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Article

Evaluation of TRMM 3B42 Precipitation Product Using Rain Gauge Data in Meichuan Watershed, Poyang Lake Basin, China

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Abstract: This study evaluated Tropical Rainfall Measuring Mission (TRMM) Multi-satellite Precipitation Analysis (TMPA) product i.e. TRMM 3B42 data, using data from 52 rain gauge stations around the Meichuan watershed, which is a representative watershed of Poyang Lake basin in China. Both the latest Version 7 (V7) and previous Version 6 (V6) of TRMM 3B42 data were compared and evaluated for a 9-year period covering 2001-2005 and 2007-2010. The evaluations were conducted at different spatial (grid and watershed) and temporal (daily, monthly and annual) scales. For evaluation at grid scale, the Thiessen polygon method was used to transform pointed-based rain gauge data to areal precipitation at the same grid scale (0.25°) as TRMM 3B42 data. The results showed that there was little difference in performances of V6 and V7 TRMM 3B42 products. Overall, both V6 and V7 products slightly overestimated precipitation with a bias of 0.04. At daily scale, both V6 and V7 data were considered to be unreliable with large relative RMSE (135%-199%) at the two spatial scales, and they were deficient in capturing large storms. These results suggest that local calibration with rain gauge data should be conducted before V6 and V7 TRMM 3B42 data are used at daily scale. At monthly and annual scales, V6 and V7 TRMM 3B42 data match the rain gauge data well (R^2 = 0.91-0.99, relative RMSE = 4%-23%) at both grid and watershed scale and thus have good potential for hydrological applications.

Key words: precipitation; TRMM 3B42; Thiessen polygons; evaluation; Poyang Lake

1 Introduction

Precipitation is a key forcing factor of the hydrological cycle and a necessary input to hydrological models. Precipitation is also one of the most difficult hydrological variables to measure because of its high spatial heterogeneity and temporal variability. The conventional precipitation measurements at point-based gauge stations cannot provide reasonable characterization of spatial variation in precipitation for areas with sparse stations and complex terrain (Duan *et al*. 2012). This situation is especially true for the developing countries where the ground-based radar is often nonexistent and the network of rain gauges is often sparse. Remote sensing is expected to solve this problem by directly providing spatially distributed precipitation estimations over large areas.

To date, several quasi-global high-resolution satellite precipitation products have been developed, including PERSIANN (Precipitation Estimation from Remotely Sensed Information Using Artificial Neural Networks) (Sorooshian *et al*. 2000), CMORPH (the Climate Prediction Center (CPC) Morphing algorithm) (Joyce *et al*. 2004) and TRMM (Tropical Rainfall Measuring Mission) Multisatellite Precipitation Analysis (TMPA) (Huffman *et al.* 2007). Some basic information of these products are shown in Table 1.

Among these products, the TMPA products were widely used in many areas. For example, Su *et al*. (2008) evaluated the TRMM 3B42 V6 product in the La Plata Basin. Their results showed that TRMM 3B42 data agreed well with the gridded gauge data at monthly time scales, but the agreement

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Table 1 Basic information of some quasi-global high-resolution satellite precipitation products.

Product	Start time	Spatial coverage	Spatial resolution	Finest temporal resolution
PERSIANN	2004-09-09	60°S – 60°N	0.04° × 0.04° lat/lon	30 minites
CMORPH	2002-12-03	60°S – 60°N	8km×8km	30 minites
TRMM TMPA	1998-01-01	50°S – 50°N	0.25°×0.25° lat/lon	3-hourly

between TRMM 3B42 and gauge precipitation estimates was reduced at daily time scales, particularly for events with high precipitation intensity. Zeng *et al*. (2012) performed the evaluation of TRMM 3B43 V6 product in drought monitoring in the Lancang River Basin China. Their validation suggested the TRMM 3B43 V6 product had good accuracy and the potential for drought monitoring in data-sparse regions. Duan *et al*. (2012) evaluated the TRMM 3B42 and 3B43 products over the Caspian Sea Region in Iran using rain gauge data at the monthly and annual scales. They found that TMPA products were unreliable with large root mean square error (RMSE) for most months and years.

The performances of TMPA products vary from place to place. So it is always necessary to evaluate the performance and accuracy of TMPA products with rain gauge data before the TMPA products are used in a specific area. The Poyang Lake basin of China is an important tributary of the Yangtze River. There have been frequent severe floods in this basin in the recent decades, so accurate estimation of spatially distributed precipitation is of great importance in this area. Li *et al*. (2012) evaluated the TRMM 3B42 V6 product in Xinjiang catchment of Poyang Lake basin. However, they used only five rain gauge stations for the 15 500 km^2 catchment. The grid-based (0.25°) TMPA products were directly compared with the point-based rain gauge data in their study. The scale discrepancy between grid-based and pointed-based data might lead to errors in evaluation (Yong *et al*. 2010). The scale discrepancy could be solved by transforming the point-based rain gauge data to areal precipitation at the same scale as TMPA products so that they can be compared at the same spatial scales.

