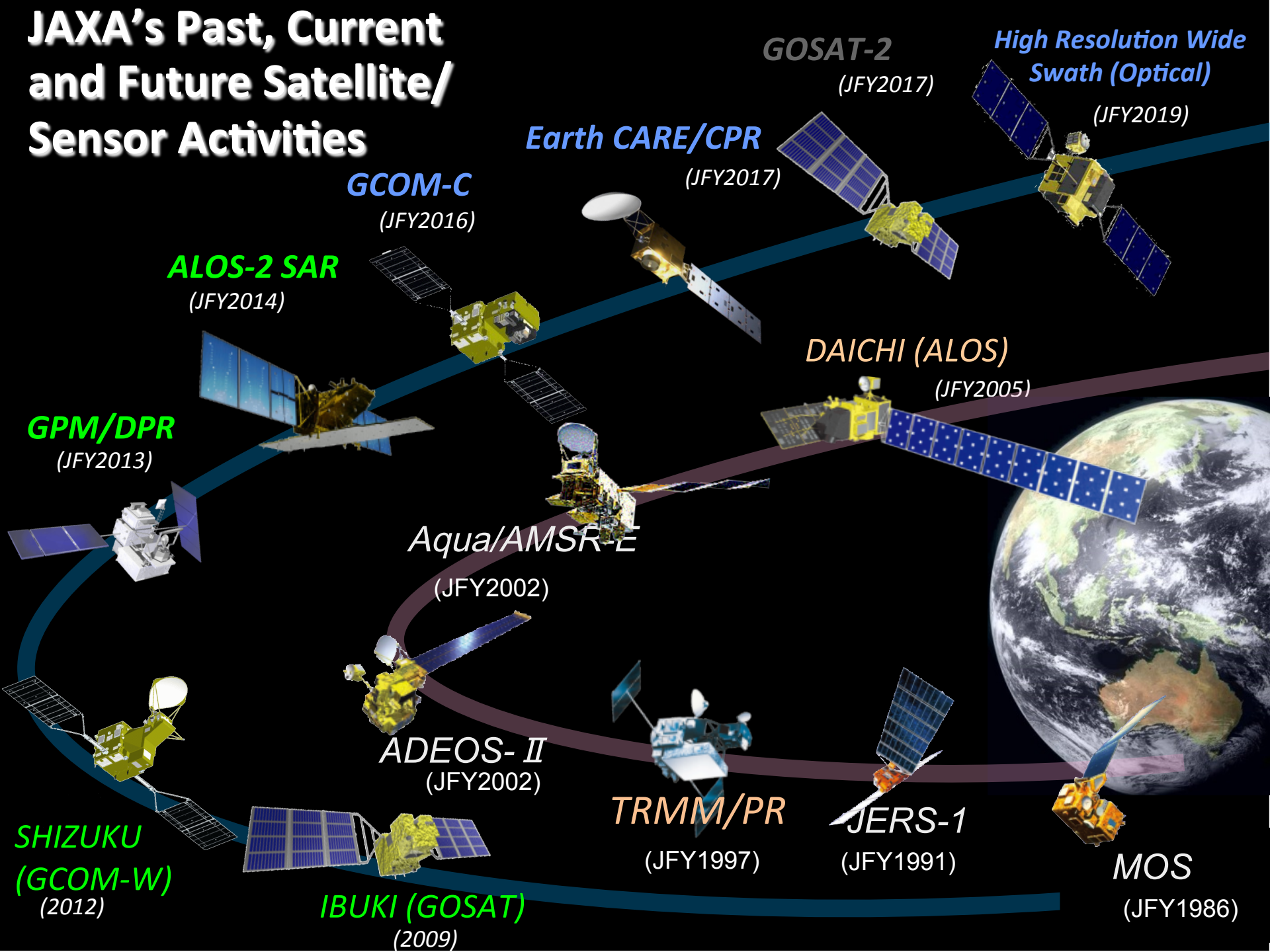
The 9TH GEOSS Asia-Pacific Symposium
12 January, 2017, Tokyo

