VERIFICATION BULLETIN

DECEMBER - JANUARY - FEBRUARY 2019-2020

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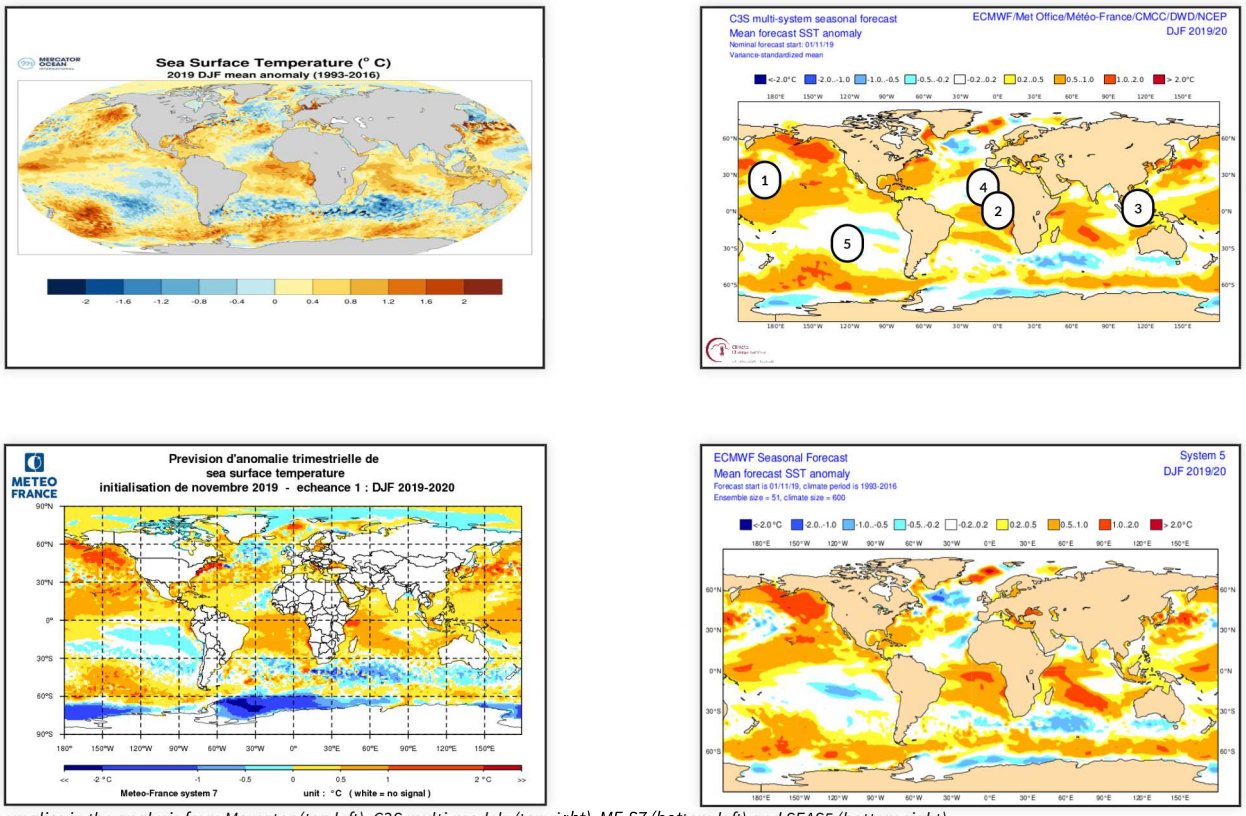
Introduction : Objective

- **The objective of the Seasonal Verification Bulletin is to present an evaluation of the main elements highlighted in the Seasonal Forecast Bulletin : oceanic forcings, large scale circulation patterns, and a focus on temperature and precipitation forecast over Northern Atlantic, Europe and the Mediterranean Basin.**
- **The aim is not to evaluate the mean skill of Seasonal Forecast models, for which scores are calculated over the whole hindcast period, but to enhance the knowledge of the behavior of models for advanced users (as National Meteorological Services), in parallel with an assessment of expertised forecast. This approach meets the need of many users, who want to know the recent real-time performances of forecasts, for specific events.**
- **Thanks to Mercator-Ocean and DWD (RCC-Climate Monitoring node for Europe) for providing products and analysis on the monitoring part.**

Oceans : surface temperature anomalies

SST patterns were generaly very well captured by models, especially the strong IOD in Indian Ocean, the neutral phase of Enso in Pacific, and the strong positive anomaly along the equatorial Atlantic.

In the North Tropical Atlantic Ocean, models have underestimated cold anomalies. In southern Pacific, the forecast was not cold enough.



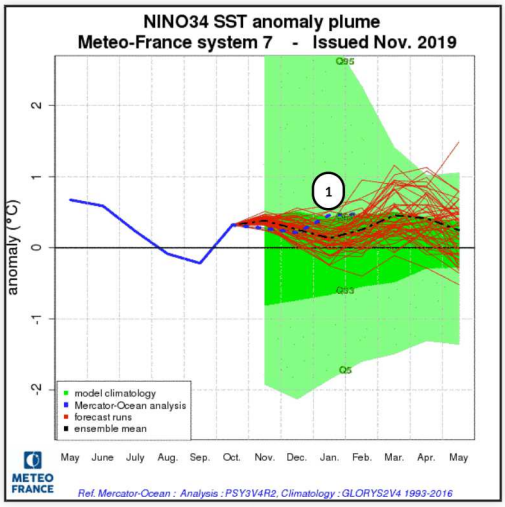
SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S7 (bottom left) and SEAS5 (bottom right)

