

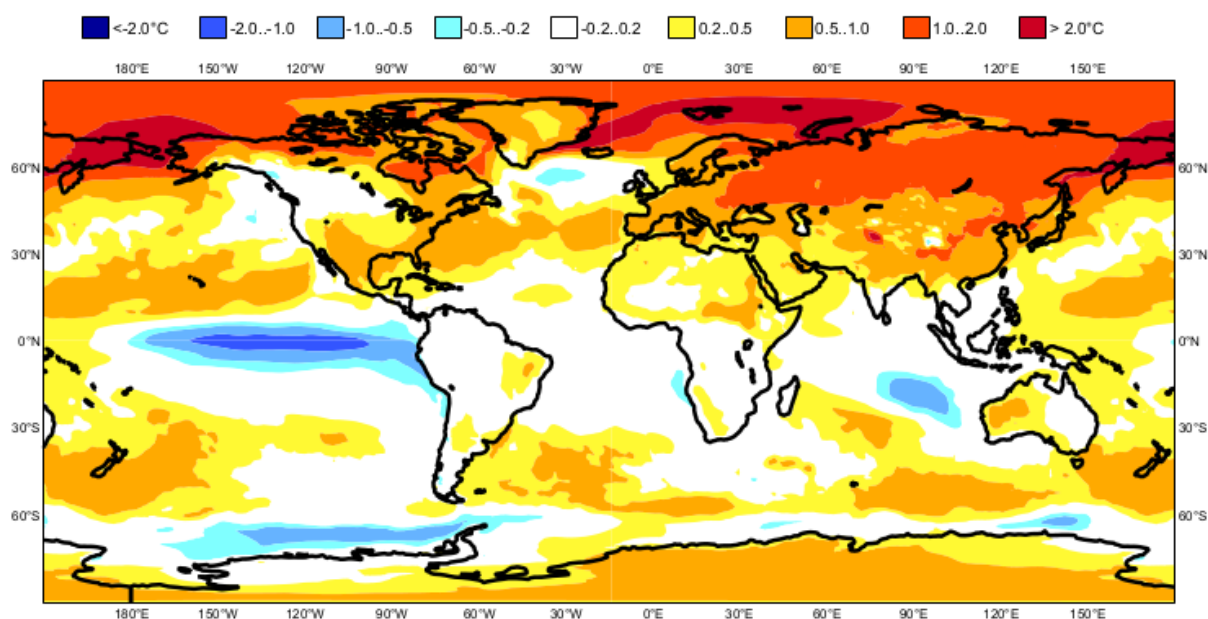
VERIFICATION BULLETIN

SEASONAL FORECAST FOR THE WINTER 2017/2018

Nov 2017 Initialisation

C3S multi-system seasonal forecast
Mean 2m temperature anomaly
Nominal forecast start: 01/11/17
Variance-standardized mean

ECMWF/Met Office/Météo-France
DJF 2017/18



Issued by: Météo-France

Date: 20th April 2018

Ref: C3S_433_Lot1_Seasonal Forecasts-Core Provider, 2015/SC1-METEO-FRANCE



Background

- *This document has been prepared by Meteo-France as a contribution for C3S/433/Lot1 to the development of Multi-Model products on Seasonal Forecast*
- *This product, elaborated in the Pre-Operational Phase of C3S, is only an experimental one and aims to assess the feasibility and the interest of such an approach for the C3S users*
- *The content of the bulletin and especially the indices and the graphical products used as support of the analysis, can evolve in a next version.*
- *In this version, this verification concerns only the three SF models selected for the PoC Phase : ECMWF SEA S5 (ECMWF S5), Meteo-France System 5 (MF S5) and Met Office GloSea5 (MO GS5). Later, the verification can be extended to all the individual SF models contributing to the C3S MM and to the MM itself.*
- *This preliminary version uses mainly first products available on the C3S website in March 2018 or in the individual Global Producing Centre (GPC) websites and especially the Meteo-France one.*
- *All products are not currently available for each model and the verification can concern the three, two or only one model referring to the analyzed parameter. One of the goals of this document is also to identify the needs of new products or functionalities (update of the forecast with recent observations) for the verification process on SF.*
- *The description of each individual SF models and their skill are not reminded here and can be consulted on the individual GPC websites (ECMWF, Meteo-France and Met Office). They will be soon available on the C3S portal.*
- *Meteo-France thanks particularly “Mercator Ocean” for their contribution to the preparation of the verification products for the oceanic analysis.*



Objectives

- *The seasonal forecast (SF) verification bulletin aims to identify and to analyze the performance of individual SF models and the C3S Multi-Model for the last winter or the last summer (main seasons of interest for most applications).*
- *The objective is not to evaluate the mean skill of the SF models or C3S Multi-Model, for which scores are calculated on the whole hindcast period but to enhance the knowledge of the behavior of the SF models for advanced users (as National Meteorological Services or Private Meteorological Company). This approach meets the need of many users, who want to know the recent real-time performances of models, over specific events.*
- *The verification process can also be of interest to the SF providers themselves for identifying the behavior of their model in a specific climate state, regional good and bad patterns for each parameter by comparing with observational references and with other models, as a possible source of improvement.*
- *This bulletin concerns the whole world for the oceanic component (especially over the tropics), the Northern hemisphere large scale atmospheric circulation and focuses over Europe and surrounding regions for temperature and precipitation forecasts.*
- *The content of this bulletin has been discussed with Q4SEAS project partners to verify the consistency of the referential datasets, methods and diagnosis applied to the SF evaluation.*



