SEASONAL FORECAST OUTLOOK for North Africa

June-July-August 2018 issued May 2018

Seasonal forecast outlook for North Africa RCC domain is based on the ARPEGE-Climat coupled model output jointly with seasonal forecasts issued from ECMWF, UK Met-Office and IRI. The ARPEGE-Climat v5.2 coupled model is running at MAROC-METEO super-computer each month to elaborate seasonal ensemble forecasts. Sets of 27 forecasts are initialized by 9 atmospheric analysis, taken from ECMWF database, and 3 ocean analysis (PSY2G3R4) issued from MERCATOR center.

We also try to exploit the sources of predictability contained in the sea surface temperature (SST) by statistical methods when it is possible. We note, however, that this influence is not the same from one region to another or throughout all the year.

NB:

1. **New:** *Introduction of Multi-model probabilistic forecasts from EUROSIP and WMO LC-LRFMME.*

2. *All dynamical forecasts are experimental.*

SYNTHESIS

The analysis of current circulation, sea surface temperature, ENSO phenomenon and dynamical/statistical models outputs show probably for June-July-August 2018:

- For temperature:
  - Normal to below normal conditions over South of Morocco.
  - Normal to above normal conditions over Tunisia, Algeria and the eastern side of Morocco.
  - Above normal conditions over Libya and Egypt.

*NB: **Precipitation forecasts are given for September to May (the main rainy season). Temperature forecasts are given for January to December***

I. Dynamical Forecast

- ### Sea Surface Temperature (SST)

Sea Surface Temperature anomalies for JJA 2018
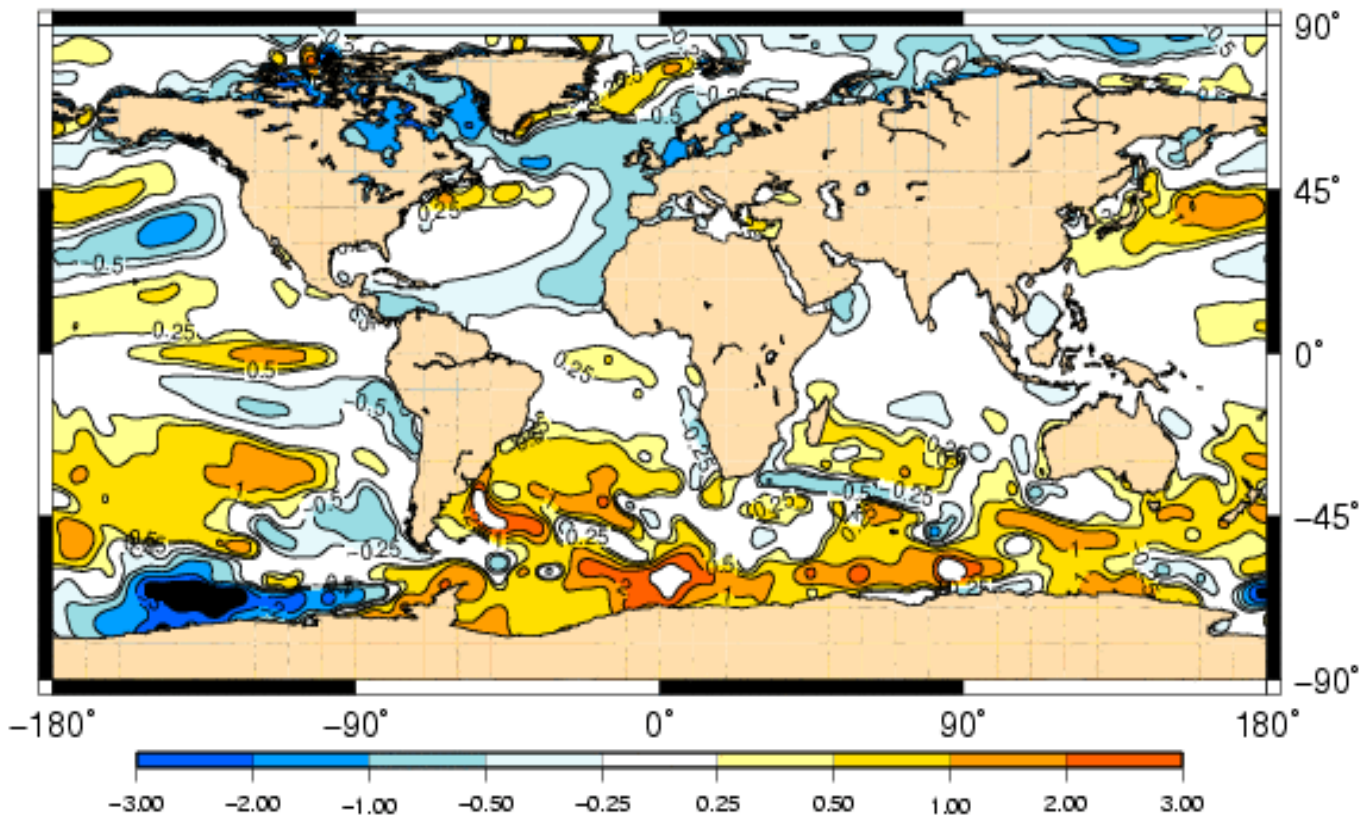(ARPEGE–Climat V5.2 coupled model, issued MAY 2018)

