Japan has wide variety of natural disasters

- Earthquakes
- Tsunamis
- Volcanic Eruptions
- Typhoons
  (July – October)
- Heavy Monsoon Rains
  (May – July)
- Floods
- Landslides
- Snow Avalanches

GROUP ON EARTH OBSERVATIONS

Framework document was adopted:

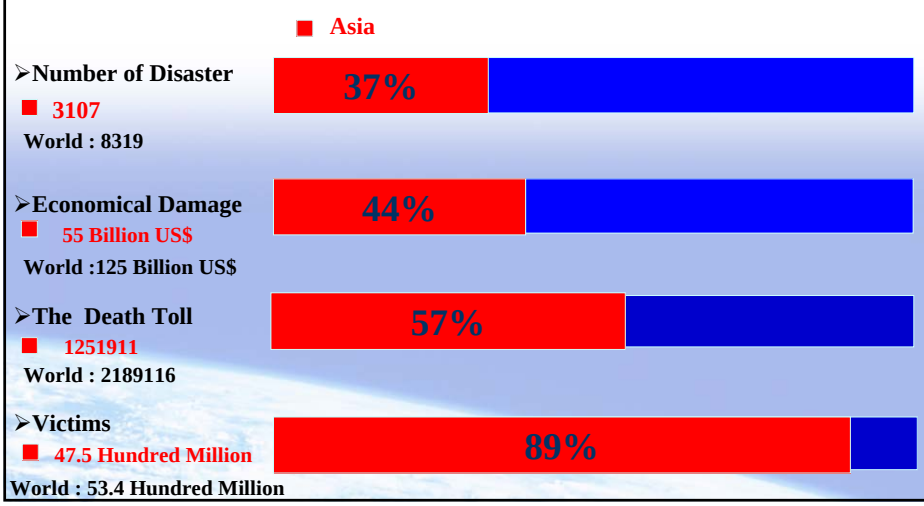
- This set out nine societal benefit topics to be derived through Global Earth Observation System of Systems, GEOSS.

Nine Societal Benefit Topics

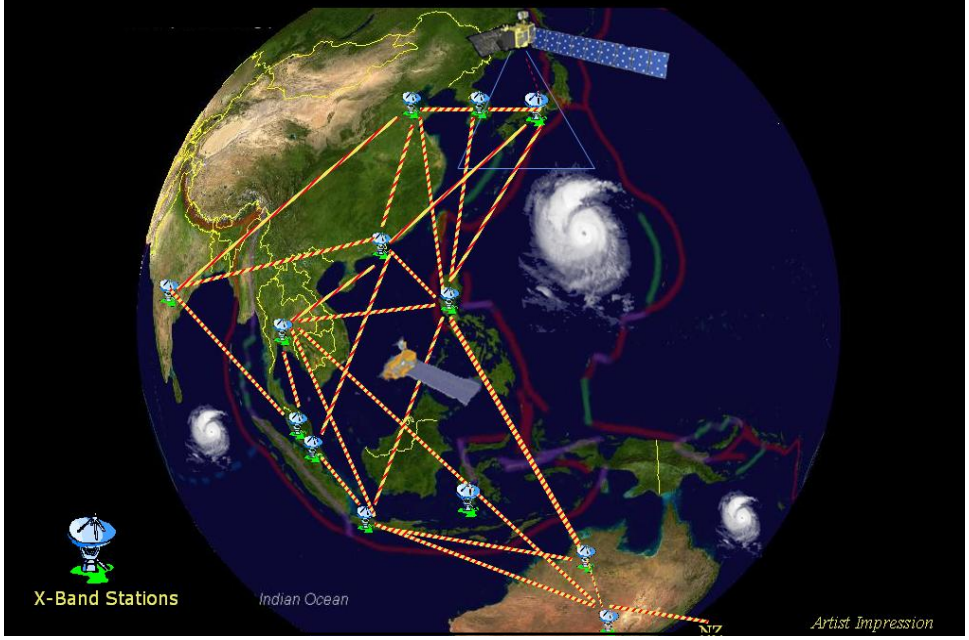
1. Reduction and Prevention of Disasters
2. Human Health
3. Energy Management
4. Climate Change
5. Water Management
6. Weather Forecasting
7. Ecosystem
8. Agriculture
9. Biodiversity

Natural Disaster Damages in Asia

Total number during 1975- 2005
quoted from 'ADRC-Natural Disasters Data Book-2005'
originated in CRED-EMDAT, 2005



SENTINEL ASIA:
Disaster Information Sharing System in Asia-Pasific



Asia-Pacific Regional Space Agency Forum

APRSAF

http://www.aprsaf.org/

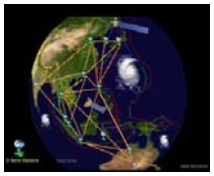
Established in 1993 after the Asia-Pacific International Space Year Conference (APIC) in 1992

Enhance the development of space programs in the Asia-Pacific region and promote regional cooperation in the field of space technology and its applications.

