

# JAXA's Contributions to the Water Cycle Observation

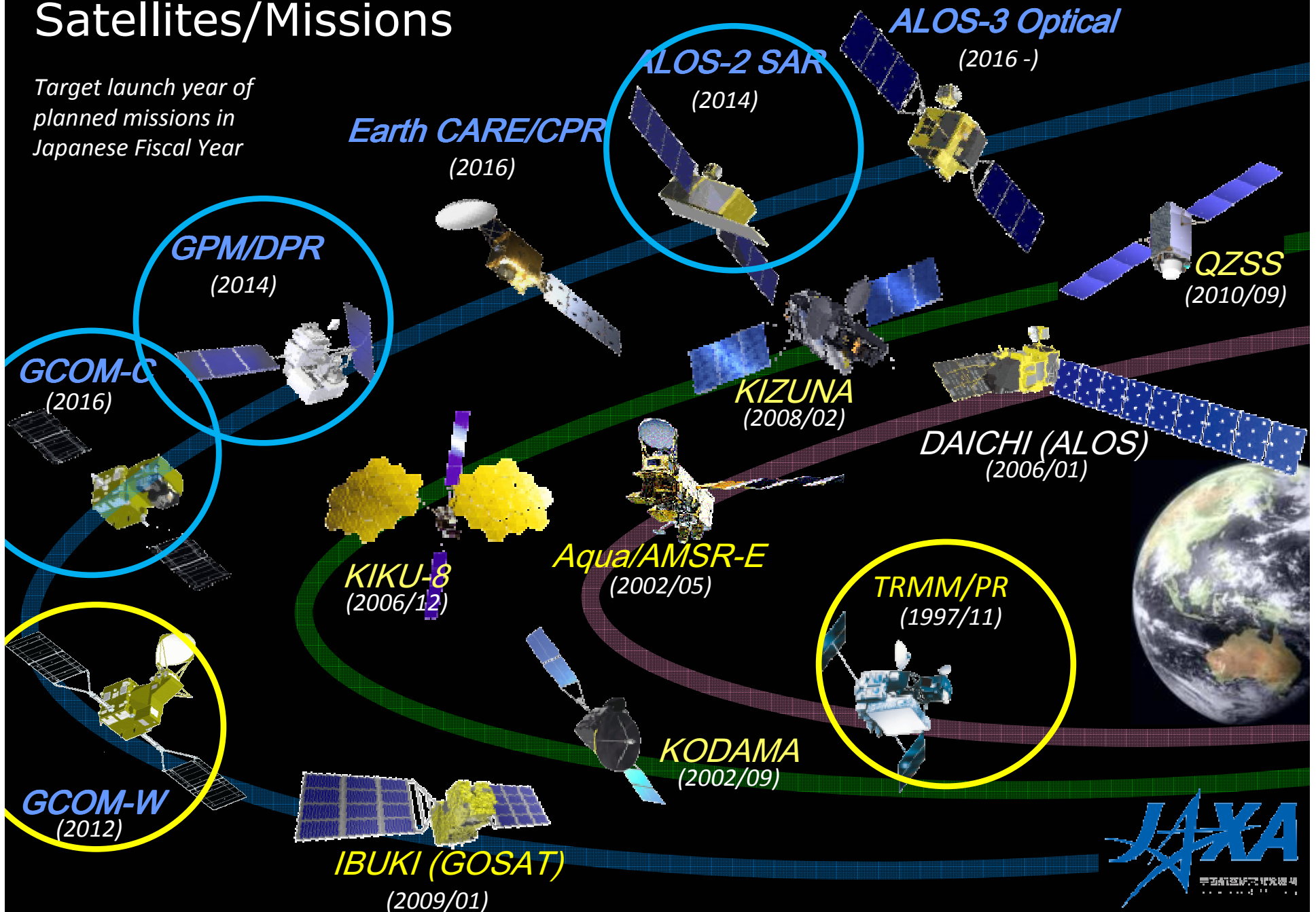
Kazuo Umezawa  
JAXA/SAPC



25 November 2013, GEOSS Joint Asia - Africa Water Cycle Symposium, Tokyo, Japan

# JAXA **Operating** and **Planned** Satellites/Missions

Target launch year of planned missions in Japanese Fiscal Year



# AMSR2 onboard GCOM-W1 "SHIZUKU"



- Successor of AMSR-E on Aqua and AMSR on ADEOS-II.
- Deployable main reflector system with 2.0m diameter (1.6m for AMSR-E).
- Frequency channel set is identical to that of AMSR-E except 7.3GHz channel for RFI mitigation.
- Two-point external calibration with improved HTS (hot-load).
- Add a redundant momentum wheel to increase reliability.

GCOM-W1/AMSR2 characteristics	
Scan and rate	Conical scan at 40 rpm
Antenna	Offset parabola with 2.0m dia.
Swath width	1450km
Incidence angle	Nominal 55 degrees
Digitization	12bits
Dynamic range	2.7-340K
Polarization	Vertical and horizontal

AMSR2 Channel Set				
Center Freq. [GHz]	Band width [MHz]	Pol.	Beam width [deg] (Ground res. [km])	Sampling interval [km]
6.925/7.3	350	V and H	1.8 (35 x 62)	10
10.65	100		1.2 (24 x 42)	
18.7	200		0.65 (14 x 22)	
23.8	400		0.75 (15 x 26)	
36.5	1000		0.35 (7 x 12)	5
89.0	3000	0.15 (3 x 5)		

