July 3, 2023

Release note for GPM Global Rainfall Map (GPM-GSMaP)

The GPM Global Rainfall Map (GPM-GSMaP) Level 3 product version 05A (Algorithm version 8) was released to the public since December 1, 2021. However, because of some reasons, the GPM-GSMaP Level 3 product version 05B was released to the public since July 3, 2023.

Updates from version 05A to version 05B

- Updated ancillary snow cover and sea ice data inputted into the GSMaP (AUTOSNOW, developed by NOAA/NESDIS).
- Adding NOAA-21 ATMS

Update from version 04 (Algorithm version 7) to version 05A (Algorithm version 8) are following.

A. Passive microwave (PMW) algorithm
   1. Improvement of PMW retrieval technique
      - Adding MHS (Metop-C) and ATMS (Suomi-NPP/ATMS, NOAA-20/ATMS)
      - Update L1 data (TMI, AMSR-E) and decoding tool (AAPP)
      - Retrievals extended to the pole-to-pole (PMW only)
      - Application of dynamic land/ocean classification for all PMW sensors
      - PMW retrieval algorithm considering frozen precipitation depth and static stability in low-level troposphere
      - PMW retrieval for low temperature conditions using scattering signature
      - Implementation of fake precipitation screening due to sea ice, snow etc. over Greenland and Hudson Bay
      - Improvement of snowfall retrievals
      - Improvement of MWS algorithms (Precipitation detection for coastal region etc.)
      - Improvement of rainfall detection method over ocean (implementation of correction method for brightness temperature for rain-free areas)
   2. Improvement of heavy orographic rainfall retrievals considering static stability in low-level troposphere
   3. Update of Database
      - Precipitation profile database (5-year DPR(MS) 06A, algorithm update)
      - Precipitation/no-precipitation classification (5-year KuPR & GMI combined)
      - Surface emissivity (adding TELSEM database outside of PR observation)
      - Change AUTOSNOW format

B. Implementation of Normalization module for PMW retrievals

C. PMW-IR Combined algorithm
   1. Improvement of MVK algorithm

2. Implementation of histogram matching method

D. Gauge-adjustment algorithm

1. Improvement of the gauge-calibrated method
2. Mitigation of artificial patterns appeared in V04

E. Data format

Adding new variables

3GSMAPH: reliability flag, surface type, and orographic rain flag

3GSMAPM: orographic rain ratio

F. Others

Minor bug fix

For details, following URLs can be helpful for your reference.

http://www.eorc.jaxa.jp/GPM/doc/product_info/release_note_gsmapv05-v8_en.pdf

(For the Japanese)

http://www.eorc.jaxa.jp/GPM/doc/product_info/release_note_gsmapv05-v8_ja.pdf

Followings are remarks and known bugs in current version of GPM-GSMaP product to be fixed in future versions.

Remaining problems

A. Retrieval issues

1. The PMW algorithm introduced in the V05 product overestimates the amount of precipitation for heavy precipitation such as typhoons and convective precipitation, and also confirms that weak precipitation is generally difficult to be detected in MWS. Misidentifying snow or sea ice as precipitation signals has been issued in the V04 product, but this issue has not been fully solved in the V05 product; the extension to the polar regions and the introduction of precipitation and snowfall estimation in low temperature regions make false strong precipitation more apparent, especially in the winter hemisphere. Users should be cautious of estimations over the cold surface (in particular, below 273.2 K).
2. The use of static stability in low-level troposphere as a condition for determining topographic precipitation has made it possible to identify orographic heavy precipitation in inland areas and areas where convective precipitation is dominant. However, overestimation and false-positive of orographic rainfall remain. We examine to resolve this issue.
3. The MMN module introduced in the V05 product largely affects the accuracy after precipitation correction due to the amount and bias of sampling of each sensor. For example, if there is a missing period and the number of missed rainfall cases is large, the average rainfall is likely to deviate from the true value, resulting in an incorrect value. In addition, the MMN algorithm is not able to change no rainfall to rainfall presence. Improvements in rain/no-rain classification method and the brightness temperature correction method are required.
4. The precipitation estimation of gauge-calibrated hourly rainfall product (GSMaP_Gauge) depends on a large

part on the Climate Prediction Center (CPC) Unified Gauge-Based Analysis of Global Daily Precipitation data sets provided by NOAA. If the CPC data sets have good estimation of precipitation in a region, the GSMaP_Gauge data sets also will show good scores in the region. However, in case the CPC data sets under or overestimate the rain fall rate seriously or miss the rainfall event, the GSMaP_Gauge product also estimates or misses the precipitation in a similar manner as the CPC data sets. Note that the CPC data sets and hence the GSMaP_Gauge data do not always show accurate estimation particularly over less dense gauge region.

5. Although the GSMaP_Gauge_NRT is a near real time version of the GSMaP_Gauge, the products do not use the gauge measurement directly. Since the global gauge measurement takes much time to collect and process the data from all over the world, the gauge data is not available in near real time. Hence, in the GSMaP_Gauge_NRT product, only the error parameters derived from the GSMaP_Gauge are used to adjust the GSMaP_NRT estimation, which is named as the GSMaP_Gague_NRT. We would like to know evaluation and validation results of this product for improvement. We appreciate if you give us some feedback.

B. Calibration issues

6. Brightness temperatures used in rainfall retrievals of GCOM-W/AMSR2 and GPM-Core/GMI are bias-corrected using parameters provided by JAXA. These parameters may be modified in future when calibration of each Level 1B data is updated.