# JAXA Earth Observation Satellites Program for Water Information

Earth Observation Research Center
JAXA

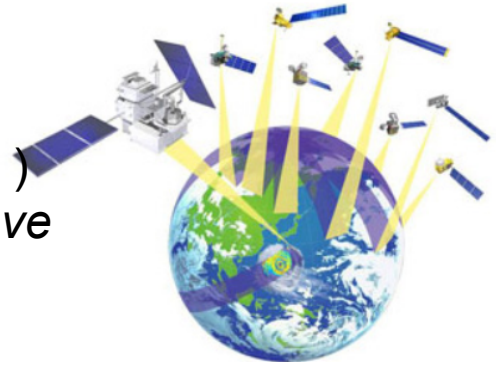

JAXA's Past, Current and Future Satellite/ Sensor Activities
GOSAT-2
(JFY2017)
High Resolution Wide Swath (Optical)
(JFY2019)
Earth CARE/CPR
(JFY2017)
GCOM-C
(JFY2016)
ALOS-2 SAR
(JFY2014)
DAICHI (ALOS)
(JFY2005)
GPM/DPR
(JFY2013)
Aqua/AMSR-E
(JFY2002)
ADEOS-Ⅱ
(JFY2002)
TRMM/PR
(JFY1997)
JERS-1
(JFY1991)
MOS
(JFY1986)
SHIZUKU (GCOM-W)
(2012)
IBUKI (GOSAT)
(2009)

# GPM - Climate Change (Adaptation)

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

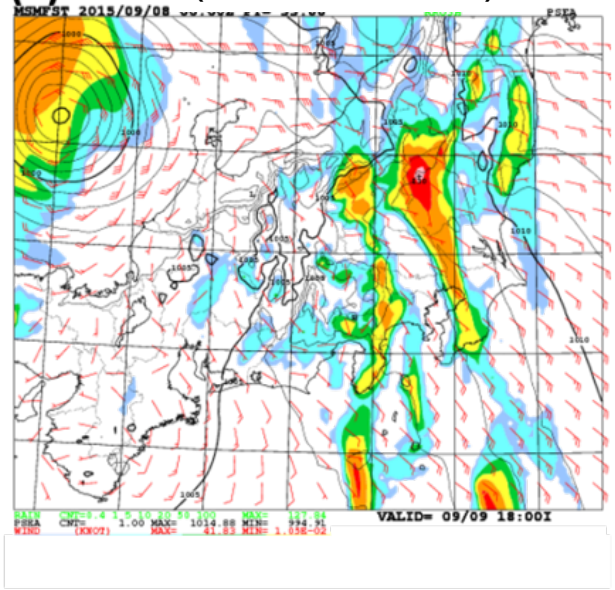
Global Precipitation Observation
at 3 Hour Intervals
with GPM Core Satellite (DPR + GMI )
and Constellation Satellites (*microwave radiometers/sounders)*

