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GPM_3IMERGDL: GPM (IMERG) Late Precipitation L3 1 day 0.1 degree x 0.1 degree V03

This dataset is the GPM Level 3 IMERG Late Daily 10 x 10 km (GPM_3IMERGDL) derived from the half-hourly GPM_3IMERGHHHL. The derived result represents a Late expedited estimate of the daily accumulated precipitation. The dataset is produced at the NASA Goddard Earth Sciences (GES) Data and Information Services Center (DISC) by simply summing the valid precipitation retrievals for the day in GPM_3IMERGHHHL and giving the result in (mm). The latency of the derived late daily product is a couple of minutes after the last granule of GPM_3IMERGHHHL for the UTC data day is received at GES DISC. Since the target latency of GPM_3IMERGHHHL is 12 hours, the daily should appear about 12 hours after the closure of the UTC day. For information on the original data (GPM_3IMERGHHHL), please see the Documentation (Related URL).

The Integrated Multi-satellite Retrievals for GPM ("IMERG") is the unified U.S. algorithm that provides the Day-1 multi-satellite precipitation product for the U.S. GPM team. The precipitation estimates from the various precipitation-relevant satellite passive microwave (PMW) sensors comprising the GPM constellation are computed using the 2014 version of the Goddard Profiling Algorithm (GPROF2014), then gridded, intercalibrated to the GPM Combined Instrument product, and combined into half-hourly 10 x 10 km fields.

These are provided to both the Climate Prediction Center (CPC) Morphing-Kalman Filter (CMORPH-KF) Lagrangian time interpolation scheme, and the Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks Cloud Classification System (PERSIANN-CCS) re-calibration scheme. In parallel, CPC assembles the zenith-angle-corrected, intercalibrated "even-odd" geo-IR fields and forward them to PPS for use in the CMORPH-KF Lagrangian time interpolation scheme and the PERSIANN-CCS computation routines.

The PERSIANN-CCS estimates are computed (supported by an asynchronous re-calibration cycle) and sent to the CMORPH-KF Lagrangian time interpolation scheme. The CMORPH-KF Lagrangian time interpolation (supported by an asynchronous KF weights updating cycle) uses the PMW and IR estimates to create half-hourly estimates.

The IMERG system is run twice in near-real time: "Early" multi-satellite product, ~4 hr after observation time, and "Late" multi-satellite product ~12 hr after observation time. After that, the IMERG system does one "Final" run, once the monthly gauge analysis is received. The "Final" satellite-gauge product has a latency of ~2 months after the observation month.

The baseline for the near real-time Late and Late half-hour estimates is to be calibrated with climatological coefficients that vary by month and location, while in the Final post-real-time run the multi-satellite half-hour estimates are adjusted so that they sum to a monthly satellite-gauge combination. In all cases the output contains multiple fields that provide information on the input data, selected intermediate fields, and estimation quality.

The following describes the derivation in more details.

The daily accumulation is derived by summing *valid* retrievals in a grid cell for the data day. Since the 0.5-hourly source data are in mm/hr, a factor of 0.5 is applied to the sum. Thus, for every grid cell we have

\[
P_{\text{daily}} = 0.5 \times \sum_i [P_i \times 1[\text{Pi valid}]], \quad i=[1,Nf]
\]

\[
P_{\text{daily} \_ \text{cnt}} = \sum [1[\text{Pi valid}]]
\]

where:

- \(P_{\text{daily}}\) - Daily accumulation (mm)
- \(P_i\) - 0.5-hourly input, in (mm/hr)
- \(Nf\) - Number of 0.5-hourly files per day, \(Nf=48\)
- \(1[.]\) - Indicator function; 1 when \(Pi\) is valid, 0 otherwise
- \(P_{\text{daily} \_ \text{cnt}}\) - Number of valid retrievals in a grid cell per day.

Grid cells for which \(P_{\text{daily} \_ \text{cnt}} = 0\), are set to fill value in the Daily files.

Note that \(Pi=0\) is a valid value.
On occasion, the 0.5-hourly source data have fill values for P in a very few grid cells. The total accumulation for such grid cells is still issued, in spite of the likelihood that this resulting accumulation has a larger uncertainty in representing the "true" daily total. These events are easily detectable using "counts" variables that contain Pdaily_cnt, whereby users can screen out any grid cells for which Pdaily_cnt less than Nf.

There are various ways the accumulated daily error could be estimated from the source 0.5-hourly error. In this release, the daily error provided in the data files is calculated as follows. First, squared 0.5-hourly errors are summed, and then square root of the sum is taken. Similarly to the precipitation, a factor of 0.5 is finally applied:

\[
Perr\textunderscore daily = 0.5 \times \{ \text{SUM}[ (Perr\textunderscore i \times 1\{Perr\textunderscore i \text{ valid}\})^2 ] \}^{0.5} , i=[1,Nf]
\]
\[
Ncnt\textunderscore err = \text{SUM}( 1\{Perr\textunderscore i \text{ valid}\} )
\]

where:

\(Perr\textunderscore daily\) - Magnitude of the daily accumulated error power, (mm)

\(Ncnt\textunderscore err\) - The counts for the error variable

Thus computed \(Perr\textunderscore daily\) represents the worst case scenario that assumes the error in the 0.5-hourly source data, which is given in mm/hr, is accumulating within the 0.5-hourly period of the source data and then during the day. These values, however, can easily be converted to root mean square error estimate of the rainfall rate:

\[
rms\textunderscore err = \{ (Perr\textunderscore daily/0.5)^2 / Ncnt\textunderscore err \}^{0.5} \text{ (mm/hr)}
\]

This estimate assumes that the error given in the 0.5-hourly files is representative of the error of the rainfall rate (mm/hr) within the 0.5-hour window of the files, and it is random throughout the day. Note, this should be interpreted as the error of the rainfall rate (mm/hr) for the day, not the daily accumulation.

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To cite the data in publications:
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