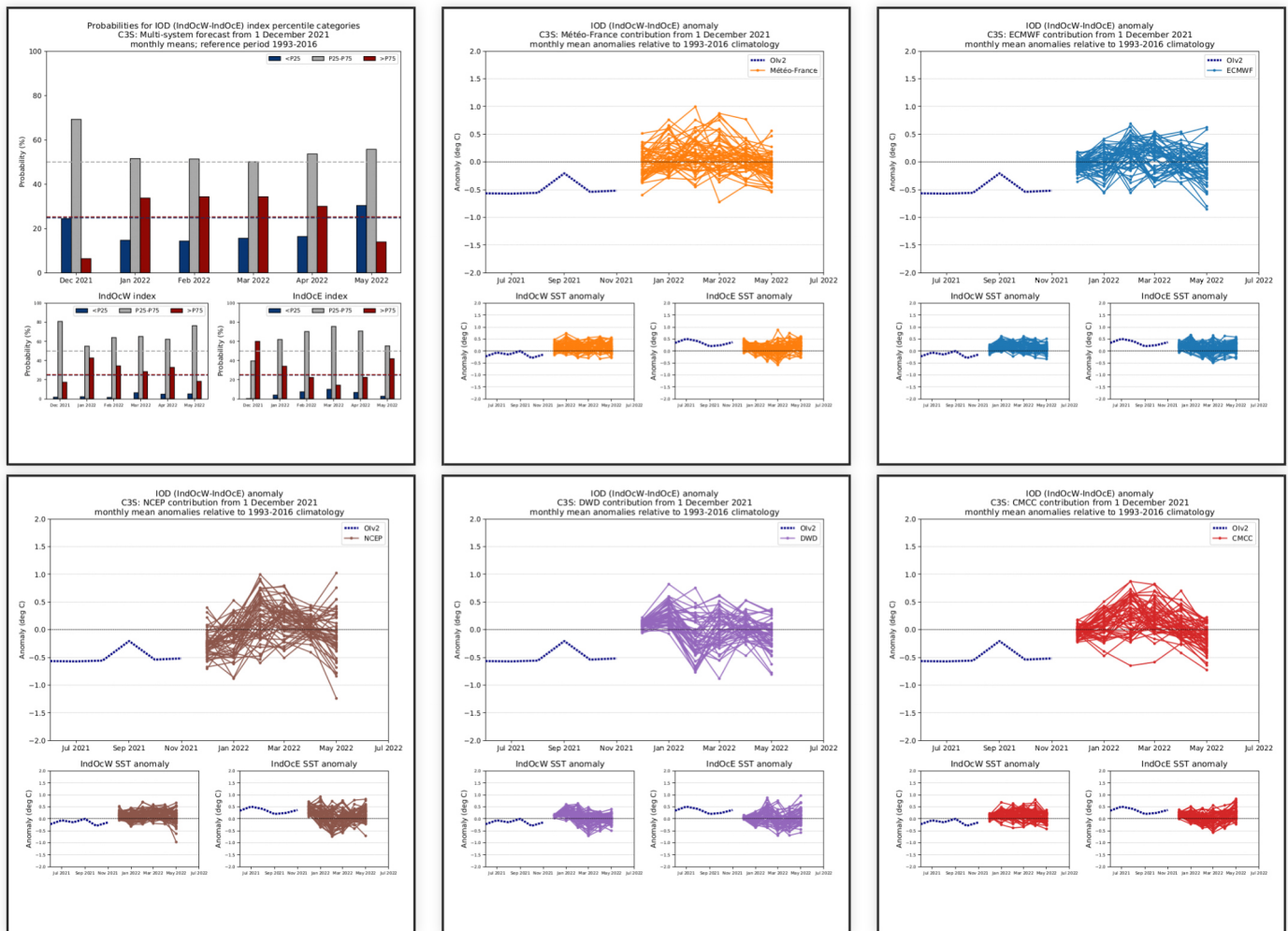


DMI index : analysis, forecasts and model climatology with MF-S7 on the left and ECM-SEAS5 on the right

Oceanic forecast : C3S IOD re-scaled plume diagrams

Good agreement between C3S models for a return to normal values, and possibly positive values.

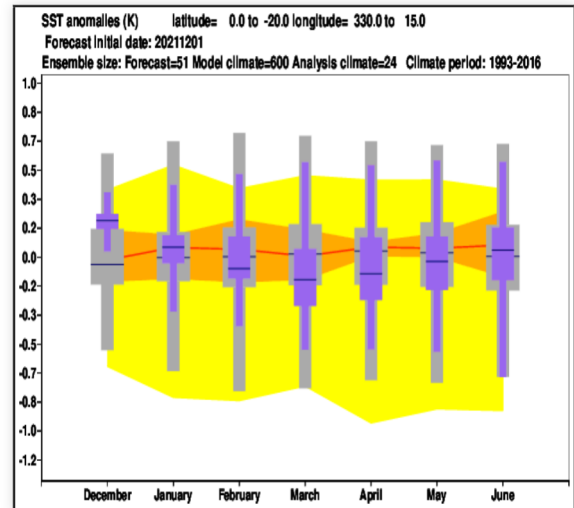
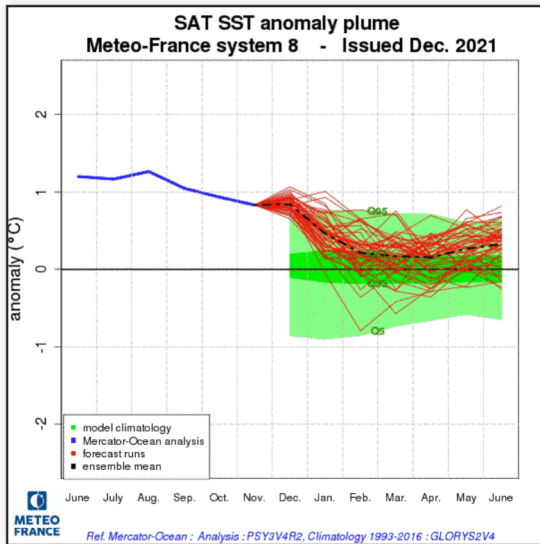
Expected Phase for the next three months : neutral.



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 : Atlantic ocean - SAT evolution

The index remains high for both models, but it drops sharply to approach neutral conditions next quarter.

