

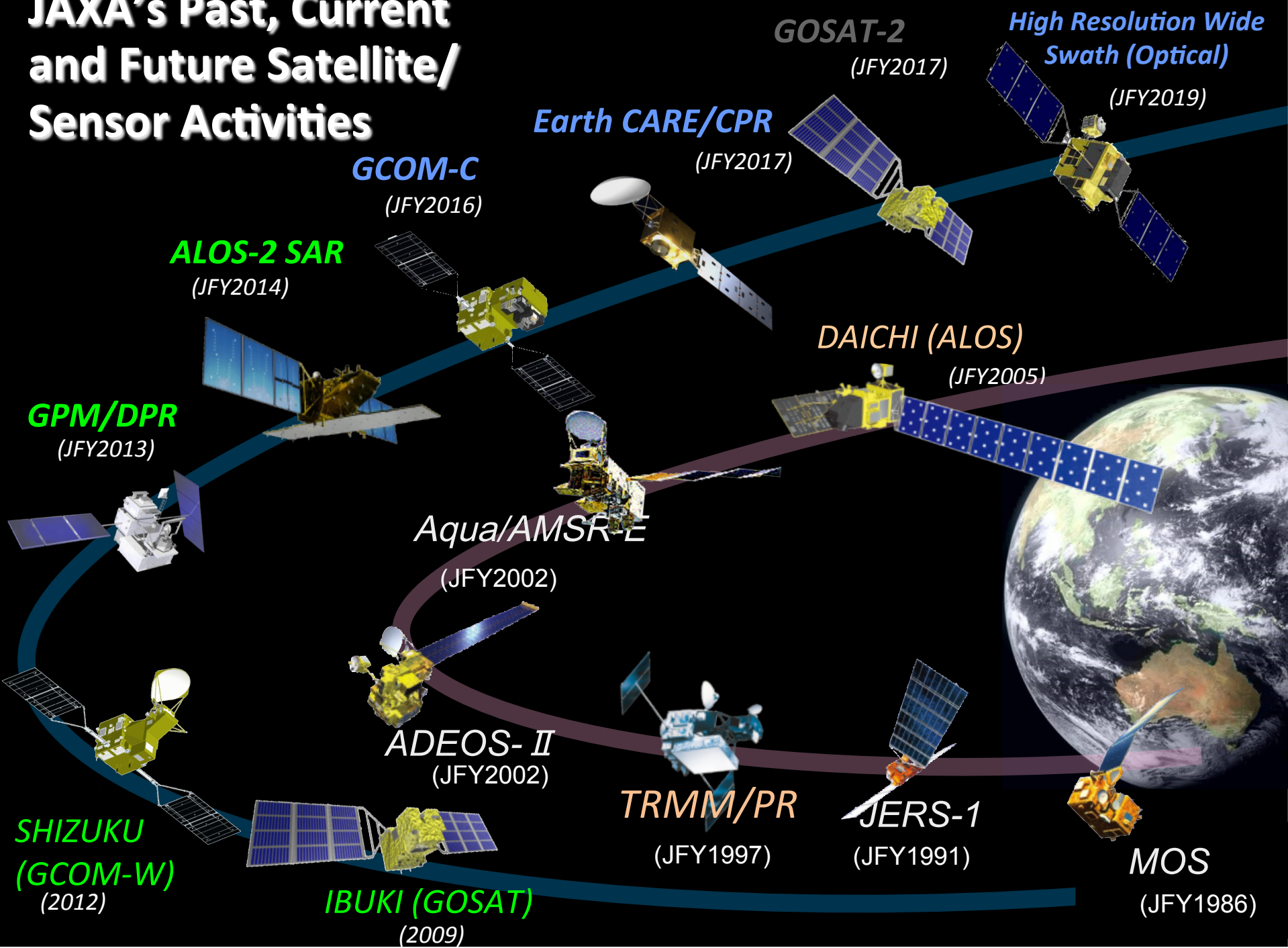


The 9TH GEOSS Asia-Pacific Symposium
12 January, 2017, Tokyo

JAXA Earth Observation Satellites Program for Water Information

Earth Observation Research Center
JAXA

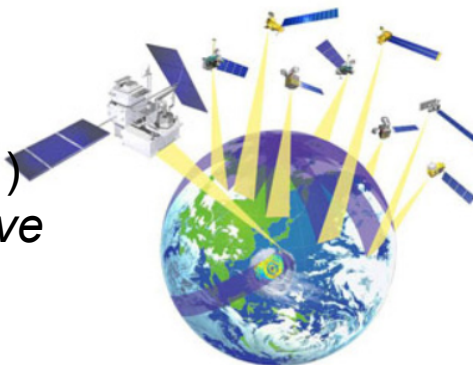
JAXA's Past, Current and Future Satellite/Sensor Activities