In addition, the latest Version 7 (V7) of TMPA products was recently developed and available to public in May, 2012. In contrast to the previous Version 6 (V6), V7 have been incorporated with improved algorithms and additional datasets (Huffman and Bolvin 2012). Several interesting scientific questions are worthy of study, i.e. that (i) whether V7 products have better accuracy than the previous V6 products compared with the rain gauge data? (ii) how much differences in the accuracy between V7 and V6?

In order to provide insights to these questions in addition to the evaluation of these datasets for application in the Poyang Lake area, this paper evaluated the V6 and V7 TRMM 3B42 products in a representative watershed of Poyang Lake area using rain gauge data at various temporal and spatial scales. Section 2 introduces the study area and the datasets. Section 3 presents the methods used in this study. Section 4 describes and discusses the evaluation results. Section 5 concludes and discusses the future research directions.

2 Study area and datasets

The Meichuan watershed, a representative watershed of Poyang Lake basin, is selected as the study area. It has a drainage area of 6366 km^2 and is located within 26°0′–27°8′N and 115°36′–116°38′E (Fig. 1). Elevation ranges from 151 to 1425 m, with an average basin slope of 9% derived from a 90×90 m^2 SRTM (Shuttle Radar Topography

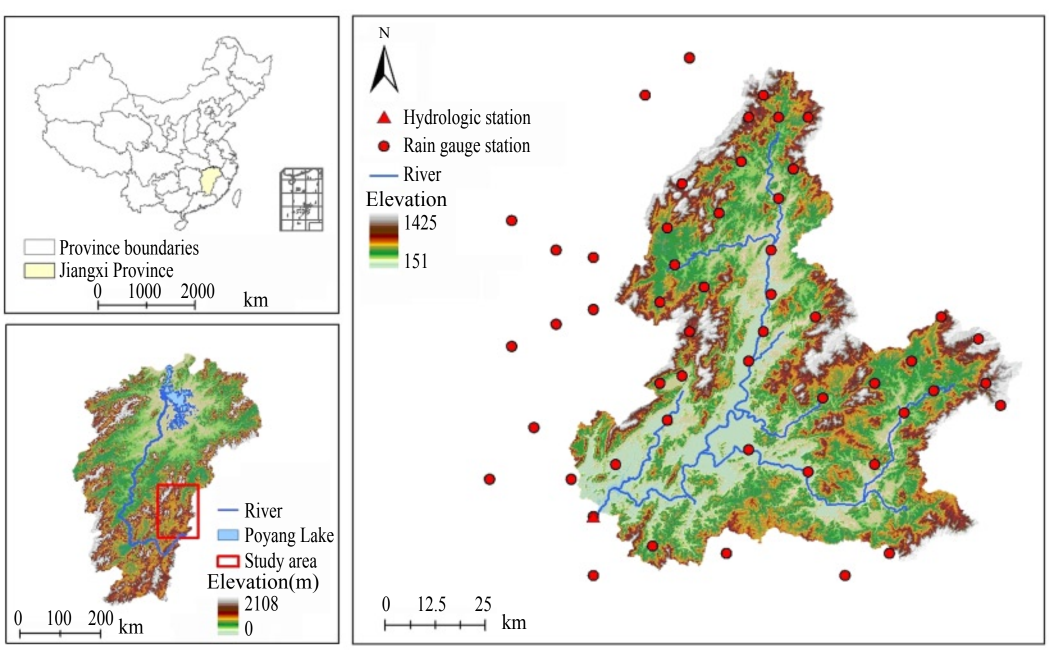

Fig. 1 Location of the Meichuan watershed (6366 km^2), Poyang Lake basin, China.

Mission) DEM. This watershed has a subtropical wet climate characterized by an annual mean temperature of 17℃ and annual mean precipitation of 1706 mm.

There are 52 rain gauge stations around the Meichuan watershed. These rain gauge stations are relatively evenly distributed (Fig. 1). The measured daily precipitation data from these 52 gauges were obtained from the Hydrologic Yearbooks published by the Hydrographic Office of Jiangxi Province in China. The available time period for daily precipitation is 9 years covering 2001–2005 and 2007–2010 due to the data missing in 2006. These rain gauge data were considered as ground truth for evaluation of TRMM 3B42 products.

TMPA products provide precipitation for the spatial coverage of 50° N-S at the 0.25°×0.25° latitude-longitude resolution. The TRMM 3B42 product is one of the TMPA products. The temporal resolution of TRMM 3B42 is 3-hour, thus rendering us to obtain daily precipitation for evaluation. More detailed information on TRMM 3B42 can be found in Huffman *et al*. (2007). Both V6 and V7 TRMM 3B42 products can be freely obtained from Goddard Earth Sciences Data and Information Services Center (http://mirador.gsfc.nasa.gov). For each version, two kinds of TRMM 3B42 data are available, that is, 3-hourly precipitation (UTC 00, 03, 06, 09, 12, 15, 18, 21) and daily aggregated. The daily aggregated precipitation is obtained by summing all 8 sets of 3-hourly precipitation totals for a given day. Fortunately, the daily rain gauge stations measured precipitation during the same period as daily aggregated TRMM products (from UTC 00 to UTC 24). Therefore, the V6 and V7 daily aggregated 3B42 products were directly used, and only the grids covering the study area (totally 18 grids) were selected for evaluation.

