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TMPA Products 3B42RT & 3B42V6: Evaluation and Application in Qinghai-Tibet Plateau

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Hydrological researchers in Qinghai-Tibet Plateau tend to be haunted by deficiency of station gauged precipitation data for the sparse and uneven distribution of local meteorological stations. Fortunately, alternative data can be obtained from TRMM (Tropic Rainfall Measurement Mission) satellite. Preliminary evaluation and necessary correction of TRMM satellite rainfall products is required for the sake of reliability and suitability considering that TRMM precipitation is unconventional and natural condition in Qinghai-Tibet Plateau is unusually complicated.
3B42RT and 3B42V6 products from TRMM Multisatellite Precipitation Analysis(TMPA) are evaluated in northeast Qinghai-Tibet Plateau with 50 stations quality-controlled gauged daily precipitation as the benchmark precipitation set. It is found that the RT data overestimates the actual precipitation greatly while V6 only overestimates it slightly. RT data shows different seasonal and inter-annual accuracies. Summer and autumn see better accuracies than winter and spring and wet years see higher accuracies than dry years. Latitude is believed to be an important factor that influences the accuracy of satellite precipitation.
Both RT and V6 can reflect the general pattern of the spatial distribution of precipitation even though RT overestimates the quantity greatly. A new parameter, accumulated precipitation weight point (APWP), was introduced to describe the temporal-spatial pattern evolution of precipitation. The APWP of both RT and V6 were moving from south to north in the past decade, but they are all in the west of station gauged precipitation APWP(s).V6 APWP track fit gauged precipitation perfectly while RT APWP track has over-exaggerated legs, indicating that spatial distribution of RT precipitation experienced unreasonable sharp changes.
A practical and operational procedure to correct satellite precipitation data is developed. For RT, there are two steps. Step 1, the downscaling, original daily precipitation was multiplied by a ratio of its monthly satellite/station precipitation gauged precipitation. Step2, objective analysis, Barnes/Cressman successive correction as well as Optimal Interpolation was applied to refine the processed daily results. Step 1 is unnecessary for V6 correction. The accuracy of RT can be improved significantly and the spatial details of satellite precipitation can be obtained as much as possible while quite little improvement showed in V6 correction. Besides, the iteration of successive correction should not be more than twice and the ideal influence radius for Optimal Interpolation is R=5.
The original/corrected RT and V6 data sets were used as precipitation inputs to drive a newly developed hydrological model DHM-SP in the headwater region of the Yellow river so as to assess their applicability in simulating the daily runoff. V6 simulation result is qualified even though it is uncorrected. The bias in RT is too much to make use of RT as model input directly while quite satisfied results can be derived from corrected RT input. The simulation results of corrected RT are even better than that of station gauged and V6.