

# **JAXA's satellites for Disaster Management and Climate Change**

August 24, 2017

Masanobu TSUJI

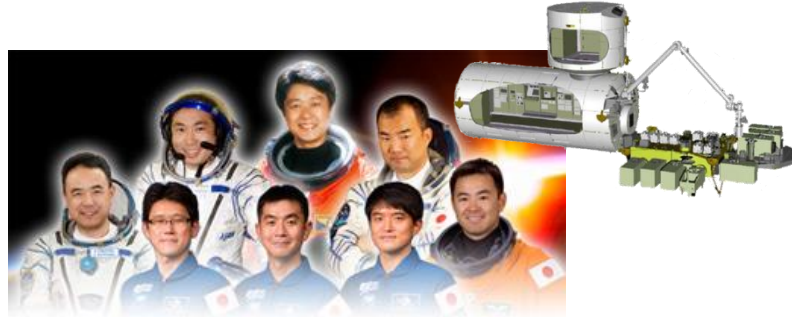
Japan Aerospace Exploration Agency (JAXA)

# JAXA Activities

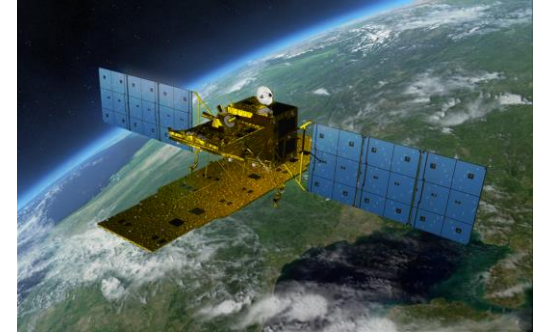
## Space Transportation



## Human Space Activities



## Satellite Programs



## Lunar & Planetary Exploration Programs



## Aviation Programs



## Space Science

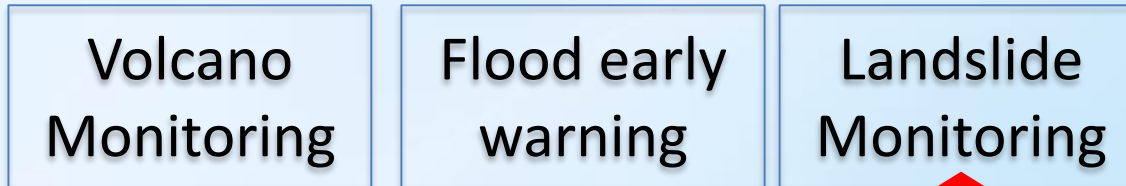




# JAXA's Earth Observation Programs

JAXA's EO scenario

## 1. Disaster Risk Management



## 2. Climate Change (Mitigation/Adaptation)



## 3. New Applications



**Geospatial Information**  
**By Satellite Remote Sensing**

- 2013

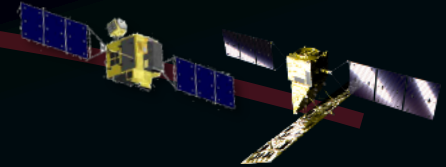
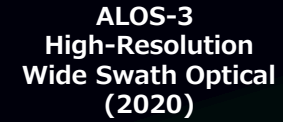
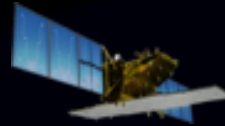
2014

2016

2018

2020 (JFY)

### High Resolution

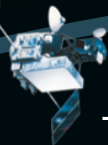


### Climate Change & Water Cycle

Aqua/AMSR-E  
(2002)



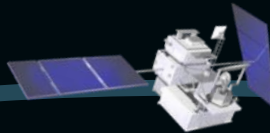
TRMM/PR  
(1997)



GCOM-W  
(2011)



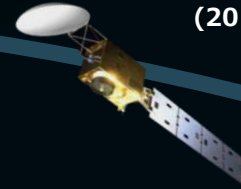
GPM/DPR  
(2013)



GCOM-C  
(2017)

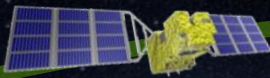


EarthCARE/CPR  
(2018)



### GHG Monitoring

GOSAT  
(2009)



