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# **New Era of Global Monitoring by ALOS-2: Advanced Land Observing Satellite-2 “DAICHI-2”**

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# Dawning Era of ALOS-2 “DAICHI-2”



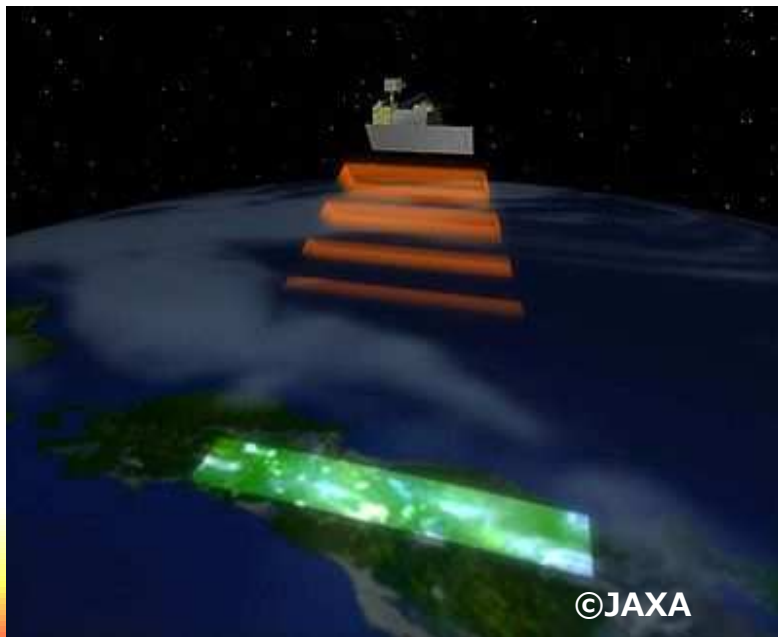
“The Earth needs a health check”



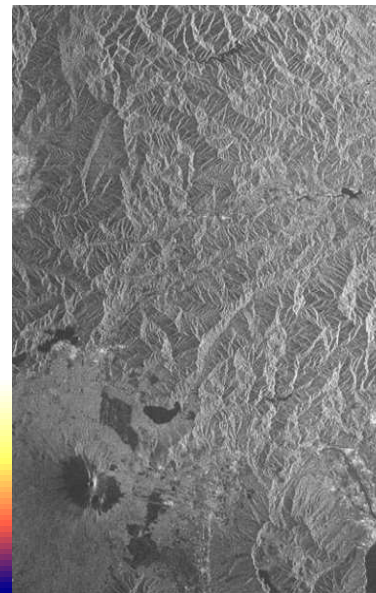
# 1. Heritage and Evolution in Synthetic Aperture Radar (SAR) Satellites in Japan

# What's SAR?

- SAR: Synthetic Aperture Radar
  - + Active sensor
- Advantage
  - + Any time of day or night
  - + All-weather
  - + Observation of land surface – penetrate through vegetation



SAR image (left)



Optical image (right)



# Advantage of L-band SAR



## L-band

(wave-length: long)

- ✓ penetrate through clouds, rain, leaves and branches
- ✓ reflected by... trunks, objects, and land surface