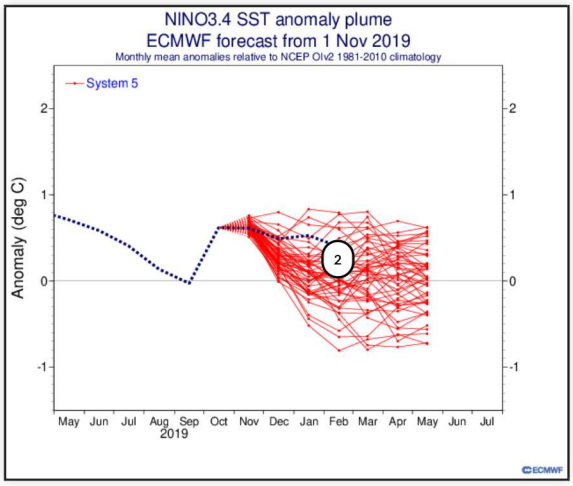
1 - Warm pattern well predicted over north Pacific
2 - Warm anomaly predicted
3 - Positive IOD very well captured
4 - Cold anomaly are underestimated
5 - Intensity of the large cold anomaly not well foreseen by models

Oceans : ENSO

CAUTION : reference analysis differ between MF-S7 (Mercator-Ocean 1993-2016) and SEAS5 (NCEP 1981-2010).

Correct forecast of the neutral phase. MF-S7 has predicted correctly Nino3.4 evolution, with a remarquable low spread.



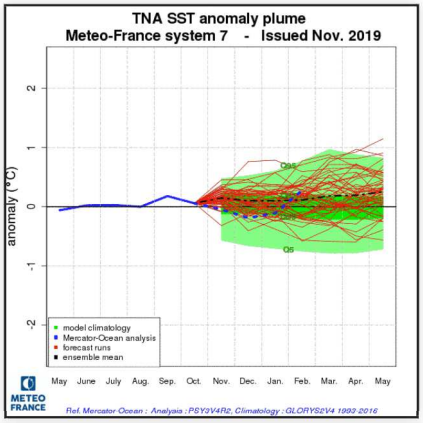


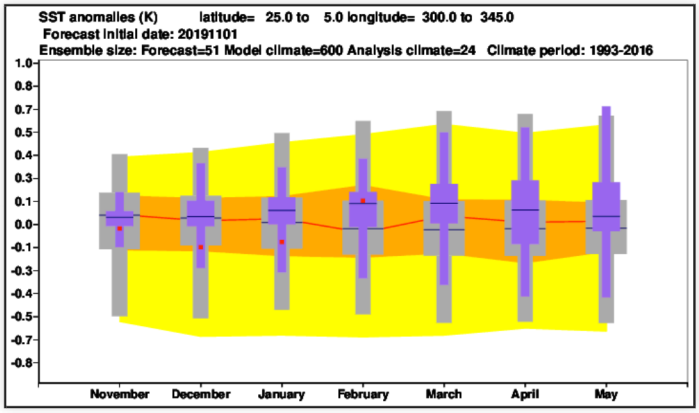
1 - Good forecasts, close to analysis
2 - Hot anomaly underestimated by most SEAS5 runs

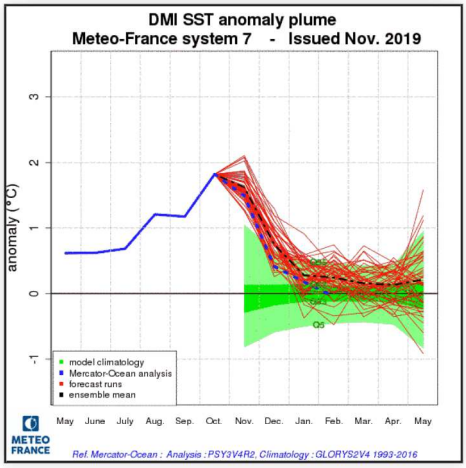
Oceans : tropical Atlantic and Indian Ocean index

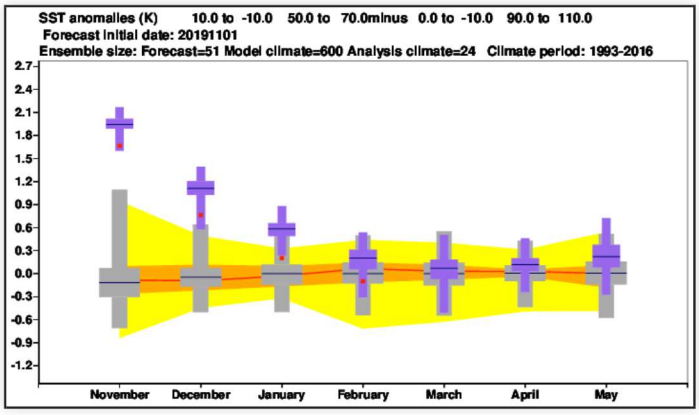
TNA : values have stayed close to climatology, good prediction.

DMI : record values in October and the decrease that followed were very well predicted by both models.



