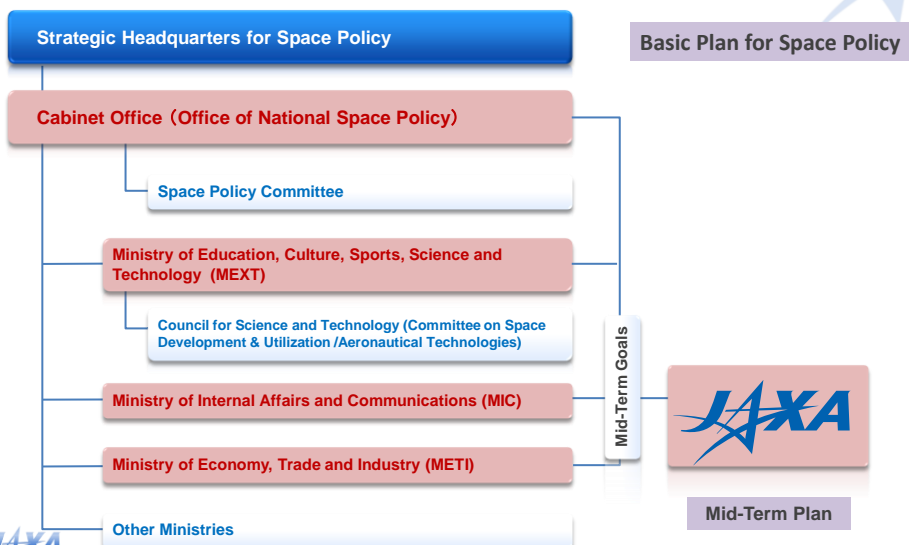


JAXA Program for Earth Observation Satellites

January 6, 2016
Japan Aerospace Exploration Agency
Space Technology Directorate I

Senior Chief Officer for Satellite Applications
Chu Ishida

Japan's Space Activities Structure

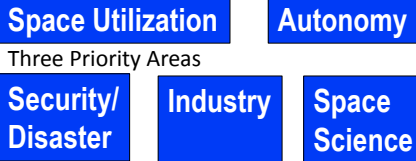


Basic Plan for Space Policy

Basic Plan for Space Policy (Jan 25, 2013)

Revision (Jan, 2015)

Basic Policy



Space Policy Goals



4 space infrastructures and 3 future projects

- A. QZSS
- B. Remote Sensing
- C. CS·BS
- D. STS
- E. Space Science
- F. Manned Mission
- G. SPS R&D

9 space projects

- i) QZSS
- ii) Remote Sensing
- iii) CS·BS
- iv) STS
- v) SSA
- vi) MDA
- vii) EWS
- viii) Space Resilience
- ix) Space Science/Exploration