## C-band

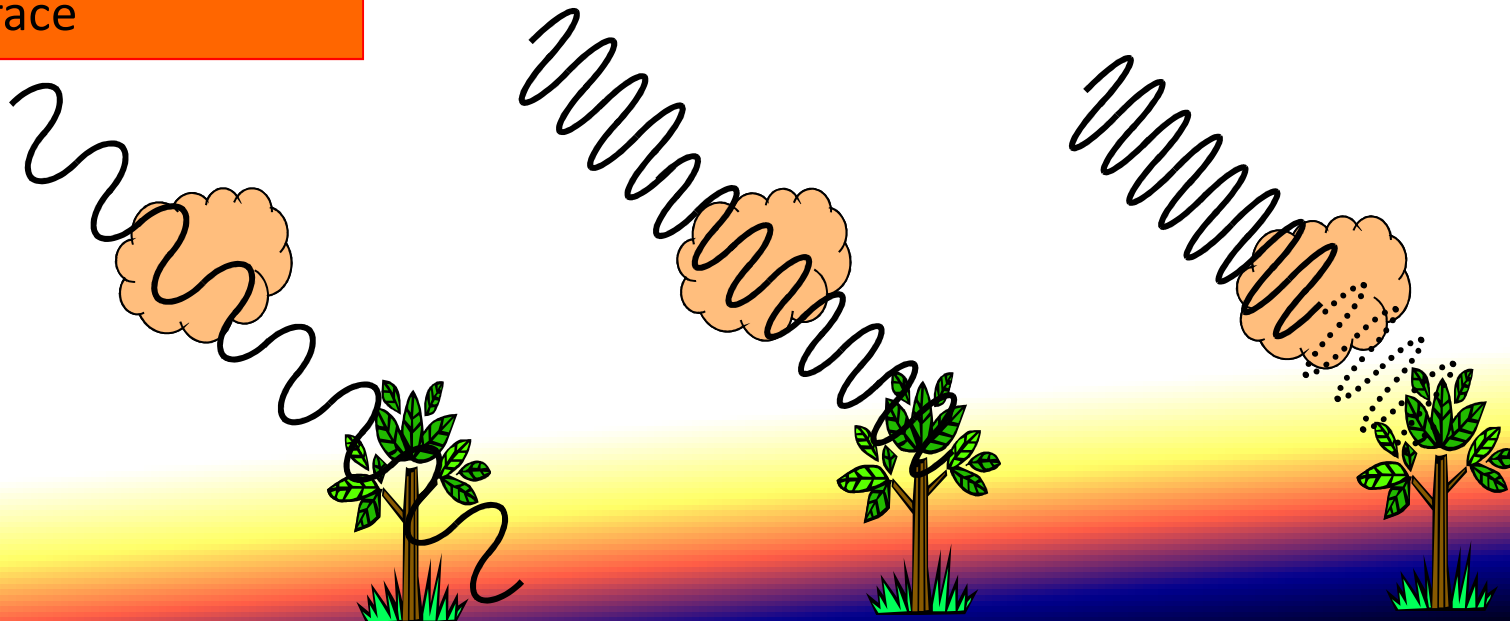
(wave-length: medium)

- ✓ penetrate through clouds, rain
- ✓ reflected by... leaves and branches

## X-band

(wave-length: short)

- ✓ attenuated by clouds, rain
- ✓ reflected by... leaves

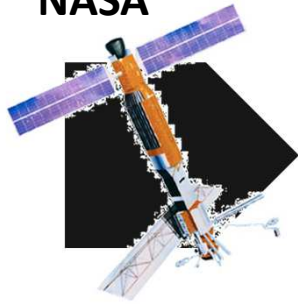


# History of Synthetic Aperture Radar(SAR)

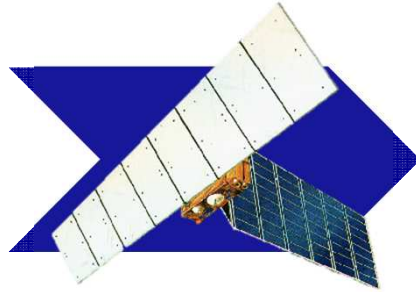


SEASAT (1978)

\*NASA



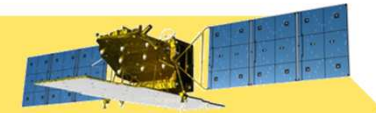
JERS-1 (1992)



ALOS (2006)



ALOS-2 (2014)