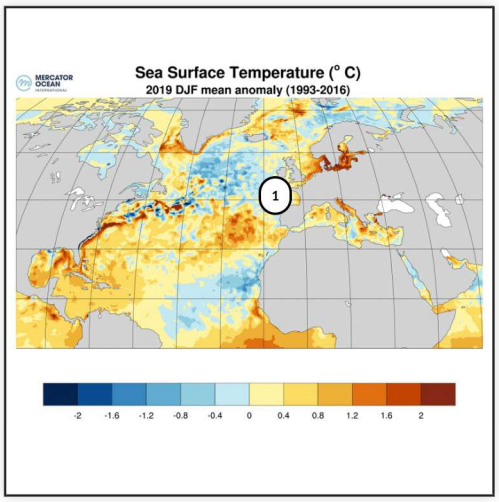


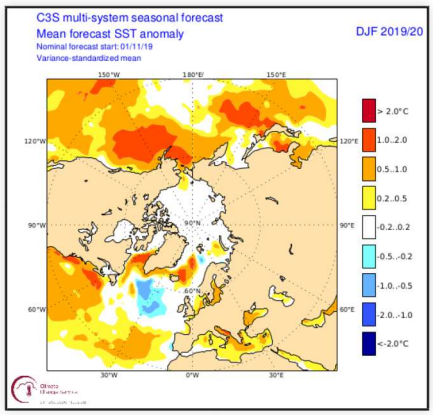


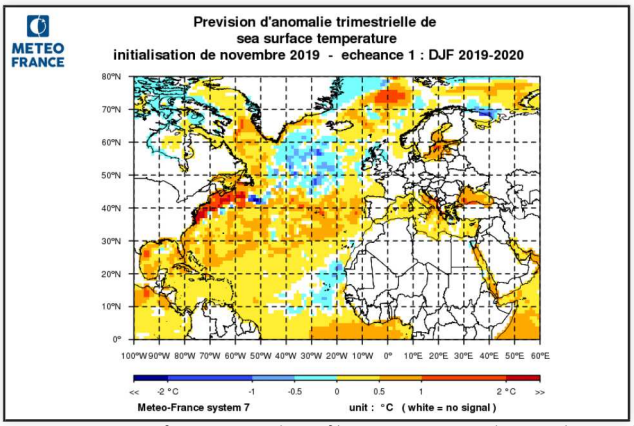


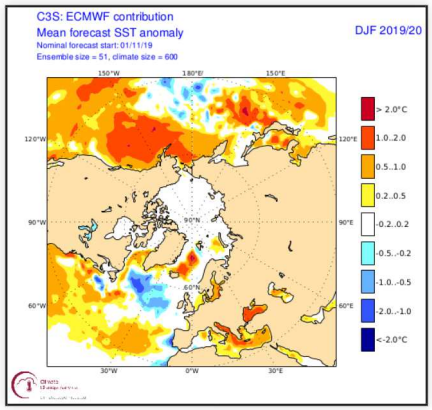
Oceans : North Atlantic SST

Patterns were correctly predicted. The extension of the cold anomaly up to western Europe was not predicted, by any model.









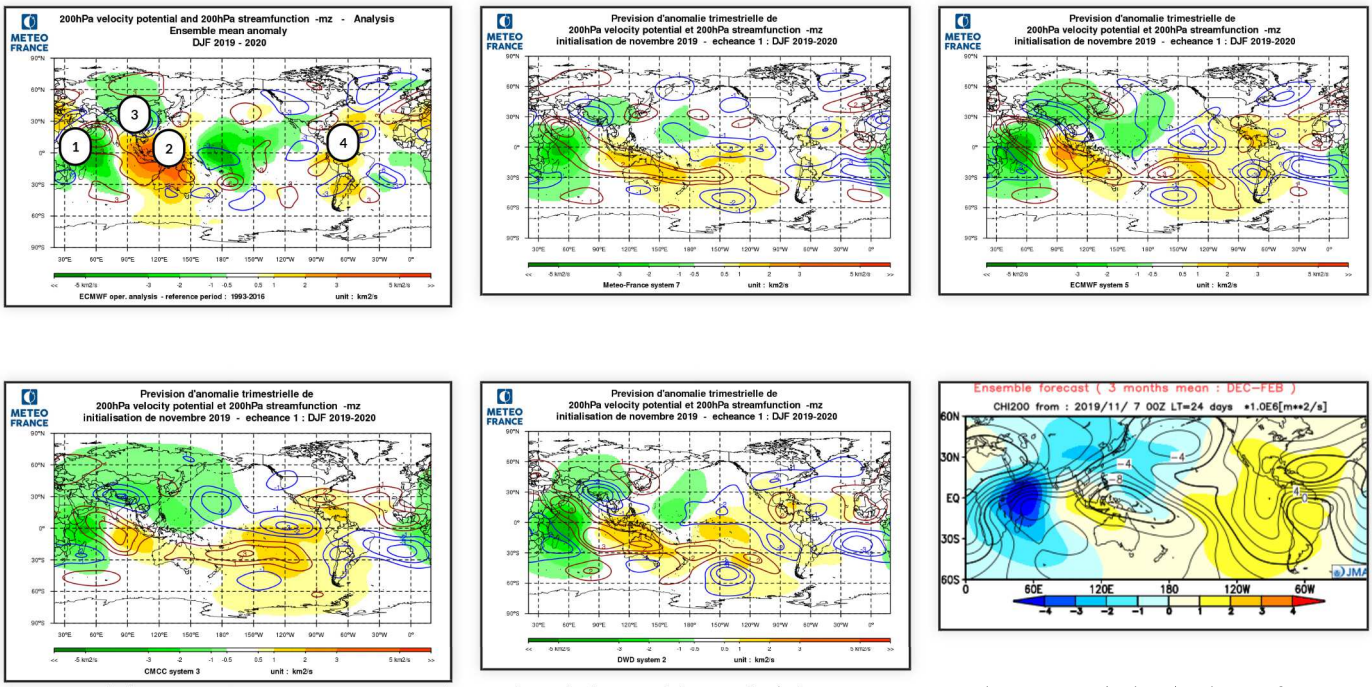
SST anomalies in the analysis from Mercator (top left), C3S multi-models (top right), MF-S7 (bottom left) and ECMWF SEAS5 (bottom right)

1 - Extension of the cold anomaly up to European coasts : not foreseen by models

Atmospheric circulation : Global teleconnection

VP 200hPa : the main anomalies were very well foreseen. Firstly the dipole in link with IOD (subsidence anomaly over Maritime Continent and Australia and upward motion anomaly over the west of Indian Ocean). Secondly the subsidence anomaly over South America. Over western Pacific, the upward motion anomaly as underestimated by models (however it was predicted).

SF 200 hPa : the main teleconnexion over Indian Ocean and nearby regions was well predicted .Elsewhere SF anomaly were not very marked, but some models (especially MF-S7) captured them quite well. Over North Atlantic, the anomaly dipole was also well predicted.