3 Methodology

For comprehensive evaluation, the comparison of V6 and V7 TRMM 3B42 data and the rain gauge data were conducted at two spatial scales: the grid scale and the watershed scale. In addition, for each spatial scale, three temporal scales i.e. daily, monthly and annual, were further performed for evaluation. For the evaluation at grid scale, the point-based rain gauge data were first transformed to areal precipitation at the same grid scale as TRMM 3B42 (i.e. 0.25°). There are many interpolation methods, such as Thiessen polygon, IDW (Inverse Distance Weighting) and Kriging, that can be used for such transformation. There is currently no criterion to judge which method is better. As the Thiessen polygon method is reported to be simple and robust (Grayson and Bloschl 2001), it is adopted in this paper. Fig. 2 shows the constructed Thiessen polygons using these 52 rain gauge stations. These Thiessen polygons were then intersected with the grid polygons of TRMM data. The aggregated value from the rain gauge data over each grid polygon area was computed using the area weighted sum method shown in Equation (1):

$$V_g = \sum_{i=1}^{n} w_i V_{si} \tag{1}$$

where V_g is the aggregated grid-scale precipitation; n is the number of intersected Thiessen polygons within a grid; w_i is the percentage of area for intersected Thiessen polygon i in the grid; V_{si} is the precipitation of the intersected Thiessen polygon i.

After the transformation, grid-based areal precipitation from rain gauge data were obtained and used as ground truth for comparison with TRMM 3B42 data in terms of a consistent scale. For the watershed-based evaluation, we first calculated the areal average precipitation of the whole watershed (i.e. average values of all the grids in the watershed) from TRMM 3B42 data and rain gauge data, respectively. Then the comparison between two datasets was conducted.

Four statistical indictors were computed for the evaluation, i.e. the coefficient of determination (R^2), the bias, the root mean square error (RMSE) and the relative RMSE (labeled as relative RMSE). The coefficient of determination represents the proportion of variability in one variable that is accounted for by another variable. For a linear regression model, R^2 is simply the square of the correlation coefficient between two variables. The bias reflects the degree to which the measured value is over- or under-estimated (Duan *et al*. 2012). The RMSE is a frequently used measure of differences between two variables. The relative RMSE is computed as RMSE divided by the mean precipitation of rain gauge data, and it can be used to evaluate the reliability of TRMM data. When relative RMSE is less than 50%, the TRMM data are considered as reliable, while unreliable when relative

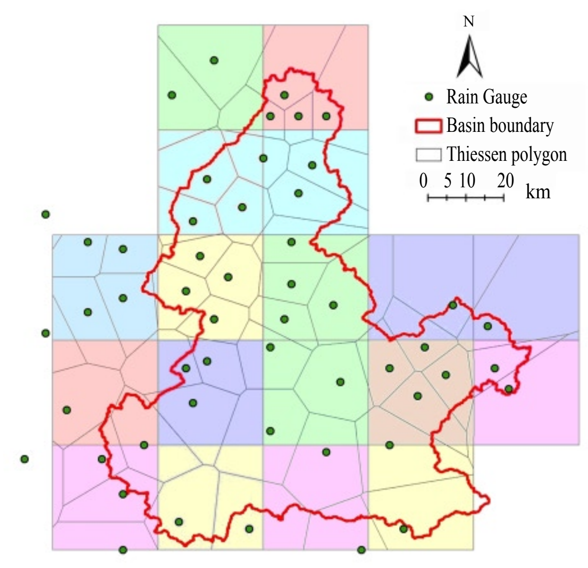

Fig. 2 Intersection of Thiessen polygons with TRMM grids. The TRMM grids are shown with different colors.

RMSE equals or is greater than 50% (Franchito *et al*. 2009). The formulas of the indictors are described as follows:

$$R^2 = \left(\frac{\sum_{i=1}^{n}\left(M_i - \overline{M}\right)\left(P_i - \overline{P}\right)}{\sqrt{\sum_{i=1}^{n}\left(M_i - \overline{M}\right)^2}\sqrt{\sum_{i=1}^{n}\left(P_i - P\right)^2}} \right)^2 \quad (2)$$

$$\text{Bias} = \frac{\sum_{i=1}^{n} P_i}{\sum_{i=1}^{n} M_i} - 1 \quad (3)$$

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}\left(P_i - M_i\right)^2}{n}} \quad (4)$$

$$\text{Relative } RMSE = \frac{RMSE}{\overline{M}} \quad (5)$$

where P_i is grid scale or aggregated watershed scale precipitation from the TRMM 3B42 data; M_i is the aggregated grid scale or watershed scale precipitation from rain gauge data; n is the total number of data; i is the index of data; $\overline{P}$ is the average value of P_i; $\overline{M}$ is the average value of M_i.

