

# **RAINFALL FORECAST VALIDATION 1st Dekad in October, 2017(SPATIAL ANALYSES)**

**Onyejuruwa A.(1), Olaniyan E.(1), Afiesimama E.(2)**

**(1) Nigerian Meteorological Agency, (2) World Meteorological Organisation  
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## **ABSTRACT**

Seasonal rainfall prediction by NiMet (Nigerian Meteorological Agency) projected rainfall cessation over northern and central states of Nigeria for ending October and second week in November respectively, with Margin Error (ME) of two to four days, but observed has shown an earlier period with about 21days as missed. This study is validating the performance of Consortium for small scale modelling (COSMO) with observed rainfall value in the first days of October (dekad), 2017. Observed ITD was outside the country with an average position of 14.6degreeNorth (1st to 9th October) while 10th October it was on 13.3degree North indicating its Emergence into the country. Likewise ENSO cycle shows the emergency of La Nina towards the end of September which definitely affects the length rainy period. The Verification was done using observed daily rainfall values against the simulated rainfall values from the COSMO-Model. The output shows that COSMO model has a better capture of rainfall values in the northern states and central states than the south, also there were misses in the south west according to the bias plots. It is agreed that the Model will give a relatively good forecast through out the country with future suggestion in adapting its climate mode for Seasonal Predictions

## INTRODUCTION

It has become imperative to adopt the use of a high resolution regional forecast model of the Consortium for Small-Scale Modeling (COSMO(7KM)) in predicting rainfall of Nigeria since Observatory stations (either Automated or Manned) are sparsely located. The model has been in use in Nigeria for over 3 years with various verifications on its sensitivity on weather predictions over the entire country and some West Africa countries like Liberia and sierralone. COSMO-Model has been developed to meet high resolution regional forecast requirements of weather services and to provide a flexible tool for various scientific applications on a broad range of spatial scale.

(Eniola et al 2015) in their research shows that the COSMO model has almost 70 percent accuracy forecasting rainfall in most places of the southern Nigeria especially South-eastern reigions. The choice of first Dekad in October was because climatology has shown that Nigeria wet season span from March to October also the southern movement of the Inter-Tropical Discontinuity (ITD) after attaining its northern peak in September which signals the retreating period of the rain. From observed ITD position (1<sup>st</sup> to 9<sup>th</sup> October, 2017) shows that the ITD was still outside the country with an average position of 14.6°N while 10<sup>th</sup> october it was on 13.3°N indicating its Emergence into the country. Likewise ENSO cycle shows the emergency of La lina towards the end of September which definitely affects the length of rainy period.

A work done by Olaniyan E, Afiesimama E, Oni F, Lawal K.A (2015) shows a spatial correlations between the observation and the COSMO forecast are generally greater than 0.64, implying that the model, though, underestimates the rainfall amount as much as half of the actual amount, it nevertheless proved to have a good representation of the spatial characteristics of the rain over Nigeria.

## METHOD AND STUDY AREA

The study area, Nigeria, lies between 4°N-14°N and 3°E - 15°E in the southeastern edge of the West African region. The country is subdivided into ecological regions or zones, ranging from a belt of Mangrove/Swamp, Tropical forests, Montane to the Savanna (Guinea, Sudan and Sahel) from the southern to central then to northern part of the country