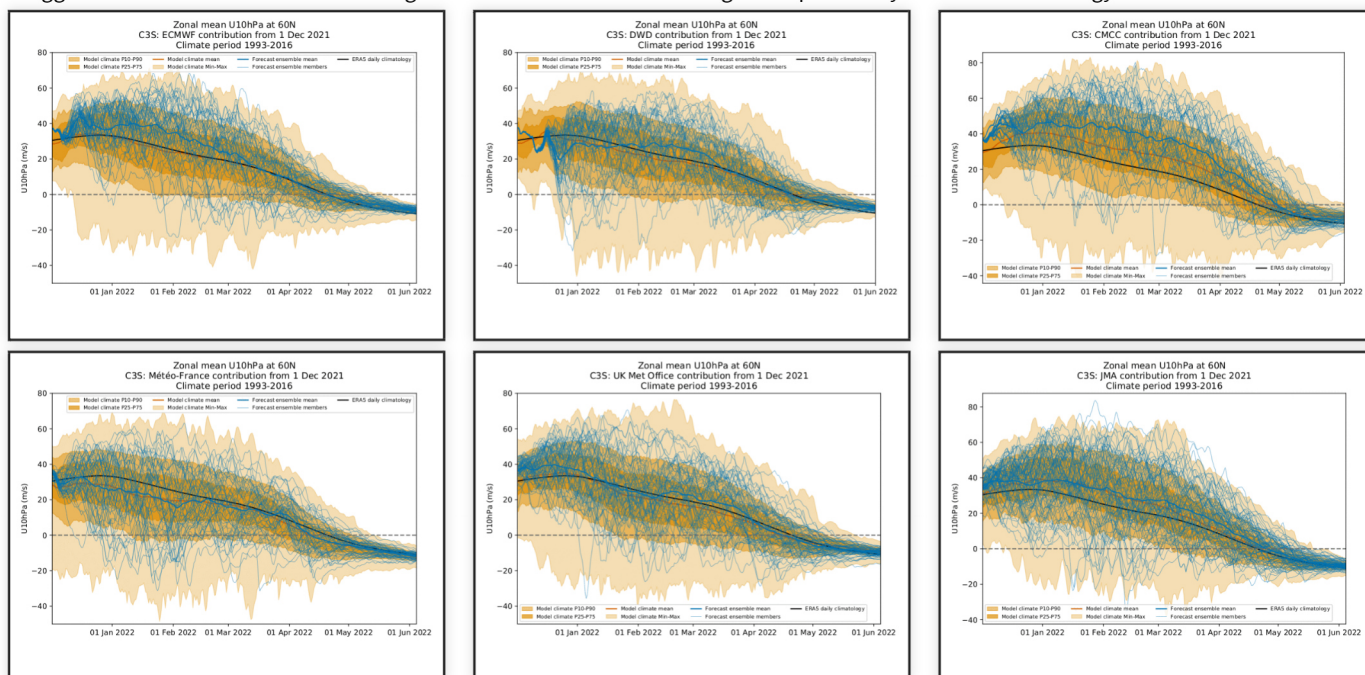


Anomaly on the SAT box : analysis, forecasts and model climatology with MF7 on the left and SEAS5 on the right

Drivers : polar vortex (U010 plumes)

There is uncertainty in the Polar Vortex forecast, looking at C3S models.

Some models forecasts a stronger than normal vortex (ECMWF, CMCC) others rather close to climatology. Only one model (DWD) suggests a marked slowdown on average at the end of December with greater possibility than the climatology of an SSW.



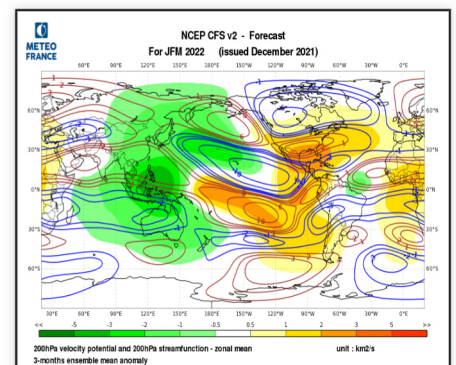
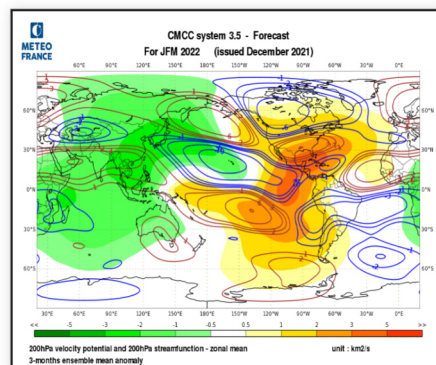
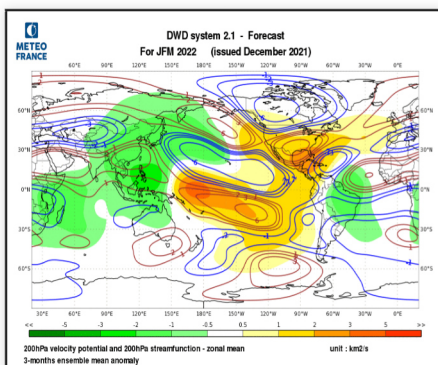
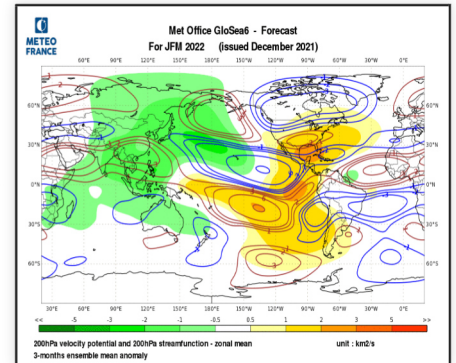
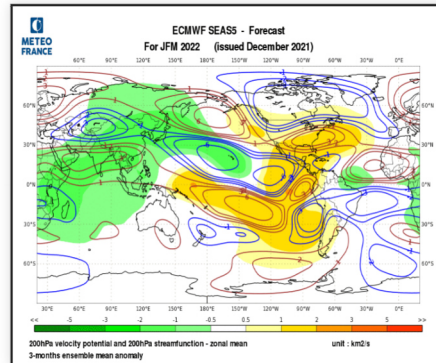
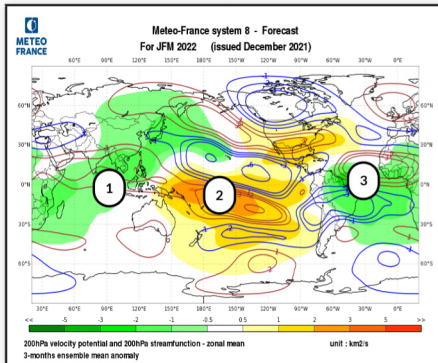
ECMWF-SEAS5, DWD, CMCC, MF-ST, UKMO, and JMA 010hPa zonal mean of u component of wind at 60°N.

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

Good agreement between models. Anomalies are stronger and more consistent between models than last month.

Velocity Potential : strong dipole pattern corresponding to a classical "La Nina" response : a downward motion anomaly over the Central/East Pacific and an upward motion anomaly over the Maritime Continent extending to the Indian basin. Over Africa and equatorial Atlantic, noticeable differences between models : the most probable scenario (consistent with the strong positive SST anomaly over the Equatorial west Atlantic) is a negative anomaly (upward anomaly motion) over west Atlantic. There is a good agreement for a positive anomaly centred on the Gulf of Mexico.