Achievement of  
Technical Bases

Accumulation of  
Application Research

Development  
& Leadership  
of Technology

Provision of  
Value to Society

Technical Demonstration

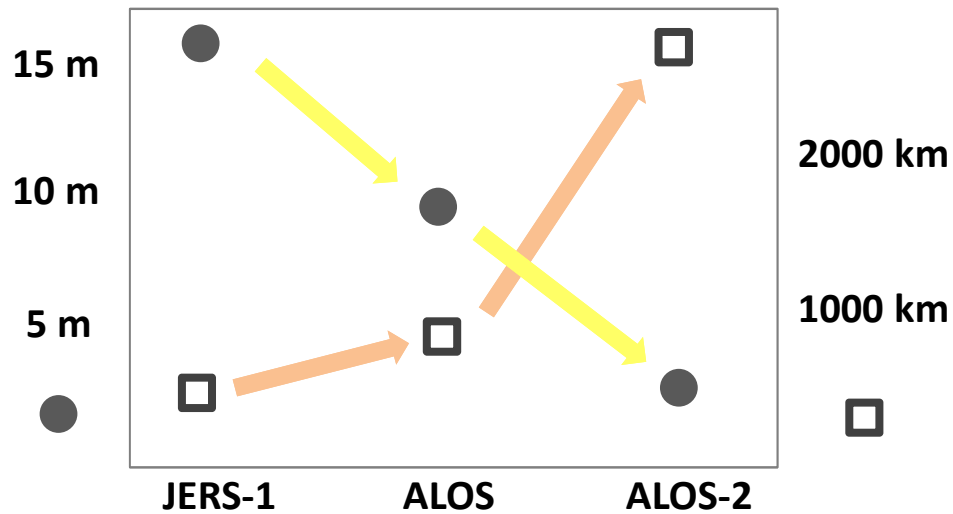
**Solutions**  
by Innovative Technology



**JAXA**  
Explore to Realize

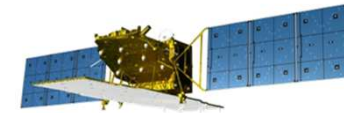


# Evolution in Japanese SAR Satellites



## “Higher & Wider”

- Resolution & Observable Area



| Resolution   | Swath |
|--|-------|
| 18 m   | 75 km |
| <ul style="list-style-type: none"> <li>- Fixed Incident Angle</li> <li>- Single Polarimetry</li> </ul> |       |

| Resolution  | Observable Area |
|---|-----------------|
| 10 m  | 870 km          |
| <ul style="list-style-type: none"> <li>- Band Width: 25 MHz</li> <li>- Phased Array / Variable Incidence Angle</li> <li>- Full Polarimetry</li> </ul> |                 |

| Resolution   | Observable Area   |
|--|-------------------|
| 3 m  | 1160 km x 2 (L&R) |
| <ul style="list-style-type: none"> <li>- High Power &amp; High Efficiency /TRM</li> <li>- Band Width: 84 MHz</li> <li>- Phased Array / Variable Incidence Angle</li> <li>- Multi Beam</li> <li>- Full Polarimetry</li> </ul> |                   |