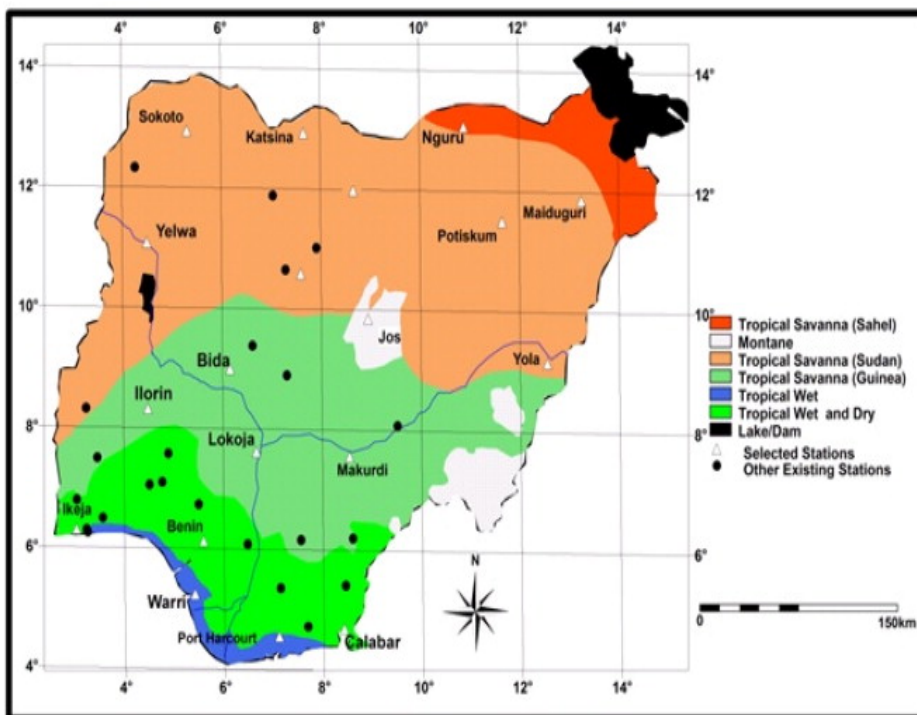


Fig1. Shows map of Nigeria and some selected and existing Meteorological Station.

COSMO-Model is a non-hydrostatic limited-area atmospheric prediction model. It has been designed for both operational numerical weather prediction (NWP) and various scientific applications. The COSMO-Model is based on the primitive thermo-hydro-dynamical equations describing compressible flow in a moist atmosphere.

Observed Rainfall Data was gotten from Nigerian Meteorological Agency (NiMet) while COSMO forecast (fc) 24hrs daily rainfall was simulated at the NWP unit work stations of NiMet. Simulated Model data and observation data were subjectively and statistical analysed using several post-processing tools such GRADS (Grid Analysis and Display System), Libreoffice Calc (line graph).

# RESULTS

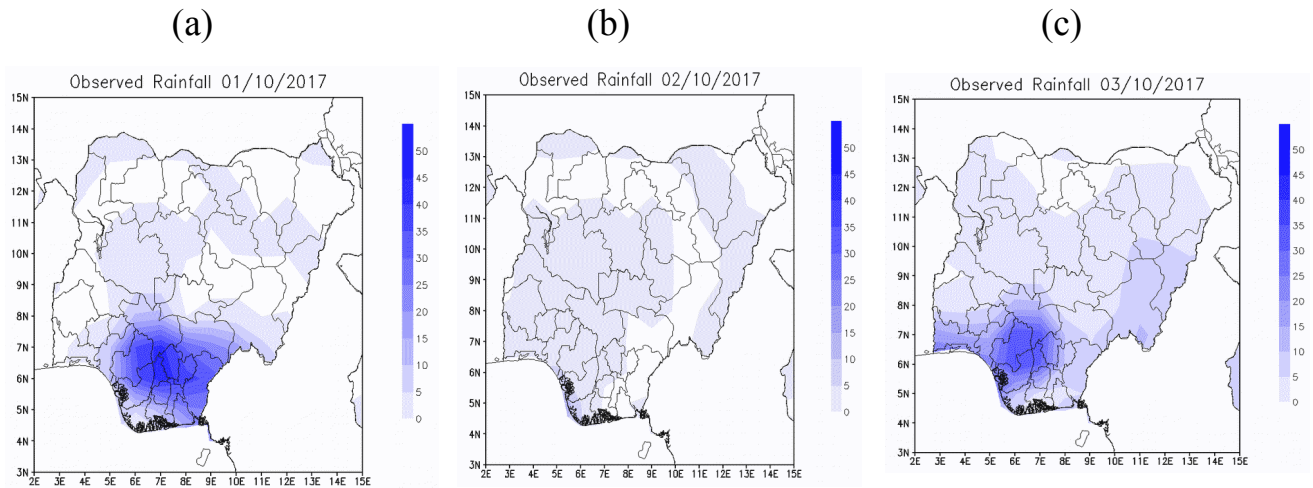


Fig. 2(a)(b)(c) shows observed rainfall over Nigeria for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> October, 2017.