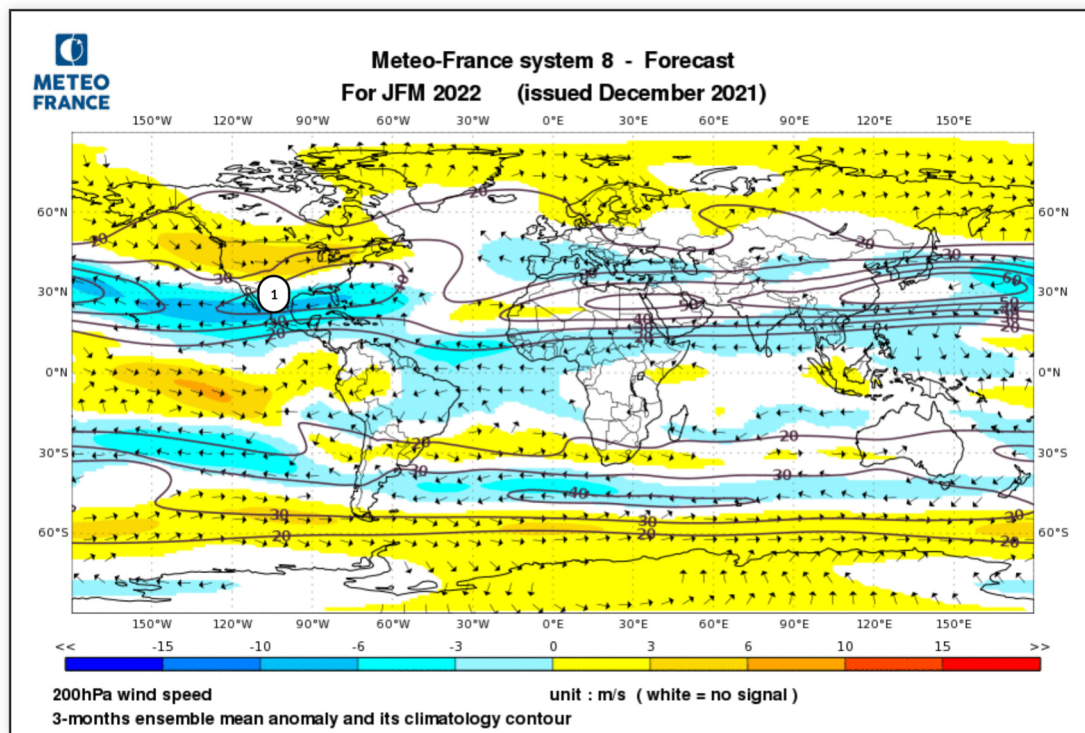
Streamfunction : clear dipoles on both sides of the equator over each basin. Teleconnexions toward mid-latitudes are predicted by the models, both in the Pacific Ocean (negative PNA), in the Atlantic Ocean (up to the Iberic Peninsula) and in the Indian Ocean (up to Central Asia)



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
- 3 - VP : upward motion anomaly in MF-S8 linked to warm SST anomalies

Atmospheric circulation forecasts : tropospheric jets



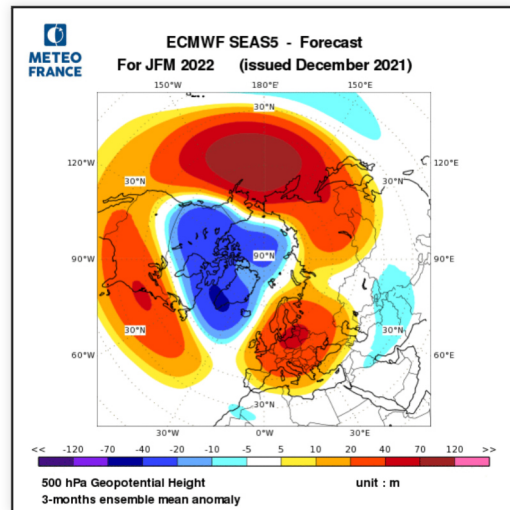
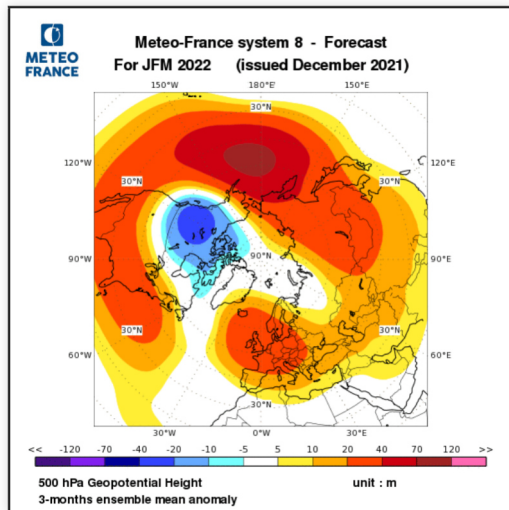
climatology of wind strength at 200 hPa (isolines) and wind force anomalies (color ranges)

1 - Jet shifted to the north over North America

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Good agreement around the Pacific with a PNA- pattern, and good agreement for the "positive belt" anomaly extending from east Pacific to west Atlantic.

Over Europe and Asia and Arctic, the anomaly looks like Blocking pattern.



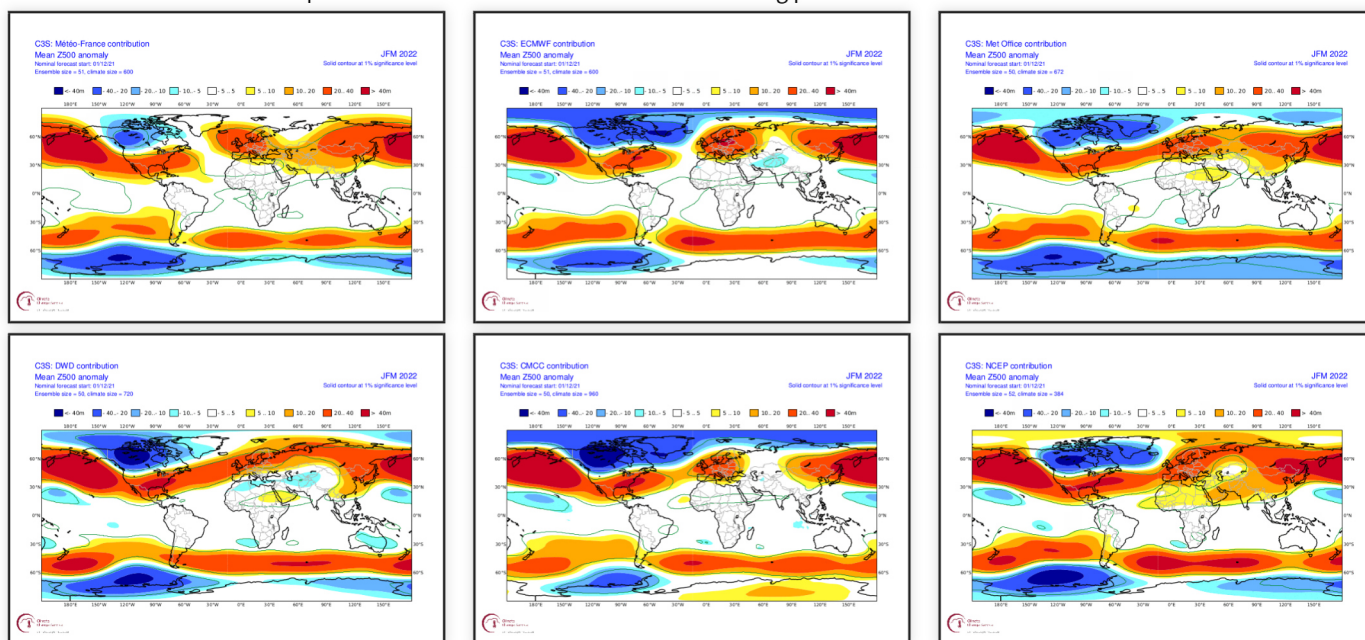
polar projection of MF8 and SEAS5 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in C3S models

Comparing C3S models, there is a good agreement around the Pacific, in link with a negative PNA pattern induced by La Niña.

The agreement extends to the west part of North Atlantic.

Over North Atlantic and Europe most of models looks like NAO+ and Blocking pattern.

