JAXA GPM status

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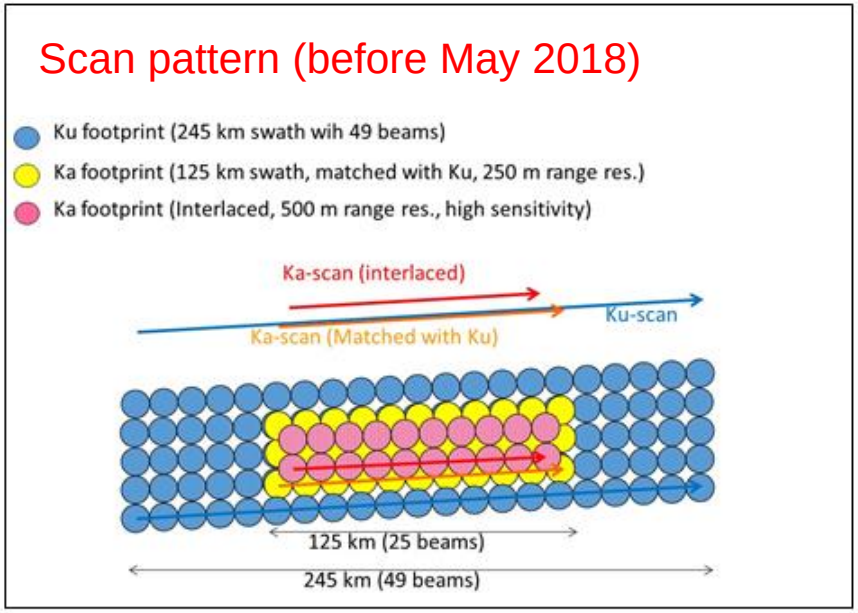
Joint PI Meeting of Global Environment Observation Mission FY2021
20th Jan. 2022

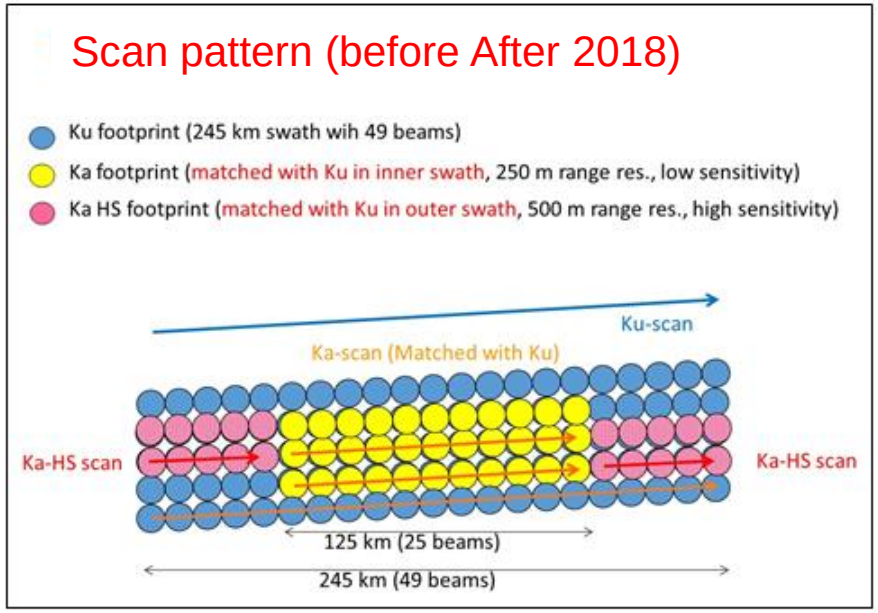
GPM/DPR Sensor Status

Global Precipitation Measurement (GPM) is now operated in the extended mission phase.
All data collection including JAXA's Dual-frequency Precipitation Radar (DPR) is nominal and instruments are in good condition.

- GPM/DPR instrument is now working well, although it experienced anomalies in April-May 2020.
  - DPR anomaly events that occurred between April and May 2020 are summarized below.
    - 22 April 2020, 2 May 2020, 20 May 2020
  - JAXA judged these occurred due to transient events such as single event upset (SEU), which caused some temporal problems of a memory in the DPR instruments.
  - Since 20 May 2020, there have been no similar events. JAXA continues to monitor the DPR status.

In Dec. 2021, JAXA and NASA started to release the DPR V07, corresponding to the KaPR scan pattern change.