# GCOM-W1 Data Products

## Standard Products

Products	Areas	Res.	Accuracy			Range	
			Release	Standard	Goal		
Brightness Temperature	Global	5-50km	$\pm 1.5K$	$\pm 1.5K$	$\pm 1.0K$ (systematic) $\pm 0.3K$ (random)	2.7-340K	
G E O	Integrated water vapor	Global, over ocean	15km	$\pm 3.5kg/m^2$	$\pm 3.5kg/m^2$	$\pm 2.0 kg/m^2$	0-70kg/m <sup>2</sup>
	Integrated cloud liquid water	Global, over ocean	15km	$\pm 0.10kg/ m^2$	$\pm 0.05kg/ m^2$	$\pm 0.02kg/ m^2$	0-1.0kg/m <sup>2</sup>
	Precipitation	Global, except cold latitude	15km	Ocean $\pm 50\%$ Land $\pm 120\%$	Ocean $\pm 50\%$ Land $\pm 120\%$	Ocean $\pm 20\%$ Land $\pm 80\%$	0-20mm h <sup>-1</sup>
	Sea surface temperature	Global, over ocean	50km	$\pm 0.8^{\circ}C$	$\pm 0.5^{\circ}C$	$\pm 0.2^{\circ}C$	-2-35 <sup>o</sup> C
	Sea surface wind speed	Global, over ocean	15km	$\pm 1.5m s^{-1}$	$\pm 1.0m s^{-1}$	$\pm 1.0m s^{-1}$	0-30m s <sup>-1</sup>
	Sea ice concentration	Polar region, over ocean	15km	$\pm 10\%$	$\pm 10\%$	$\pm 5\%$	0-100%
	Snow depth	Land	30km	$\pm 20cm$	$\pm 20cm$	$\pm 10cm$	0-100 cm
	Soil moisture	Land	50km	$\pm 10\%$	$\pm 10\%$	$\pm 5\%$	0-40%

**Research Products:** Potential candidates include all-weather sea surface wind speed, sea ice moving vector, sea ice thickness, land hydrological assimilated products, and so forth.

# GCOM-W1 Data Providing Service



GCOM-W1 Data Providing Service



## Welcome,

This web service is online data service to provide products processed from Advanced Microwave Scanning Radiometer sensor series data. We provide products derived from data obtained by AMSR onboard ADEOS-II (Midori II) and AMSR-E onboard Aqua with free of charge. The new products, which are observed by AMSR2 onboard GCOM-W1 (SHIZUKU), will be available soon after the distributing preparation is completed.

User registration is required to use the products. If you have not registered yet, register your e-mail address as your user account at "User Registration". If you try services at this site before user registration, login with a e-mail address "guest" (password is not required).

Input e-mail address and password.

E-mail address:  
(User Account)


Password:

日本語  English

Save Login Status

Login

[User Registration](#) | [If you forgot your password](#)

 [For Beginners](#)

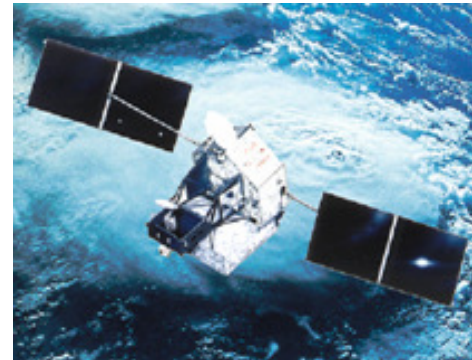
Copyright (C) 2011 Japan Aerospace Exploration Agency

- <https://gcom-w1.jaxa.jp/>
- Standard products of AMSR2, AMSR-E, and AMSR
- AMSR2 brightness temperatures were released in January 2013.
- AMSR2 geophysical parameters were released in May 2013.

# Tropical Rainfall Measuring Mission

## (TRMM)

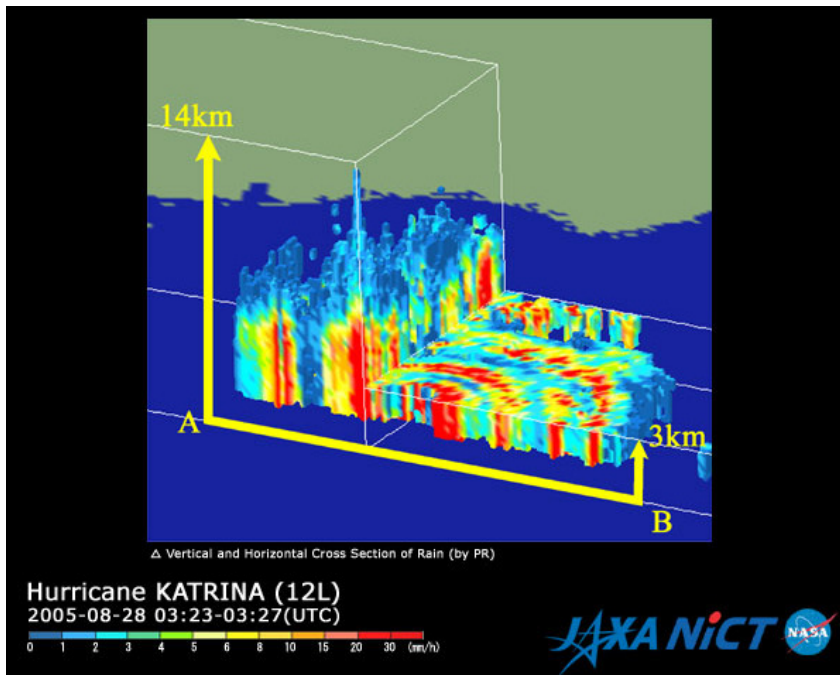
- **Focused on rainfall observation.** First instantaneous rainfall observation by three different sensors (PR, TMI, VIRS). **PR, active sensor, can observe 3D structure of rainfall.**
- Targeting tropical and subtropical region, and chose non-sun-synchronous orbit (inc. angle 35 degree) to observe diurnal variation.



