VALIDATION OF SATELLITE PRECIPITATION ADJUSTMENT METHODOLOGY

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The precipitation science community has expressed significant concern regarding the ability of satellite-based precipitation products to accurately capture rainfall values over land. Significant problems exist in terms of bias, false alarm rate (FAR), and probability of detection (POD). There has been some work that has focused on addressing the deficiencies of satellite precipitation products, particularly on the adjustment of bias (Vila et al. 2009; Wilk et al. 2006). This paper outlines a methodology that adjusts satellite products utilizing ground-based precipitation data. The approach is not a simple bias adjustment, but is a three-step process that transforms a satellite product based on a ground-based precipitation produc (NEXRAD derived MPE product or rain gauge data). Autoregression of ground-based precipitation is used to develop a filter eliminating FAR in our adjusted product. The PDF of the satellite product is adjusted to the PDF of the ground-based product minimizing bias. Failure of precipitation detection (POD) is addressed by utilizing a ground-based product during these periods in our adjusted product.

The developed methodology was successfully applied to six moderate-to-large sized watersheds from continental United States (CONUS) and northern Mexico over a spectrum of climatic regimes including arid, semi-arid, and humid settings (Fig. 1).

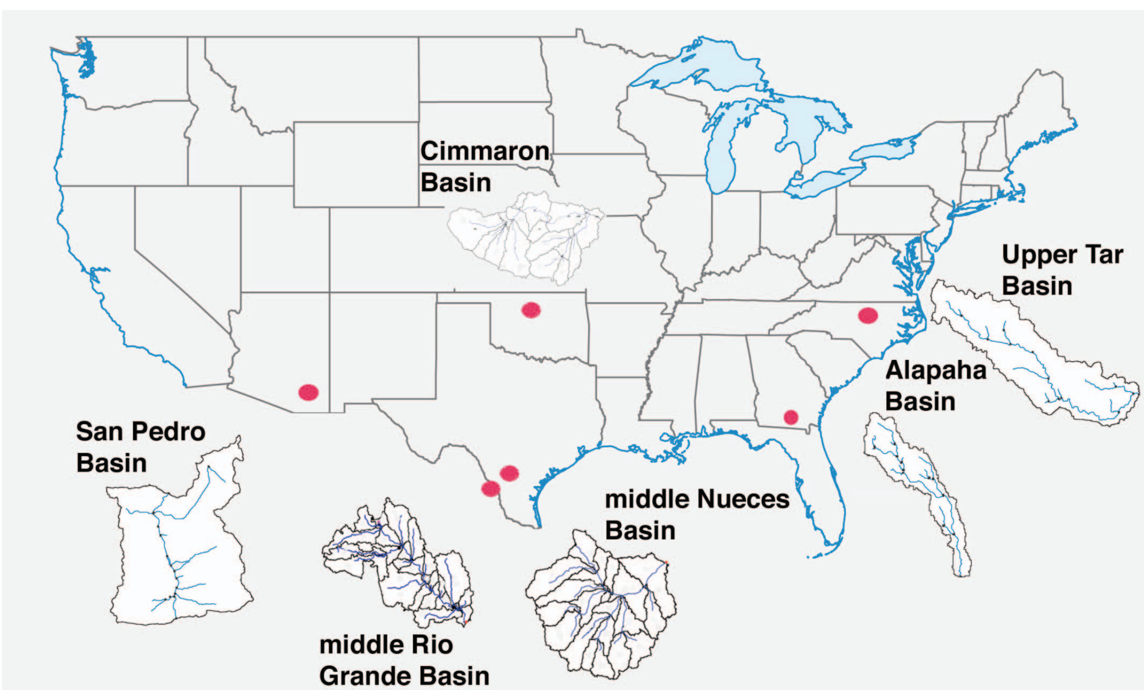

Figure 1. Map of six basins examined from CONUS.

