GSMaP

GLOBAL SATELLITE MAPPING OF PRECIPITATION

Global Satellite Mapping of Precipitation (GSMaP) Product in the GPM Era

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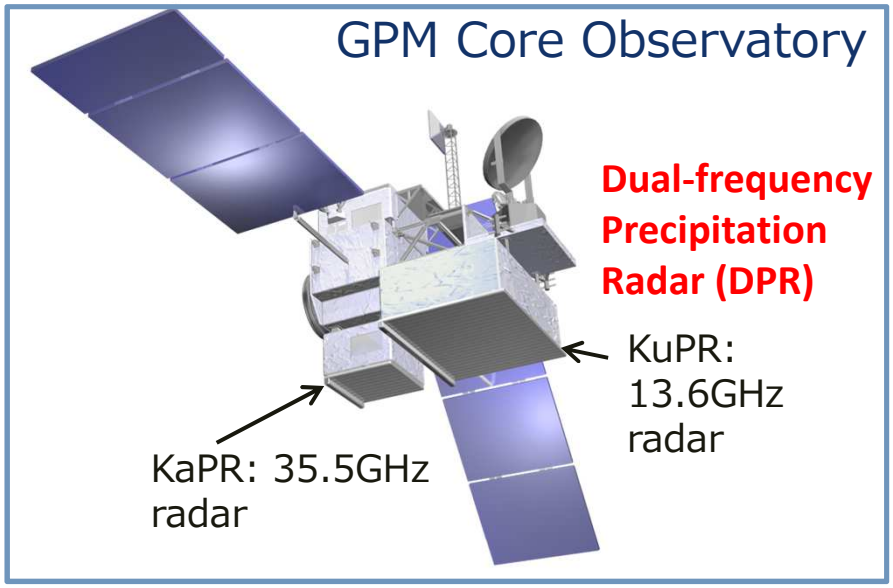
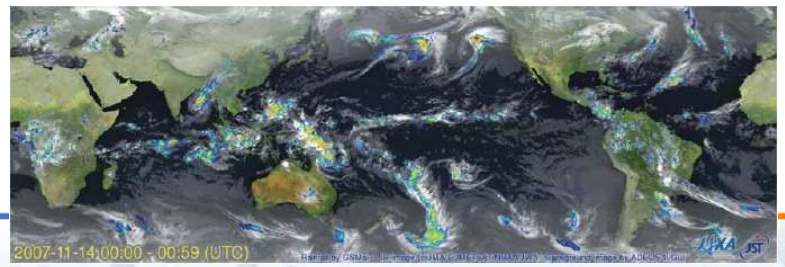
JAXA

Global Precipitation Measurement (GPM)

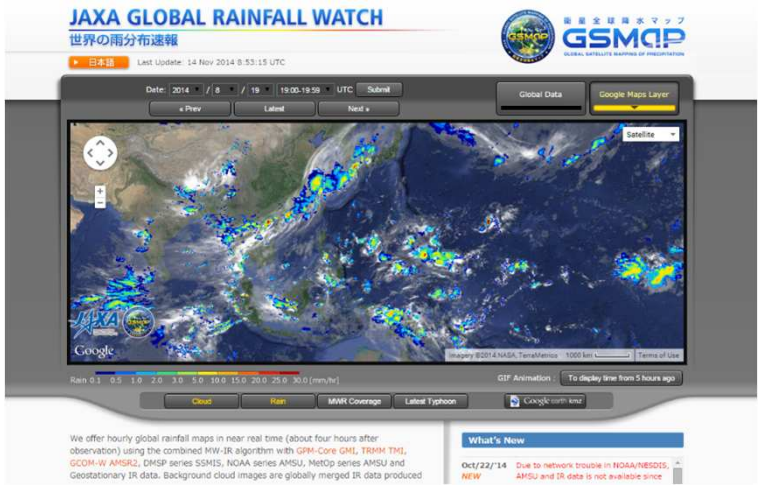


- International mission consisting of the GPM Core Observatory and Constellation Satellites for high accurate and frequent global precipitation observation
  - Core Observatory: developed under NASA and JAXA equal partnership.
    - Dual-frequency Precipitation Radar (DPR) developed by JAXA and NICT
    - GPM Microwave Imager (GMI) developed by NASA
  - Constellation satellites: provided by international partners.
- GPM Core Observatory was successfully launched on 28 Feb. 2014 (JST).



Global Satellite Mapping of Precipitation (GSMaP)

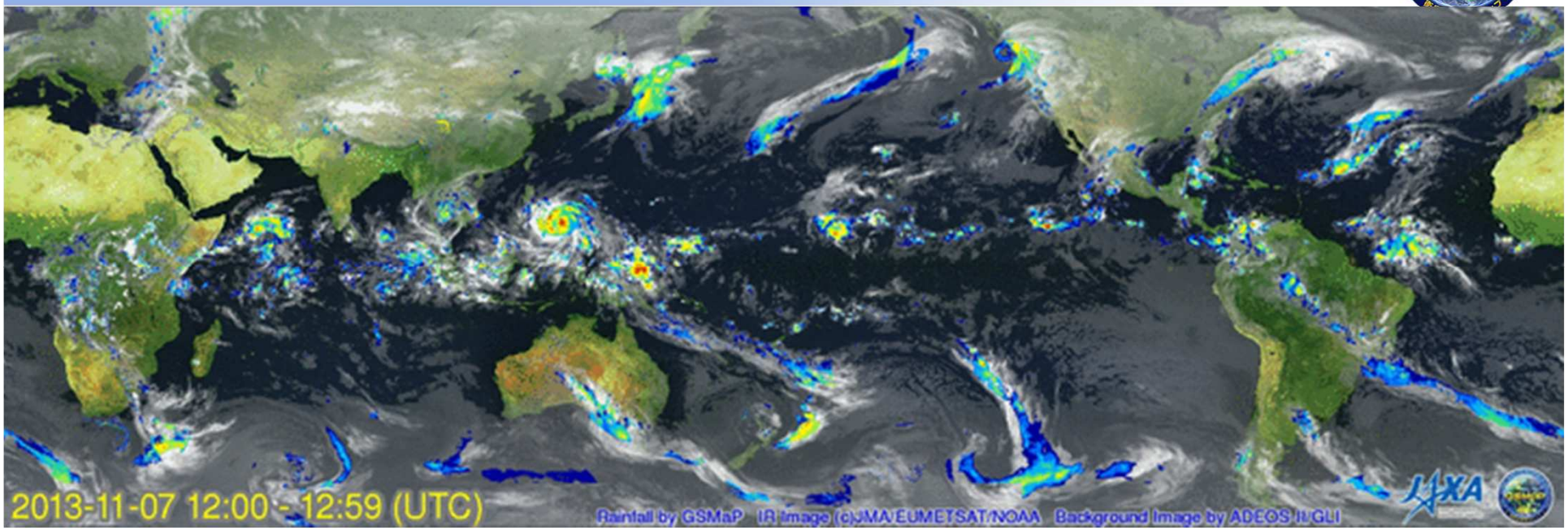
- Developed in Japan toward the GPM mission.
- About 1000 registered users (Sep 2014 statistics)
- Processed and distributed in near real time basis (about 4-hour after observations) **by merging multi-satellite data**.
- **Hourly product in 0.1x0.1deg. lat/lon grid**.
- Proto-type version has been in operation in JAXA since 2007.
  → **"GPM-GSMaP" data were released on Sep. 2014.**
  - The data during Mar.2014 to the current are available now (we have a plan of reprocessing since 2000).