4 Results and discussion

4.1 Evaluation results at daily scale

The V6 and V7 daily TRMM 3B42 data and the rain gauge data were compared at both grid and watershed scales. Fig.3 shows the scatter plots of data from rain gauge stations versus V6 and V7 TRMM 3B42 at two spatial scales. There are totally 59166 points for grid-based evaluation and 3287 pairs for watershed-based evaluation during the nine-year period. The computed statistical indicators are all included in Fig. 3. At grid scale, both V6 and V7 TRMM 3B42 data showed moderate agreement with the rain gauge data with R^2 of 0.54 and 0.52, respectively. The same Bias of 0.04 for both V6 and V7 TRMM 3B42 products reflects the slightly overestimation on the whole by these two datasets. The V7 TRMM 3B42 product even performed slightly worse than V6 with higher RMSE and relative RMSE, but the difference between two datasets was very small. The high relative RMSE (199% for V7 and 198% for V6) indicates both the V7 and V6 daily TRMM 3B42 data are unreliable at grid scale. As expected, the V6 and V7 TRMM 3B42 data showed a better agreement with the rain gauge data with R^2 of 0.69 and 0.68, respectively, at watershed scale. There was still litter difference in performances between V7 and V6 products. Although the RMSE was reduced compared to those at grid scale, the relative RMSE is still much greater than 50% for both V6 and V7 products, indicating that both V6 and V7 are similarly unreliable at watershed scale. Therefore, it can be concluded that V6 and V7 perform similarly badly at daily scale. The local calibration (Li and Shao 2010; Tobin and Bennett 2010) should be carried out first to improve the daily TRMM 3B42 data before further applications at the daily scale.

The performances of TRMM 3B42 products in different rain intensities at daily scale were also evaluated. This

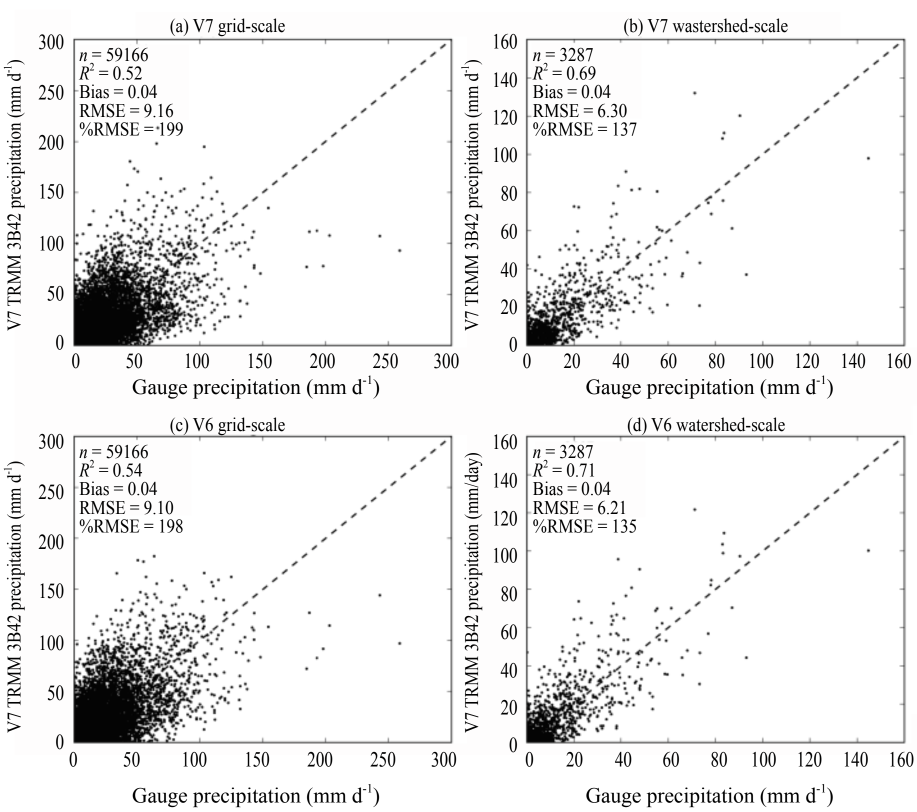

Fig. 3 Scatter plots of daily precipitation from rain gauge stations versus V6 and V7 TRMM 3B42 data at grid and watershed scales.