Content

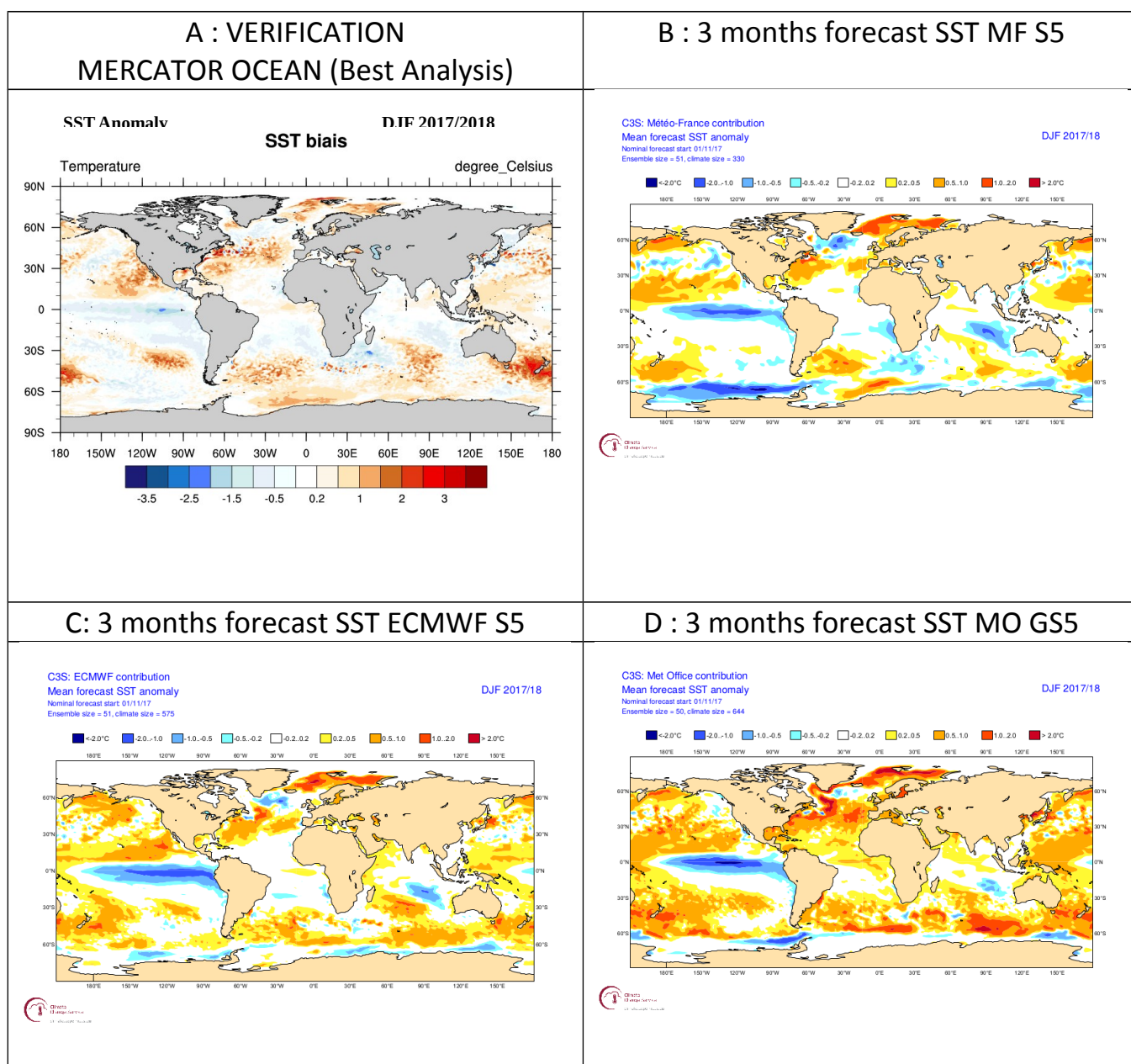
I) Oceanic forecast :	5
I-1) Global SST forecast	5
I-2) Ocean Indices	6
II) Atmospheric circulation forecast	8
II-1) Global Teleconnection	8
II-2) Geopotential height 500 hPa anomalies	9
II-3) Variability modes and weather regimes	10
III) Regional temperature and precipitation forecast	11
III-1) Temperature	11
III-2) Precipitation	12



I) Oceanic forecast :

I-1) Global SST forecast:

The verification concerns here the mean SST anomaly, forecast by the three individual C3S models.



COMMENTS :

- A: OBSERVATION : The observational reference used for the 3-month mean of oceanic sea surface temperature anomaly has been provided by Mercator Ocean (Lead of the Copernicus Marine Environment Monitoring Service). Note that the climate reference used here is 1993-2014.



