

Wed. Sep 4, 2024

Introduction

Forecasting the onset of rainfall is crucial for early warning activities in rainfed agriculture economies like West Africa. The onset is the first day of the wet season, characterized by at least 20 mm of rainfall over three consecutive days, with no dry spell of at least 7 days in the next 21 days. For the Sahel region, the search for the onset of June-September (JJAS) rainy season starts on May 15.

Objectives

The goal of this study is to examine the utility of global circulation model (GCM)-based products in predicting the onset of rainfall in the Sahel region of West Africa to promote early warning in drought-prone areas. Also, use statistical approach to improve forecasting of rainfall onset in the Sahel region of West Africa.

Data

(a) Observational data:

(i) Rainfall Estimate version 2 (RFE2) data (2001-2023).

(ii) CPC MORPHing technique (CMORPH) global precip. data (2001-2023).

(b) **GCM models:** CFSv2, ECMWF, CMCC, Meteo France, and ECCC global models precipitation hindcast (1993-2016) and forecast (246 days ahead on a daily time scale) data.

Results

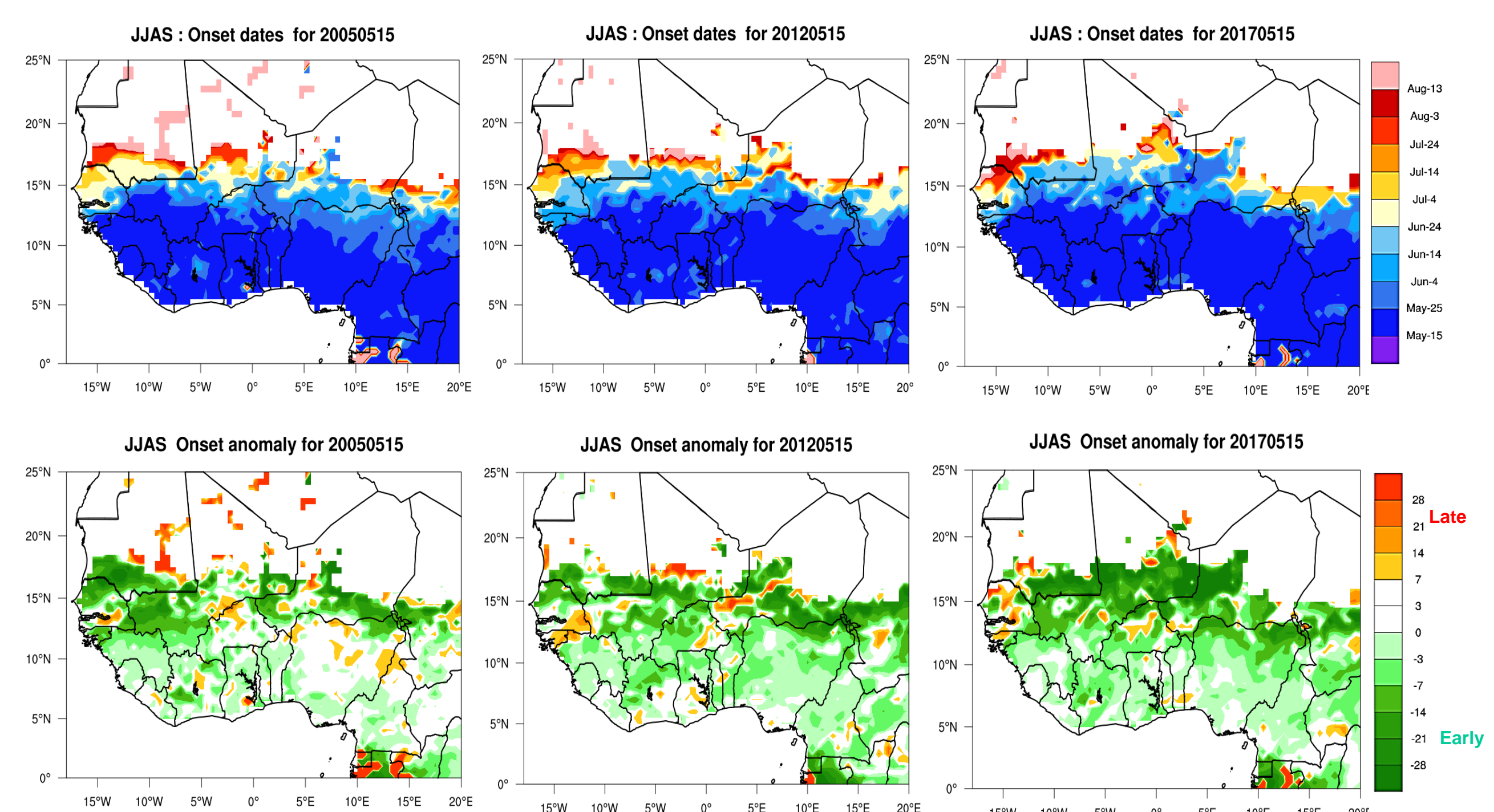


Figure 1. Early onset dates (2005, 2012 & 2017) over West Africa Sahel Region.

- The CMORPH data can capture below-than-normal (early) onset in the Sahel region, especially in 2017.

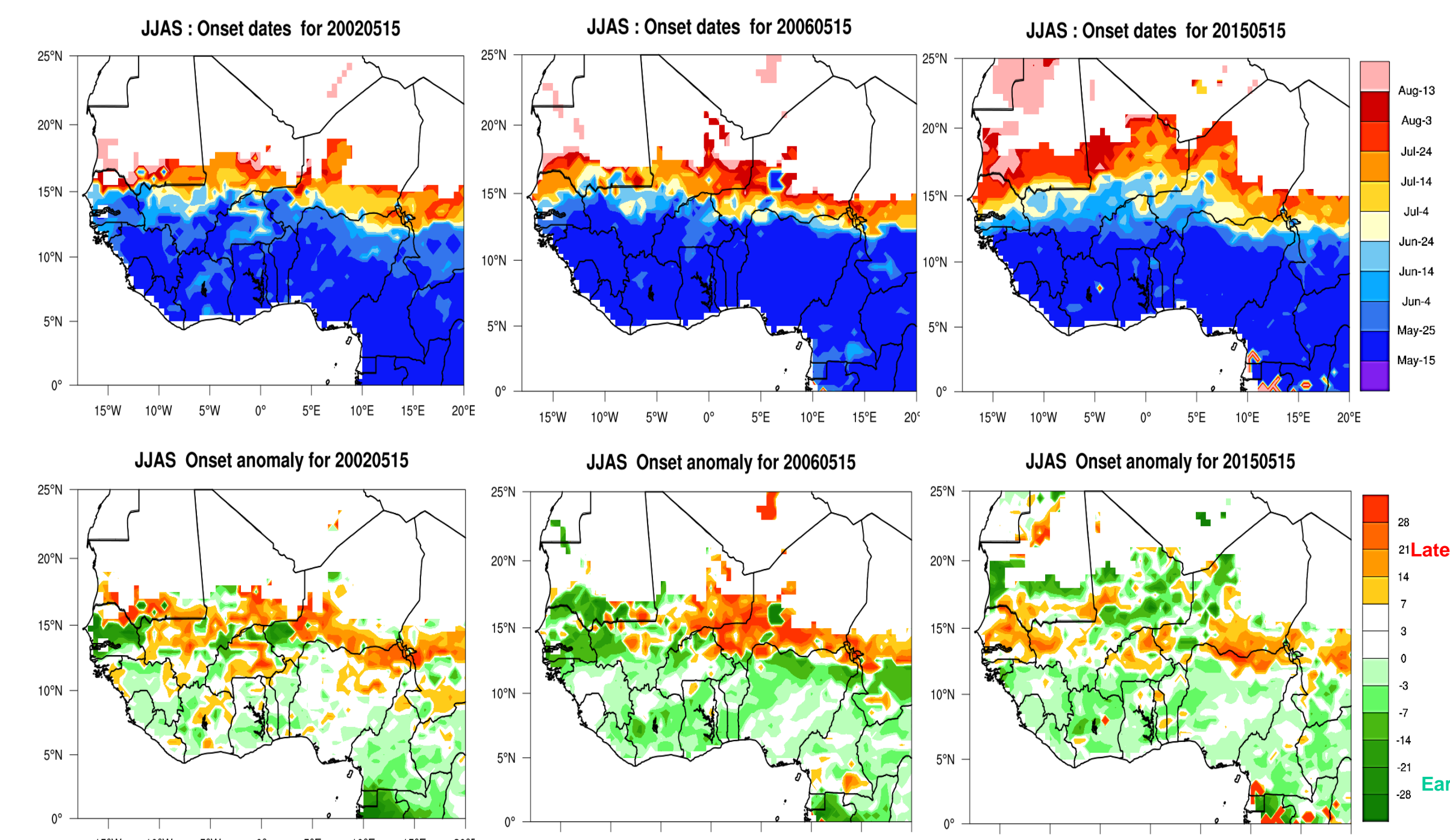


Figure 2. Late onset dates (2005, 2012 & 2017) over West Africa Sahel Region .