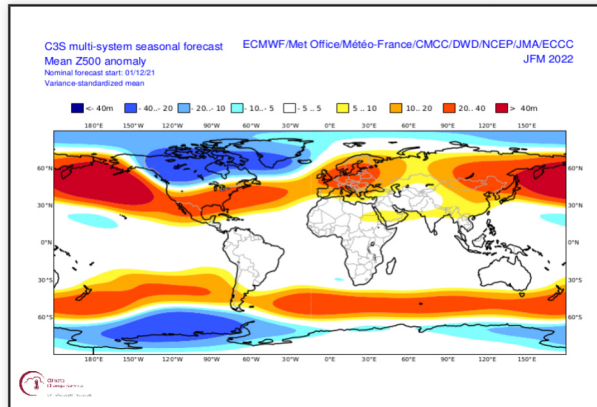


MF-S8, SEAS5, UKMO, DWD, CMCC and NCEP 500hPa geopotential height anomalies.

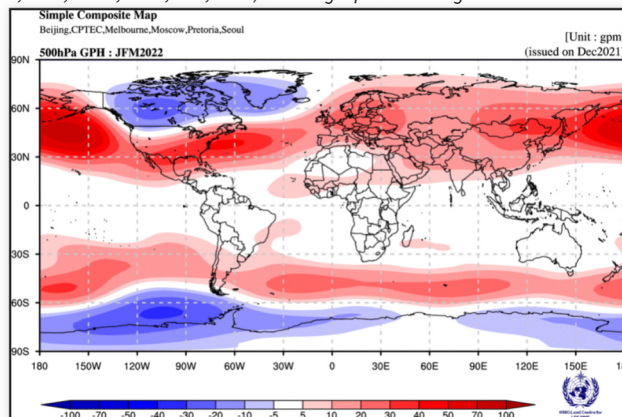
Atmospheric circulation forecasts : Z500 anomalies multi-systems

Good agreement over North America, a typical PNA- pattern is visible in both multi-model charts.

The C3S multi-model chart correspond to positive NAO on North Atlantic and Blocking regim on Europe.



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 : Forecast stability

Good stability around the Pacific and North America.

Over North Atlantic, the Z500 anomaly pattern looks more and more to Atlantic Ridge, and the positive anomaly over centre Europe becomes stronger.



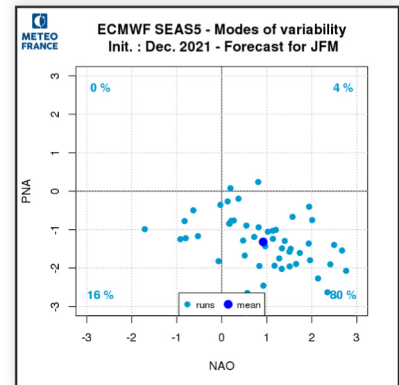
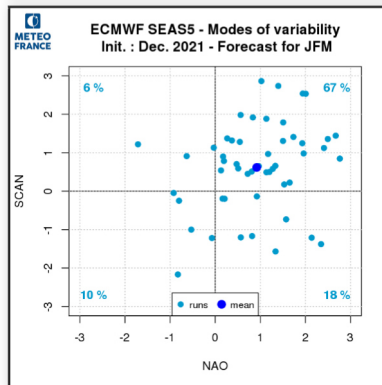
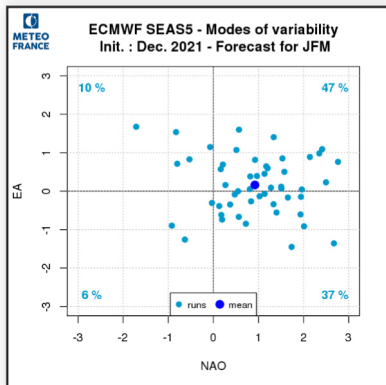
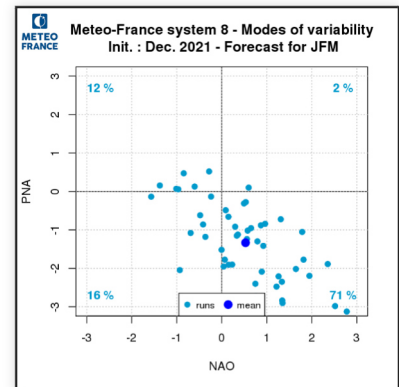
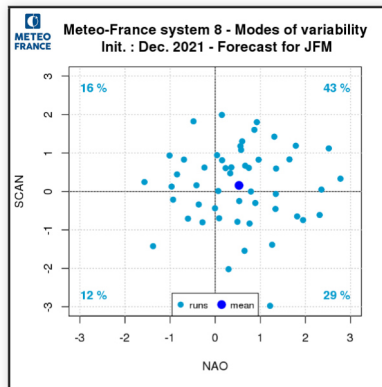
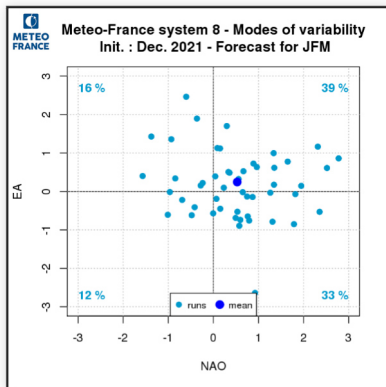
Successive forecasts of the C3S multi-model for the coming quarter

Modes of variability : forecast

High confidence in a negative PNA.

NAO + is the most probable and there is a clear shift toward SCAN+

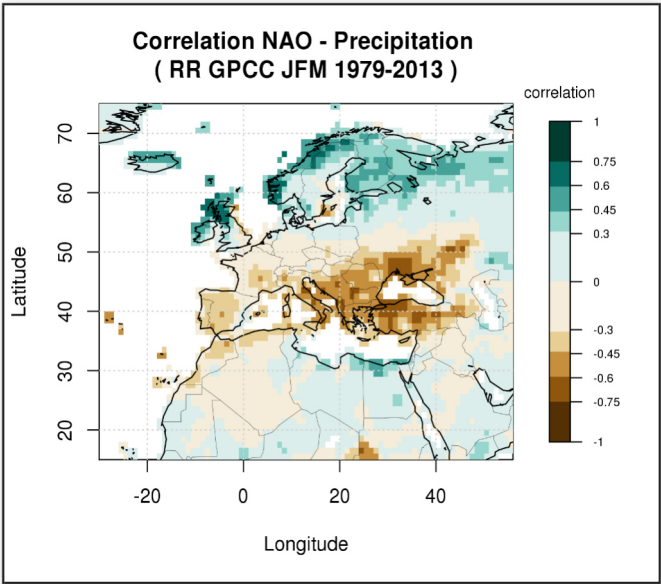
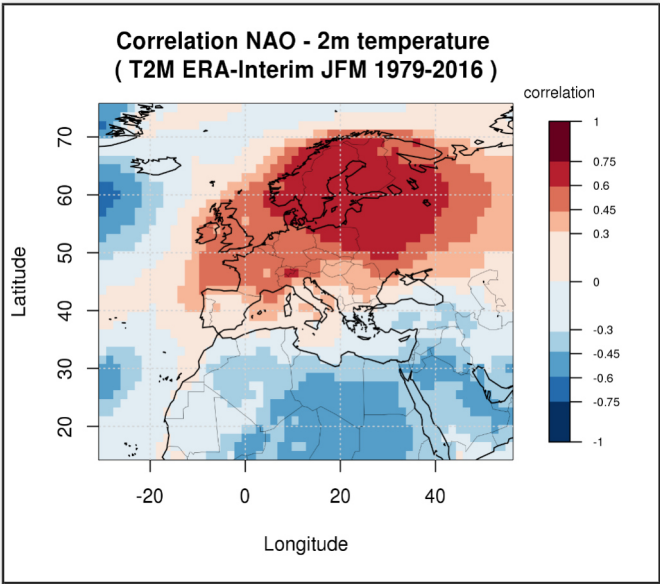
No signal for EA