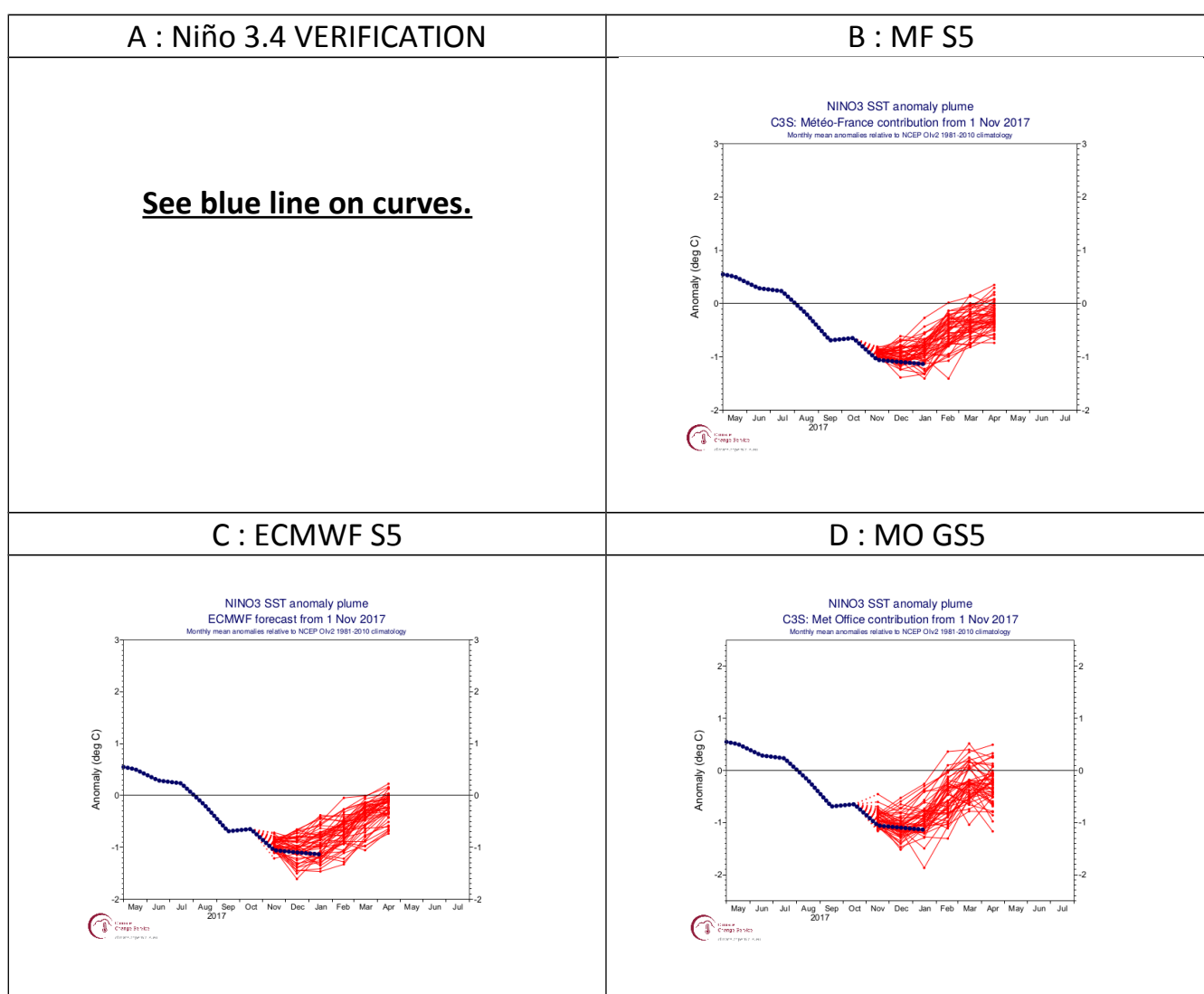
- B: MF S5 : The forecast is quite good over the North Pacific except for an underestimation of the warm anomaly west of the Florida coast. Over the South Pacific the dipole negative anomalies near South America/positive anomalies toward South-West is not forecast and the warm anomaly South-East of Australia is underestimated. Over the north Atlantic the forecast is too cold. Over the Indian Ocean, forecast anomalies are consistent with the analysis, but they are too weak particularly over the eastern part of the basin.
- C : ECMWF S5 : Over the Pacific ocean the forecast is correct except for the underestimation of the dipole in the South-East of the basin. Over the Atlantic and Indian Ocean, same conclusions as for MF S5.
- D : MO GS5 : Over the Atlantic positive anomalies are too strong. Elsewhere same conclusions as for ECMWF S5: anomalies are poorly forecasted in the southeast Pacific and in the southwest Indian Ocean.



I-2) Ocean Indices

Selection of the parameters : The chosen indices to represent the oceanic dynamics are the more frequently indices used over each main basin : Niño 3.4 for the Pacific, TNA for Atlantic and DMI for Indian. The definitions of each index are available on the MF website (<http://seasonal.meteo.fr/>). The forecast products come from the C3S, Meteo-France and ECMWF websites.

.1 Niño 3.4 Index



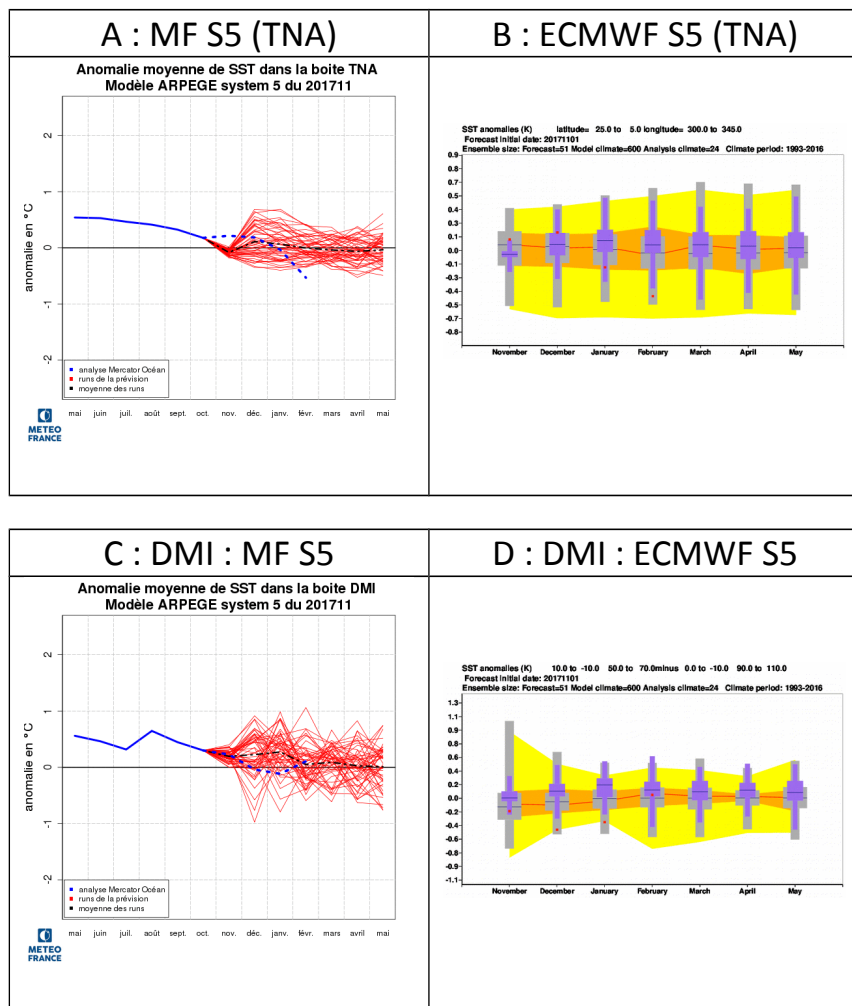
COMMENTS :

