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Performance Assessment of Global Satellite Mapping of Precipitation Products over the Tianjin City Centre, China

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The Eco-city site is located 40 km from Tianjin city centre and 150 km from Beijing city centre in China. It is located within the Tianjin Binhai New Area – one of the fastest growing regions. Tianjin Eco-city has a total land area of 30 km^2. The Eco-city is planned for a population of 350,000 as show in Figure 1.

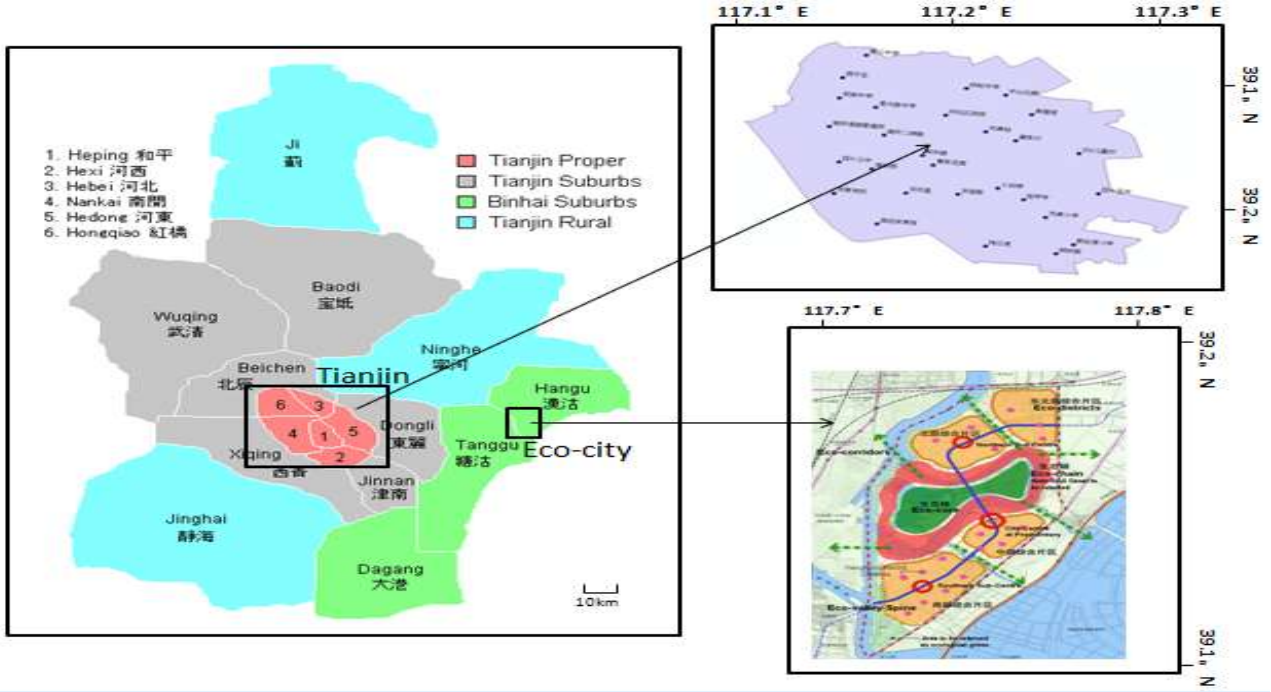

Figure 1 Location of the study domain

The goal is to develop the Eco-city over 10-15 years. Hourly data is required to run the rainfall-runoff-inundation model of the Eco-city in order to testify the risk of flood and extreme rainfall events meanwhile there is no gauge in or around the eco-city and 36 rainfall stations in Tianjin city centre (40km away) with high coverage density but short time period (hourly data, 4-year rainfall season from 2007 to 2010). Due to the constraint in time period, the limited spatial coverage of rainfall stations, and unavailability of real-time rainfall data, the GSMaP dataset at a finer temporal (hourly and daily) and spatial resolution (0.1 ° × 0.1 °) is used as a viable tool to provide rainfall data for modeling and further analysis. The GSMaP project was promoted for a study "Production of a high-precision, high-resolution global precipitation map using satellite data", and the dataset used in this study is GSMaP_RNL (the dataset v6). It is a reanalysis product which depends on a large part on the Climate Prediction Center (CPC) Unified Gauge-Based Analysis of Global Daily Precipitation data sets provided by NOAA. Efforts to improve the quality for the hourly and 0.1 ° × 0.1 ° product GSMaP_RNL have been conducted. These improvements are not only suitable to hourly rainfall , but accurately describe the characteristics of extreme

rainfall events in Tianjin. This rainfall product is called GSMaP_RNL Calibration.