GPM-GSMaP data is now available from JAXA G-portal (https://www.gportal.jaxa.jp) as well as current GSMaP web site (http://sharaku.eorc.jaxa.jp/GSMaP/).

http://sharaku.eorc.jaxa.jp/GSMaP/

GSMaP (Global Satellite Mapping of Precipitation)



Typhoon Haiyan: Nov. 3 – 11, 2013 (Big impact in Philippine)

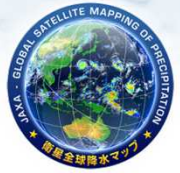
Rain 0.1 0.5 1.0 2.0 3.0 5.0 10.0 15.0 20.0 25.0 30.0 [mm/hr]

- Global rainfall map merging GPM, GCOM-W and other satellite information
  - ✓ Available 4-hour after observation, hourly update
  - ✓ 0.1-degree latitude/longitude grid
- GSMaP contribute to flood forecast and early warning in poorly-gauged river basins.

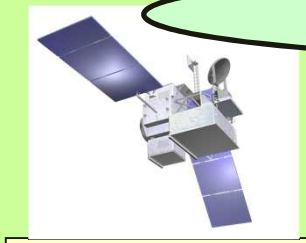
JAXA

http://sharaku.eorc.jaxa.jp/GSMaP/

Overview of GSMaP Algorithm



Microwave Imager / Sounder



GPM Core GMI

GCOM-W1 AMSR2

DMSP SSM/I, SSMIS

NOAA/MetOp AMSU (sounder)

Good: high-frequent (wide swath, multi-satellites)
Bad: cannot measure vertical structure (need info. from radar)

GPM era

GSMaP Microwave Radiometer Algorithms

Precipitation Radar

TRMM PR

Rainfall Data Base

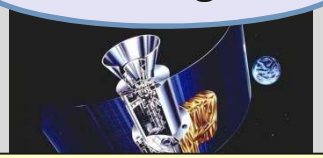
Rainfall Data from each Microwave Radiometer

Merged Microwave Rainfall Data

Good: can observe vertical structure.
Bad: there are not many.

(Okamoto et al. 2005, Kubota et al, 2007, Aonashi et al. 2009, Ushio et al. 2009, Shige et al. 2009, Kachi et al. 2011, Mega et al., 2014, etc.)

IR Imager



Geostationary Satellites

Microwave-IR Merged Algorithm (CMV, K/F)

GSMaP_MVK (satellite-only)
GSMaP_Gauge
(0.1x0.1 deg. box, Hourly)

A movie of GPM-GSMaP in early June 2014 (Rainy season in Japan)

GPM-GSMaP Product list

Standard product (Latency: 3 days)

Product name	Variables	Horizontal resolution	Temporal resolution	Latency	Correction
L3 GSMaP Hourly	Hourly Precip Rate (**GSMaP_MVK**)	0.1×0.1deg. lat/lon	1 hour	3 days	None
	Gauge-corrected Hourly Precip Rate corrected by gauge (**GSMaP_Gauge**)				Corrected by daily rain gauges (NOAA CPC Gauge-Based Analysis, Chen et al. 2008)

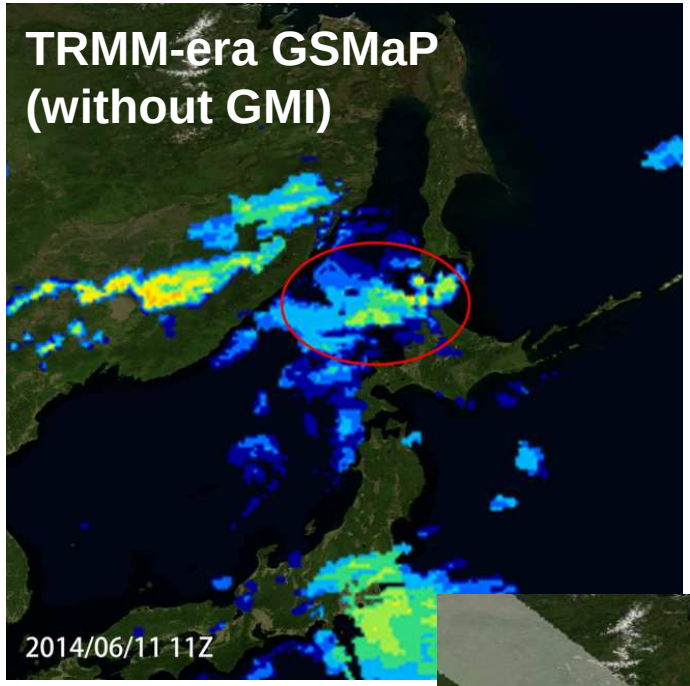
Near-real-time product (Latency: 4 hours)

