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Comparison and evaluation of satellite- and reanalysis-based precipitation products for water resources management in the Brahmaputra River basin

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The Brahmaputra River, with a transboundary basin area of approx. 554,500 km2, has its origin on the northern slope of the Himalayas in China, from where it flows through India, Bhutan and finally Bangladesh. Brahmaputra basin's climatology is heavily conditioned by precipitation during the monsoon months, concentrating about the 85 % of the rainfall in this period and originating severe and frequent floods that impact specially the Bangladeshi population in the delta region. Recent campaigns to increase the quality and to share ground-based hydro-meteorological data, in particular precipitation, within the basin have provided limited results. Global rainfall data from satellite and reanalysis may improve the temporal and spatial availability of in-situ observations for advanced water resources management.

This study aims to evaluate the applicability of several global precipitation products from satellite and re-analysis in comparison with in-situ data to quantify their added value for hydrological modeling at a basin and sub-basin scale for the Brahmaputra River. Precipitation products from CMORPH, TRMM-3B42, GsMAP, WFDEI, MSWEP and various combinations with ground-based data were evaluated at basin and sub-basin level at a daily and monthly temporal resolution. The Brahmaputra was delineated into 54 sub-basins for a more detailed evaluation of the precipitation products. The data were analysed and inter-compared for the time period from 2002 to 2010. Precipitation performance assessment was conducted including several indicators, such as probability of detection (POD), false alarm ratio (FAR), Pearson's correlation coefficient (r), bias and root mean square error (RMSE).

Preliminary results indicate high correlation and low bias and RMSE values between WFDEI, TRMM-3B42 and CMORPH precipitation and in-situ observations at a monthly time scale. Lower correlations and higher bias and RMSE values were found between GsMAP and MSWEP and ground-observed precipitation. The best performance was achieved with TRMM-3B42 precipitation.

Preliminary results also show that precipitation is better captured during monsoon season rather than in dry seasons with all the analysed precipitation products. Moreover, in the comparison at a sub-basin level, precipitation estimates are more accurate in those sub-basins located in the southern part of the Brahmaputra River basin.

These results identify the added value of satellite-based and reanalysis derived precipitation products for improving available information and water resources management in the Brahmaputra River basin.

Keywords: precipitation, earth observations, hydrological modeling, Brahmaputra River basin.