- B, C and D : The observed anomaly is on the lower limit of the forecast plume.



.2 TNA and DMI Index :

Note that for TNA and DMI Indices, the verification products come from the specific production of ECMWF and Meteo-France (No information available from the C3S website)



COMMENTS :

- A and B (TNA) : The negative anomaly at the end of the period was not forecast.
- C and D (DMI) : Bad forecast: Positive index was forecast by MF and ECWMF while neutral or negative index has been observed (negative index in January). Notice that analyses are significantly different between MF and ECMWF



II) Atmospheric circulation forecast

II-1) Global Teleconnection

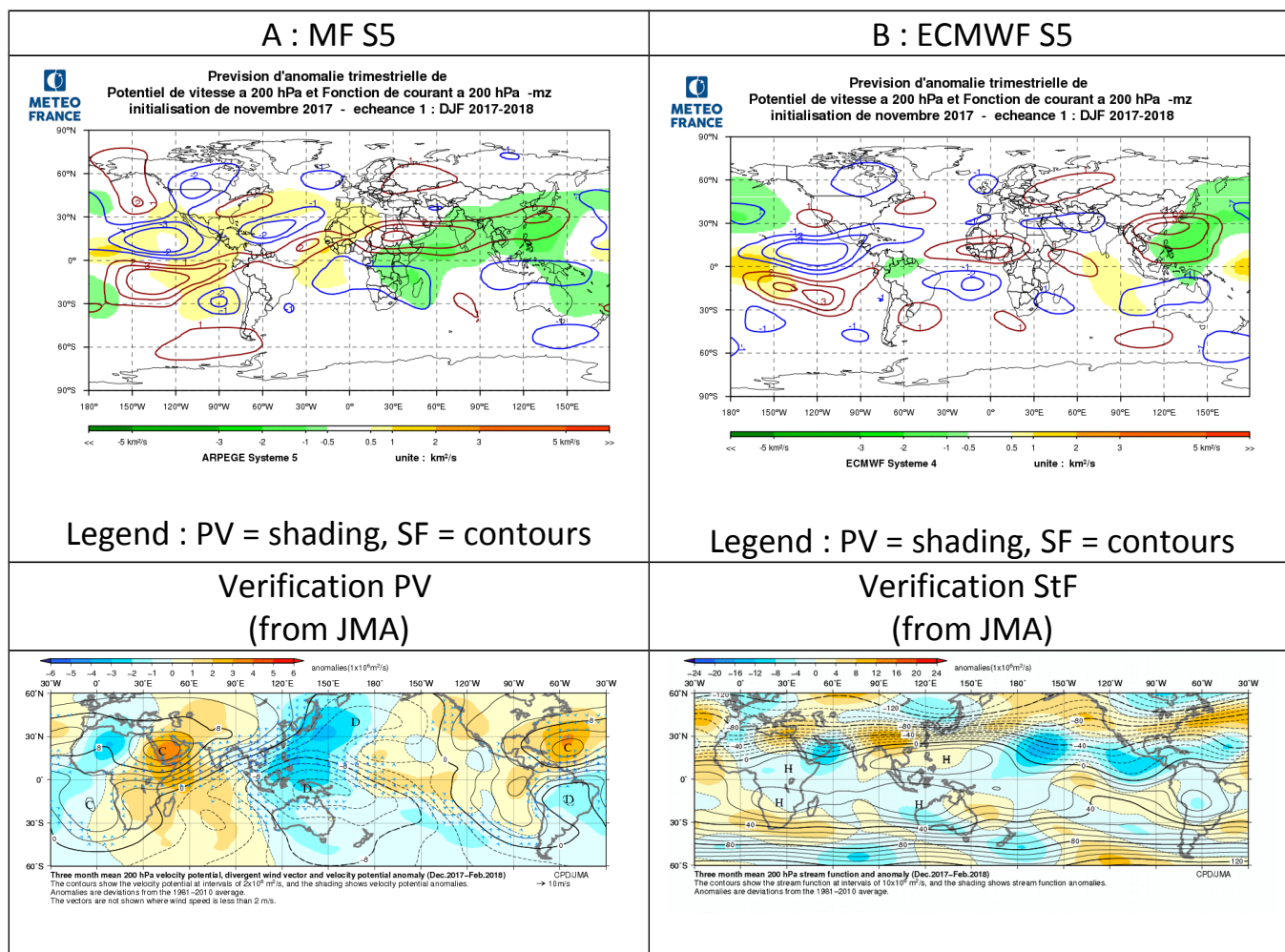
Selection of the parameter: Two parameters have been selected to represent the atmospheric teleconnection between tropical and mid-latitude areas: Potential Velocity (PV) and Stream Function (StF) .

The definitions of these two parameters are available on the MF website <http://seasonal.meteo.fr/>.

The verification used comes from the JMA analysis :

http://ds.data.jma.go.jp/tcc/tcc/products/clisys/figures/db_hist_3mon_tcc.html

Note also that the PV and SF forecast products (here from the MF website) are currently available only for Arp S5 and ECMWF S5.