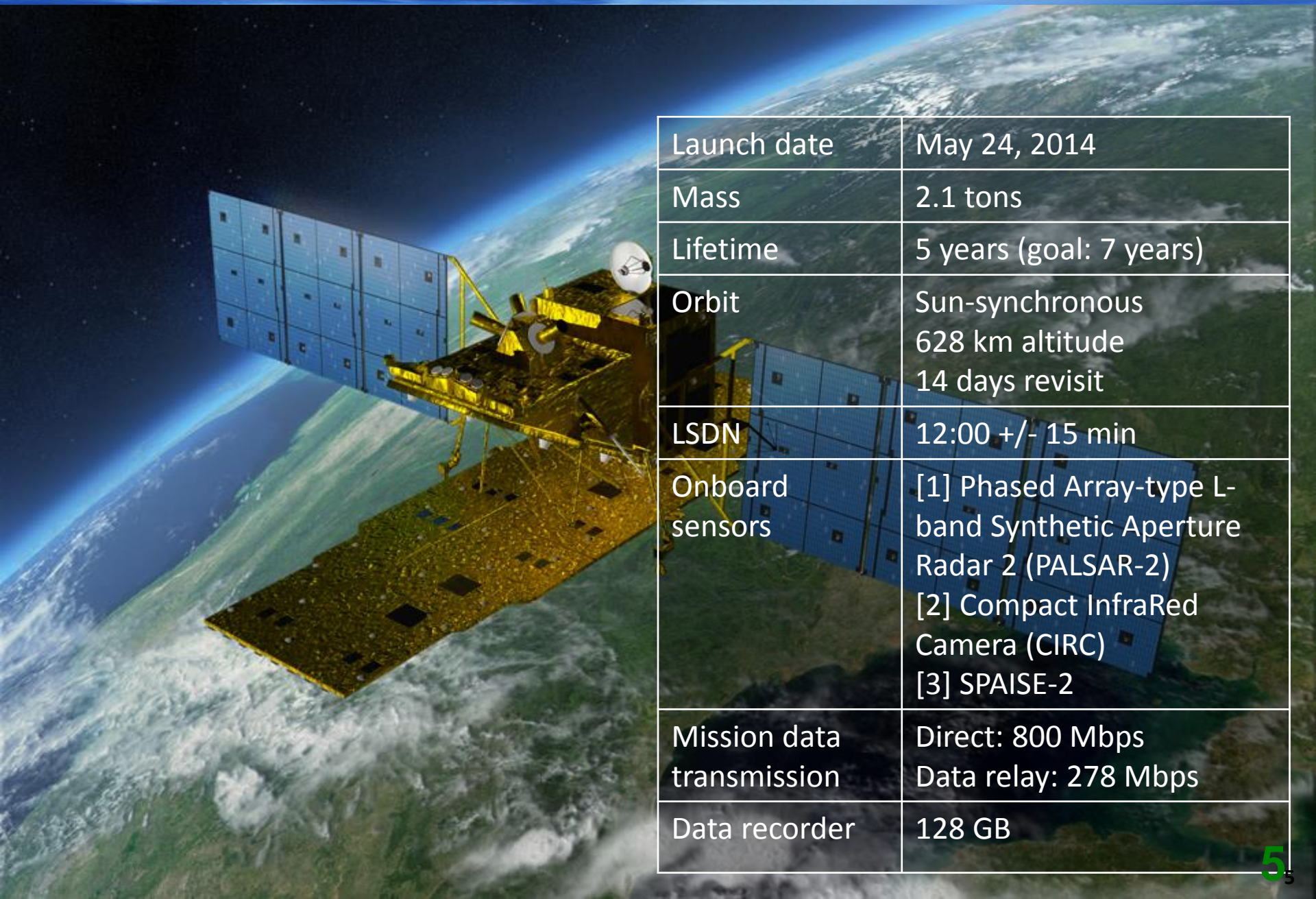
GOSAT-2  
(2018)



# Japanese Current and Future Missions

# Disaster Risk Management

# “Daichi-2” (ALOS-2)

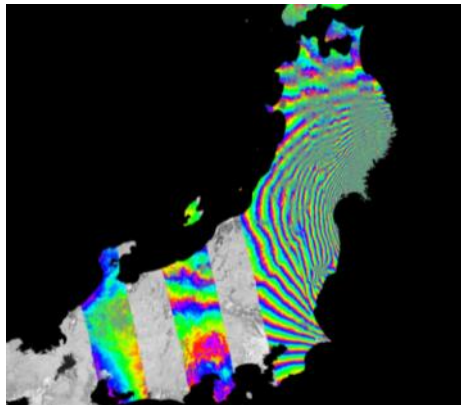


Launch date	May 24, 2014
Mass	2.1 tons
Lifetime	5 years (goal: 7 years)
Orbit	Sun-synchronous 628 km altitude 14 days revisit
LSDN	12:00 +/- 15 min
Onboard sensors	[1] Phased Array-type L-band Synthetic Aperture Radar 2 (PALSAR-2) [2] Compact InfraRed Camera (CIRC) [3] SPAISE-2
Mission data transmission	Direct: 800 Mbps Data relay: 278 Mbps
Data recorder	128 GB

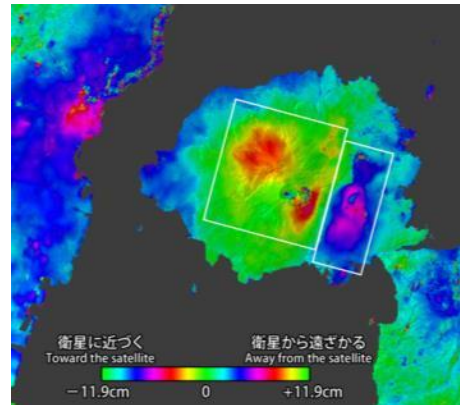
## Mission Objectives:

### Disaster monitoring

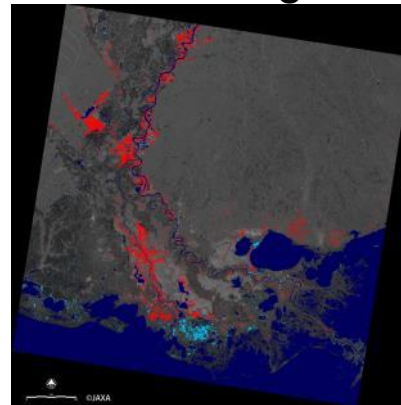
Earthquake



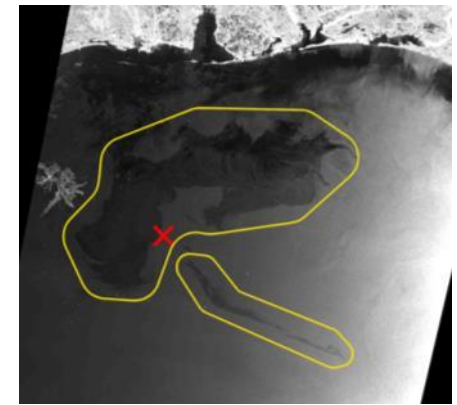
Volcano



Flooding

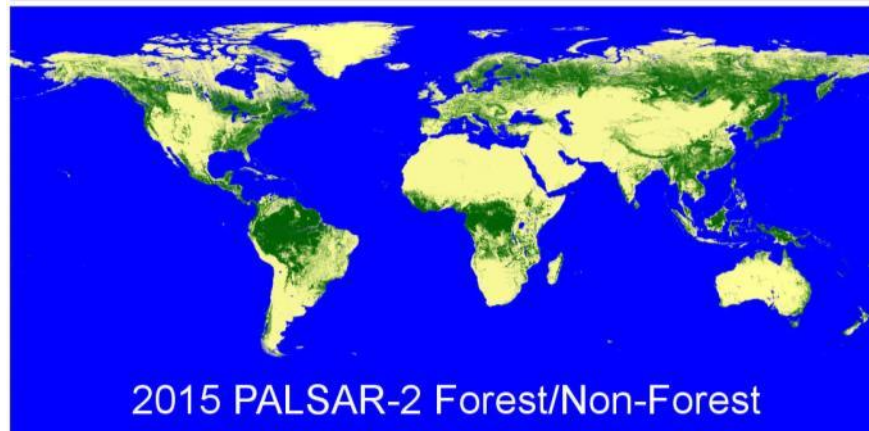


### Ocean

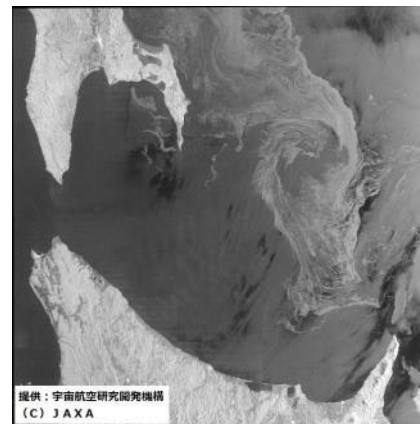


### Environment and land management

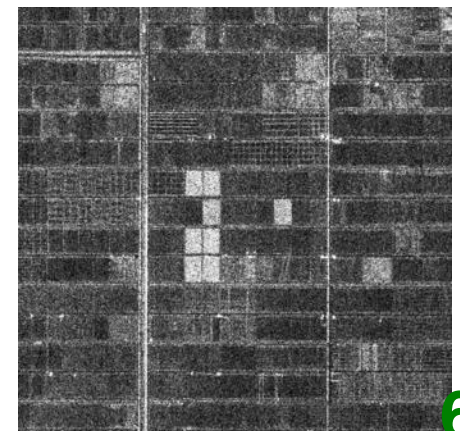
Forest and wetland



Ice

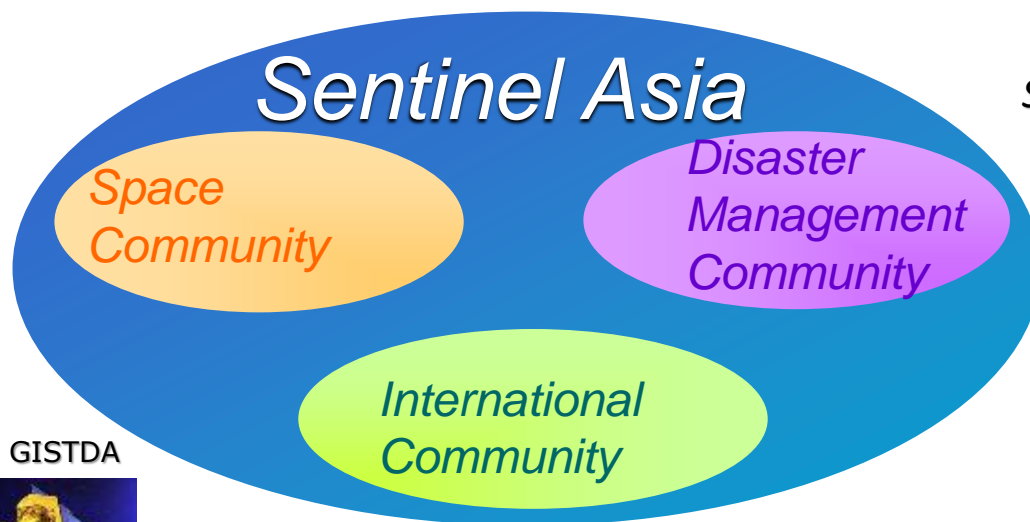


### Agriculture & natural resources



# Sentinel Asia

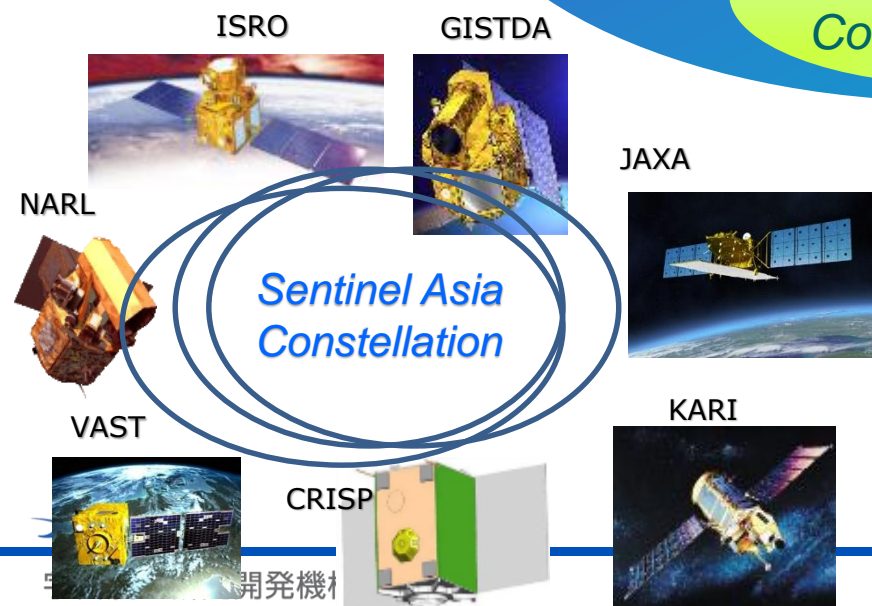
Sentinel Asia is a voluntary initiative by a collaboration between space agencies and disaster management agencies, applying Remote Sensing and Web-GIS technologies to assist disaster management in the Asia-Pacific region.



