



## Participant from Nigerian Meteorological Agency(NiMet)

- ▶ Climate Services Unit
- ▶ Name: Agatha Oluchukwu

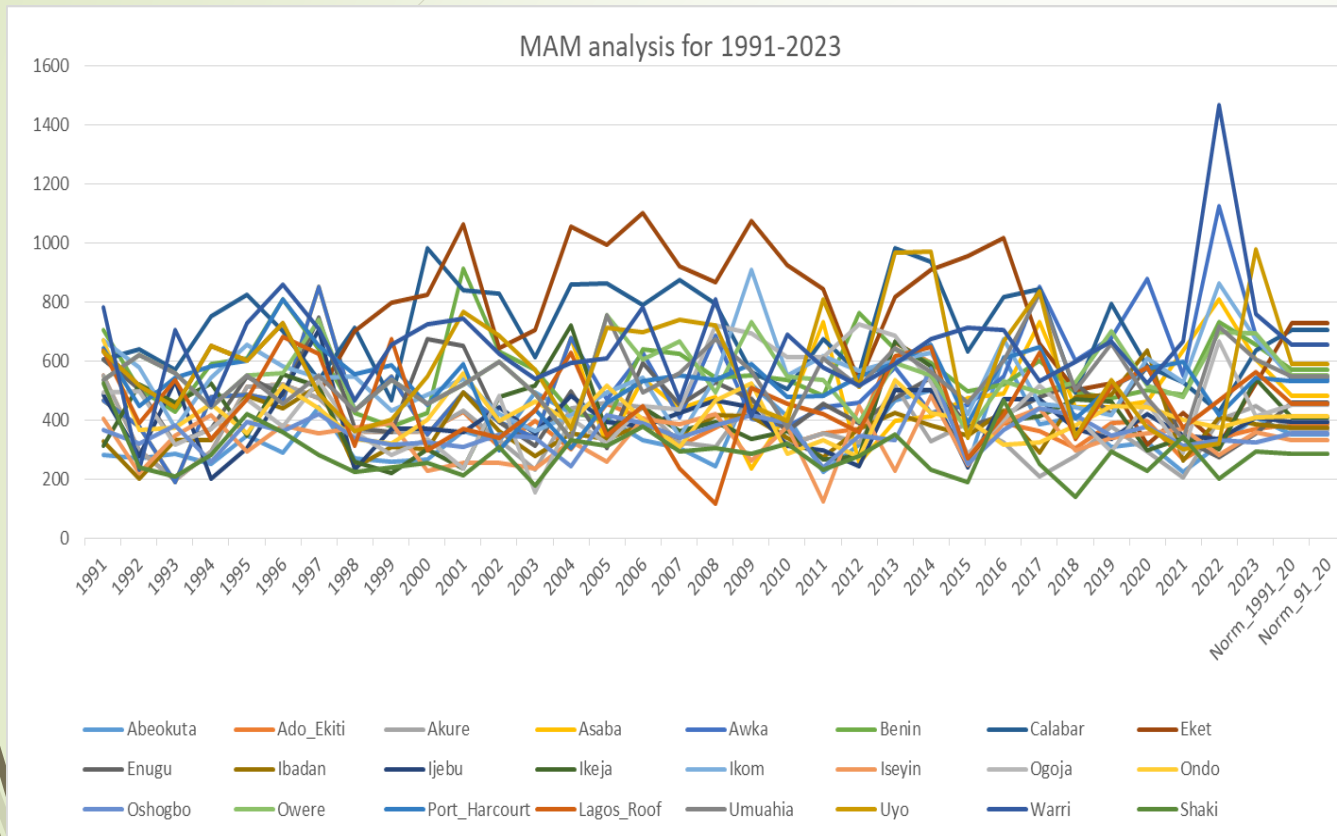
**Anokwu**

# 2024 MAM and AMJ Climate Forecasts

## Outline

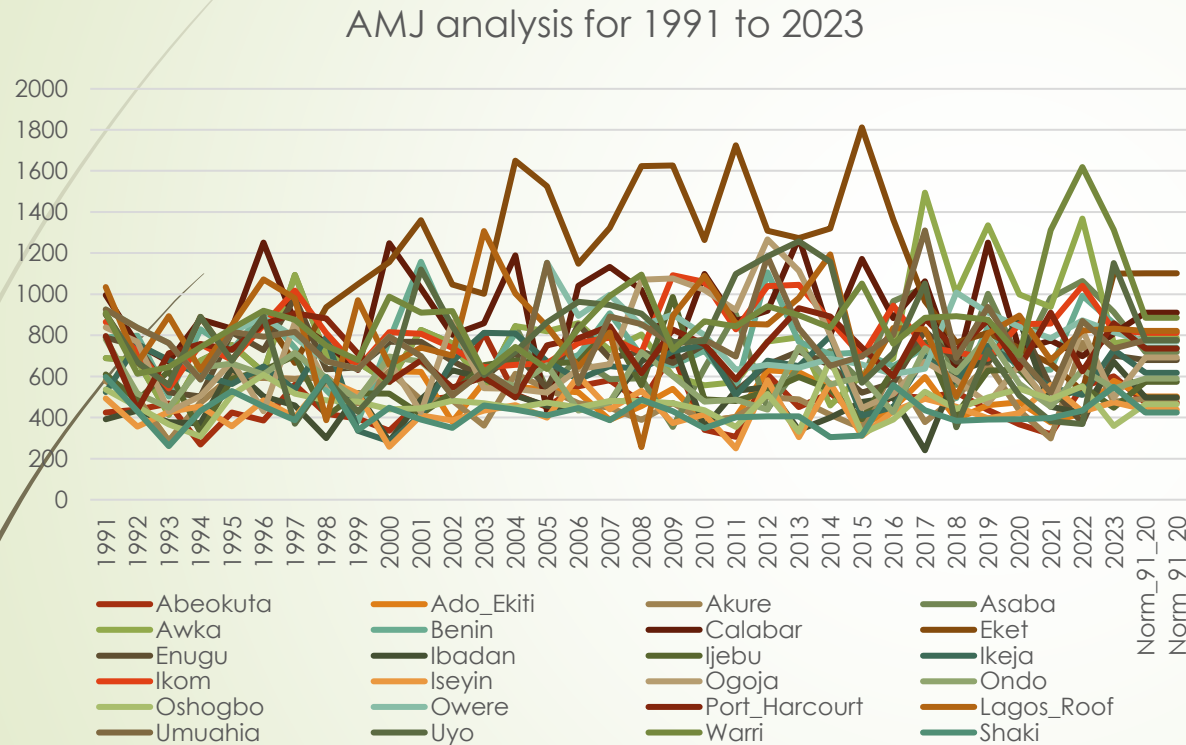
1. *Time series analysis of Climate variability (seasonal and annual cycles, interannual/interdecadal variability) and trends*
2. *Composite analysis*
3. *Analogue Analysis*
4. *Linear regression, principal component, canonical correlation analysis*
5. *Teleconnections analysis (i.e ENSO, AMO, IOD, SIOD, Atlantic Dipole, NAO, AO, SAM, Benguela Nino, Mediterranean SSTAs)*
6. *Interactions analysis between seasons (summer and following winter) and regions for the same target season (i.e summer African monsoon and Atlantic cyclone activity)*
7. *Single Model Ensemble Analysis (i.e ECMWF, NCEP, UKMET)*
8. *Multi-model Ensemble Analysis (ie MME, Copernicus, IRI)*

# MAM Rainfall analysis 1991-2023



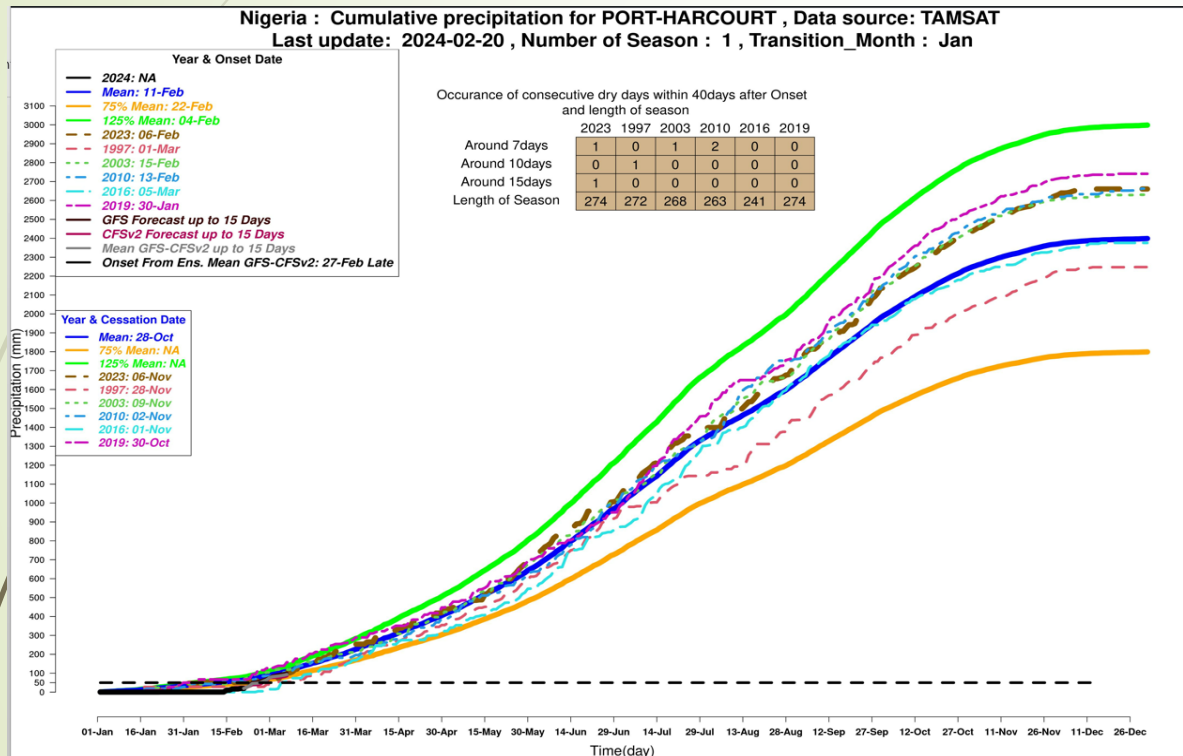
- MAM trend from 1991 to 2023 over Nigeria.
- The general pattern showed similar, high and low seasonal cumulative.
- Year 2022 showed highest cumulative seasonal MAM

# AMJ Rainfall analysis 1991-2023



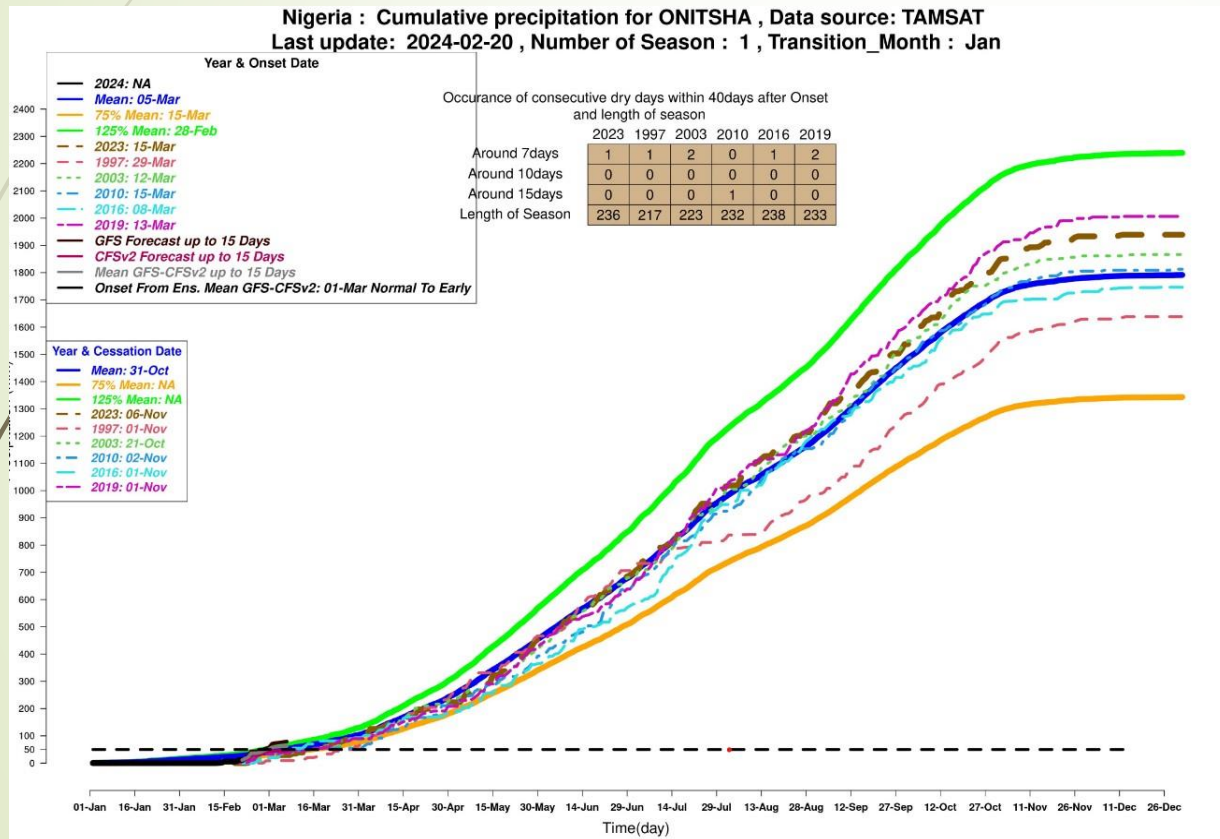
- AMJ trend from 1991 to 2023 over Nigeria.
- The general pattern showed similar, high and low seasonal cumulative.
- Year 2015 showed highest cumulative seasonal AMJ in Eket station

# Past and current State of a station(PH) coast of Nigeria



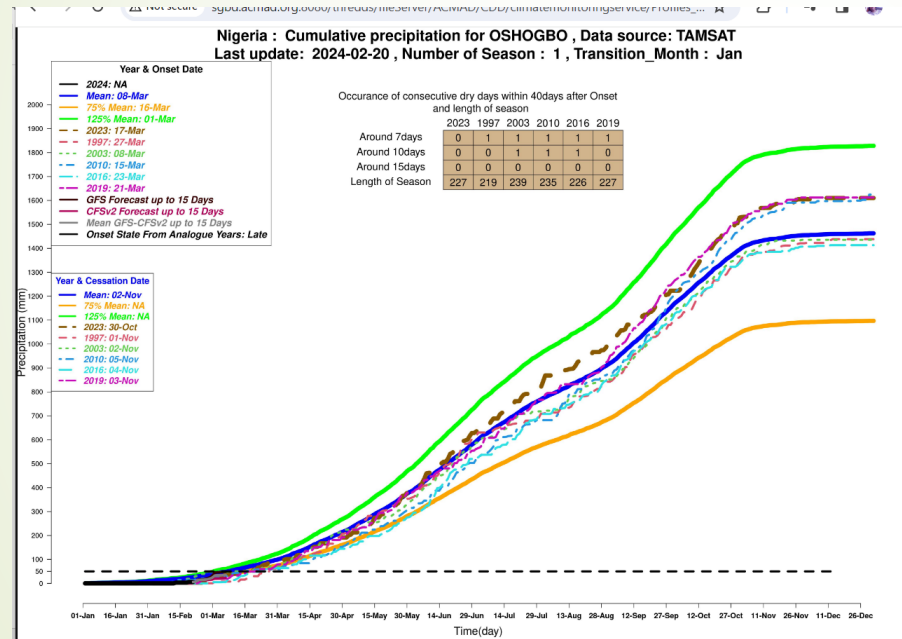
➤ This analysis shows that in the last decade, rainfall has been within the band of normal especially the positive side.