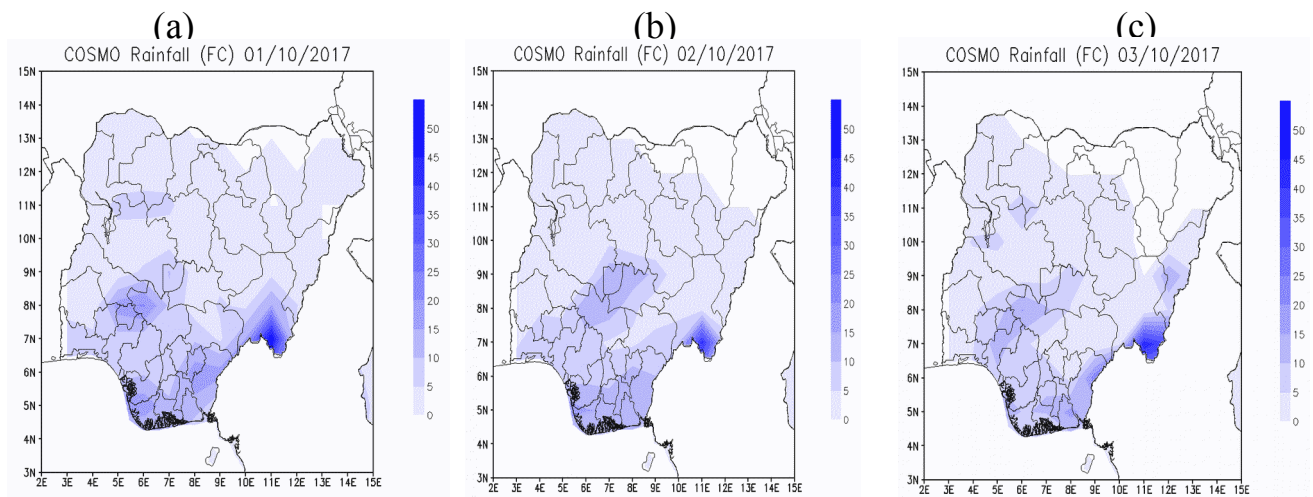


Fig.3(a)(b)(c) shows COSMO rainfall over Nigeria for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> October, 2017.

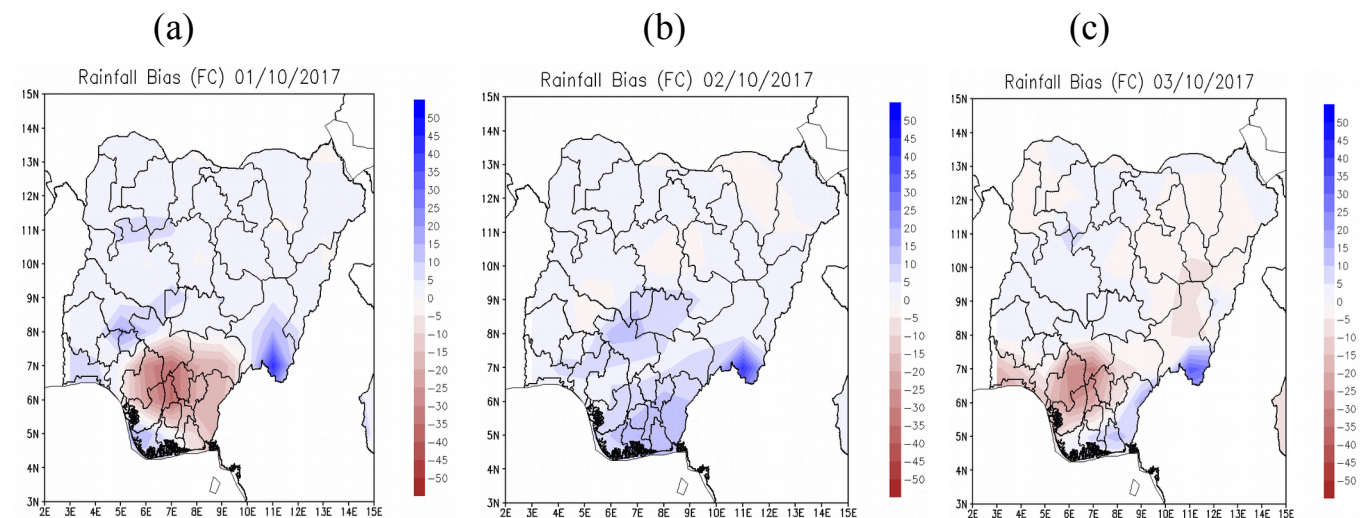


Fig. 4(a)(b)(c) shows bias plot over Nigeria for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> October, 2017.

