Météo-France Seasonal Forecast Bulletin

JANUARY - FEBRUARY - MARCH 2020

General synthesis : JFM 2020

A) Good agreement between models for oceanic forecast.

- **neutral ENSO situation** for the coming 3 months but negative SST anomalies on the tropical south pacific associated with large-scale subsidence and **anomalies of streamfunction extending to the north of America by teleconnection**.

- **Positive phase of IOD** decreasing continues to have an influence on atmospheric circulation :

1) downward potential velocity and cold SST anomaly over western Maritime Continent. Consequently, **drier than normal signal over south-east Asia.**

2) upward potential velocity over western Indian Ocean and Eastern Africa. Consequently, **wetter than normal on eastern Africa.**

3) **teleconnections with IOD** foreseen by most of the models towards Middle East and Central Asia

- **South tropical Atlantic** significantly warmer than climatology.

B) On atmospheric circulation **EA+ and NAO+ continue to be favoured by most of the models**, in the continuity on last month's forecast. Over Europe, there could be a link with the IOD forcing. Over the Atlantic, the strongest Azores high could be explained by a reinforcement of the Hadley circulation related to warm anomaly of SST in south tropical Atlantic.

=> Most likely conditions :

- **For Europe : warmer than normal**
- **For Northern Europe : wetter than normal**
- **For the Mediterranean basin : warmer and drier than normal**

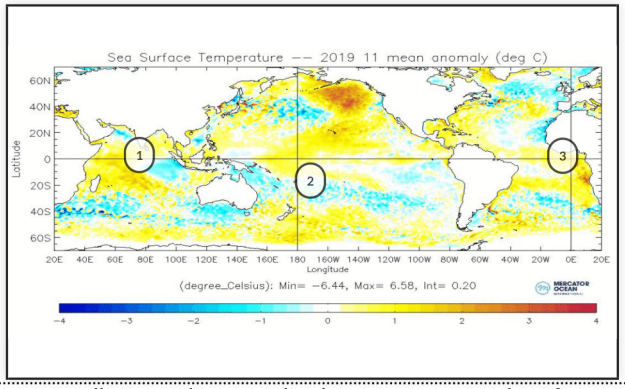
Oceanic analysis of November 2019 : SST anomalies

Current situation : Neutral ENSO conditions. Strongly positive IOD.

November NINO3.4 index : +0.3 °C (Mercator Ocean PSYV4R2 analysis) ; see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/nino3_4.png

November DMI index : +1.5 °C (Mercator Ocean PSYV4R2 analysis); remain strongly positive but have weakened slightly over the past fortnight;
see BOM site for weekly values : http://www.bom.gov.au/climate/enso/monitoring/iod1.png

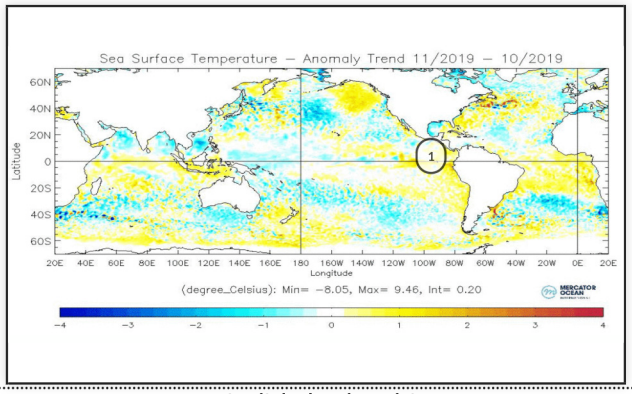
Tropical south Atlantic is getting warmer in November : even is the anomaly is modest (~ 1.0°C), it corresponds to a strong deviation from normal.



2- still warmer than normal in the western equatorial Pacific

1- Persistance of a relative strong DMI despite less East-West contrast in SST

3- Strong positive SST anomalies relative to the climatology

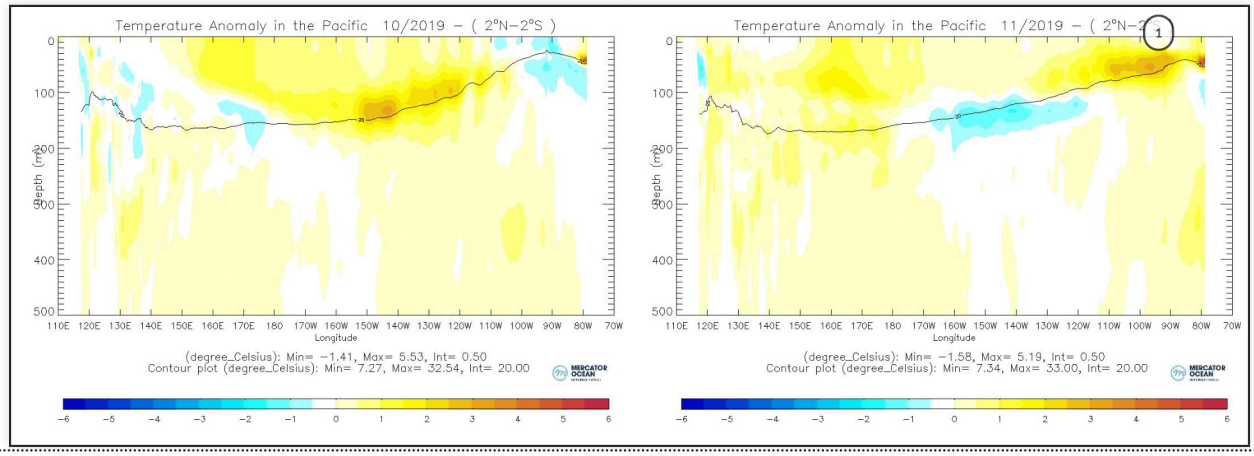


1- Warming linked to the Kelvin wave

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

Oceanic analysis of November 2019 : vertical section

Significant anomalies in subsurface. Propagation of a positive anomaly easterwardly.

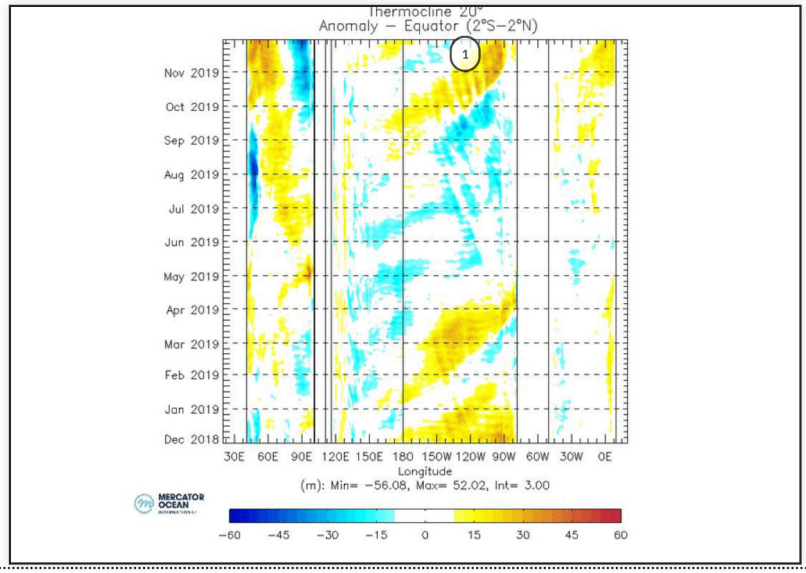


1- warming caused by kelvin wave.

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

Oceanic analysis of November 2019 : Hovmüller diagram of the 20°C isotherm

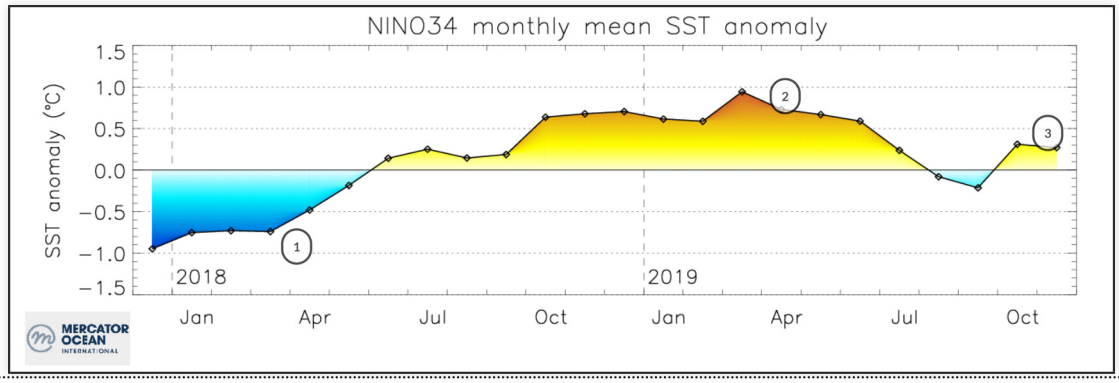
Noticeable kelvin wave has finished crossing the Pacific basin in November.



1- The warm anomaly corresponding to a Kelvin wave is reaching the Eastern part of the basin in November.