**JERS-1**

**ALOS**

**ALOS-2**

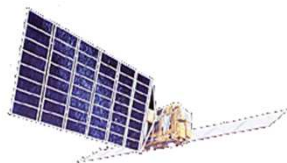


# Improvement of spatial resolution



Improvement in Observation area

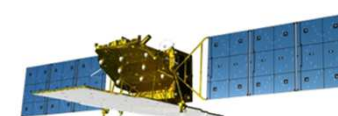
**JERS-1**



**ALOS**



**ALOS-2**



**JERS-1 (Res: 18m)**



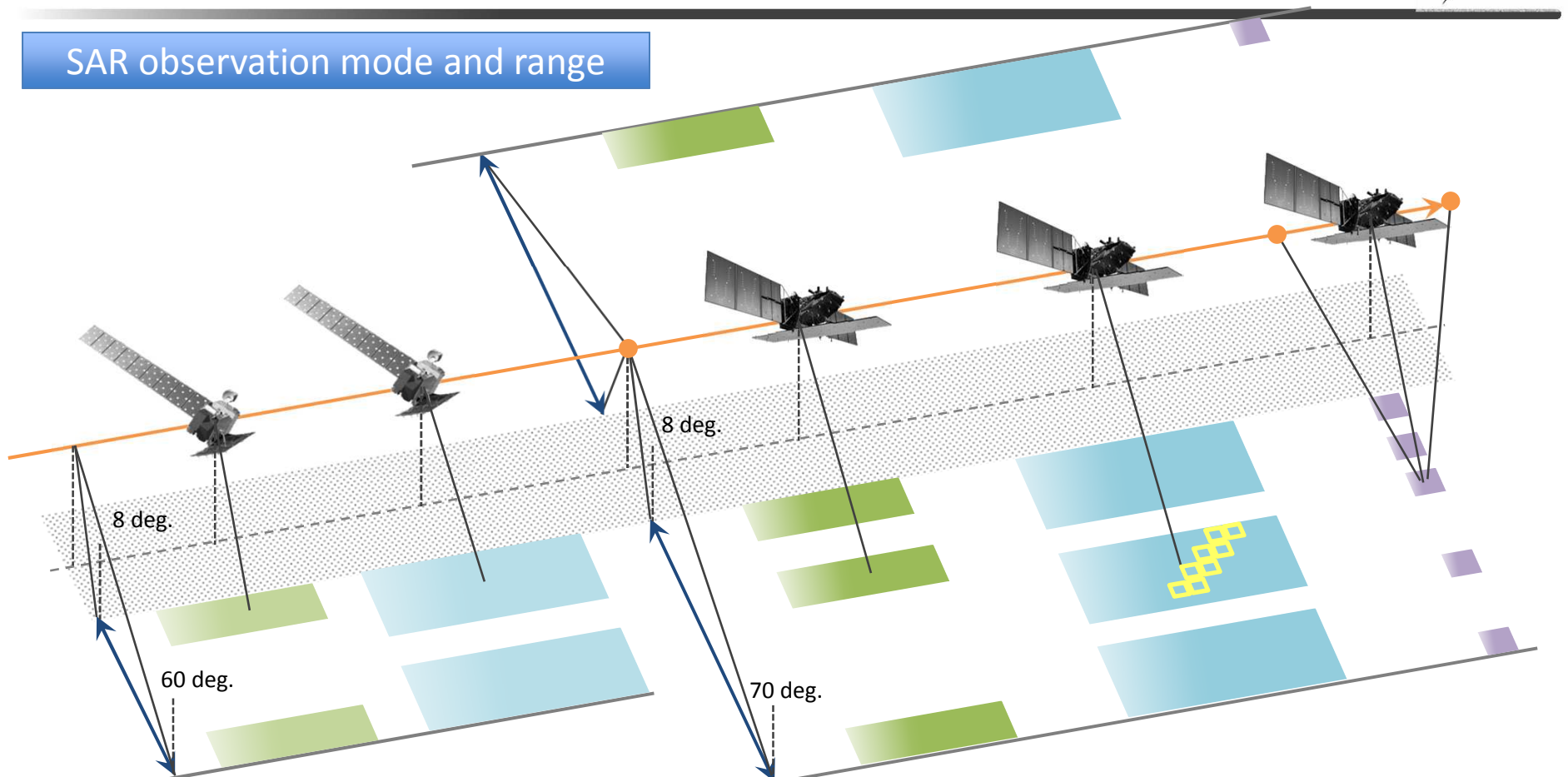
**ALOS (Res: 10m)**



**ALOS-2 (Res: 3m)**

# Improvement of observation frequency

## SAR observation mode and range



|            | Observable  | Stripmap    | ScanSAR       | Observable                    | Stripmap    | ScanSAR       | Spotlight  |
|------------|-------------|-------------|---------------|-------------------------------|-------------|---------------|------------|
| Swath      | 870 km      | 40 to 70 km | 250 to 350 km | 1160 km x 2<br>(right & left) | 50 or 70 km | 350 or 490 km | 25 x 25 km |
| Resolution |             | 10 m        | 100 m         | 3 to 10 m                     |             | 100 m         | 1 x 3 m    |
|            | ALOS/PALSAR |             |               | ALOS-2/PALSAR-2               |             |               |            |

# ALOS-2 in the world



| Name          | Freq/BW/Pol        | Mode      | GSD (m) | Swath (km) | DLT          | Duty (min.)    |
|---------------|--------------------|-----------|---------|------------|--------------|----------------|
| <b>ALOS-2</b> | <b>L-band</b>      | Spotlight | 1-3     | 25         | <b>12:00</b> | <b>48 min.</b> |
|               | BW=84MHz           | Stripmap  | 3/6/10  | 50/50/70   |              |                |
|               | <b>HH,HV,VH,VV</b> | ScanSAR   | 100/60  | 350/490    |              |                |
| Sentinel-1    | C-band             | Spotlight | N/A     | N/A        | 6:00         | 25 min.        |
|               | BW=100MHz          | Stripmap  | 5       | 80         |              |                |
|               | HH,HV,VH,VV        | ScanSAR   | 100     | 400        |              |                |
| Radarsat-2    | C-band             | Spotlight | 3       | 20         | 6:00         | 28 min.        |
|               | BW=100MHz          | Stripmap  | 25      | 100        |              |                |
|               | HH,HV,VH,VV        | ScanSAR   | 130     | 500        |              |                |
| TerraSAR-X    | X-band             | Spotlight | 1       | 10         | 6:00         | 3 min.         |
|               | BW=150MHz          | Stripmap  | 3       | 30         |              |                |
|               | HH,VV              | ScanSAR   | 16      | 100        |              |                |
| Cosmo SkyMed  | X-band             | Spotlight | 1       | 10         | 6:00         | 10 min.        |
|               | BW=150MHz          | Stripmap  | 3       | 40         |              |                |
|               | HH,VV              | ScanSAR   | 30      | 200        |              |                |