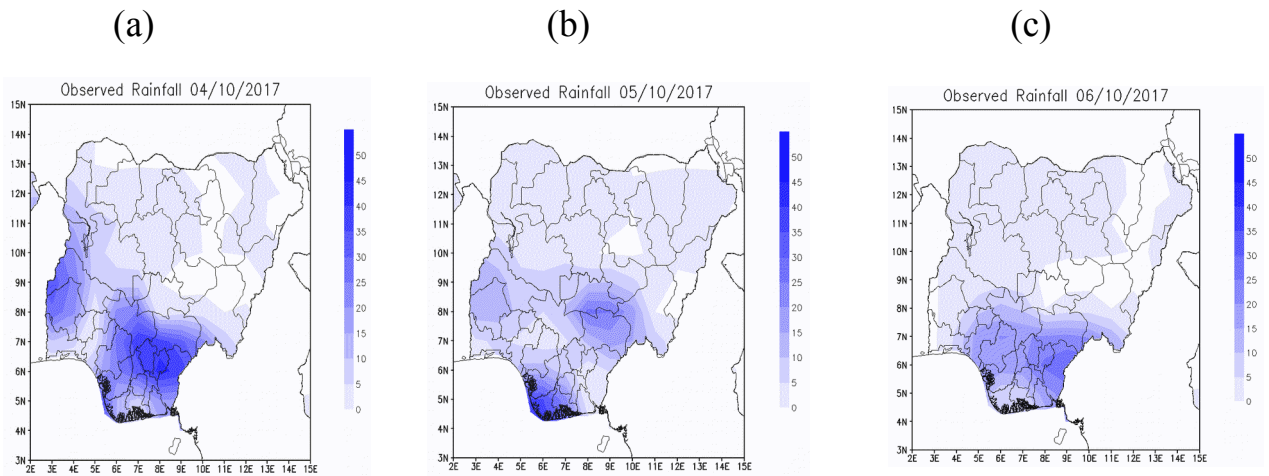


Fig.5(a)(b)(c) shows observed rainfall over Nigeria for 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> October, 2017.

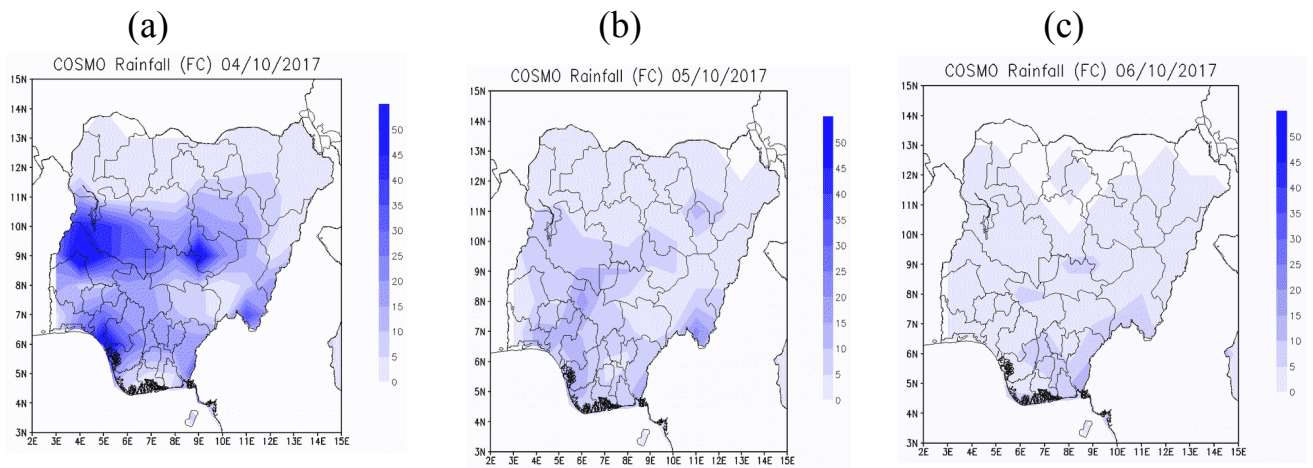


Fig. 6(a)(b)(c) shows COSMO rainfall over Nigeria for 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> October, 2017.