Core sat in cooperation with NASA

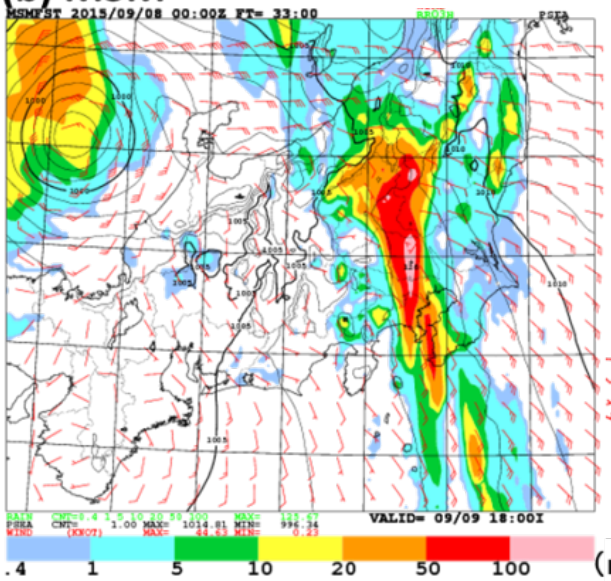


Japan Meteorological Agency

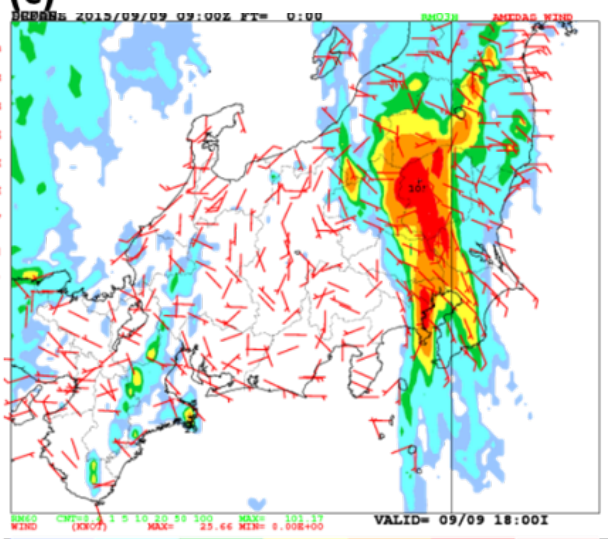
**(a) MSM** (Without DPR)




**(b) MSM** (With DPR)




**(c)** Ground Radar Obs.

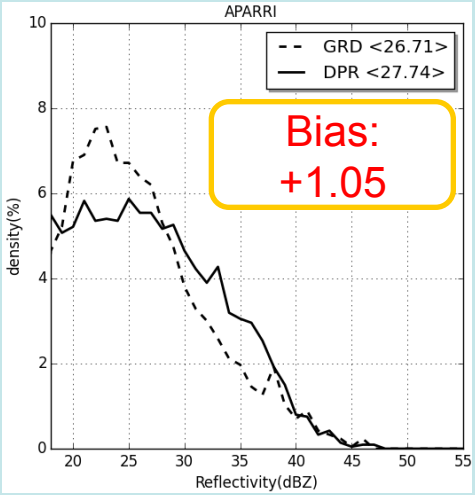


# Ground radar calibration using spaceborne precipitation radar

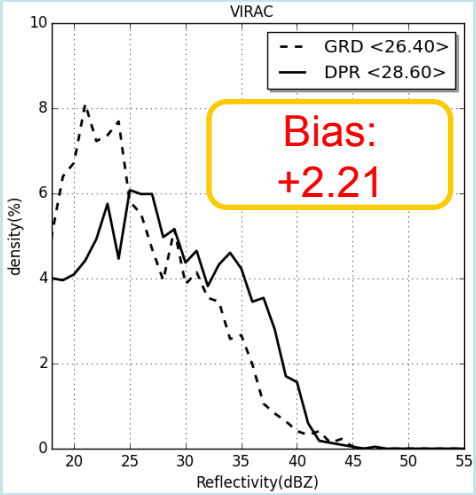
## Bias adjustment of ground radar using the spaceborne precipitation radar (GPM/DPR)