JAXA Activities

Space Transportation



Human Space Activities



Satellite Program



Lunar & Planetary Exploration Program



Aviation Program



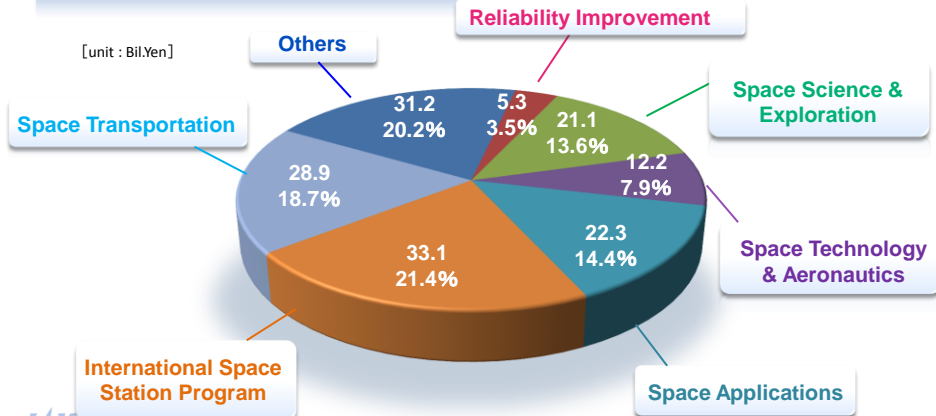
Space Science



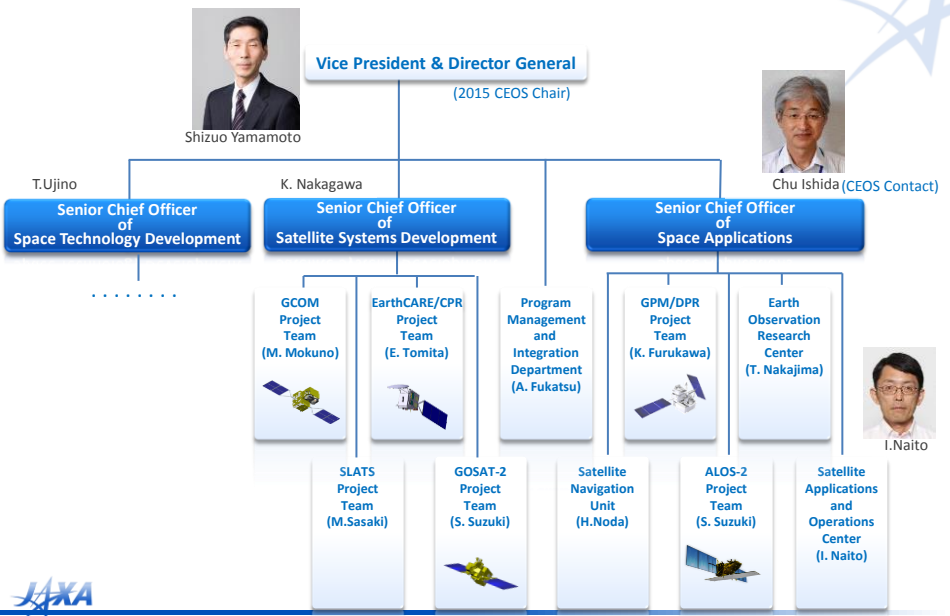
FY2015 Annual Budget

Approved April 9, 2015

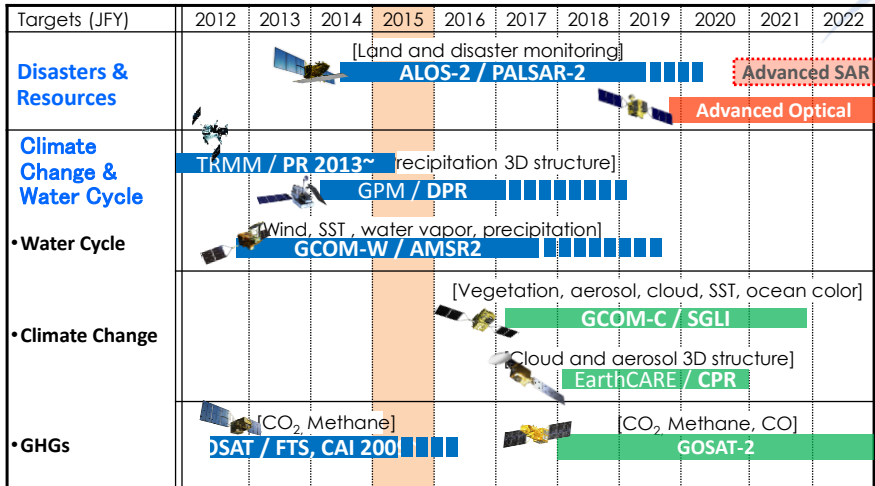
FY2015 : 154.1 Bil. Yen (≒1.3 Bil. US\$)
 FY2014: 154.5 Bil. Yen
 FY2013: 162.5 Bil. Yen



Space Technology Directorate I



JAXA EO Satellites



Mission status ■ On orbit ■ Development ■ Study ■ Pre-phase-A



7

JAXA's Data Policy

A. Data with Low or Middle Resolution

- i) In principle, the data with Low or Middle resolution such as earth environment monitoring satellite data is distributed with "full and open access" policy.
- ii) JAXA accepts non-discriminatory use and re-distribution of those satellite data by users.