COMMENTS :

- A : MF S5 :

PV : forecast is rather correct over the Maritime Continent and Pacific. Inversed sign forecast over Africa and Indian Ocean. Positive anomaly over Atlantic is underestimated and negative anomaly over Brazil is not forecasted.

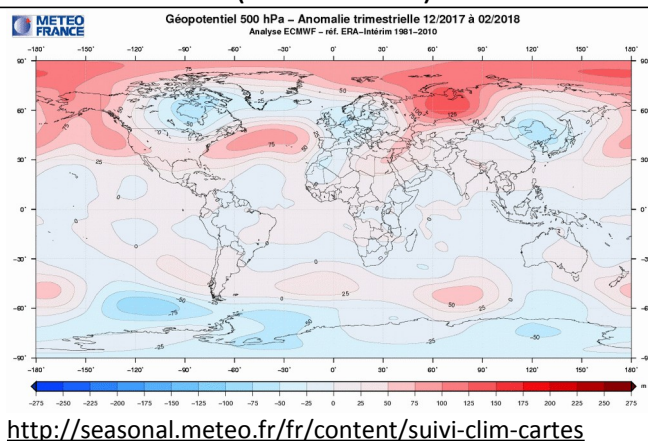


- StF : StF anomalies are rather well forecasted over Pacific and North America with PNA teleconnection pattern. Elsewhere anomalies are predominantly poorly (or not) forecasted.
- B: ECMWF S5 :
 - PV : a rather correct forecast over the maritime continent and the Pacific. Elsewhere anomalies are predominantly poorly (or not) forecasted.
 - StF : Good forecast over Pacific like MF-S5. Over North America the PNA teleconnexion pattern was too weak.

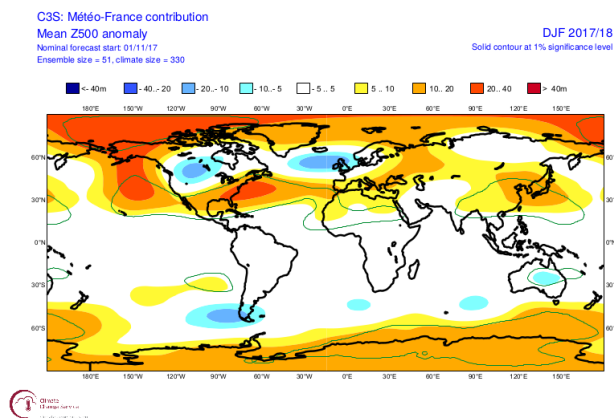


II-2) Geopotential height 500 hPa anomalies

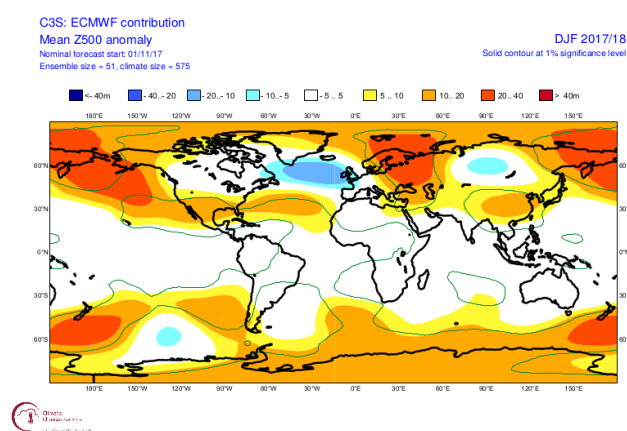
**A : Verification from ERA I analysis
(MF website)**



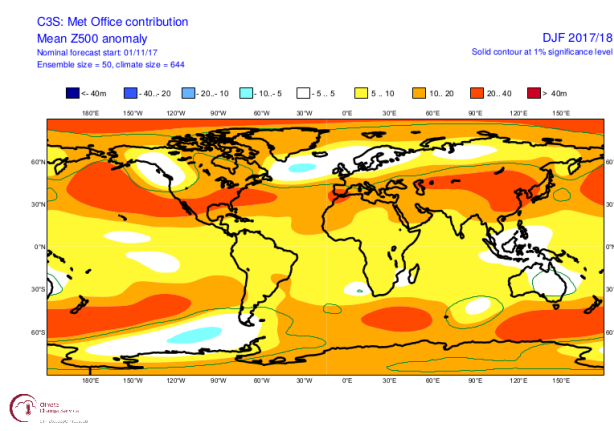
**B : MF-S5
(C3S website)**



**C: ECMWF S5
(C3S website)**



**D : GloSea5
(C3S website)**



COMMENTS :

- **A : Observation :** Positive anomaly from Alaska to Florida, negative over the East of Canada and positive south of America. This structure looks like the negative PNA pattern shifted east.
Positive anomaly over Atlantic Ocean near 50°N, Negative extending from South Greenland far western Europa: this zonal structure of anomalies is projected on the mode of variability NOA (positive phase).
Dipole positive anomaly over western Russia/negative anomaly over Eastern Russia and North China.
- **B : MF S5 :** Forecast anomalies over North America are quite good but they are shifted to West (look like PNA - pattern). Negative forecast anomaly South of Iceland is not extended



enough towards Western Europe and North Africa. Over Asia the forecast is shifted to the North.