**US-Japan joint mission**

**Japan: PR, launch**

**US: satellite, TMI, VIRS, CERES, LIS, operation**

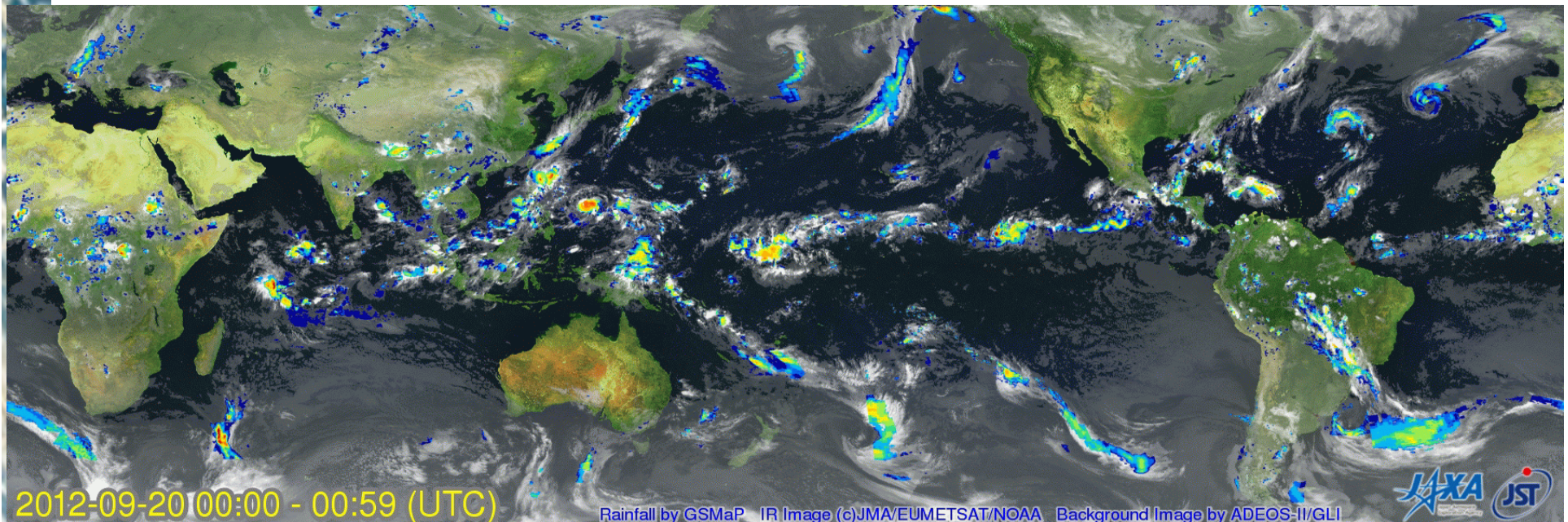


Launch	28 Nov. 1997 (JST)
Altitude	About 350km (since 2001, boosted to 402km to extend mission operation)
Inc. angle	About 35 degree, non-sun-synchronous orbit
Design life	3-year and 2month (still operating)
Instruments	<b>Precipitation Radar (PR)</b> <b>TRMM Microwave Imager (TMI)</b> <b>Visible Infrared Scanner (VIRS)</b> Lightning Imaging Sensor (LIS) CERES (not in operation)

# JAXA/EORC Global Rainfall Watch

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

3-hourly animation of Typhoon 17 and global rainfall observed by GSMaP\_NRT from 20 Sep. to 1 Oct., 2012.