Fig1: SST anomalies for JJA2018 from ARPEGE-Climat-(Operation at Maroc-Météo)

According to ARPEGE-Climat V5.2 model, cold SSTs are expected over TNA region, in the vicinity of Moroccan Atlantic coast and towards European coast and Groenland region. While in the pacific, near average SSTs are given over the central-eastern part.
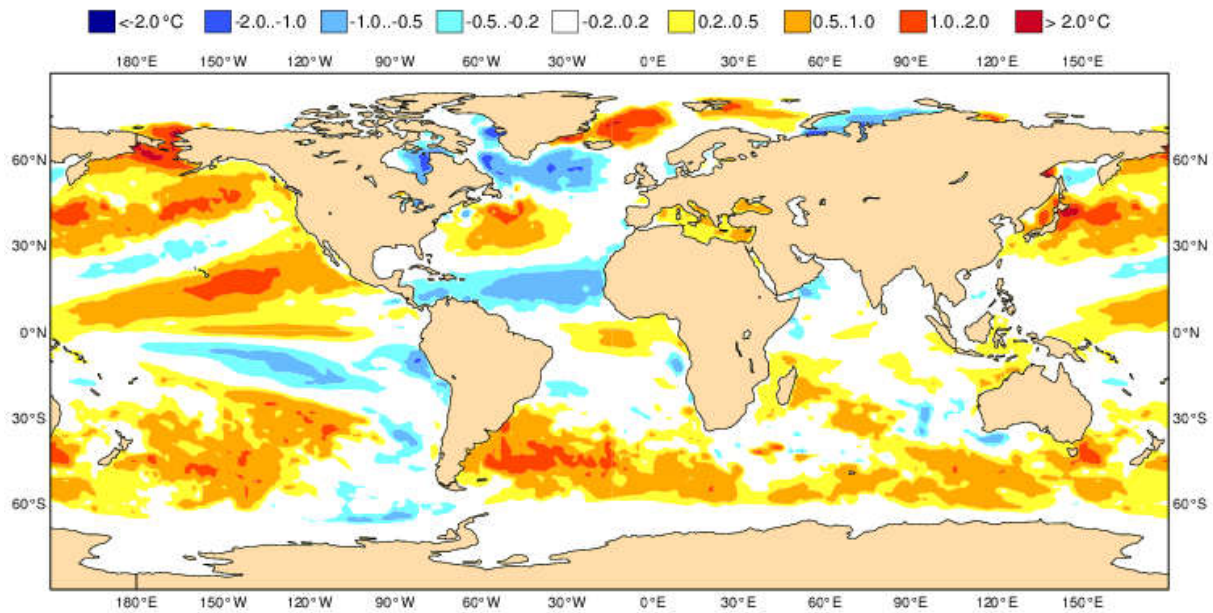
Fig2: SST anomalies for JJA2018 from ECMWF

