How do GPM IMERG precipitation estimates perform as hydrological model forcing? Evaluation for 300 catchments across Mainland China

Accurate precipitation estimates are essential for reliable hydrological simulations of fluxes and states. Satellite precipitation products have been widely used for hydrological applications, especially for ungauged regions. The Global Precipitation Measurement (GPM) product is starting to provide a new generation of precipitation estimates. This work first evaluates several GPM Integrated Multi-satellite Retrievals (IMERG) against gauge-based precipitation over Mainland China for a two-year period (2016–2017), and then explores the feasibility of using GPM to force a lumped hydrological model over 300 catchments of varying size and climate.

The analysis indicates that IMERG Final run estimates (gauge-adjusted) agree well with gauge-based precipitation at daily scale, while IMERG Early run estimates (near-real time without gauge adjustments) are consistently lower than the rain gauge records. Nevertheless, both Final run and Early run estimates are slightly better than TRMM 3B42 estimates in terms of rainfall detection skill. Moreover, all three products show better skill over humid regions than over high elevation zones.

When used as hydrological model forcing, IMERG Final and Early estimates provide comparable performances to gauge-based precipitation. However, TRMM 3B42 performs relatively poor in terms of hydrological simulation. Moreover, models generally perform better in humid than in arid areas for all three products. The evaluation sheds light on how IMERG-driven hydrological predictions perform in different regions across China. The findings also indicate the potential of IMERG Early run for flood forecasting and Final run for climatological/hydrological modeling in ungauged or poorly gauged basins.

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Corresponding author: Jiang, L.
Contributors: Jiang, L., Bauer-Gottwein, P.
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