B. Data with High Resolution

- i) Limited amount of data is provided to the user for the purpose of Disaster Management, Scientific Research, free of charge
- ii) Distribution with the marginal cost to government users under the cooperative agreement
- iii) Private business operator distribute data with commercial price



8

Year 2015

- Three major international agreements which will affect future of the Earth were concluded in 2015
 - Sendai Framework for Disaster Risk Reduction (Mar, Sendai)
 - UN Sustainable Development Goals (Sep, NY)
 - COP 21 Paris Agreement (Dec, Paris)



World Conference on
Disaster Risk Reduction
2015 Sendai Japan



SDGs



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21-CMP11



ALOS-2: Advanced Land Observing Satellite -2

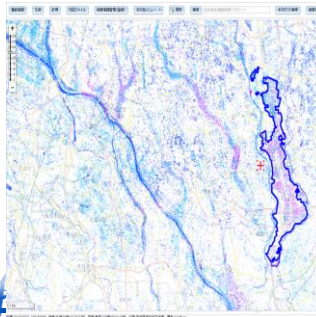
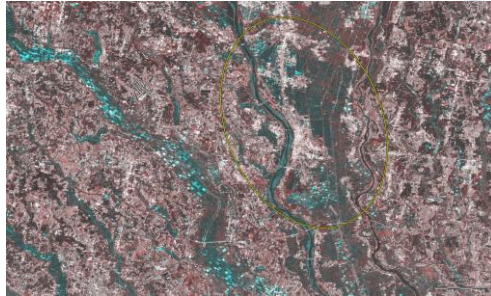


Characteristics of ALOS-2

- ❖ World's Top Observation Duty
- ❖ Autonomous Precise Orbit Control
- ❖ Emergency Observation is possible after **One hour** of Setting up

Flood in Kinugwa-river and Observation by ALOS-2

- ❖ Emergency observation after one hour setting up
- ❖ Only means to grasp the situation of wide area in bad weather
- ❖ Assisting decision making for the dispatch request of drain pump vehicles

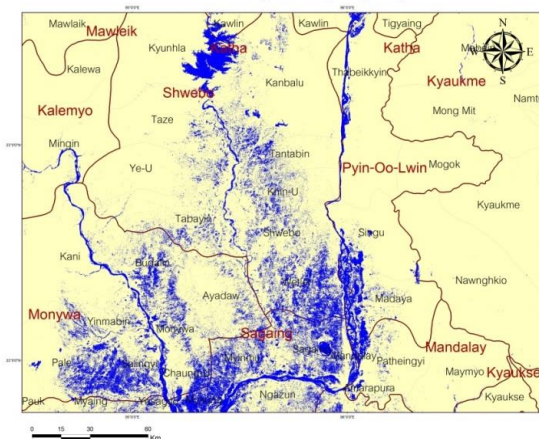


出典: 関東地方整備局ホームページ

Sentinel Asia Triggered for Myanmar Flood 2015 July

SA promptly coordinated with Disaster Authorities and data products was shared among the authorities and used for listing flooded villages (incl. potential), also for response actions etc.

FLOOD DETECTION BY ALOS-2/PALSAR-2
Myanmar, July 24, 2015



MAP INFORMATION
This is possible water area include normal water extent, paddy field, flood area, or others.

Data Source:

Post-Disaster image
ALOS-2/ PALSAR-2
Acquired on 24 July 2015
Copyright: JAXA

Map Produced by:
The University of Tokyo and
Asian Institute of Technology



Letter from
Relief & Resettlement
Dept. Myanmar,
Jul 29, 2015



Ministry of Natural Resources and Environmental Conservation
Department of Relief and Resettlement
Ministry of Natural Resources and Environmental Conservation
111, Dagon Road, Yangon, Myanmar
Tel: +95-9-2526111
Fax: +95-9-2526112