# Past and current State of a station(Onitsha) inland of the south East Nigeria



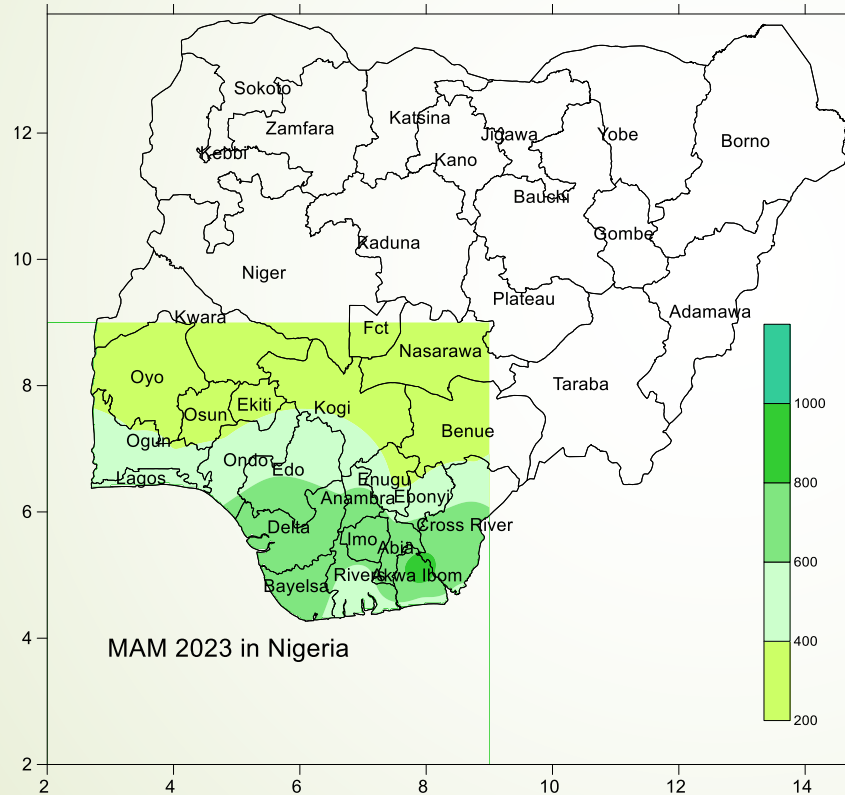
➤ This analysis shows that in the past few years, rainfall has been within the band of normal especially the positive side.

# Past and current State of a station(Oshogbo) inland of the south West Nigeria



- This analysis shows that in the past few years, rainfall has been within the band of normal especially the negative side.

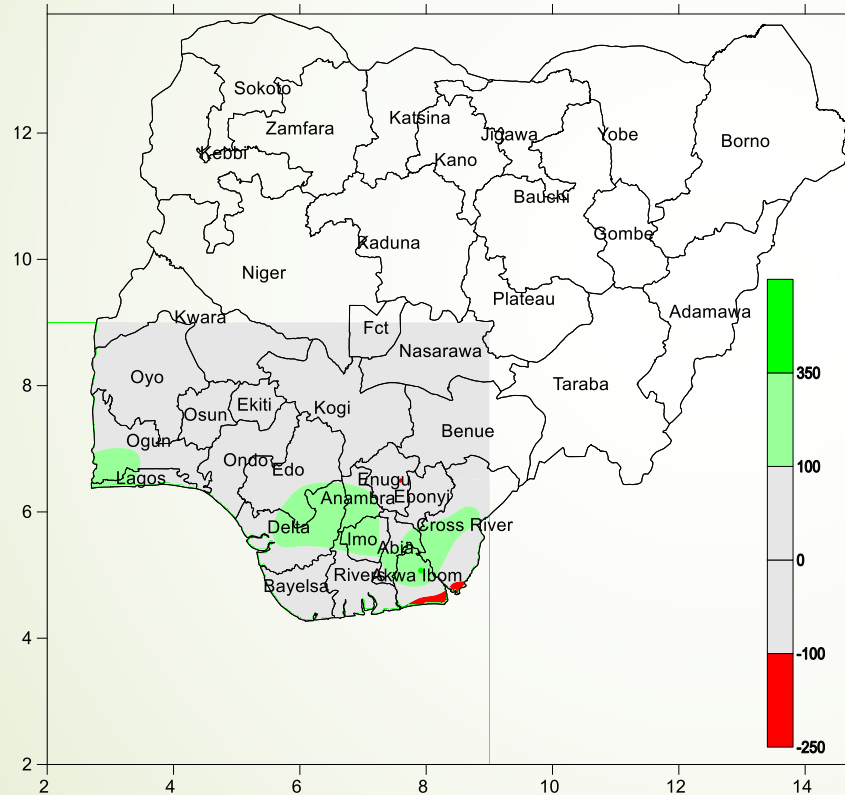
# A review of the 2023 MAM cumulative Rainfall Observation over South of Nigeria



➤ The MAM cumulative rainfall observation range from 270-960mm in 2023.

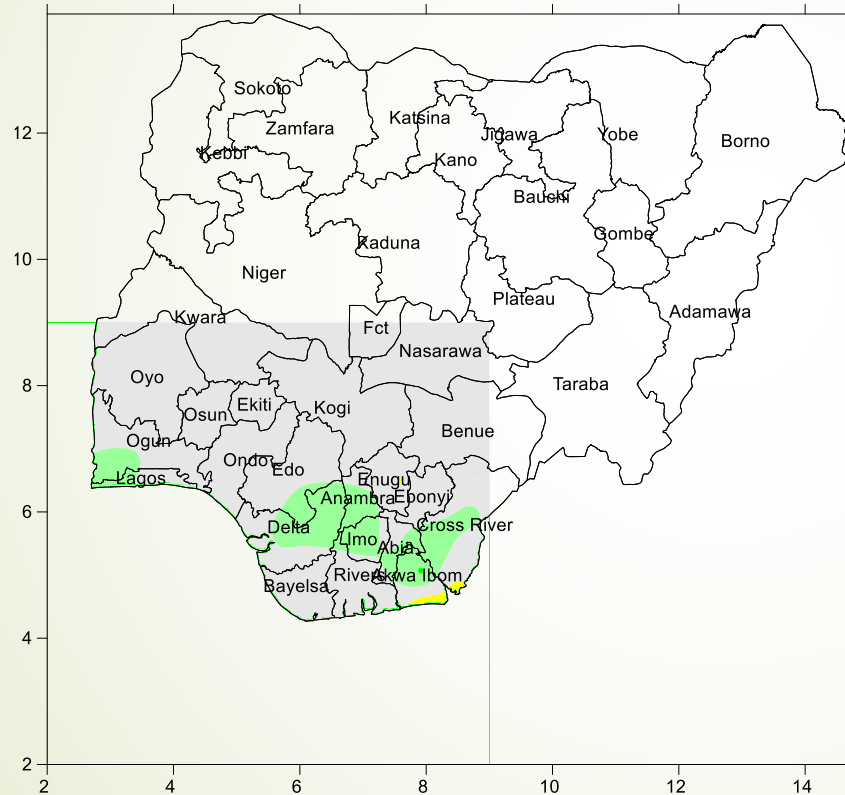


# MAM departure from Normal in 2023



- The departure from long time mean shows over 75% normal rainfall in MAM season across Southern Nigeria.
- Few areas recorded above normal and south east coast had a short fall.

# Predicted MAM for 2023

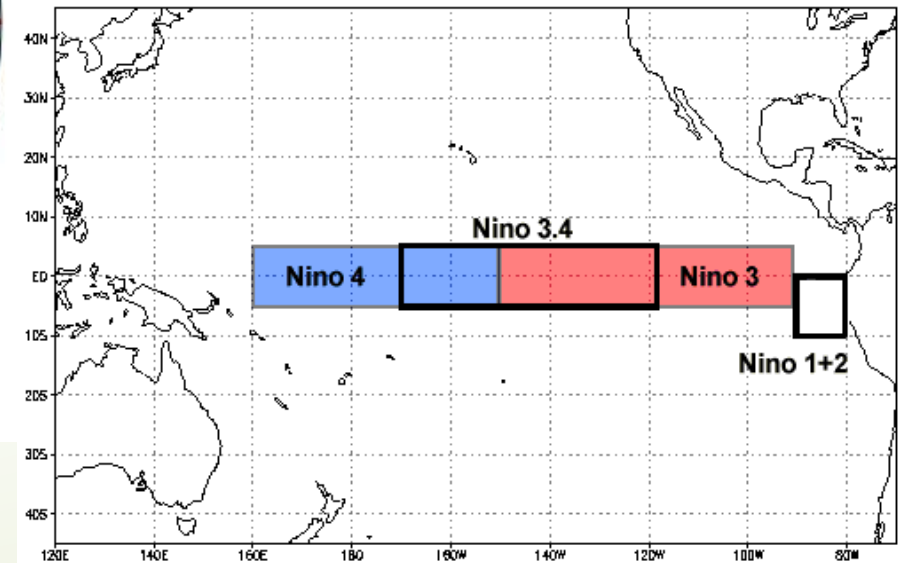


- The anticipated rainfall pattern came out very well
- Above 80% accuracy.

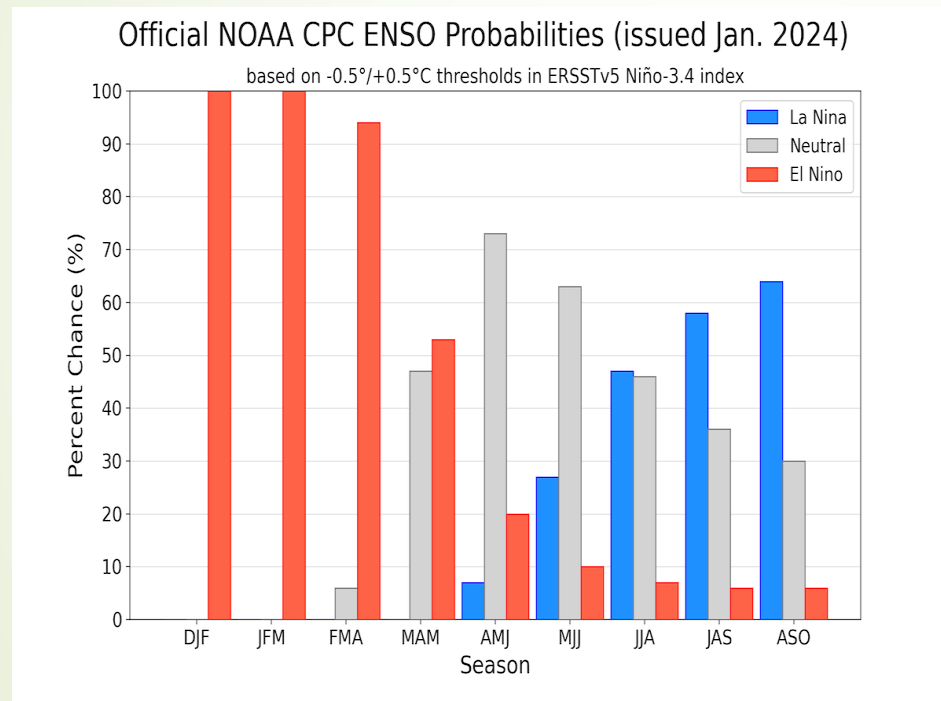
# Approach to forecast for MAM and AMJ for 2024.



- Paying a close attention to nino 3.4 region, gulf of Guinea, and Indian Ocean region and equatorial region.