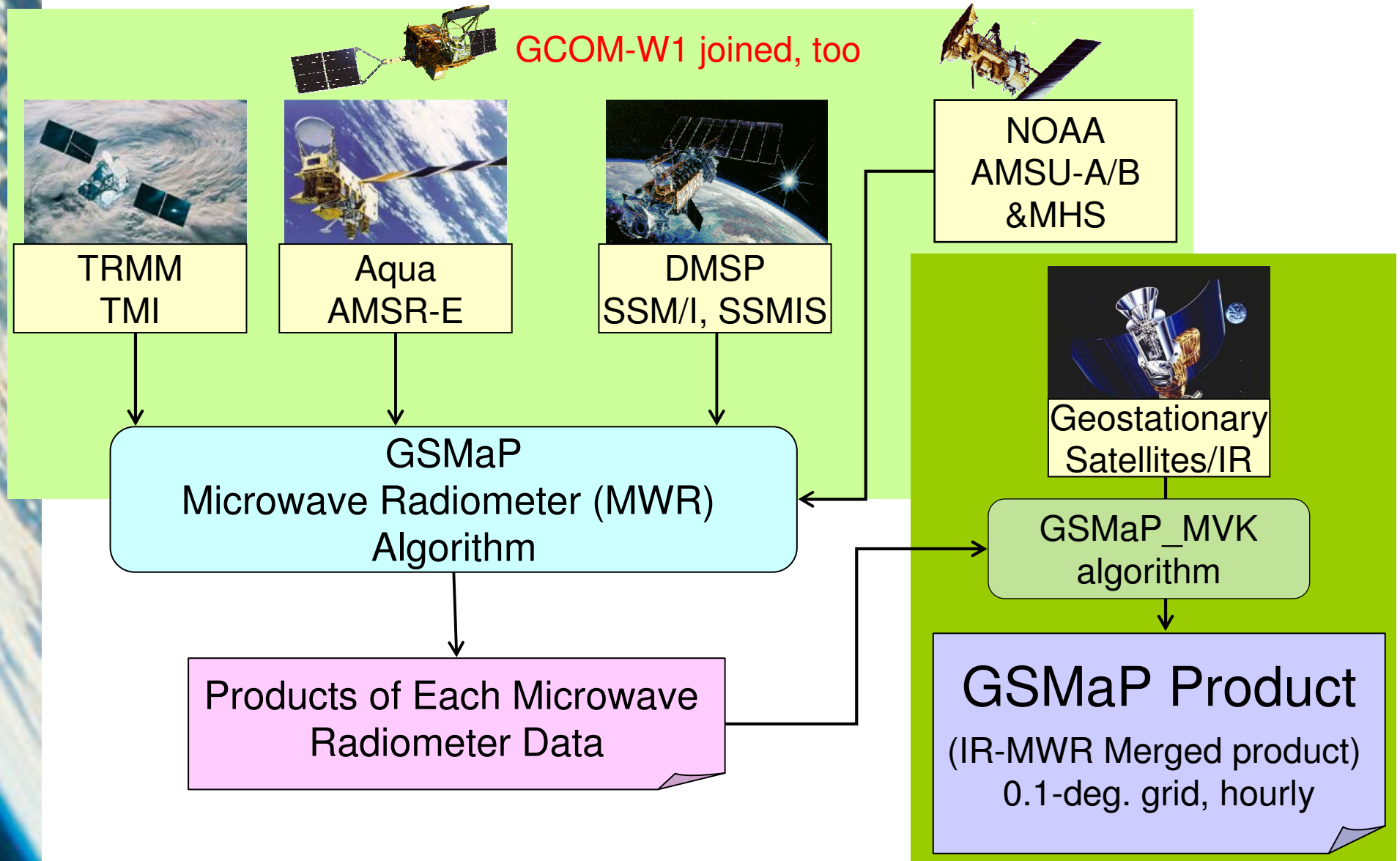


Rain 0.1 0.5 1.0 2.0 3.0 5.0 10.0 15.0 20.0 25.0 30.0 [mm/hr]

**JAXA/EORC Global Rainfall Watch** web site releases GSMaP\_NRT products by merging TRMM and a number of passive microwave radiometers with geo-stationary IR information. Providing hourly and 0.1-degree grid data 4-hour after observation.

- browse images, Google Earth KMZ files, 24-hour animations
- binary data for research purposes
- reanalysis version (GSMaP\_MVK) from Mar. 2000 to Nov. 2010 is also available

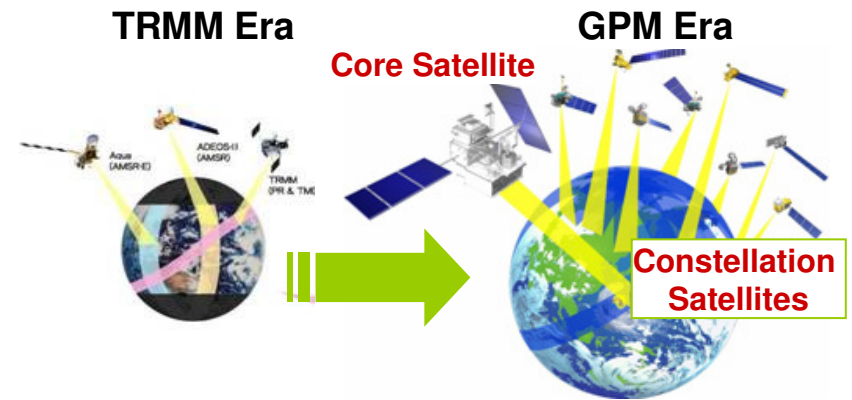
# Global Satellite Mapping of Precipitation (GSMaP)





# Global Precipitation Measurement (GPM)

- GPM: An international satellite mission to be launched by JAXA and NASA in 2014 for precipitation measurements worldwide



## Core Satellite (JAXA, NASA)

*Dual-frequency precipitation radar (DPR)*  
*GPM Microwave Imager (GMI)*

- Precipitation with high precision
- Discrimination between rain and snow
- Adjustment of data from constellation satellites (The core satellite will fly in **non-sun-synchronous orbit.**)

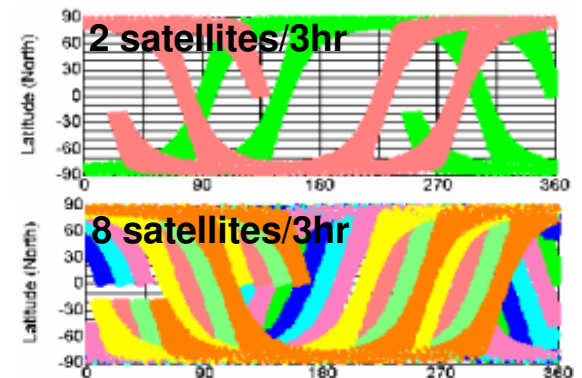
(launch in early 2014)

## Constellation Satellites (International Partners)

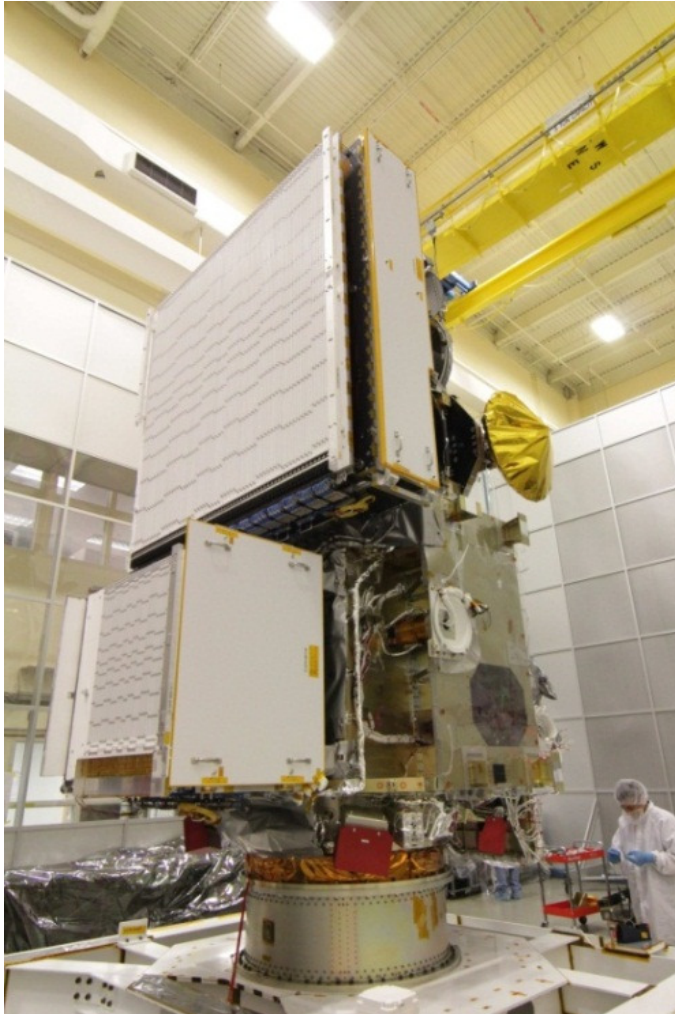
- Microwave radiometers*  
*Microwave sounders*
- Global precipitation every 3 hours

