Research of Precipitation Measuring Mission

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Abstract

Calculation of the global rainfall map derived from Tropical Rainfall Measuring Mission (TRMM) during a period from 2000 to 2014 using the GSMaP algorithm (V07).

Checks of consistency between the TRMM Precipitation Radar (PR) algorithm (V8) and the GPM/DPR algorithm (V06) with long-term observation data.

Ref. URL: https://www.eorc.jaxa.jp/TRMM/index_e.htm

Reasons and benefits of using JAXA Supercomputer System

The JSS2 is necessary for calculation of the long-term data which consists of multiple satellites and sensors for the precipitation measurement with earlier computational times for algorithm evaluations, improvements, and long-term production. Because of the complexity of the processing algorithms, strict business progress management, emergency response, detailed user response by the operation side, etc. are required. When we do not use the JSS2, it can be said that reprocessing in a short period cannot be achieved.

Achievements of the Year

GSMaP validation test was performed to evaluate the algorithm for the GSMaP major versionup scheduled in 2020. A series of GSMaP modules such as forward calculation, retrieval, and gridding part are executed for a total of eight months data, and the difference and validity of the estimated rainfall before and after the replacement of the database and algorithm for orographic/nonorographic rainfall classification scheme.

In some tests, significant overestimation was observed under orographic rainfall detection area or in some areas (Fig. 1) due to insufficient DB samples for GPM/DPR, and due to the value of hail density which is largely depended on the estimated precipitation. After the replacement of DB for TRMM/PR and dynamic value of hail density based on freezing precipitation depth, the rain estimation is improved (Fig. 2).

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In JSS2, processing time was shortened by executing parallel processing, which led to acceleration of the development cycle.

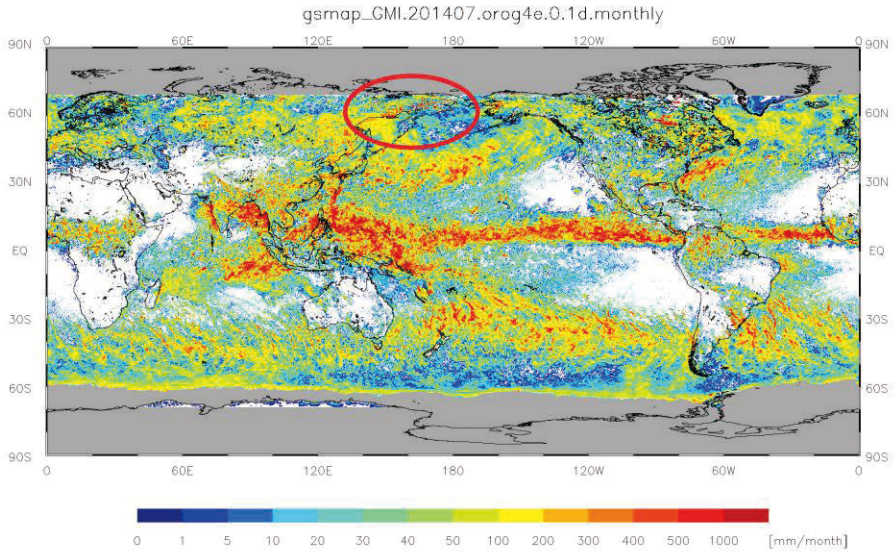

Fig. 1: Monthly mean rainfall in July 2014. Database for orographic/nonorographic rainfall classificat ion sheme is 5 years of GPM/DPR data. Precipitation in Chukchi region in Russia (red circle) and some areas of the middle- and high-latitudes is significantly overestimated.