evaluation was only conducted at watershed spatial scale. The daily precipitation was categorized into seven ranges i.e. 0, 0–3, 3–10, 10–25, 25–50, 50–100, >100 mm d^{-1}. Fig.4 depicts the occurrence frequencies of areal average daily precipitation at watershed scale in different precipitation intensity ranges and their relative contributions to total precipitation for rain gauge data, V6 and V7 TRMM 3B42 products. The occurrence frequency is equal to the number of rainy days within a range divided by the total number of rainy days. The relative contribution is equal to the sum of precipitation within a range divided by the total precipitation. The differences between V7 products and rain gauge data were slightly smaller than those between V6 and rain gauge data, but there are only very small differences between V6 and V7 products. The occurrence frequencies of zero precipitation and high intensity precipitation (>25 mm d^{-1}) were overestimated by both V6 and V7 products. The overestimation for high intensity precipitation was also reported in other studies (Su *et al*. 2008; Yong *et al*. 2010). For low intensity precipitation (<25mm d^{-1}), the occurrence frequencies were underestimated, especially for the precipitation of 0-3 mm d^{-1}. The underestimation or overestimation in the relative contributions by V6 and V7 products shared the same trends as the results for the occurrence frequencies.

Because the Poyang Lake basin, including the study area, faced frequent severe floods in the recent decades, capturing extreme storms are very important for flood control and watershed management. Therefore, it is necessary to further evaluate the performance of the TRMM 3B42 data in capturing storms. The annual maximum daily and 5-day areal average precipitation at watershed scale were computed from rain gauge data and both V6 and V7 for all nine-year period. The comparisons between them are shown in Fig. 5, and there were obvious differences between V6 and V7 products. For most years (except 2001), the annual maximum daily precipitation of V7 product was greater than that of V6. There were no such patterns for maximum 5-day precipitation. The statistics for the errors

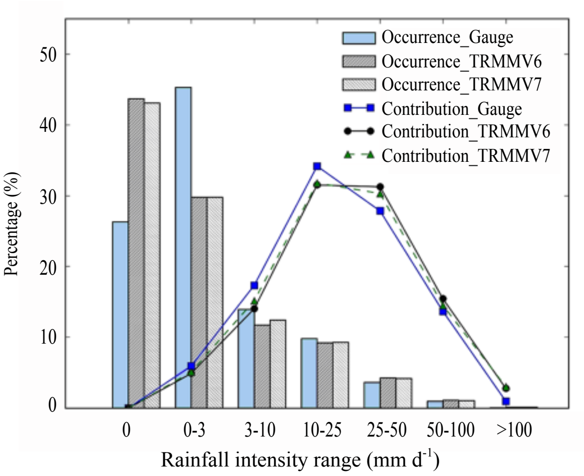

Fig. 4 Occurrence frequencies of daily precipitation in different precipitation intensity ranges and their relative contributions to total precipitation. “Occurrence” in the legend means the occurrence frequency of each range, and “Contribution” means the relative contribution of each range.

of maximum daily and 5-day TRMM precipitation are shown in Table 2. The average errors of V7 product were slight smaller than those of V6 product, but the maximum errors of V7 product were larger than those of V6 product. Overall, both V6 and V7 TRMM 3B42 data were deemed to be not good at capturing large storms because of their large relative errors.

4.2 Evaluation results at monthly scale

The daily precipitation data were accumulated to monthly total precipitation for rain gauge data, V6 and V7 TRMM 3B42 products. The monthly total precipitation from three datasets were compared at both grid and watershed scales, and the results with statistical indicators are shown in Fig.6. There are totally 1944 comparison points at grid scale and 108 points at watershed scale during the nine-year period. Excellent agreements with the rain gauge data were observed for both V6 and V7 products at grid scale with

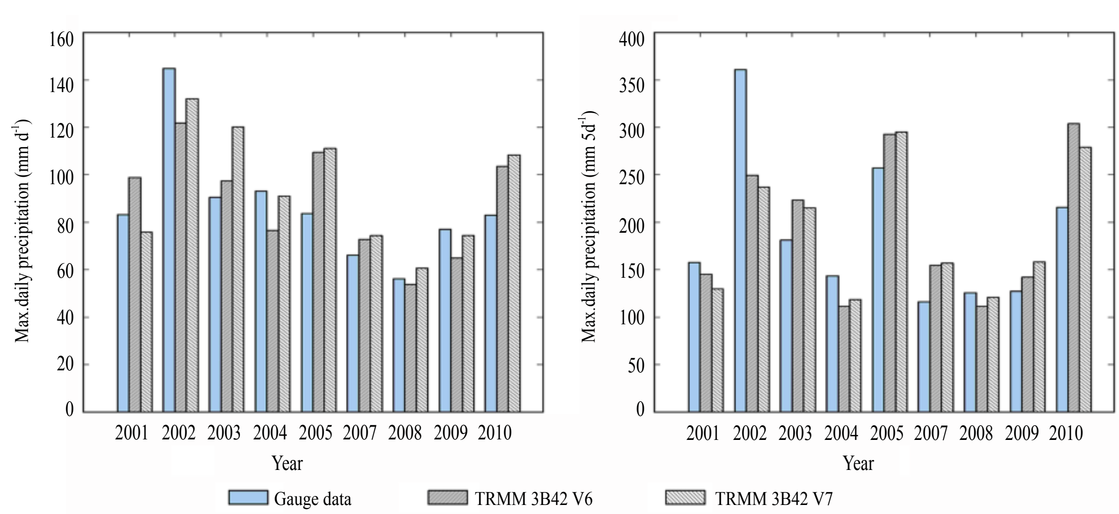

Fig. 5 Annual maximal daily and 5-day areal average precipitation at watershed scale.