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

Oceanic analysis of November 2019 : History of Nino3.4



1- La Nina event of winter 2017-2018

2- Weak El Niño during winter 2018-2019 and spring 2019

3- Persistence of neutral conditions in November

Evolution of SST in the NINO3.4 box

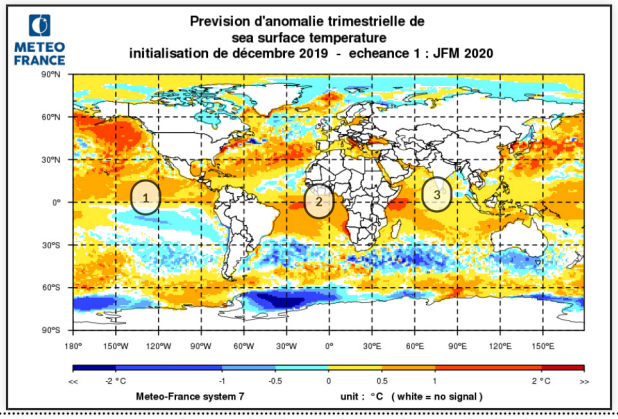
Oceanic forecast : SST anomaly

Good agreement between MF-S7 and ECMWF-SEAS5

Along the Equatorial Pacific, neutral conditions should continue . The west (warm)/east(normal) gradient would persist.

In the Indian Ocean, DMI index decrease.

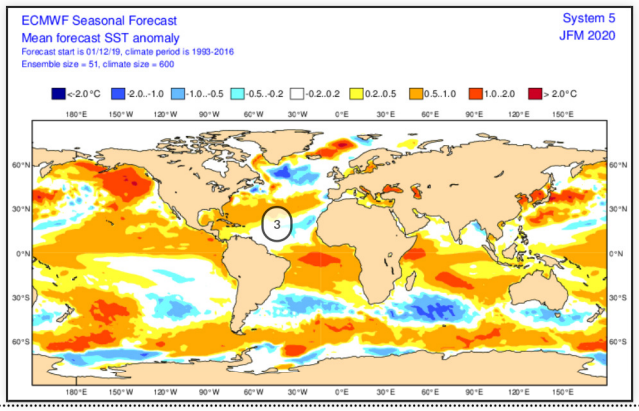
For the Atlantic, persistence of a large positive anomaly from the North American coasts and the Caribbean sea to the Iberian Peninsula. Persistence of strong positive anomaly south of the equator.



1- Positive PDO and neutral Niño conditions forseen by both models

2- Strong positive anomalies in both models

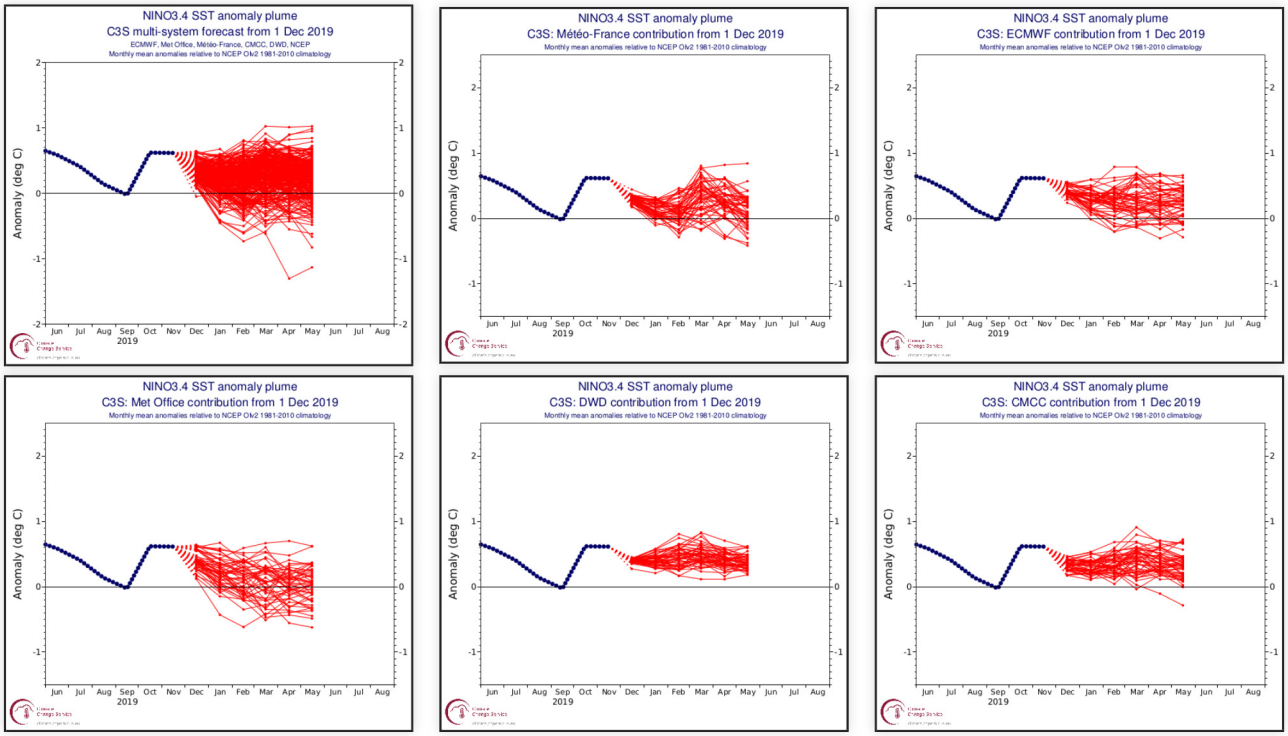
3- IOD decrease



3- Large positive anomaly

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

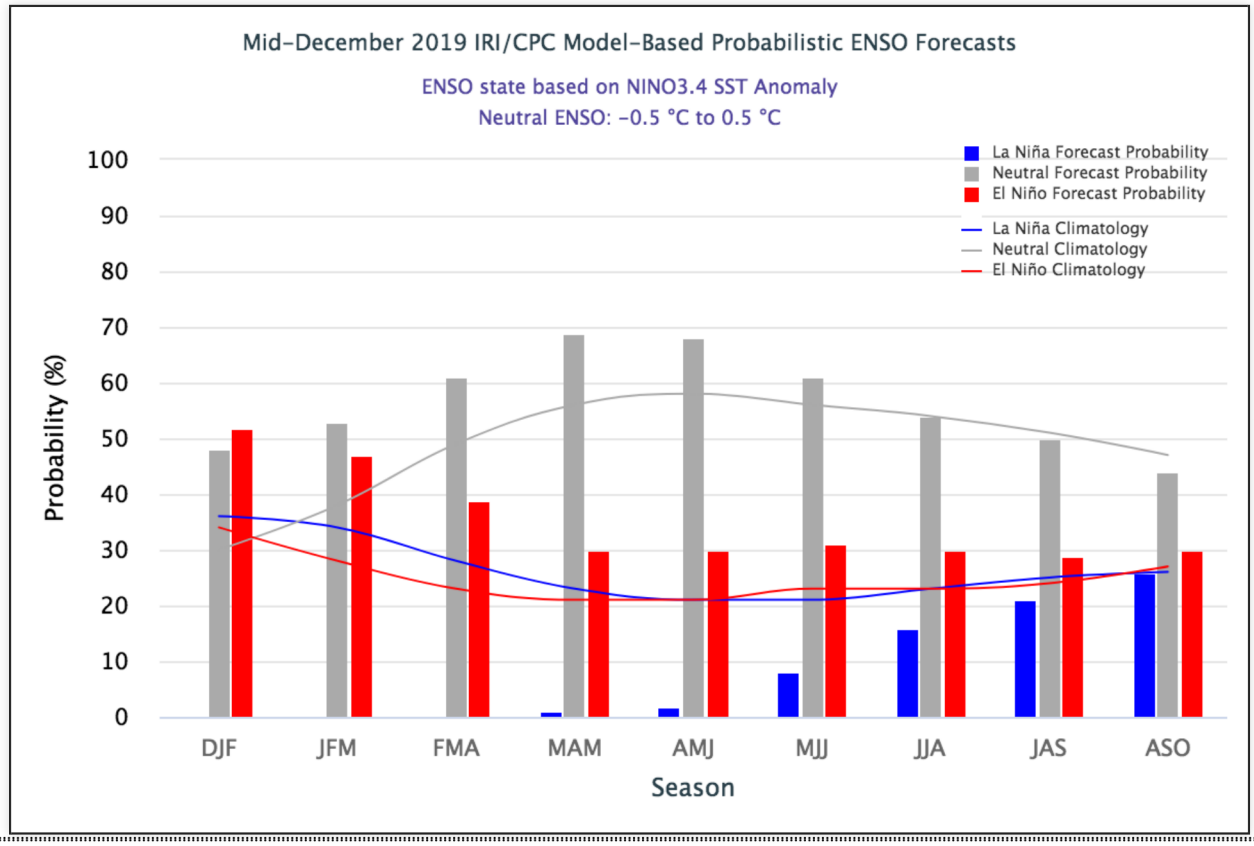
Very good agreement between models. A very large majority of members are forecasting a persistence of neutral conditions for the next few months.