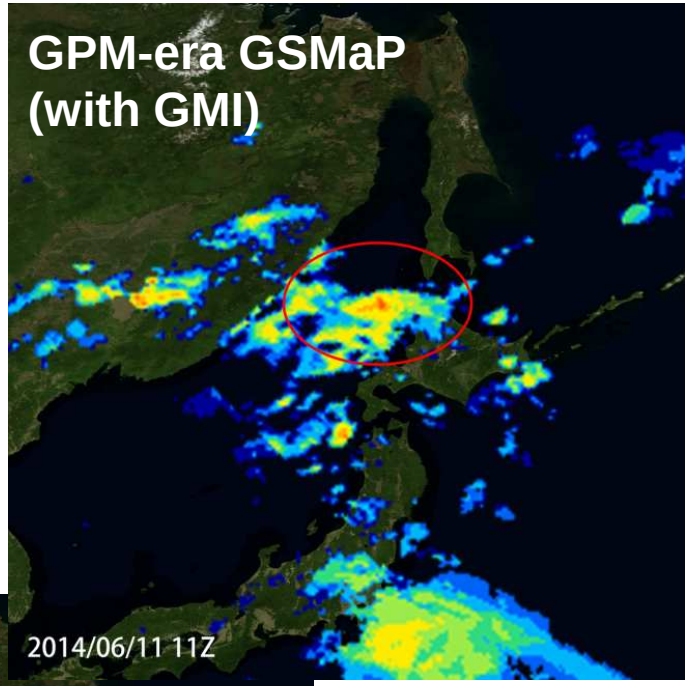
Product name	Variables	Horizontal resolution	Temporal resolution	Latency	Correction
L3R GSMaP Hourly	Hourly Precip Rate (**GSMaP_NRT**)	0.1×0.1deg. lat/lon	1 hour	4 hours	None
	Gauge-corrected Hourly Precip Rate corrected by gauge (GSMaP_Gauge_NRT)				Correction by empirical coefficients

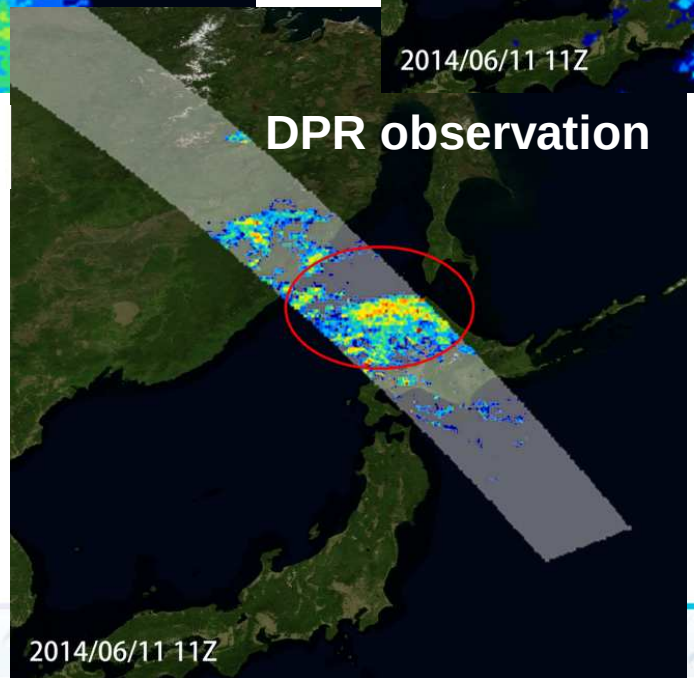
Improvements in GPM-GSMaP

- Main features of “GPM-era GSMaP”(GPM-GSMaP)
  - **GMI** which can observe 70N-70S area is installed.
  - Intercalibrated microwave radiometer data (L1c) by NASA is used.
  - **Gauge-calibrated** GSMaP algorithm (Mega *et al., Osaka Univ.*) is operated as one of standard outputs (*3-day-after*).
- Update of GSMaP algorithms
  - Improvements in microwave imager algorithm based on AMSR2 precipitation standard algorithm, including new land algorithm, new coast detection scheme, etc. (*Aonashi, MRI/JMA*)
  - Development of orographic rainfall correction method for warm rainfall in coastal area (*Shige and Yamamoto, Kyoto Univ.*)
  - Update of database such as, land surface emission database developed by Japanese DPR/GMI combined team (Furuzawa *and Masunaga, Nagoya Univ.*), etc.
  - Development of microwave sounder algorithm over land

Addition of GMI in the GSMaP



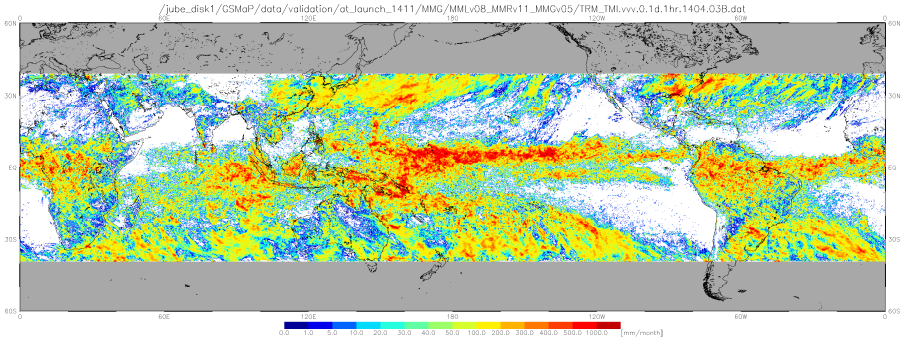




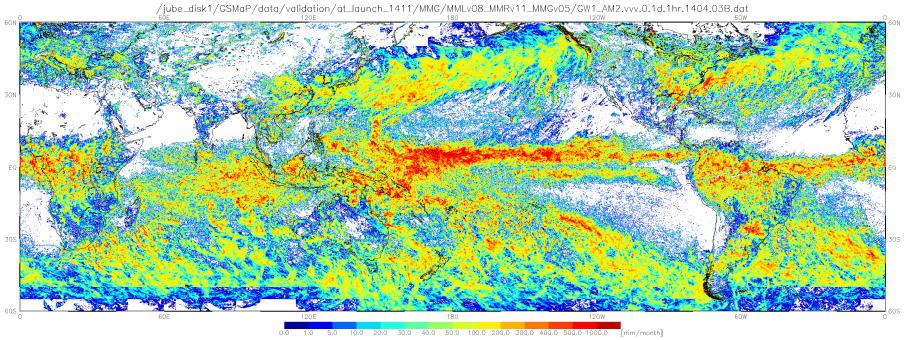
Addition of GMI brought result that rainfall area, which was previously estimated by using geostationary IR information, is observed correctly.