It is for the first time in the world for meteorological agencies to utilize satellite radar precipitation data such as DPR for numerical prediction.

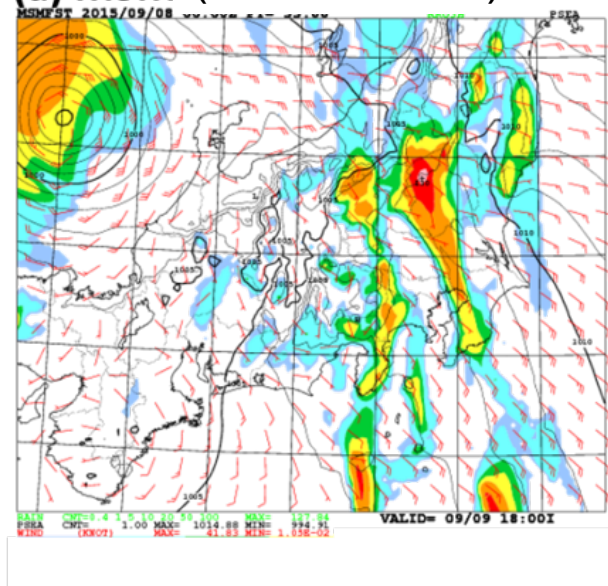
Global Precipitation Observation
at 3 Hour Intervals
with GPM Core Satellite (DPR + GMI)
and Constellation Satellites (*microwave radiometers/sounders*)

Core sat in cooperation with NASA

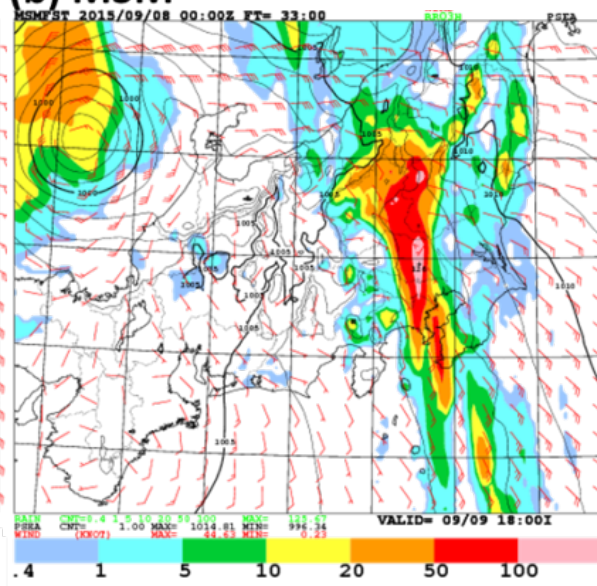


Japan
Meteorological
Agency

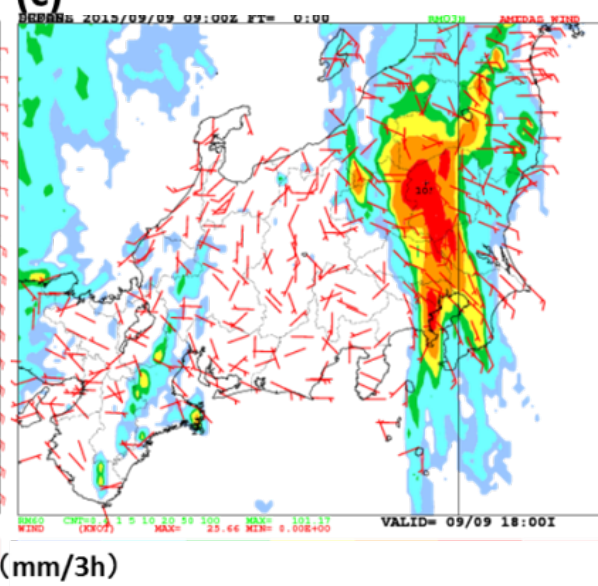
(a) MSM (Without DPR)



(b) MSM (With DPR)



(c) Ground Radar Obs.