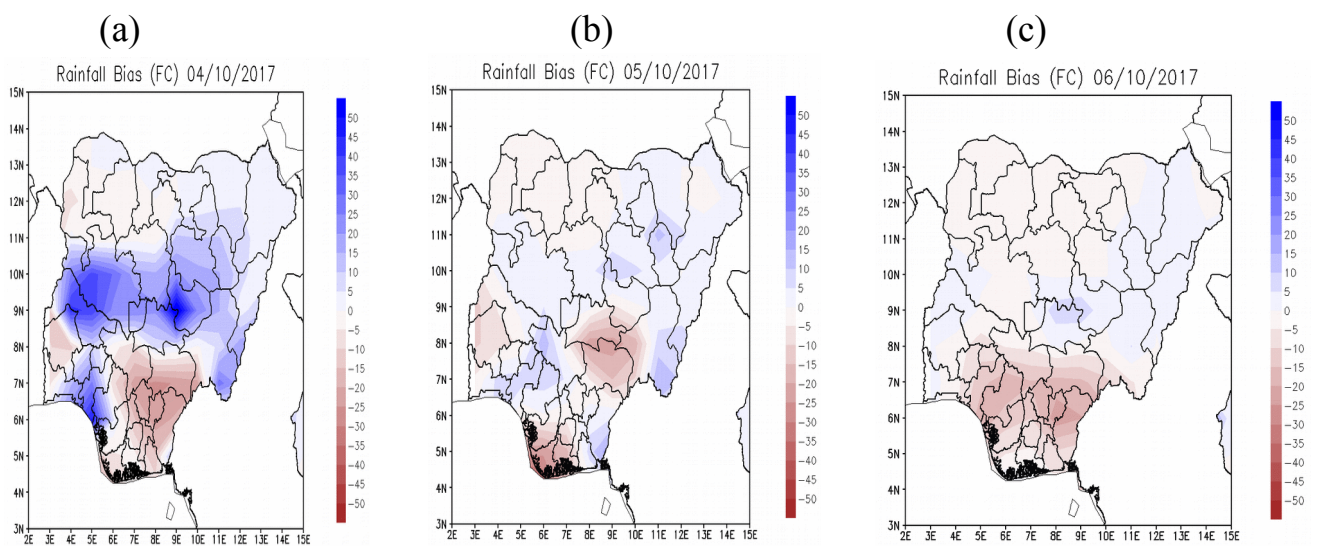


Fig. 7(a)(b)(c) shows Bias plot rainfall over Nigeria for 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> October, 2017..



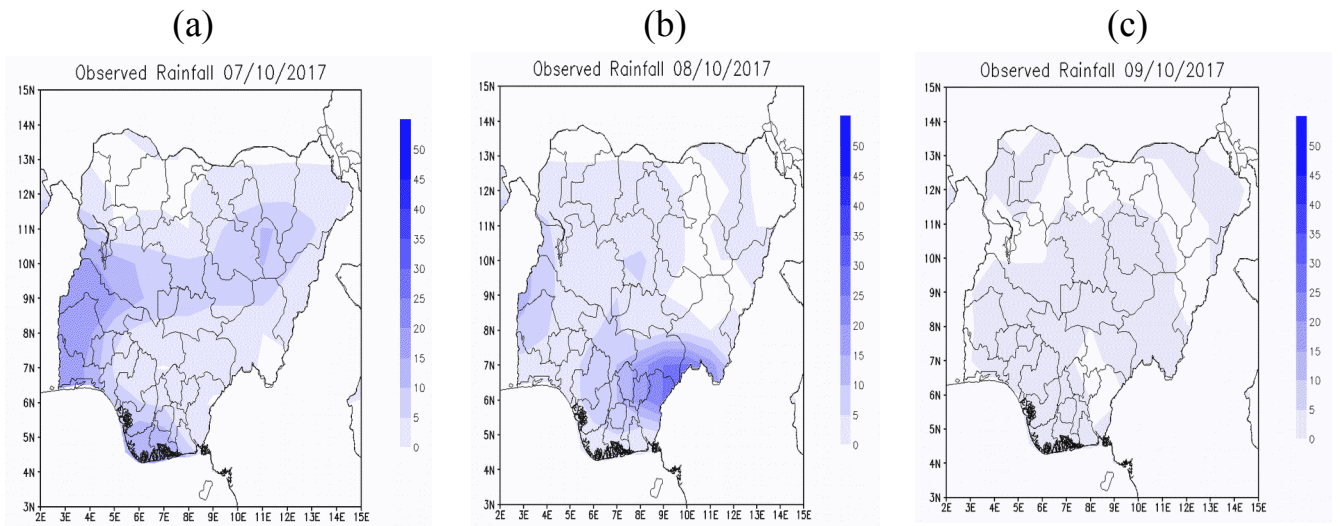


Fig.8(a)(b)(c) shows observed rainfall over Nigeria for 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> October, 2017.