Regarding ECMWF model, Mediterranean sea is projected to be warmer than normal during JJA. While in the Atlantic, cold anomalies are expected in the North Tropical Atlantic region and in the vicinity of Moroccan coast. In the pacific, similar to ARPEGE-Climat,the SSTs in the central eastern part are also expected to be close to the average.
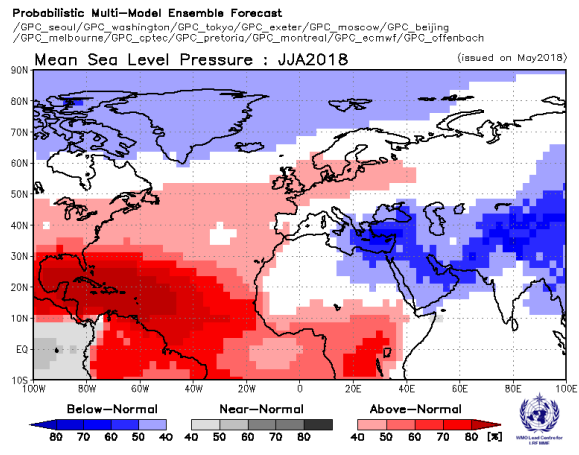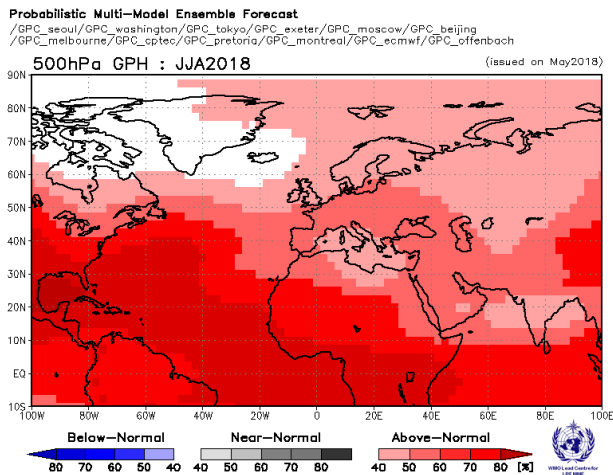
- *Dynamical Circulation (Z500&SLP)*
  -