- C : ECMWF S5 : Forecast anomalies over North America are quite good but negative anomaly over the East of Canada is underestimated. Over Eastern Atlantic and West Europe same conclusions as MF S5. Over East Europe and Asia the dipole anomaly is rather well forecast but it's shifted west.
- D : MO GS5 : Anomalies are weak or not forecast

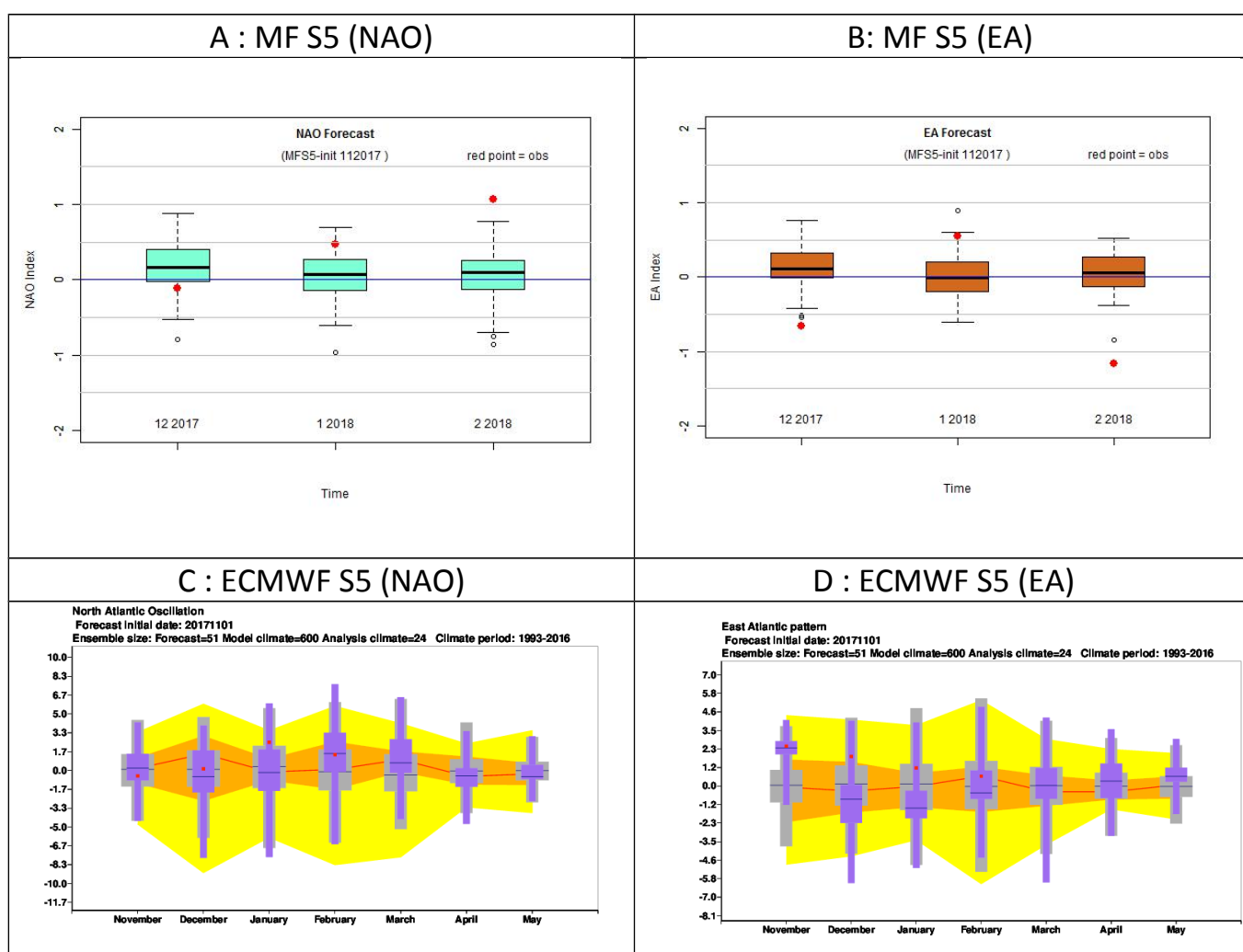
II-3) Modes of Variability

Selection of the parameter: Two monthly modes of variability have been selected to represent the large scale circulation over North Atlantic and Europe: North Atlantic Oscillation (NAO) and East Atlantic Mode (EA).

The definitions of these indices are available on the MF website <http://seasonal.meteo.fr/>.

The verifications are included in each product and come from MF and ECMWF website with significant differences (to pay attention).

Note also that these products are not currently available for the GloSea5 model.





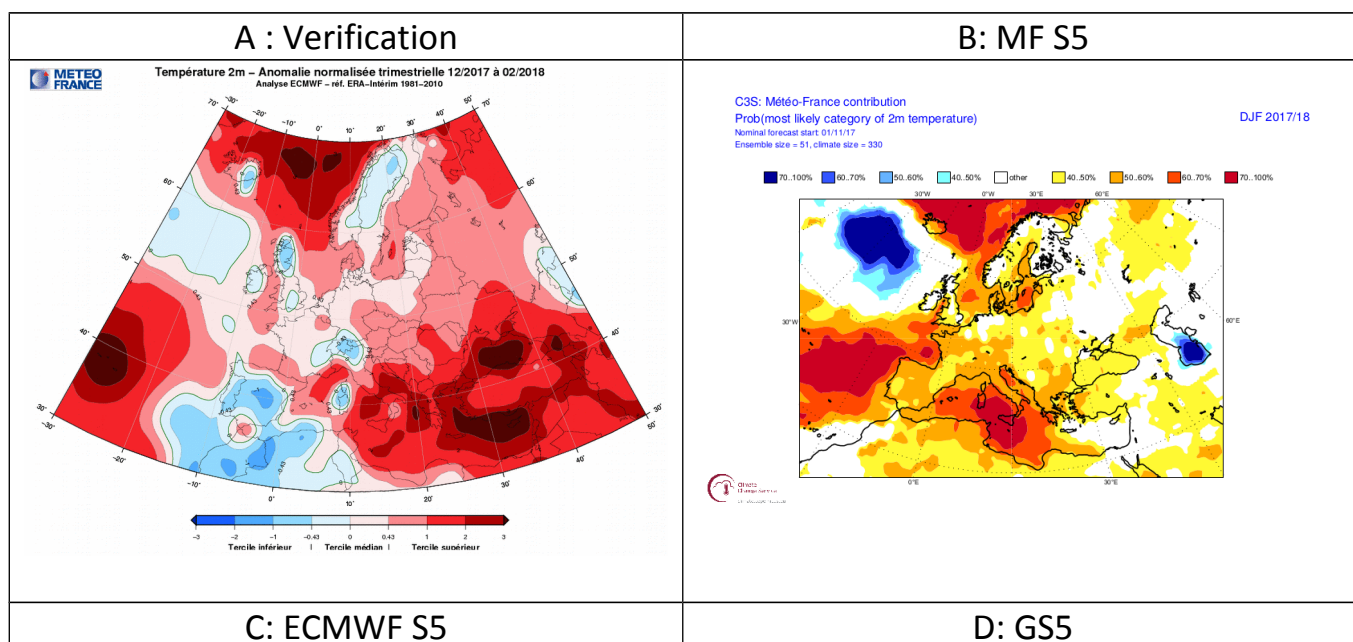
COMMENTS :