Table 2 The statistics for the errors of maximum daily and 5-day TRMM precipitation. The “Relative (%)” in the table is equal to absolute error divided by the corresponding precipitation of rain gauge data.

Index	Version of TRMM	Minimum error		Maximum error		Average error	
		Absolute (mm)	Relative (%)	Absolute (mm)	Relative (%)	Absolute (mm)	Relative (%)
Maximum daily precipitation	V6	2.51	4.46	25.76	30.79	14.4	16.68
	V7	2.13	2.29	29.75	32.92	13.3	15.41
Maximum 5-day precipitation	V6	12.43	7.90	111.42	30.87	43.02	23.06
	V7	4.57	3.64	123.94	34.34	43.01	22.97

R^2 of 0.93 and 0.92, respectively. Such agreements were expectedly better at watershed scale with R^2 of 0.98 for both V6 and V7 products. Interestingly, in contrast to the results at daily scale, the V7 product performed slightly better with reduced RMSE than V6 at monthly scale for both spatial scales. The similar small values of relative RMSE (23% and 24% at grid scale; 13% at watershed scale) indicated that the monthly accumulated V6 and V7 TRMM 3B42 data are reliable at both spatial scales for the study area during the 9-year period. The higher precision at monthly scale than at daily scale is due to the fact that the errors at daily scale are nearly symmetrical (see Fig. 3) and thus can cancel each other out after the aggregation.

4.3 Evaluation results at annual scale

The monthly accumulated precipitation data were further accumulated to annual total precipitation for rain gauge data, V6 and V7 TRMM 3B42 products. Fig. 7 compares the annual precipitation from rain gauge data versus V6 and V7 products, respectively, at two spatial scales. There are totally 162 points at grid scale and only 9 points at watershed scale during the 9-year period. In terms of RMSE values, V7 products performed better than V6 product but still in a very slightly extent at both spatial scales. The agreements with rain gauge data at annual scale were very similar to results at monthly scale. In contrast to monthly scale, the relative RMSE values were reduced to 8% at grid scale and 4%–5% at watershed scale, indicating the annual accumulated precipitation from V6 and V7 TRMM 3B42 data are reliable at both grid and watershed scales. The extent of reliability was indeed improved as the aggregation in the temporal scale.

5 Conclusions

In this study, the latest V7 and previous V6 TRMM 3B42 daily precipitation data in Meichuan watershed in China were compared and evaluated using rain gauge data during a 9-year period. The evaluations were conducted at grid and watershed spatial scales and at daily, monthly and annual temporal scales. For the grid scale evaluation, the