Fig3: Probabilistic Forecast of Z500 and SLP   for JJA2018 from WMO LC-LRFMME

According to WMO LC-LRFMME, dynamical circulation at mid-troposphere shows above normal conditions over the whole region while sea level pressure is projected to be below normal in the East of the domain and above normal over the Atlantic Ocean.
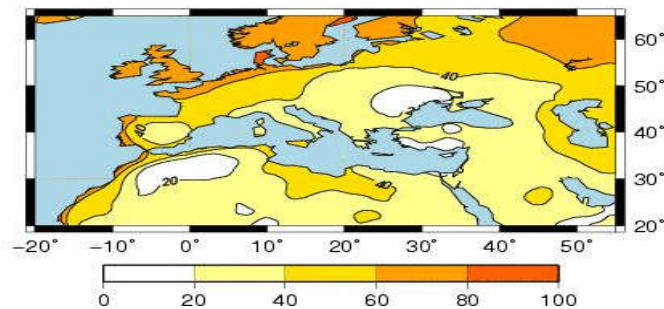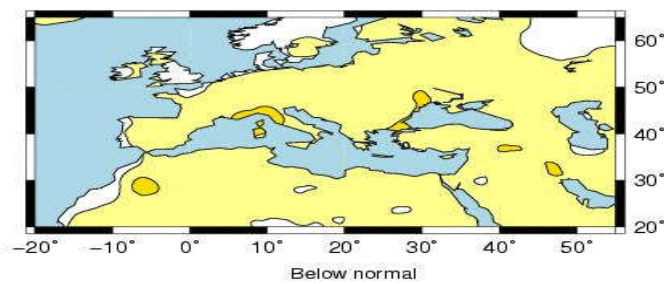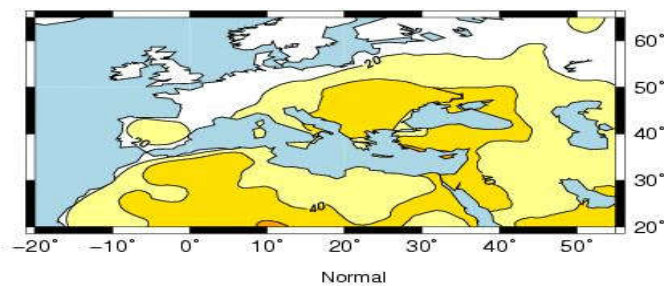
- ***Temperatures***
  - MAROC-Météo

Fig4: Probabilistic Forecast of T2M for JJA2018 from ARPEGE-Climat

According to ARPEGE-Climat model, temperatures are expected to be below normal over large area over Morocco except the eastern part, over coast of Algeria, coast of Tunisia and North of Libya. Probabilities are between (40 to 80%) with maximum of the probability over Atlantic Coast. Above normal temperatures are projected for JJA 2018 over the remaining part of North Africa region.

ECMWF Seasonal Forecast
Prob(most likely category of 2m temperature)
Forecast start is 01/05/18, climate period is 1993-2016
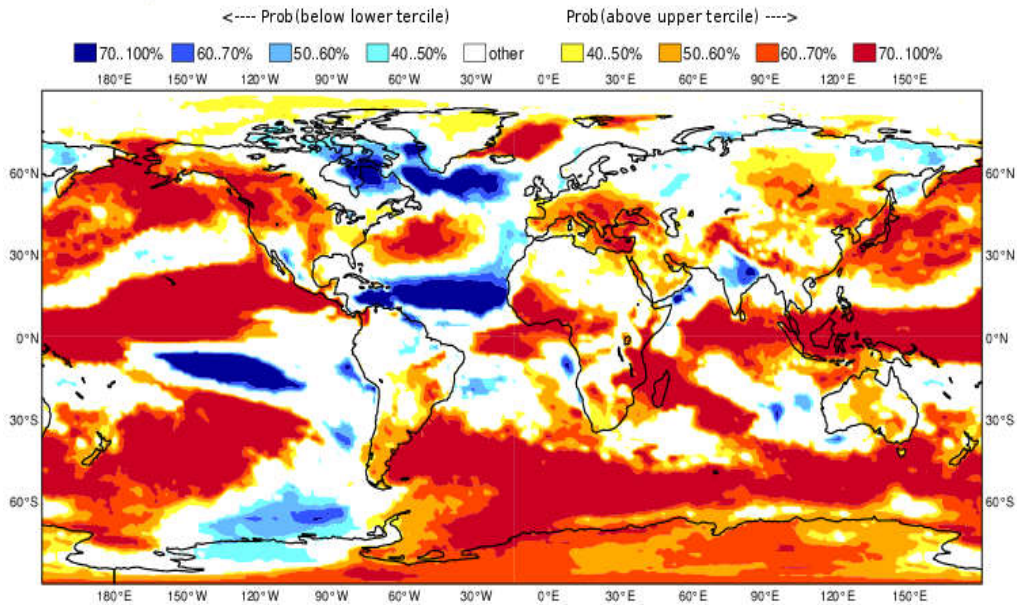Ensemble size = 51, climate size = 600

System 5
JJA 2018

<---- Prob(below lower tercile)   Prob(above upper tercile) ---->

70..100%   60..70%   50..60%   40..50%   other   40..50%   50..60%   60..70%   70..100%

Fig5: Probabilistic Forecast of T2M for JJA2018 from ECMWF

Regarding ECMWF model, no special scenario is given for JJA2018 over almost all North African countries. Above normal temperatures are expected over most part of Egypt with probabilities of 40 to 60%.