*Sentinel Asia consists of 104 JPT members incl. 89 agencies from 27 countries and 15 international organizations (as of Apr 2017) and ADRC members*

*Platform to discuss cross-cutting issues*

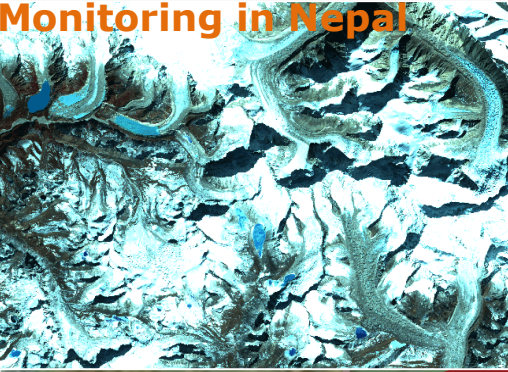
JPT meeting Colombo, Sri Lanka in January 2016





# Asian Disasters Observed by Sentinel Asia

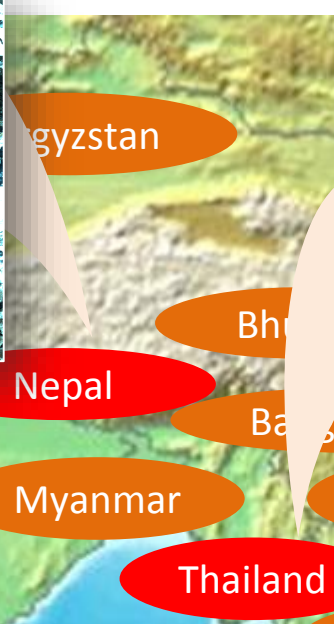
Monitoring in Nepal



Flood in Thailand



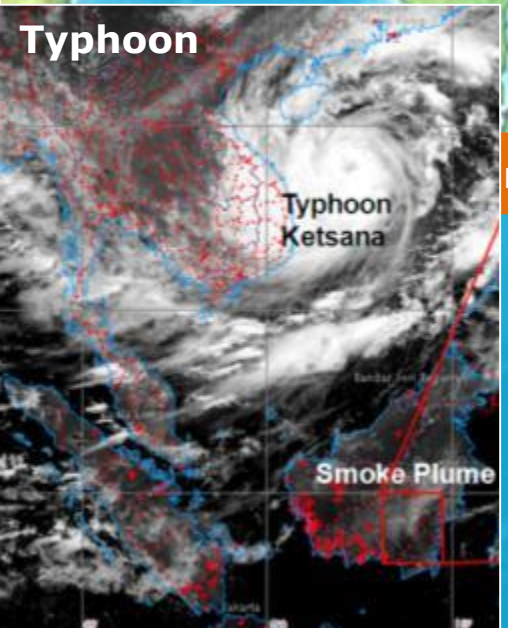
observed more than 200 disasters of 24 countries for last 8 years



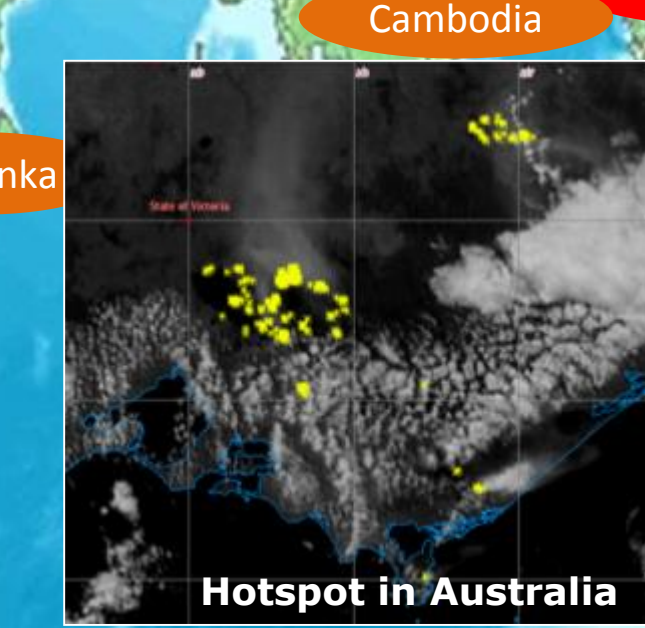
Japan



Landslide in Philippines



Typhoon



Hotspot in Australia



Philippines

Cambodia

Guinea

Fiji

Solomon Island

Australia

New Zealand



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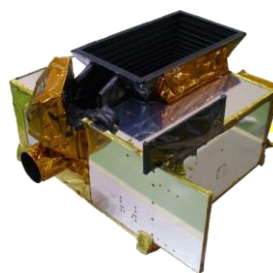
# Climate Change (Mitigation/Adaptation)

# GOSAT (Greenhouse gases Observing SATellite)

Size	Main body	3.7m(H) x1.8m(W) x 2.0m(D)(Except attachment)
	Wing Span	13.7 m
Mass	Total	1,750 kg
Power	Total	3.8KW(EOL)
Design Life	5 years	
Orbit	Sun Synchronous Orbit	
	Local time	13:00±0:15 (February 2015 - January 2016) 12:46-12:52
	Altitude, inclination, period, revisit	666±0.6 km, 98.0±0.1 deg, 98.1 min, 3 days (44 rotations)
Launch	Vehicle, date	H-IIA, Jan. 23, 2009