C3S plume diagrams re-scaled from the variance of observations for the period 1981-2010. https://climate.copernicus.eu/charts/c3s_seasonal/

Oceanic forecast : Synthesis from IRI

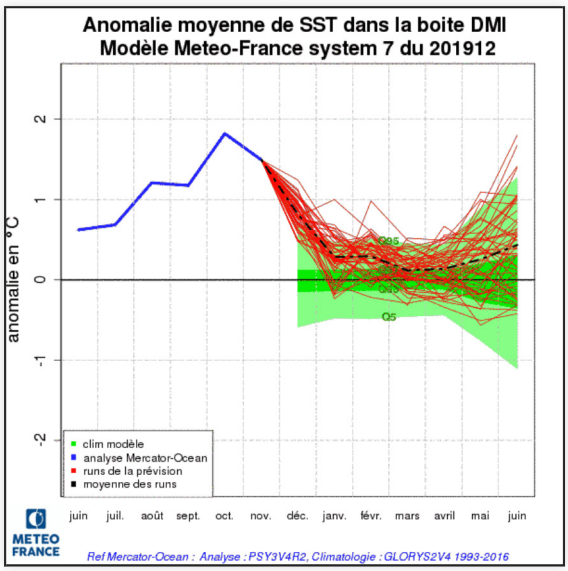
Neutral conditions are most likely (about 53 %) for the JFM period

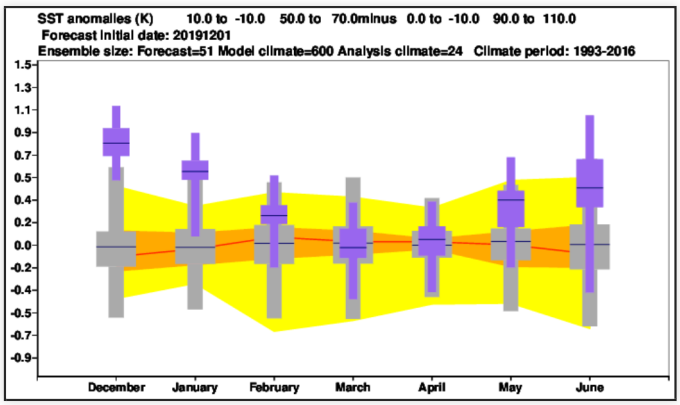


Probability of Niño, Niña, and neutral phases for the next 8 quarters. source http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

Oceanic forecast : Indian ocean - DMI evolution

Rapid decrease of the DMI with both models. This is a normal evolution at this season. Anyway it remains positive compared to climatology (many members in the upper tercile)

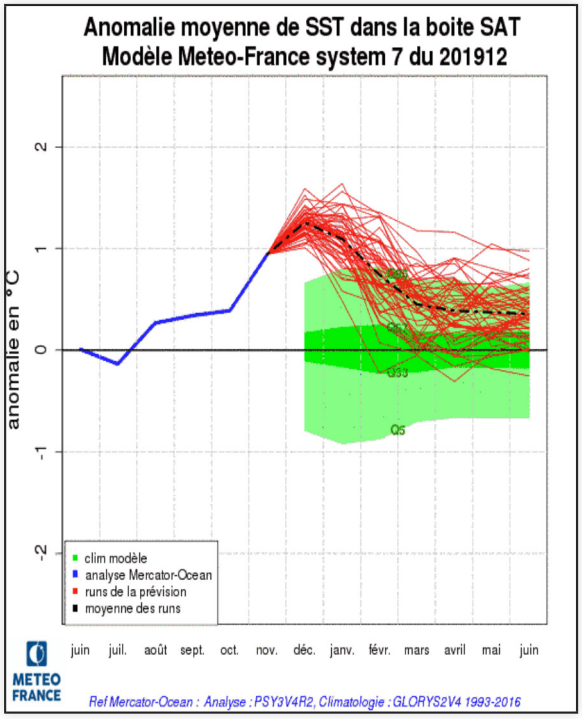


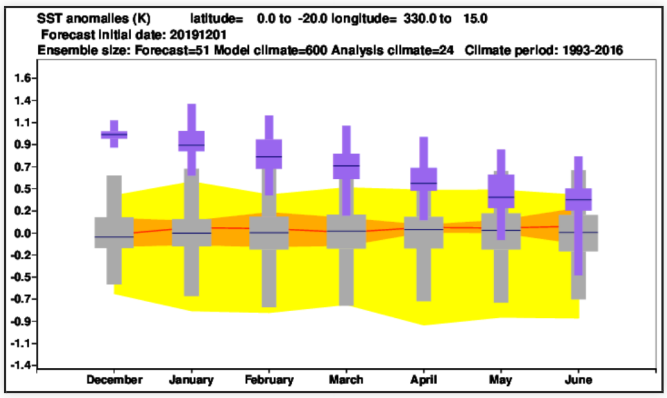


DMI index : analysis, forecasts and model climatology with MF7 on the right and SEAS5 on the left

Oceanic forecast : Atlantic ocean - TAS evolution

High positive temperature anomaly relative to climatology



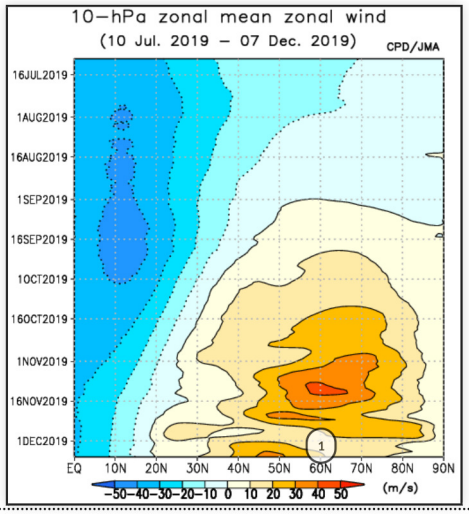


Anomaly on the SAT box : analysis, forecasts and model climatology with MF7 on the right and SEAS5 on the left

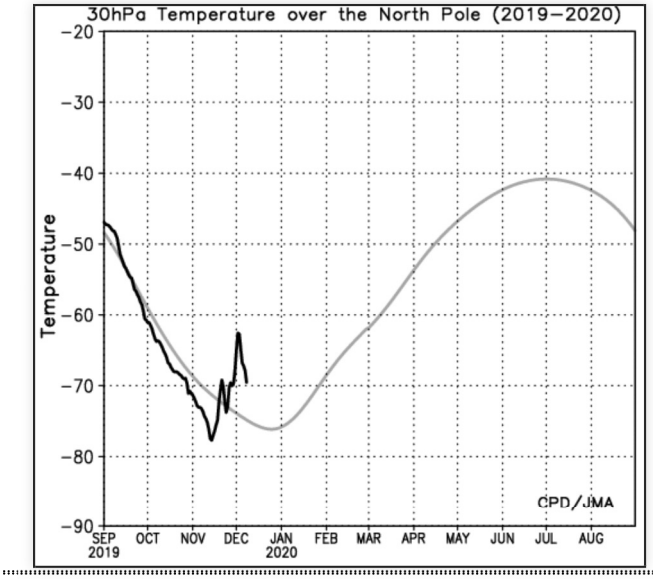
Drivers : SSW

Polar vortex returned to normal in November.

Slight warming of temperatures in strastosphere (but no SSW)



1- Zonal winds returned to normal after record values in October.



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

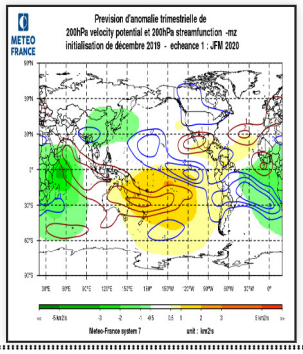
Drivers : Summary

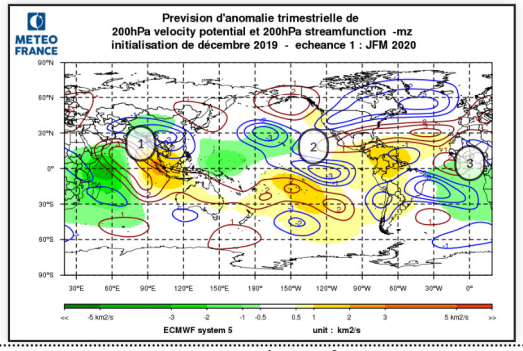
- ENSO remains neutral the next quarter
- Eurasian snow cover contrasted in November with a deficit on southern Russia and a excess on Scandinavia and Kazakhstan to Mongolia
- SST positives anomalies on the southern atlantic and the declining DMI index have no effet reported in the research articles on atmospheric circulation over the North Atlantic at this season.
- Conclusion : No drivers identified concerning atmospheric circulation over the North Atlantic

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

Velocity Potential : Good agreement between models on strong ascents anomalies for the west of Indian Ocean to the south of the Atlantic linked to IOD and SST anomalies. Quite a good agreement elswhere with subsidence of the east of Pacific to the North Atlantic. Difference on southeast asia and the west Pacific with a subsident/ascendant dipole based on SEAS5 and CMCC. This dipole is suggested by DWD but not by MF7.

Streamfunction : models continues to propose a response to the IOD, with a cyclonic circulation for Central Asia/Middle East and an anticyclonic circulation on the eastern Indian Ocean . In addition we can note a teleconnection from the east of the Pacific to the north of america. Finally another teleconnection is suggested by models from the gulf of Guinea to the Mediterranean.

