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Evaluating satellite-based diurnal cycles of precipitation in the African tropics

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Precipitation plays a major role in the energy- and water cycle of the earth. Due to its variable nature precipitation is difficult to measure globally consistent. In recent years large efforts have been made to develop satellite-based precipitation datasets with quasi-global coverage, usable for climate analysis. These datasets present an alternative to in-situ based datasets, especially in areas sparsely covered by ground stations.
Satellite-based precipitation datasets give valuable information on the distribution and variability of rainfall on a wide range of spatial and temporal scales and are therefore a unique tool to do model evaluations. But the value of satellite-based precipitation datasets is application dependent. There are studies that validated these datasets on seasonal and monthly or daily scales. Instead, when it comes to the diurnal variability of rainfall, it is still not clear whether satellite-based precipitation datasets can capture a reasonable timing and amplitude of the diurnal cycle.
We did a validation of the diurnal cycle of rainfall in the tropics, which exhibit a strong systematic diurnal variability. In a region in West Africa, we validated several satellite-based precipitation datasets, including Multi-satellite Precipitation Analysis (TMPA) products and CPC MORPHing technique (CMORPH) data. As reference, we used highly resolved in-situ data from the African Monsoon Multidisciplinary Analysis (AMMA) database.
As a result we found the it seems to be a matter of temporal sampling whether the analyzed dataset can capture the true diurnal cycles of rainfall reasonably. Referring on this, both the multi-satellite TMPA and CMORPH perform reasonably, with mean biases of about 20% for amplitudes and deviations mostly below three hours for the timing of diurnal cycles.