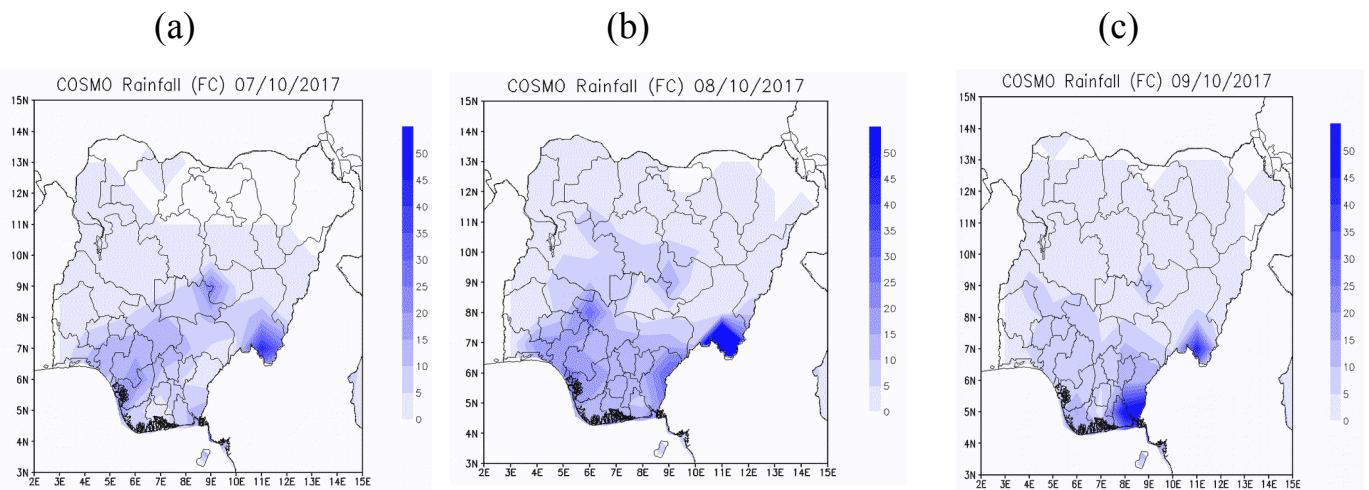


Fig.9(a)(b)(c) shows COSMO rainfall over Nigeria for 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> October, 2017.