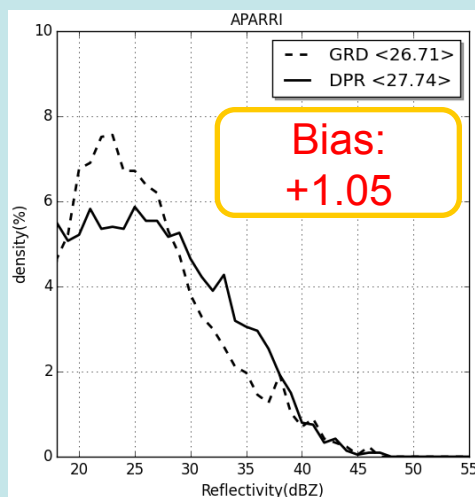


Ground radar calibration using spaceborne precipitation radar

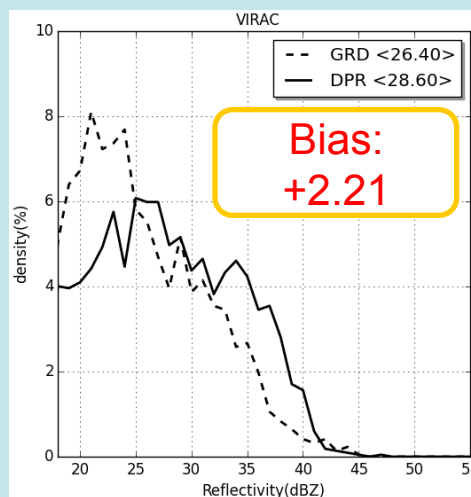
Bias adjustment of ground radar using the spaceborne precipitation radar (GPM/DPR)

Histogram of near-surface radar reflectivity for the ground radar and the DPR using 10 cases.