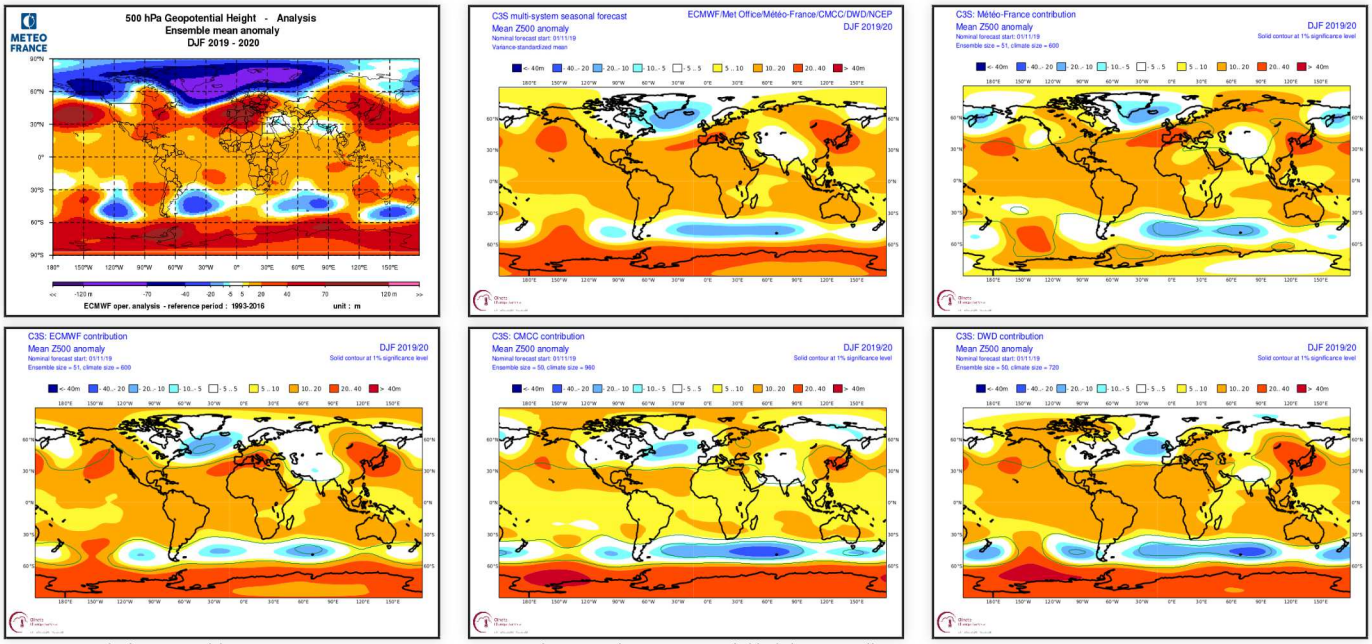
ECMWF analysis, MF-S7, ECMWF-SEAS5, CMCC, DWD and JMA 200hPa velocity potential anomalies (color range, green : ascending, orange: subsidence) and stream function anomalies (isolines, red: anticyclonic in the northern hemisphere, blue: cyclonic in the northern hemisphere).

1 - Anomaly related to IOD forcing
2 - Anomaly related to IOD forcing
3 - blue isolines (SF 200hPa) : circulation induced by downward motion anomaly over the maritime continent
4 - Downward motion anomaly

Atmospheric circulation : 500hPa Geopotential height

Almost all the important patterns were well predicted by a majority of models, in both hemisphere.

The circulation over North Atlantic and Eurasia very fairly well by almost all the models. The impact of IOD in terms of mid-troposphere circulation (negative anomaly in Central Asia surounded by positive anomalies on Europe and east Asia) was correctly reproduced.

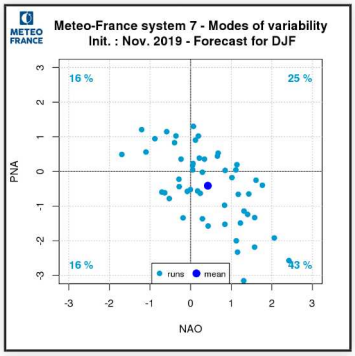


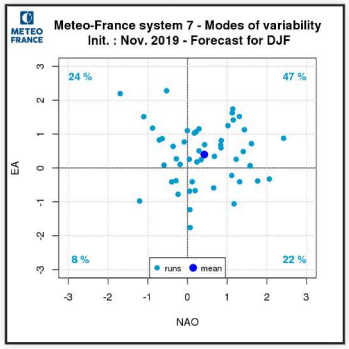
ECMWF analysis, C3S multi-system, MF-S7, ECMWF-SEAS5, CMCC and DWD 500hPa geopotential height anomalies.

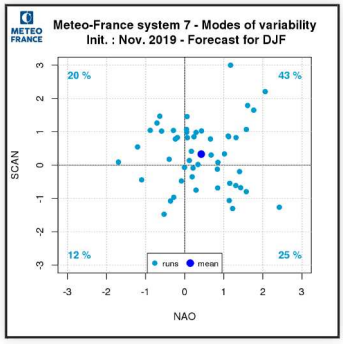
Atmospheric circulation : Modes of variability

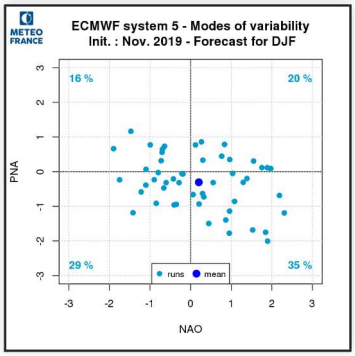
The positive phase of NAO and EA and the negative phase of PNA were correctly predicted.