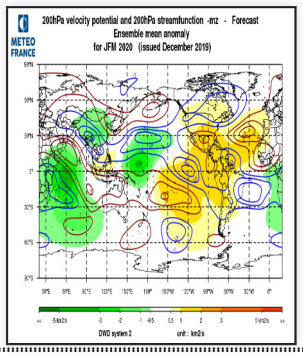


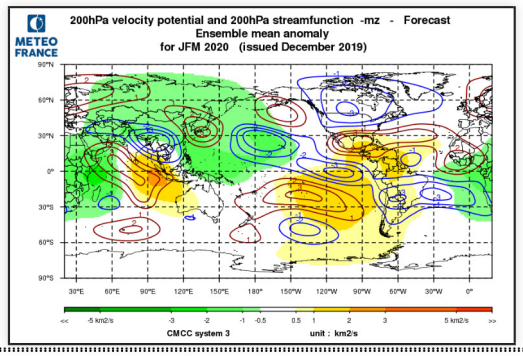


1- Response to the IOD forcing.

3- Warm anomaly in SST, which could favour upward anomaly in velocity potentiel (green anomaly), and thus a dipole of anticyclonic circulation. Possible teleconnection to Europe.

2- Teleconnection from the pacific

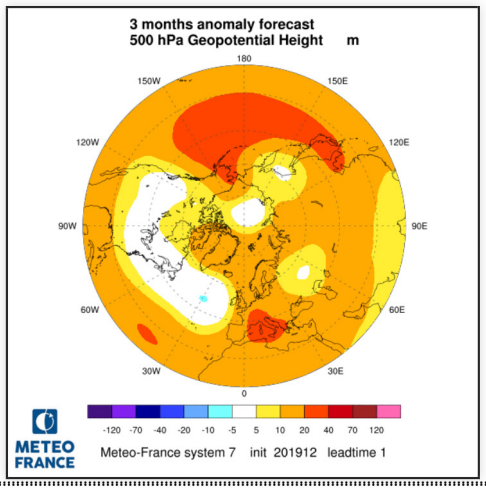


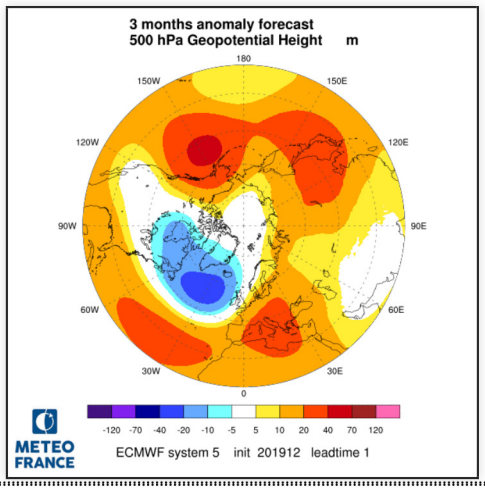


MF7,SEAS5, DWD and CMCC 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

Atmospheric circulation forecasts : 500 hPa Geopotential anomalies

Like last month, good agreement between MF7 and ECMWF over the Atlantic and Euro-Mediterraen region : enhanced zonal circulation for the North Atlantic basin close to Europe (it looks like EA+ mode of variability).



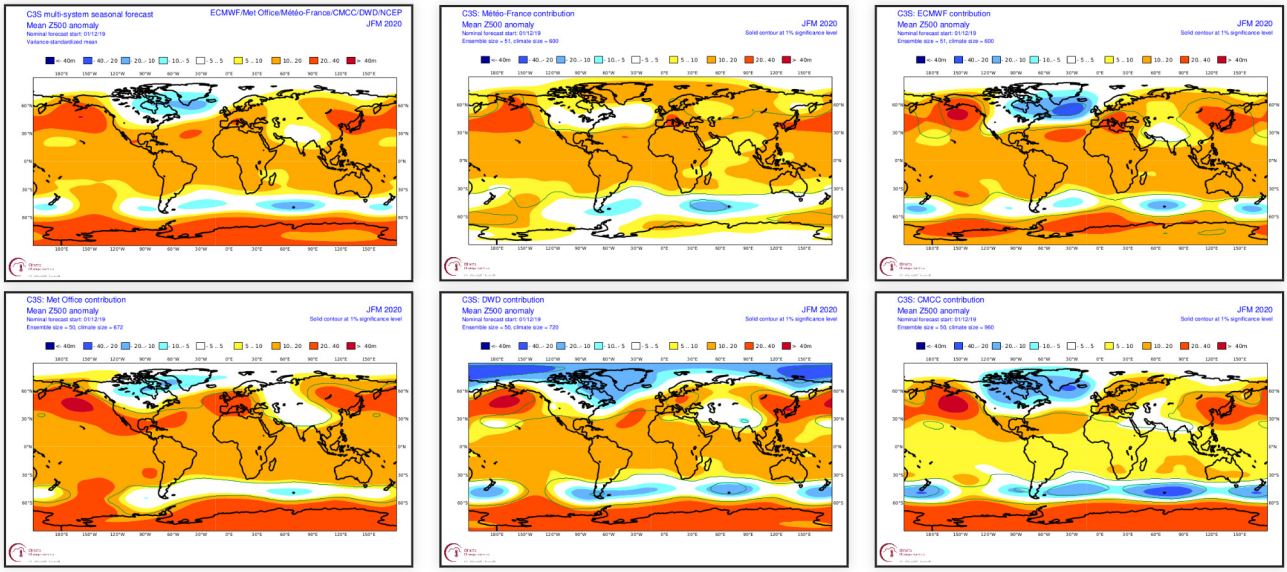


polar projection of MF7 and SEAS5 500hPa geopotential height anomalies.

Atmospheric circulation forecasts : Z500 anomalies in C3S models

Rather good agreement between models regarding general situation for winter : EA+ and/or NAO+ circulation types seem to be highly likely. A positive geopotential anomaly concerns a large part of Europe. The relative low or Middle East/Asia is the trace of the Stream-Function cyclonic anomaly that we have pointed out previsously.

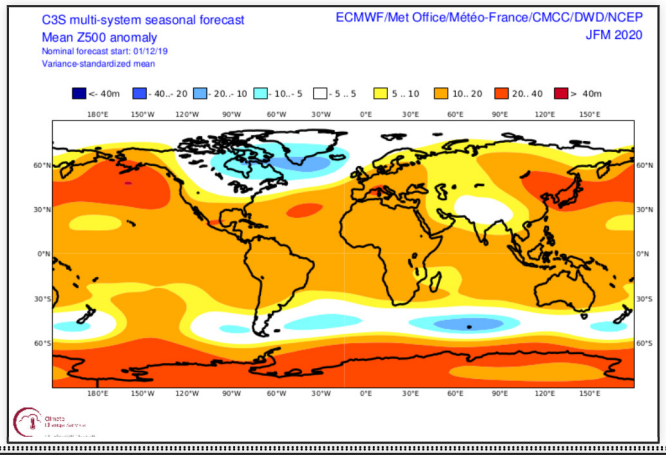
Looking at "details", MF7 is different from other models with less marked negative anomaly in central Asia (linked to difference in 200hPa Velocity and streamfunction) and NAO+ circulation lower than other.

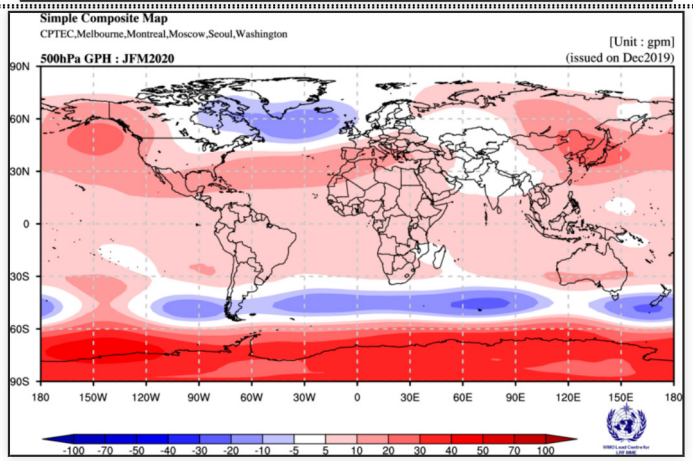


C3S multi-system, MF7, SEAS5, UKMO, DWD and CMCC 500hPa geopotential height anomalies.

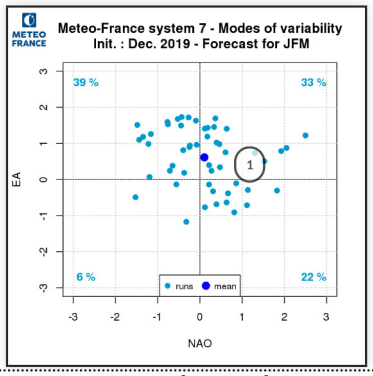
Atmospheric circulation forecasts : Z500 anomalies multi-systems

When looking at all models but C3S (see second figure down below), the forecast pattern is very well correlated with C3S Multi-Model : zonal circulation favoured, but little shifted to the south.