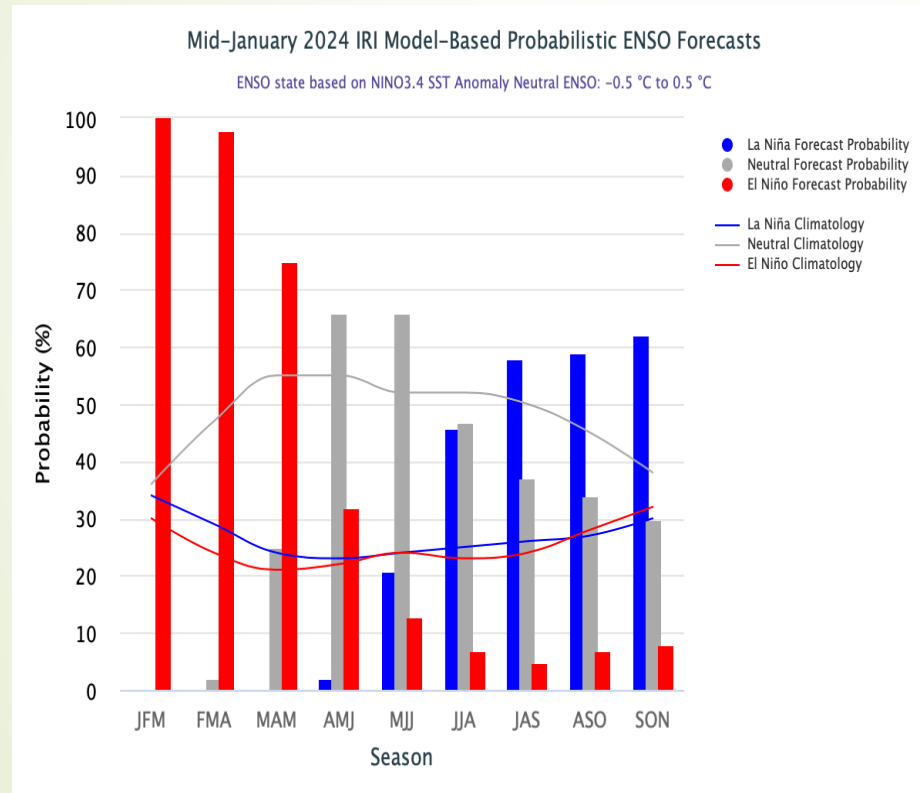


# ENSO phase issued in January 2024



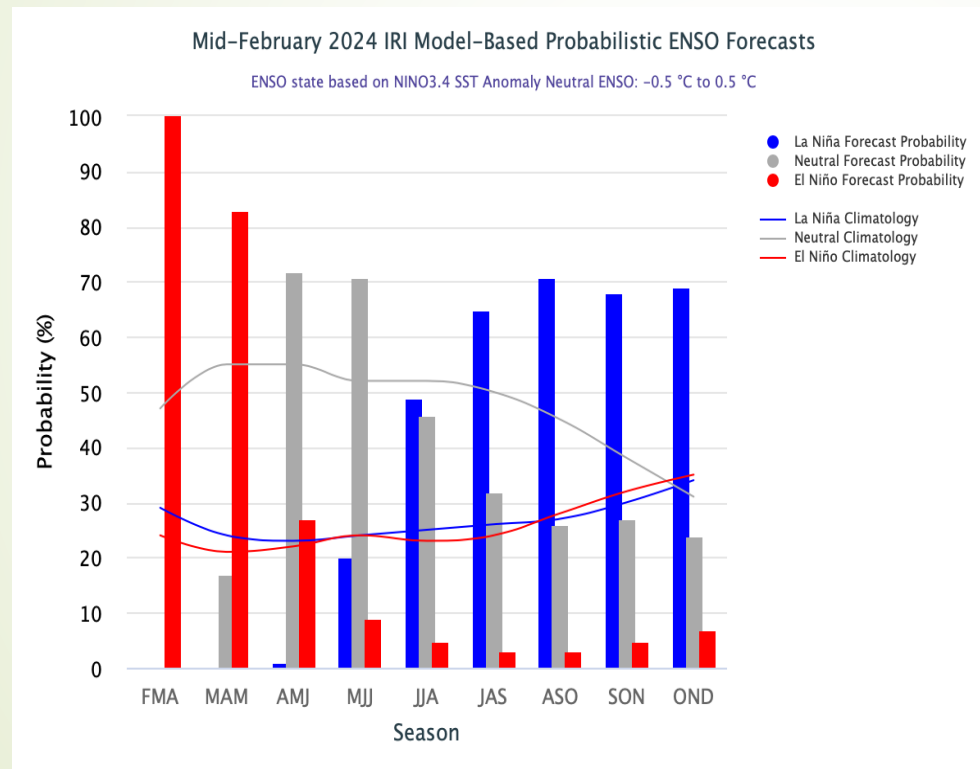
- DJF, JFM showed strong El Niño phase then the phase began to decrease further in the season.
- Neutral phase pushing through fast and becomes dominant in AMJ and MJJ

# Mid January ENSO outlook for 2024



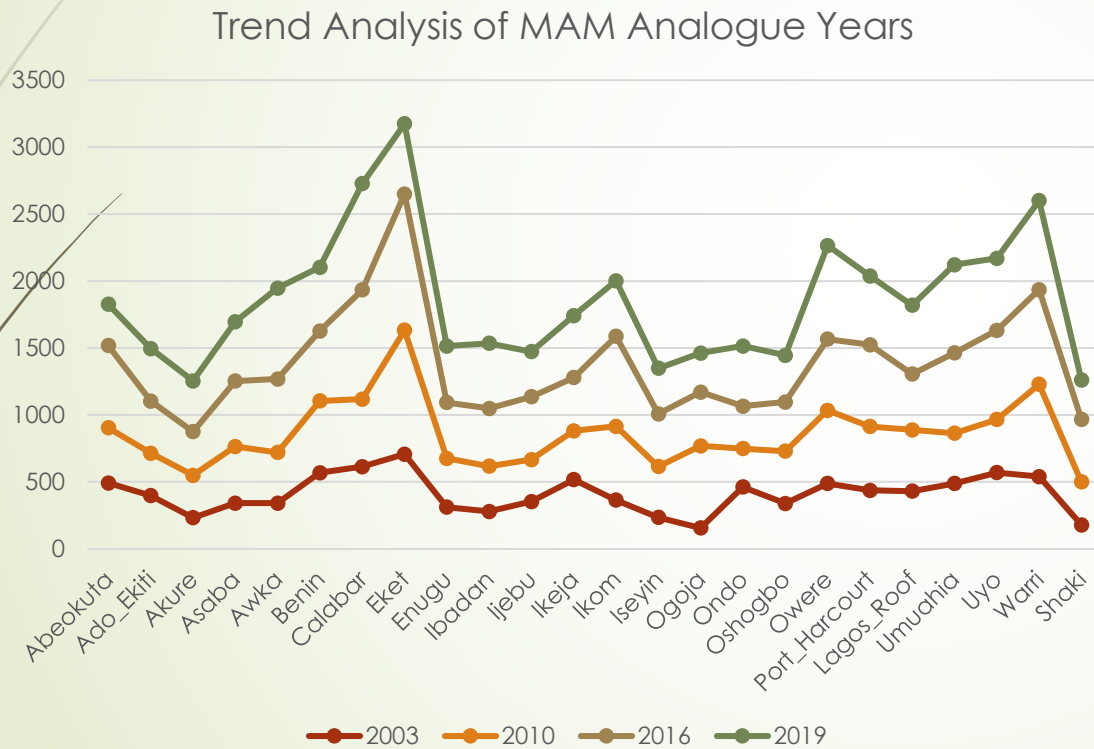
➤ Between early January and Mid January outlook showed a short fall in El Niño phase in FMA and MAM

# February ENSO outlook for 2024



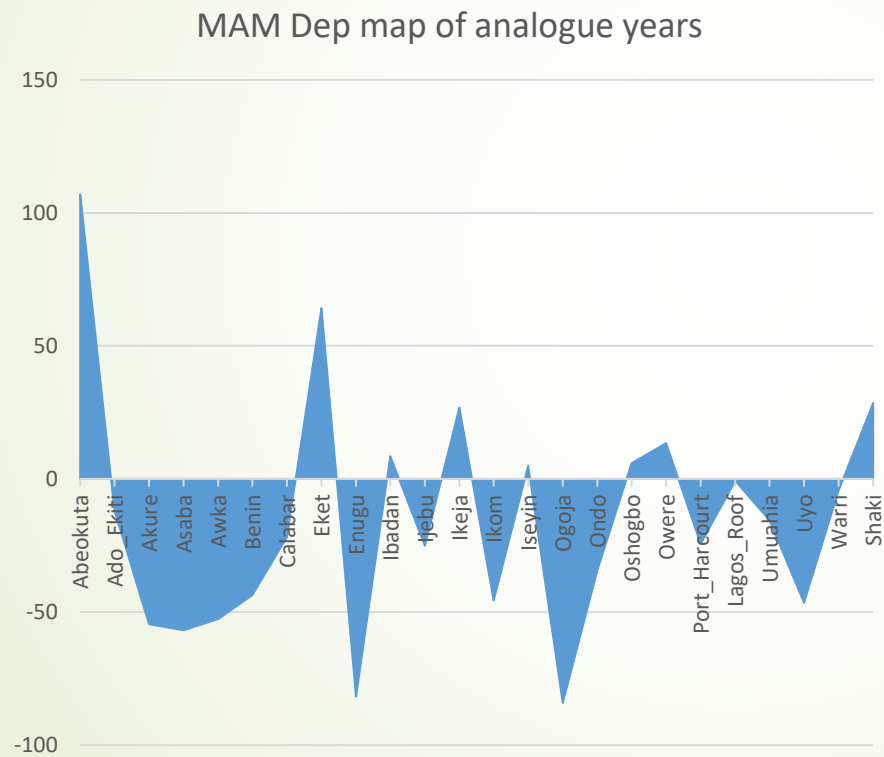
ENSO outlook in February has further confirm that FMA and MAM will maintain El Niño while AMJ and MJJ will be Neutral afterward's the La nina phase becomes dominant.

# Looking at the Analogue years (2003, 2010, 2016 and 2019)



- The seasonal trend look very similar.
- From 2003 to 2019 rainfall showed a positive increase in cumulative value.

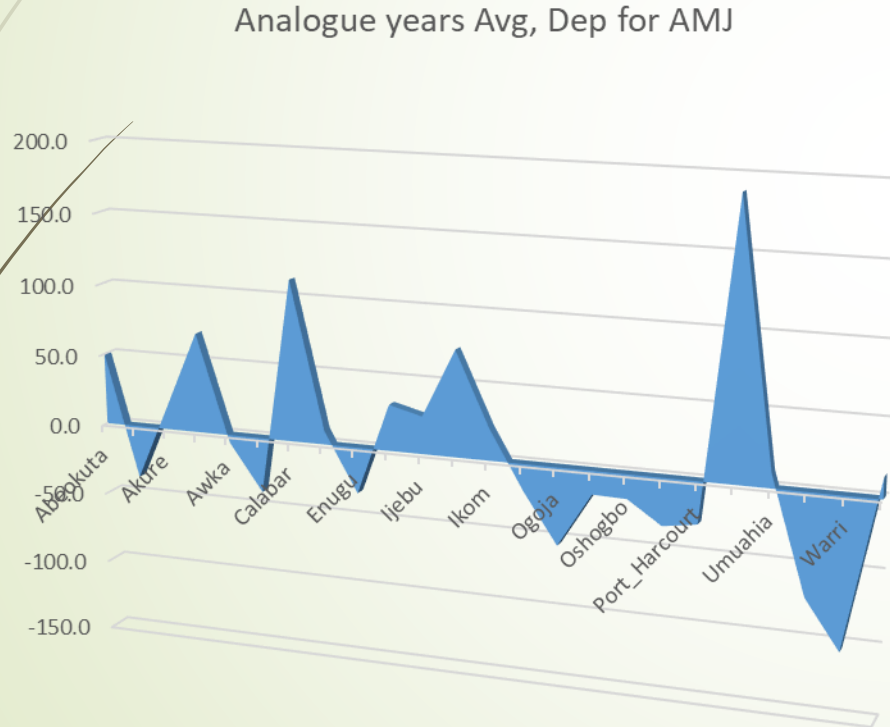
# MAM departure from Normal: Focus is Analogue years



- Most all the station fell within the normal band,
- Four station out of 24 station fell off the normal band.

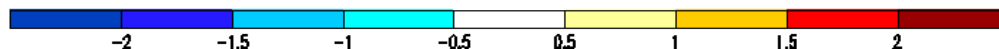
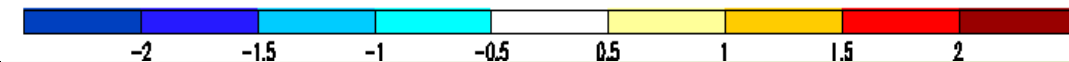
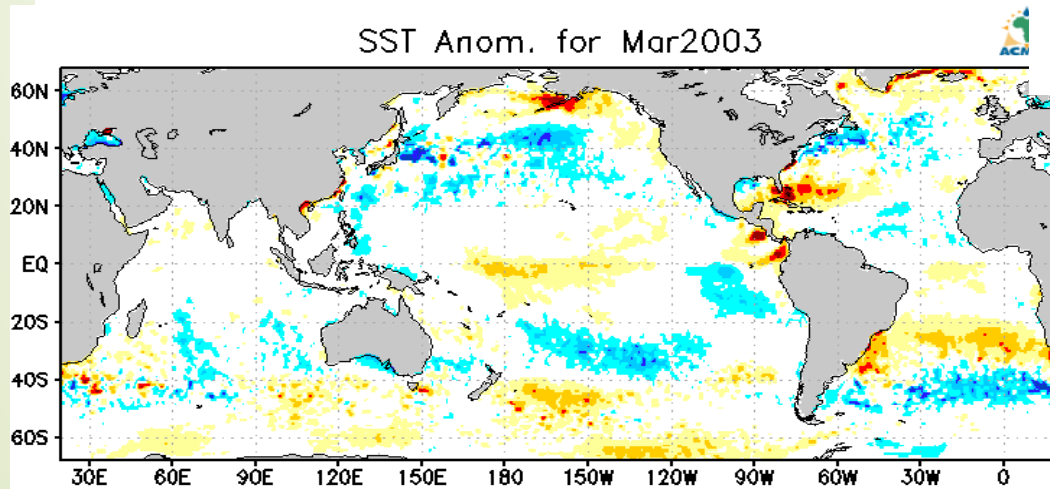
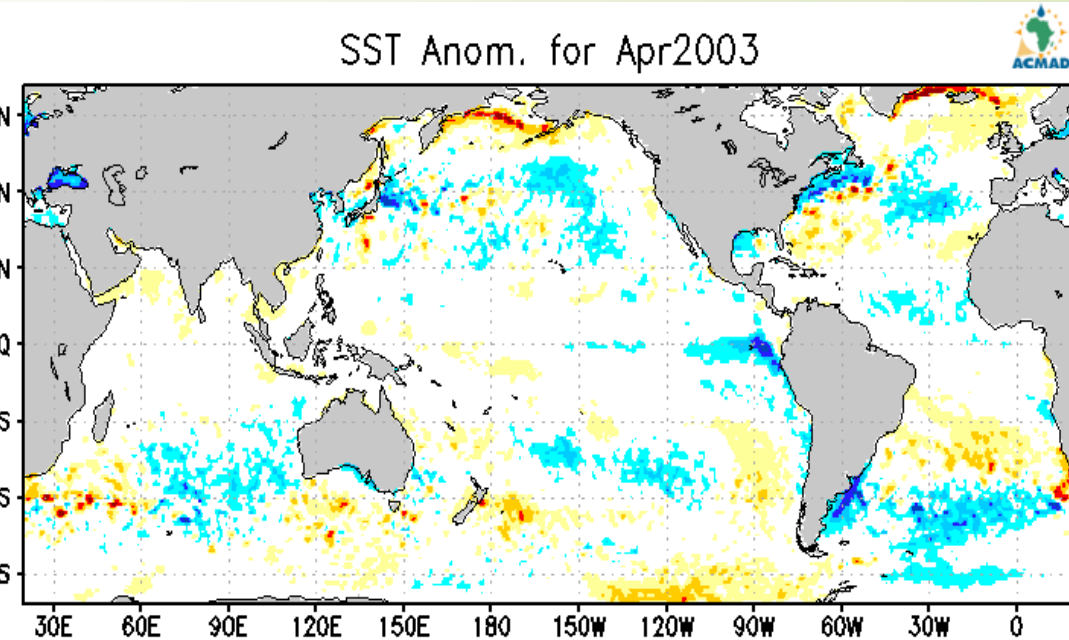
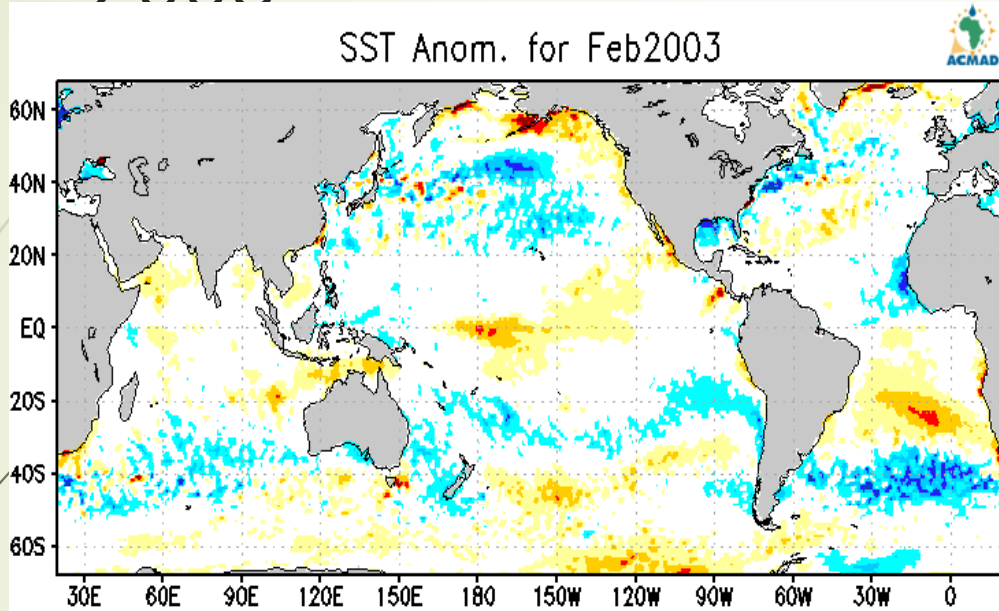


