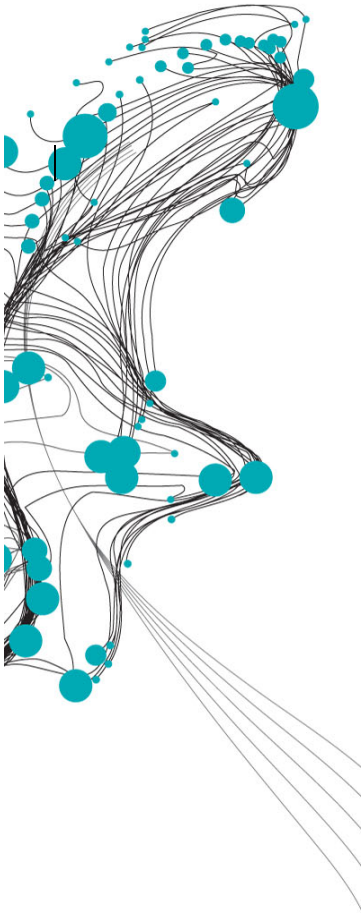
ACCURACY AND SUITABILITY OF SATELLITE-BASED RETRIEVAL PRODUCTS FOR OPERATIONAL PRECIPITATION NOWCASTING IN GHANA



There is an urgent need for reliable now- and forecasting of (extreme) precipitation on the African continent. Early warning for extreme rainfall contributes to disaster preparedness and can decrease the associated risks. Precipitation data with a high temporal and spatial resolution is of high value for hazard models, especially flash floods. For short lead times (0-6 h), -nowcasting approaches that extrapolate ground-radar observations are commonly applied in practice. However, operational nowcasting efforts on the African continent are hindered due to the limited availability of ground-radar data. The increasing availability and resolution of satellite-based retrieval products show the potential to partly overcome the need for ground-based radar stations.

The high spatio-temporal resolution of Meteosat satellite-based MSG-CPP retrieval data (15 minutes and 3 km) in combination with its relatively short latency of 45 minutes offers potential for operational nowcasting initiatives. This study focuses on the accuracy and applicability of the MSG-CPP retrieval products (infrared & visual). First, the accuracy of the retrieval products is examined using ground measurement data from 19 stations of the Trans-African Hydro-Meteorological Observatory (TAHMO) organization. It is concluded that the MSG-CPP retrieval products significantly overestimate the measured precipitation intensities. On a 15-minute temporal resolution, the probability of detecting precipitation is 49% for the IR-based MSG-CPP retrieval product and 81% for the visual retrieval product. The visual product has a higher false alarm ratio, significantly influencing the associated critical success indices.

To study the MSG-CPP retrieval performance in relation to other satellite-based precipitation products, an event-based comparative analysis is made using precipitation data from CMORPH and GPM IMERG. The results show that all satellite precipitation products present higher rainfall depths than the TAHMO measurements. The retrieval products with longer latencies (IMERG Final & CMORPH), do not show a higher correspondence with ground observations than those with short latencies (MSG-CPP IR and IMERG Early). Subsequently, the deterministic S-PROG nowcast method is applied to analyze the nowcasting skill using the MSG-CPP IR retrieval product for 116 precipitation events in Ghana. Median skillful nowcast performances are observed for lead times of 45, 90, 120 and 135 minutes for the spatial scale levels of 9, 60, 180, and 300 km, respectively. Overall, this study aims to underline the potential of satellite-based precipitation nowcasting while being transparent concerning the existing limitations and remaining uncertainties.

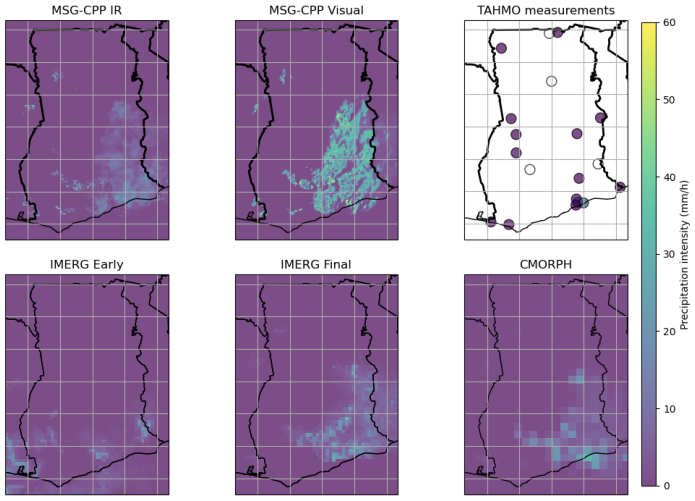


Figure 1: Different precipitation retrieval products representing precipitation intensity on 28/05/2020 16:30

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