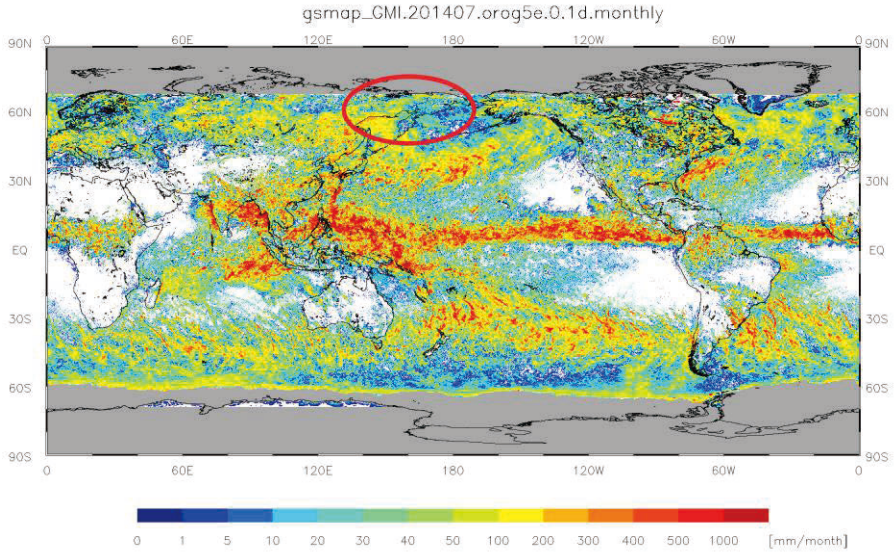

Fig. 2: The same as Caption 1 but for database for orographic/nonorographic rainfall classification sheme is 11 years of TRMM/PR data.

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Publications

- Peer-reviewed papers

1. M. Yamaji, H. G. Takahashi, T. Kubota, R. Oki, A. Hamada, and Y. N. Takayabu, 2020: 4-year Climatology of Global Drop Size Distribution and its Seasonal Variability Observed by Spaceborne Dual-frequency Precipitation Radar, JMSJ, in revision.

2. Y. You, N.-Y. Wang, T. Kubota, K. Aonashi, S. Shige, K. Kachi, C. Kummerow, D. Randel, R. Ferraro, S. Braun, Y. Takayabu, Comparison of TRMM Microwave Imager Rainfall Datasets from NASA and JAXA, JHM, in press.

3. T. Kubota, K. Aonashi, T. Ushio, S. Shige, Y. N. Takayabu, M. Kachi, Y. Arai, T. Tashima, T. Masaki, N. Kawamoto, T. Mega, M. K. Yamamoto, A. Hamada, M. Yamaji, G. Liu and R. Oki, 2020: Global Satellite Mapping of Precipitation (GSMaP) products in the GPM era, Satellite precipitation measurement, Springer, in press.

4. T. Mega, T. Ushio, T. Matsuda, T. Kubota, M. Kachi and R. Oki, 2019: Gauge-Adjusted Global Satellite Mapping of Precipitation, IEEE Trans. Geosci. Remote Sens, vol. 57, no. 4, pp. 1928-1935, doi: 10.1109/TGRS.2018.2870199.

- Non peer-reviewed papers

1. Kuleshov, Y., Kubota, T., Tashima,T., Xie, P., Kurino, T., Hechler, P., Alexander, L.V., 2020: WMO Space-based Weather and Climate Extremes Monitoring Demonstration Project for East Asia and Western Pacific, WMO Bulletin, in press.

2. Yuriy Kuleshov, Lynette Bettio, Takuji Kubota, Tomoko Tashima, Pingping Xie, Toshiyuki Kurino, Peer Hechler, 2020: Drought monitoring in Australia: utilizing products from the WMO Space-based Weather and Climate Extremes Monitoring Demonstration Project, WMO Statement on theState of the Global Climate in 2019, in press.

3. T. Kubota, 2020: GSMaP: Monitoring Rainfall from Space to Protect Communities, Scientia, https://doi.org/10.33548/SCIENTIA392

4. Y. Kuleshov, K. Inape, A. B. Watkins, A. Bear-Crozier, Z.-W. Chua, P. Xie, T. Kubota, T. Tashima, R. Stefanski, T. Kurino, 2019. Climate Risk and Early Warning Systems (CREWS) for Papua New Guinea. IntechOpen, DOI: 10.5772/intechopen.85962.