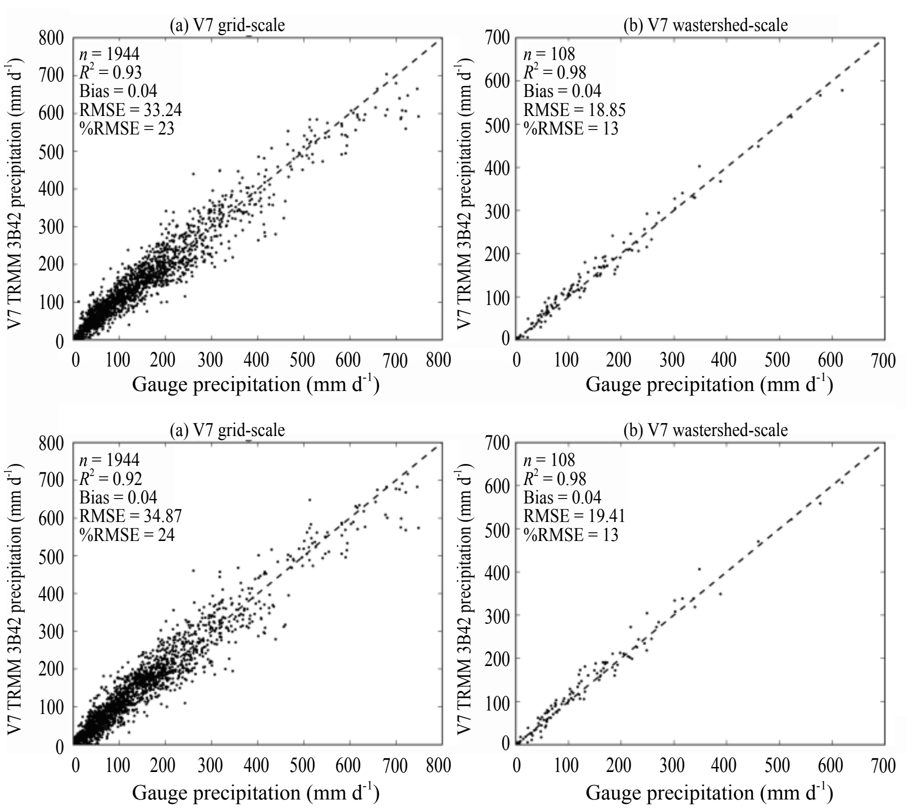

Fig. 6 Scatter plots of monthly accumulated precipitation from rain gauge stations versus V6 and V7 TRMM 3B42 data at grid and watershed scales.

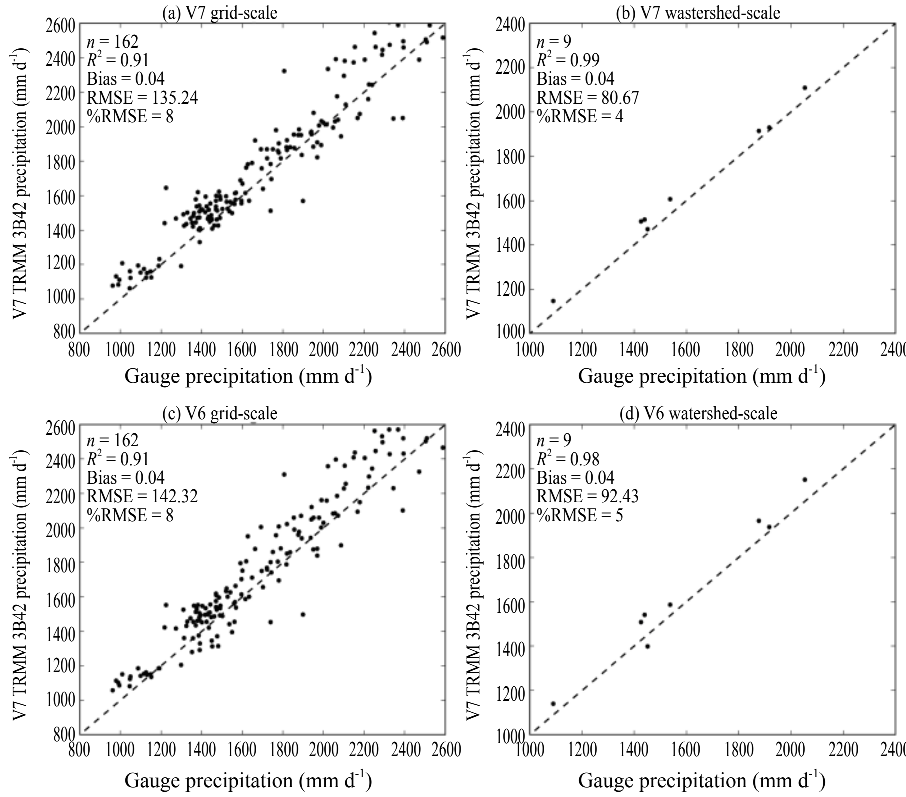

Fig. 7 Scatter plots of annual accumulated precipitation from rain gauge stations versus V6 and V7 TRMM 3B42 data at grid and watershed scales.

point-based rain gauge data were first transformed to the consistent grid scale using the Thiessen polygon method for the grid versus grid comparison. At watershed scale, average precipitation of the watershed was calculated by averaging values of all the grids in the watershed.

The results showed that although the improved algorithms and additional datasets implemented in V7, V7 product only performed slightly better than V6 product at monthly and annual scales and even performed slightly worse than V6 at daily scale. Overall, both V6 and V7 slightly overestimated the precipitation with a bias of 0.04. At daily scale, both V7 and V6 products were unreliable with relative RMSE far exceeding 50%. They also performed badly in capturing the large storms. Base on this finding we suggest that local calibration should be carried out first to improve the daily precipitation estimations before further applications. As the temporal scales scales increase, the performances of both V6 and V7 were improved. At monthly and annual temporal scales, V6 and V7 TRMM 3B42 data were in excellent agreement with the rain gauge data (R^2 ranges from 0.91 to 0.99) with low relative RMSE (ranges from 4%–23%). Therefore, it can be concluded the TRMM 3B42 product are reliable and have good potential for hydrological applications when they are used at monthly and annual scales.

The poor performances of TRMM 3B42 precipitation at daily scale highlights the TRMM 3B42 precipitation at fine temporal scale need to be improved in the future. On the other hand, the combination of TRMM 3B42 data with rain gauge data could have potential to improve the daily precipitation for further applications. The distributed hydrological model for Poyang Lake basin is being developed by our team. In the future, the daily data from satellite precipitation products including V6 and V7 TRMM 3B42 will be integrated as input into such hydrological model for streamflow simulation. The differences in streamflow simulation between using satellite precipitation products and using rain gauge data can be explored to evaluate whether the errors in satellite-based precipitation can be tolerated by hydrologic models for practical applications.