GPM-GSMaP MWR Retrievals: Apr. 2014
(Version 03B.EORC)

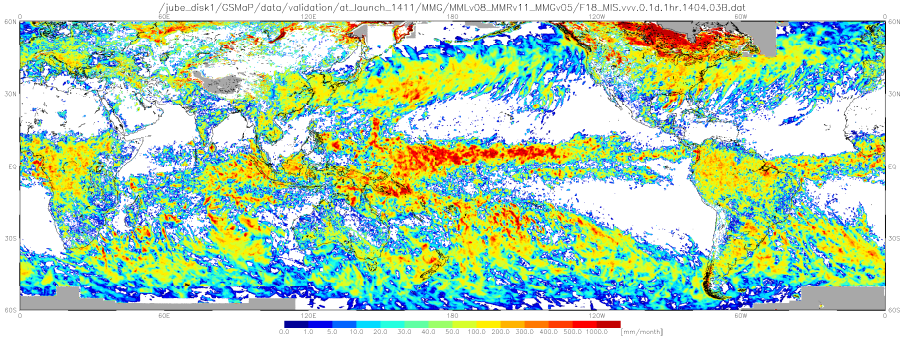
TRMM/TMI



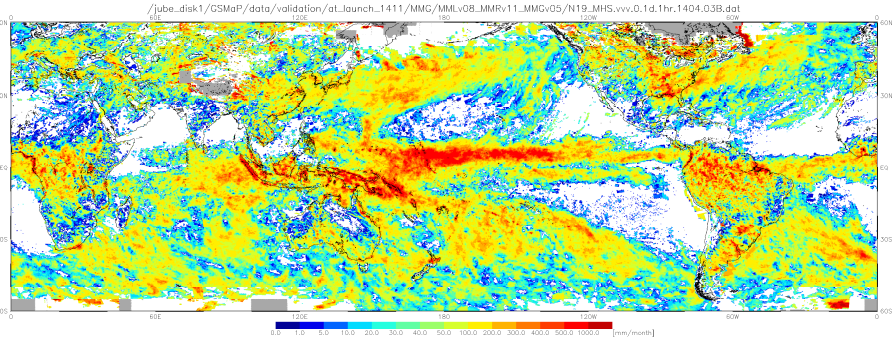
GCOM-W/AMSR2



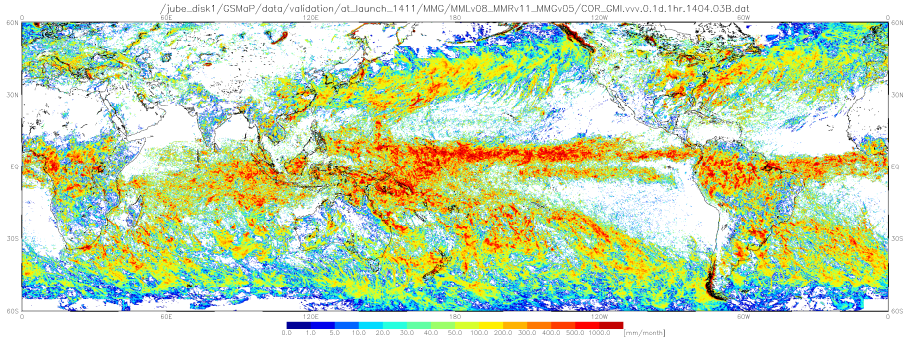
DMSP-F18/SSMIS



NOAA-N19/AMSU/MHS



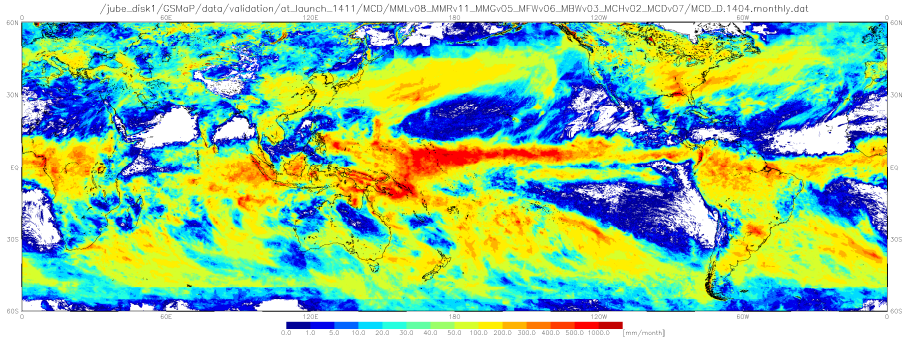
GPM Core/GMI



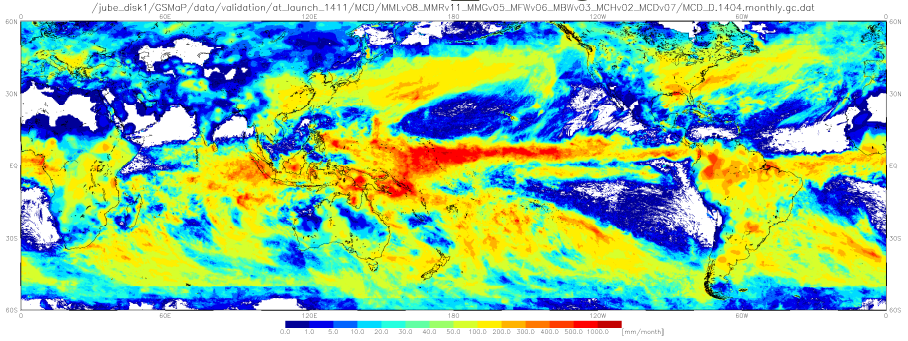
EORC/JAXA is developing GMI Tb bias correction (Okuyama, Imaoka *et al.*)

GPM-GSMaP Outputs: Apr. 2014
(Version 03B.EORC)

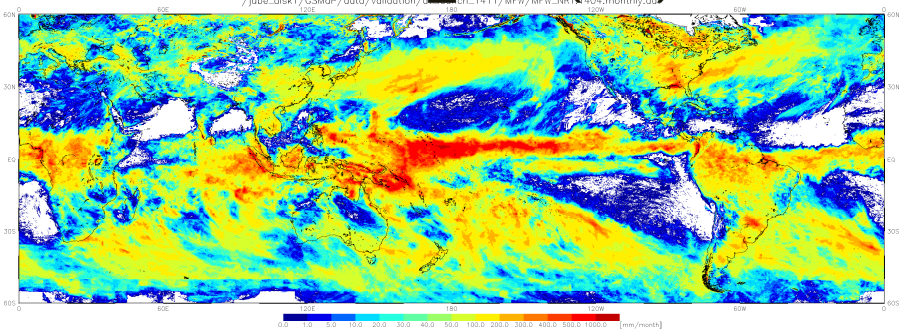
GSMaP_MVK



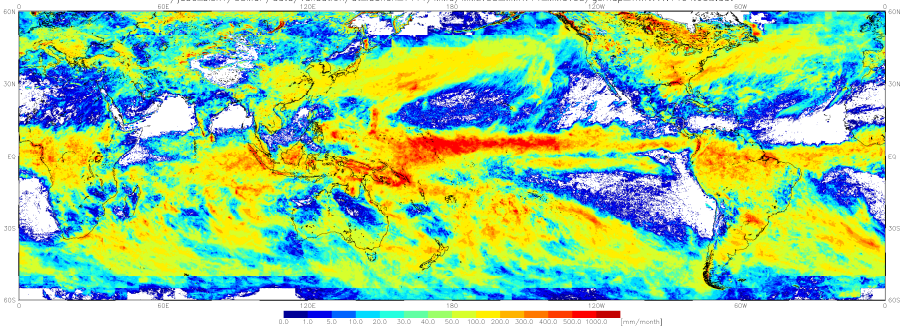
GSMaP_Gauge



GSMaP_NRT (FW)