5. Y. Kuleshov, T. Kurino, T. Kubota, T. Tashima, P. Xie, 2019. WMO Space-based Weather and Climate Extremes Monitoring Demonstration Project (SEMDP): First outcomes of regional cooperation on drought and heavy precipitation monitoring for Australia and South-East Asia. IntechOpen, DOI: 10.5772/intechopen.85824

- Oral Presentations

1. Yamaji, M. R. Oki, T. Kubota, T. Tashima, Y. Kaneko, K. Yamamoto, T. Iguchi, N. Takahashi, and Y. N. Takayabu. 2019: Recent results of the Global Precipitation Measurement (GPM) mission in Japan. EGU2019-3903, EGU General Assembly 2019, April 2019, Vienna, Austria.

2. Yamaji, M. et al. 2019: JAXA Earth Observation Program and Data Product. CGMS-47 Working Group II session, agenda item 9, May 2019, Sochi, Russia.

3. T. Kubota et al., Precipitation Extremes Monitoring Using Global Satellite Mapping of Precipitation (GSMaP) product, JpGU Meeting 2019, May 2019, Makuhari-Messe, Chiba.

4. Tashima, T., T. Kubota, and R. Oki. 2019: Precipitation Extremes Monitoring Using GSMaP Products. 32nd ISTS symposium, June 2019, Fukui, Japan.

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5. Yamaji, M. and T, Kubota. 2019: Impact Study on the Accuracy of Global Satellite Mapping of Precipitation (GSMaP) Caused by Future Small Precipitation Radar Constellation. 32nd ISTS symposium, June 2019, Fukui, Japan.
6. M. Yamaji, T. Kubota, and R. Oki. 2019: OBSERVING SYSTEM SIMULATION EXPERIMENT ON THE ACCURACY OF GLOBAL SATELLITE MAPPING OF PRECIPITATION (GSMAP) BY FUTURE SMALL PRECIPITATION RADAR CONSTELLATION. WE2.R2.4, IGARSS 2019, July 2019, Yokohama, Japan.
7. T. Tashima, T. Kubota, and R. Oki. 2019: Precipitation Extremes Monitoring Using Global Satellite Mapping of Precipitation (GSMaP) Products. IGARSS 2019, July 2019, Yokohama, Japan.
8. T. Kubota et al. Recent Status of the Global Precipitation Measurement (GPM) Mission in Japan, AOGS 2019@Singapore on Aug. 2019
9. Kubota, T., 2019JAXA GSMaP & Applications Status, NASA PMM Science Team Meeting 2019, Indianapolis, U.S.
10. Yamaji, M. et al. 2019: Application of Global Satellite Mapping of Precipitation (GSMaP) in Asia-Pacific region. APRSAF Space Application Working Group, Nov 2019, Nagoya, Japan.

- Poster Presentations
1. Yamaji, M. et al. 2019: JAXA Earth Observation Program and Data Product. CGMS-47 Working Group II session, agenda item 9, May 2019, Sochi, Russia.
2. Yamaji, M., H. G. Takahashi, T. Kubota, R. Oki, A. Hamada, and Y. N. Takayabu. 2019: Gloal Drop Size Distribution observed by GPM/DPR. Poster1-01, 39th International Conference on Radar Meteorology, Sep. 2019, Nara, Japan.
3. Yamaji, M., H. G. Takahashi, T. Kubota, R. Oki, A. Hamada, and Y. N. Takayabu. 2019: Global Drop Size Distribution in Liquid Phase and its Seasonal Variability Observed by GPM/DPR. #217, NASA PMM Science Team Meeting 2019, Indianapolis, U.S.

- Web
JAXA Global Rainfall watch
https://sharaku.eorc.jaxa.jp/GSMaP/index.htm
EORC TRMM
https://www.eorc.jaxa.jp/TRMM/index_e.htm

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Usage of JSS2

Computational Information

Process Parallelization Methods	N/A
Thread Parallelization Methods	N/A
Number of Processes	1
Elapsed Time per Case	24 Hour(s)

Resources Used

Fraction of Usage in Total Resources[*1](%): 0.03

Details

Computational Resources		
System Name	Amount of Core Time (core x hours)	Fraction of Usage[*2](%)
SORA-MA	0.00	0.00
SORA-PP	21,193.57	0.14
SORA-LM	43.20	0.02
SORA-TPP	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage*2(%)
/home	60.40	0.05
/data	71,147.32	1.22
/ltmp	10,904.95	0.93

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage*2(%)
J-SPACE	23.54	0.59

[*1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.

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