Methodology validation is based on comparison of observed and simulated streamflow generated with Soil and Water Assessment Tool (SWAT) model using unadjusted and adjusted precipitation products as input. Streamflow comparison is based on three measures of goodness of fit: mass balance error, Nash-Sutcliffe efficiency coefficient, and root mean square error. Preliminary results from the San Pedro Basin in Arizona are illustrated below, which reveal poor fit of simulations based on TRMM 3B42-Real-Time data but excellent agreement between ground-based MPE and Adjusted TRMM 3B42-Real-Time simulations with observed streamflow (Fig. 2). In conclusion, the developed approach can be applied to any satellite precipitation product, including real-time products (*e.g.* TRMM 3B41-Real-Time) and can be utilized to support hydrological modeling in poorly gauged regions of the world.

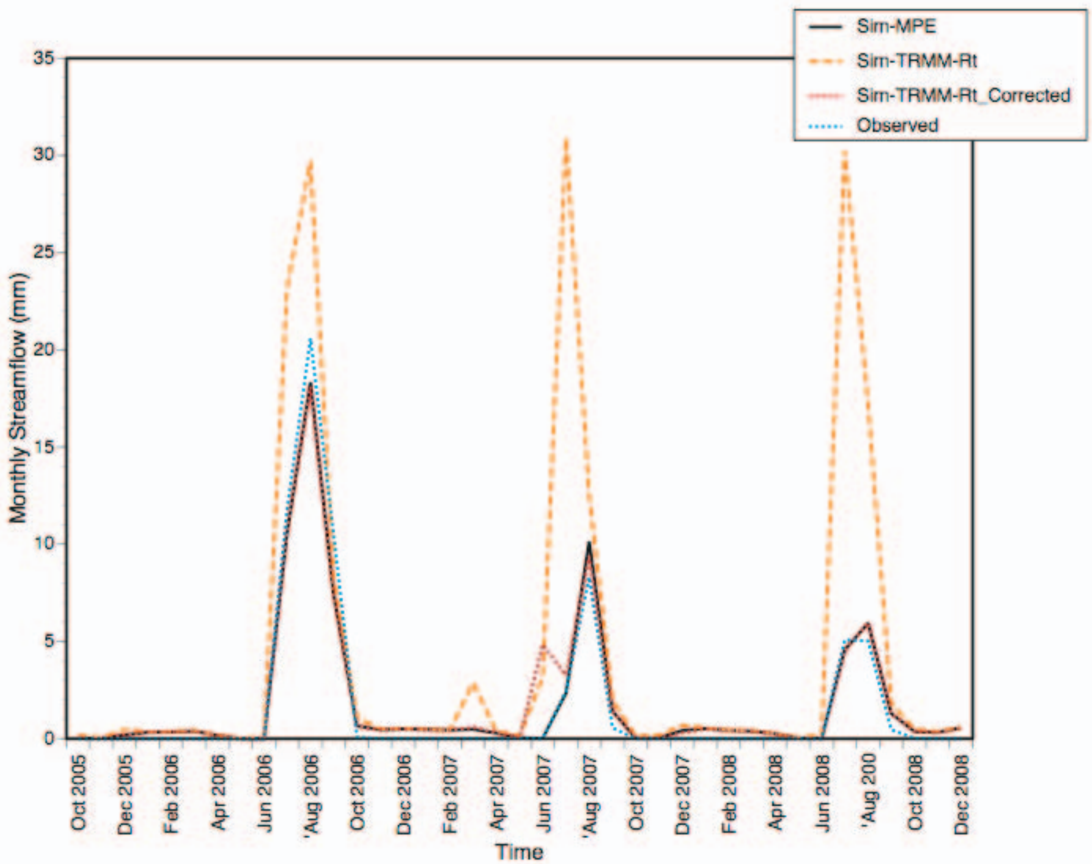

Figure 2. Observed monthly streamflow and simulated streamflow based on SWAT modeling for the San Pedro Basin watershed using MPE and TRMM 3B42 (Real-Time, Unadjusted - TRMMRt and MPE Adjusted- TRMMRt Corrected) precipitation data.

References

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