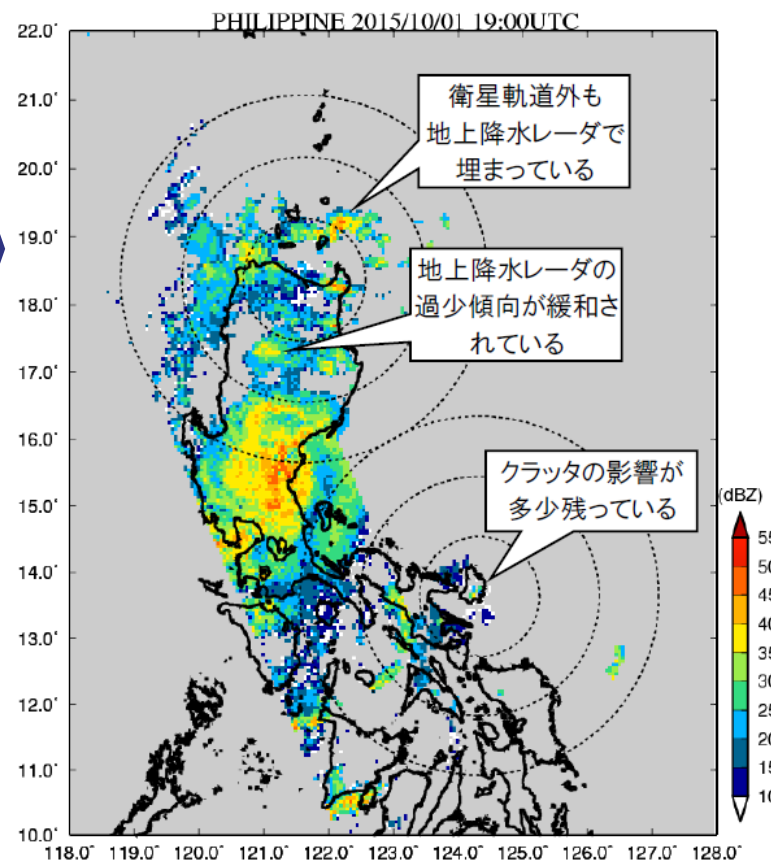
APPARI site



VIRAC site



Composite of Satellite Radar and Ground Radar Data in the PHILIPPINES



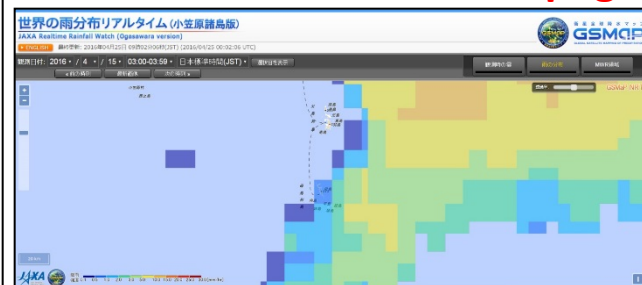
- After the meeting with the village officers, the Homepage of the Ogasawara Village started to link to the JAXA/EORC GSMaP Homepage on April 2016.

<http://www.vill.ogasawara.tokyo.jp/>



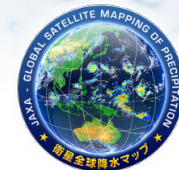
The screenshot shows the homepage of Ogasawara Village. At the top, it features the JAXA logo and the text "World Natural Heritage Ogasawara Islands". The main header includes "小笠原村" (Ogasawara Village) and "世界自然遺産 小笠原諸島" (World Natural Heritage Ogasawara Islands). Below the header is a large image of the Ogasawara Islands. On the left side, there is a navigation menu with links such as "概要" (Overview), "観光" (Tourism), "アクセス" (Access), "村営バス" (Village Bus), "各課のページ" (Pages of each department), "小笠原村診療所" (Ogasawara Village Clinic), "村民だより" (Village News), and "各種申込み" (Various applications). The main content area includes a section titled "H28.4.21新情報更新" (New information update H28.4.21) with a date of "2016.4.21". It contains a notice about a disaster relief fund for the Great East Japan Earthquake and a link to the "GSMaP" homepage. At the bottom, there are several banners, including one for "ライブ映像" (Live video) and another for "小笠原の天気" (Ogasawara Weather).

JAXA/EORC GSMaP Homepage

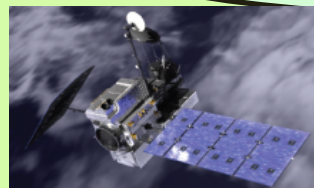


about 700 visits during 1month (Aug. 2016)

