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An Error Model for Uncertainty Quantification in High-Time Resolution Precipitation Products

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This study proposes a new framework to provide error estimates at all locations (including oceans) and times, for high time resolution, multi-satellite precipitation products, based on calibration and testing in locations where high-quality validation or comparison data are available. In particular, we define estimates of random error for one highly used merged satellite precipitation data set, the TRMM Multi-satellite Precipitation Analysis (TMPA, often known by its TRMM product designation of 3B42) at daily time resolution. The proposed scheme generates an error estimate at each grid point (0.25°, 1 day) that is based only on the precipitation estimate at each grid-box, each day. This error model takes into consideration different components of the random error affecting satellite estimates, such as false alarms and missed rain detection. The resulting error estimates are validated against independent ground data, and will be attached to the standard products for the scientific community to use. Specifically, we separate the two cases when the satellite measurement is zero, and when the satellite estimate is greater than zero (i.e. when the satellite estimates rain). For each of these two cases, there are two possible outcomes: the reference ground measurement agrees with the satellite estimates or does not. This study investigates each case and proposes a methodology to quantify the error given the satellite estimate. Preliminary results are promising, as the estimated probability distributions of the error are shown to reproduce the distribution of the actual error, capturing both missed rainfall errors and false alarms. Slight differences are observed between the two seasons (winter and summer) considered in the study.