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

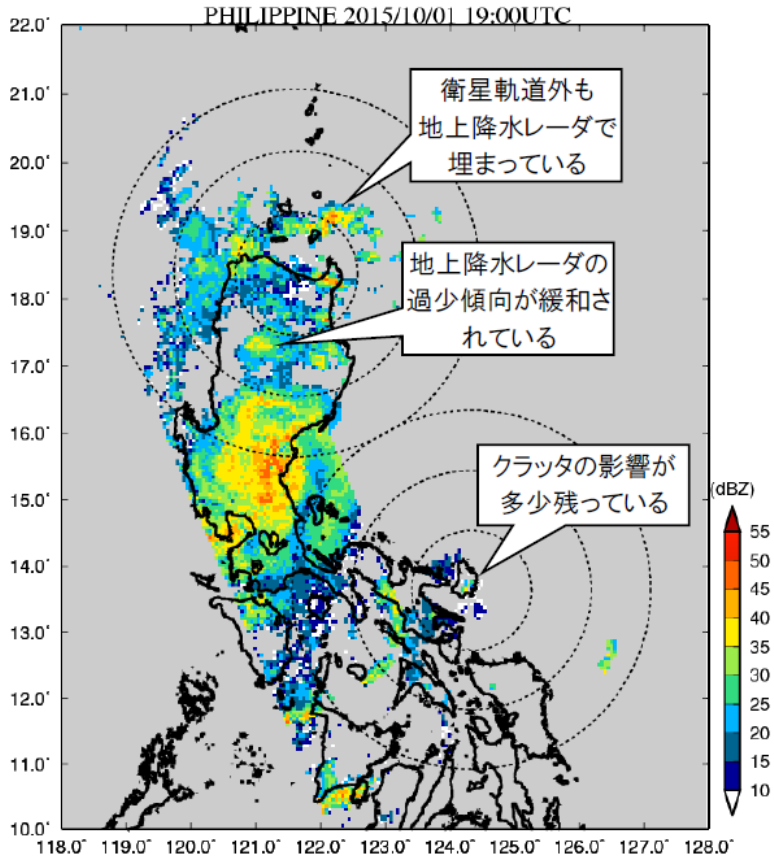
APPARI site




VIRAC site




Composite of Satellite Radar and Ground Radar Data in the PHILIPPINES

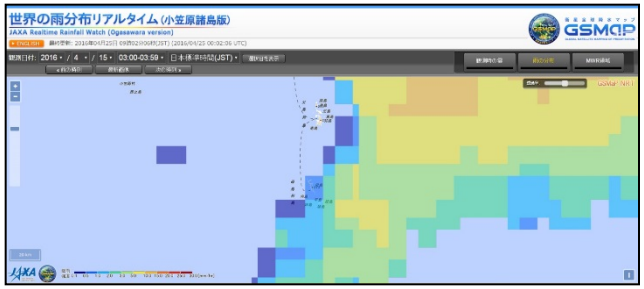


# Utilization of Ogasawara Village (Bonin Islands) in Japan

- 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/

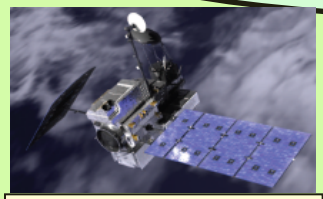

**JAXA/EORC GSMaP Homepage**




about 700 visits during 1month (Aug. 2016)

# Overview of GSMaP

Microwave Imagers & Sounders



GPM-Core GMI

GCOM-W AMSR2

DMSP SSM/I, SSMIS

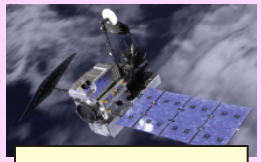
NOAA/MetOp AMSU

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

GSMaP Microwave Radiometer Retrieval Algorithm

Precipitation Radars

TRMM PR



GPM-Core DPR

Data Base

Rainfall Data from each Microwave Radiometer

Merged Microwave Rainfall Data

IR Imagers

Geostationary Satellites

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

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

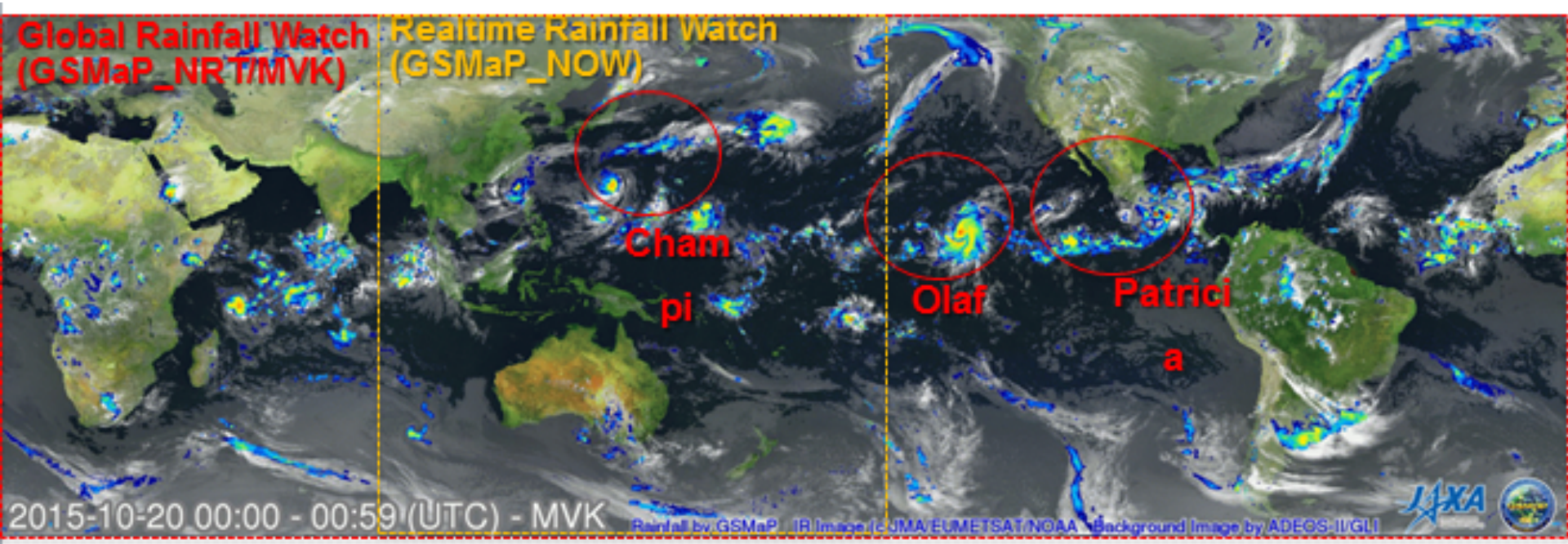
(*Okamoto et al. 2005, Kubota et al, 2007, Aonashi et al. 2009, Ushio et al. 2009, Shige et al. 2009, Kachi et al. 2011*)