(launch around 2014)

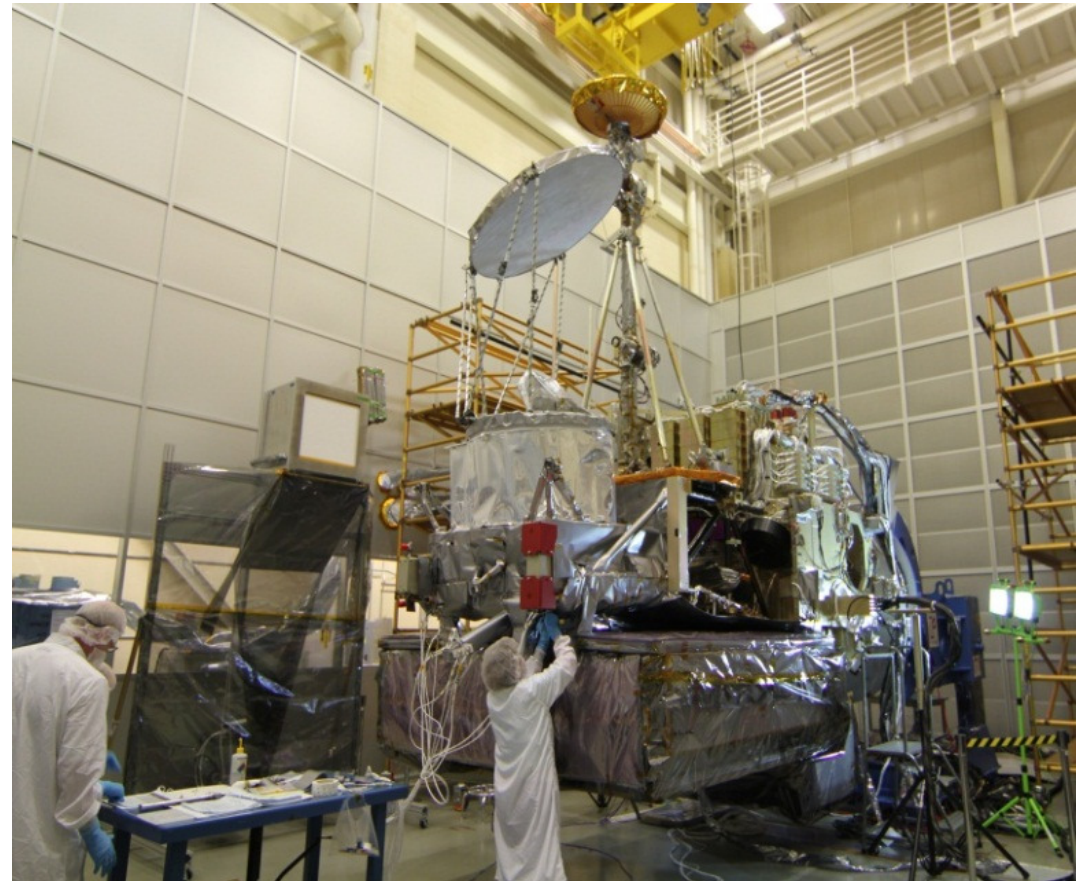
- Improve the accuracy of both long-term and short-term weather forecasts
- Improve water resource management in river control and irrigation systems for agriculture



# GPM Core Observatory with DPR

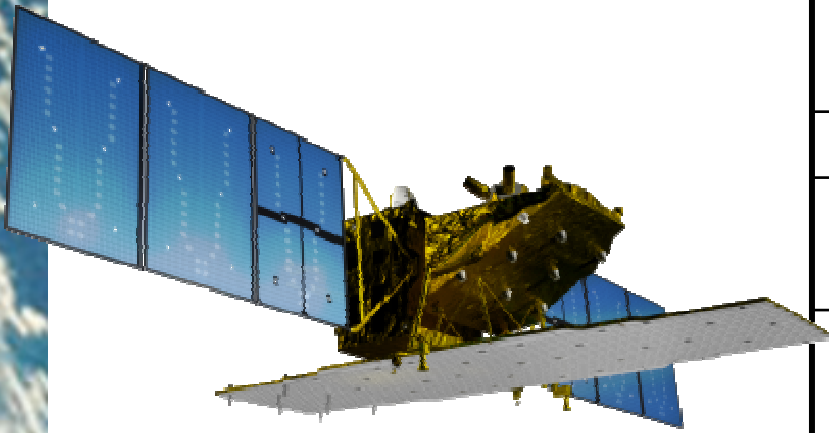


DPR mechanically integrated to the core observatory (photo provided by NASA)



GPM core observatory in GMI and HGA deployed configuration (photo provided by NASA)

# ALOS-2 Specification



**ALOS-2: SAR Satellite**

- ✓ August, 2009: Project Team was established
- ✓ December 2009: Preliminary Design Phase
- ✓ October 2010: Critical Design Phase
- ✓ Planned to be launch in 2013

Orbit		Sun-Synchronous Sub-Recurrent
		Altitude: Approx. 630km
		LST: 12:00 in descending orbit
Design Life		5 years
Launch	Target	JFY2013
	Rocket	H-2A
Satellite	Mass	Approx. 2 ton
	Solar Paddle	Two-wings type panel
Mission Data Transmission		Direct / via. Data Relay Satellite
Mission Sensor		Synthetic Aperture Radar (SAR)
Frequency		L-band (1.2GHz)
Major Observation Mode	Fine	Resolution: 1-3 m, Width: 25 km
	Basic	Resolution: 3 / 6 / 10 m Width: 50 / 50 / 70 km
	Wide	Resolution: 100 m, Width: 350 km
Mission Objectives		Crustal change, volcano monitoring, surface deformation
		Sea ice, river, forest and agriculture monitoring etc.