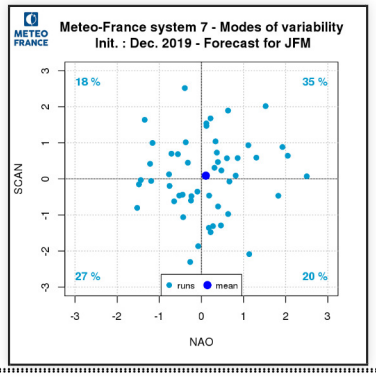


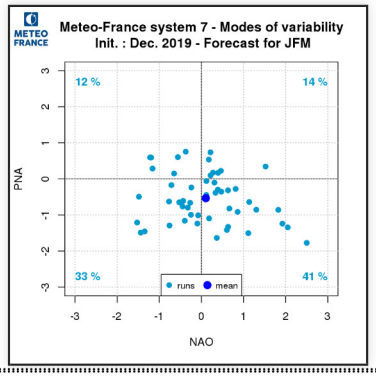


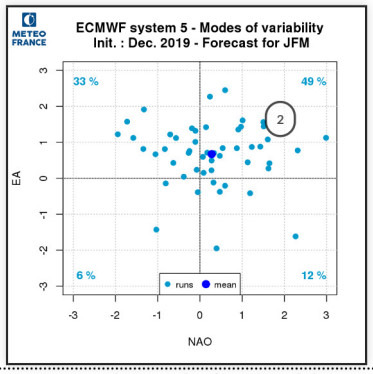
Modes of variability : forecast



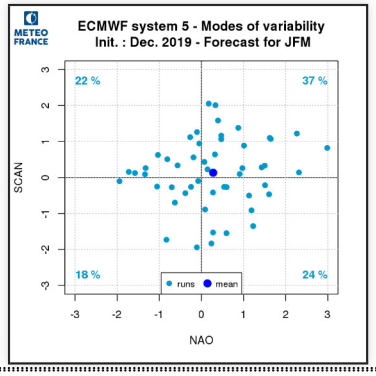
1- positive EA for 72% of runs.

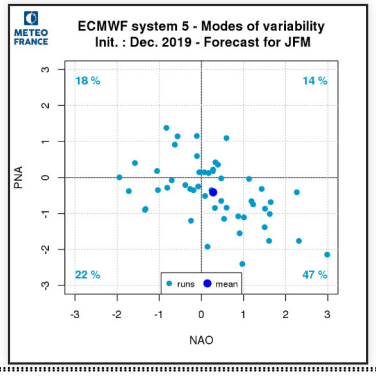






2- Positive NAO and EA modes for 49% of the members.



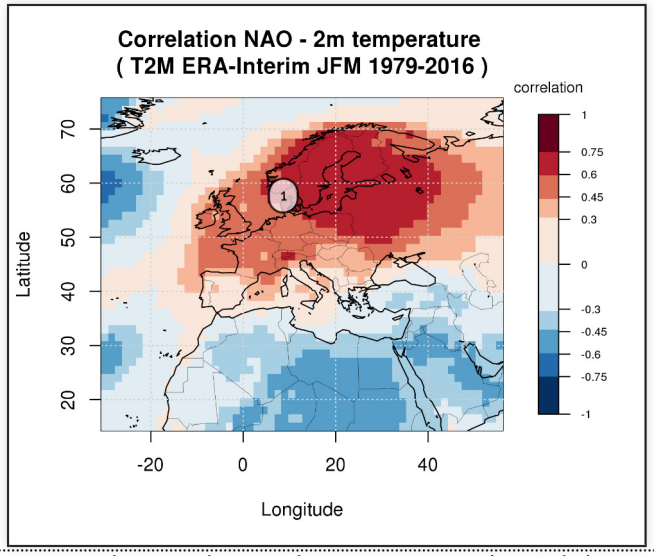


see the modes of variability patterns

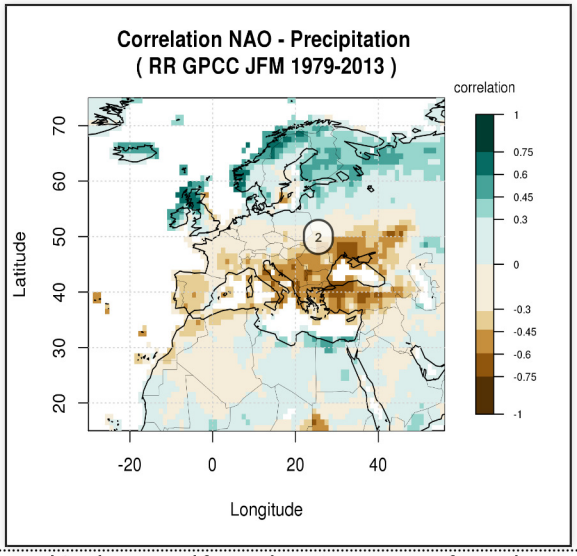
Both models suggest a high probability of positive EA and they are more dispersed for NAO mode with a preference for positive mode.

Modes of variability : NAO impacts

NAO+ mode should be favoured by most models



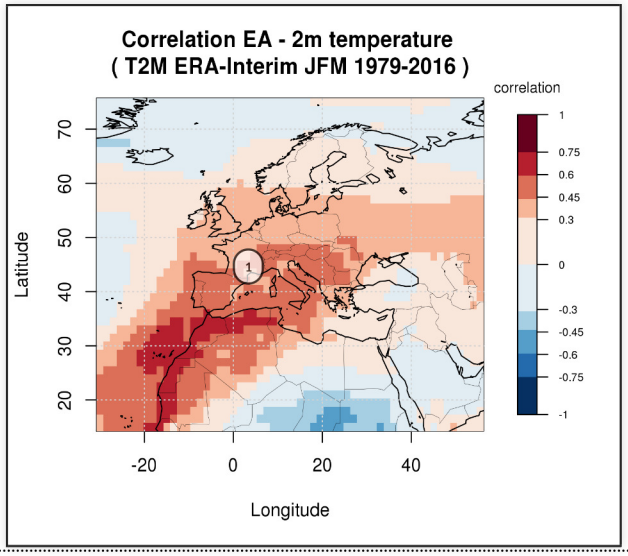
1- Warmer than normal over north-western Europe, and particularly over Scandinavia



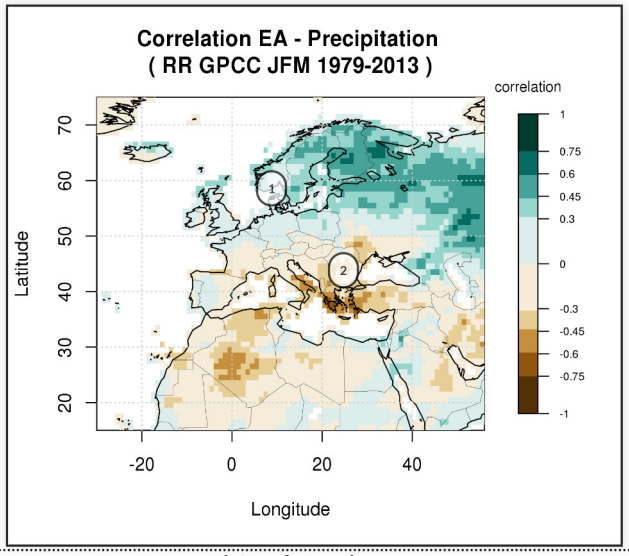
2- drier than normal for southern Europe; wetter for northern Europe.

Modes of variability : East Atlantic impacts

EA+ mode should be favoured



1- Warm signal over Europe



2- Dry conditions for south-eastern Europe

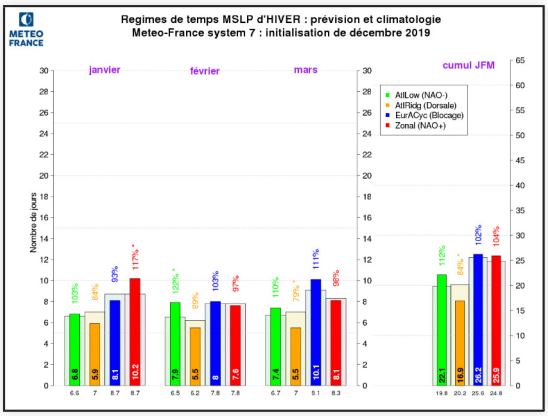
1- wet conditions over northern Europe

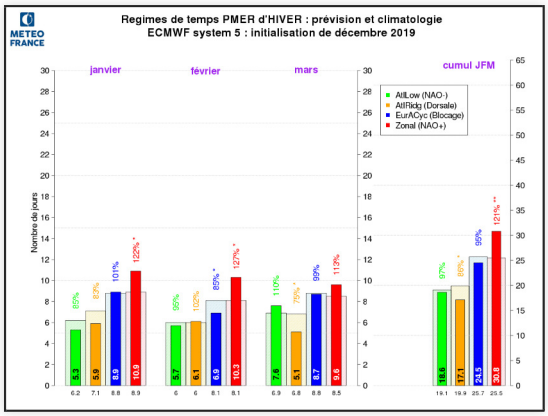
Weather regimes : winter Sea Level Pressure classification

SEAS5 suggest a preeminence of NAO+ unlike MF7

Both models forecast the Atlantic Ridge regime less frequent than normal

No clear signal regarding the other regimes.

