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Evaluation of high-resolution satellite precipitation products for streamflow simulation in Mishui Basin, south China

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Abstract An attempt was made to evaluate three high-resolution satellite precipitation products (TRMM 3B42V6, 3B42RT and CMORPH) for streamflow simulation in the Mishui basin, south China. Firstly, three satellite precipitation products were compared with the dense raingauged observations at the basin scale from 2003 to 2008. Secondly, satellite precipitation products were used as input into the gridded Xinanjiang model in order to evaluate their hydrological predictive capability. Finally, the authors corrected the systematic bias at monthly and annual time-scales for the two near-real-time 3B42RT and CMORPH products. The direct comparison shows that these three satellite precipitation products perform very well in detecting the occurrence of the precipitation events, while there are some different biases in terms of the quantity of precipitation. 3B42V6 data sets with a bias of –5% fit best with the raingauged observations, while 3B42RT and CMORPH data sets underestimate precipitation by 43% and 41%, respectively, which are much higher than a normal acceptable threshold. The results of the three satellite precipitation products used in streamflow simulation are similar to those of the direct comparison. The behaviour of streamflow simulation from 3B42V6, with a bias of –2% and the daily Nash-Sutcliffe coefficient of 47%, is the optimal amongst the three products. However, it still reveals that the accuracy of daily time-scale distribution of 3B42V6 data sets should provide an increasing possibility to follow the real situation. The 3B42RT and CMORPH data sets produced a larger bias and lower Nash-Sutcliffe coefficient. The correction of monthly-scale bias is better in improving streamflow simulation in the monsoon climatic area than the adjustment of yearly-scale bias with respect to the 3B42RT and CMORPH data.

Key words satellite precipitation product; streamflow simulation; gridded Xinanjiang model; Mishui Basin