# AMJ Report over Nigeria

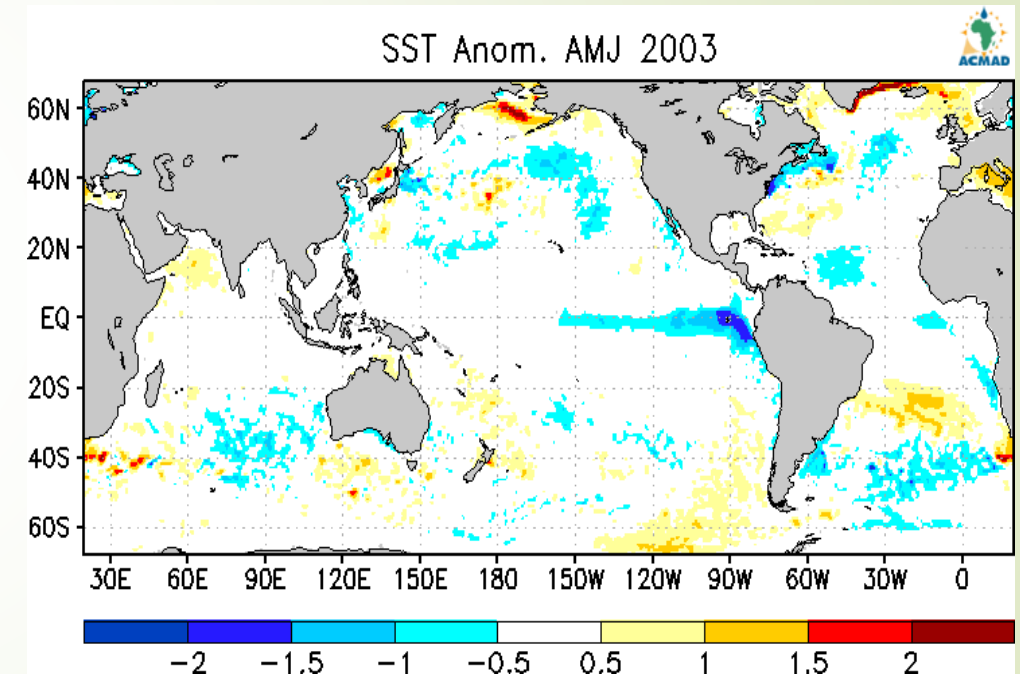
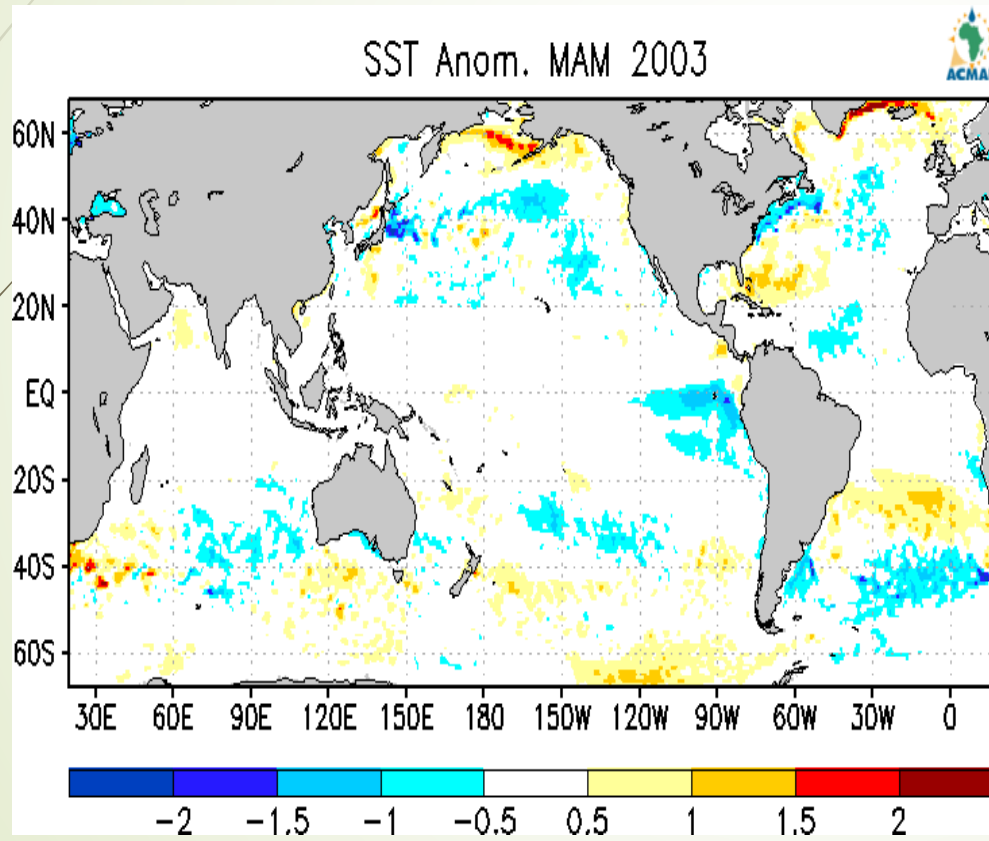


- The AMJ showed that three stations fell off the normal band;
- The suggest that majority of the station in the south were within the normal band in the last decades.

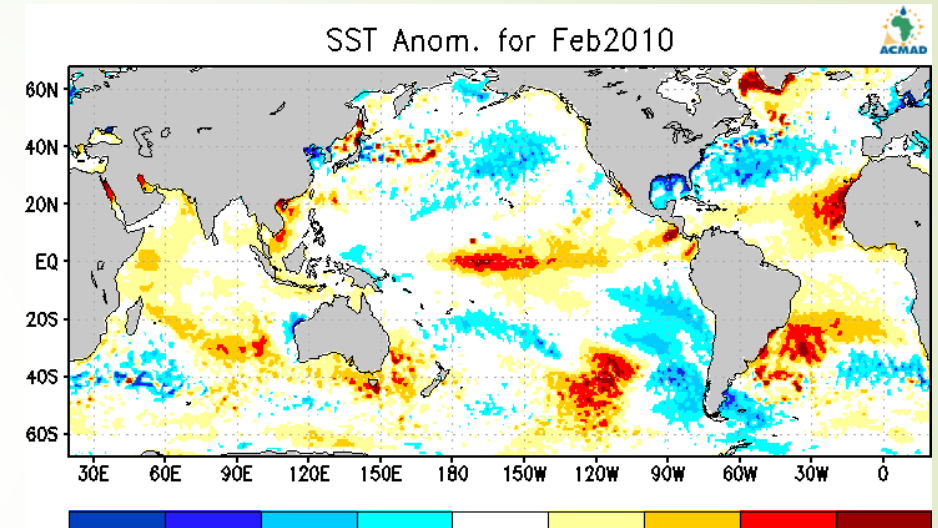
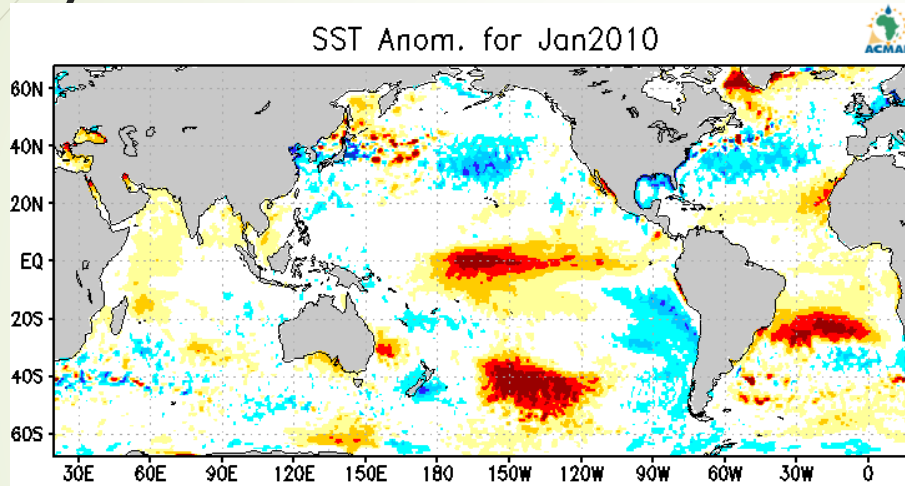
# Behaviour of SST's of the Analogue years 2003



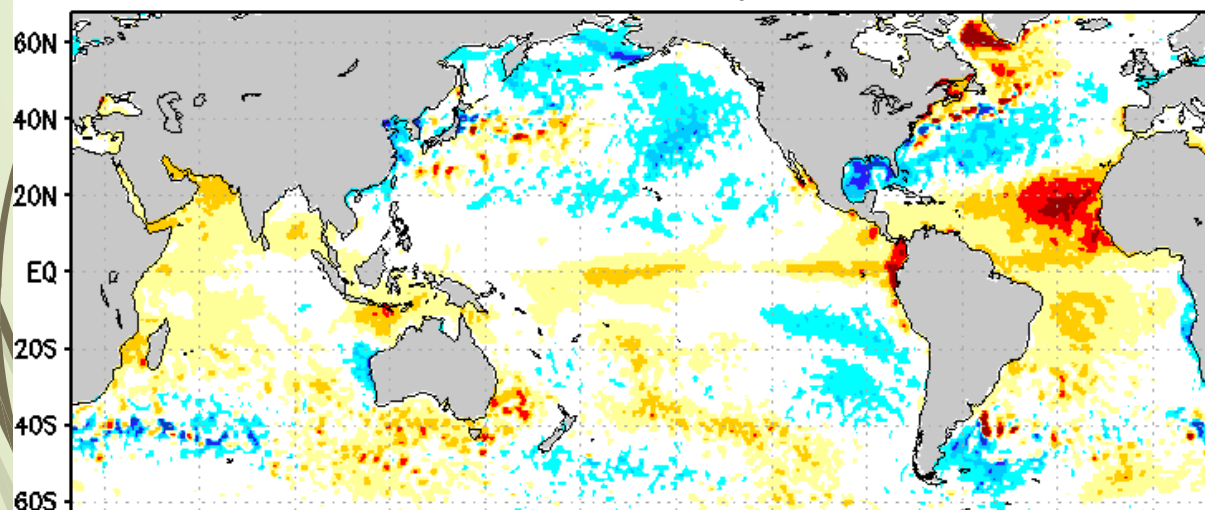
# Behaviour of SST's of the Analogue years 2003



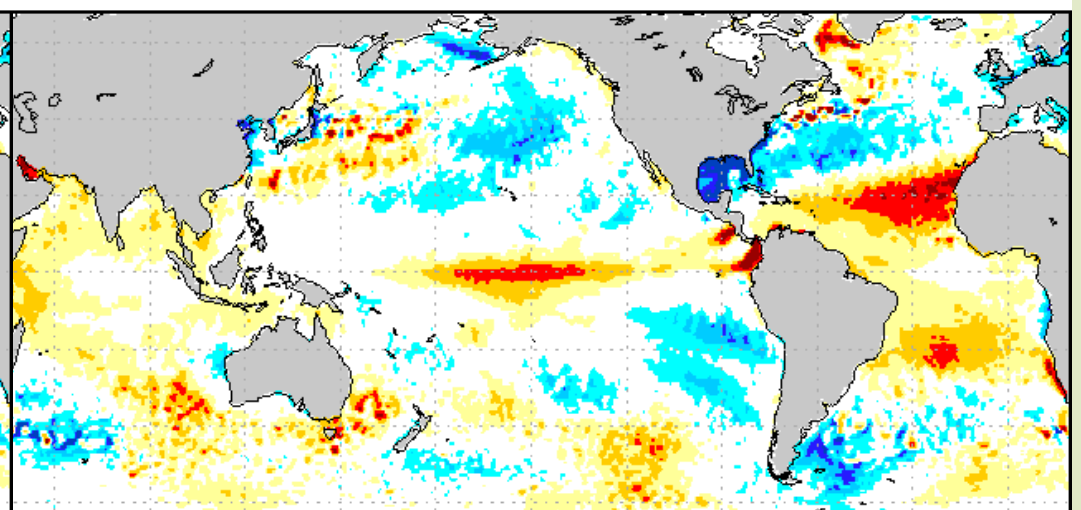
# Behaviour of SST's of the Analogue years 2010



