How do diverse precipitation datasets perform in daily precipitation estimations over Africa?

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Abstract

Characterizing the performance of precipitation (hereafter PRE) products in estimating the uncertainties in daily PRE in the era of global warming is of great value to the ecosystem's sustainability and human survival. This study intercompares the performance of different PRE products (gauge-based, satellite and reanalysis) sourced from the Frequent Rainfall Observations on GridS (FROGS) database over diverse climate zones in Africa and identifies regions where they depict minimal uncertainties in order to build optimal maps as a guide for different climate users. This is achieved by utilizing various techniques, including the triple collection (TC) approach, to assess the capabilities and limitations of different PRE products over nine climatic zones over the continent. For daily scale analysis, the uncertainties in light PRE (0.1 5mm/day) are prevalent over most regions in Africa during the study duration (2001-2016). Estimating the occurrence of extreme PRE events based on daily PRE 90th percentile suggests that extreme PRE is mainly detected over central Africa (CAF) region and some coastal regions of west Africa (WAF) where the majority of uncorrected satellite products show good agreement. The detection of PRE days and non-PRE days based on categorical statistics suggests that a perfect POD/FAR score is unattainable irrespective of the product type. Daily PRE uncertainties determined based on quantitative metrics show that consistent, satisfactory performance is demonstrated by the IMERG products (uncorrected), ARCv2, CHIRPSv2, 3B42v7.0 and PERSIANN_CDRv1r1 (corrected), and GPCC, CPC_v1.0, and REGEN_ALL (gauge) during the study period. The optimal maps that show the classification of products in regions where they depict reliable performance can be recommended for various usage for different stakeholders.

Keywords : Africa, Climate change, Datasets, Extreme, Precipitation, Uncertainty

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