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Gauge-adjustment of satellite-based rainfall estimates using morphing

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Satellite-based rainfall estimates are a valuable source of information. This is especially the case for regions with low gauge density, such as many regions in sub-Saharan Africa. Satellites do not measure rainfall directly, instead it is derived from other measured variables. This can lead to errors in the position of the rainfall events beside the errors in their intensity. Such errors are particularly critical for localized events such as the convective storms occurring during the monsoon season which produce most of the rainfall in sub-Saharan Africa.

We propose a morphing approach to adjust both the intensity and the position of satellite estimates with gauge data. Morphing is a well-known image processing technique that transforms an image into another, using cross-dissolving and warping. Thus, both the intensity and the position are taken into account. Our approach uses an automatic registration, so only the two images are needed as input. There is no need to predefine the rain events, or any other features.

The automatic morphing method is applied for a rainfall event during the monsoon season over the Volta Basin region. We gauge-adjust the satellite-based estimates IMERG-early (Integrated Multi-Satellite Retrievals for GPM), using the gauge network from TAHMO (Trans-African Hydro-Meteorological Observatory). The automatic morphing has encouraging results when the precipitation fields are similar enough.