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Investigating the error budget of tropical rainfall accumulations derived from combined passive microwave and infrared satellite measurements

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Measuring rainfall requires a high density of observations, which, over the whole tropical elt, can only be provided from space. For several decades, the availability of satellite observations has greatly increased; thanks to newly implemented missions like the Megha-Tropiques mission and the forthcoming GPM constellation, measurements from space become available from a set of observing systems. In this work, we focus on rainfall error estimations at the 1 $^{\circ}$/1-day accumulated scale, key scale of meteorological and hydrological studies. A novel methodology for quantitative precipitation estimation is introduced; its name is TAPEER (Tropical Amount of Precipitation with an Estimate of ERrors) and it aims to provide 1 $^{\circ}$/1-day rain accumulations and associated errors over the whole Tropical belt. This approach is based on a combination of infrared imagery from a fleet of geostationary satellites and passive microwave derived rain rates from a constellation of low earth orbiting satellites. A three-stage disaggregation of error into sampling, algorithmic and calibration errors is performed; the magnitudes of the three terms are then estimated separately. A dedicated error model is used to evaluate sampling errors and a forward error propagation approach is used for an estimation of algorithmic and calibration errors. One of the main findings in this study is the large contribution of the sampling errors and the algorithmic errors of BRAIN on medium rain rates (2 mm h-1 to 10 mm h-1) in the total error budget.