Dependence of GPM precipitation product performance on the spatial extent of precipitation system and relative location in precipitation system

Runze Li\(^1\), Kaicun Wang\(^1\), and Dan Qi\(^2\)

\(^1\)Beijing Normal University, College of Global Change and Earth System Science, Beijing, China (kcwang@bnu.edu.cn)
\(^2\)National Meteorological Center, China Meteorological Administration, Beijing, China

Evaluations of satellite precipitation estimates have been routinely conducted, often in individual gridbox. However, real precipitation is organized as precipitation system in space with a certain extent and structure. Evaluation from the perspective of precipitation system to understand the relationship between satellite errors with the spatial extent of precipitation system and relative location in precipitation system system may help to the better knowledge of satellite error sources but has rare been concerned. To address this issue, the Integrated Multi-satellitE Retrievals for GPM (IMERG) V05B final run half-hourly product is evaluated in this study with hourly rain gauge data collected at approximately 50,000 stations in China. We first identify the precipitation system in IMERG and make comparison in gridboxes with gauge observations as a function of gridboxes’ distance to the boundaries of system and the system sizes to investigate their relationships. Our results show that the false alarm proportions generally decrease as the increase of precipitation system sizes, while it is opposite for the miss proportions. Both the miss and false alarm proportion evidently decrease with the longer distance from the boundaries. Over 90% false alarms occur within the distance of 10% of the square root of precipitation system sizes from the boundaries, while 90% misses locate within the distance of 20% the square root of system sizes. The difference between the false alarm proportion inside the systems and miss proportion outside the systems in accordant distances from the boundaries indicate the generally overestimation of IMERG precipitation system sizes, but much severer for small systems than large systems. For the hit bias, IMERG generally underestimates in small precipitation systems but have regional-dependent sign of bias for larger systems. Accordantly, IMERG underestimates the hit precipitation rates for all distances from the boundaries, but the situation is more complex for larger precipitation systems, with an overestimation for about 0-50 km but underestimation for about 50-200km and again overestimation for over about 200km, indicating the evident location-dependent errors in precipitation system of IMERG.