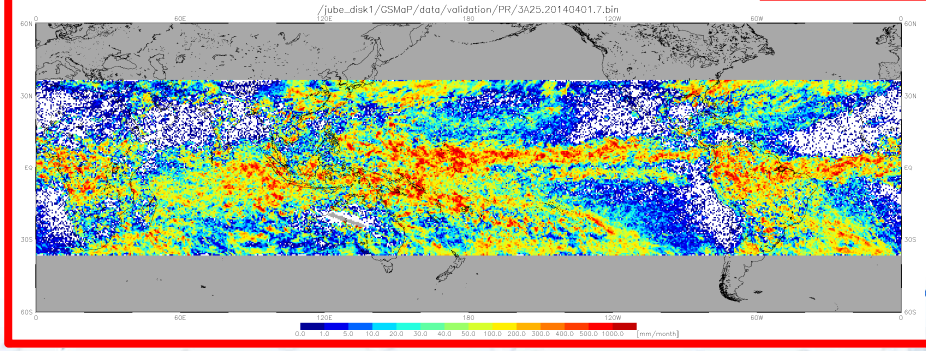


MWR Merged

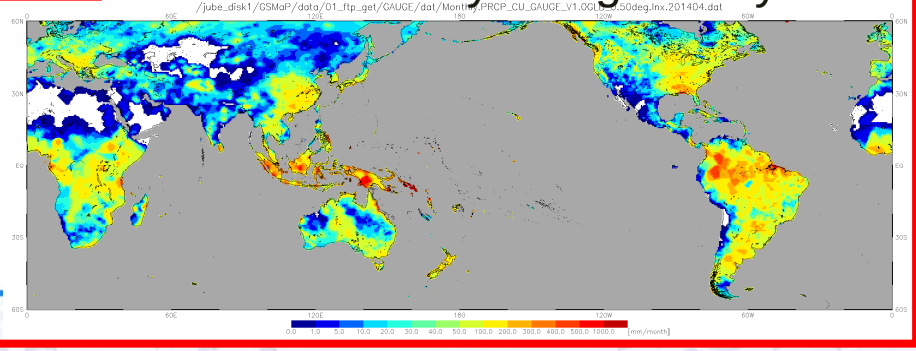


Reference

TRMMPR 3A25



NOAA/CPC daily Gauge Analysis

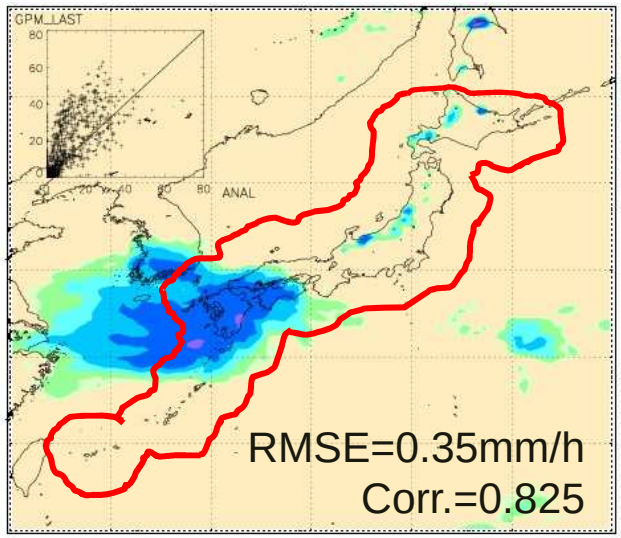


Evaluation of GPM-GSMaP

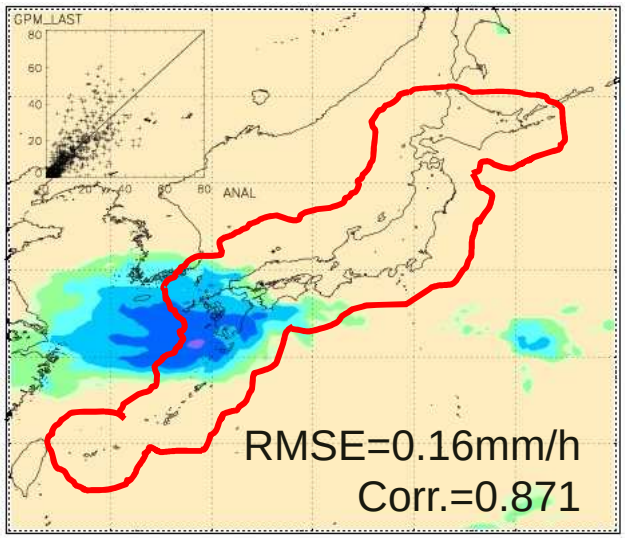
- Daily averaged rainfall around Japan in 0.25 degree grid was compared with JMA's Radar AMeDAS (gauge-calibrated radar analysis rainfall).