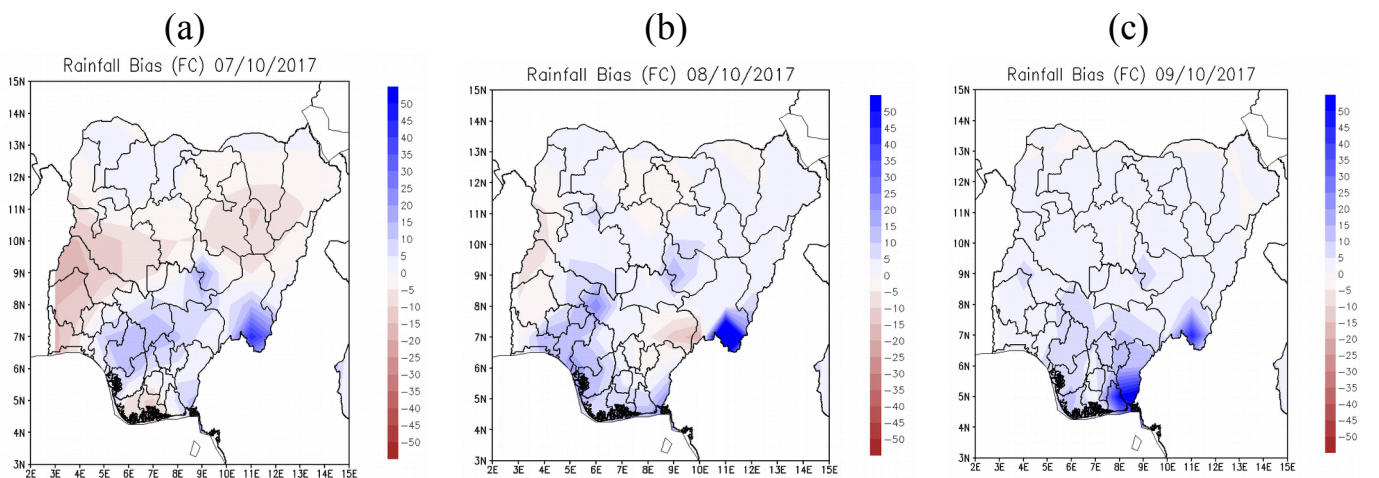
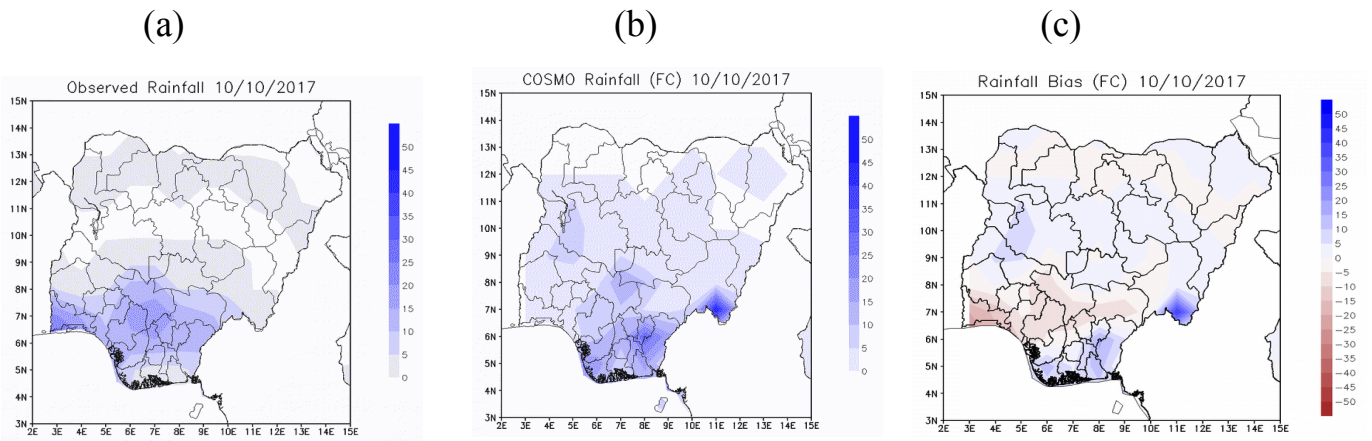
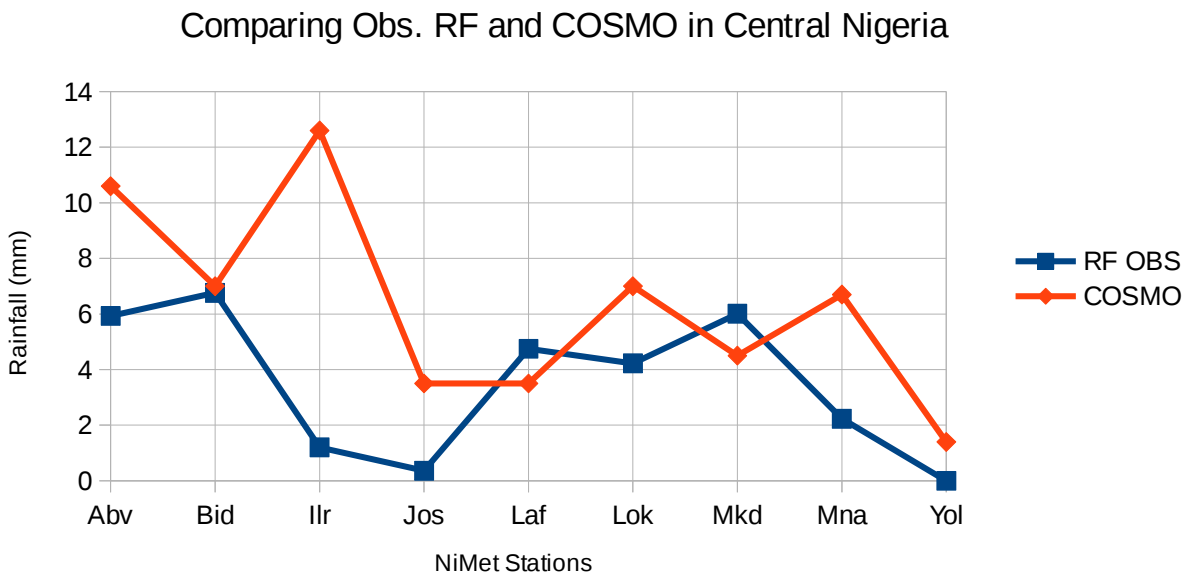


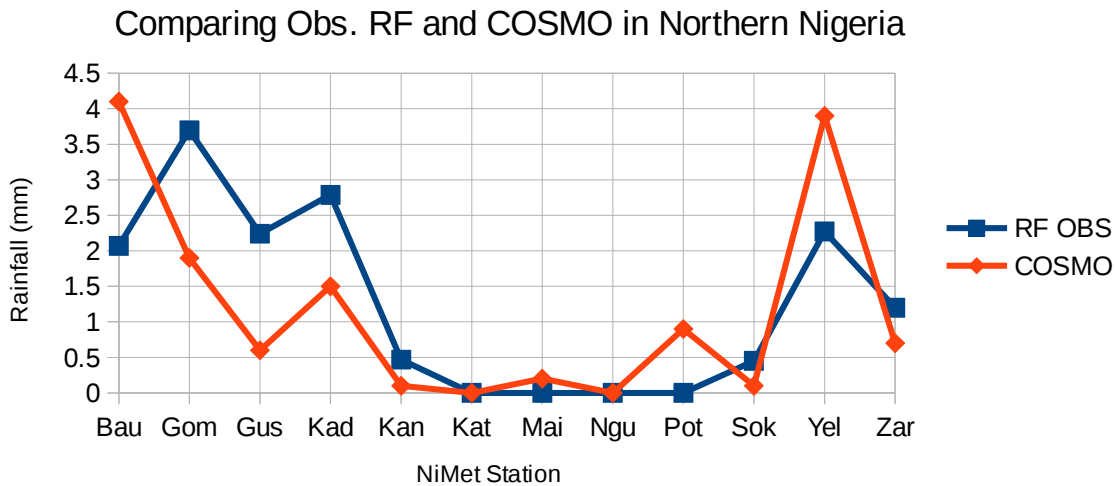
Fig.10(a)(b)(c) shows Bias plot rainfall over Nigeria for 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> October, 2017.