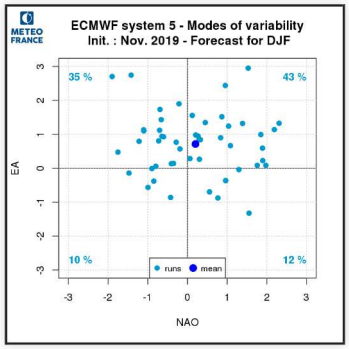
The negative mode of SCAN was not aniticipated (no signal in the models)

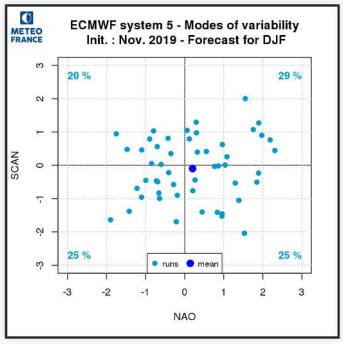






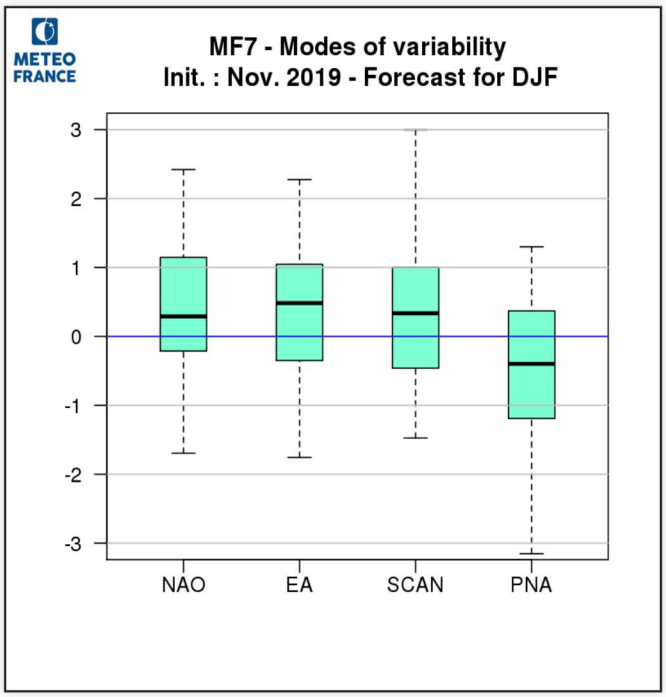


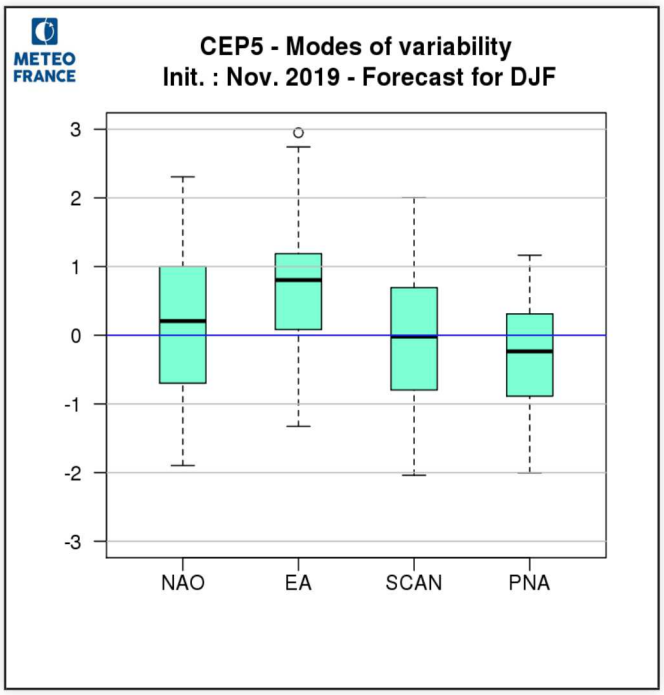




Atmospheric circulation : Modes verification

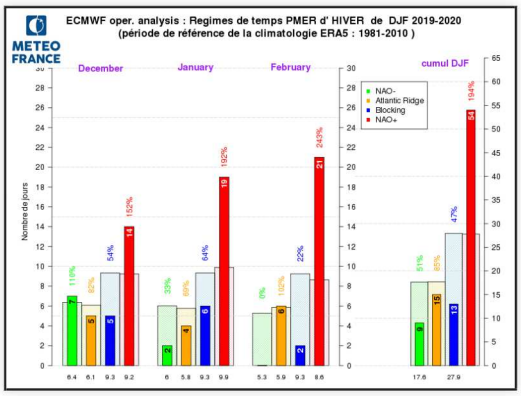
MF-S7 and SEAS5 had similar forecasts.

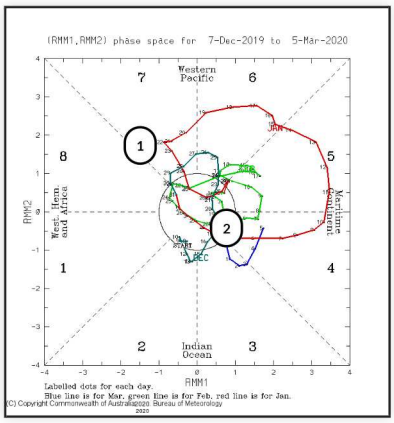


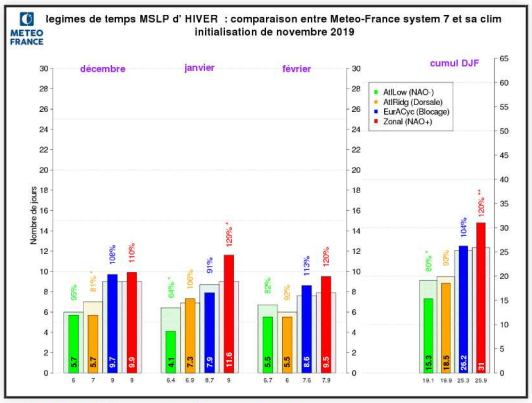


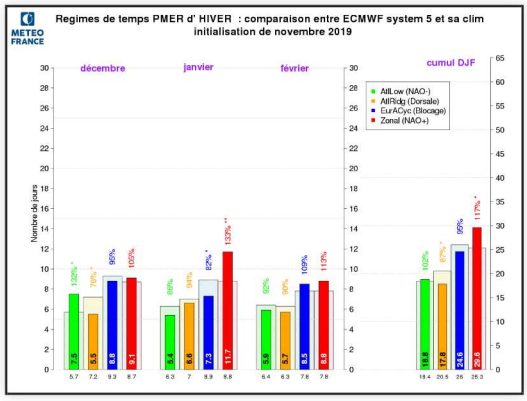
Atmospheric circulation : Winter SLP weather regimes

