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# Precipitation morphing: TAHMO-adjusted satellite products over the Volta Basin region

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In sub-Saharan Africa, precipitation is mainly produced by convective rainstorms during the monsoon season. Rainstorms can be very localized in time and space, which make them difficult to estimate accurately. The gauge network in this region is not dense enough to represent such rain events. Some satellite-based rainfall products with high spatial resolution are available. However, satellite measurements of rainfall are indirect. This can lead to errors in the position of such localized events beside the uncertainty in their intensity. For some applications, such as hydrological modelling or data assimilation in a numerical weather model, the positions of the rainfall events are as important as their intensities.

We investigate the use of a morphing approach for the gauge-adjustment of satellite-based estimates in order to improve the location of rainfall events. Image morphing is a well-known image processing method which allow the smooth transformation of an image into another one. The morphing technique includes both the position and the intensity difference between the two images. We apply the morphing to 2D rainfall data from IMERG (Integrated Multi-Satellite Retrievals for GPM), a well-known rainfall product, and the new Trans-African Hydro-Meteorological Observatory (TAHMO) gauge network over the Volta Basin region during the monsoon season.

Morphing is based on a spatial mapping that transforms two images, in our case two rainfall fields, into each other. Finding this spatial mapping is called image registration. We use an automatic registration procedure that only require the two images as input, without extra specifications. To perform well, this method needs the precipitation fields to be similar enough.

The gauge data were interpolated on a regular grid. The automatic registration is applied, at this (relatively coarse) grid resolution, to the IMERG-early product and the gridded TAHMO estimates. The resulting mapping is linearly interpolated to the finer resolution of IMERG. The morphing is then applied to the IMERG-early product. In contrast to the IMERG-final product, the IMERG-early product is not calibrated with monthly gauge data . We present preliminary results on the performance of the gauge-morphed estimates and an outlook on using morphing for rainfall assimilation.