## **2. Heritage New Era of Global Monitoring by ALOS-2/Phased Array type L-band Synthetic Aperture Radar (PALSAR-2)**

# ALOS-2 Mission & Users



## Society & Economy

Food Security  
Resource & Energy etc...

- GEOGLAM
- ADB

## Public Safety

Disaster Monitoring  
Land Deformation  
etc...

- Sentinel Asia
- International Charter

- MAFF

- MLIT
- JMA

- JCG
- GSI

- FFPRI

- GEO Partners
- REDD+ Partners

## Land and Sea

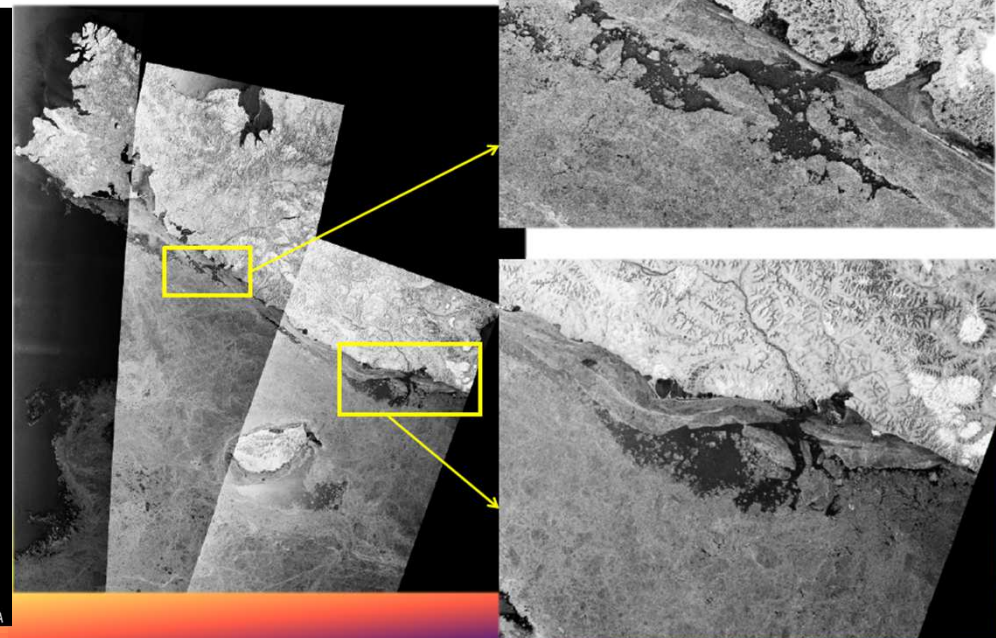
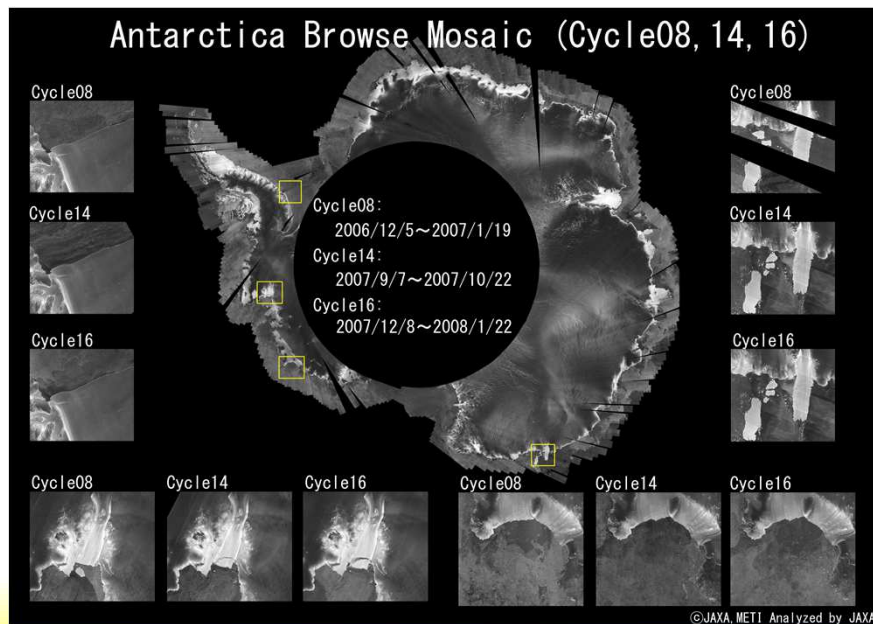
Systematic Archive  
Sea Ice Monitoring  
etc...