Both models foresaw an excess of NAO+, this was a good forecast.
The MJO doesn't seem to have played a major role in this situation : MJO was not predominantly active in phase 3 et 4 (favoring the NAO+ *regime*)









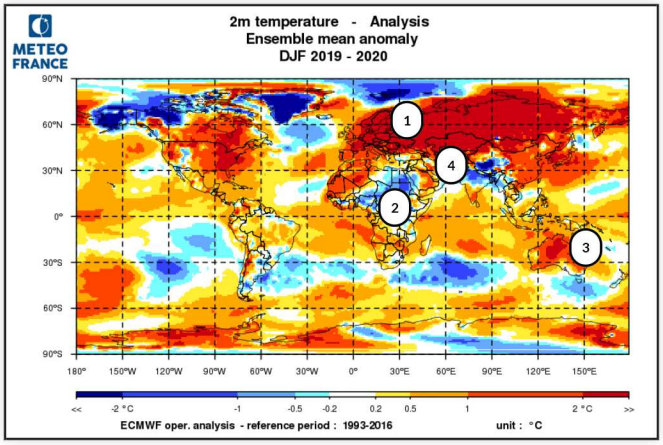
1 - The MJO in this sector favors NAO-.
2 - no clear influence for the rest of the period

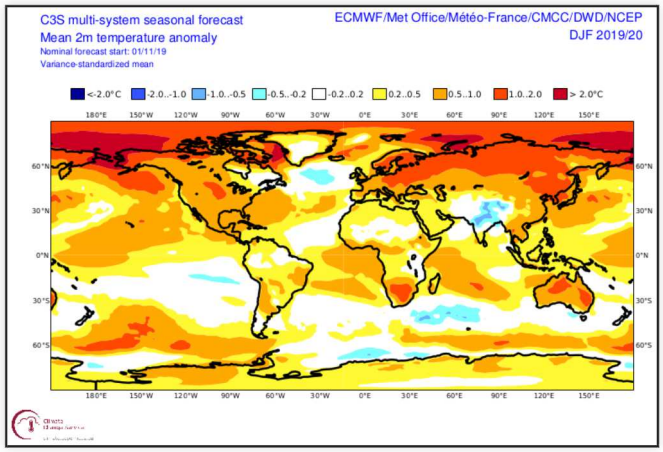
Climatic parameters : temperature on the globe

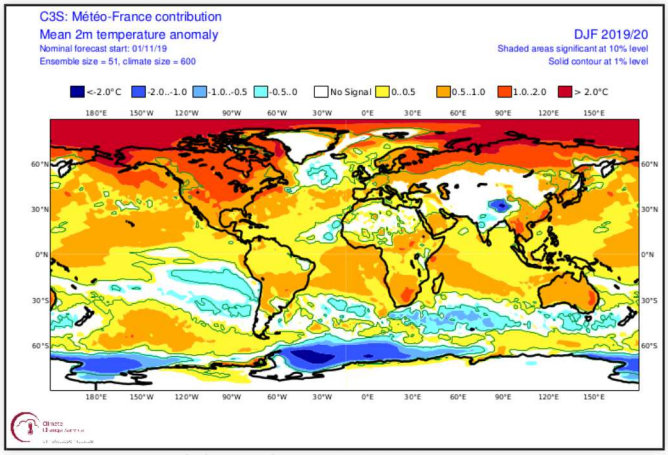
At large scale, very good forecast over the contiental areas.

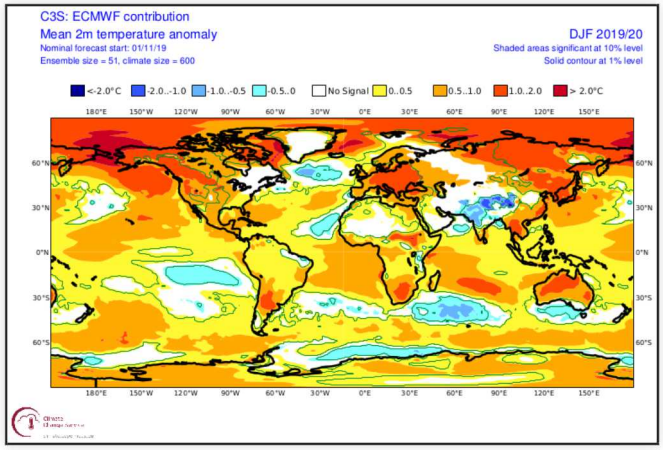
Most of the strongest anomalies obderved were quite weel anticipated : Eastern Europe and Russia, Australia, India ans East China. Over North America and Africa, mixed results even though the anaomly patterns were globally well positioned.

The strong cold anomalies over Alaska and Greenland were clearly not predicted.







