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Impacts of spatio-temporal precipitation variabilities on flood event simulation with satellite-based precipitation estimates

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Precipitation is a key factor in controlling the accuracy of runoff simulation, as well as the performance of flood event simulation. Compared with the in-situ rainfall measurement, satellite-based precipitation products provide critical precipitation sources of higher resolution along with detailed depiction of precipitation variability, especially for data-sparse or ungauged regions. This study aims to investigate the impacts of temporal and spatial resolutions of precipitation on flood simulation over a humid region of Southern China. Three versions of Integrated Multi-satellite Retrievals for GPM (IMERG-E, IMERG-L, and IMERG-F) and a gauge-satellite merged precipitation product released by China Meteorological Administration (CMA) at 0.1° and 1 h resolution are used in the study. The lumped hydrological model HBV and semi-distributed hydrological model SWAT are applied to simulate 12 flood events to investigate the impacts of temporal and spatial variabilities of precipitation on flood event simulation. The results show that the spatial resolution of precipitation data affects its capture of characteristics of precipitation events, specifically in magnitude of precipitation variability and the central location of the precipitation event. Furthermore, SWAT shows no improvement compared with HBV in flood event simulation in this case, which may due to the uncertainty of the precipitation spatial variability. The flood events simulated with SWAT indicate that the biases of flood peaks forcing by IMERG-E and IMERG-L increase with the decreasing of precipitation variability, while that forced by IMERG-F are less affected and perform the best among the three IMERG precipitation estimates. The impact of temporal variability of precipitation is conducted with HBV model and the corresponding results are that the higher temporal resolution ensures the better flood event simulation. Furthermore, the CMA source overperforms the other three satellite-based precipitation estimates, and followed by IMERG-F.