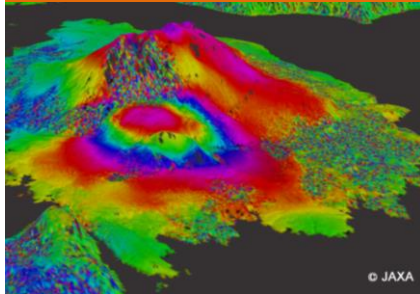
As a contribution of relief and resettle team, JAXA, Myanmar is now having
access to satellite data and images. Myanmar government is currently coping with the
natural disaster in Myanmar.
Regarding this, we would like to express our best appreciation to Relief and
Resettlement Dept. (RRD) which provided the emergency response request. RRD is
Japan Emergency Response Agency (JERA) in Myanmar. We would like to express our
sincerest thanks to JAXA for providing satellite images and data. We would like to
express our best regards to the relief and resettle team. RRD and Resettlement Department appreciate to
share the satellite data and images. We would like to express our best regards to the relief and resettle team.

Disaster Risk Assessment at Local Level

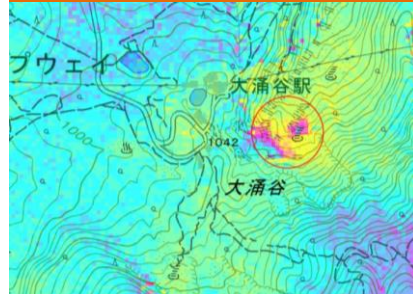
ALOS-2 monitors eruption risk of Mt.Hakone and Mt.Sakurajima.
Satellite data is transformed to information by GSI and JMA's volcanic Eruption Prediction Liaison Council for decision making at local levels.

Sakurajima Mt.Hakone

Surface deformation of Mt. Sakurajima
Jan 14, 2015 – Aug 8, 2015
Max 16 cm surface rise was monitored.



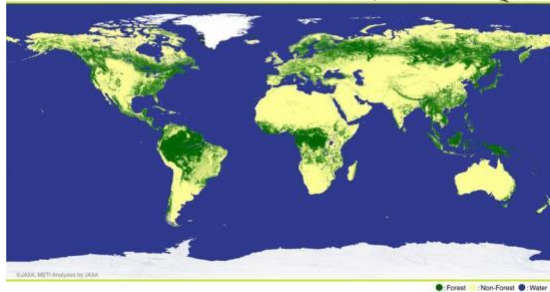
Surface deformation of Mt. Hakone
April 17, 2015 – May 15, 2015
Max 12 cm shift was monitored



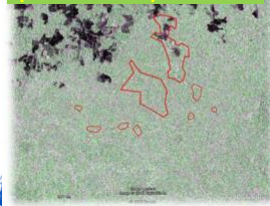
13

Global Forest/Non-forest Map

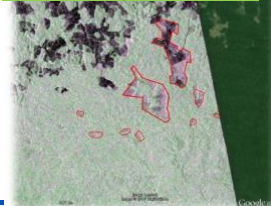
PALSAR 10m Global Forest/Non-Forest Map 2009



PALSAR (HH/HV, 25m)
(2010 Mosaic)



PALSAR-2 (HH/HV, 10m)
(2015 1/24)



L-band SAR (PALSAR, PALSAR-2) is more suitable for forest monitoring than C- and X-band SAR, since L-band SAR is not affected by the fine structure on the ground and can readily distinguish forested and deforested areas