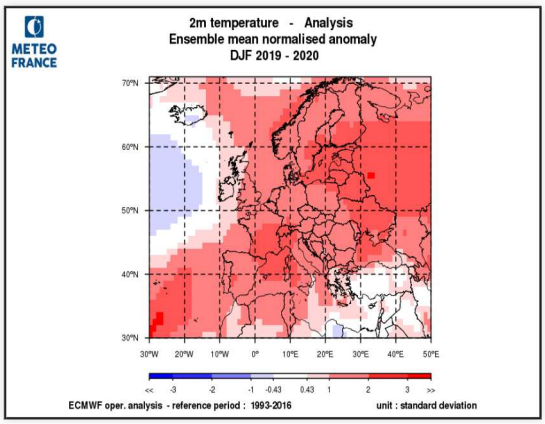


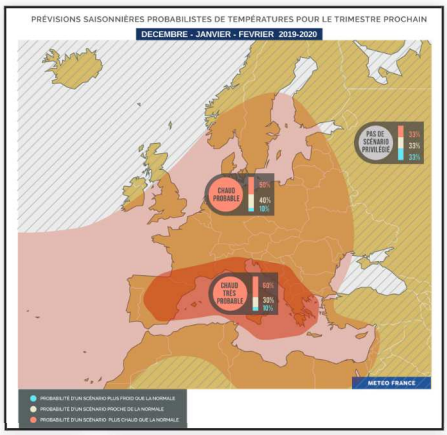
ECMWF analysis top left, forecast for multi-model top right and MF-S7 and SEAS5 on the bottom line.

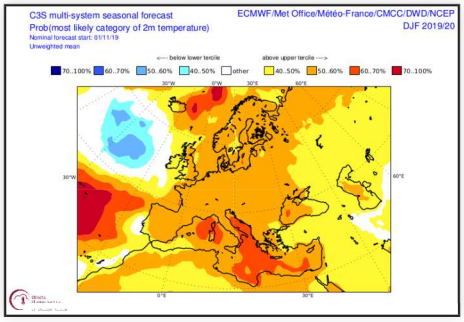
1 - Very strong hot anomaly on a large scale
2 - Cold anomaly related to the rain due to the IOD
3 - Hot anomaly related to the IOD
4 - Cold anomalie linked to IOD

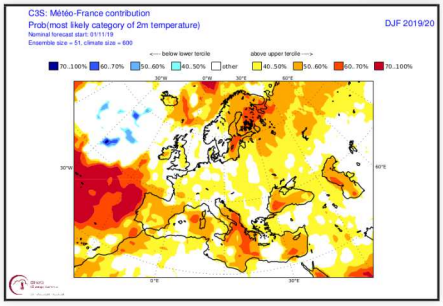
Climatic parameters : temperature over Europe

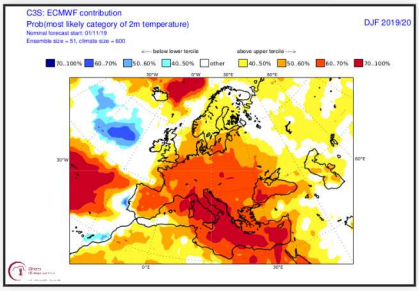
Very warm anomaly observed all over the European continent and the Western aprt of the Mediteranean basin. Models have forecasted the appropriate signal. Because of the strength of the observed anomaly, we could have expected stronger probabilities for the "above normal" tercile. On the synthesis map, the "warm" area didn't extend enough Easterly











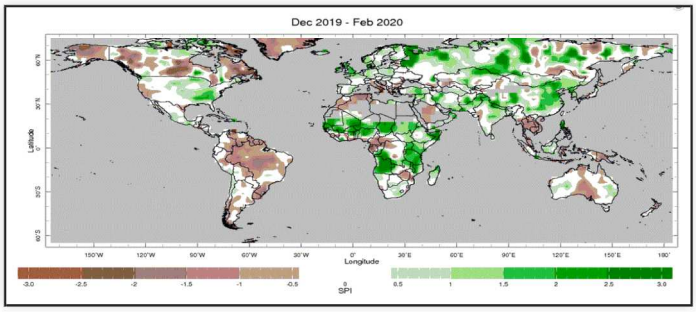
ECMWF analysis top left, synthetic forecast map top right. Forecast for multi-system , MF-S7 and SEAS5 on the bottom line.

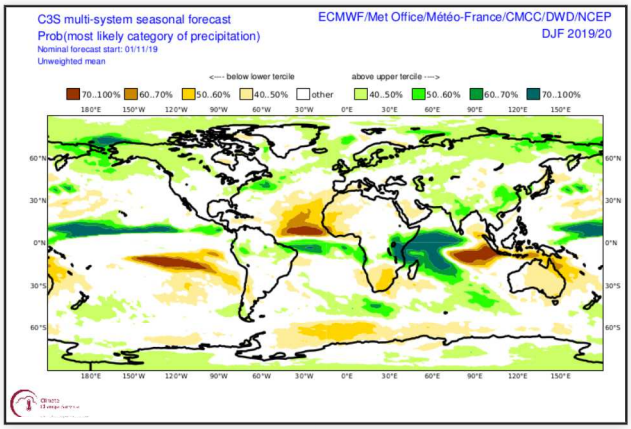
Climatic parameters : Precipitations over the globe

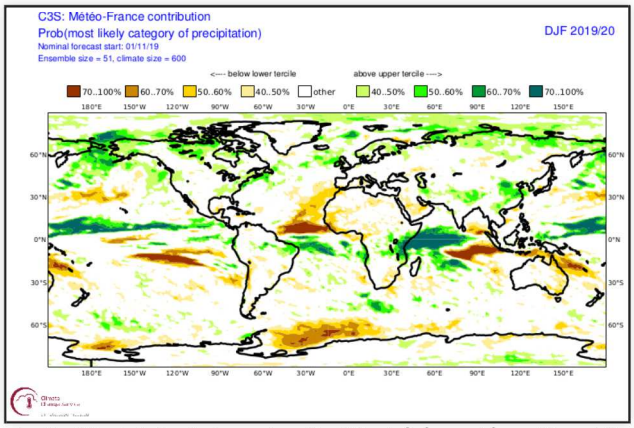
Very good forecast around the Indian Ocean : east of Africa, Madagascar, India, the Maritime Continent and Australia.

