Evaluation of different rainfall products over India for the summer monsoon

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Summer rainfall over India forms an integral part of the Asian monsoon, which plays a key role in the global water cycle and climate system through coupled atmospheric and oceanic processes. Accurate prediction of Indian summer monsoon rainfall and its variability at various spatiotemporal scales are crucial for agriculture, water resources and hydroelectric-power sectors. Reliable rainfall observations are very important for verification of numerical model outputs and model development. However, high spatiotemporal variability of rainfall makes it difficult to measure adequately with ground-based instruments over a large region of various surface types from deserts to oceans. A number of multi-satellite rainfall products are available to users at different spatial and temporal scales. Each rainfall product has some advantages as well as limitations, hence it is essential to find a suitable region-specific data set among these rainfall products for a particular user application, such as water resources, agricultural modelling etc.

In this study, we examine seasonal-mean and daily rainfall datasets for monsoon model validation. First, six multi-satellite and gauge-only rainfall products were evaluated over India at seasonal scale for 27 (JJAS 1979-2005) summer monsoon seasons against gridded 0.5-degree IMD gauge-based rainfall. Various skill metrics are computed to assess the potential of these data sets in representation of large-scale monsoon rainfall at all-India and sub-regional scales. Among the gauge-only data sets, APHRODITE and GPCC appear to outperform the others whereas GPCP is better than CMAP in the merged multi-satellite category. However, there are significant differences among these data sets indicating uncertainty in the observed rainfall over this region, with important implications for the evaluation of model simulations.

At the daily scale, TRMM TMPA-3B42 is one of the best available products and is widely used for various hydro-meteorological applications. The existing version 6 (V6) products of TRMM underwent major changes and version 7 (V7) products were released in late 2012, and we compare these to the IMD daily gridded data over the 1998-2010 period. We show a clear improvement in V7 over V6 in the South Asian monsoon region using various skill metrics. Over typical monsoon rainfall zones, biases are improved by 5-10% in V7 over higher-rainfall regions. These results will help users to select appropriate rainfall product for their application. With the recent launch of the GPM Core Observatory, the release of a more advanced high-resolution multi-satellite rainfall product is expected soon.