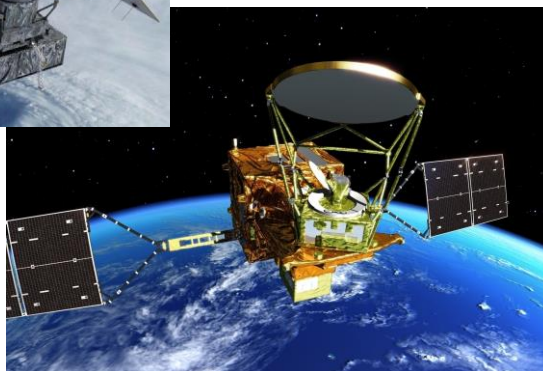


14

GPM and GCOM-W



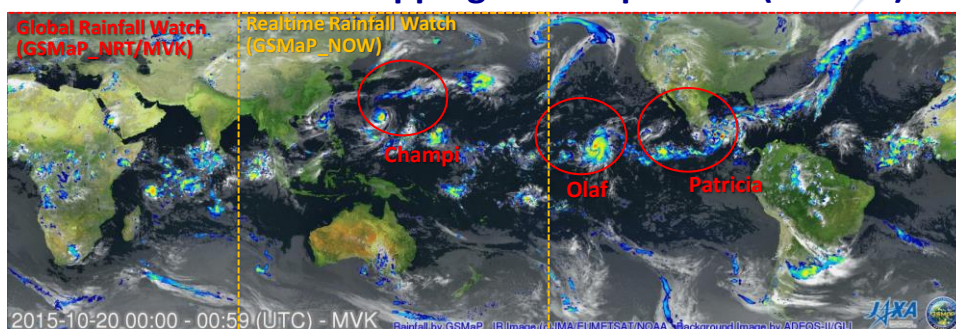
CG Image by NASA



15

JAXA's Contribution to Forecasting

“GSMaP_NOW” over “Himawari-8” area start just now! Global Satellite Mapping of Precipitation (GSMaP)



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

- Rapidly changing precipitation phenomena need frequent observations.
- Global rainfall map merging GPM Core Observatory, polar orbiting microwave radiometer/sounders, and geostationary infrared radiometers.

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

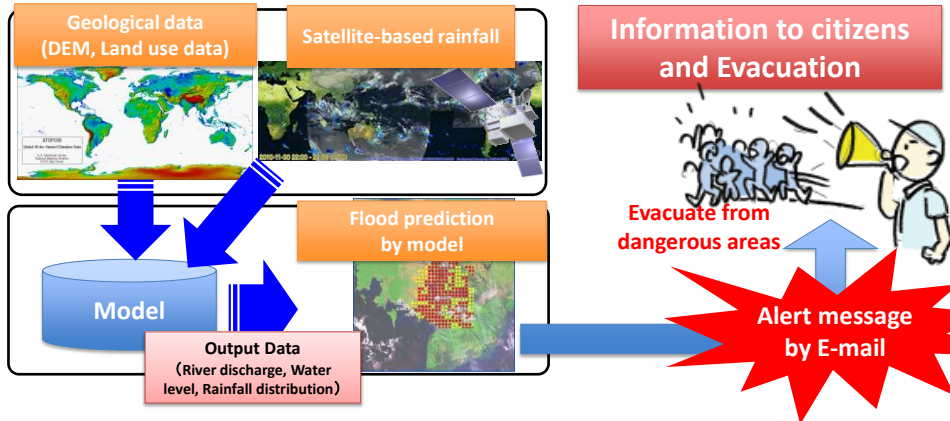
16

Flood Early Warning System

UNESCO Pakistan flood project (2012-14)

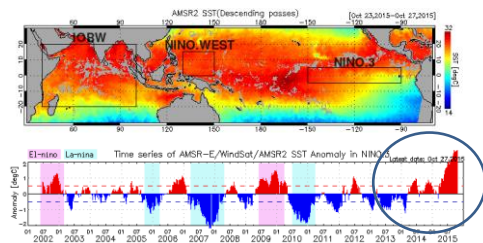
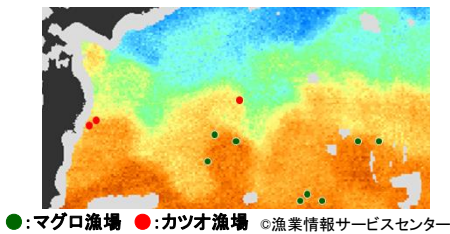
“Strategic Strengthening of Flood Warning and Management Capacity”

Agencies involved: UNESCO, PMD, SUPARCO, ICHARM, JAXA



GCOM-W Applications

Observing the Sea Surface Temperature and using these data to save fuel for fishing boats