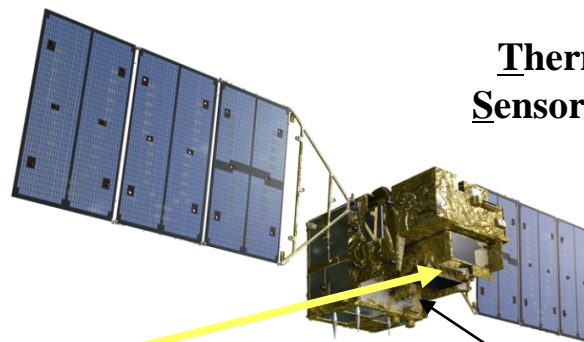


## TANSO-FTS



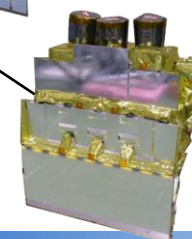
SWIR/TIR FTS

Thermal And Near infrared  
Sensor for carbon Observation



## TANSO-CAI

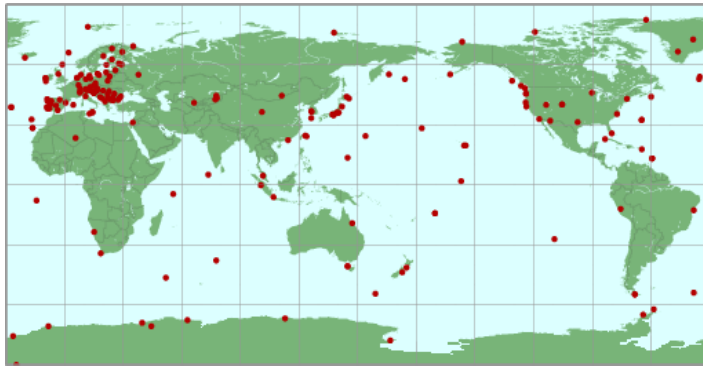
UV, Visible, SWIR Imager



# GHG Observing Points



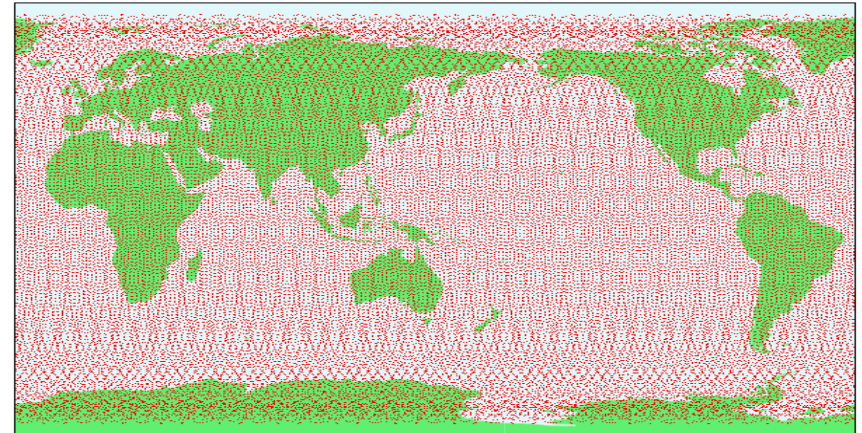
## Ground Stations



( By WMO WDCGG )



## From Space (Now)

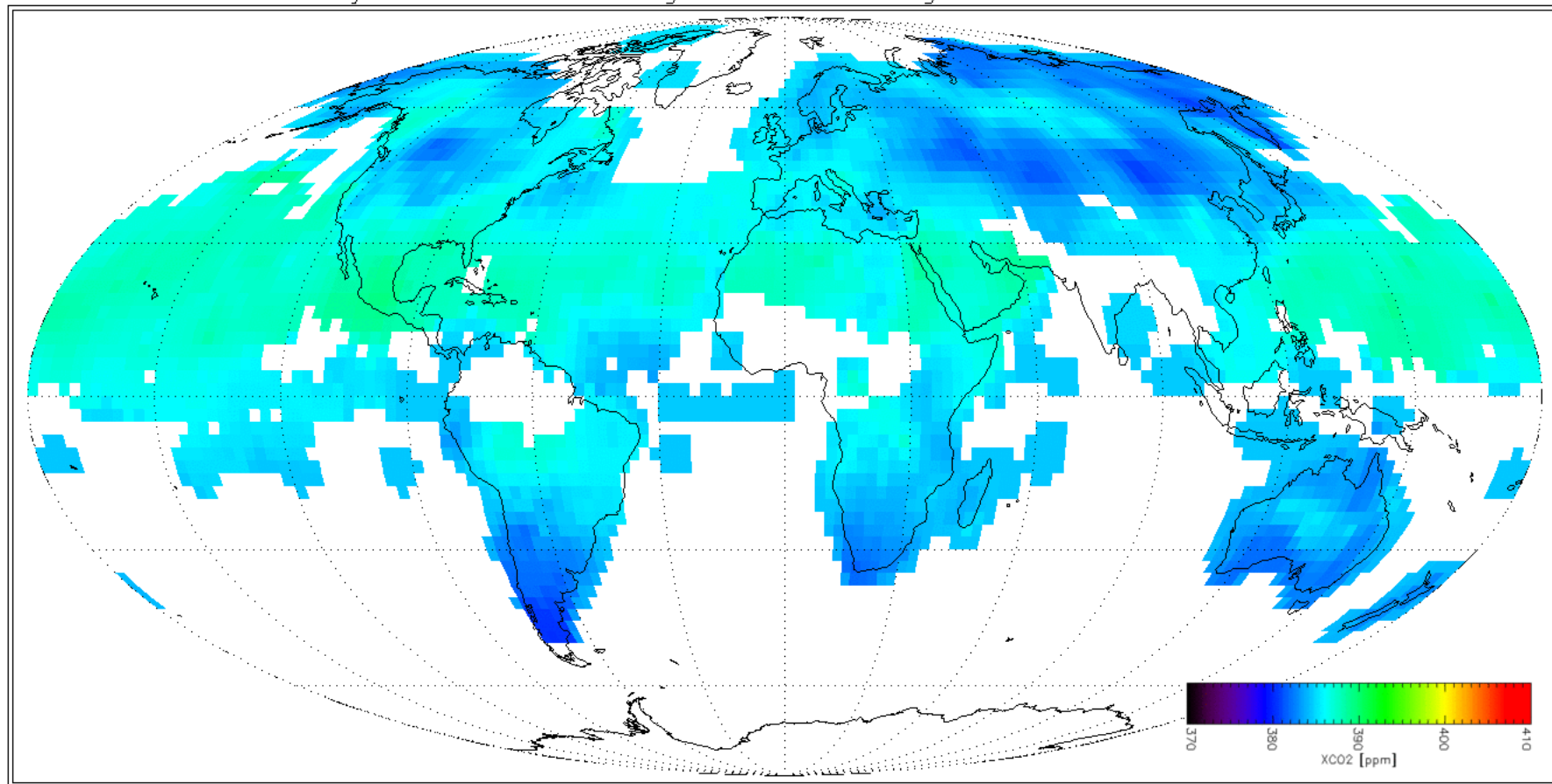


- **337** ground stations in the world.  
(at the beginning of the GOSAT program)
- The number of stations is limited, and they exist unevenly in the world.