# GCOM-C1 and SGLI

- Improvement of land, coastal, and aerosol observations.
  - fine (250m) spatial resolution
  - polarization/along-track slant view



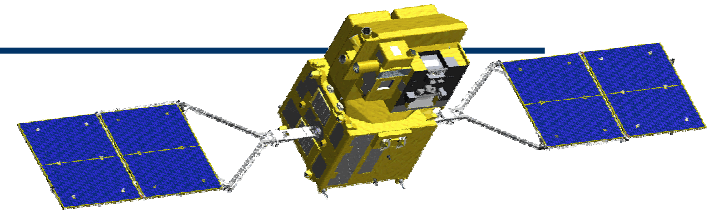
GCOM-C SGLI characteristics (Current baseline)	
Orbit	Sun-synchronous (descending local time: 10:30) Altitude: 798km, Inclination: 98.6deg
Launch Date	Jan. 2014 (HII-A)
Mission Life	5 years (3 satellites; total 13 years)
Scan	Push-broom electric scan (VNR: VN & P) Wisk-broom mechanical scan (IRS: SW & T)
Scan width	1150km cross track (VNR: VN & P) 1400km cross track (IRS: SW & T)
Digitalization	12bit
Polarization	3 polarization angles for P
Along track direction	Nadir for VN, SW and T, +45 deg and -45 deg for P
On-board calibration	VN: Solar diffuser, Internal lamp (LED, halogen), Lunar by pitch maneuvers (~once/month), and dark current by masked pixels and nighttime obs. SW: Solar diffuser, Internal lamp, Lunar, and dark current by deep space window T: Black body and dark current by deep space window All: Electric calibration

Multi-angle obs. for 674nm and 869nm

SGLI channels						
CH	$\lambda$	$\Delta\lambda$	$L_{std}$	$L_{max}$	SNR <sub>1σ</sub> Lstd	FOV
	VN, P, SW: nm T: $\mu\text{m}$	VN, P: W/m <sup>2</sup> /sr/ $\mu\text{m}$ T: Kelvin	VN, P, SW: T: NE $\Delta$ T		m	
VN1	380	10	60	210	250	250
VN2	412	10	75	250	400	250
VN3	443	10	64	400	300	250
VN4	490	10	53	120	400	250
VN5	530	20	41	350	250	250
VN6	565	20	33	90	400	250
VN7	673.5	20	23	62	400	250
VN8	673.5	20	25	210	250	250
VN9	763	12	40	350	1200(@1km)	250
VN10	868.5	20	8	30	400	250
VN11	868.5	20	30	300	200	250
P1	673.5	20	25	250	250	1000
P2	868.5	20	30	300	250	1000
SW1	1050	20	57	248	500	1000
SW2	1380	20	8	103	150	1000
SW3	1630	200	3	50	57	250
SW4	2210	50	1.9	20	211	1000
T1	10.8	0.7	300	340	0.2	500/250
T2	12.0	0.7	300	340	0.2	500/250

250m-mode possibility

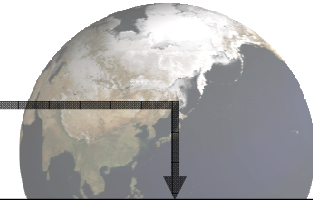
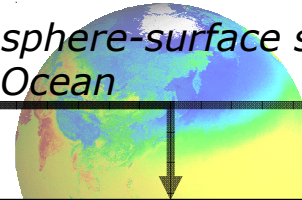
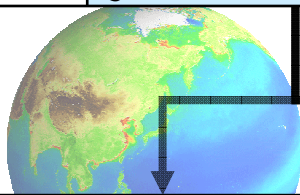
# GCOM-C Products



Common	
Radiance	<ul style="list-style-type: none"> <li>TOA radiance (including system geometric correction)</li> </ul>

Blue: standard products  
Red: research products

- Radiation budget by the atmosphere-surface system
- Carbon cycle in the Land and Ocean



Land	
Surface reflectance	<ul style="list-style-type: none"> <li>Precise geometric correction</li> <li>Atmospheric corrected reflectance</li> </ul>
Vegetation and carbon cycle	<ul style="list-style-type: none"> <li>Vegetation index</li> <li>Above-ground biomass <b>ECV</b></li> <li>Vegetation roughness index</li> <li>Shadow index</li> </ul>
	<ul style="list-style-type: none"> <li>Fraction of Absorbed Photosynthetically available radiation <b>ECV</b></li> <li>Leaf area index <b>ECV</b></li> </ul>
	Temp. <ul style="list-style-type: none"> <li>Surface temperature</li> </ul>
	Application <ul style="list-style-type: none"> <li>Land net primary production</li> <li>Water stress trend</li> <li>Fire detection index <b>ECV</b></li> <li>Land cover type <b>ECV</b></li> <li>Land surface albedo <b>ECV</b></li> </ul>

Atmosphere	
Cloud <b>ECV</b>	<ul style="list-style-type: none"> <li>Cloud flag/Classification</li> <li>Classified cloud fraction</li> <li>Cloud top temp/height</li> </ul>
	<ul style="list-style-type: none"> <li>Water cloud optical thickness / effective radius</li> <li>Ice cloud optical thickness</li> <li>Water cloud geometrical thickness</li> </ul>
	Aerosol <b>ECV</b> <ul style="list-style-type: none"> <li>Aerosol over the ocean</li> <li>Land aerosol by near ultra violet</li> <li>Aerosol by Polarization</li> </ul>
	Radiation budget <b>ECV</b> <ul style="list-style-type: none"> <li>Long-wave radiation flux</li> <li>Short-wave radiation flux</li> </ul>

