EGU26-11597, updated on 13 Jun 2026
https://doi.org/10.5194/egusphere-egu26-11597
EGU General Assembly 2026

Validation of satellite rainfall estimates over transboundary river catchments in Southern Africa

Simon Ageet and Andreas H. Fink
Karlsruhe Institute of Technology (KIT), Meteorology and Climate Research, Troposphere Research, Karlsruhe, Germany (simon.ageet@kit.edu)

Southern Africa is among the world's most water-insecure regions, underscored by the 2023/2024 drought that affected an about 60 million people (OCHA 2024). As a result, mitigation and adaptation efforts are critical. One such effort is ongoing under the Co-design of a Hydro-Meteorological Information System for Sustainable Water Resources Management in Southern Africa (Co-HYDIM-SA) project, which leverages new technologies to enhance early warning and optimize water resources management through user-friendly monitoring and forecasting tools. However, interventions such as Co-HYDIM-SA heavily rely on the availability of high-quality in-situ (or surface) data, which remains scarce across sub-Saharan Africa. As a result, alternative rainfall data sets such as satellite rainfall estimates (SREs) or atmospheric reanalysis are commonly used as surrogates, though their suitability for regional hydrometeorological applications must be verified before informing critical decisions.

This study evaluates the performance of satellite rainfall estimates (SREs), including the Integrated Multi-satellitE Retrievals for Global Precipitation Measurement version 7 (IMERGv7), Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS; versions 2 and 3), Multi-Source Weighted-Ensemble Precipitation (MSWEP; versions 2.8 and 3), and the Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks-Climate Data Record (PERSIANN-CSS-CDR). In addition, a reanalysis product (ERA5-Land) and a gauge-only gridded product (the Global Precipitation Climatology Centre, GPCC, dataset) are evaluated. These datasets are assessed against daily observations from a network of 243 rain gauges spanning 2000-2024 across Southern Africa, with a focus on the transboundary Cuvelai-Cunene Basin (Angola-Namibia) and the Notwane Basin in the Upper Limpopo (Botswana-South Africa). Skill is evaluated based on the ability to detect rainy days and accurately reproduce rainfall amounts (including extremes) across daily to annual timescales and multiple spatial scales, thereby determining the suitability of the gridded rainfall products for hydrometeorological applications, including drought and flood monitoring and forecasting. The influence of rain gauge density used (a) to calibrate SRE products and (b) for the validation on SRE performance is also examined. Furthermore, improvements resulting from algorithm refinement are demonstrated by comparing the latest and predecessor versions of CHIRPS and MSWEP, with preliminary results indicating approximately a 25% improvement for CHIRPS.