Probabilistic Multi—Model Ensemble Forecast
/GPC_seoul/GPC_washington/GPC_tokyo/GPC_exeter/GPC_moscow/GPC_beijing
/GPC_melbourne/GPC_cptec/GPC_pretoria/GPC_montreal/GPC_ecmwf/GPC_offenbach

2m Temperature : JJA2018   (issued on May2018)

Below-Normal   Near-Normal   Above-Normal
80 70 60 50 40   40 50 60 70 80   40 50 60 70 80 [%]
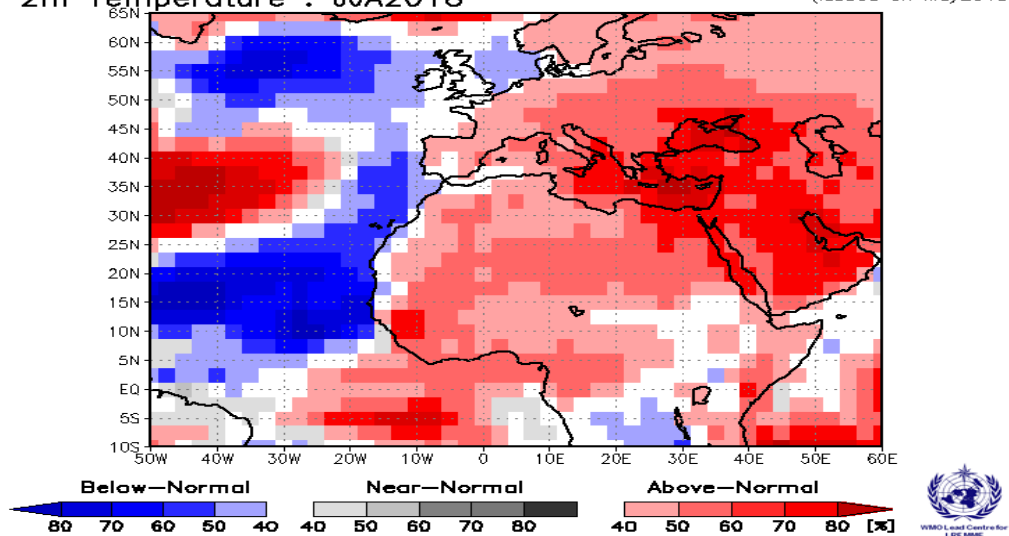
WMO Lead Centre for
LRF MME