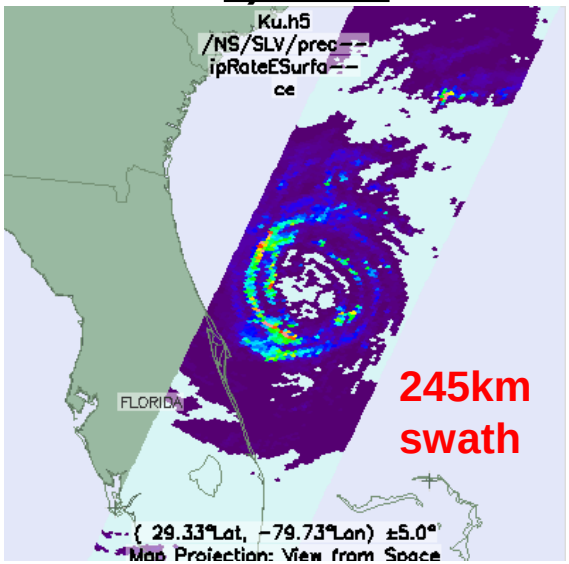
- By the scan pattern change in May 2018, dual-frequency technique can be applied in a full swath, which can enable us more accurate estimates.
- In June. 2020, JAXA and NASA started to release the DPR V06X (experimental product), corresponding to the scan pattern change.
  - In V06X, DPR observation data only after May 2018 were reprocessed.
- In Dec. 2021, JAXA and NASA started to release the DPR V07 (standard product).
  - V07 is the first standard product, corresponding to the scan pattern change. V07 will be reprocessed in all GPM/DPR observations.

In Dec. 2021, JAXA and NASA started to release the DPR V07, corresponding to the KaPR scan pattern change.

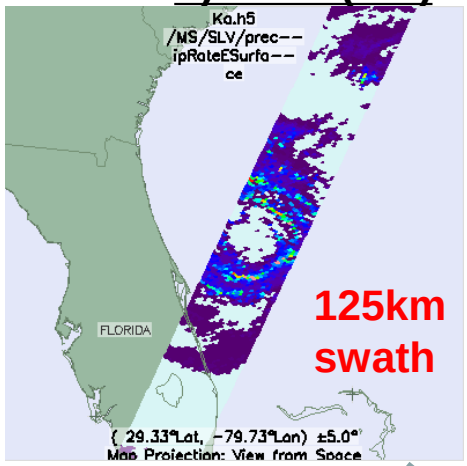
Color in Figures: DPR L2 surface precipitation rate

[mm/h]

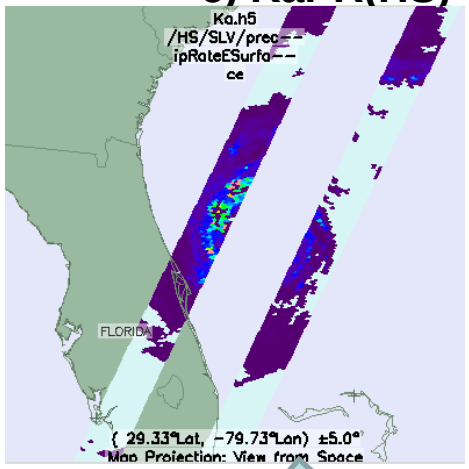
a) KuPR

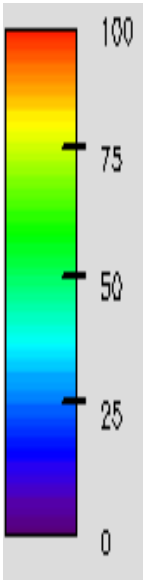


b) KaPR(MS)

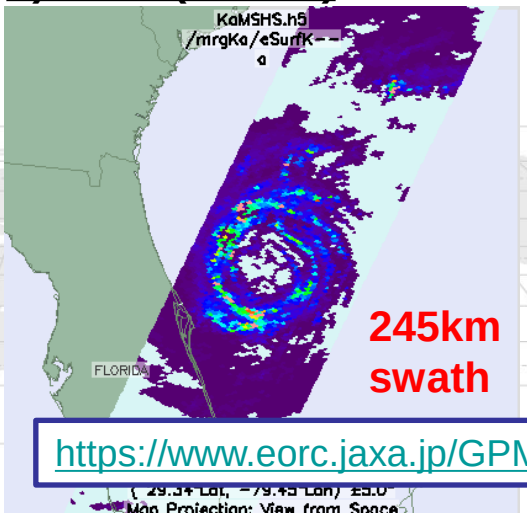


c) KaPR(HS)





d) KaPR(MS/HS)



Hurricane Dorian

2019/09/04 10:35(UTC)

Dual-frequency technique can be applied in a full swath, which can enable us more accurate estimates in the full swath since May 2018.

https://www.eorc.jaxa.jp/GPM/en/index.html

GSMaP (Global Satellite Mapping of Precipitation) updates

https://sharaku.eorc.jaxa.jp/GSMaP/index.htm

- GSMaP conducted the major update in Dec. 2021.