[See the modes of variability patterns](#)

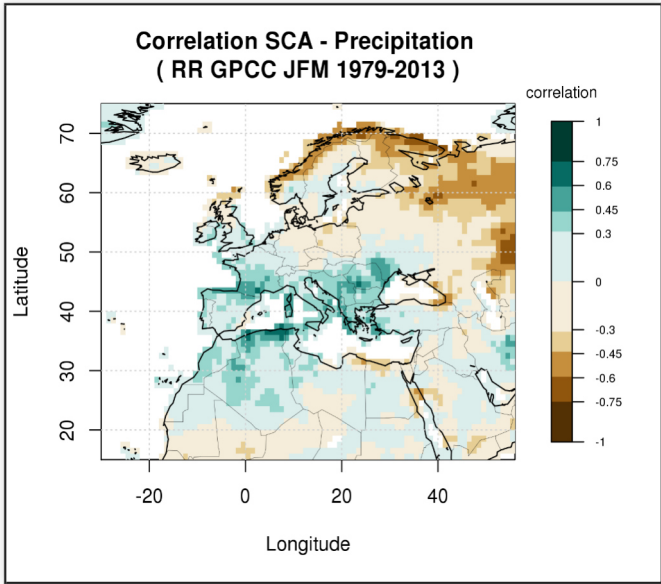
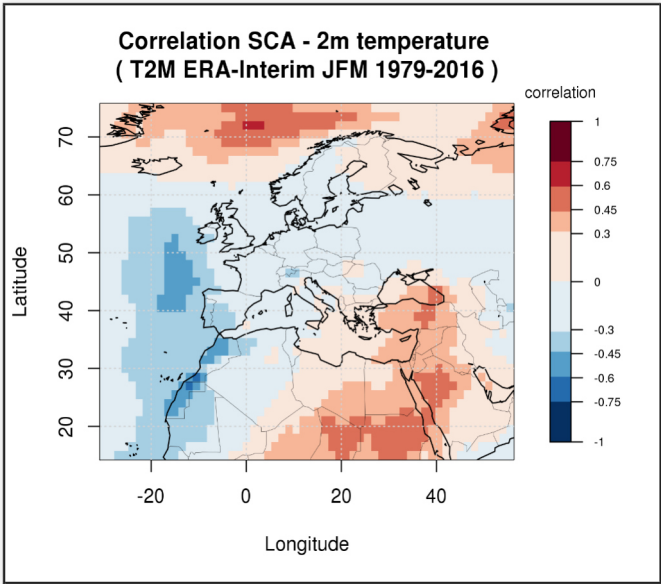
Modes of variability : NAO impacts

The NAO phase has a strong impact on Europe for this 3-month period



Modes of variability : SCA impacts

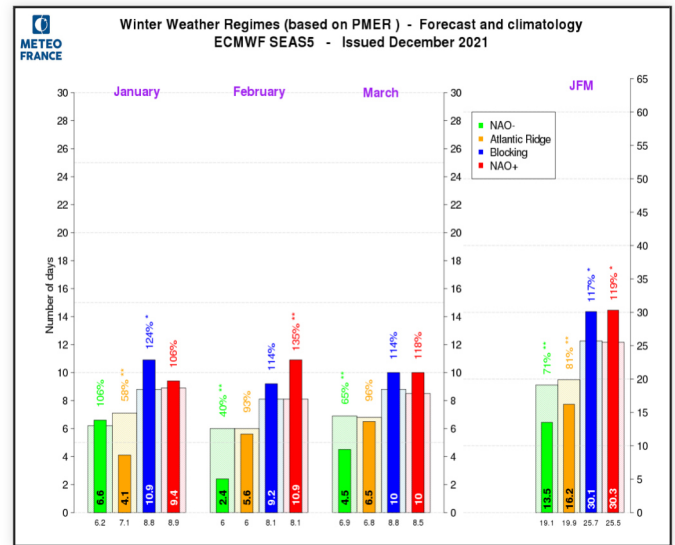
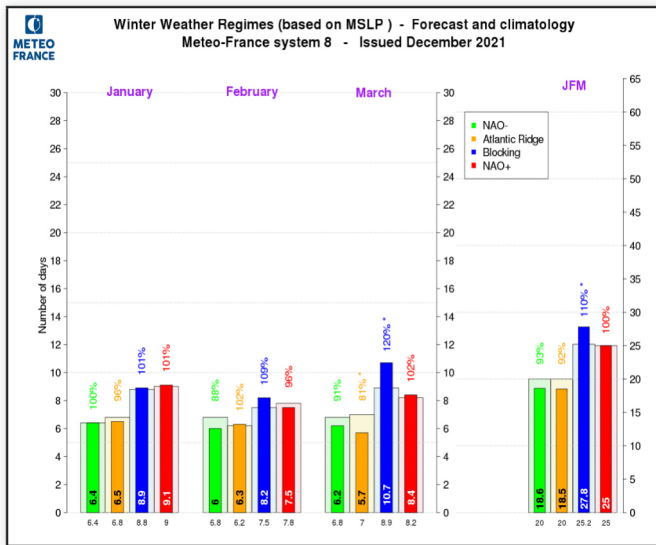
The impacts of NAO and SCAN mode are opposite.



Weather regimes : winter MSLP

Significant excess of Blocking with both models.

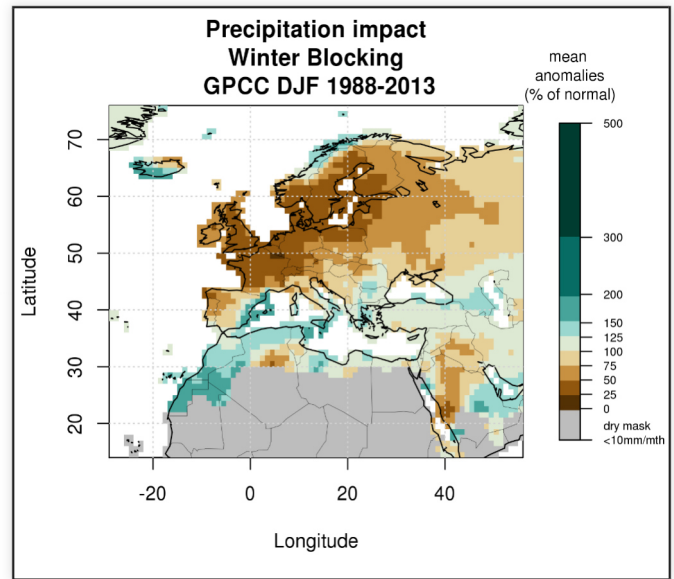
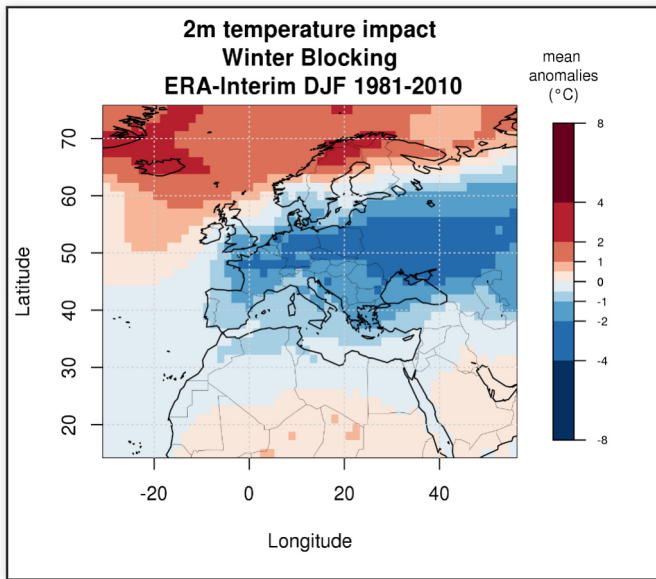
SEAS5 also favors NAO+ and very significantly disadvantages NAO- and Atlantic Ridge



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

Winter Blocking weather regime should be favored according models, over the quarter.