JAXA

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

# Global Satellite Mapping of Precipitation (GSMaP)

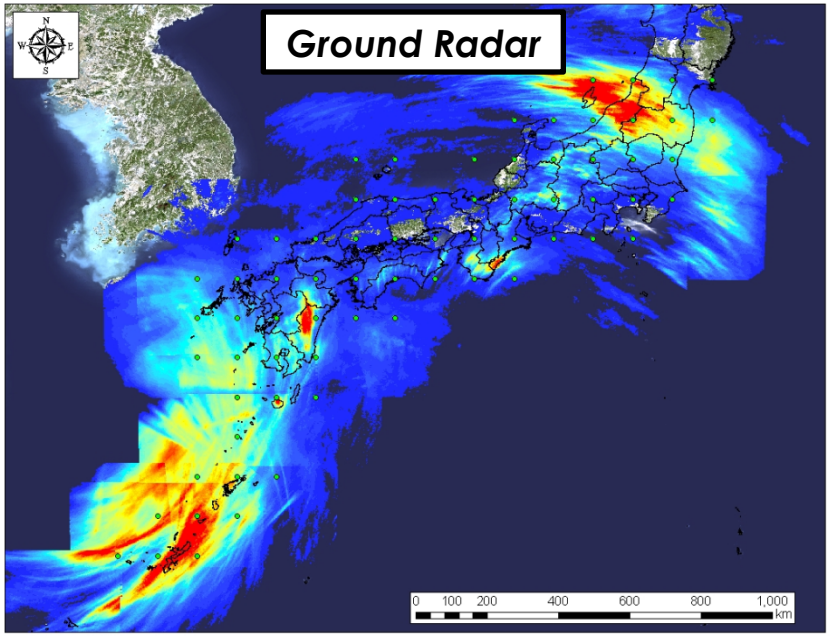
## using GCOM-W, GPM, and others (European and US satellites)