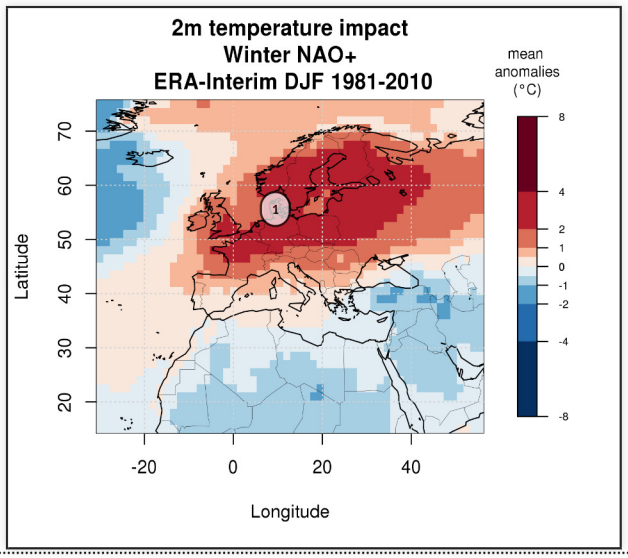




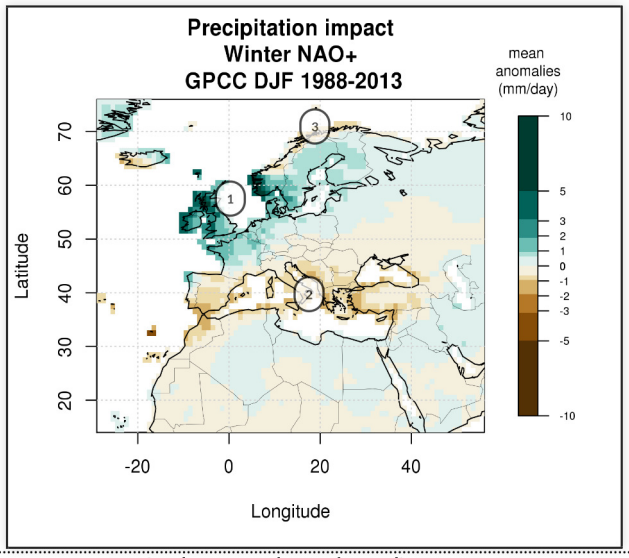
Frequency of SLP weather regimes, compared to model's own climatology, for the next three months and aggregation over the entire quarter, for MF7 (left) and SEAS5 (right).

See the winter weather regime patterns

Weather regimes : Impacts



1- Warmer than normal over Northern Europe



2- Drier than normal over the Mediterranean sea

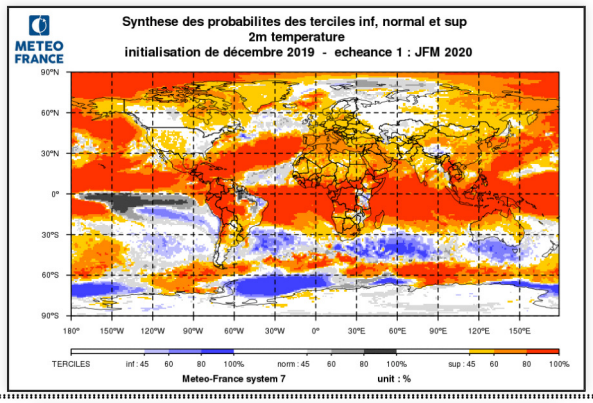
3- Drier than normal

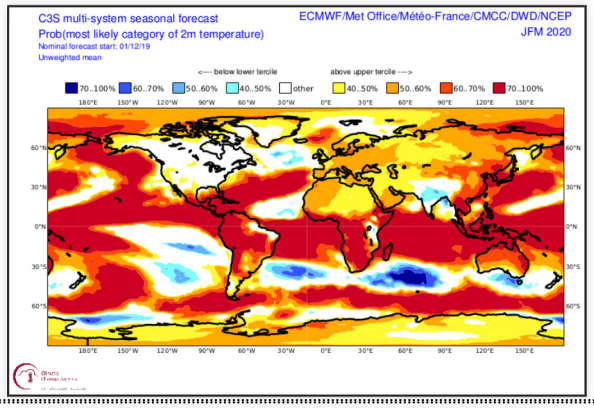
1- Wetter than normal over much of Northern Europe

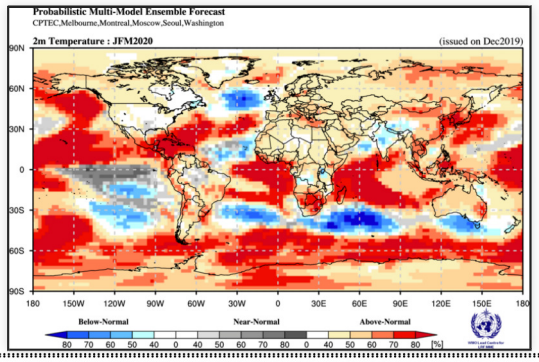
Impact of Winter NAO+ weather regimes on temperature and precipitation. (ref ERA-interim 1981-2010)

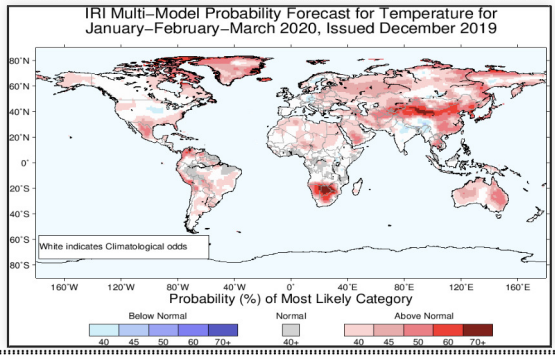
Forecast of climatic parameters : Temperature probabilities

Remarkable good agreement between models all over the world.
Widespread warm signal with the exception of Eastern Africa (consistent with positive IOD and wet conditions) and the Indian Subcontinent, and, to a lesser extent Middle East and North Africa (consistent with positive NAO/EA). For western Europe, only IRI multi-model system does not predict warmer than normal conditions.





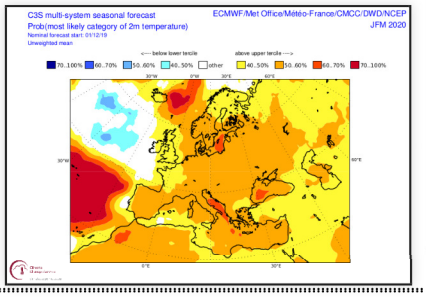


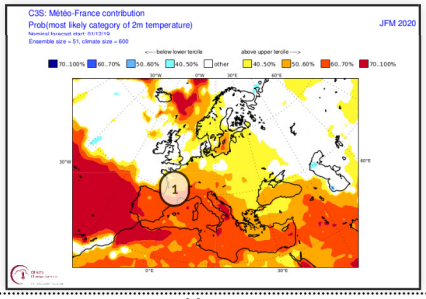


2m temperature probability map from MF7 (top left), C3S multi-models (top right), others models of WMO multi-models (bottom left) and IRI multi-models synthesis (bottom right)

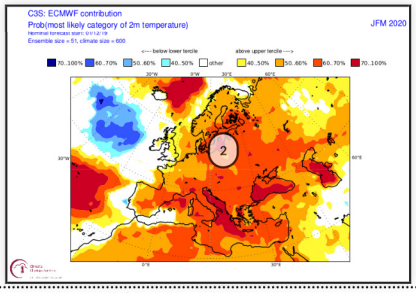
Forecast of climatic parameters : T2M probabilities over Europe in C3S models

In agreement with their general circulation pattern for JMA (NAO and/or EA positive), all the systems favor the Warm tercile over Europe and the Mediterranean basin, with some differences in the patterns and the probabilities.

