**Supplement 1.**

**Table S1**. Applied metrics to validate precipitation products.

| Method | Equation | Unit |
|---|---|---|
| Root Mean Square Error | $RMSE = \sqrt{\frac{\sum_{i=1}^{n}(S_i - O_i)^2}{n}}$ | mm |
| Bias | $Bias = \frac{\sum_{i=1}^{n}(S_i - O_i)}{n}$ | mm |
| Relative Bias | $RB = \frac{\sum_{i=1}^{N}(S_i - O_i)}{\sum_{i=1}^{N}(O_i)} \times 100$ | percent |
| Pearson Linear Correlation Coefficient | $r = \frac{\sum_{i=1}^{n}(O_i - \bar{O})(S_i - \bar{S})}{\sqrt{\sum_{i=1}^{n}(O_i - \bar{O})^2}\sqrt{\sum_{i=1}^{n}(S_i - \bar{S})^2}}$ | – |

**Text S1.**

To examine the possible impact of land-cover type on the accuracy of satellite estimation of precipitation, we downloaded the Collection 6 MODIS Land Cover (MCD12Q1) data over the study region at the spatial resolution of 500 × 500 meters over the years from 2001 to 2018. In the first step, maps of land-cover type distribution were drawn for each year from 2001 to 2018. The visual examination of the maps showed that no significant changes in land cover type could be observed over the study period, therefore, the middle year 2008 was chosen as the reference year. Next, we masked the pixels that fall in the boundary of the study region and extracted the values of each pixel; it should be noted that each surface phenomenon is identified by a numerical code in MCD12Q1 product.

The frequency analysis shows that more than 39% of the study area is covered by Open Shrub lands followed by Grasslands (31.9%), Barren (17.15%) and Croplands (10.8%). Percentage of area of other land cover types including Savannas, Permanent Wetlands, Urban and Built-up Lands, Water Bodies were less than 0.75% and therefore were excluded from the analysis (see Table S2).

Using digital elevation model, the average altitude of each type of land cover was calculated. The results show that Grasslands areas are mainly seen at higher altitudes, followed by Open Shrub lands, Croplands cover, Urban and Built-up Lands and Barren areas.

Due to differences in the spatial resolution of satellite precipitation (0.25º × 0.25º) and land cover type data (500 × 500) we used the nearest neighbor approach and the nearest pixel of land cover type data to each of the precipitation pixels were selected to represent the land cover type of the satellite precipitation pixels.

The findings show that the lowest amount of overall relative bias of the two satellite precipitation products is observed over Grasslands areas. After that, the best performance is seen over Open Shrub lands, Croplands and Barren, respectively (see Table S2).

Interestingly, Grasslands, Open Shrub lands, Croplands and Barren are seen over the higher altitudes respectively.

It seems that there may not be a significant relationship between precipitation and the land cover type because the spatial distribution of natural land-cover depends on the climate and the climate of the study region is strongly controlled by altitude, it may be concluded that land cover has little effect on the accuracy of satellite estimates, and it is the altitude factor that play the main role.

Table S2. The percentages of land cover distribution along with satellite performance on each land cover type.

| *Name* | *Area (%)* | *Mean elevation (meter)* | *Overall relative Bias (%) of 3B42 product over different land cover types* | *Overall relative Bias (%) of 3B43 product over different land cover types* |
|---|---|---|---|---|
| Evergreen Needle leaf Forests | 0.00 | - | - | - |
| Evergreen Broad leaf Forests | 0.00 | - | - | - |
| Deciduous Needle leaf Forests | 0.00 | - | - | - |
| Deciduous Broad leaf Forests | 0.00 | - | - | - |
| Mixed Forests | 0.00 | - | - | - |
| Closed Shrub lands | 0.00 | - | - | - |
| Open Shrub lands | **39.09** | **1162.7** | **18.7** | **16.2** |
| Woody Savannas | 0.00 | - | - | - |
| Savannas | 0.05 | 82.5 | - | - |
| Grasslands | **31.90** | **1815.2** | **9.2** | **7.8** |
| Permanent Wetlands | 0.13 | 24.4 | - | - |
| Croplands | **10.80** | **904.7** | **30.0** | **33.5** |
| Urban and Built-up Lands | 0.74 | 833.8 | - | - |
| Cropland/Natural Vegetation Mosaics | 0.00 | 80.6 | - | - |
| Permanent Snow and Ice | 0.00 | - | - | - |
| Barren | **17.15** | **173.8** | **54.7** | **94.0** |
| Water Bodies | 0.14 | 81.1 | - | - |