

# **Global Circulation Models-Based Prediction of Rainfall Onset for Early Warning in the Sahel Region of West Africa**

William Agyakwah<sup>a</sup>, Zewdu T. Segele<sup>a</sup>, Endalkachew B. Bekele<sup>a</sup>, and Wassila M. Thiaw<sup>a</sup>

<sup>a</sup> *NOAA/NCEP Climate Prediction Center, College Park, Maryland*

## **Abstract**

Forecasting the onset of rainfall is crucial for early warning activities in rainfed agriculture economies like West Africa. This study seeks 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. 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. The Climate Prediction Center morphing method (CMORPH) and Rainfall Estimate version 2 (RFE2) data were used to analyze the historical onset of the rains from 2001-2022. The onset date for 2024 was predicted using the CFSv2, ECMWF, CMCC, Meteo France, and ECCC global models precipitation hindcast (1993-2016) and forecast (246 days ahead on a daily time scale) data. The forecast was calibrated using linear regression. Results showed that the rainfall season was early in 2005, 2012, and 2017 and late in 2002, 2006, and 2015 over the western Sahel region. Using the five (5) models, an average onset was estimated, and the results show an earlier-than-normal onset date in much of the Sahel with a greater than 90% probability of occurrence in Senegal, Mali, and Niger. Overall, the correlation between observed and predicted onset dates is statistically significant for 2001-2022 in the Sahel region.