Table 1 Error statistics of two scenarios in GSMaP_RNL and GSMaP_RNL Calibration

	GSMaP_RNL	GSMaP_RNL Calibration
POD	0.50	0.58
FAR	0.65	0.36
ACC	0.95	0.98

Table 1 illustrates that GSMaP_RNL Calibration can detect more rain events which leads to higher hits and false alarms compared with GSMaP_RNL in capturing the heavy rainfall based on probability of detection (POD), false alarm ratio (FAR) and accuracy (ACC). GSMaP_RNL Calibration performs better in heavy rainfall (the threshold for heavy rainfall in Tianjin is 25.4 mm per day) estimation comparable to that of GSMaP_RNL considering higher POD and lower FAR. The POD and FAR value of GSMaP_RNL is 0.50 and 0.65, at the same time, the POD and FAR value of GSMaP_RNL Calibration is 0.58 and 0.36. Figure 2 shows that the daily heavy rain (>25.4 mm per day) scatter plots of data from observation versus GSMaP_RNL and GSMaP_RNL Calibration whose correlation coefficients are 0.59 and 0.96 respectively. From the zero-crossing trend line, GSMaP_RNL Calibration is more likely to detect rainfall than GSMaP_RNL. We conclude that the improved product GSMaP_RNL Calibration can better capture some varying features of extreme rainfall events in Tianjin, China.

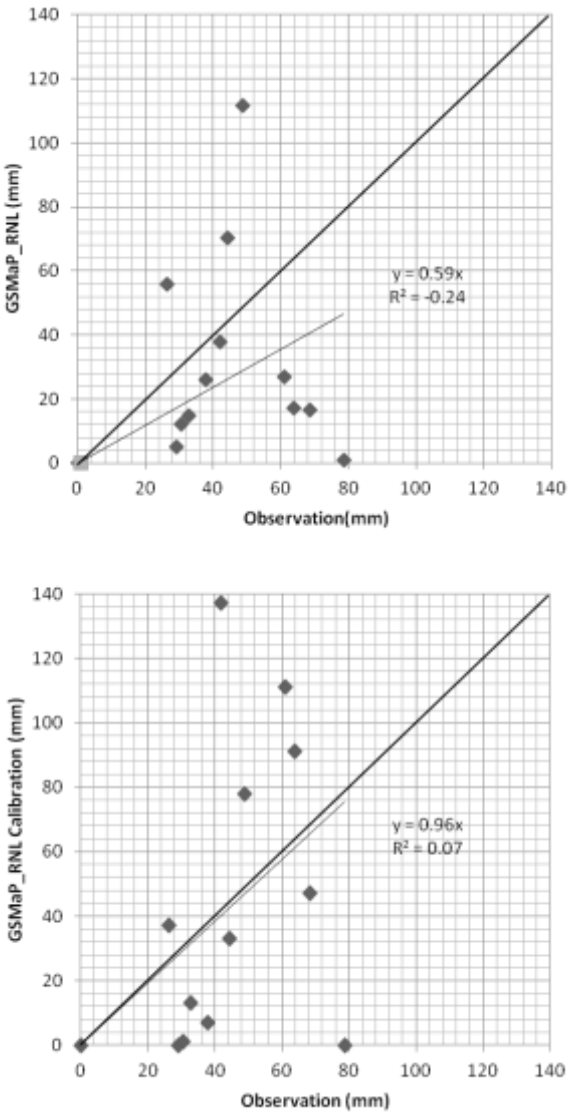

Figure 2 The daily heavy rain (>25.4 mm per day) scatter plots of data from observation versus GSMaP_RNL and GSMaP_RNL Calibration