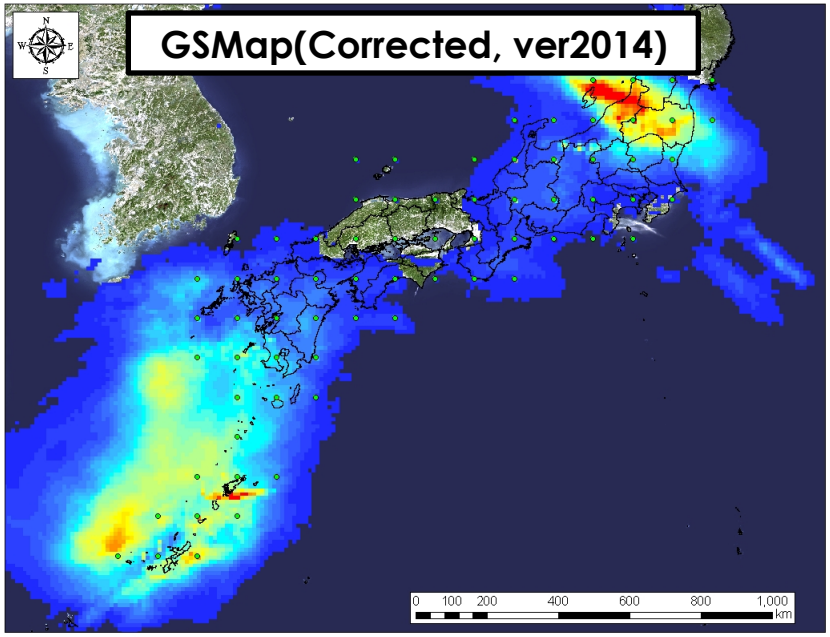


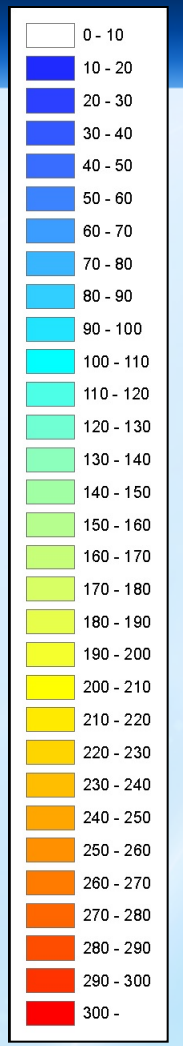

GSMaP (Global) observed Hurricane Patricia and Olaf, and Typhoon Champi: 20-24 Oct. 2015, hourly animation

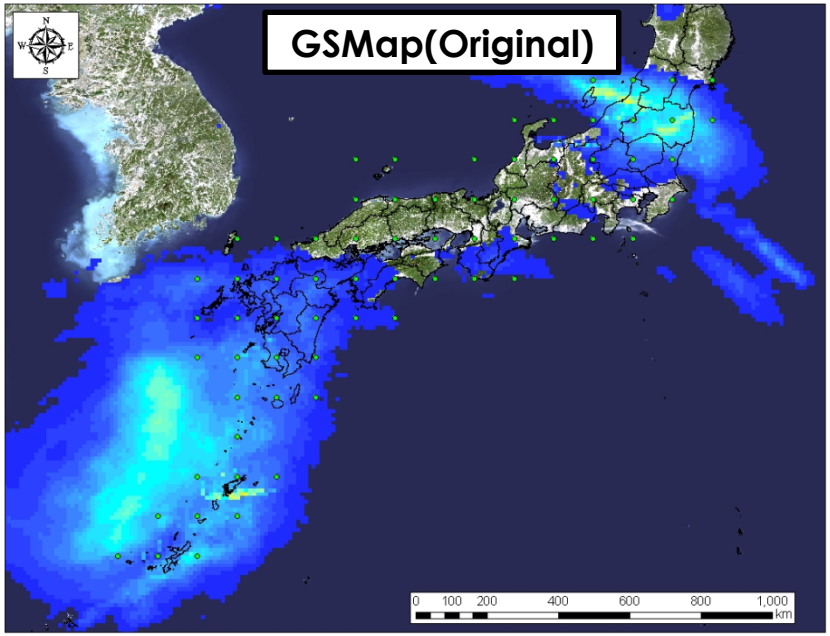
JAXA Global Rainfall Watch (4-hr delay) : http://sharaku.eorc.jaxa.jp/GSMaP
JAXA Realtime Rainfall Watch (Himawari-area): http://sharaku.eorc.jaxa.jp/GSMaP_NOW

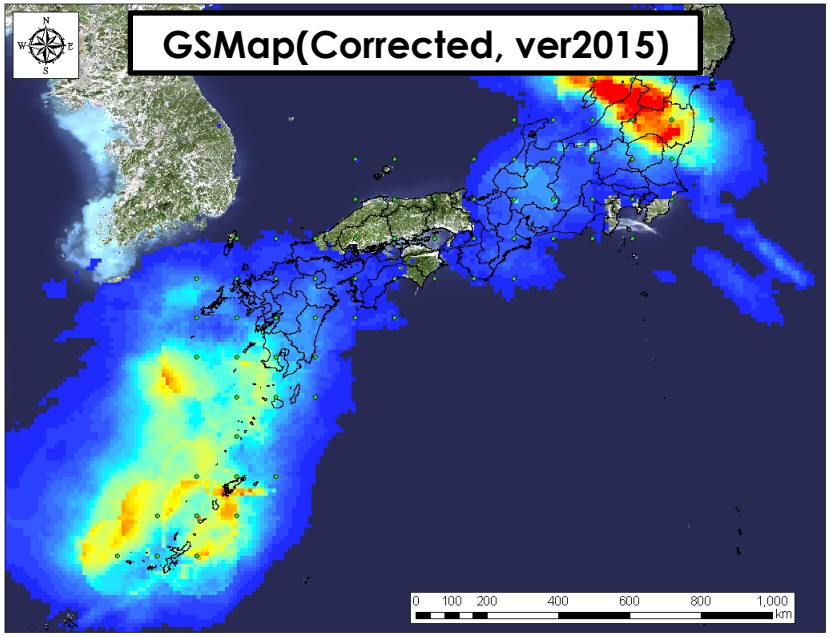
# Typhoon No.8, July 8, 2014 (Daily Rainfall) calibrated by NTT-D (GSMaP-IF)