- Over **56,000** points per 3 days by GOSAT  
(L1 data, L2 before screening)
- Global and frequent observation with a single instrument

## XCO<sub>2</sub> long term trend (movie)

Monthly CO<sub>2</sub> column-averaged volume mixing ratios 20090601 V02.21





# Forest Management 25m Global Forest Map

JJ-FAST  
WEB page

**JICA-JAXA Forest Early Warning System in the Tropics**

Rainforest Monitoring Map   Topics   Partnership   Forest Governance Improvement Initiative   About JICA & JAXA

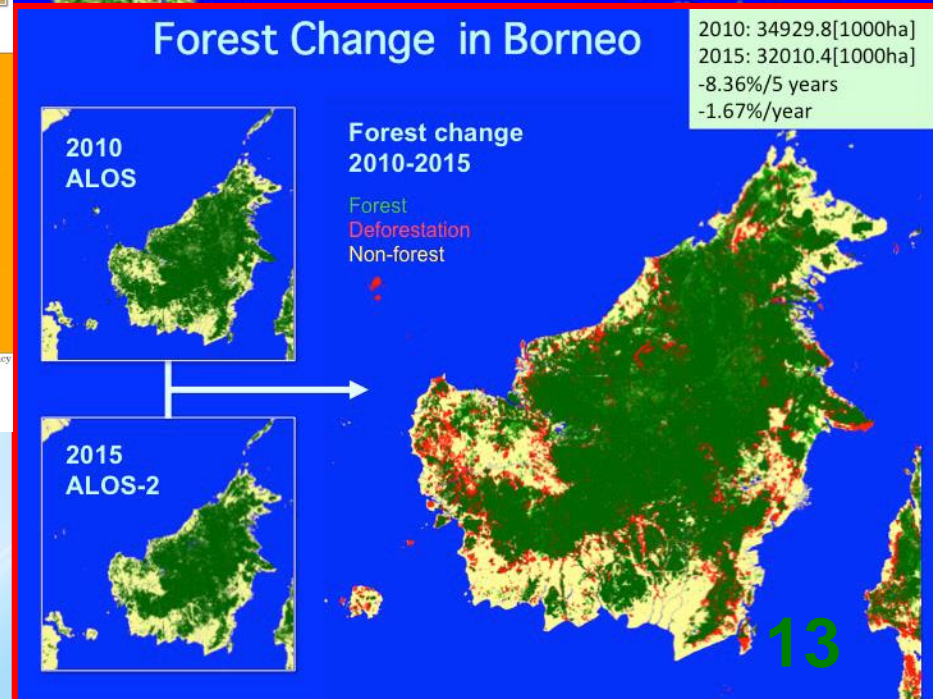
**From Partners**

Voices from the system users (government organizations, private companies, NGOs, international organizations etc.) arrive.

**Information**

- 2016.8.25** "The JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST)" will be demonstrated at the TICAD VI side event.
- 2016.8.22** New field reports and pictures from participated countries arrive.
- 2016.8.19** "The JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST)" newly opened!
- 2015.12.16** A press release on "the JICA-JAXA Forest Early Warning System in the Tropics (JJ-FAST)" was released at the JICA's web-site.

Copyright © Japan International Cooperation Agency

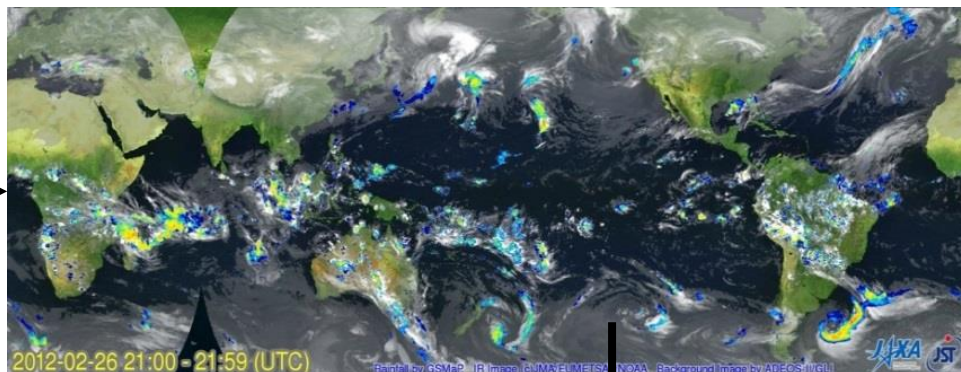


- JICA-JAXA cooperation (JJ-FAST)
- ✓ Every 1.5 month forest change data
  - ✓ Mobile data access
  - ✓ Forest change 2010 – 2015 in Indonesia

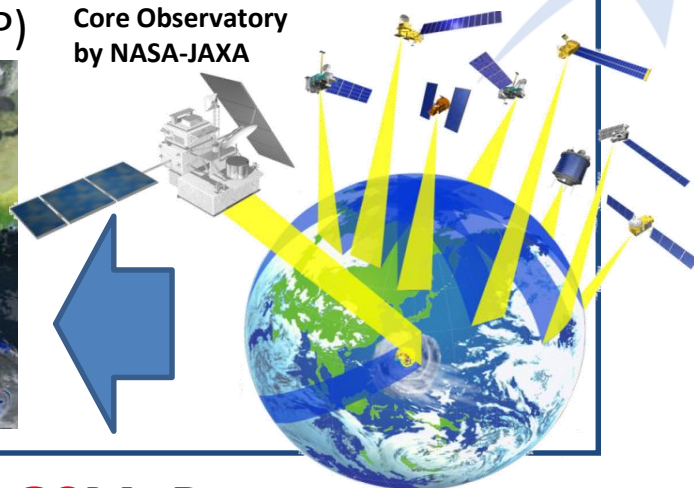
# Flood Warning System establishment

Participating countries: **Bangladesh**, the Philippines, and Viet Nam

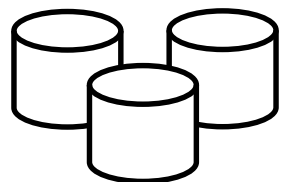
Global Satellite Mapping of Precipitation (GSMaP)