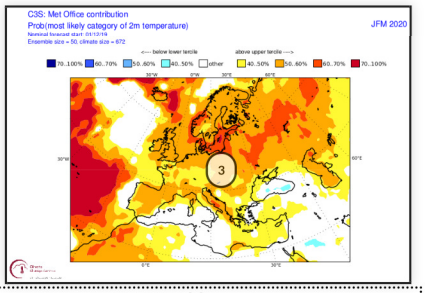




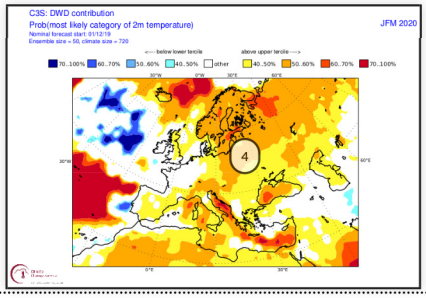
1- EA+ like response



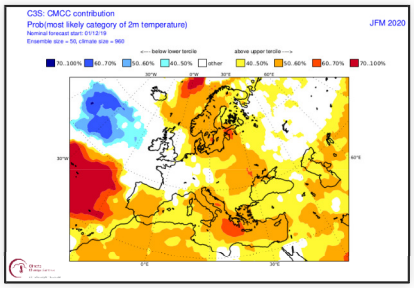
2- mixte EA+ NAO+ response



3- NAO+ like response



4- NAO + like response attenuated

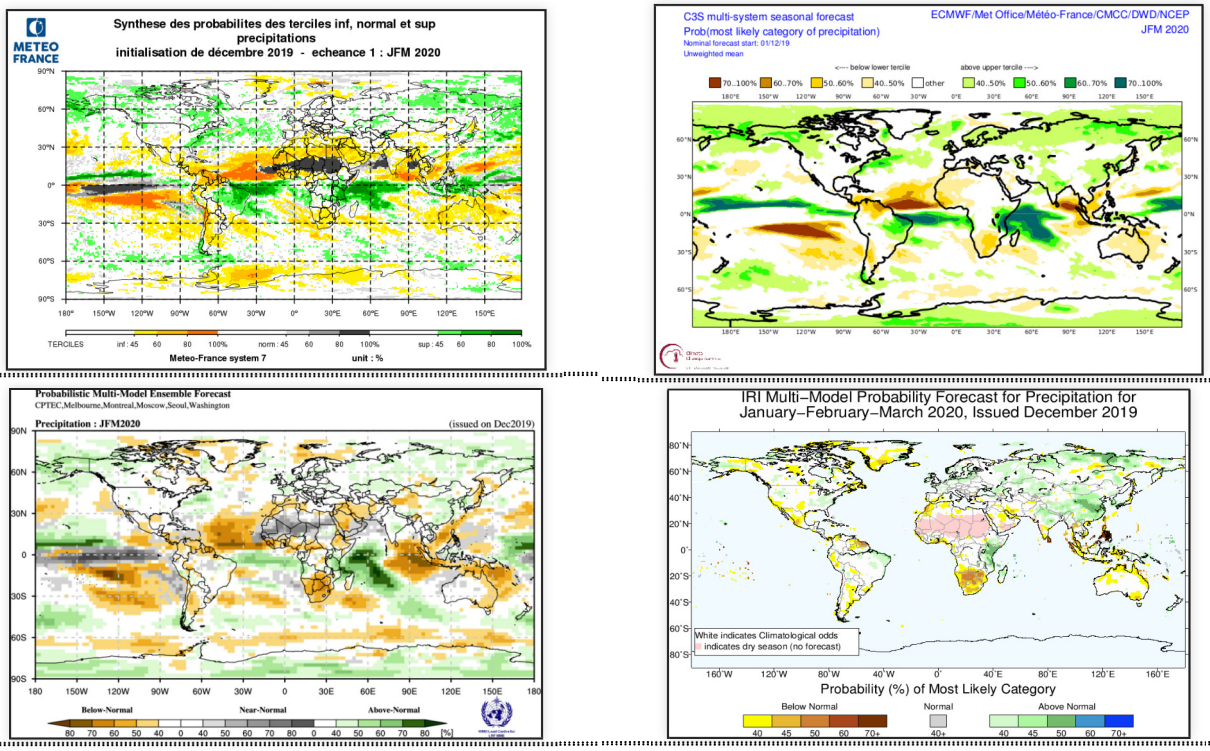


C3S multi-models probability map (top left) and MF7, ECMWF5, UKMO, DWD, CMCC models.

Forecast of climatic parameters : Precipitation

Main features are the the strong wet signal from the east of Indian Ocean to the south of tropical Atlantic both consistent with the SST forecast and velocity potential anomalies. Dry signal is forecasted around southeast Asia, and south tropical Pacific. Over the Atlantic, strong dry signal from Northern tropics to West Africa.

Wet conditions for North hemisphere in high latitudes : Europe, Russia, North America..

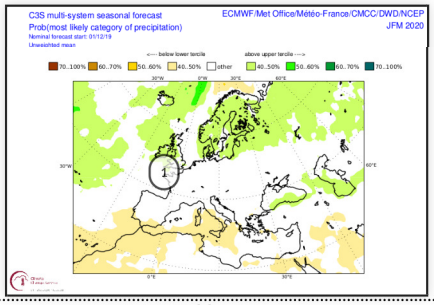


precipitation probability map from MF7 (top left), C3S multi-models (top right), others models of WMO multi-models (bottom left) and IRI multi-models synthesis (bottom right)

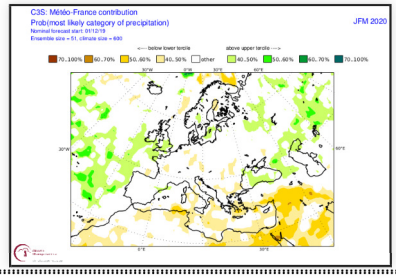
Forecast of climatic parameters : Precipitation probabilities over Europe in C3S models

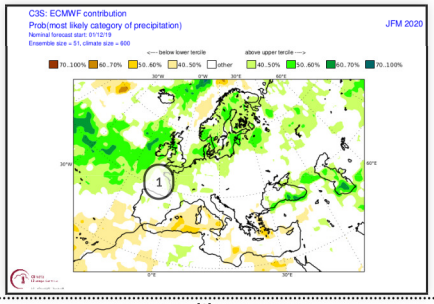
In agreement with positive NAO and/or EA modes, enhanced wet signal for northern Europe and dry signal for southern Europe.

For the Mediterrean basin, clear dry conditions favored in the Western part, patches of wet signal in the Eastern part.

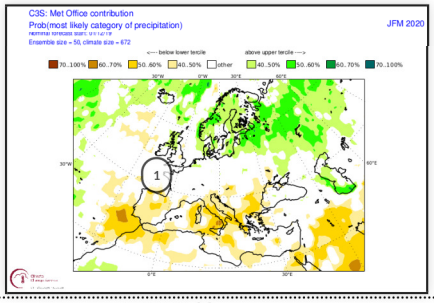


1- NAO+ like response

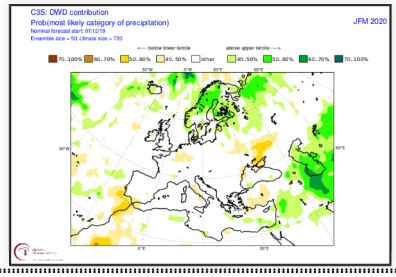


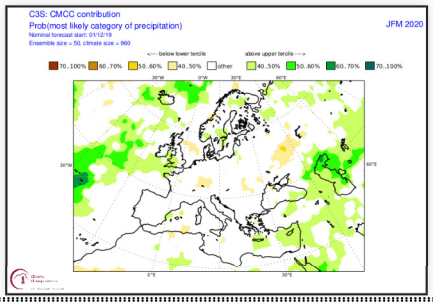


1- NAO+ like response



1- NAO+ like response



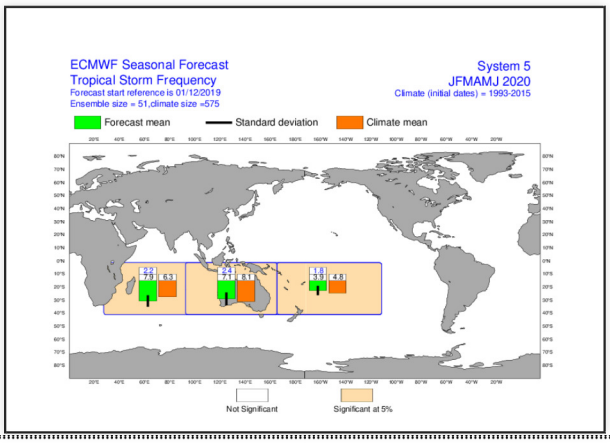


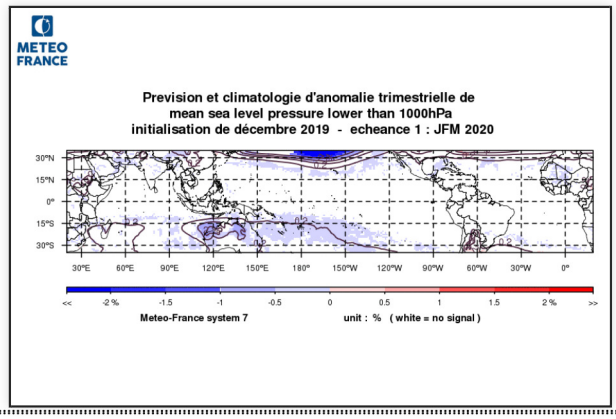
C3S multi-models probability map (top left) and MF7, SEAS5, UKMO, DWD, CMCC models.

Forecast of climatic parameters : Tropical Storm Frequency

According to IOD and VP200 anomalies, above normal activity is forecast for Western Indian Ocean and below normal activity is forecast around Australia and over Southern Pacific.

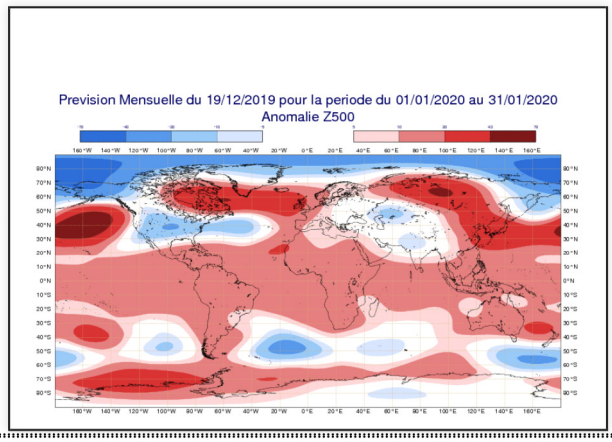
MF7 (index based on the frequency of low < 100hPa) shows also a reduction of stropical storm activity around Australia and over Southern Pacific.

