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Comparison of TRMM satellite and ground-based precipitation data for predicting streamflow in Kucuk Menderes river basin, Turkey

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Satellite-based precipitation products have made a notable contribution in recent years to provide rainfall estimates over large scales and in data sparse regions. In this paper, our aim is to compare the utility of TRMM satellite-derived and ground-based rainfall measurements for predicting monthly streamflow at a catchment located in data sparse region. We use a spatially lumped hydrological model called EXP-HYDRO to simulate monthly streamflow at Kucuk Menderes river basin (3930 km2) in western Turkey. Both TRMM (3B42 Version 7) and ground gauge rainfall data are used independently as inputs to calibrate EXP-HYDRO for the 2003 to 2009 period and then to perform a validation run for the 2010 to 2012 period. Results show that the use of ground gauge rainfall data (KGE = 0.82 for calibration; KGE = 0.76 for validation) provides much better hydrological model performance than the use of TRMM data (KGE = 0.54 for calibration; KGE = -1.08 for validation). We further test whether bias correcting the TRMM rainfall data with respect to the ground gauge rainfall data provides any improvement in streamflow prediction. We find that the use of bias corrected TRMM data provides substantial improvement in streamflow prediction (KGE = 0.81 for calibration; KGE = 0.62 for validation). Results suggest that satellite rainfall data can be useful for providing streamflow predictions in data sparse catchments. However, the accuracy of streamflow predictions will most likely improve if some ground measured rainfall data is also available to bias correct the satellite measurements.