## Environment

Forest Monitoring  
Wetland Monitoring  
Illegal Logging  
etc...



- Okhotsk Sea Ice Monitoring with Japan Coast Guard (JCG)
- Arctic Sea Ice
  - + Climate Change Monitoring
  - + Glacier Movement
  - + Northern Sea Route (NSR)

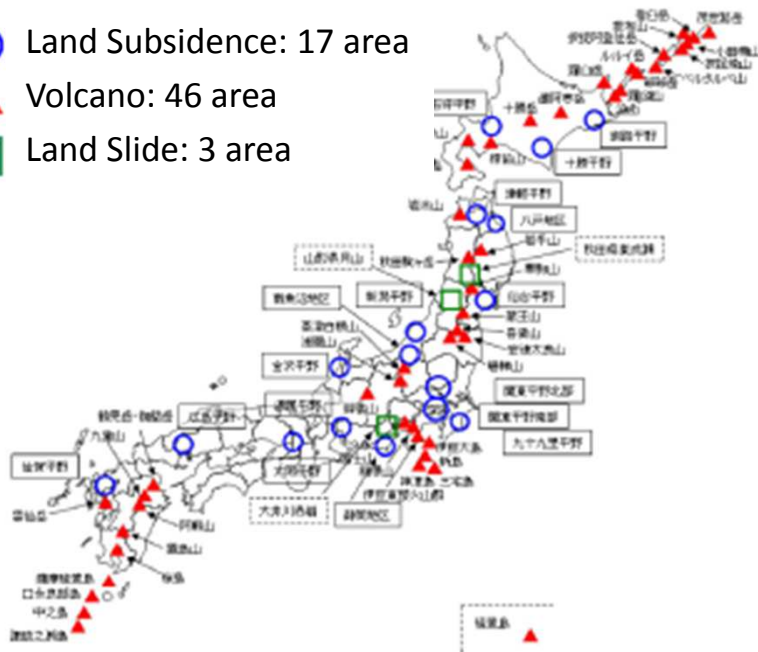


# Land and Sea – Systematic Archive

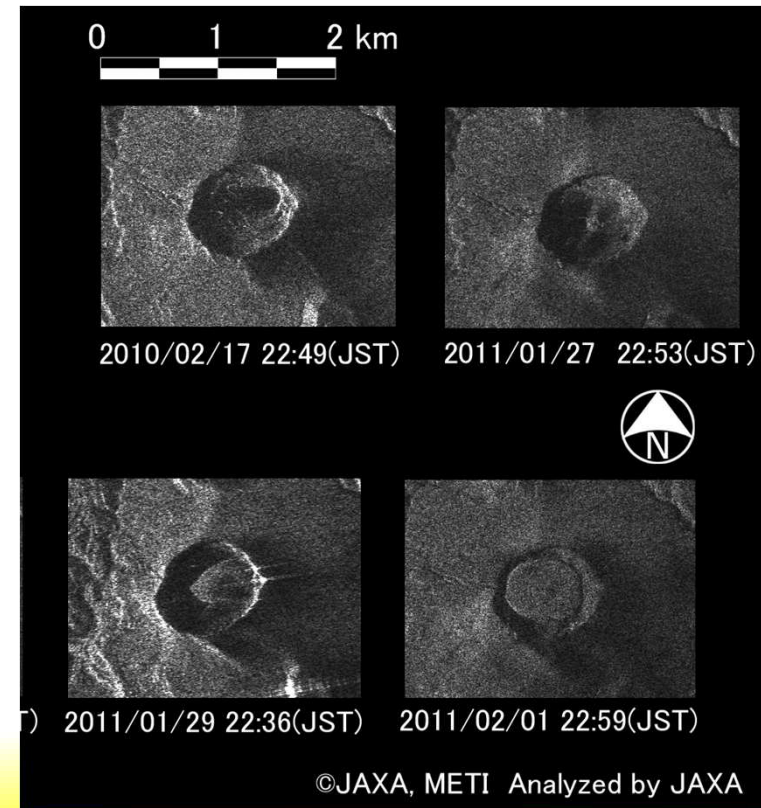


- ALOS-2 data will be practically used for routine and emergency observation.