- The CMORPH data detects an above-than-normal (late) onset in the Sahel region, especially in the year 2006

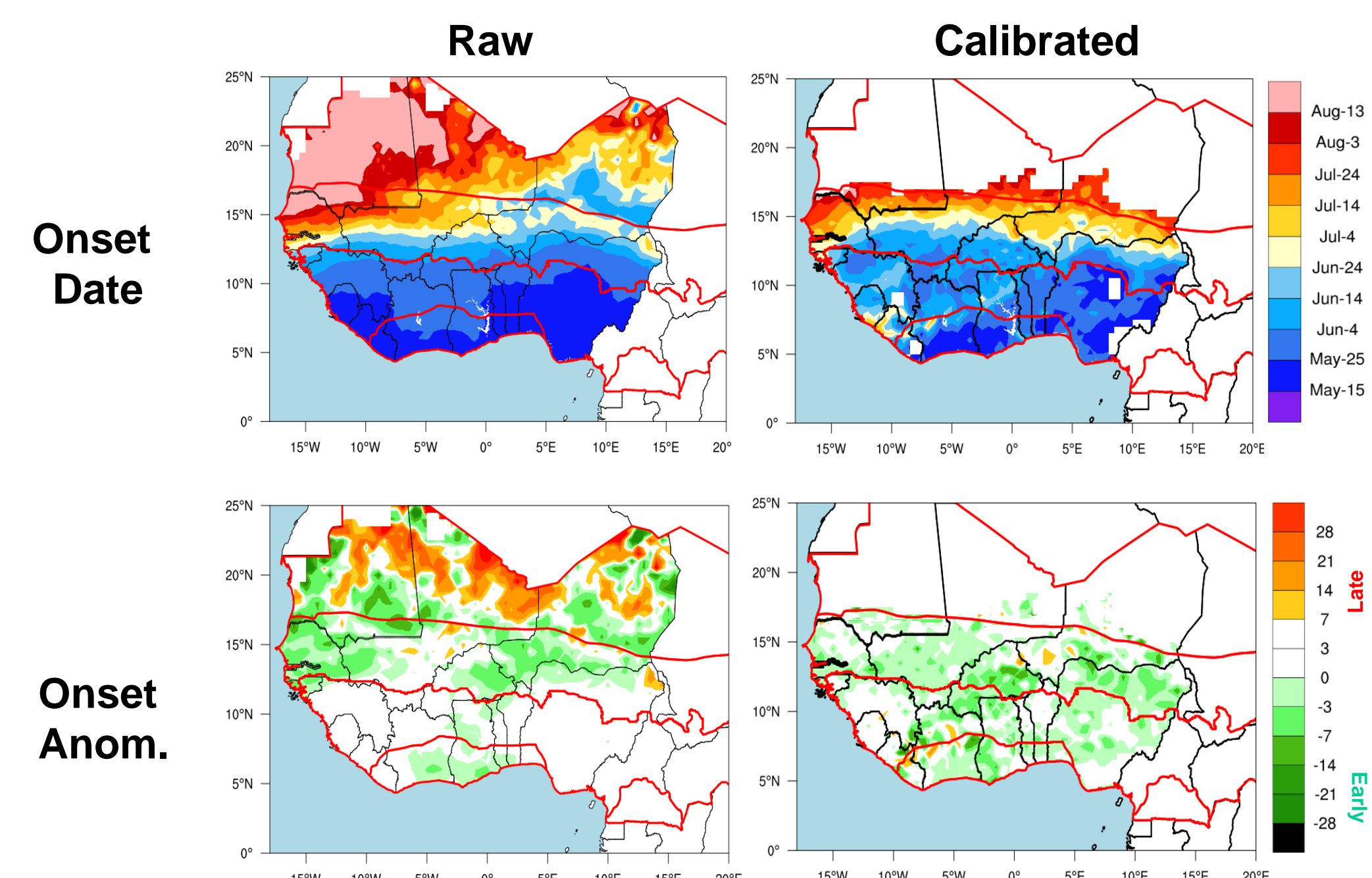


Figure 3. Raw versus calibrated onset forecast (2023)

- Raw forecast shows below-than-normal (early) onset over the Sahel region except for some northern parts of Mali and northeastern Nigeria.
- In the calibrated forecast, below-than-normal (early) onset occurs over the entire Sahel region (max. over Burkina Faso, Niger and Nigeria).
- The calibrated forecast shows an improvement in the onset forecast.