Core Observatory  
by NASA-JAXA



Calibration



Rain Gauges

Flood Forecasting  
System

**GSMaP**  
**+ rain gauges data**

SMS distribution  
system

**Flood Warning**

- Direct distribution of information
- Improvement of the flood warning lead time from 3 days to 5 days (**Bangladesh**)



**ADB** Asian Development Bank  
FIGHTING POVERTY IN ASIA AND THE PACIFIC

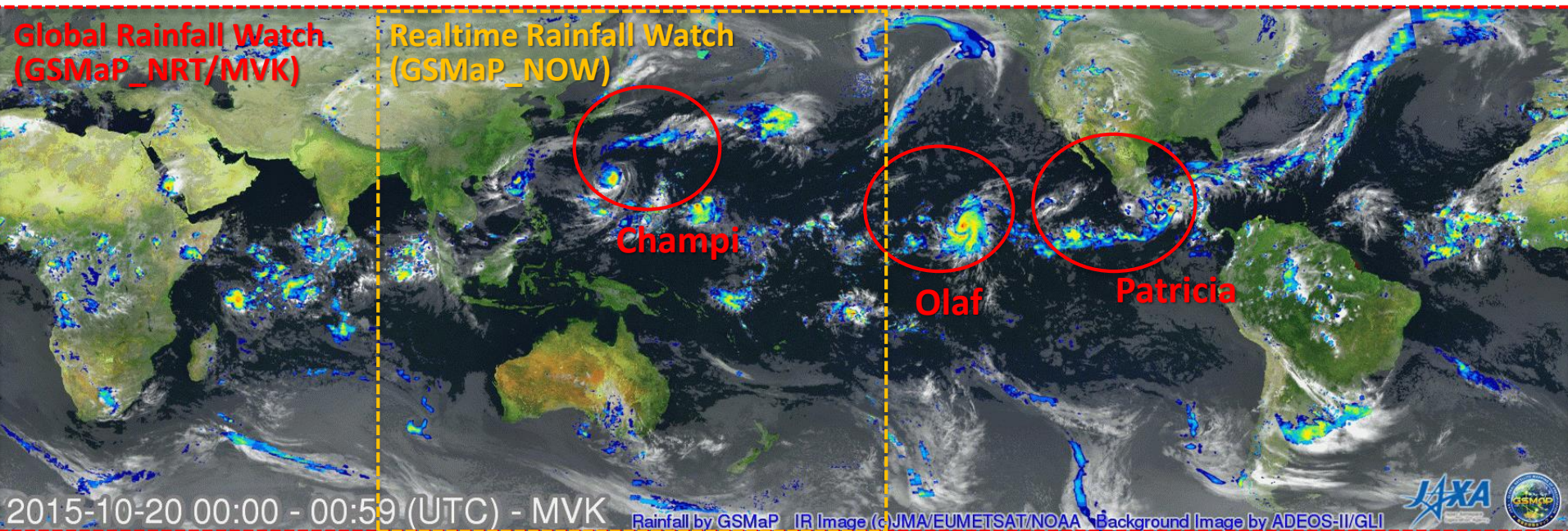
**JAXA**

宇宙航空研究開発機構

# New versions of GSMaP: GSMaP\_NOW

We have started to provide GSMaP\_NOW over the area of Himawari-8!

- It provides precipitation data in an hour after observation
- We improved the data latency from GSMaP's 4 hours to "quasi-real-time"



GSMaP observing harricane Patricia and Olaf and Typhoon Champi: 2015/10/20~2015/10/24 (hourly animation)

- For climate phenomena that changes rapidly, frequent observations are very much needed.
- Global precipitation map integrating the data from GPM core observatory, microwave radiometers/sounders, and infrared radiometers of geostationary satellites

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

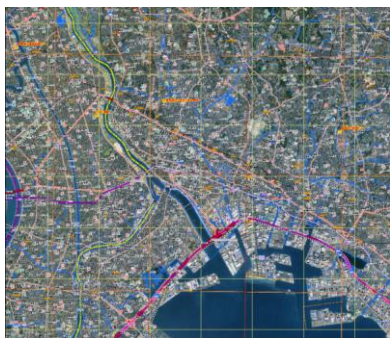
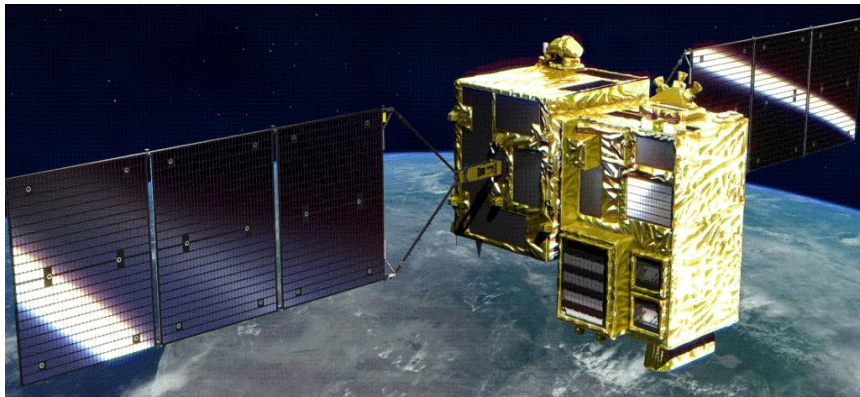
JAXA Realtime Rainfall Watch (Himawari-area): [http://sharaku.eorc.jaxa.jp/GSMaP\\_NOW](http://sharaku.eorc.jaxa.jp/GSMaP_NOW)