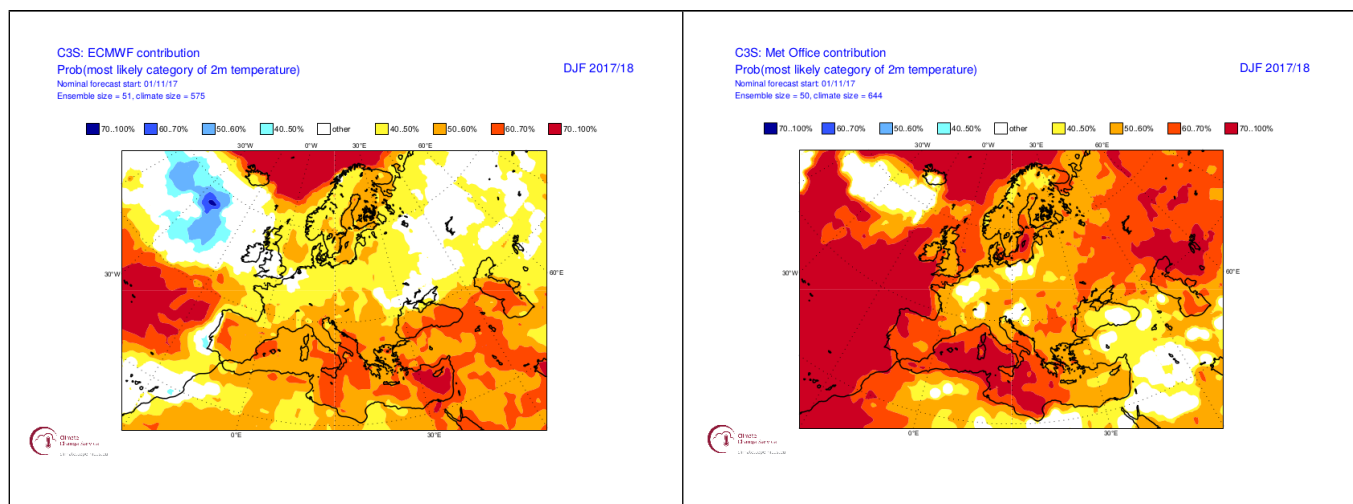
- A and C : The NAO mode increased during the winter 2017/2018 with monthly index values respectively of -0.11/0,47/1,06. These positive values were rather well forecast both for MF S5 and ECMWF S5.
- B and D : The EA mode has been changed during the winter 2017/2018 with monthly index values respectively of -0,66/+0,55/-1,17: The signal was not correctly identified both for MF S5 and ECMWF S5 (Pay attention that the EA patterns are inconsistent between MF and ECMWF)

III) Regional temperature and precipitation forecast

Selection of the parameter : For temperature and precipitation, the verification concerns the synthesis of the tercile (most likely category) and not an anomaly.

III-1) Temperature





COMMENTS :

- A : Observation : From ERA-I analysis (MF product), strong positive normalized temperature anomaly over the South-East of Europe and over Middle East. The anomalies are negative over Morocco and Spain
- B : MF S5 : Poor forecast (reverse forecast over Morocco and Spain)
- C : ECMWF S5 : Good forecast except over Morocco and Spain where a cold scenario was not forecast.
- D : MO GS5 : Poor forecast like MF S5