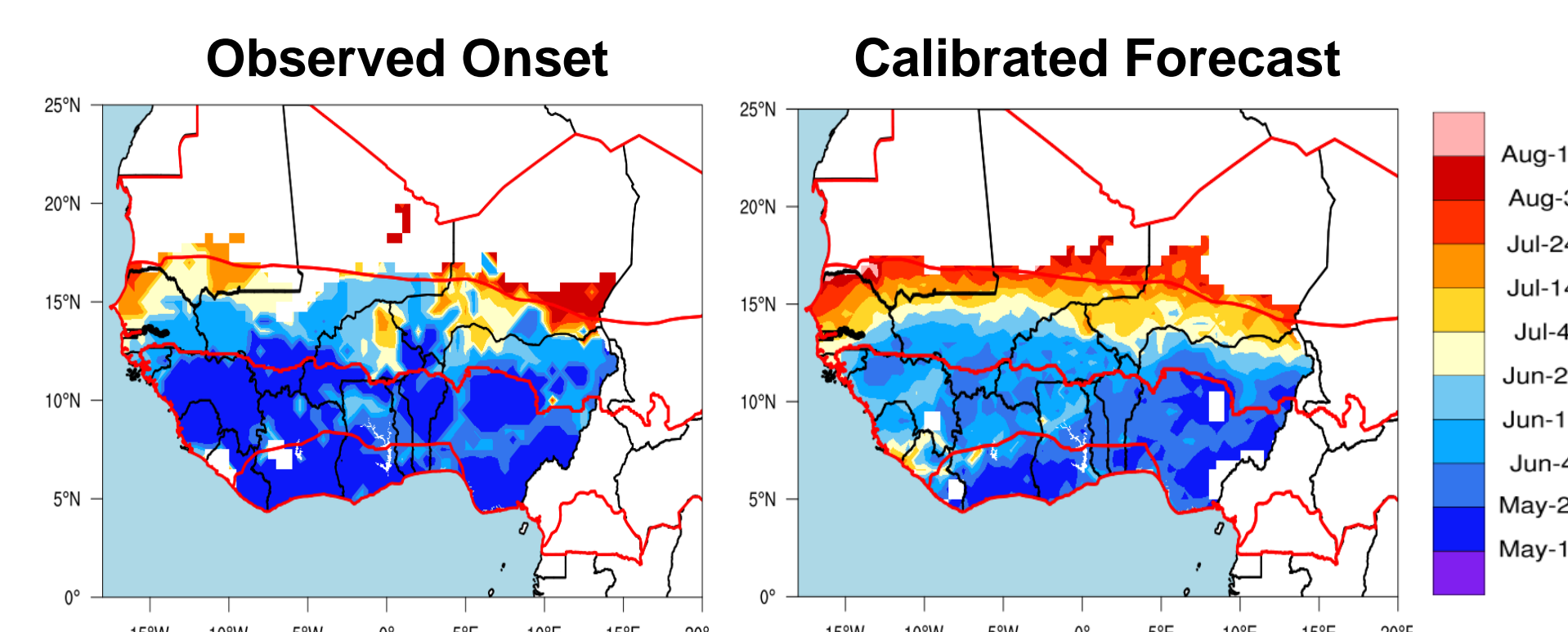


Figure 4. Observed Rainfall Onset versus Calibrated Onset Forecast (2023)

- The calibrated forecast successfully predicted the onset date (Jul 4 - Aug 3) in northern Senegal, northern Burkina Faso, and southern Niger.
- The calibrated forecast matches the observed onset date over the southern Sahel region.