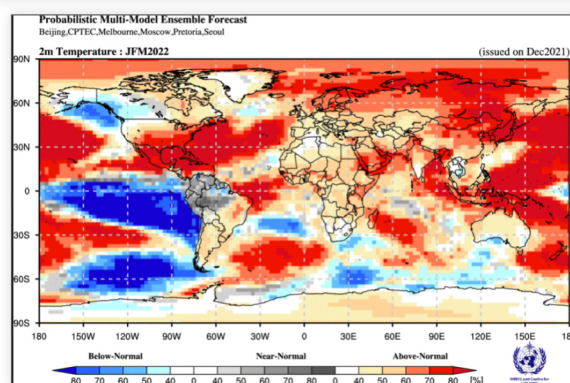
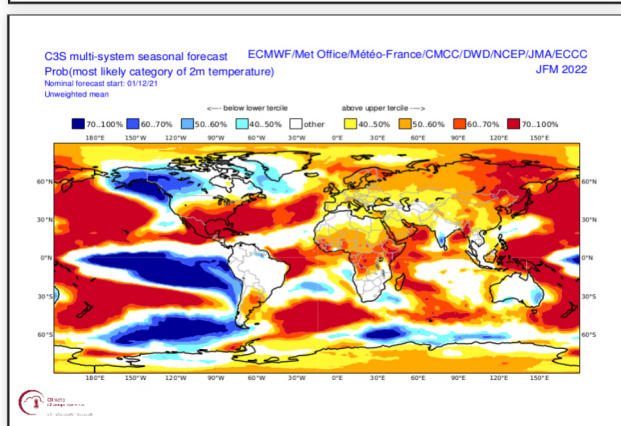
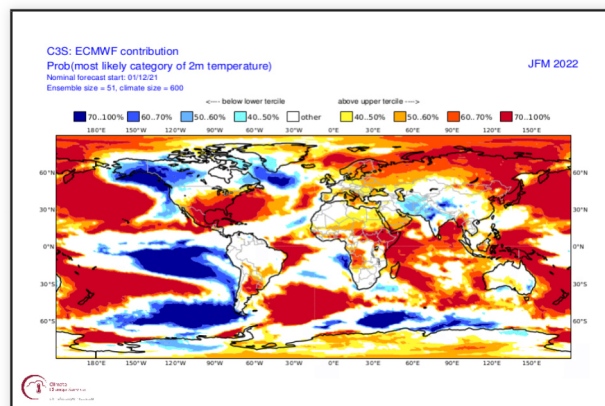
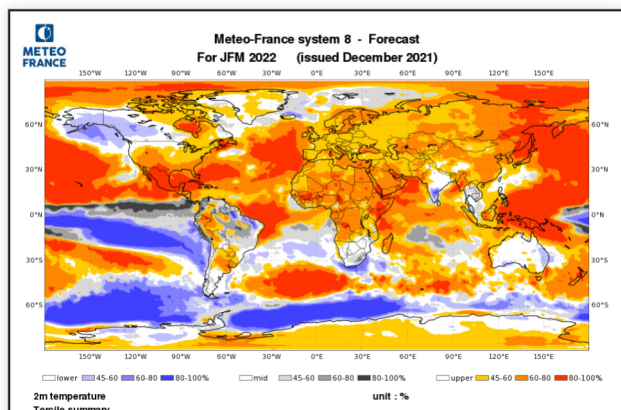


Impact of Summer Blocking weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)

Forecast of climatic parameters : Temperature probabilities

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

Over North America, good agreement for a colder than normal signal from Alaska to the Western Canada and a warm one from Mexico to the South of the United States.

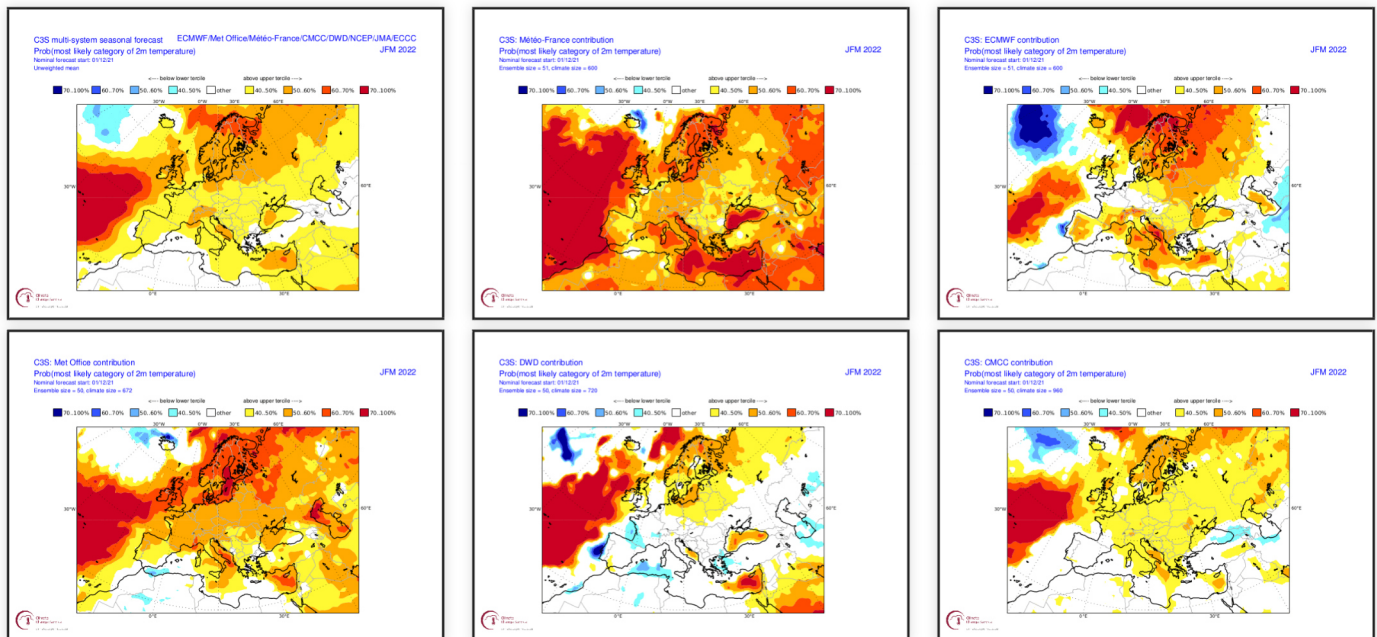


2m temperature probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models(bottom left) and others models of WMO multi-models (bottom right)

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

Over Europe, the cold tercile is nowhere the most probable, due partly to the positive climate trend (see for instance [MF-S8 trend](#)).