Fig6: Probabilistic Forecast of T2M for JJA2018 from ECMWF

Regarding WMO LRF-MME, a warm temperature category is provided for JJA season for almost all NA countries with probabilities of 40 to 70 % (except West of the domain). While cold temperature category is given over Atlantic Moroccan Coast.
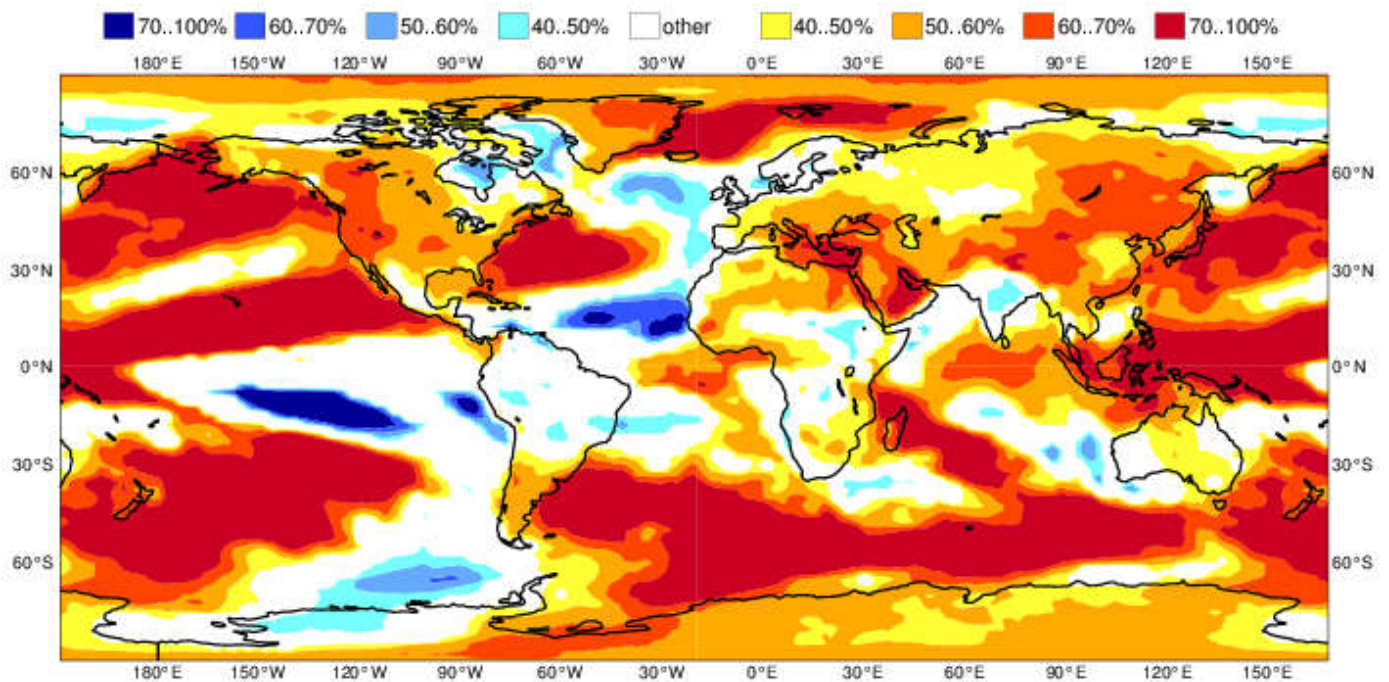
- Euro-SIP

Fig7: Probabilistic Forecast of T2M for JJA2018 from EUROSIP.

The multi-model probabilistic forecast issued from EUROSIP favor a warm state of temperature for North Africa except a large area of Morocco and North of Algeria. The maximum of probabilities is reached over Egypt with probabilities between 60 and 70%.

