Evaluation of New Satellite Precipitation Dataset: PDIR-Climate Data Record

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Despite the rapid advance of satellite precipitation estimation techniques, it has proved challenging to overcome the inconsistencies of historic remotely sensed data to produce climate data records of precipitation that accurately capture the variance of surface precipitation while remaining homogeneous over its record. In this study, we assess the performance of a new long-term precipitation data set produced by a satellite infrared-based algorithm called Precipitation Estimations from Remotely Sensed Information Using Artificial Neural Networks (PERSIANN) Dynamic Infrared Rain-rate (PDIR). The PDIR algorithm is run using the Gridded Satellite (GridSat-B1) infrared information as input, then the monthly accumulations of precipitation estimates are bias-corrected at the monthly scale using the Global Precipitation Climatology Project (GPCP) v2.3 monthly gridded gauge data, following the homogeneity-focused methodology of other PERSIANN-based Climate Data Records (CDR). PDIR-CDR provides precipitation estimates at 0.04◦ spatial resolution and 3-hourly temporal resolution for more than 40 years (1980-2021) over sub-polar regions (60°S-60°N). In our investigations, PDIR-CDR is compared with both widely used ground- and satellite-based precipitation products, such as Stage IV, MRMS, CMORPH, and IMERG Final Run, over the United States. Evaluations done over Hurricane Katrina (2005) and Sandy (2012) showed probability of detection rates of or greater than 0.90, false alarm ratios of less than 0.30, cumulating into a critical success index score of ~0.7, an impressive score when considering satellite quantitative precipitation estimates at fine scales. In general, PDIR-CDR shows its ability for capturing the extreme precipitation events inherent to tropical cyclones, especially those with torrential rainfall over land. Moreover, when observing the spatial patterns of the precipitation rates derived from PDIR-CDR versus high-quality Stage IV dataset, PDIR-CDR is clearly well-suited for hydroclimate extreme retrospective analysis (e.g., floods and droughts), while its high spatial resolution and long duration make it valuable for regional trend analysis.