**What's next?**

## Advanced Optical Satellite (ALOS-3)



**Hazard Map**

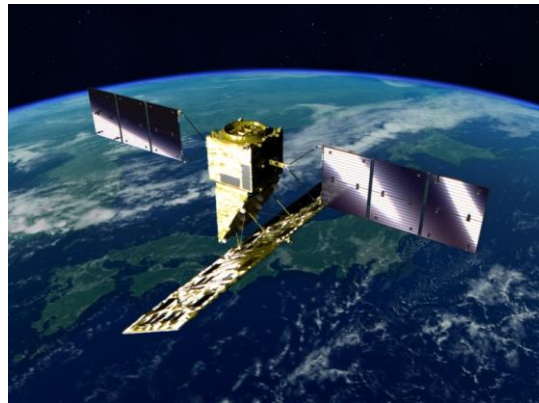
Pan: 0.8 m  
 Mu: 6 bands, 3.2 m  
 Swath: 70 km  
 Recurrent: 35 days  
 LST: 10:30am  
 Launch: to be in JFY2020



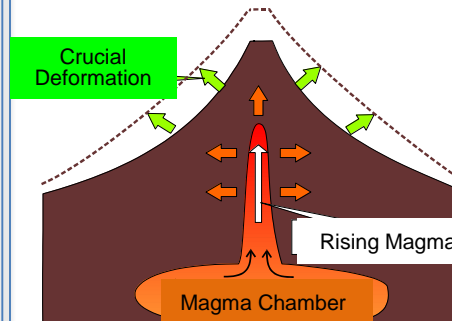
© GSI

**Precise 1/25,000 Map**

## Advanced SAR Satellite (ALOS-4)

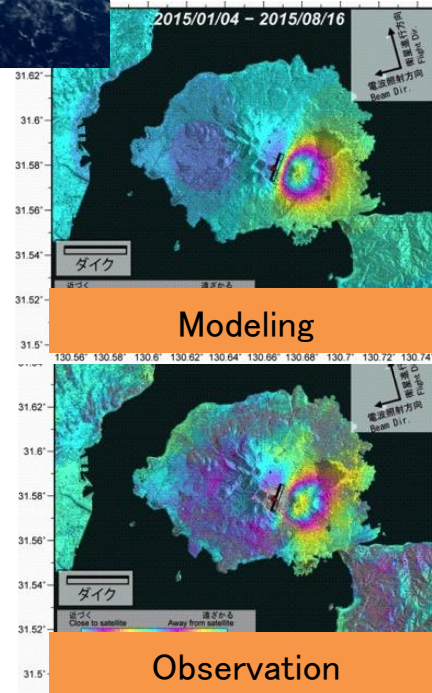


(Configuration is TBD)

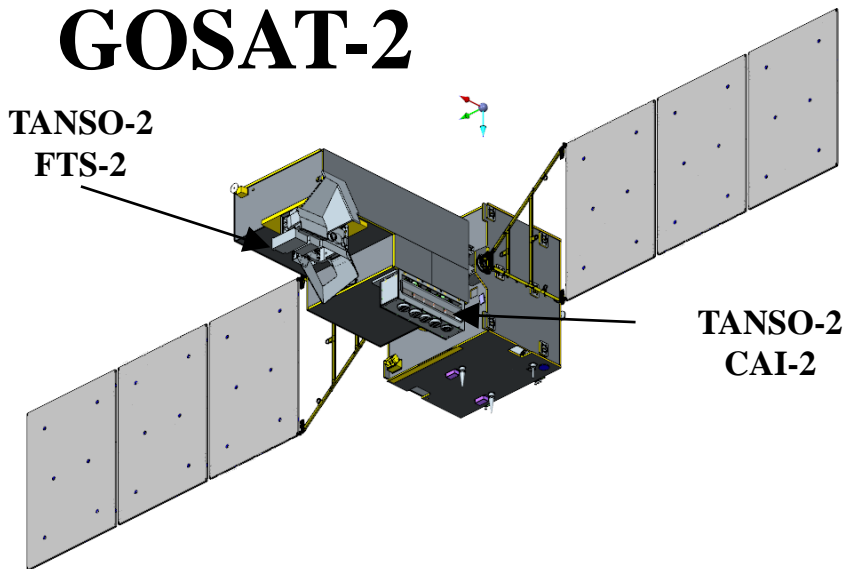


**Estimate situation of magma chamber under the ground and faulting**

**Take a decision for evacuation**



© GSI



		GOSAT-2	GOSAT
Main body Size(m) X*Y*Z		5.8 x 2.0 x 2.1 ( Wing Span 16.5m )	3.7 x 1.8 x 2.0 Wing Span 13.7m )
Total Mass		1800kg	1750kg
Total Power		5.0 kW(EOL)	3.8 kW (EOL)
Life Time		5 years	5 years
Orbit		sun synchronous	sun synchronous
	Local time	13:00+/-0:15	13:00+/-0:15
	Altitude	613km	666km
	Inclination	98deg	98deg
	Repeat	6 days (89 revol.)	3 days (44 revol.)
Launch	Vehicle	H-IIA	H-IIA
	Schedule	2018	23 Jan., 2009



# THE 24<sup>TH</sup> SESSION OF THE ASIA-PACIFIC REGIONAL SPACE AGENCY FORUM

SPACE TECHNOLOGY FOR ENHANCED GOVERNANCE AND DEVELOPMENT

14-17 NOVEMBER 2017, BENGALURU, INDIA

ORGANIZED BY  
INDIAN SPACE RESEARCH ORGANISATION (ISRO)  
MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY  
OF JAPAN (MEXT)  
JAPAN AEROSPACE EXPLORATION AGENCY (JAXA)

WEBSITE: <http://aprsaf.org>





**Thank you for your attention.**