An example on 12th Apr. 2014

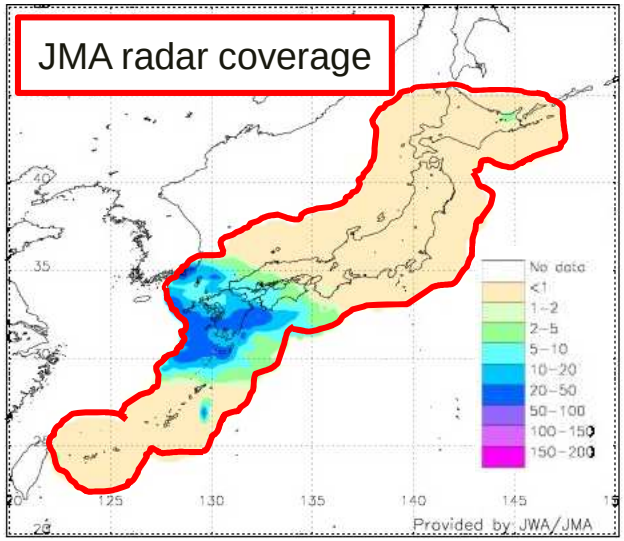
GSMaP_MVK



GSMaP_Gauge



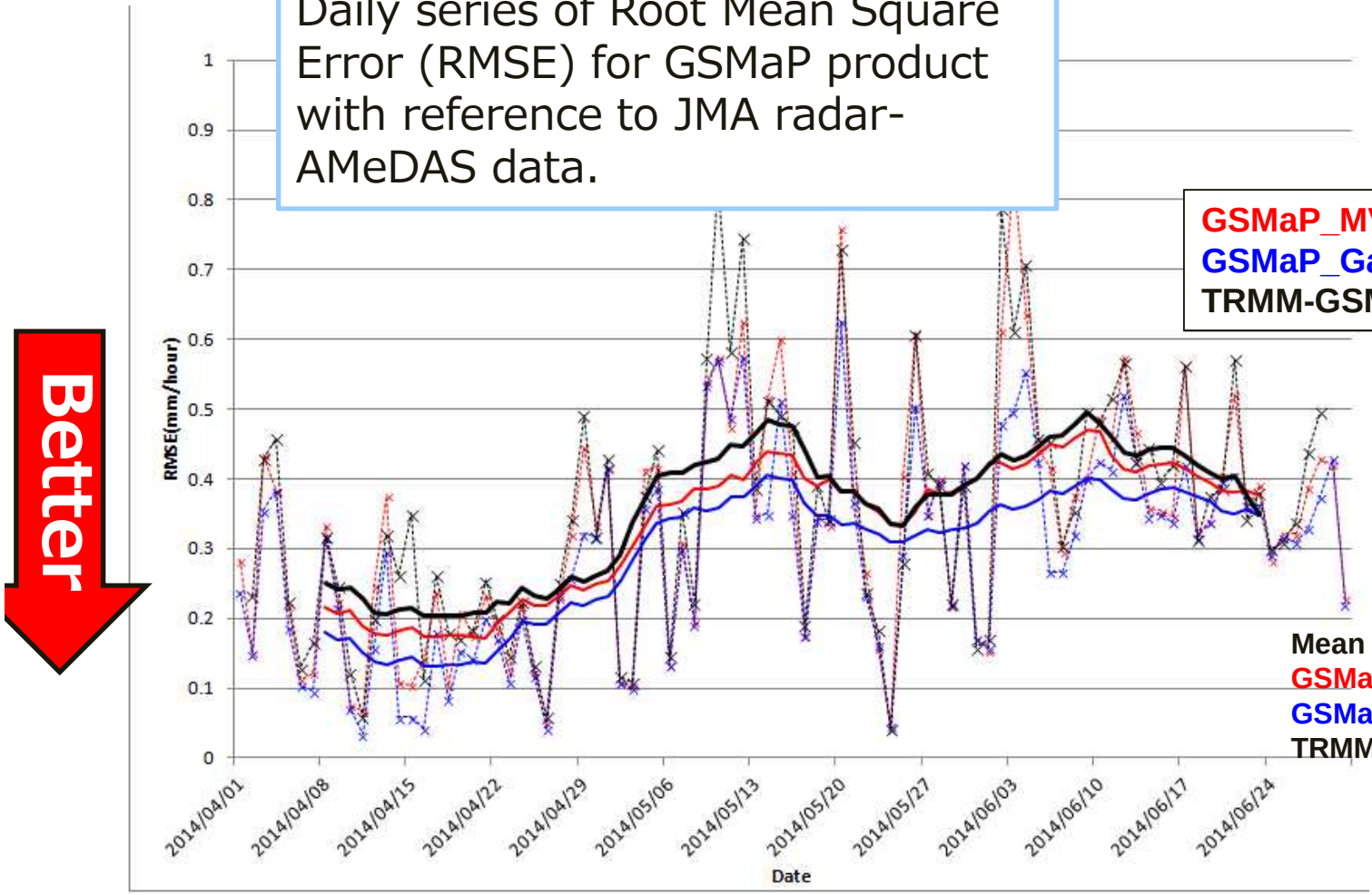
Gauge-Radar Analysis



→ **GSMaP_Gauge** shows better correlation with less Root Mean Square Error (RMSE) on 12th Apr. 2014.

Evaluations by RMSE

Daily series of Root Mean Square Error (RMSE) for GSMaP product with reference to JMA radar-AMeDAS data.



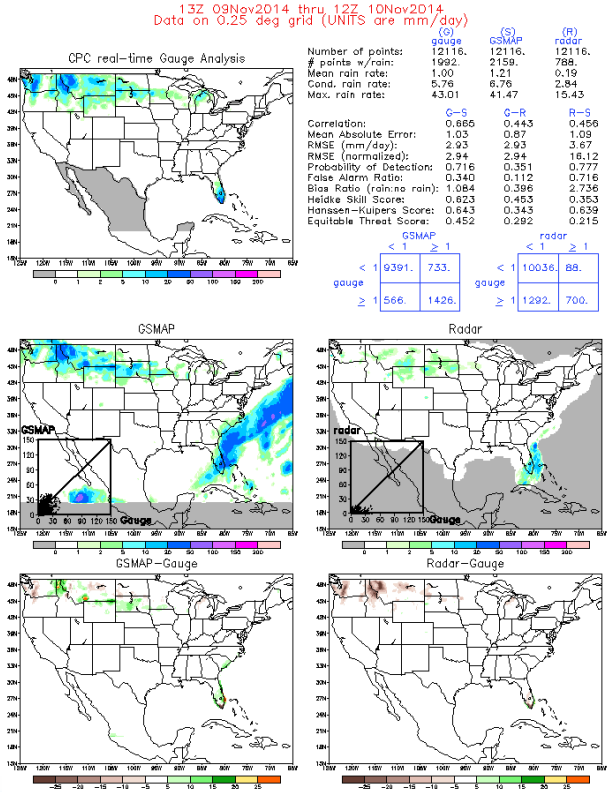
Mean RMSE (Apr.-Jun. 2014):
GSMaP_MVK: 0.33 mm/h
GSMaP_Gauge: 0.29 mm/h
TRMM-GSMaP_NRT: 0.35 mm/h