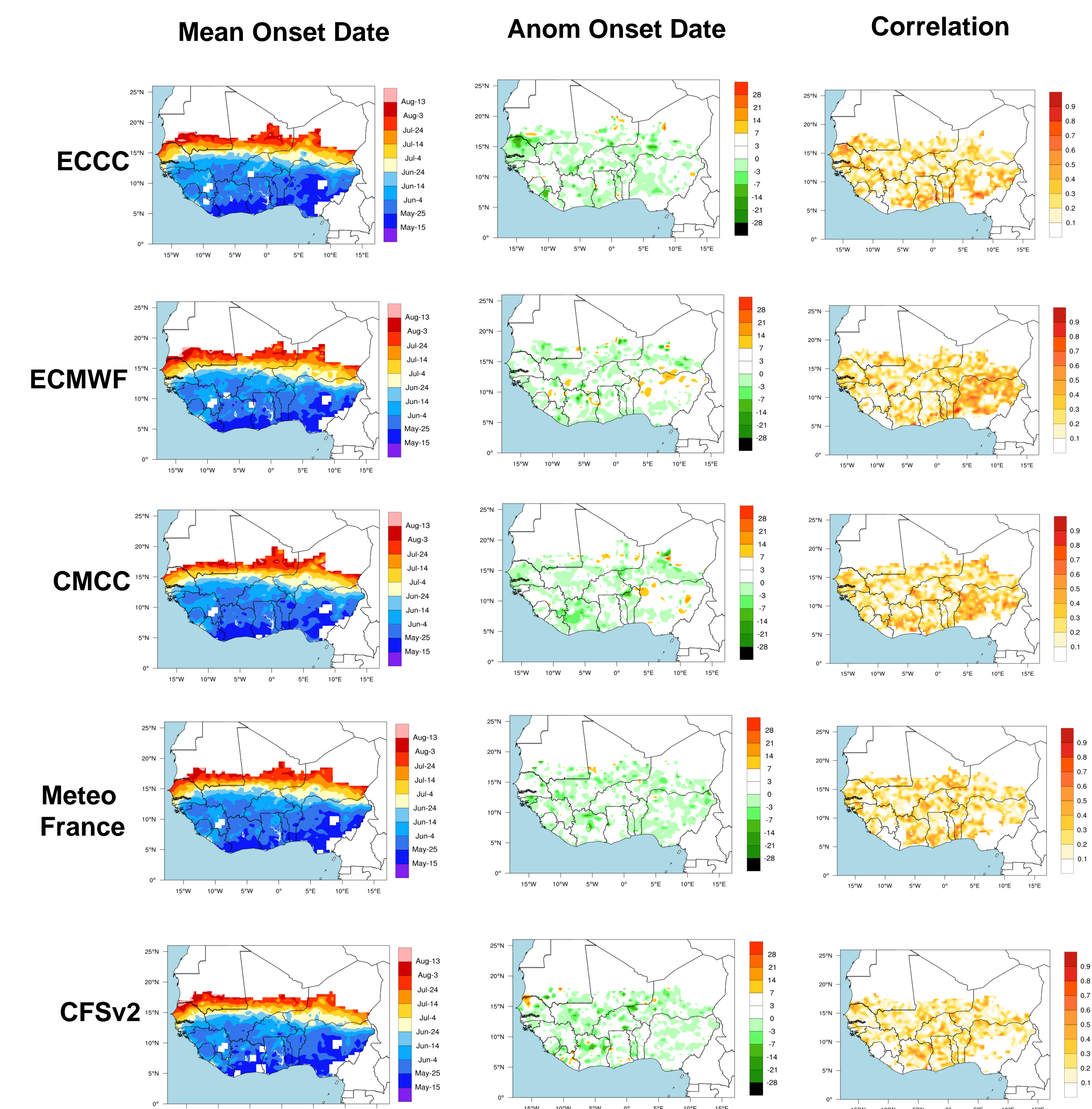


Figure 5. Individual Onset, Onset Anomaly and Hindcast Correlation.

- All the models show a similar onset date, with below-than-normal (early) onset occurring over the Sahel region. In contrast, ECMWF and CMCC models show late onset over northern Nigeria. Also, CFSv2 models identifies late onset in northwestern Senegal.
- Positive correlation exists in the Sahel region by all the models with the highest occurrence in northern Senegal and central Nigeria by ECCC and ECMWF models respectively.

Conclusion

- With the ability to capture both early and late onset over the Sahel region, these models are a valuable tool for predicting the rainfall onset date over West Africa Sahel region.
- The models have demonstrated high predictive skill for the Sahel region in West Africa.
- There is a high probability of early rainfall onset date during the months of June, July, August, and September (JJAS) in the Sahel Region in 2024.
- Overall, the correlation between observed and predicted onset dates is statistically significant in the Sahel region.