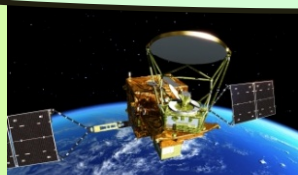
Overview of GSMaP



Microwave Imagers & Sounders



**GPM-Core
GMI**



**GCOM-W
AMSR2**



**DMSP
SSM/I, SSMIS**



**NOAA/MetOp
AMSU**

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

GSMaP Microwave Radiometer
Retrieval Algorithm

Rainfall Data from each
Microwave Radiometer

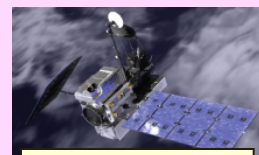
Merged Microwave
Rainfall Data

Precipitation
Radars



**TRMM
PR**

Data
Base



**GPM-Core
DPR**

IR
Imagers



**Geostationary
Satellites**

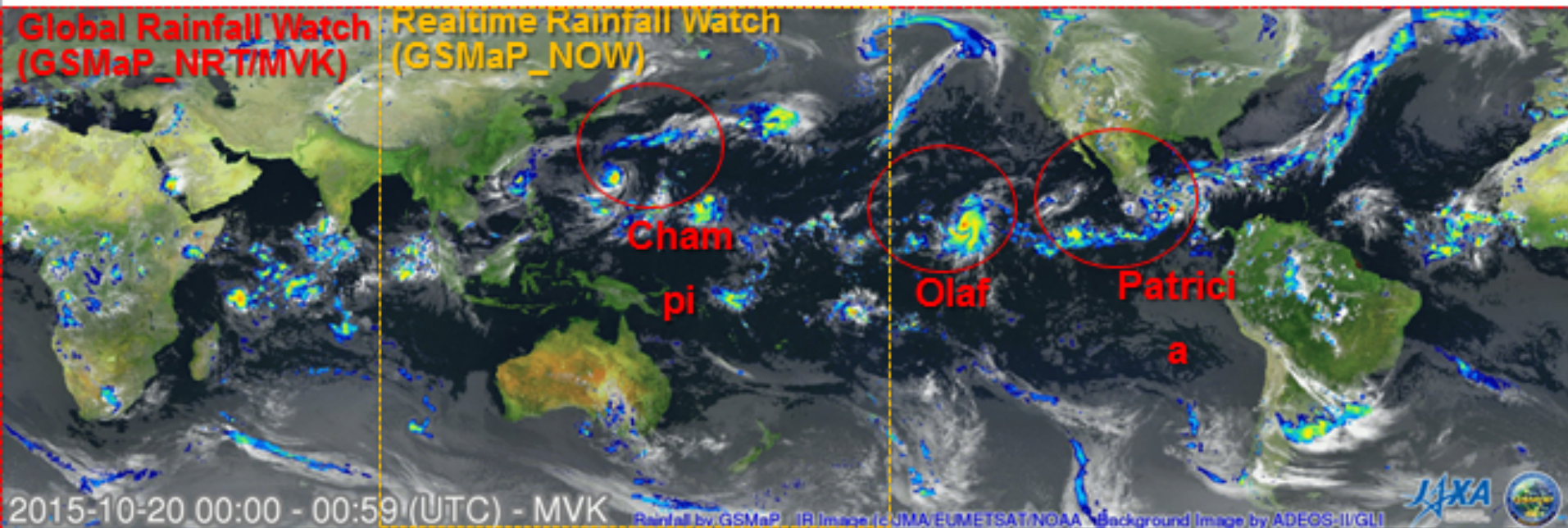
Microwave-IR Merged
Algorithm (CMV, K/F)

**Global Rainfall Map
+ Gauge-calibrated
Rainfall Map**
(0.1 degree grid, Hourly)

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



Global Satellite Mapping of Precipitation (GSMaP) using GCOM-W, GPM, and others (European and US satellites)