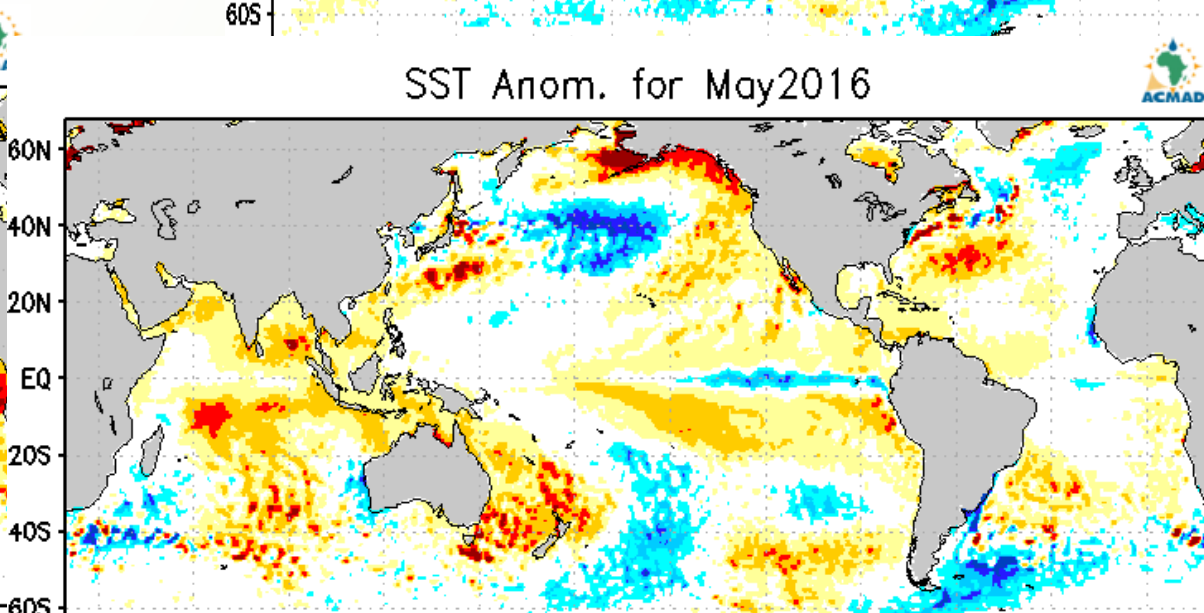
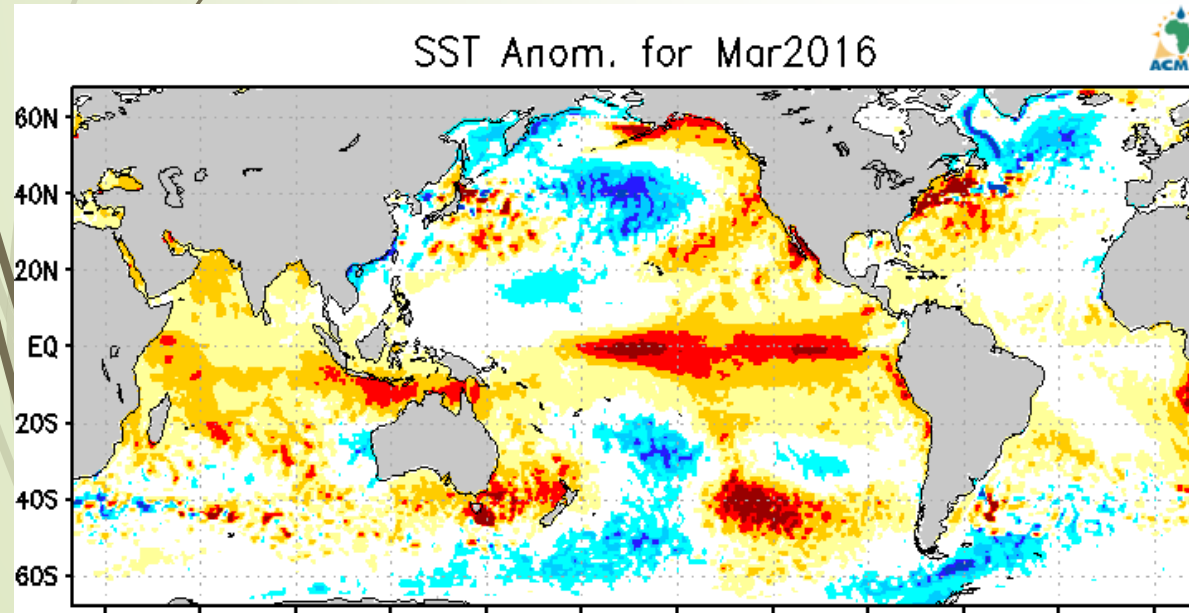
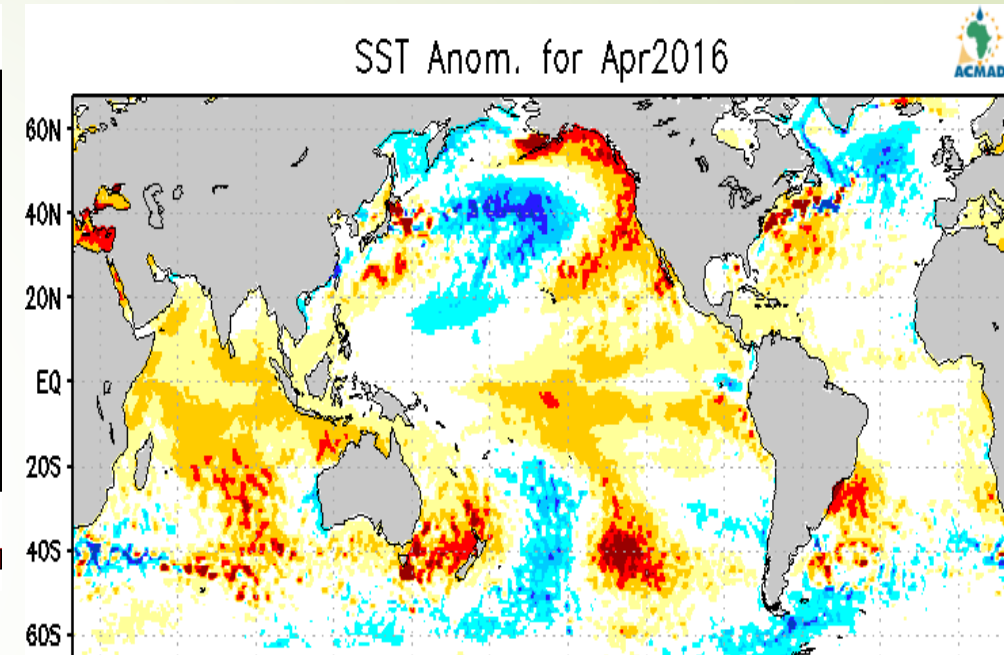
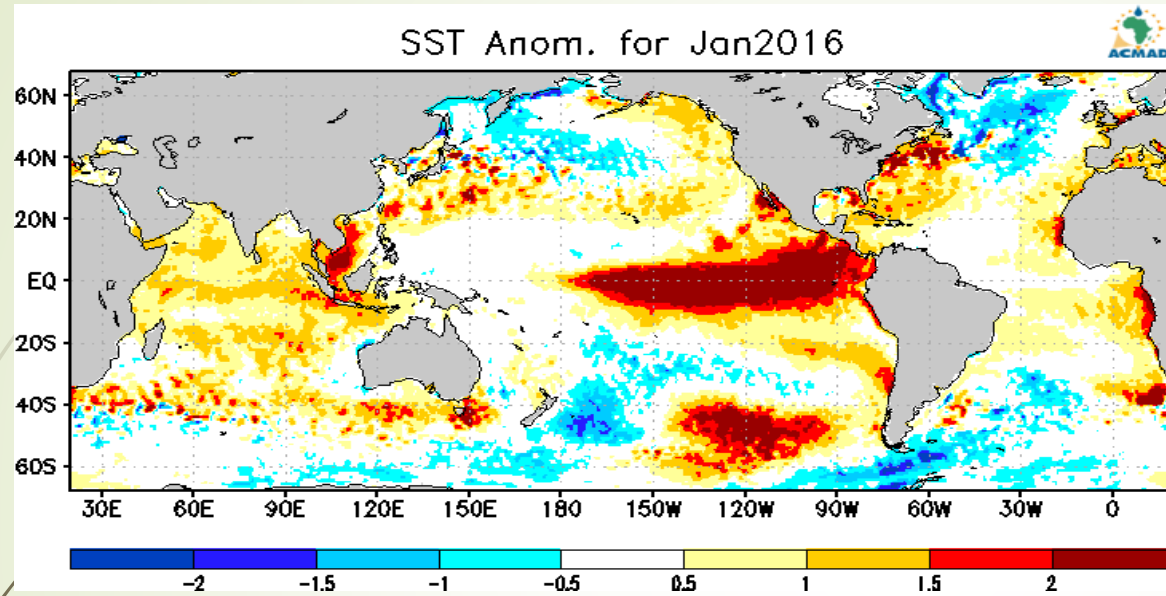
SST Anom. for Apr2010



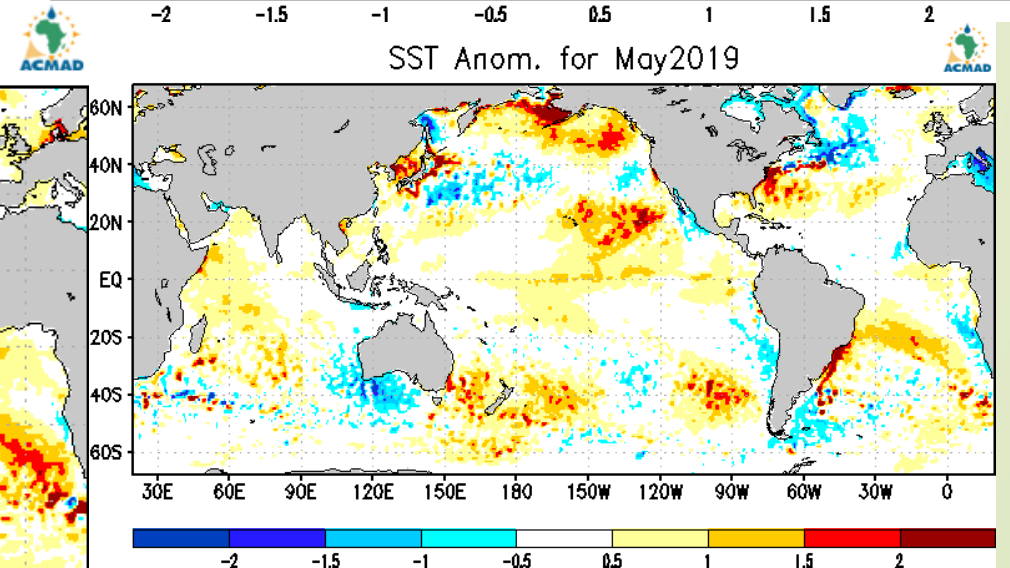
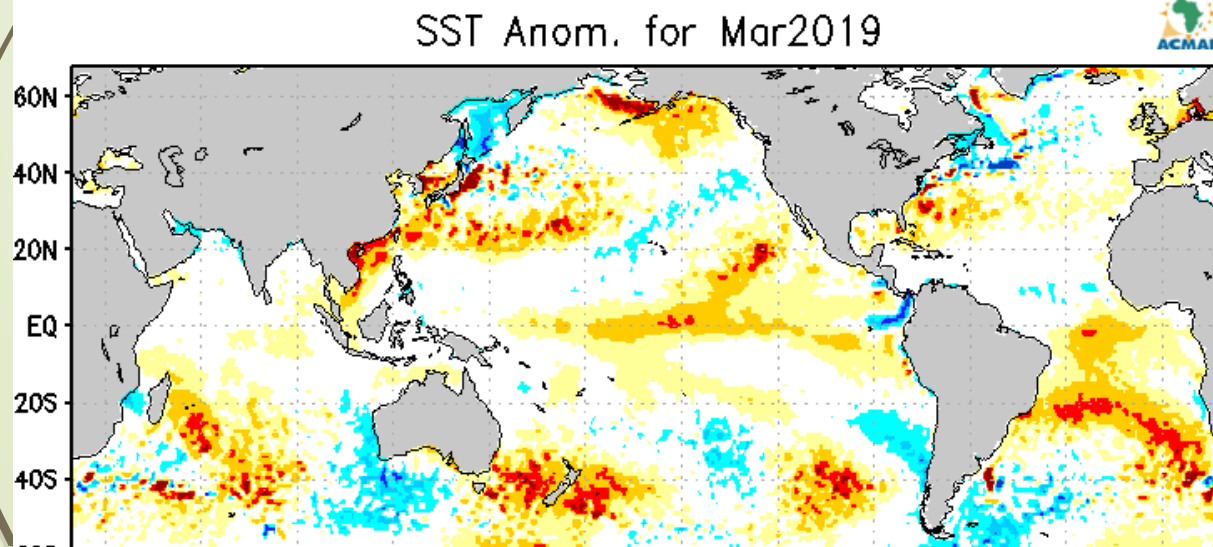
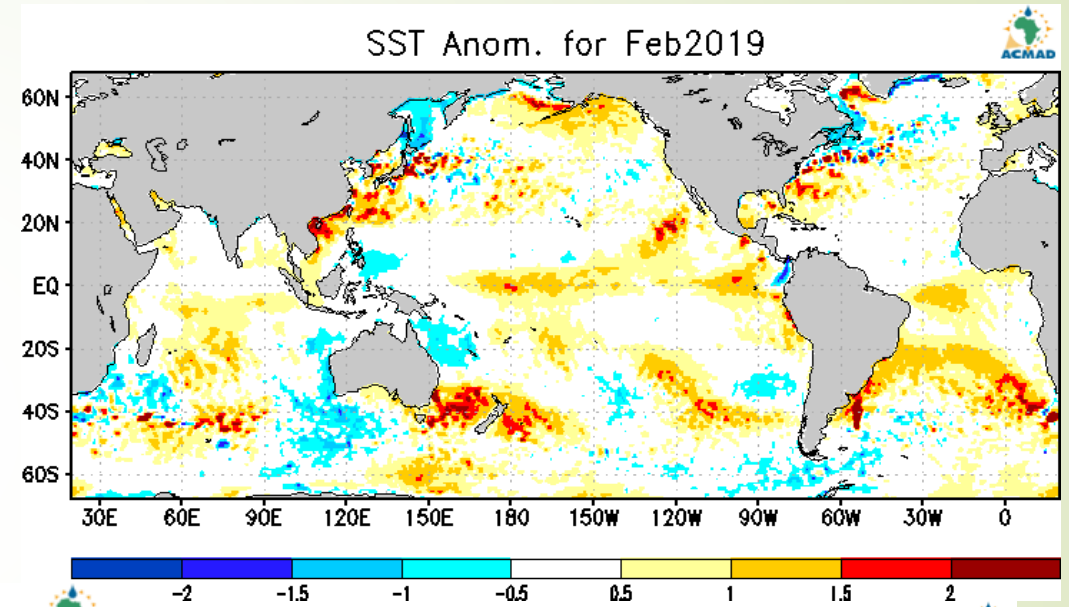
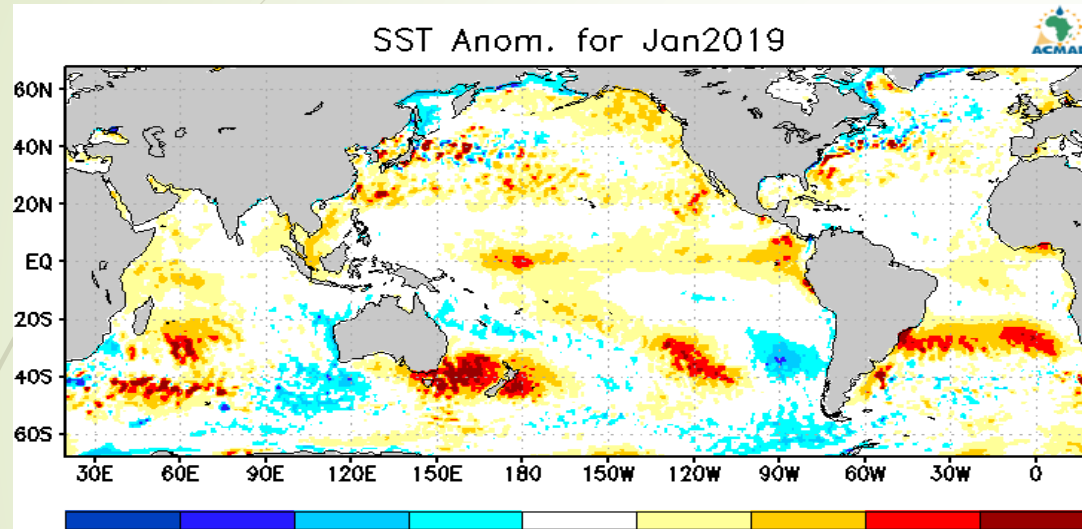
SST Anom. for Mar2010