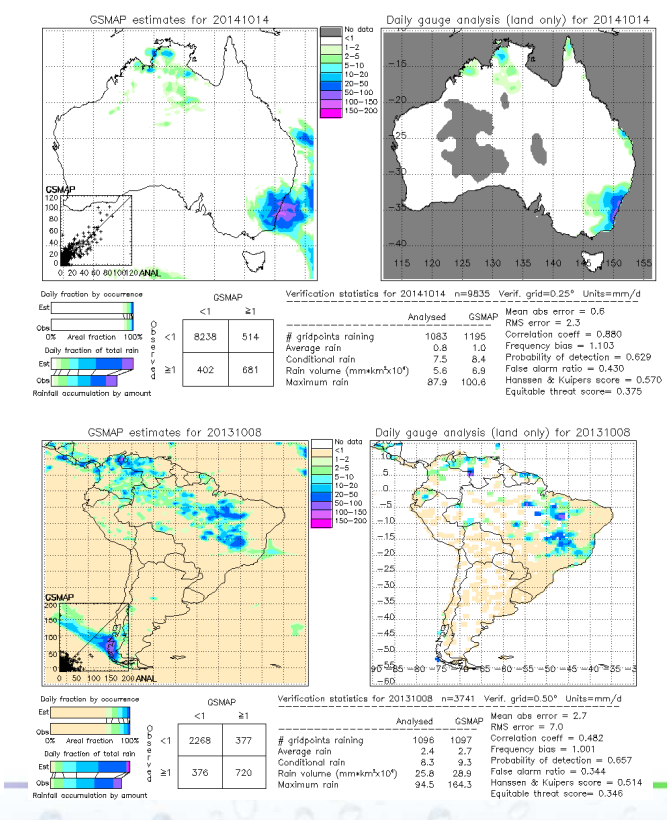
- **GSMaP_Gauge** shows the least RMSE.
- RMSE values of **GSMaP_Gauge** and **GSMaP_MVK** are smaller than those of the **TRMM-era GSMaP_NRT**.

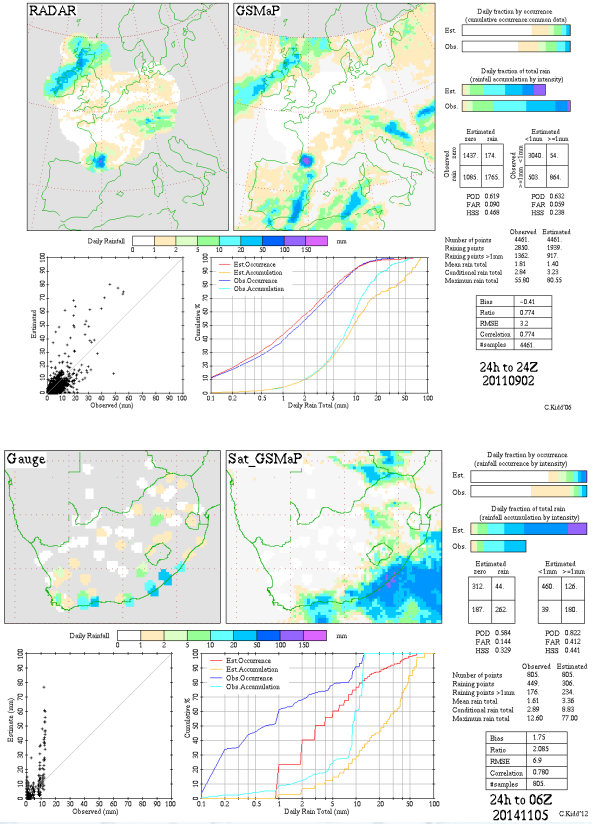
Validation collaboration in IPWG

The GSMaP joins the International Precipitation Working Group (IPWG) validation activities. http://cawcr.gov.au/projects/SatRainVal/validation-intercomparison.html

- We validates various satellite estimates around Japan.
- Our GSMaP products are validated in U.S.(J.-J.Wang/J. Janowiak), Australia (E. Ebert), South America (D. Vila), Europe (C. Kidd), South Africa (E. Becker) and Japan (S. Shige).







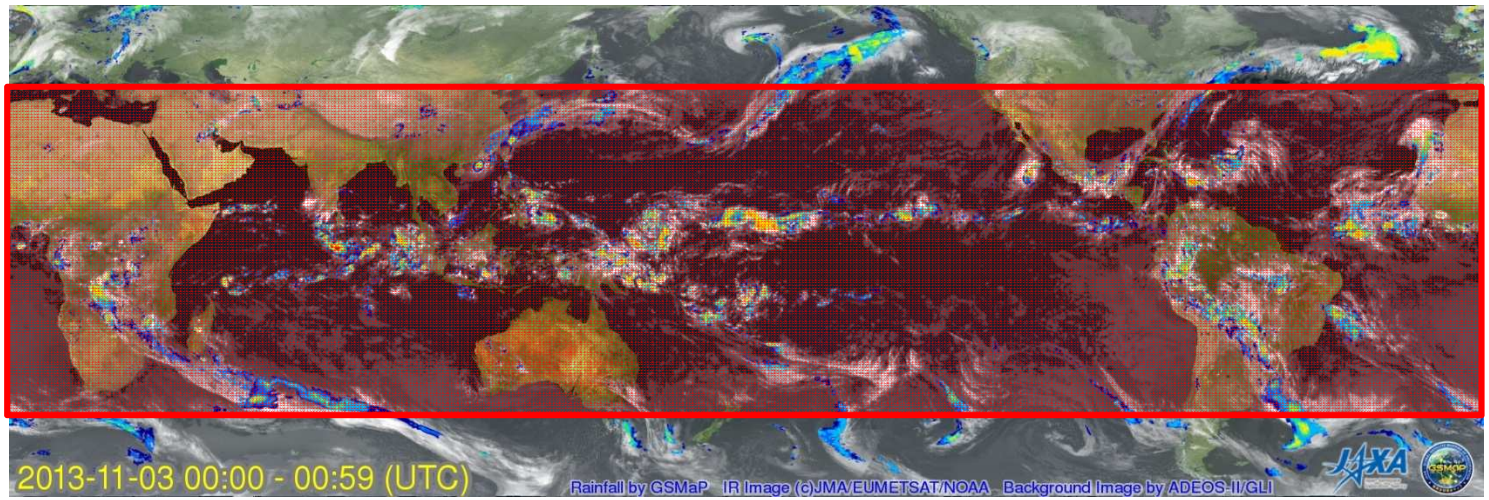
Future plan: Use of GPM/DPR data

Current TRMM/PR-based Database (DB)