Detecting El Niño by monitoring SST



Monitoring the change of Arctic Sea Ice And ship detection in the Northern Sea



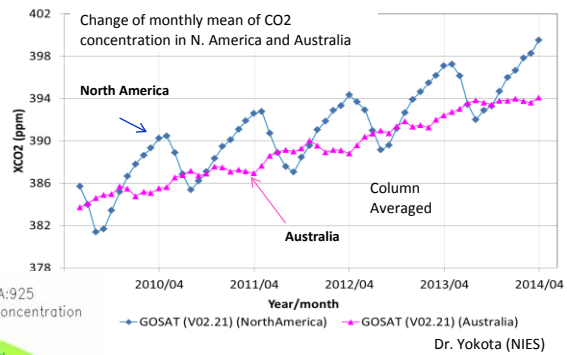
GOSAT: Greenhouse Gases Observing Satellite



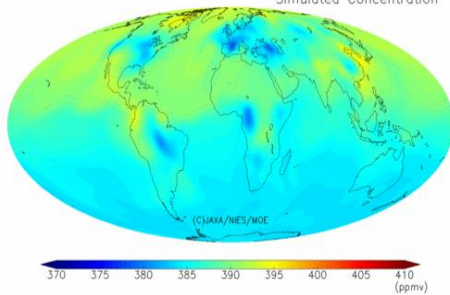
- ❖ Monitoring global distribution of Greenhouse Gases (CO₂, CH₄) from space.
- ❖ Joint project by JAXA, NIES, and MOE.
- ❖ Launch: 23 January 2009 by H2A launch vehicle

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CO₂ Concentrations by GOSAT



GOSAT L4B V02.02 CO₂ (2009/06/01) ETA:925
 Simulated Concentration



Animation of daily mean of CO₂ concentration
 (June 2009 - May 2011, at 800 m altitude)

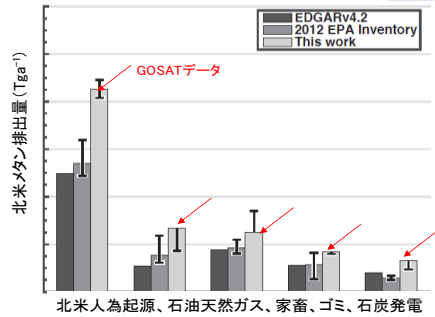
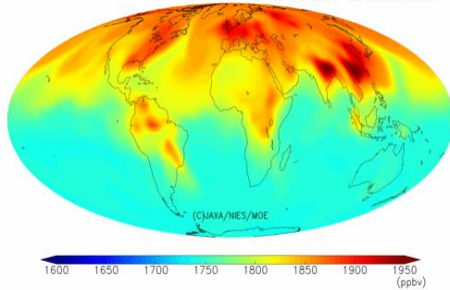
(c) MOE/NIES/JAXA

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Estimating CH4 methane emissions by GOSAT

- GOSAT observation data of methane concentration was used for verification of North American methane emission adopted by IPCC (released by the report of Harvard University group in the journal "Atmospheric Chemistry and Physics"). The research revealed the emission estimate was underestimated. The usefulness of GOSAT observation data is shown.

GOSAT L4B V01.01 CH₄ (2009/06/01) ETA:925
Simulated Concentration



GOSAT CH₄ observation data showed that the existing EPA Inventory is underestimated (By Dr. Turner/Harvard University)

Animation of daily mean of CH₄ concentration
(June 2009 - May 2011, at 800 m altitude)