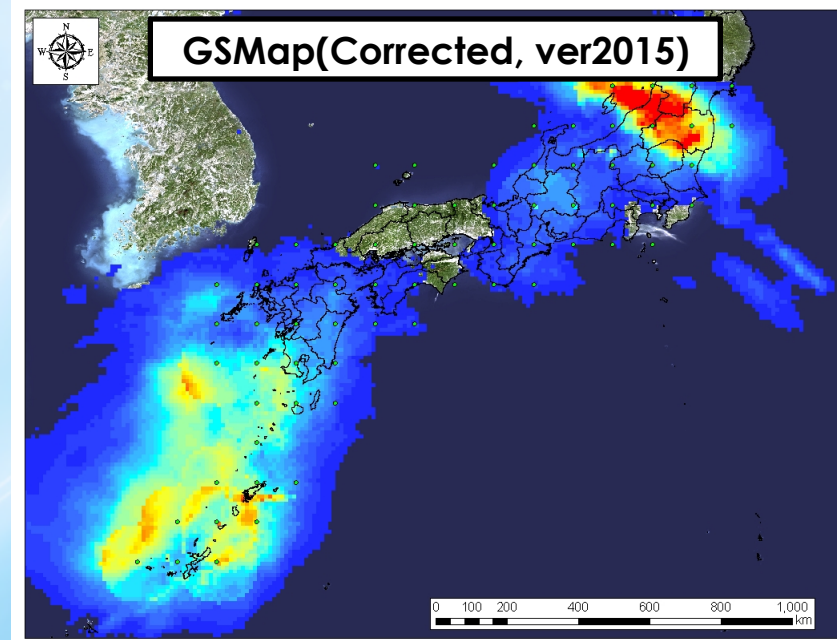
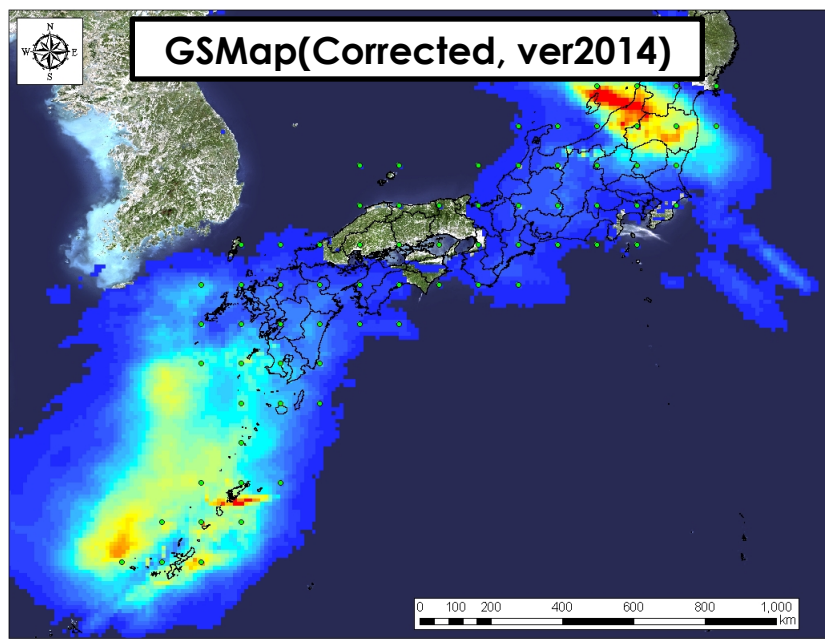
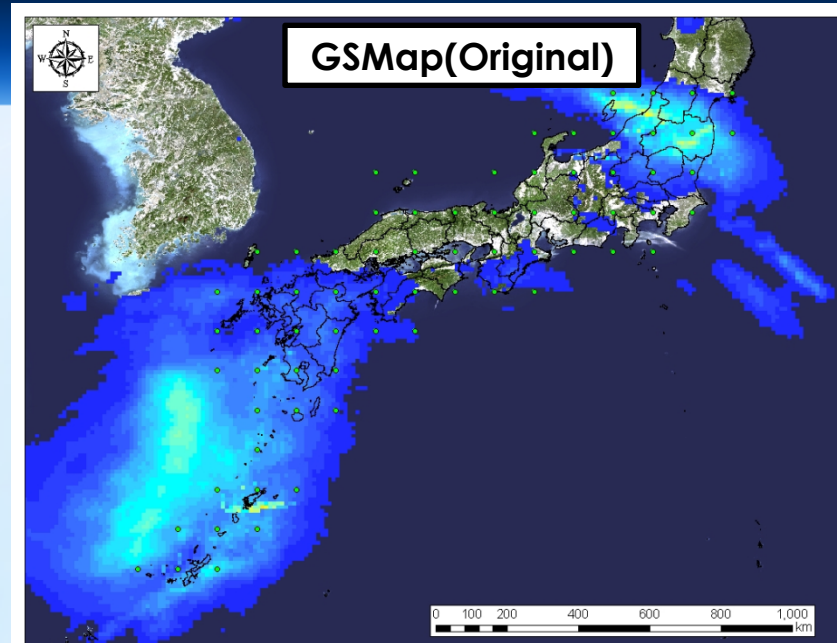
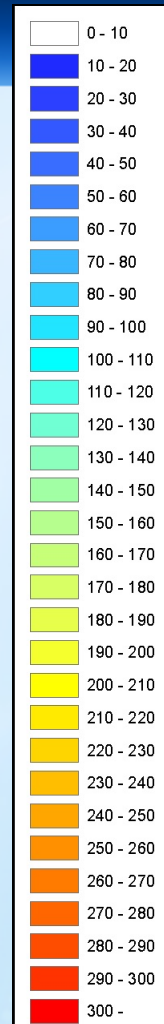
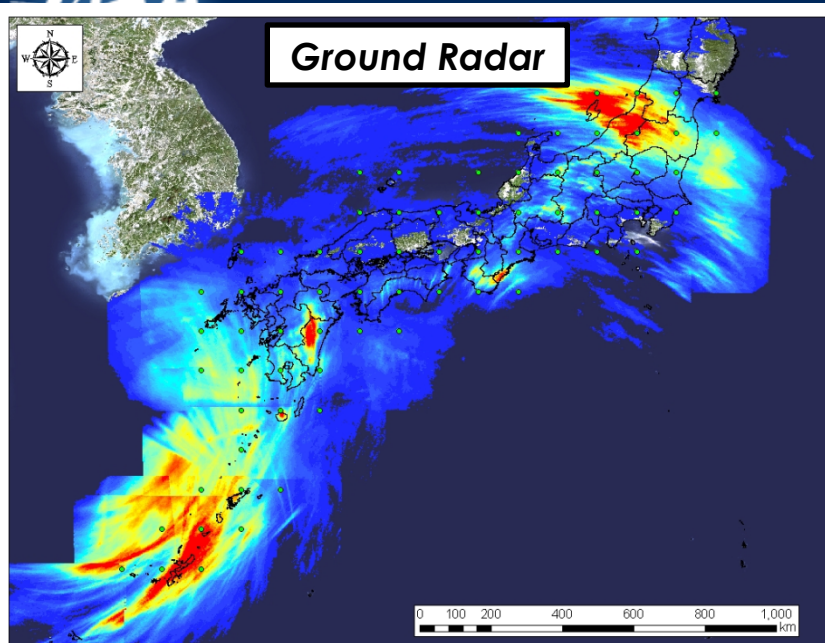