  - + There are 66 geological hazard hotspot in Japan where are routinely observed by GSI.

- Land Subsidence: 17 area
- ▲ Volcano: 46 area
- Land Slide: 3 area



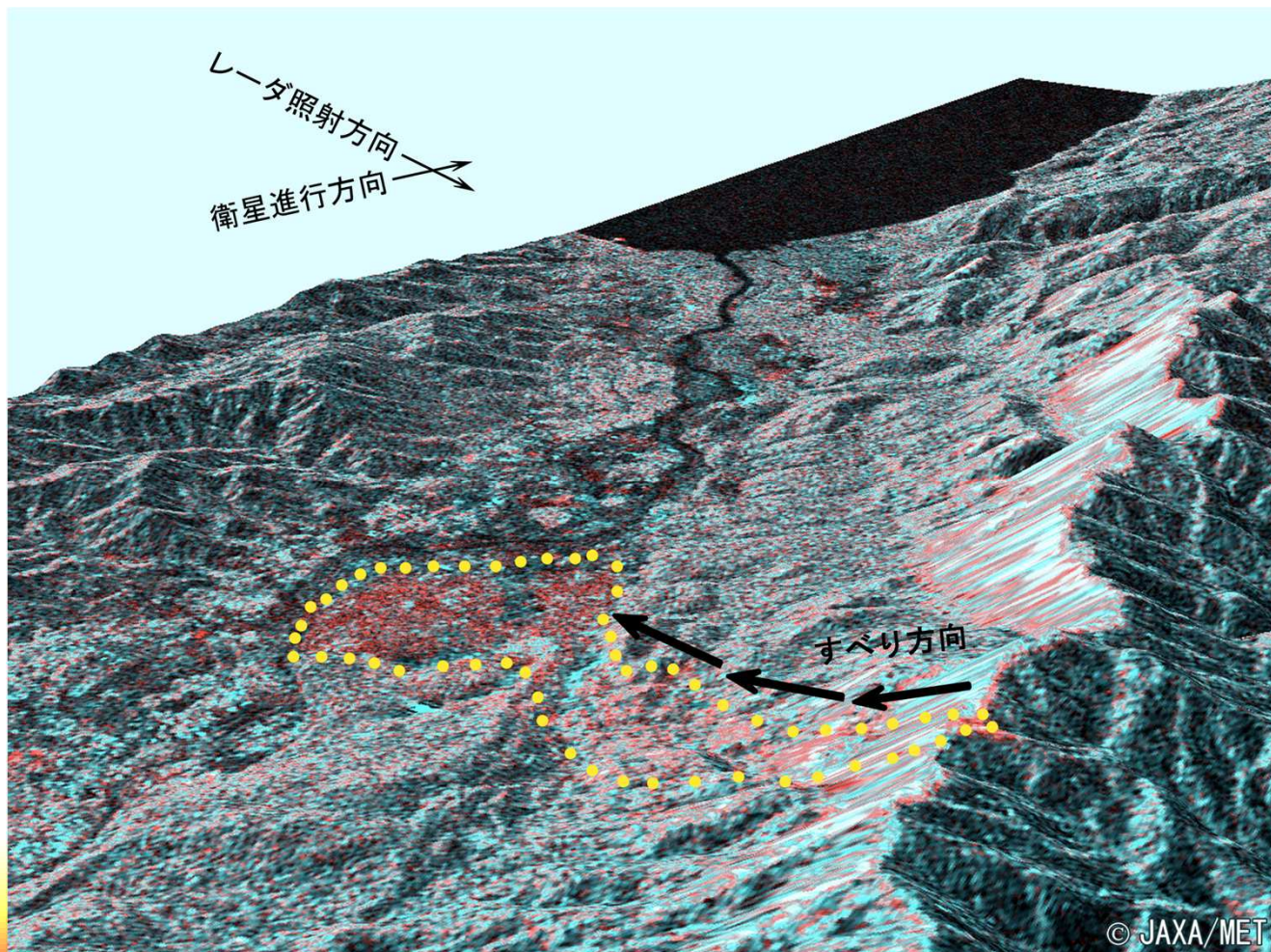
Geological Hazard Hotspot



# Public Safety – Disaster Monitoring



- ALOS-2 agility to observe major disaster
  - + ALOS-2 observation data will be provided to users within 1 hour from observation.