Ocean	
Ocean color <b>ECV</b>	<ul style="list-style-type: none"> <li>Normalized water leaving radiance</li> <li>Atmospheric correction parameter</li> <li>Photosynthetically available radiation</li> </ul>
	Euphotic zone depth
	In-water <ul style="list-style-type: none"> <li>Chlorophyll-a conc.</li> <li>Suspended solid conc.</li> <li>Colored dissolved organic matter</li> </ul>
In-water	Inherent optical properties
Temp.	Sea surface temp. <b>ECV</b>
Application	Ocean net primary productivity
	Phytoplankton functional type
	Redtide
	multi sensor merged ocean color
	multi sensor merged SST

Cryosphere	
Area/distribution	<ul style="list-style-type: none"> <li>Snow and Ice covered area <b>ECV</b></li> <li>Okhotsk sea-ice distribution</li> </ul>
	<ul style="list-style-type: none"> <li>Snow and ice classification</li> <li>Snow covered area in forest and mountain</li> </ul>
	Surface properties <ul style="list-style-type: none"> <li>Snow and ice surface Temperature</li> <li>Snow grain size of shallow layer</li> <li>Snow grain size of subsurface layer</li> <li>Snow grain size of top layer</li> <li>Snow and ice albedo <b>ECV</b></li> <li>Snow impurity</li> <li>Ice sheet surface roughness</li> </ul>
Boundary	Ice sheet boundary monitoring <b>ECV</b>

# JASMES Daily

**JASMES** JAXA Satellite Monitoring for Environmental Studies  
**for water cycle**

**Search Menu**

Show Images

Date: 2013 Jan 22

Projection: Parallel Lat./Lon. (EQR)

Sensor(Multiple selection):  AMSR2 Asc/Des(Both)  AMSR-E Asc/Des(Both)  TMI Asc/Des(Both)  WindSat Asc/Des(Both)  SSM/I F13 Asc/Des(Both)  SSM/I F15 Asc/Des(Both)

Product(Multiple selection):  Sea Surface Temperature  Snow Depth  Soil Moisture Content  Total Precipitable Water

We are now validating the AMSR2 data, and will provide the following schedule.  
 - Level1 data: JAN, 2013  
 - Level2,3 data: MAY, 2013  
 AMSR2(GCOM-W1) Data Providing Service(<https://ecom-w1.jaxa.jp/auth.html>)

< prev. **2013-Jan-22** next >

AMSR2 SST(Ascending) AMSR2 SST(Descending)

0 10 20 30 [deg C]

0 10 20 30 [deg C]

AMSR2 SND(Ascending) AMSR2 SND(Descending)

[http://suzaku.eorc.jaxa.jp/GCOM\\_W/JASMES\\_daily/](http://suzaku.eorc.jaxa.jp/GCOM_W/JASMES_daily/)

## Space Application For Environment

1. SAFE is conducted as an Asia-Pacific Space Agency Forum (APRSAF) initiative
2. SAFE is aiming to enhance the **capability of Satellite technology** in the Asia Pacific region
3. Each SAFE implementing team is expected to construct a prototype of **operational use** of Satellite technology within **two years**
4. It is recommended to transfer SAFE accomplishments to stake holders to realize **sustainable use** of the technology

# SAFE prototyping line-up

N	Country	Prototyping title
Completed	VIETNAM	Integrated water resource management
	VIETNAM	Forest monitoring
	LAO PDR	Forest monitoring and management
	CAMBODIA	Water Cycle and Agricultural Activities
	PAKISTAN	Monitoring Water Cycle Variations & Assessing Climate Change Impacts
	SRI LANKA	Risk of Sea Level Rise on Coastal Zone
	INDONESIA	Potential Drought Monitoring
	VIETNAM	Mangrove Forest Mapping and Carbon Stock Estimation
	THAILAND	Economic Fish Larvae Mapping and Monitoring
	SRI LANKA	Modeling ocean frontal zones using high resolution satellite and float data to locate tuna fish aggregations
On-going	SRI LANKA	Mapping and Detecting Wetlands in River Basin
	INDONESIA	Assessment of drought impact on rice production in Indonesia by satellite remote sensing and dissemination with web-GIS
	CAMBODIA	Water and Food Security under the Climate Change
	BANGLADESH	Investigation of sedimentation process and stability of the area around the cross-dams in Meghna estuary
	INDONESIA	The assessment of Mangrove Forest Carbon Stock Monitoring of Indonesia using Remote Sensing Approach
	MALAYSIA	Agricultural land abandonment
	INDONESIA	SAR Rice crop
	VIETNAM	Rice crop monitoring



# Sri Lanka case

## The case of giving an impact to considering the law in the country

Prototyping title; Risk of Sea Level Rise on Coastal Zone (Coastal management)