# Behaviour of SST's of the Analogue years 2016

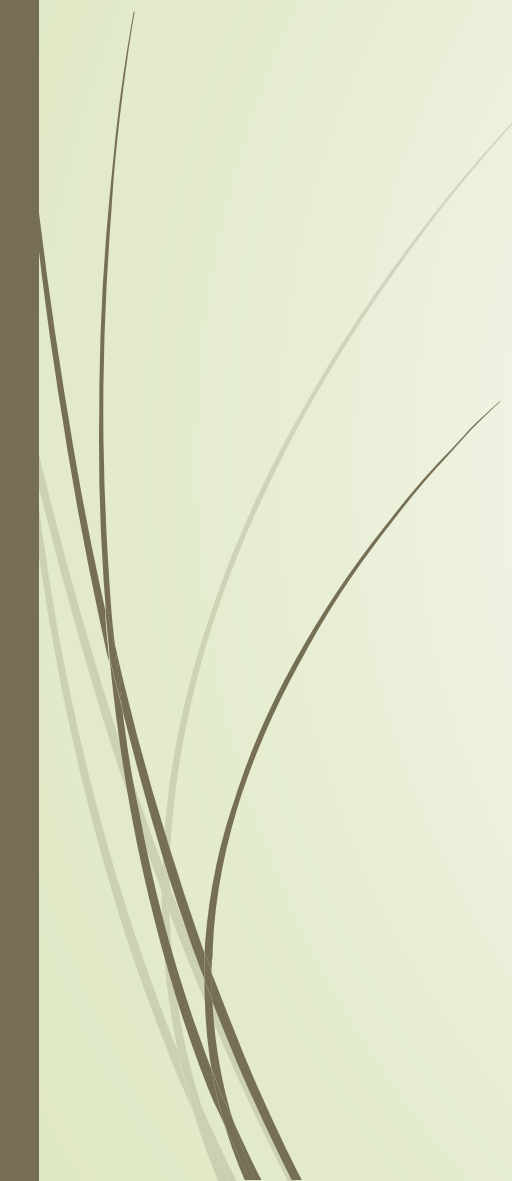


# Behaviour of SST's of the Analogue years 2019

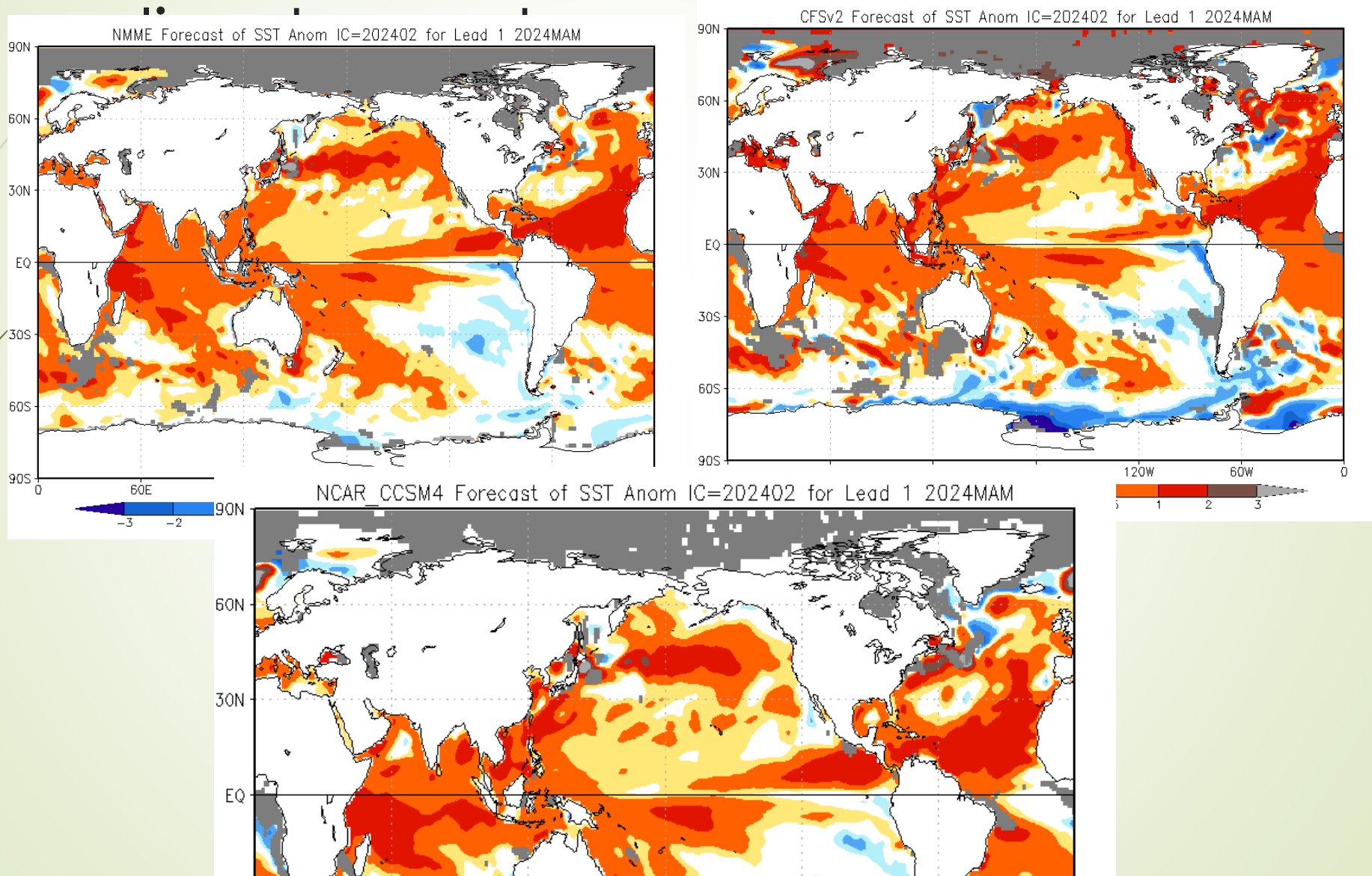




## Behaviour of SST's of the Analogue years

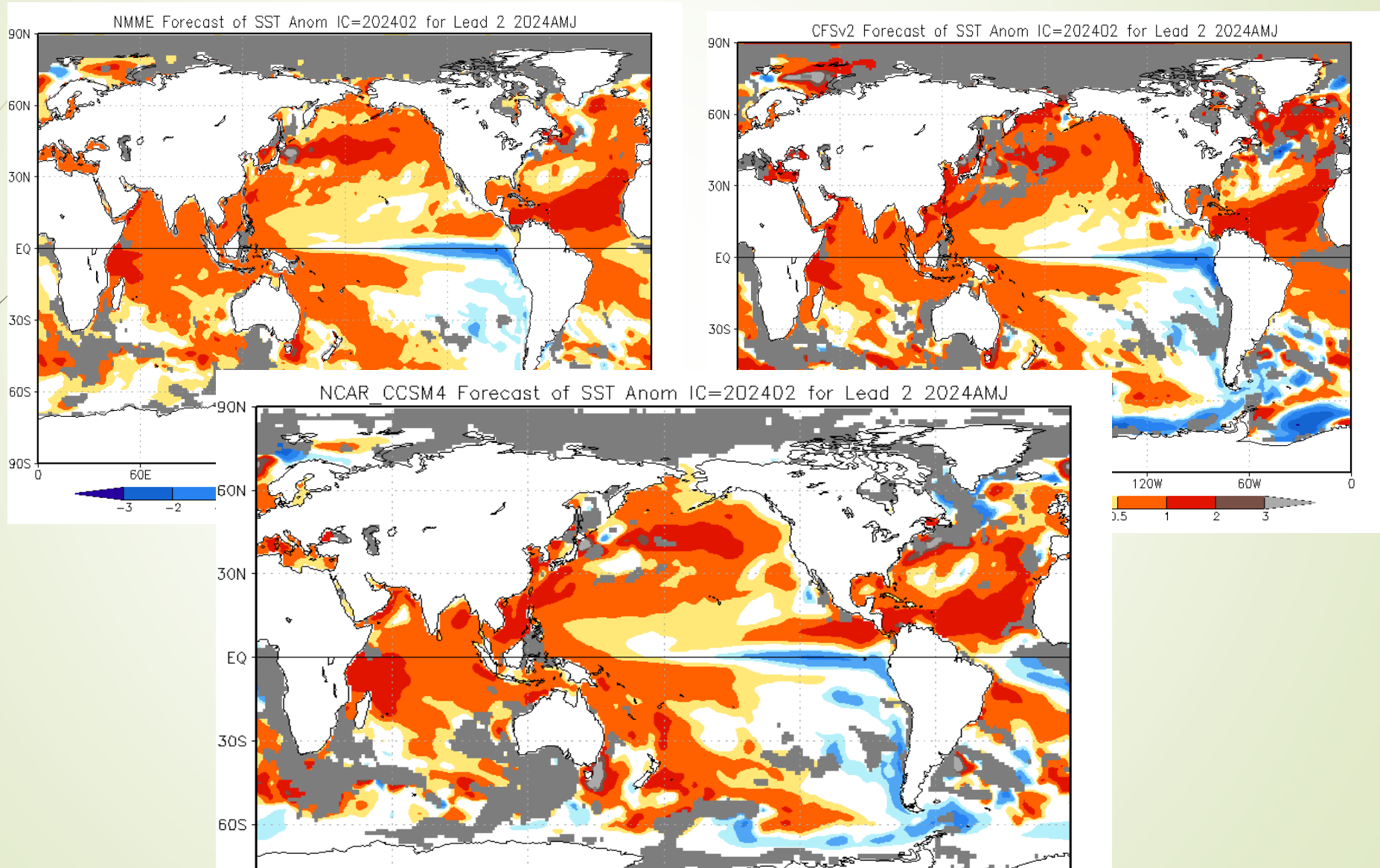
- For the four analogue years, 2010 and 2016 appear to behave closer to the expected pattern in 2024 MAM and AMJ.
- 