Date	Product version	Algorithm Version
Sep. 2014	V03	v6
Jan. 2017	V04	v7
Dec. 2021	**V05**	**v8**

  - A review paper of GPM-GSMaP V03 & V04: Kubota et al. (2020), https://doi.org/10.1007/978-3-030-24568-9_20

- Standard/NRT versions of GPM-GSMaP V05 (algorithm version 8) were released in 1st Dec. 2021.
  - https://www.eorc.jaxa.jp/GPM/doc/product_info/release_note_gsmapv05-v8_en.pdf
  - We plan the reprocessing of the GSMaP standard version in a period during the past 24 years since Jan. 1998.
    - We expect the reprocessing will be completed by September 2022.

Improvements in GPM-GSMaP V05

- Implementation of histogram matching method by Hirose et al. (2021) leaded to the mitigation of biases due to sensor differences.

Histogram matching method

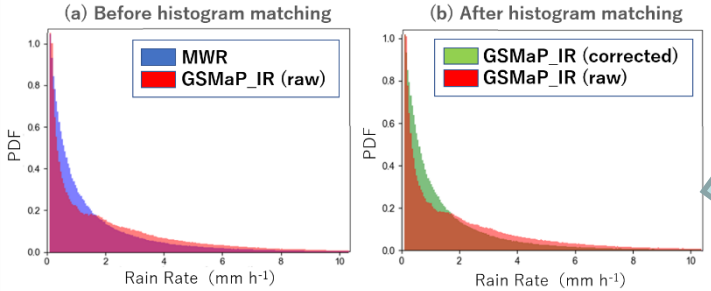


Fig. 1: (a) A rain rate histogram of MWR is shown in blue PDF and that of GSMaP_IR is shown in red PDF. (b) Same as (a), but green PDF shows a rain rate histogram of GSMaP_IR after applying histogram matching.

Mitigations of spatial gaps between PMW and IR retrievals

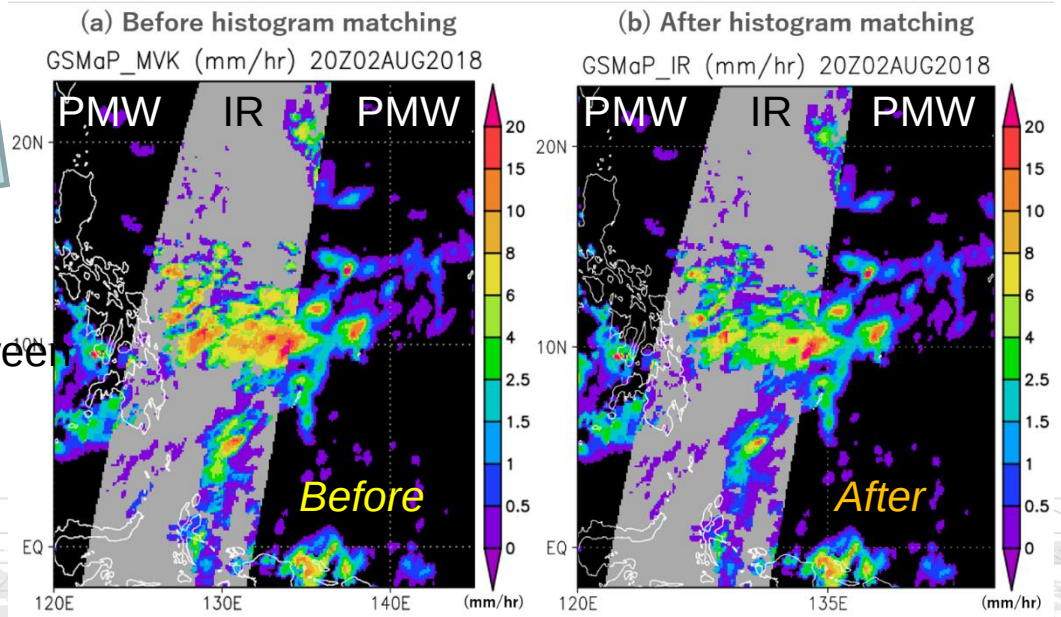


Fig. 3: (a) Snapshot of GSMaP_MVK, black areas are observed by MWR and gray areas are interpolated by GEO IR. (b) same as (a), but histogram correction has been applied.