II. Temperature Driver
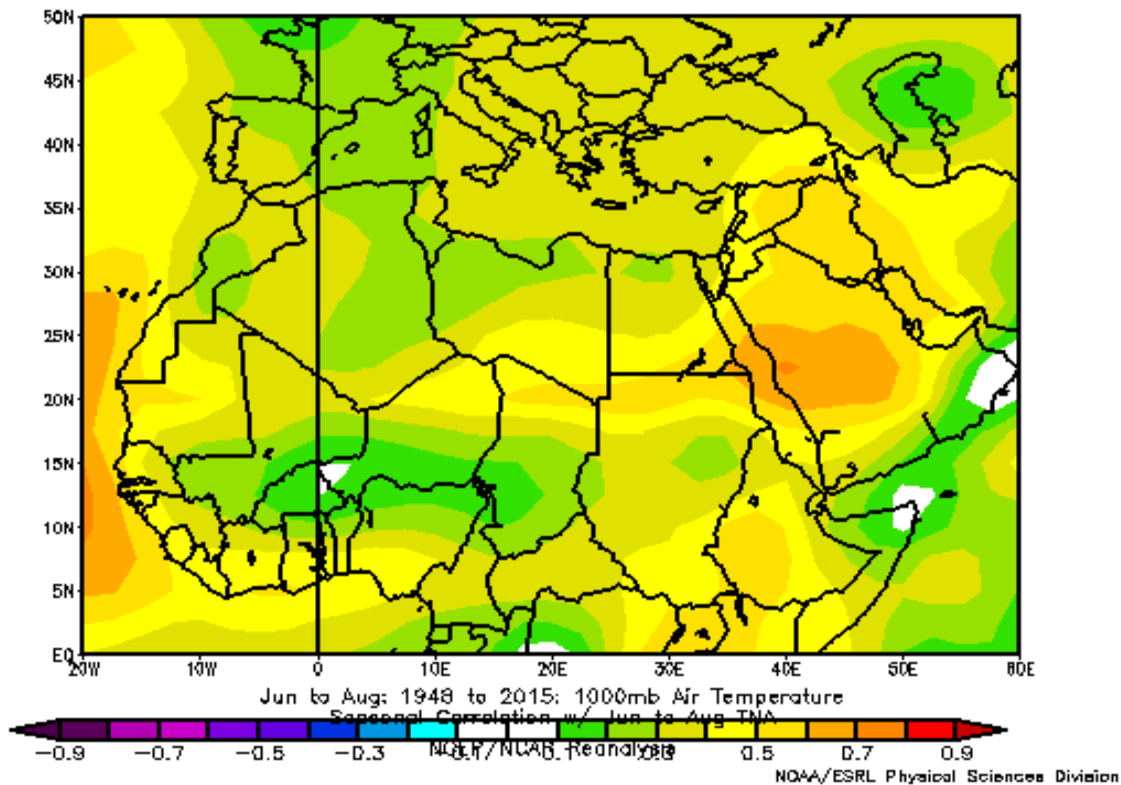
- ### *Tropical North Atlantic SST*

Fig7: Linear correlation between TNA index and temperature of JJA.

The figure above shows a positive synchronous link between TNA and temperature over West of NA domain especially in south of Morocco.

The prediction of TNA for JJA2018 shows a negative anomaly. This ,in addition to below normal temperature given by some dynamical models, may prevail normal to below normal temperatures over southern coast of Morocco.

Besides that, negative anomalies of Atlantic SST for JJA 2018 given in the vicinity of Morocco could contribute to a cooling over atlantic coasts which is consistent with the scenario provided by ARPEGE-Climat and WMO-LRF MME. Otherwise,the other models do not favor any scenario for the same region.