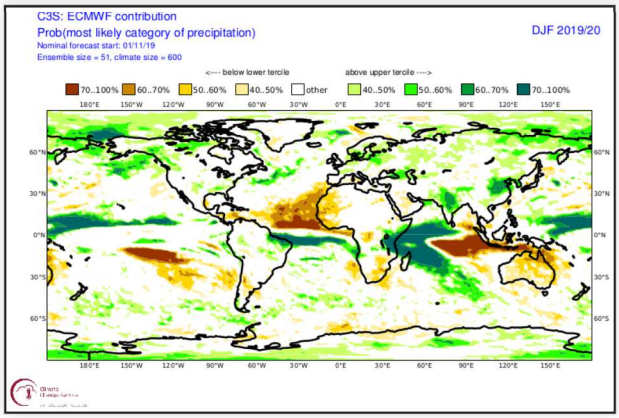
Globally over the Eurasian continent, the forecast was realistic, with an excess of precipitation in many regions.

Over South and North America, models hardly forecast any signal. Actually, the continent recorded globally a deficit of precipitations. And over areas were models agreed on a signal (a wet signal), it appears it didn't occur.









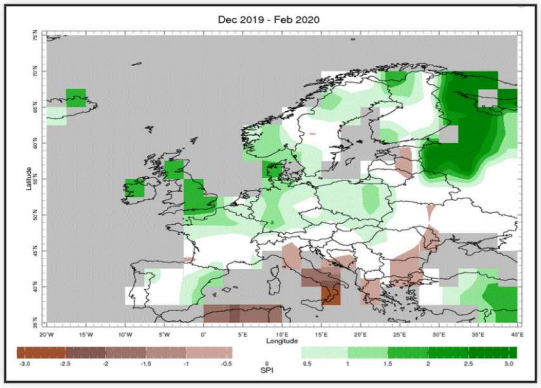
Standardized Precipitation Index analysed by IRI top left, forecast for multi-model top right and MF-S7 and SEAS5 on the bottom line.

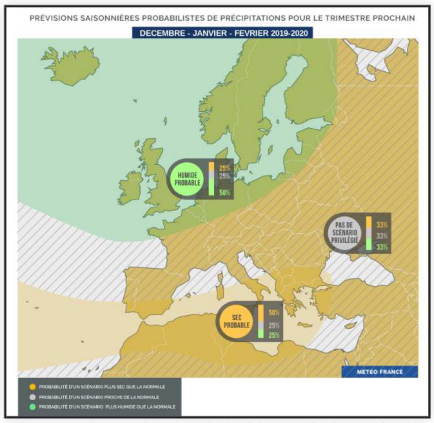
Climatic parameters : Precipitations over Europe

The overall pattern was very well foreseen, with a North-South dipole over the domain of interest.

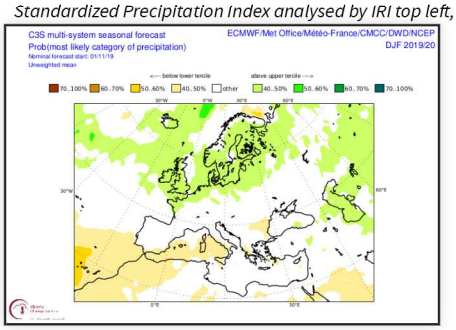
The Northern part (wet signal) was a common feature among models, and correctly reported on the synthesis map.

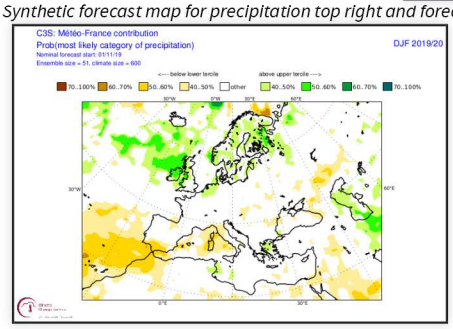
The dry signal (from Algeria to Italy to the Black Sea) was suggested by some models. It has been drawn on the synthesis map, with a correct location.

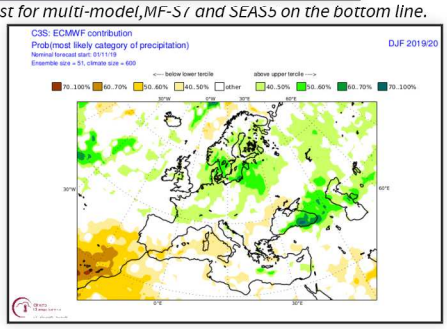




Standardized Precipitation Index analysed by IRI top left, Synthetic forecast map for precipitation top right and forecast for multi-model,MF-S7 and SEAS5 on the bottom line.







General summary : for the period DJF 2019-2020

1) **Oceans :**

SST patterns were generaly very well captured by the models. Especially the tropical patterns : still strong IOD (in decrease), neutral ENSO, strong positive anomaly over equatorial Atlantic.

2) **Large scale atmospheric circulation :**

VP and SF 200hPa : remarquable forecast on the main anomalies. Particularly the response over the Indian Ocean and nearby regions through teleconnexions (see SF200) was very consisten : it probably played an important role in the good predictability of this situation.

Z500 : Almost all the important patterns were well predicted by a majority of models, in both hemisphere.

The positive phase of EA and NAO modes of variability were better captured by most of the models.

3) **Climatic parameters over Europe :**

For temperature at large scale, very good forecast over the contiental areas, including Europe and countries around the Mediteranean basin.

Regarding precipitation, very good forecast around the Indian Ocean (including Australia) and the eurasian continent. Over Europe and the Mediteranean basin, models were very informative (with less consistency over the Mediteranean basin).

The synthesis maps were very relevant.