

# **Evaluation of Gridded Precipitation Products for Meteorological and Hydrological Drought Monitoring in the Ogooué River Basin Using Satellite Radar Altimetry-Derived Standardized River Stage Index (Oral)**

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## **ABSTRACT**

Accurate precipitation data are fundamental for effective water resource management and drought early warning, yet this remains a significant challenge in data-sparse regions of Central Africa. This study provides a comprehensive evaluation of the hydrological utility of five high-resolution gridded precipitation products (GPPs)—MSWEP, CHIRPS, IMERG, TAMSAT, and PERSIANN-CDR—within the Ogooué River Basin in Gabon. We assess their performance in characterizing meteorological drought and its propagation into hydrological drought, a critical linkage for proactive water security planning. Our methodology involves calculating the Standardized Precipitation Index (SPI) from each GPP across multiple temporal scales (1-, 3-, 6-, and 12-month) to represent meteorological drought. These SPI time series are then quantitatively compared against a benchmark hydrological drought index, the Standardized River Stage Index (SRSI), derived from satellite radar altimetry estimated water stages.

Performance was rigorously assessed via a two-pronged approach: first, a temporal lag-correlation analysis was conducted to identify the optimal lag time between precipitation deficits and hydrological response. Second, we employ a suite of statistical metrics, including Pearson correlation, alongside categorical skill scores such as Probability of Detection (POD) and False Alarm Ratio (FAR), to evaluate the GPPs' ability to replicate the magnitude, timing, and occurrence of historical drought events. Our results reveal significant disparities in product performance. The MSWEP product, which synergizes gauge, satellite, and reanalysis data, consistently demonstrated the strongest correlation with the SRSI benchmark, particularly at longer accumulation periods (SPI-6 and SPI-12), indicating its superior ability to capture the basin's hydrological memory. CHIRPS and the high-resolution IMERG also showed robust performance, while TAMSAT and PERSIANN-CDR exhibited higher variability and a weaker ability to replicate the timing of hydrological drought events. The findings underscore that product choice is a primary source of uncertainty in regional drought assessment. This study provides critical, evidence-based guidance for stakeholders in selecting the most appropriate GPP for hydrological modeling, drought risk assessment, and climate adaptation strategies in the Ogooué basin and similar ungauged or data-sparse tropical catchments.

**Keywords:** Hydrological Drought; Gridded Precipitation Products; Standardized Precipitation Index; Standardized River Stage Index; Ogooué River Basin.