# SST forecast MAM 2024 from different



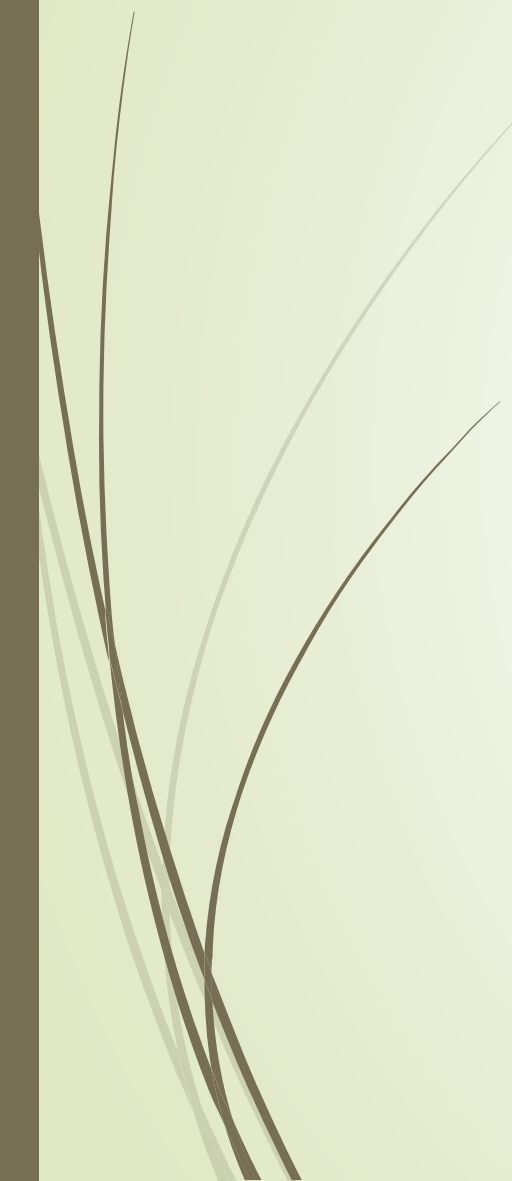


# SST forecast AMJ 2024 from different Centre's

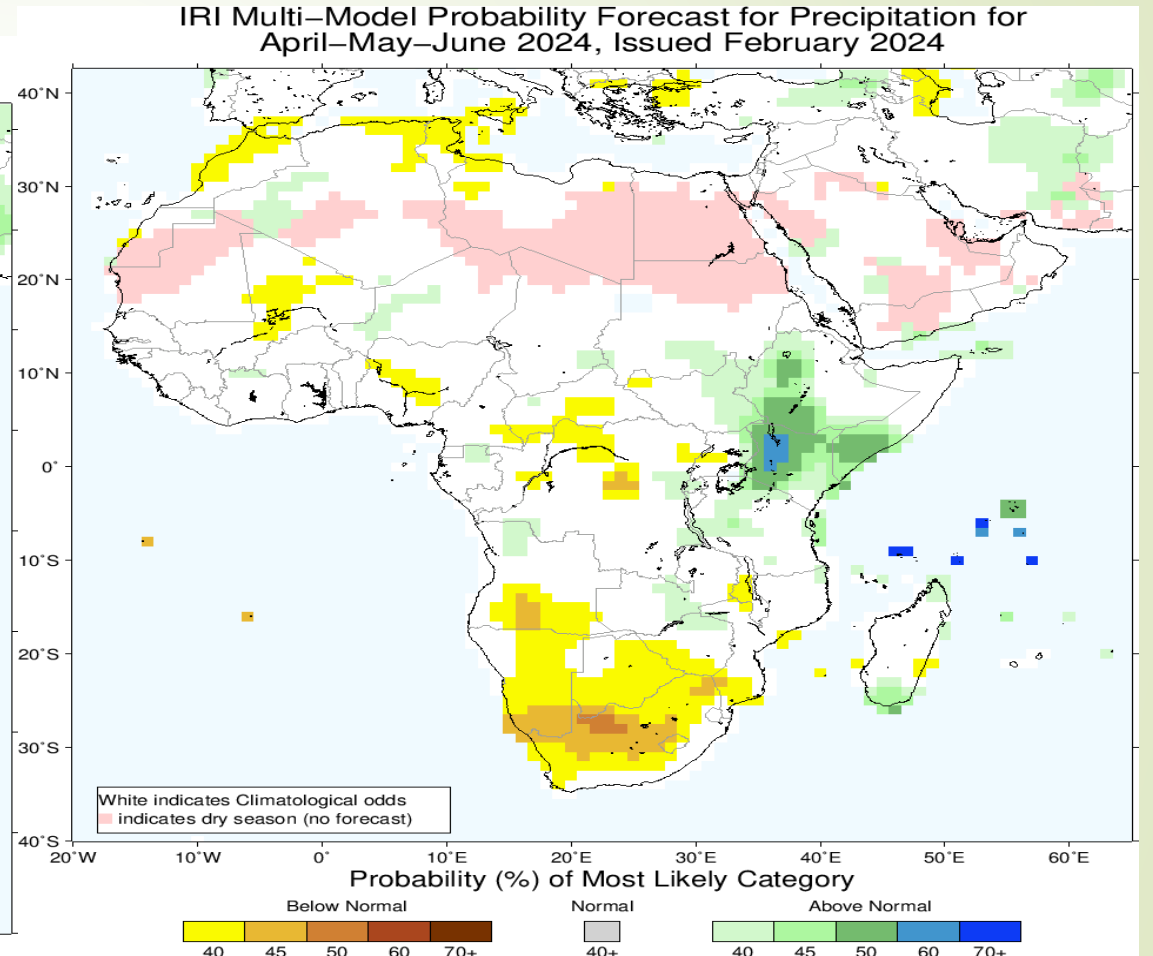
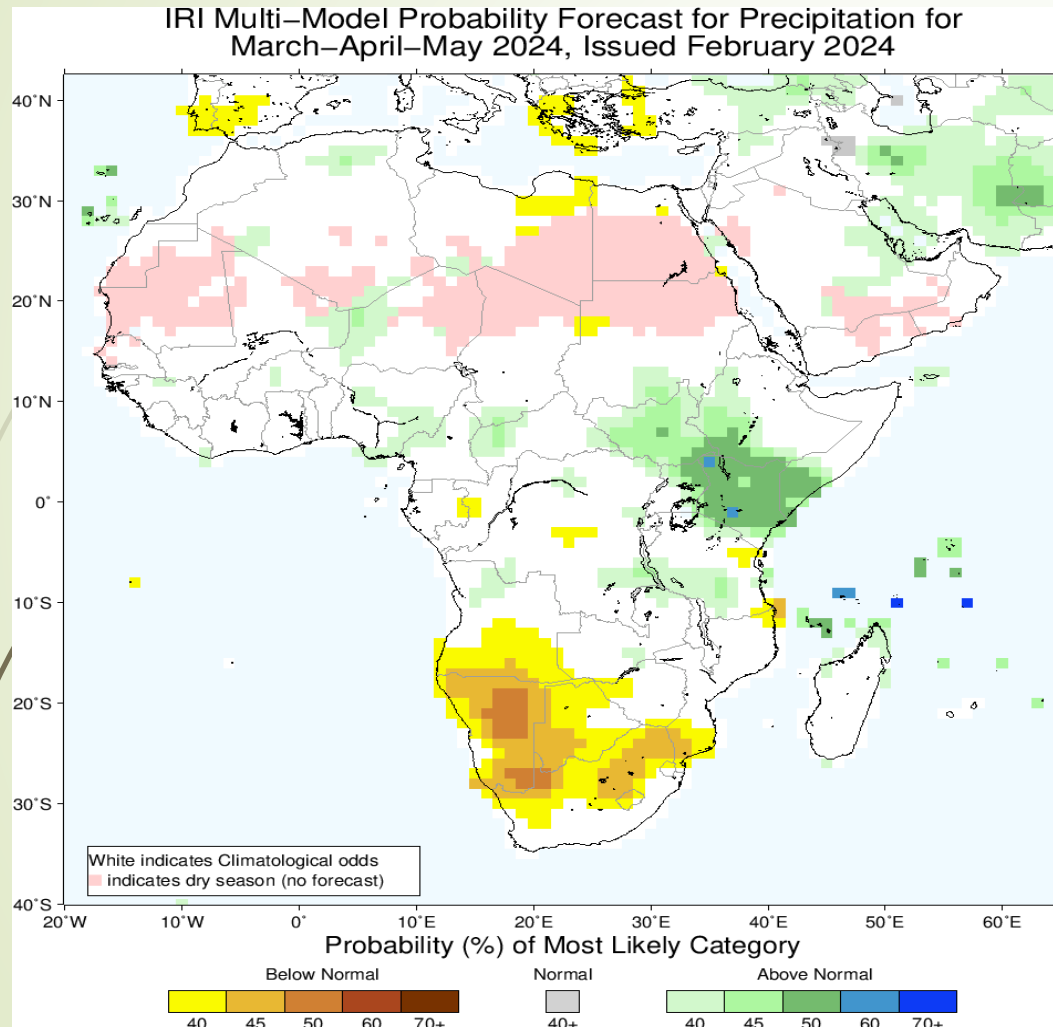




# Comment on current and future ENSO phase

- The skill of the forecast maps were good and the projection follows that the current El Niño will decrease to neutral phase from MAM into AMJ, thereafter becomes strong La Niña
- 

# Forecast over Africa from IRI Multi Model ensemble for MAM and AMJ



Forecast Run for MAM and AMJ. The Skill map for MAM and AMJ for Tamsat data was good. Goodness index ranges from 0.15 to 0.26. Note, other runs were carried out but the focus is on highest skill result

**Predictors (X)**

File name: nmme\_sst\_hcst\_FEBic\_3-5\_1991

First data: MAM 1991

Last data: MAM 2020

Start at: MAM 1991

Number of fields: 1

Number of lags: 1

Number of gridpoints: 10800

Number used: 7898

**Predictands (Y)**

File name: CPT\_FMT\_WAfr\_tamsat\_MAM\_1

First data: MAM 1991

Last data: MAM 2020

Start at: Mar 1991

Number of fields: 1

Number of lags: 1

Number of gridpoints: 34782

Number used: 18246

**New Predictors (Z)**

File name: nmme\_sst\_fcst\_FEBic\_3-5\_2024

First data: MAM 2024

Last data: MAM 2024

Start at: MAM 2024

Number of fields: 1

Number of lags: 1

Number of gridpoints: 10800

Number used: 0

**Input Files Predictands (Y)**

File name: CPT\_FMT\_WAfr\_tamsat\_AMJ\_1

First data: AMJ 1991

Last data: AMJ 2020

Start at: Apr 1991

Number of fields: 1

Number of lags: 1

Number of gridpoints: 34782

Number used: 0

**New Predictors (Z)**

File name: nmme\_sst\_fcst\_FEBic\_4-6\_2024

First data: AMJ 2024

Last data: AMJ 2024

Start at: AMJ 2024

Number of fields: 1

Number of lags: 1

Number of gridpoints: 10440

Number used: 0

Length of training period: 30		Length of d		Actions			
4	3	3	0.083	1	1	1	0.154
4	4	1	0.101	1	1	1	0.154
4	4	2	0.111	1	1	1	0.154
4	4	3	0.088	1	1	1	0.154
4	4	4	0.084	1	1	1	0.154
4	5	1	0.117	1	1	1	0.154
4	5	2	0.107	1	1	1	0.154
4	5	3	0.060	1	1	1	0.154
4	5	4	0.073	1	1	1	0.154
5	1	1	0.151	1	1	1	0.154
5	2	1	0.142	1	1	1	0.154
5	2	2	0.107	1	1	1	0.154
5	3	1	0.084	1	1	1	0.154
5	3	2	0.097	1	1	1	0.154
5	3	3	0.082	1	1	1	0.154
5	4	1	0.052	1	1	1	0.154
5	4	2	0.112	1	1	1	0.154
5	4	3	0.086	1	1	1	0.154
5	4	4	0.081	1	1	1	0.154
5	5	1	0.116	1	1	1	0.154
5	5	2	0.075	1	1	1	0.154
5	5	3	0.067	1	1	1	0.154
5	5	4	0.072	1	1	1	0.154
5	5	5	0.072	1	1	1	0.154

**Scores**

- Pearson's correlation
- Spearman's correlation
- 2AFC score
- % variance
- Variance ratio
- Mean bias
- Root mean squared error
- Mean absolute error
- Hit score
- Hit skill score
- LEPS
- Gerrity score
- 2AFC (forecast categories)
- 2AFC (continuous forecasts; GROC)
- ROC area (below-normal)
- ROC area (above-normal)