[Participation] Space agencies, related governments, regional and international organizations, institutions responsible for applying space technology.

[Organizers] MEXT, JAXA and co-host organizations

- **Past co-organizers:** Government entities of Mongolia, Malaysia, The Republic of Korea, Thailand, Australia



Sentinel Asia Project
establishing Disaster Management Support System

Working Groups

Earth Observation

Communication Satellite Applications

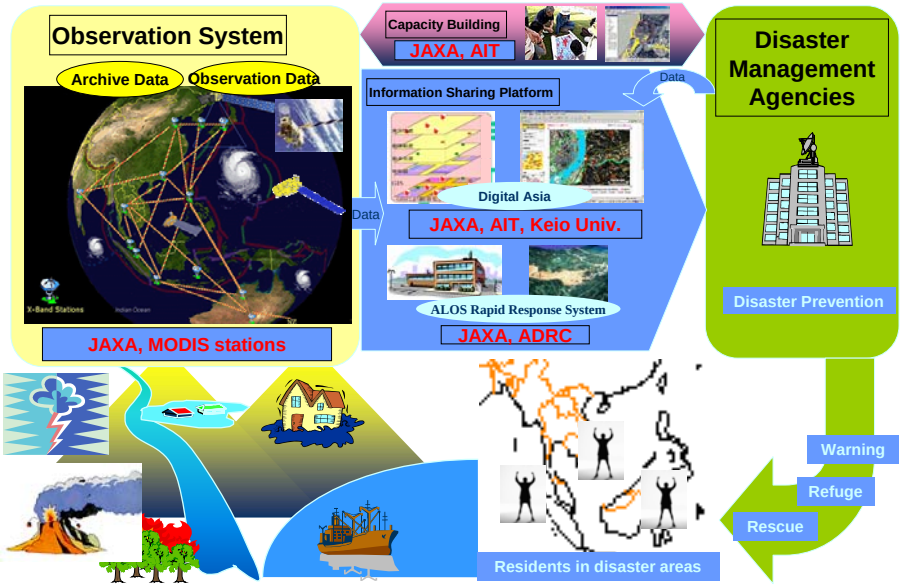
ISS

Space Education & Awareness

The 13th Session of APRSAF (APRSAF-13)
22-24 Nov. 2006 in Jakarta Indonesia

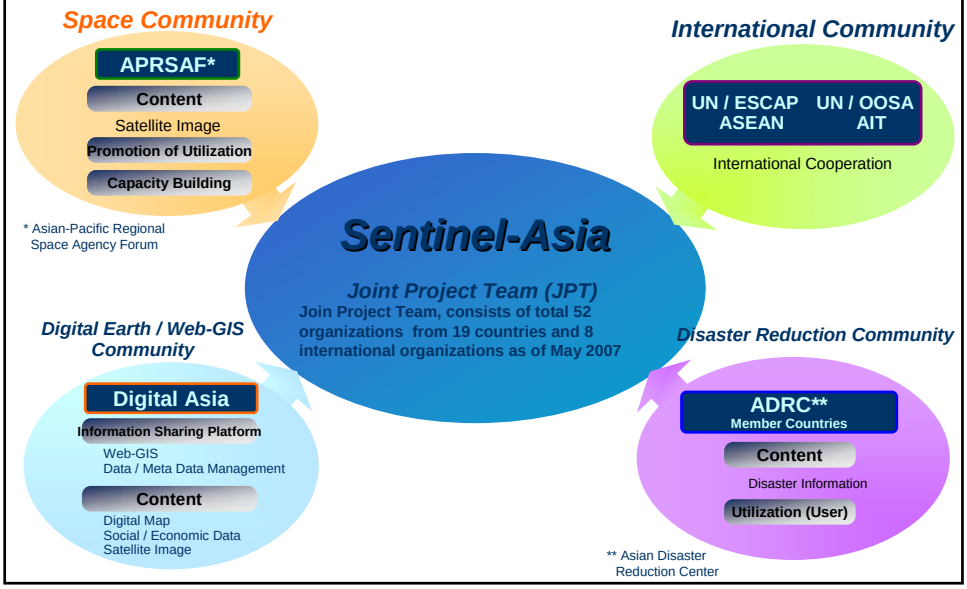
RISTEK MEXT JAXA

Sentinel Asia System



Framework of Sentinel-Asia Project

Best-efforts, voluntary initiative by participating organizations



Philosophy

>> Contribute life first society by ICT and Space technology
>> Improve speed and accuracy for disaster preparedness and early warning
>> Minimize victims and social economic losses by natural disaster