Major Land slide  
Observed By ALOS

Laytee Island,  
Philippine

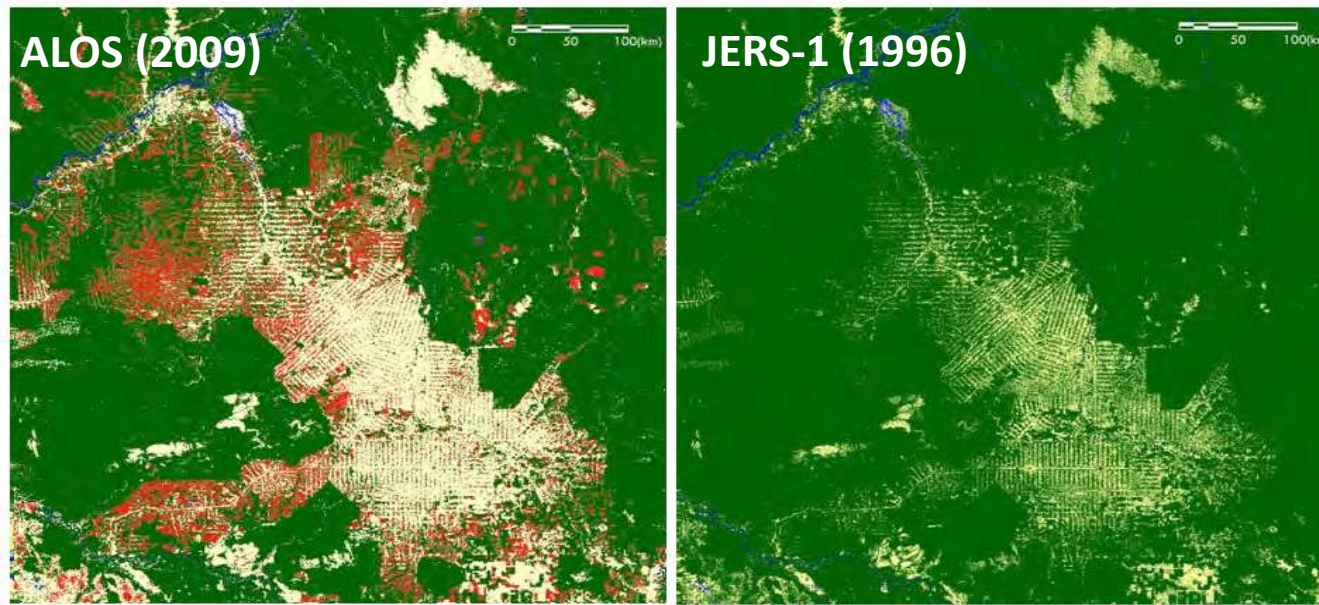
Feb. 24. 2006  
ALOS/PALSAR



## ■ Environment – Forest Monitoring



- Monitoring forest in years – JERS-1 ~ ALOS-2.
  - + JAXA has a long history of forest monitoring using L-band SAR – JERS-1, ALOS and ALOS-2.
  - + L-band SAR is especially useful to observe tropical rainforest area in constantly cloudy conditions.
- Stamp out illegal logging.
  - + In cooperation with IBAMA, ALOS data was used for protection of Amazon rainforest from illegal logging. It could reduce illegal logging to 7,000km<sup>2</sup> in 2009, from 12,000km<sup>2</sup> in 2008.



- 1. JAXA leads the world in development and applications of L-band SAR.**
- 2. JAXA expects expansion of the horizons of both science and applications with our new state-of-art L-band SAR satellite, ALOS-2/PALSAR-2.**
- 3. JAXA will continue leading the world in SAR and contribute to the international public good.**

**Thank you for your attention.**