Executor; Mr. Eng. BANDULA Wickramarachchi, Coastal Conservation Department

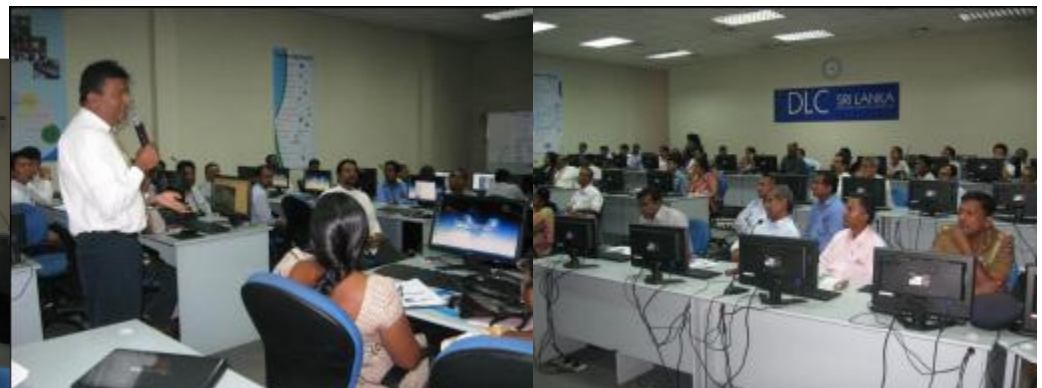
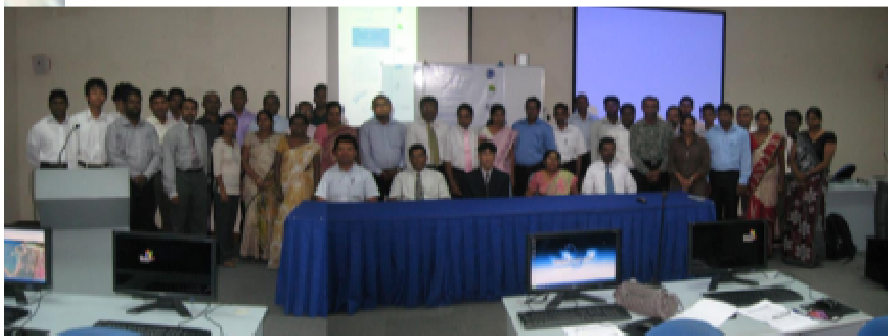
Overview of the stake holder meeting:

Date; 24 Aug 2011

Attendees; Authorities, high rankers and private sectors who has responsible for developing the area

Result of the stake holder meeting;

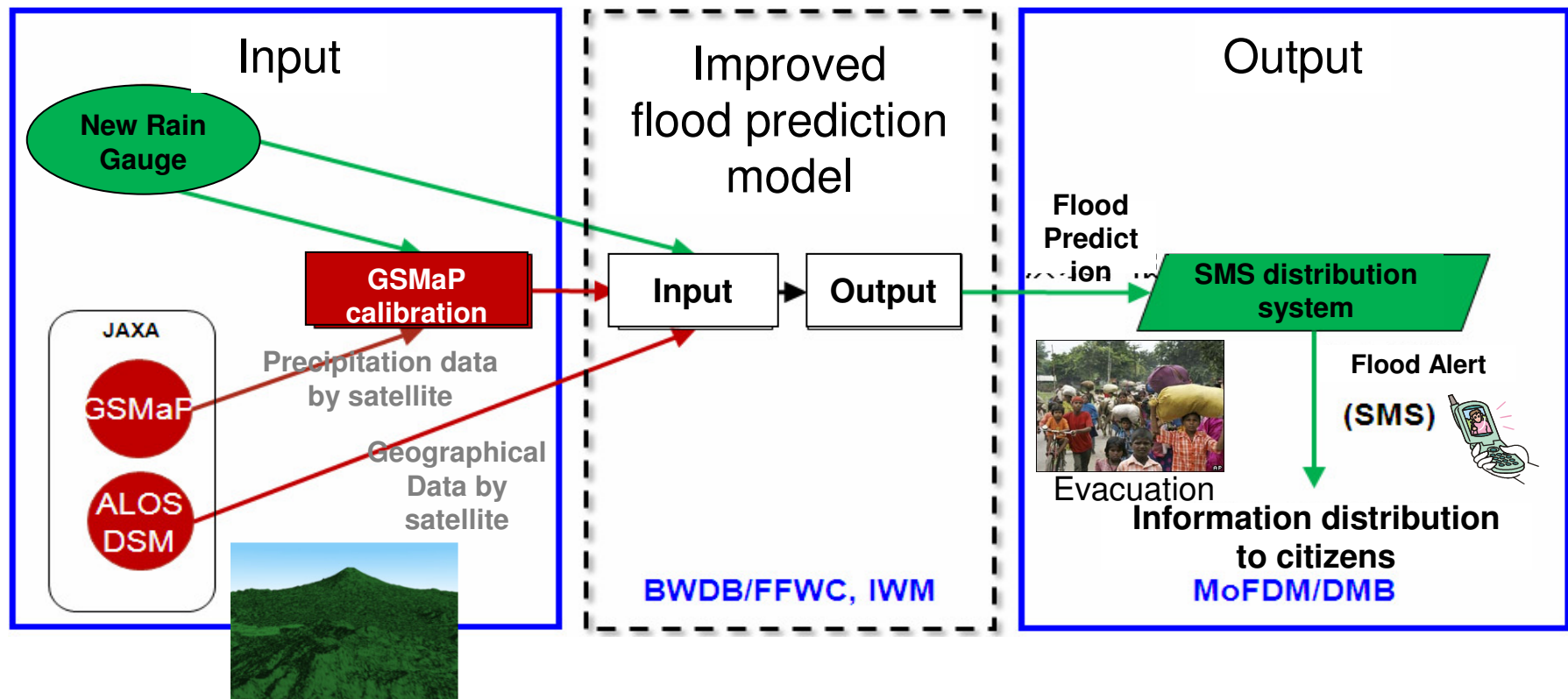
- Giving committee by including people concerned with work-site operations, as the governmental policy.
- Started discussions for establishment preparations of governmental or administrative laws and ordinances.



# ADB and JAXA joint project "Remote sensing application for river basin management" (2012~2014) in Bangladesh, Vietnam, and Philippines



- Earlier flood forecasting system using rain precipitation data in upper river basins obtained by Global Satellite Mapping of Precipitation (GSMaP) using TRMM and other satellites, as well as using elevation information of land surface by ALOS.
- Rapid message delivery of flood information to cell phones for the related organizations and the public.
- Development of plan and capacity buildings to continue utilizations.



Thank you for your attention