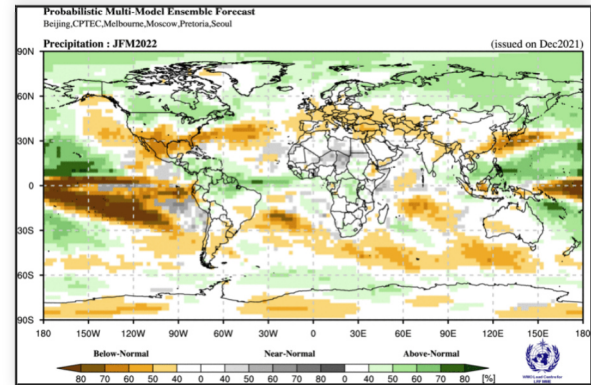
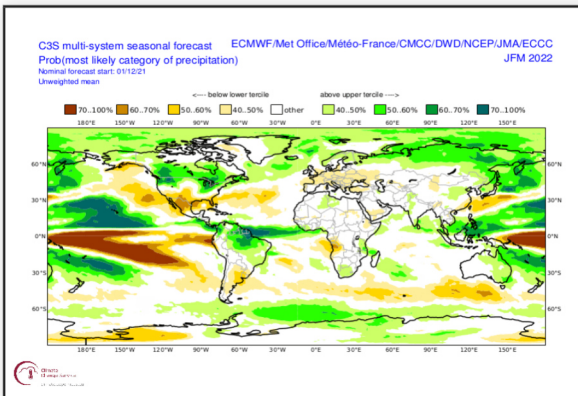
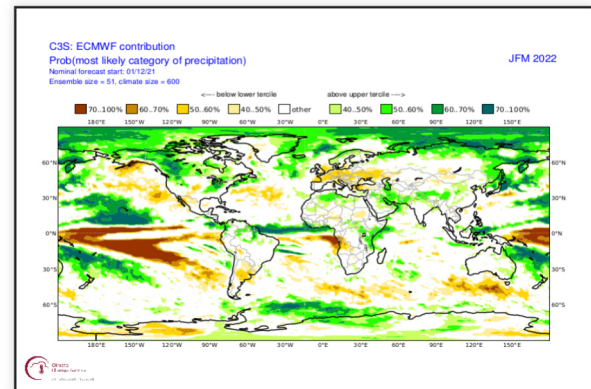
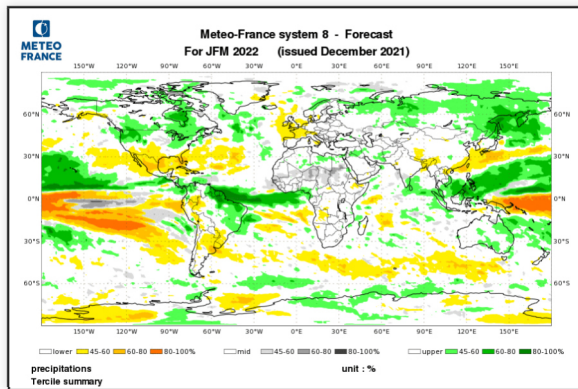
Dominant circulations, Blocking and NAO+, have an opposite impact on temperature on continental Europe. Instead they favour above normal temperatures near Scandinavia. This is the signal that emerges on the charts.



C3S multi-models probability map (top left) and MF-S8, ECMWF-SEA55, UKMO, DWD, CMCC models.

Forecast of climatic parameters : Precipitation

Classical effects of La Niña over the American continent, Africa, around the Maritime Continent.

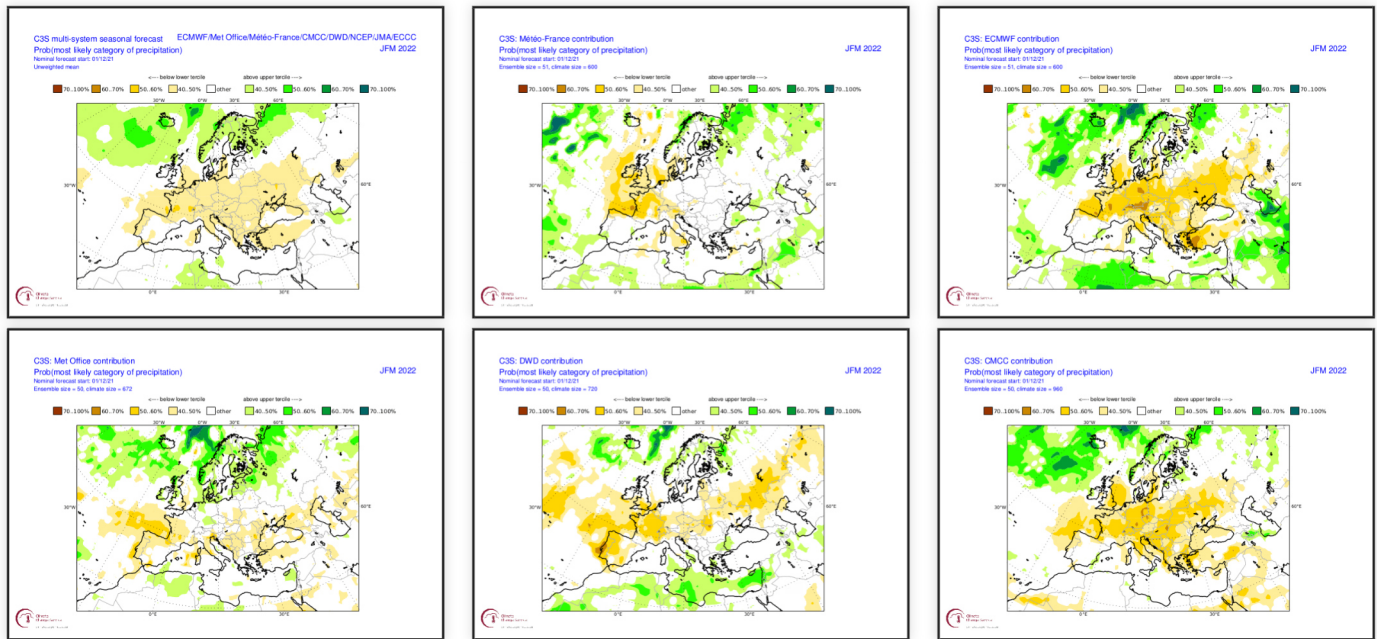


precipitation probability map from MF-S8 (top left), ECMWF-SEAS5 (top right), C3S multi-models (bottom left) and others models of WMO multi-models (bottom right)

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

Blocking and NAO+ have on opposite effect on precipitation in Europe.

