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Evaluation of the performance of a satellite precipitation product from the precipitation event perspective

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Precipitation often presents in the form of events. Precipitation events are closely linked to precipitation dynamics but are not often studied, which is likely due to limited data availability. High spatial-temporal resolution satellite datasets have great potential for investigating such topics, but the performances of these products are unknown. Here, we first design metrics to delineate the properties of precipitation events and methods to track satellite errors with the evolution of the precipitation process. Then the global precipitation measurement (GPM) IMERG V05B final run half-hourly product are evaluated using hourly rain gauge data collected at approximately 50,000 stations in China. Our results show the region-dependent bias of the event-based properties in the IMERG data, especially event duration. A strong positive relationship between duration and intensity exists in the IMERG data, while this relationship is not obvious in the gauge data. The IMERG data have a universally weaker ratio of peak to mean intensity and delayed peak time than the gauge data. The peak time in the gauge data varies with duration and intensity but remains steady in the IMERG data. Relatively high false alarm ratios and low miss ratios exist around the beginning of an event in the IMERG data, and this pattern reverses around the end of an event. IMERG data underestimate the mean precipitation rate at the beginning of an event but overestimate the rate later in the event, and the probability of the signs of bias also varies during the events. The results of this study can guide the targeted improvement of retrieval algorithms.