GSMaP (Global) observed Hurricane Patricia and Olaf, and Typhoon Champi: 20-24 Oct. 2015, hourly animation

JAXA Global Rainfall Watch (4-hr delay) : <http://sharaku.eorc.jaxa.jp/GSMaP>

JAXA Realtime Rainfall Watch (Himawari-area): http://sharaku.eorc.jaxa.jp/GSMaP_NOW

Typhoon No.8, July 8, 2014 (Daily Rainfall) calibrated by NTT-D (GSMap-IF)

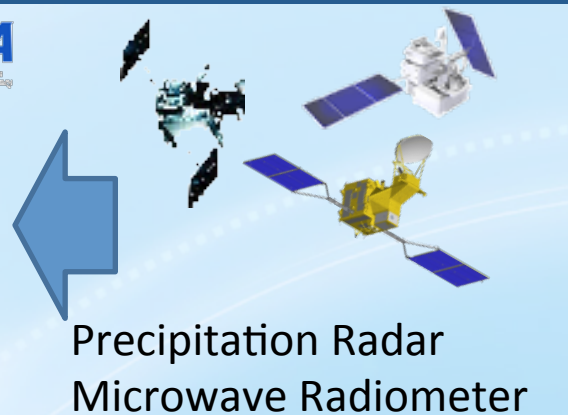
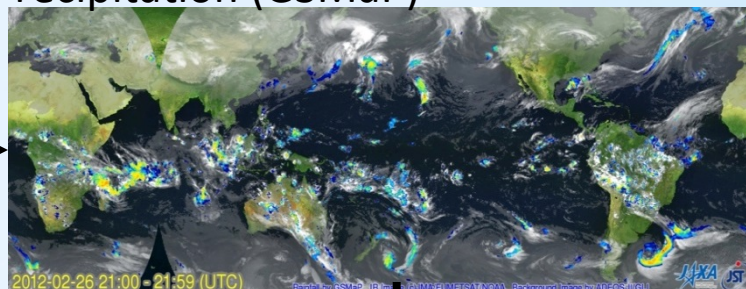


Flood Warning System (ADB TA project)

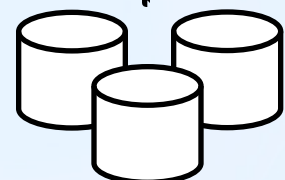
Participating countries: Bangladesh, the Philippines, and Viet Nam

JAXA contributes to flood forecasting using space technology

Global Satellite Mapping of Precipitation (GSMaP)



Calibration



Rain Gauges

Flood Forecasting System

SMS distribution system

Input to the **flood forecasting model of GSMaP Precipitation data** calibrated by rain gauges on the ground

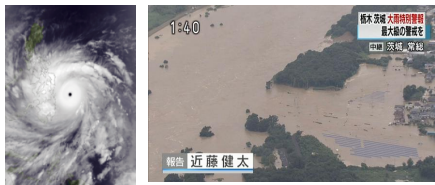
Flood Warning



- Improvement of the flood warning lead time from 3 days to 5 days. → **Mitigation of loss of assets and damages**
- Direct distribution of information to the people by using cellular phones