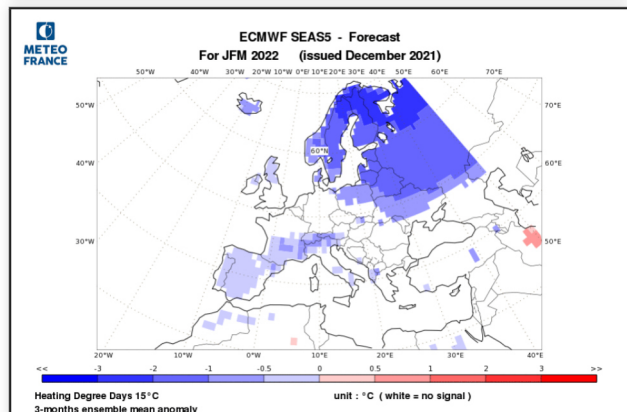
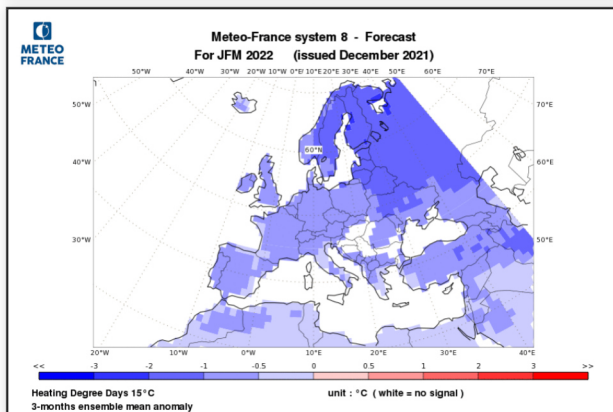
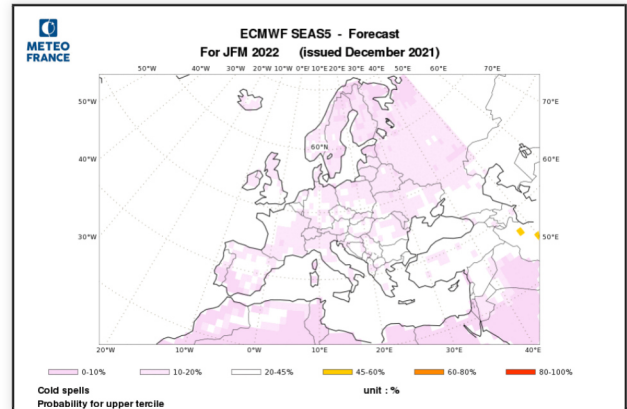
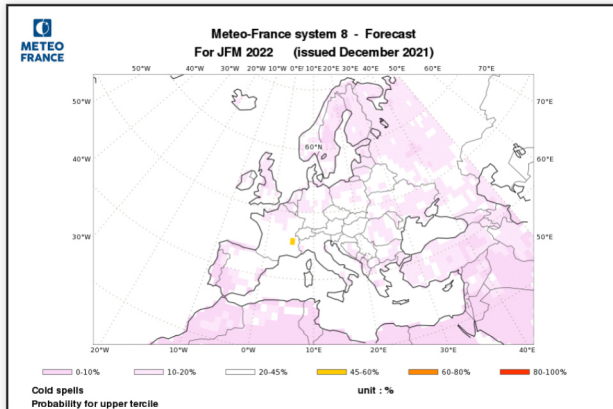
Most of models focus on dry conditions in most contry (effect of dominant blockage) except on the north (effect of dominant NAO+).



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

Forecast of climatic parameters : cold spell

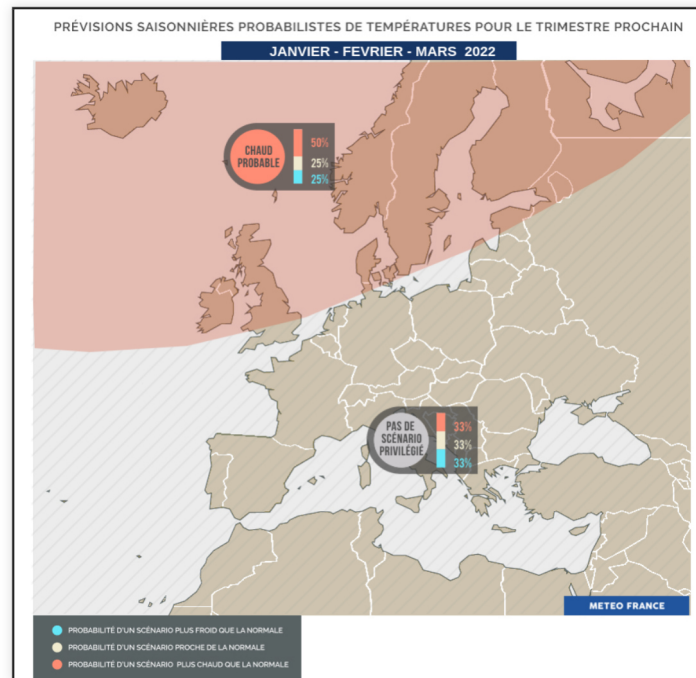
In line with the expected temperature anomalies, the risk of cold waves is reduced in the north-east of Europe as well as the need for heating.



Above, cold wave probability and below, heating degree-days (base 15°C) for MF7 (right) and ECMWF (left)

Synthesis map for Europe : Temperature

Dominant circulations, Blocking and NAO+, have an opposite impact on temperature on continental Europe. Instead they favour above normal temperatures near Scandinavia. This is the signal that emerges on multi-model forecasts. Elsewhere there is no privileged scenario.

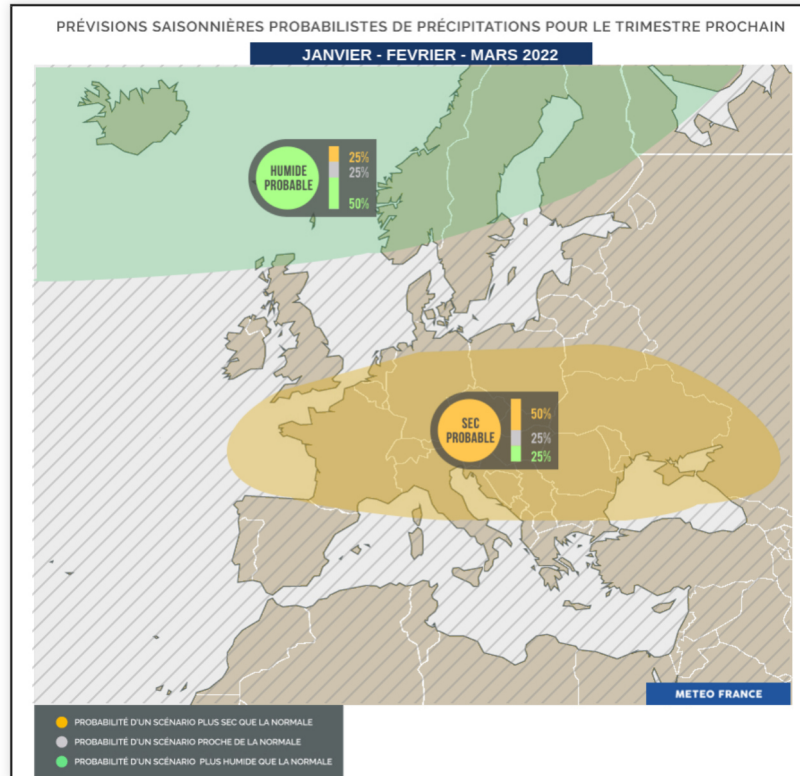


Synthesis map of probabilistic forecast for Europe. (c) Météo-France/DCSC/ACS

Synthesis map for Europe : Precipitation

The dominant regimes over the next quarter (blockage and NAO+) have a opposite effect on precipitation over Europe.

Most models focus on dry conditions in most countries (dominant blocking effect) except in the north where wet conditions are most likely (dominant NAO + effect) .



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