Fixed DB

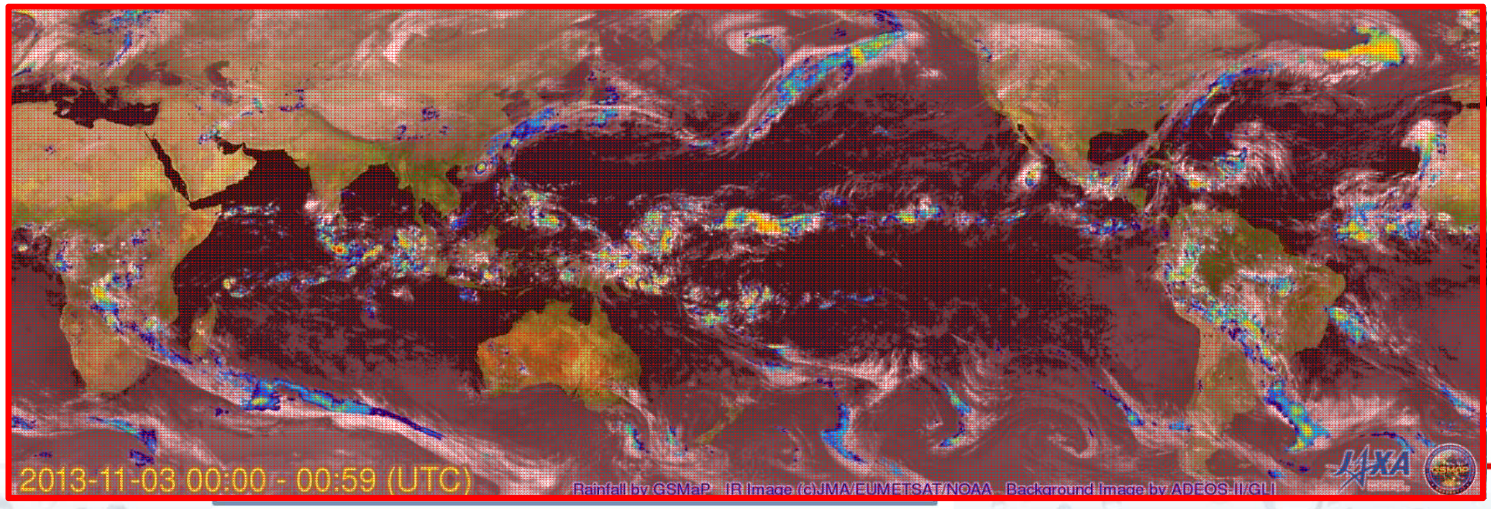
Use DB based on TRMM/PR obs.

Fixed DB



GPM-era (future; at least 1-year data is needed)

Use DB based on both PR and DPR obs.
Mid-to-high latitudes outside PR ranges will be covered by DPR.

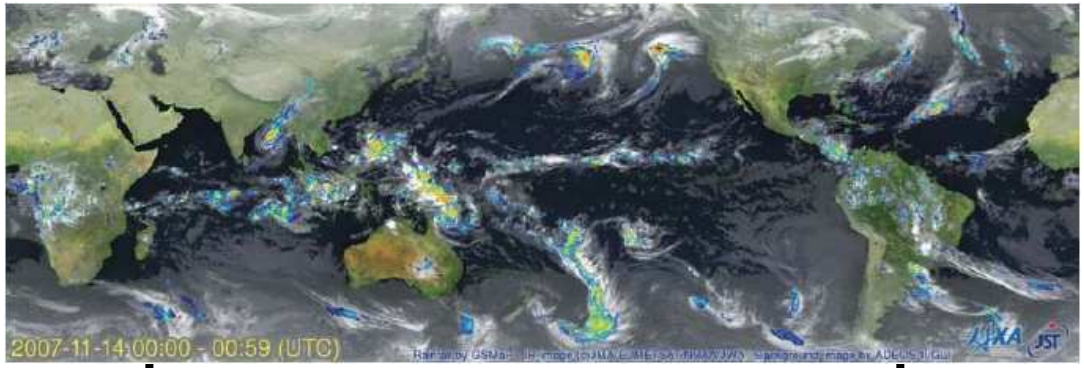


Summary

- “GPM-GSMaP” data were released on Sep. 2014.
  - The data during Mar.2014 to the current are available now.
    - We have a plan of reprocessing since Mar. 2000.
  - Evaluation of accuracy by comparison with JMA gauge calibrated radar analysis (this work: GPM-GSMaP version 03B)
  - Validation collaboration in IPWG
  - GPM-GSMaP data is available from JAXA G-portal (**https://www.gportal.jaxa.jp**) as well as current GSMaP web site (**http://sharaku.eorc.jaxa.jp/GSMaP/**).

ADB Flood Warning & Drought Warning in Asia

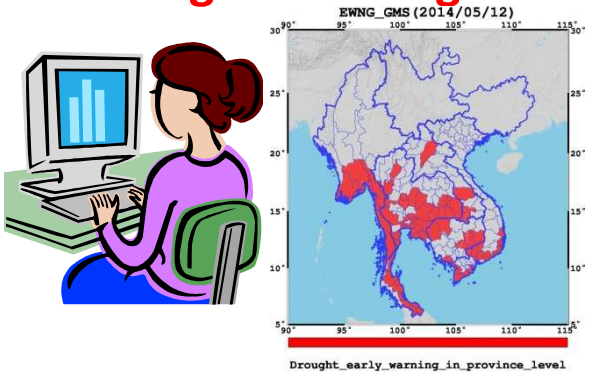
Global Satellite Mapping of Precipitation (GSMaP)



Flood Forecasting System → **Cell Phone Short Message** → **Flood Warning**

Automatic Calculation of Drought Indices → **Website** → **Drought Warning**

Bangladesh
Viet Nam
Philippines



Great Mekong Subregion

ADB Asian Development Bank
FIGHTING POVERTY IN ASIA AND THE PACIFIC

UNESCO Pakistan Flood Prediction Project

"Strategic Strengthening of Flood Warning and Management Capacity"

- Duration - 2011/6 to 2014/7
- Participating Agencies: UNESCO(lead), SUPARCO, PMD, ICHARM, JAXA
- Activities:

(a) flood early warning system development

(b) development and implementation of flood hazard maps at the community level

(c) development in both international and local platforms for timely sharing of hydrometeorological observations.

- Outcome: improved river basin management including flood risk management using flood analysis model and GSMaP
- JAXA's tasks: GSMaP Customization & ALOS Dataset Generation

United Nations Educational, Scientific and Cultural Organization

2nd Phase Project is now under coordination.


JAXA
Explore to Realize