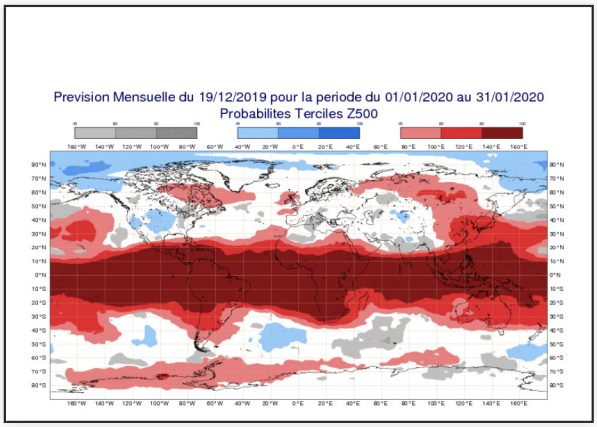




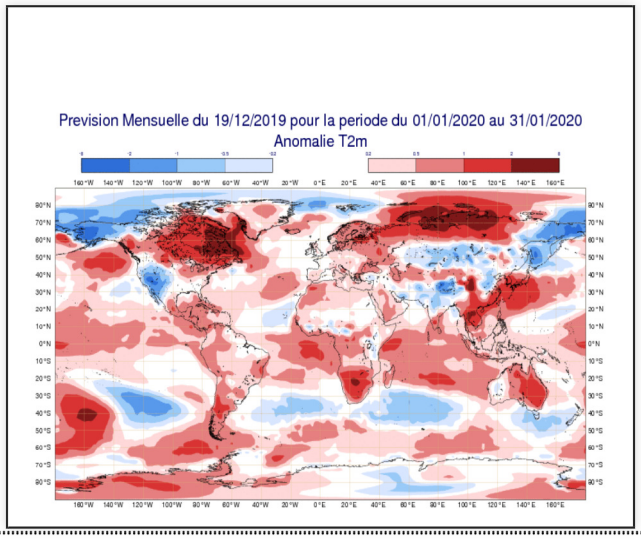
Monthly forecast of 20191219 : Z500

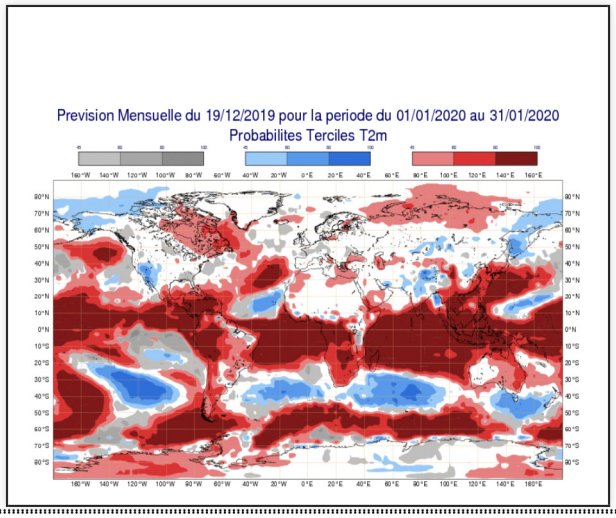
Monthly forecast has similarities with the seasonal forecast on Asia (probable effect of the Indian dipole) but it is very different on the Atlantic.



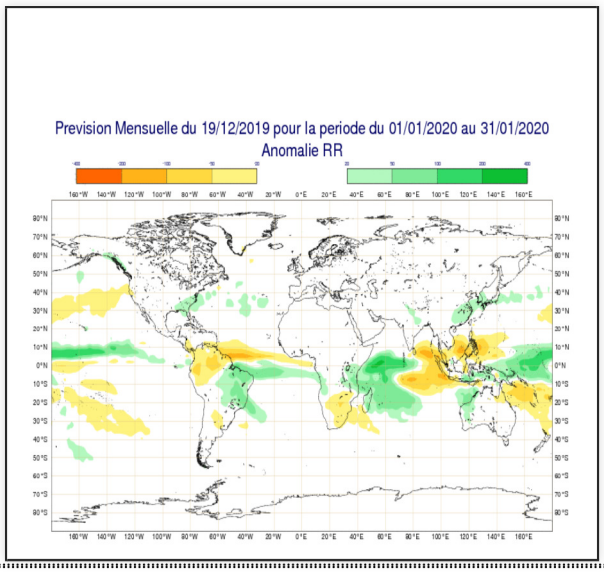


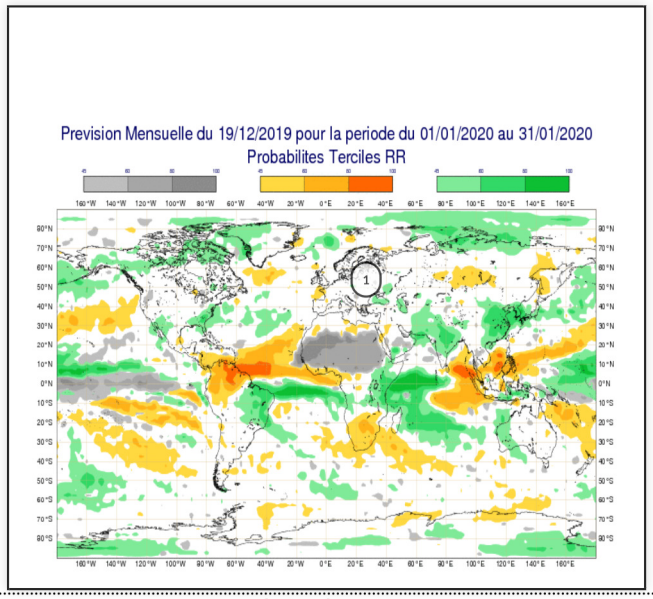
Monthly forecast of 20191219 : temperature





Monthly forecast of 20191219 : precipitation

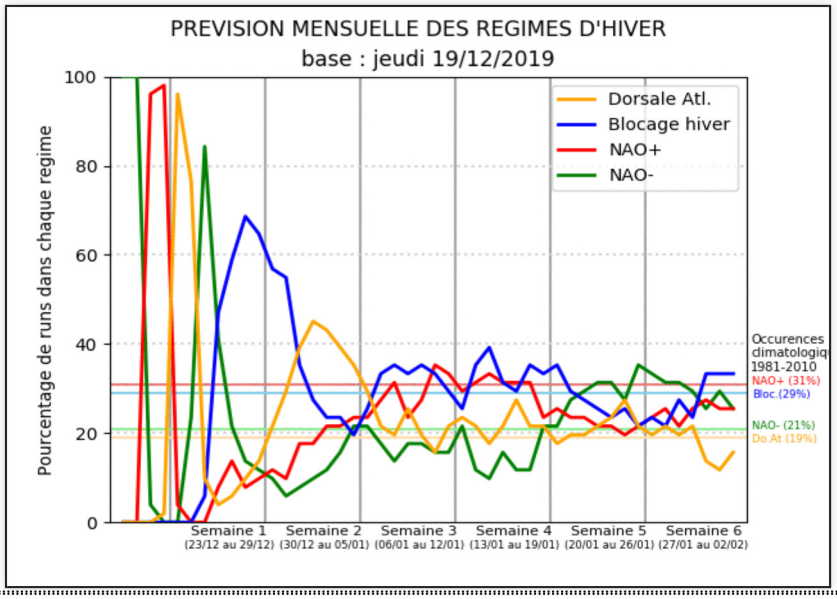




1- weak signal over Europe.

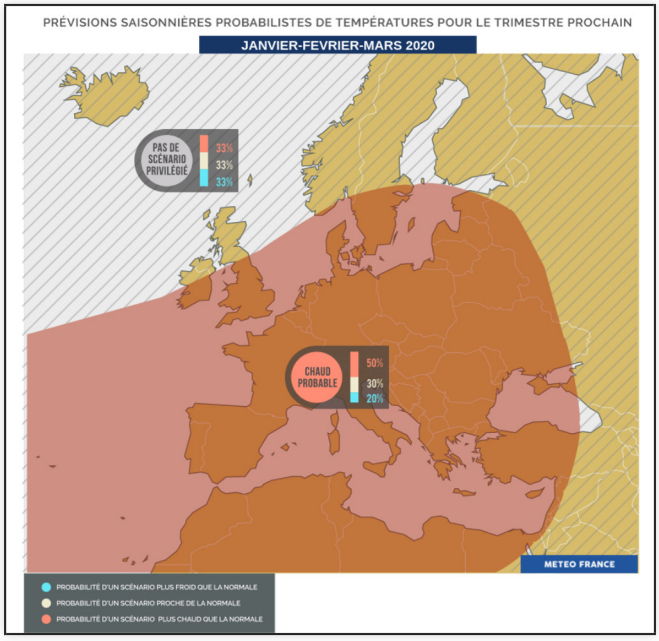
Monthly forecast of 20191219 : winter SLP weather regimes

No cleary dominant regimes the next month



Synthesis map for Europe : Temperature

According to a circulation dominated by EA+ and NOA+ modes of variability, warmer than normal conditions are expected over most of European countries.



Synthesis map for Europe : Precipitation

As expected with EA + and NAO + modes of variability, drier than normal conditions should prevail over Southern and South-Eastern Europe and globably over the Mediterranean Basin. At the contrary, over North Europe, wetter than normal conditions should prevail.