III. Statistical Forecast

Statistical forecasts of 2m temperature anomalies are produced by Canonical Correlation Analysis method using as predictors North Atlantic and Mediterranean FMA SST (NCDC) and as predictand North Africa T2m(CPC /GHCN_CAMS). Statistical forecast is represented by probabilities of 3 categories above normal, normal and below normal.
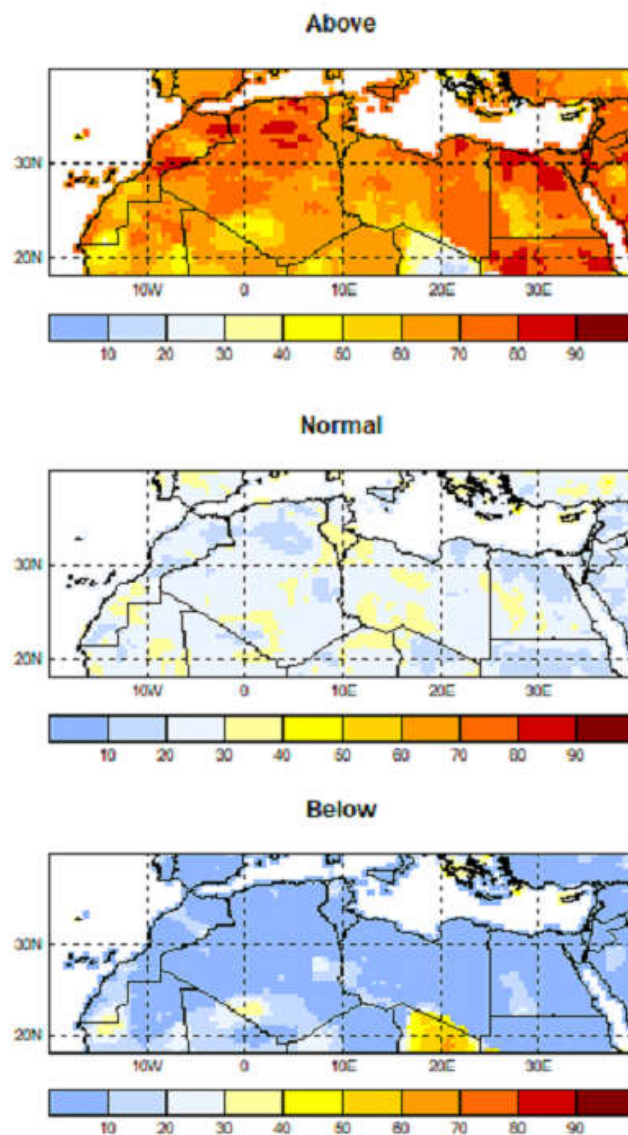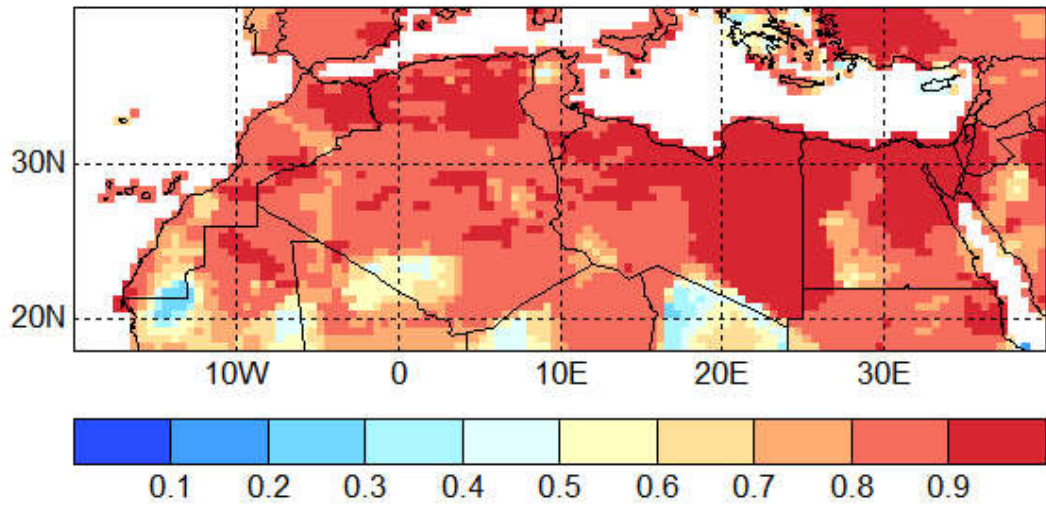

Fig8: Statistical Probabilistic Forecast of T2M for JJA 2018.

ROC Area (Above-Normal)

Fig9: Skill of statistical forecast using CCA method
(predictor: FMA SST(NCDC) ; predictand North Africa T2m(CPC /GHCN_CAMS))

Statitical CCA model output shows probably for temperature for June-July-August 2018 above normal conditions over North African countries with probabilities of 40 to 90%. The roc map for above normal category shows good scores over almost all North African countries (roc >0.7) except the southern part of the domain.