<Background>

1. Water Disasters; Shared issue in Asia



Typhoon, Heavy Rain, Flood, and Drought

2. Lack of Sustainable Ground-based Rainfall Measurement in Emerging Countries

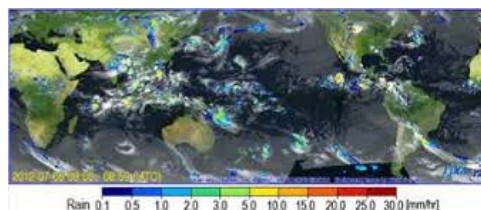


Lack of archive, maintenance and calibration, and power shortage

3. Improved Capacity on Satellites in Emerging Countries

- > 1000 kg : THEOS 1(Thailand), Razaksat 1(Malaysia), Lotusat 1(Viet Nam), TeLEOS1(Sinagapore)
- > 100 kg: LAPAN A2 (Indonesia), Diwata-1 (Philippines)

4. Available Satellite-based Rainfall Data

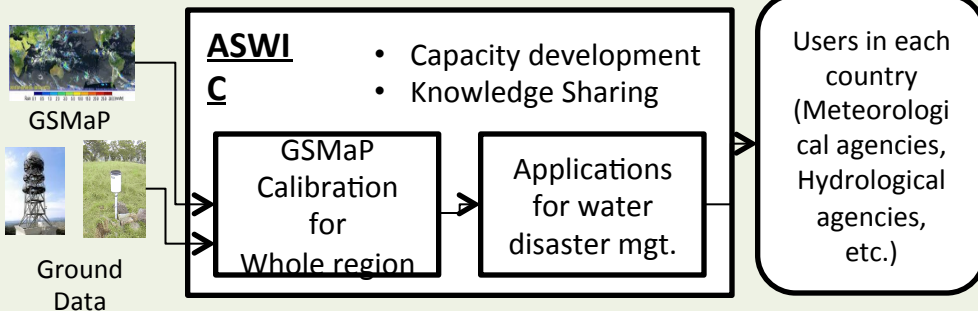


Free hourly rainfall data for 10 km x 10 km grid

Global Satellite Mapping of Precipitation (GSMaP)

<Step 1> Asian Satellite Water Information Center

- Establishment of regional center which provides satellite based information and applications for water disaster management.
- Headquartered at XXX(TBD)
- Funding from donors and member countries



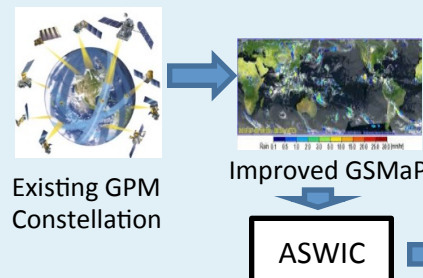
<Step 2> Asian Small Precipitation Radar Constellation

ODA projects in each

- (i) Small Precipitation Radar Satellite System
- (ii) Strengthening ground-based sensor network
- (iii) User applications for meteorology, hydrology, etc.
- (iv) Capacity Development

ASPRC by Asian country

Orbit: Alt. 800km, inclination 20 deg.
 Mass: Smaller than 800kg
 Lifetime: More than 5 years
 Payload: Ku band precipitation radar
 Data: Precipitation intensity (mm/h)
 Swath: around 800km
 Resolution: around 10km x 10km
 Minimum detection: around 1mm/h
 Frequency: ave. 4-6 times/ day by four satellites



Our Visions

- **JAXA will further strive to enhance space development activities under the new framework of the space strategy, focusing on technical innovation and international cooperation as on providing effective solutions to the society as a whole.**
- **Specifically, in the field of application, JAXA values technological advancement and continuous utilization of satellites for the improvement of the daily lives for humankind as observation infrastructure:**
 - ✓ **Long-term observations by continual satellite missions**
 - ✓ **Multiple satellite data utilization**
 - ✓ **Involvement of the private sector**
- **For the Earth Observation Satellites, JAXA will clarify our role in the society and develop the system to further collaboration with Japanese government and other implementing organizations, so that we can realize the world which utilizes satellites to provide a benefit of human society as a part of observation infrastructure.**

Looking forward to further fruitful collaboration with our partners around the globe.