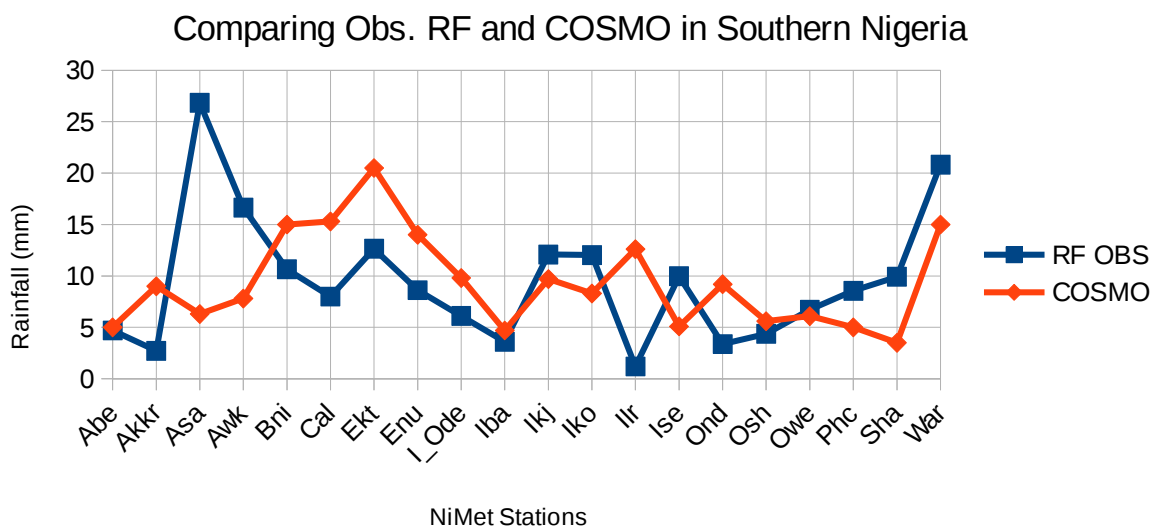
**FIG. 11 (a)(b)(c) shows the Observed, COSMO and Bias Rainfal Plots respectively for 10<sup>th</sup> October, 2017.**



**Fig. 12 shows the comparison of average Observed and COSMO rainfall in the 1<sup>st</sup> dekad of october 2017 over Central Nigeria**



**Fig. 13 shows the comparison of average Observed and COSMO rainfall in the 1<sup>st</sup> dekad of october 2017 over Northern Nigeria**



**Fig. 14 shows the comparison of average Observed and COSMO rainfall in the 1<sup>st</sup> dekad of october 2017 over Southern Nigeria**



## **DISCUSSION**

Considering the bias plots and the the statistical analyses of the spatial rainfall over the entire country we can see that the model`s Underestimation of rainfall values at the southern cities on the 1<sup>st</sup>, 3<sup>rd</sup> 6<sup>th</sup> and 10<sup>th</sup> while places Bauchi, Gombe and some Central states, rainfall values was also underestimated on the 7<sup>th</sup> and 4<sup>th</sup> respectively. Overestimation of rainfall values can be seen around some Central cities (Abuja, Plateau, Ilorin and Mabila) and some southern states (Oshogbo, Abeokuta) on the 1<sup>st</sup>, 2<sup>nd</sup>, 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> while other places show good forecast.

## **CONCLUSION**

The study validated COSMO spatial rainfall distribution and the Observed rainfall in the first Dekad of October, 2017 over Nigeria. Its findings were that the COSMO model performance over cities had relatively good forecasts in the period under review and there were underestimations of rainfall amounts in the southern cities. In general model performance was relatively good in most of the days. The results also implies that COSMO model in Climate mode can be used for seasonal prediction especially for rainfall retreat over the Northern part of Nigeria.

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