Mitigations of zonally averaged biases between PMW and IR retrievals

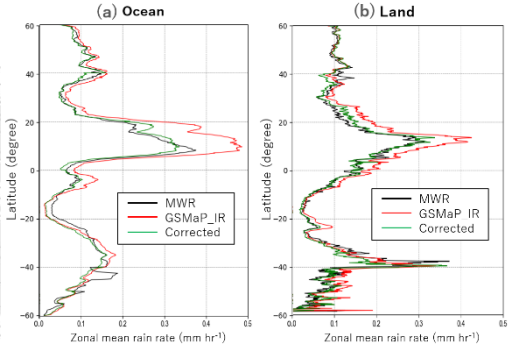


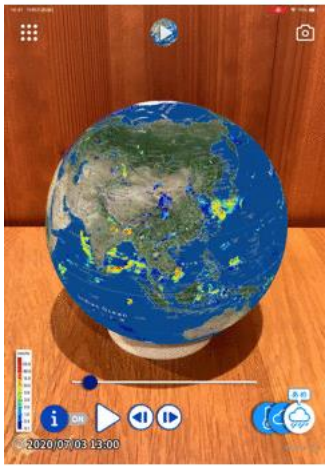
Fig. 6: Zonal mean rain rate (a) over ocean, (b) over land. Black lines show MWR reuslts, red lines show GSMaP_IR results and green lines show those after applying histogram matching.

Hirose et al., 2021: Histogram Matching to Improve Homogeneity in Satellite Merged Precipitation Products, *IEEE GRSL*, *accepted*.

Outreach activities using GSMaP

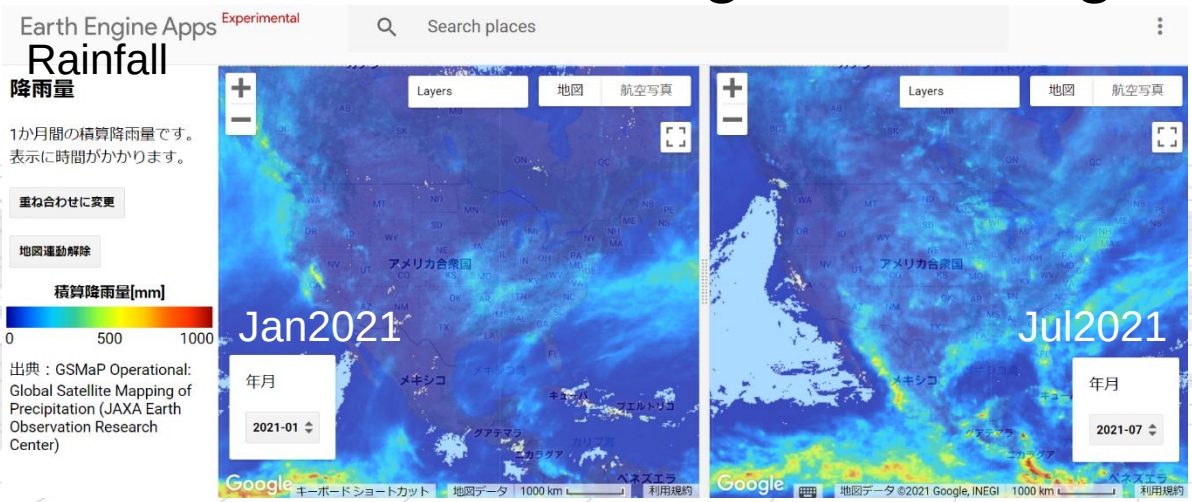
Augmented Reality (AR) globe using the GSMaP

https://earthball.1101.com/en/



A Japanese private company (HOBONICHI) uses GSMaP realtime rainfall image to show the Earth's current status on the AR globe.
When you view its Globe with a smartphone or tablet, you can see the Earth's current status, including GSMaP rainfall.