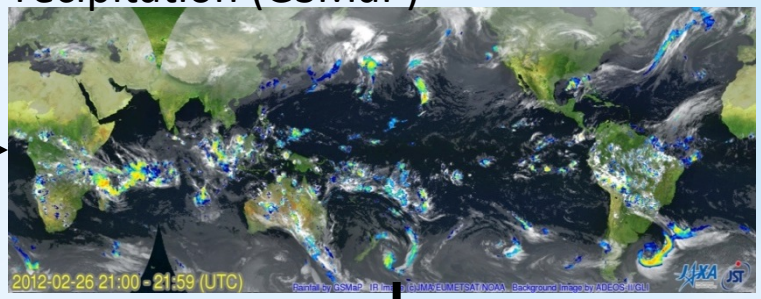



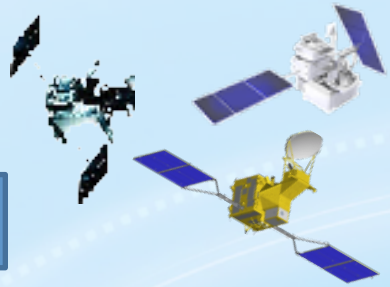
# Flood Warning System (ADB TA project)

Participating countries: Bangladesh, the Philippines, and Viet Nam

*JAXA contributes to flood forecasting using space technology*

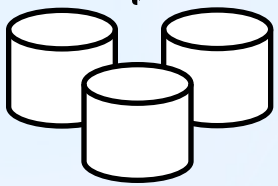
Global Satellite Mapping of Precipitation (GSMaP)



Precipitation Radar
Microwave Radiometer

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**

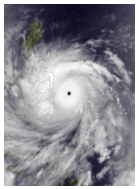
- Improvement of the flood warning lead time from 3 days to 5 days. →**Mitigation of loss of assets and damages**
- Direct distribution of information to the people by using cellular phones

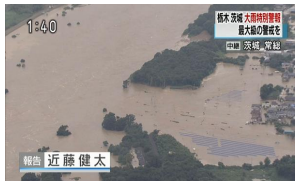
ADB Asian Development Bank
FIGHTING POVERTY IN ASIA AND THE PACIFIC

# Future Idea: Satellite-based Water Disaster Management in emerging countries in Asia

## <Background>

### 1. Water Disasters; Shared issue in Asia






Tyhoon, Heavy Rain, Flood, and Drought

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

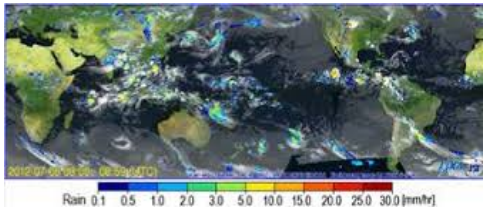
Lack of archive, maintenance and calibration, and power shortage

### 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

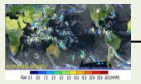



Free houly rainfall data for 10 km x 10 km grid

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



GSMaP

Ground Data

**ASWIC**

- Capacity development
- Knowledge Sharing

GSMaP Calibration for Whole region → Applications for water disaster mgt.

Users in each country (Meteorological agencies, Hydrological agencies, etc.)

## <Step 2> Asian Small Precipitation Radar Constellation

### ODA projects in each

(i) Small Precipitation Radar Satellite System

(ii) Strengthening ground-based sensor network

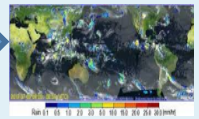
(iii) User applications for meteorology, hydorology, etc.

(iv) Capacity Development

### ASPRC by Asian countr

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

Existing GPM Constellation



Improved GSMaP

ASWIC → Users

# 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.**