(c) MOE/NIES/JAXA

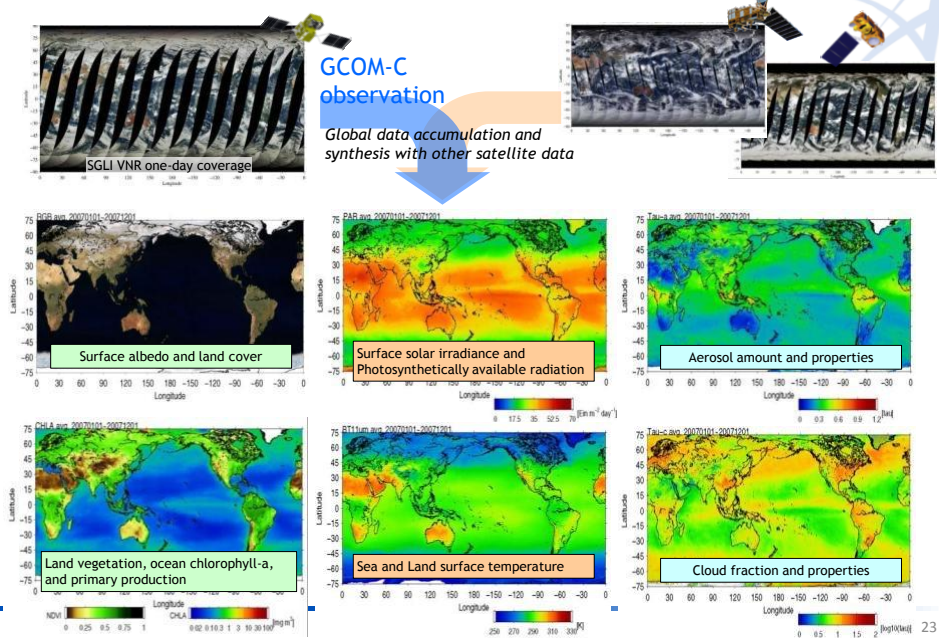
21

GCOM-C

GCOM-C SGLI characteristics	
Orbit	Sun-synchronous (descending local time: 10:30), Altitude: 798km, Inclination: 98.6deg
Launch Date	JFY 2016
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)
Spatial resolution	250m (land and coastal areas), 500m, 1km
Polarization	3 polarization angles for POL
Along track tilt	Nadir for VN, SW and TIR, & +/-45 deg for P

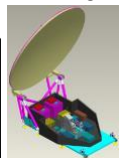
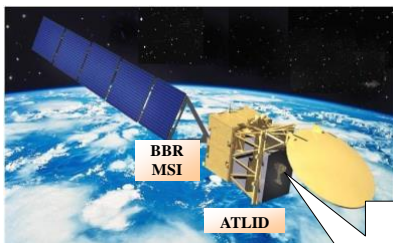
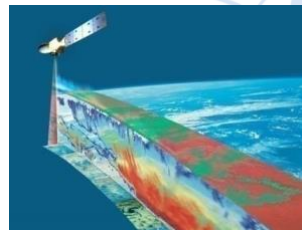
22

Examples of GCOM-C SGLI Products



EarthCARE/CPR

- EarthCARE will observe **3D structure of clouds and aerosols**, and reduce errors in climate change and weather forecast, by **Japan (JAXA/NICT)-Europe (ESA)** cooperation.
- JAXA provides **Cloud Profiling Radar (CPR)**, the world's first **W-band Doppler radar (94GHz)** to observe **vertical structure and dynamics of clouds**.



- Instrument**
 - CPR (Cloud Profile Radar)
 - ATLID (Atmospheric LIDAR)
 - MSI (Multi-Spectral Imager)
 - BBR (Broad Band Radiometer)

- Mission**
 - Vertical profile of clouds, aerosol
 - Interaction between clouds and aerosol
 - Cloud stability and precipitation
- Orbit**
 - Sun synchronous
 - Equator crossing time 13:45
 - Altitude 400km
- Task sharing**
 - JAXA/NICT (CPR)
 - ESA (LIDAR, MSI, BBR, Spacecraft)
- Launch target**
 - JFY2017

Summary

- Basic Plan for Space Policy was revised to reflect national security need.
- JAXA has been developing satellite missions for disaster, climate and water to contribute to societal benefits.
- JAXA has data policy for mid and low-resolution environmental missions and high resolution missions.
- JAXA promoted roles of satellite EO for 2015 major international frameworks such as Sendai Framework for DRR, SDGs and COP21 Paris Agreement.
- Environmental satellite missions after GCOM-C are not included in the mission chart of the Basic Plan. JAXA is now developing next-generation mission scenario to propose to the government.