GSMaP on Google Earth Engine for education

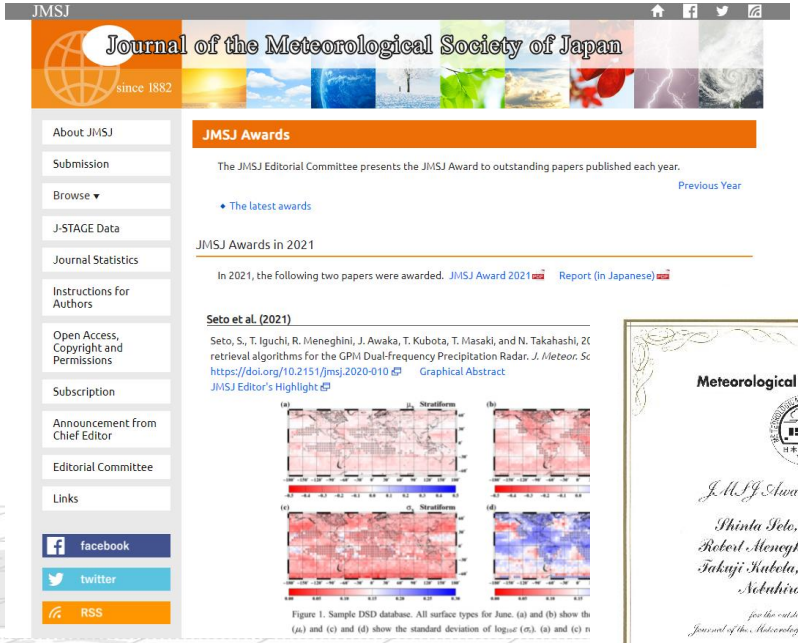


In Japan's GIGA School Program, each elementary school student uses each one PC to learn ICT skills.
JAXA provides GEE apps using monthly GSMaP rainfall data to support the study of global rainfall climatology.

https://gakkoushien.users.earthengine.app/view/rainfallr2

Special Edition on
"Global Precipitation Measurement (GPM): 5th Anniversary"
in Journal of the Meteorological Society of Japan (JMSJ)

- GPM Special Edition in Journal of the Meteorological Society of Japan (JMSJ).
- You can see 30 papers from the following URL.
  - http://jmsj.metsoc.jp/special_issues_editions/GPM.html



Seto et al. (2021) for precipitation rate retrieval algorithms of the GPM/DPR got **JMSJ Awards in 2021** (announced in Dec. 2021)

Announcement of JMSJ Awards in 2021
http://jmsj.metsoc.jp/awards/index.html
https://www.metsoc.jp/about/awards/jmsj-recipients

Seto, S., T. Iguchi, R. Meneghini, J. Awaka, T. Kubota, T. Masaki, and N. Takahashi, 2021: The Precipitation rate retrieval algorithms for the GPM Dual-frequency Precipitation Radar.
J. Meteor. Soc. Japan, 99, 205-237.
https://doi.org/10.2151/jmsj.2021-011

Next Generation Precipitation Radar studied in JAXA

JAXA Mission Definition Review (MDR) for the Next Generation Precipitation Radar satellite was completed in August 2021.
The review board confirmed the validity of mission value as follows:

- **Mission Value: As a successor of GPM/DPR, the JAXA mission with a spacecraft carrying Ku-band Doppler radar is valuable** in ;
  1. Elucidation of global water cycle parameters and understanding of cloud-precipitation processes,
  2. Contribution to enhancement of weather and disaster management,
  3. Provision of long-term information on water resources infrastructure contributing to global-scale climate and water issues
- **Participation to the inclined orbit of the NASA ACCP mission enhances the mission value for improving weather/climate models in the context of international collaboration.**

→ "宇宙基本計画 工程表（令和3年12月28日 宇宙開発戦略本部決定)" noting the Precipitation Radar Satellite development research was release in 28th Dec. 2021 from Cabinet Office of the Japanese government.
→Precipitation Measuring Mission (PMM) Pre-Project Team (Project manager: Mr. Kinji Furukawa) was established on January 1, 2022, for the JAXA Spacecraft carrying the Ku-band Doppler Precipitation Radar in the AOS (formerly, ACCP).

Summary

- GPM is now operated in the extended mission phase, and GPM/DPR instrument is now working well.
- DPR products V07 and GSMaP V05 (algorithm version v8) were released in Dec. 2021.
- GPM-related news
  - Outreach activities using GSMaP
  - GPM 5th Anniversary special edition in JMSJ
- Next Generation Precipitation Radar satellite studied in JAXA