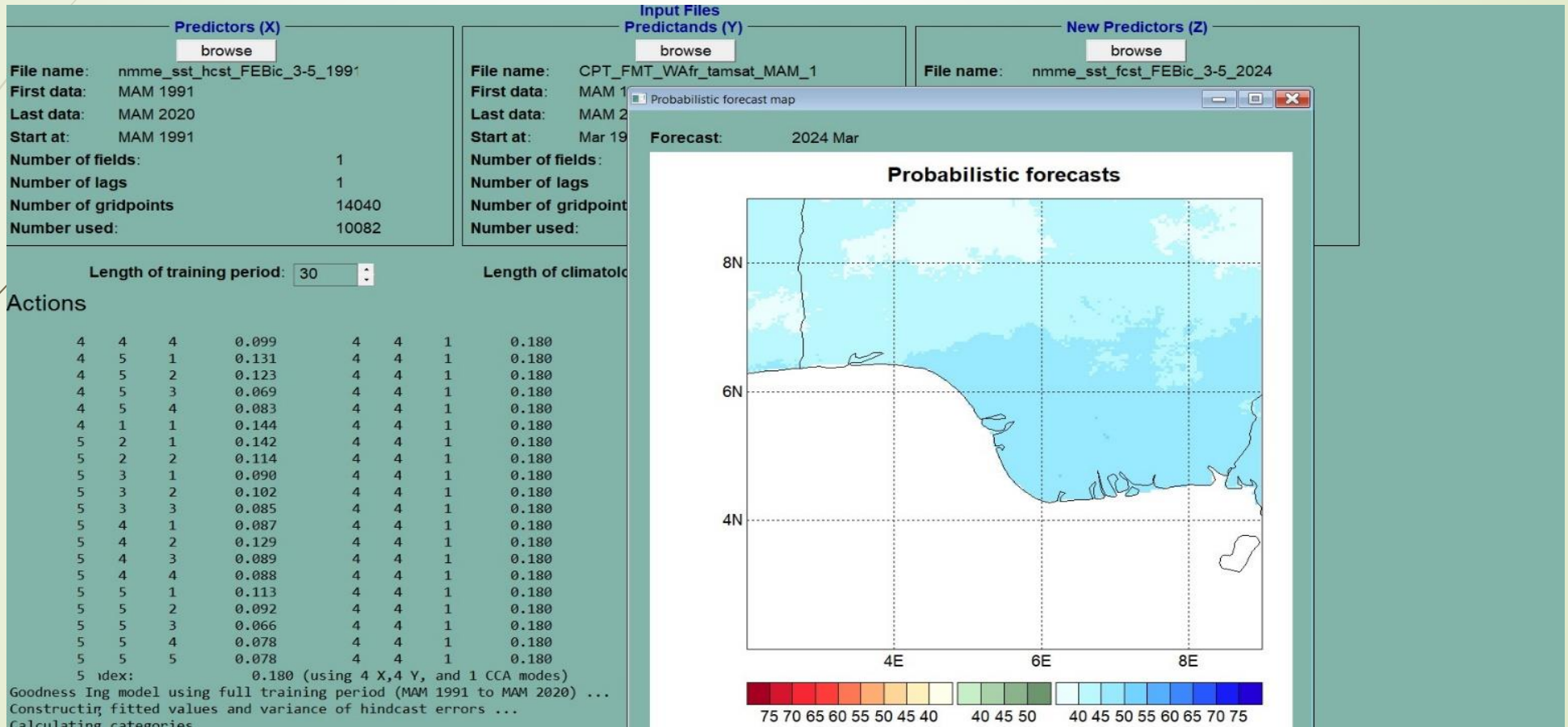
**Pearson's correlation**

**Scores**

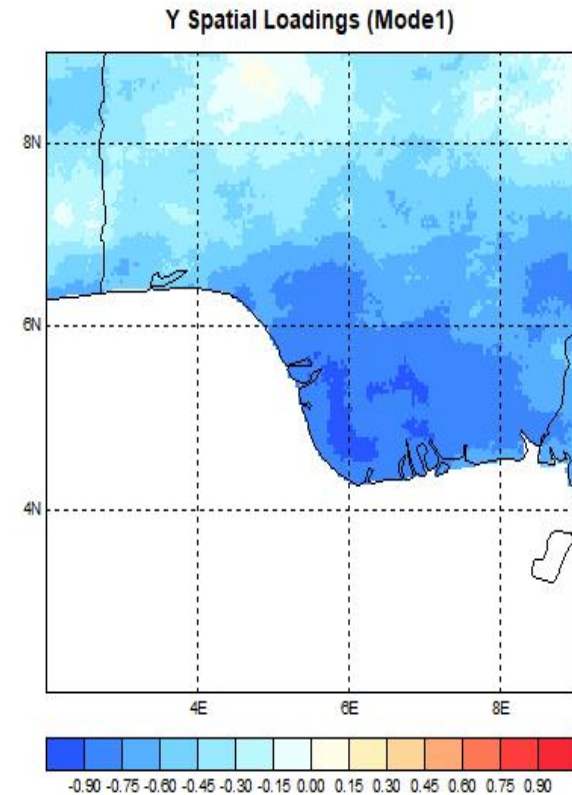
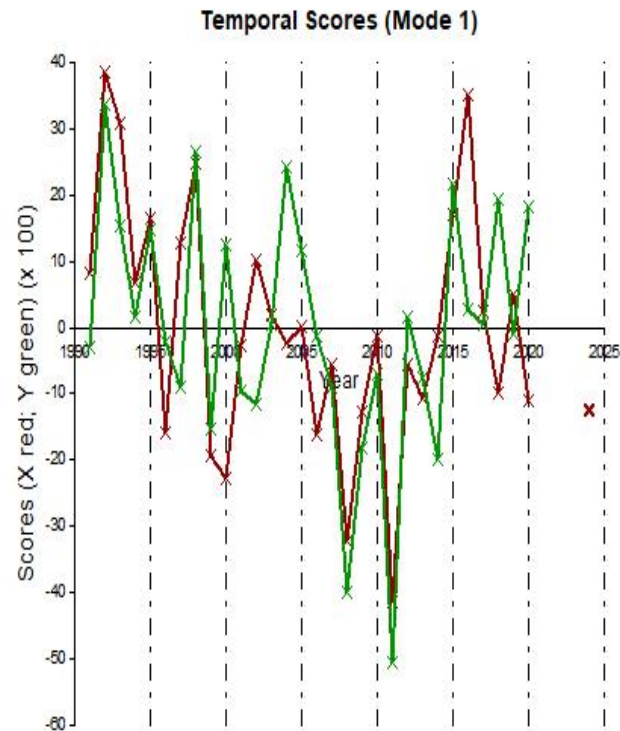
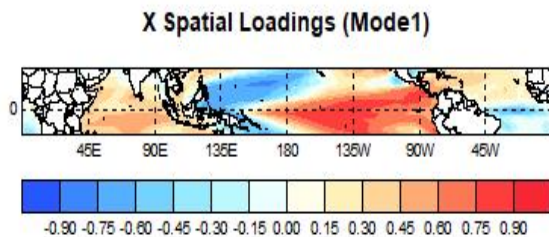
- Pearson's correlation
- Spearman's correlation
- 2AFC score
- % variance
- Variance ratio
- Mean bias
- Root mean squared error
- Mean absolute error
- Hit score
- Hit skill score
- LEPS
- Gerrity score
- 2AFC (forecast categories)
- 2AFC (continuous forecasts; GROC)
- ROC area (below-normal)
- ROC area (above-normal)

**Pearson's correlation**

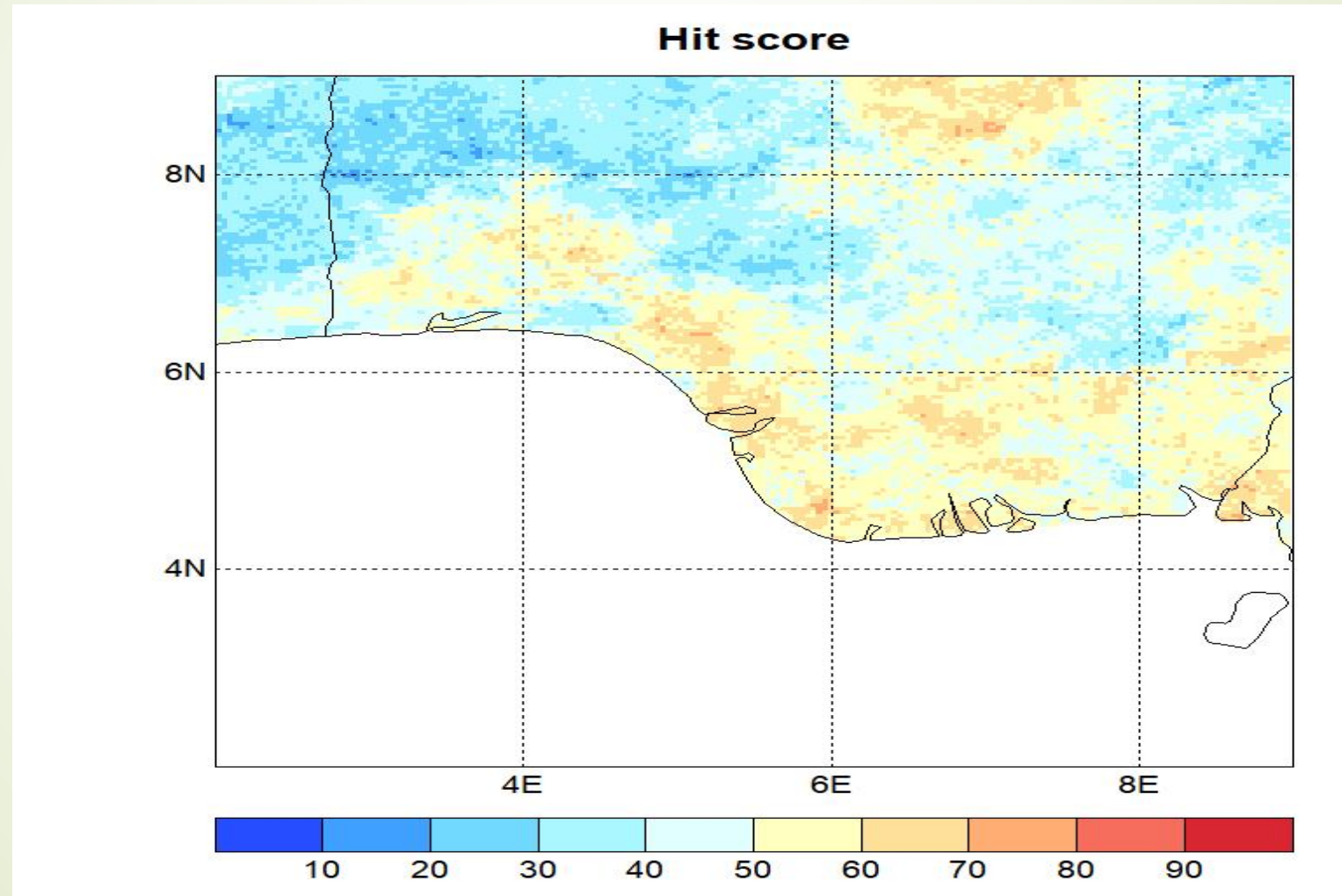
# MAM run suggest above to normal rainfall forecast.



Forecast Run for MAM suggest a warm eastern pacific and cold Gulf of Guinea brings about shortfall in rainfall over southern Nigeria



# AMJ Hit score: This map support the skill map



# AMJ run suggest normal to above

**Predictors (X)**

browse

File name: nmme\_sst\_hcst\_FEBic\_4-6\_1991  
 First data: AMJ 1991  
 Last data: AMJ 2020  
 Start at: AMJ 1991

Number of fields:	1
Number of lags	1
Number of gridpoints	10440
Number used:	7612

**Input Files Predictands (Y)**

browse

File name: CPT\_FMT\_WAfr\_tamsat\_AMJ\_1991  
 First data: AMJ 1991  
 Last data: AMJ 2020  
 Start at: Apr 1991

Number of fields:	1
Number of lags	1
Number of gridpoints	34782
Number used:	18246

**New Predictors (Z)**

browse

File name: nmme\_sst\_fcst\_FEBic\_4-6\_2024  
 First data: AMJ 2024  
 Last data: AMJ 2024  
 Start at: AMJ 2024

Number of fields:	1
Number of lags	1
Number of gridpoints	10440
Number used:	7612

Length of training period:      
 Length of climatological period (years): 30     
 Number of forecasts:

**Actions**

5	3	1	0.217	5	3	1	0.217
5	3	2	0.175	5	3	1	0.217
5	3	3	0.177	5	3	1	0.217
5	4	1	0.246	5	4	1	0.246
5	4	2	0.145	5	4	1	0.246
5	4	3	0.167	5	4	1	0.246
5	4	4	0.169	5	4	1	0.246
5	5	1	0.259	5	5	1	0.259
5	5	2	0.153	5	5	1	0.259
5	5	3	0.170	5	5	1	0.259
5	5	4	0.168	5	5	1	0.259
5	5	5	0.165	5	5	1	0.259

Goodness Index: 0.259 (using 5 X, 5 Y, and 1 CCA modes)  
 Constructing model using full training period (AMJ 1991 to AMJ 2020)  
 Calculating fitted values and variance of hindcast errors ...  
 Identifying categories ...

Done!  
 Calculating Pearson's correlation ...  
 Done!  
 Done!  
 Calculating validation statistics ...  
 Calculating

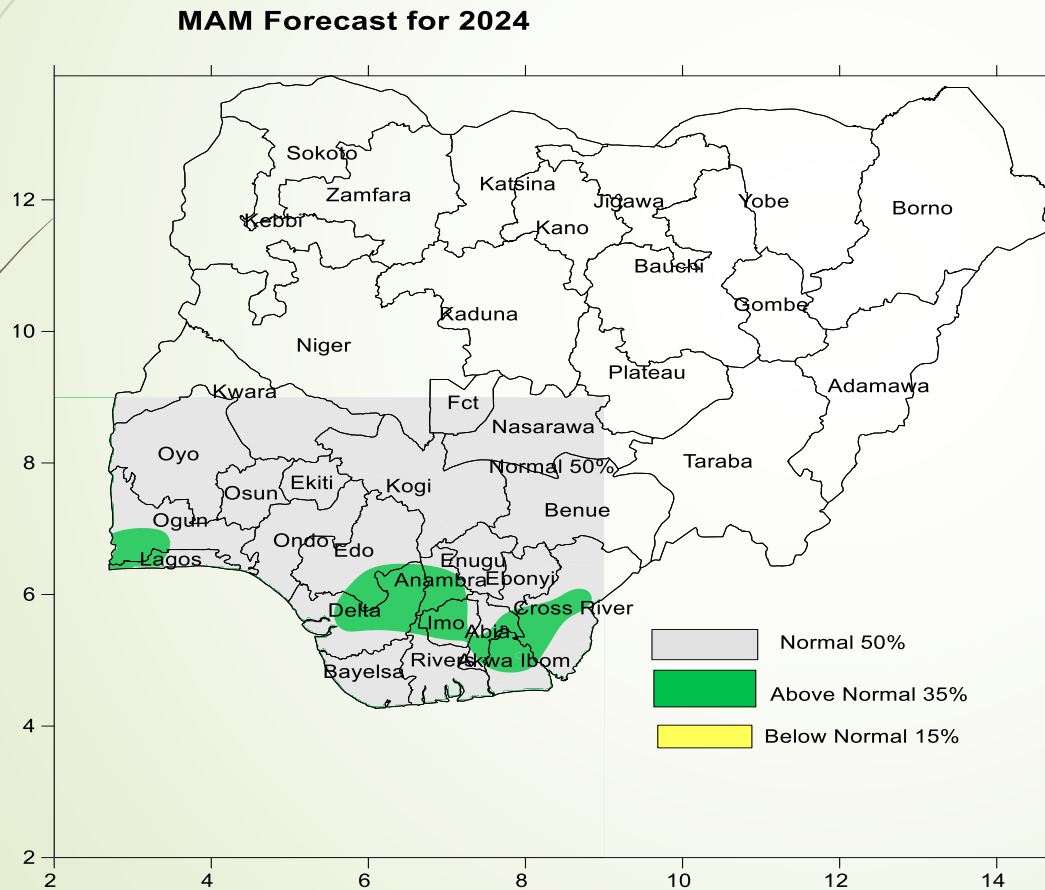
Probabilistic forecast map

Forecast: 2024 Apr

**Probabilistic forecasts**

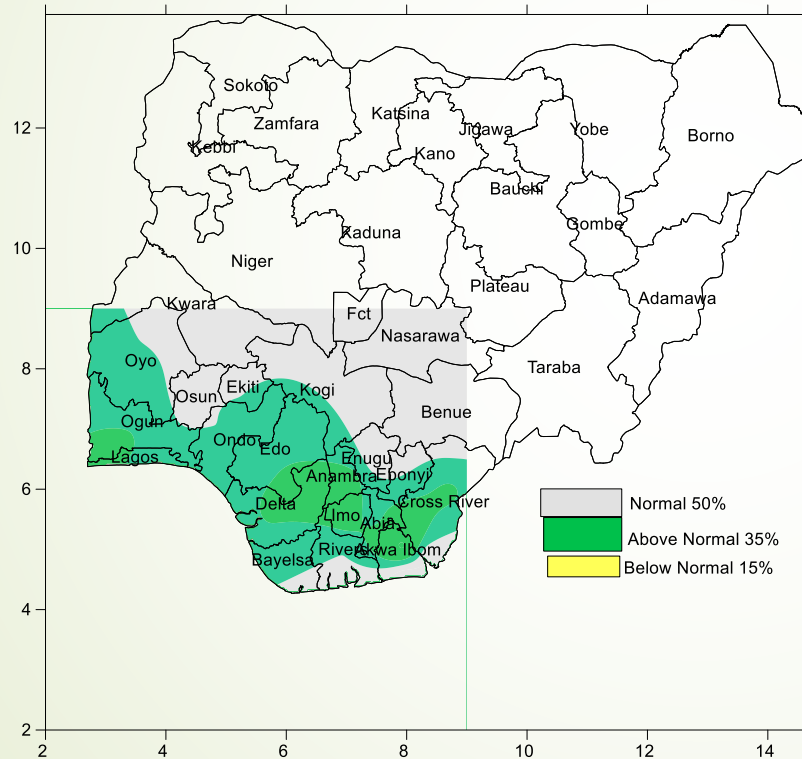


# MAM forecast for 2024



- Normal rainfall is expected across the southern Nigeria for the MAM season.
- Few areas will likely experience above normal rainfall.
- The chance for below normal rainfall is very slim based on the features on ground.

AMJ Forecast for 2024



- Normal rainfall is expected across the southern Nigeria for the AMJ season.
- More areas will likely experience above normal rainfall compare to MAM season.
- The chance for below normal rainfall is very low as well.