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Towards stochastically downscaled precipitation in the Tropics based on a robust 1DD combined satellite product and a high resolution IR-based rain mask

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In the Tropics where the ground-based rain gauges network is very sparse, satellite rainfall estimates are becoming a compulsory source of information for various applications: hydrological modeling, water resources management or vegetation-monitoring. The tropical Tropical Amount of Precipitation with Estimate of Error (TAPEER) algorithm, developed within the framework of Megha-Tropiques satellite mission is a robust estimate of surface rainfall accumulations at the daily, one degree resolution. TAPEER validation in West Africa has proven its accuracy. Nevertheless applications that involve non-linear processes (such as surface runoff) require finer space / time resolution than one degree one day, or at least the statistical characterization of the sub-grid rainfall variability.
TAPEER is based on a Universally Adjusted Global Precipitation Index (UAGPI) technique. The one degree, one day estimation relies on the combination of observations from microwave radiometers embarked on the 7 platforms forming the GPM constellation of low earth orbit satellites together with geostationary infra-red (GEO-IR) imagery. TAPEER provides as an intermediate product a high-resolution rain-mask based on the GEO-IR information (2.8 km, 15 min in Africa). The main question of this work is, how to use this high-resolution mask information as a constraint for downscaling ?
This work first presents the multi-scale evaluation of TAPEER's rain detection mask against ground X-band polarimetric radar data and TRMM precipitation radar data in West Africa, through wavelet transform. Other algorithms (climate prediction center morphing technique CMORPH, global satellite mapping of precipitation GSMaP, multi-sensor precipitation estimate MPE) detection capabilities are also evaluated.
Spatio-temporal wavelet filtering of the detection mask is then used to compute precipitation probability at the GEO-IR resolution. The wavelet tool is finally used to stochastically generate rain / no rain field ensemble consistent with the original TAPEER estimation. This binary mask generation is the first step for the generation of quantitative rain fields ensemble at GEO-IR resolution.