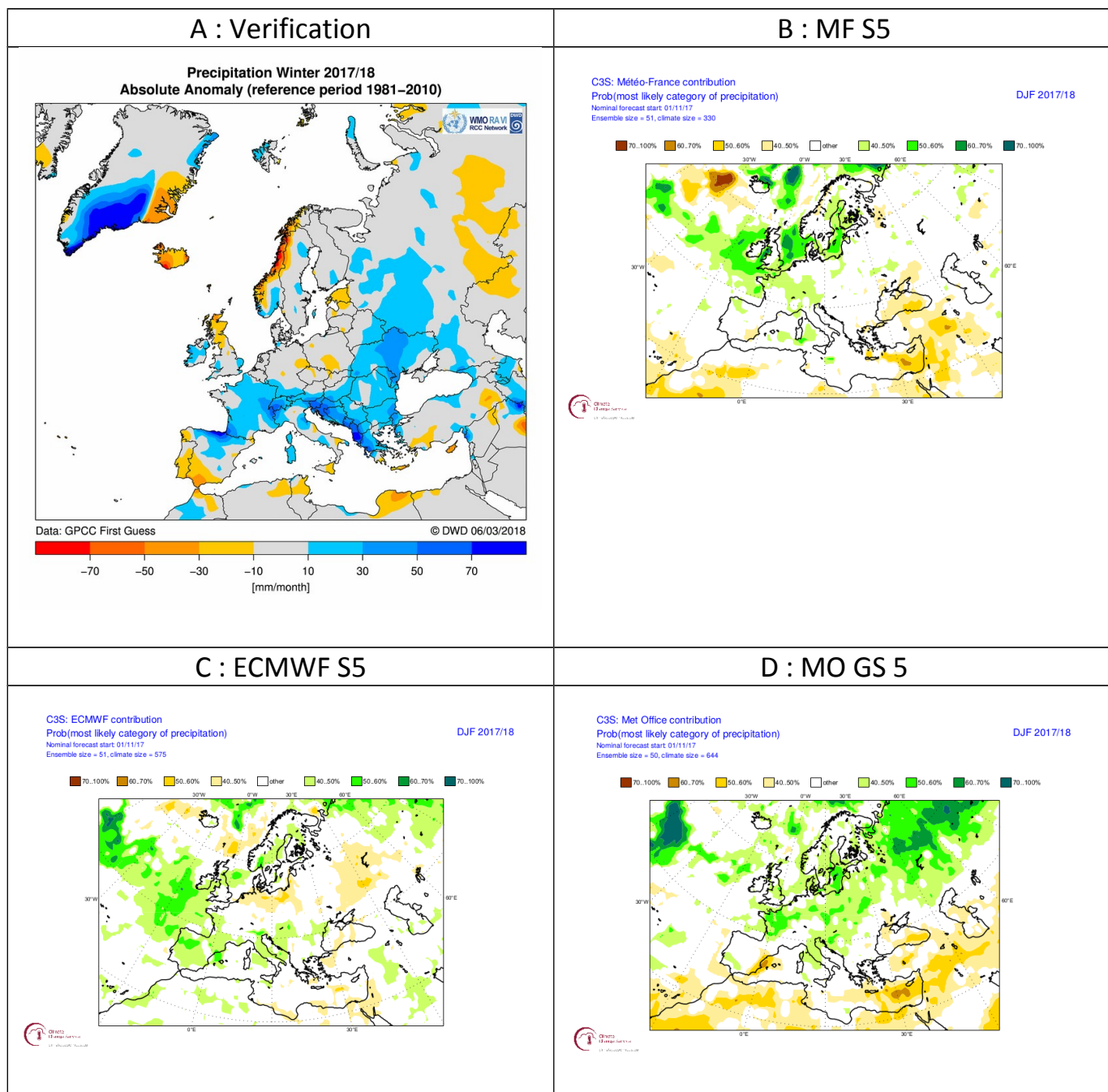
Forecast Performance Index : The performance of a specific forecast can be globally estimated over a domain of interest by a spatial calculation of the area under a ROC Curve for lower/higher tercile. As an example, this skill has been performed for the MFS5 model over Europe

Temperature	Europe
MF S5 (lower tercile)	0,43
MF S5 (upper tercile)	0,32

COMMENT : Very low spatial skill over Europe, worst than the climatology.



III-2) Precipitation



COMMENTS :

- A : Observation : According to the GPCC analysis, above normal precipitation from France to the Balkans to Ukraine, whereas Iceland, Scotland and coast of Norway received below normal precipitation.



- B : MF S5 : Wet area shifted to North Europe instead of West Central to South East Europe
- C: ECMWF S5 : This model captured partially excess of precipitation over the South of Europe. Bad forecast for South Spain and Morocco
- D : MO GS 5 : Forecasts were shifted between North West (too wet) and South East Europe (too dry)

Forecast Performance Index : The performance of a specific forecast can be globally estimated over the domain of interest by a spatial calculation of the area under a ROC Curve for lower/higher tercile. As an example, this skill has been performed for the MFS5 model over Europe

Precipitation	Europe
MF S5 (lower tercile)	0,52
MF S5 (upper tercile)	0,5

COMMENT : low spatial skill over Europe, at the same level as climatology.



VERIFICATION OF THE SEASONAL FORECAST FOR THE SUMMER 2017

*(From the individual SF models : MF Syst 5, ECMWF Syst 5 et Met Office GloSea 5,
initialisation of Nov 2017)*

GENERAL SUMMARY

1) Oceanic Forecast :

In the Pacific ocean forecasts were rather good even if the light drop in SST over the Niño 3.4 area over the winter was not well forecast by the three models. The models missed also the negative SST anomalies observed over the south-eastern part of the tropical Pacific. More or less good forecast over the north Pacific. On the Atlantic basin, forecasts were consensual between the models despite a cold bias with MFS5, ECMWFS5 and a hot bias with MO GS5. Over the Indian basin, forecasts were more consensual and correct except for the cold anomaly south of Madagascar.

2) Large scale atmospheric circulation :

The negative PNA mode and positive NAO mode were rather well predicted by MF-S5 and ECMWFS5 (and not really by MO GS5). On the other hand EA mode forecast was bad and the dipole over East Europe and Asia was rather well forecast only by ECMWFS5

3) Regional temperature and precipitation :

Poor or shifted forecasts with MF-S5 and MO GS5.

ECMWF S5 has captured the warm signal on south-eastern Europe and Middle East. Furthermore this model partially forecast excess of precipitation over the South of Europe.

These results have been contracted by the European Centre for Medium-Range Weather Forecasts, operator of C3S on behalf of the European Union (Delegation Agreement signed on 11/11/2014). All information in this document is provided "as is" and no guarantee or warranty is given that the information is fit for any particular purpose.

The user thereof uses the information at its sole risk and liability. For the avoidance of all doubts, the European Commission and the European Centre for Medium-Range Weather Forecasts has no liability in respect of this document, which is merely representing the authors view