References

Duan Z, W G M Bastiaanssen, Liu J Z. 2012. Monthly and annual validation of TRMM Multisatellite Precipitation Analysis (TMPA) products in the Caspian Sea Region for the period 1999-2003. In: Proceedings of International Geoscience and Remote Sensing Symposium (IGARSS) 2012, Munich, Germany, July 22-27: 3696-3699.

Franchito S H, V B Rao, A C Vasques, *et al*. 2009. Validation of TRMM precipitation radar monthly rainfall estimates over Brazil. Journal of Geophysical Research-Atmospheres, 114, D02105.

Grayson R, G Bloschl. 2001. Spatial Patterns in Catchment Hydrology: Observations and Modelling, 1st ed. Cambridge: Cambridge University Press.

Huffman G J, R F Adler, D T Bolvin, *et al*. 2007. The TRMM multisatellite precipitation analysis (TMPA): Quasi-global, multiyear, combined-sensor precipitation estimates at fine scales. *Journal of Hydrometeorology*, 8(1): 38-55.

Huffman G J, D T Bolvin. 2012. TRMM and other data precipitation data set documentation. (ftp://precip.gsfc.nasa.gov/pub/trmmdocs/3B42_3B43_doc.pdf). Access date: Octorber 2012.

Islam M N, H Uyeda. 2007. Use of TRMM in determining the climatic characteristics of rainfall over Bangladesh. *Remote Sensing of*

Environment, 108(3): 264-276.
Joyce R J, J E Janowiak, P A Arkin, *et al*. 2004. CMORPH: A method that produces global precipitation estimates from passive microwave and infrared data at high spatial and temporal resolution. *Journal of Hydrometeorology*, 5(3): 487-503.
Li M, Shao Q X. 2010. An improved statistical approach to merge satellite rainfall estimates and rain gauge data. *Journal of Hydrology*, 385(1-4): 51-64.
Li X H, Zhang Q, Xu C Y. 2012. Suitability of the TRMM satellite rainfalls in driving a distributed hydrological model for water balance computations in Xinjiang catchment, Poyang Lake basin. *Journal of Hydrology*, 426: 28-38.
Sorooshian S, K L Hsu, X Gao, *et al*. 2000. Evaluation of PERSIANN system satellite-based estimates of tropical rainfall. *Bulletin of the American Meteorological Society*, 81(9): 2035-2046.
Su F G, Y Hong, D P Lettenmaier. 2008. Evaluation of TRMM Multisatellite Precipitation Analysis (TMPA) and its utility in hydrologic prediction in the La Plata Basin. *Journal of Hydrometeorology*, 9(4): 622-640.
Tobin K J, M E Bennett. 2010. Adjusting satellite precipitation data to facilitate hydrologic modeling. *Journal of Hydrometeorology*, 11(4): 966-978.
Yong B, Ren L L, Hong Y, *et al*. 2010. Hydrologic evaluation of Multisatellite Precipitation Analysis standard precipitation products in basins beyond its inclined latitude band: A case study in Laohahe basin, China. *Water Resources Research*, 46(7): W07542.
Zeng H W, Li L J, Li J Y. 2012. The evaluation of TRMM Multisatellite Precipitation Analysis (TMPA) in drought monitoring in the Lancang River Basin. *Journal of Geographical Sciences*, 22(2): 273-282.

TRMM 3B42降水产品在鄱阳湖流域梅川江子流域的精度评价

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摘 要：在鄱阳湖流域的梅川江子流域，利用52个站点9年（2001−2005及2007−2010）的日降水数据对V6和V7两个版本的TRMM 3B42降水产品进行了精度评价。该评价针对多个时空尺度进行，包括栅格和流域两个空间尺度，日、月和年三个时间尺度。为避免尺度不匹配问题，本文利用泰森多边形方法将点尺度的站点观测数据转换到与TRMM数据相同的栅格尺度。评价结果表明，V6和V7两个版本的TRMM 3B42降水产品差别较小，整体上均轻微高估了降水量（偏差均为0.04）。在日尺度，栅格和流域空间尺度上V6和V7 TRMM 3B42降水产品的精度均较差，相对均方根误差在135%−199%之间。因此，在该地区利用3B42数据进行日尺度的水文分析前需要对其进行校正。在月和年尺度，栅格和流域两个空间尺度上V6和V7两个版本的TRMM 3B42降水产品精度均较高，决定系数达到0.91−0.99，相对均方根误差在4%−23%之间。这表明TRMM 3B42降水产品在该地区月和年尺度的水文分析方面具有很好的应用前景。

关键词：降水；TRMM 3B42；泰森多边形；精度评价；鄱阳湖流域