Framework

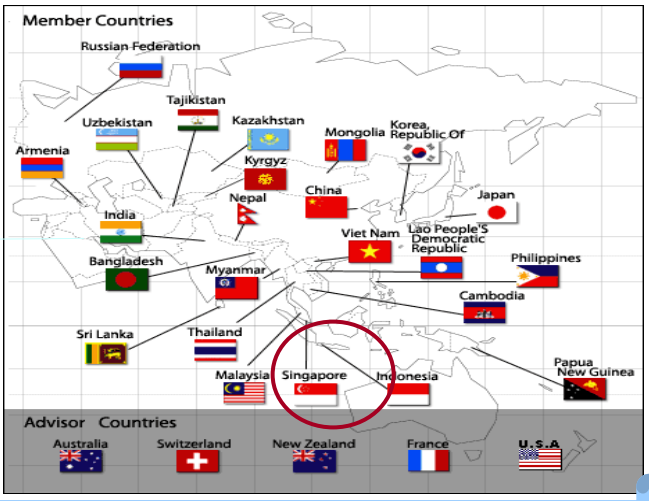
>> Best-efforts and Voluntary initiative by participating organizations (Satellite data provison)
>> Capacity building (lecture, hands on training, mini projects)
>> Knowledge and technology transfer
>> Working group activity (Forest fire, Flood, ...)
>> Stepwise approach by refrecting user requirement
>> Cooperation among space agency and disaster authorities

System Operation

>> Internet based user oriented information sharing platform
>> 24Hs reception for emergency observation request
>> Quick dissemination of disaster information/data
>> WebGIS
>> Levels of service contents
>> Variety of data sourse(satellite, map, photo...)

ADRC Member Countries

25 Member Countries, 5 Advisor Countries, 1 Observer

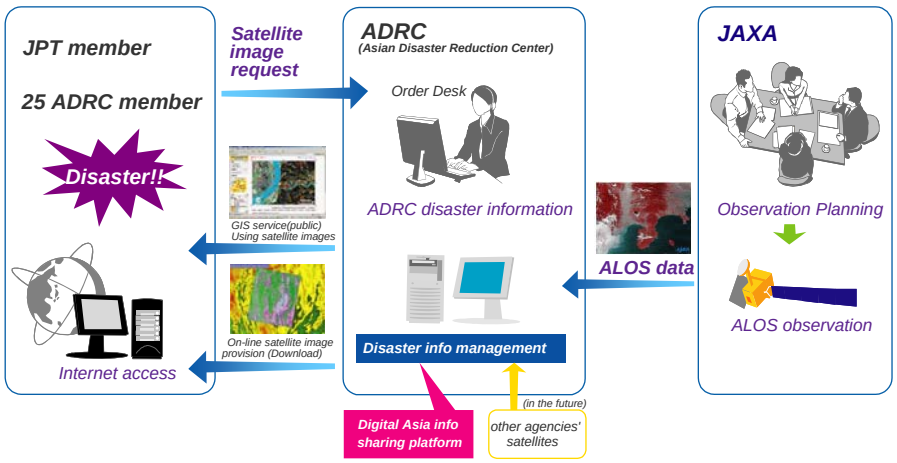


Pakistan

* Implement Various Projects in cooperation with UN/ISDR, UN/OCHA, UNESCO, UNU, WMO, UN/ESCAP, etc.

Emergency Observation Request for Major Disasters

JAXA accepts ALOS observation request from JPT and ADRC member through ADRC



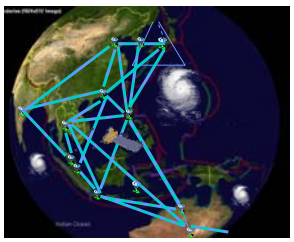
Sentinel Asia Wildfire Monitoring

Hokkaido Univ.(Japan)

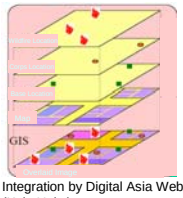
AIT/Tokyo Univ. (Thailand)

CRISP (Singapore)

CSIRO (Australia)



Satellite observation network



Integration by Digital Asia Web-GIS interface (Keio Univ.)

Wildfire map of Asia

Main Activities

- Establishment and Improvement of Early Wildfire Detection based on **MODIS**
- Development of Wildfire Expansion Forecasting
- Serving Value-Added Information to Forest Fire Control Agency

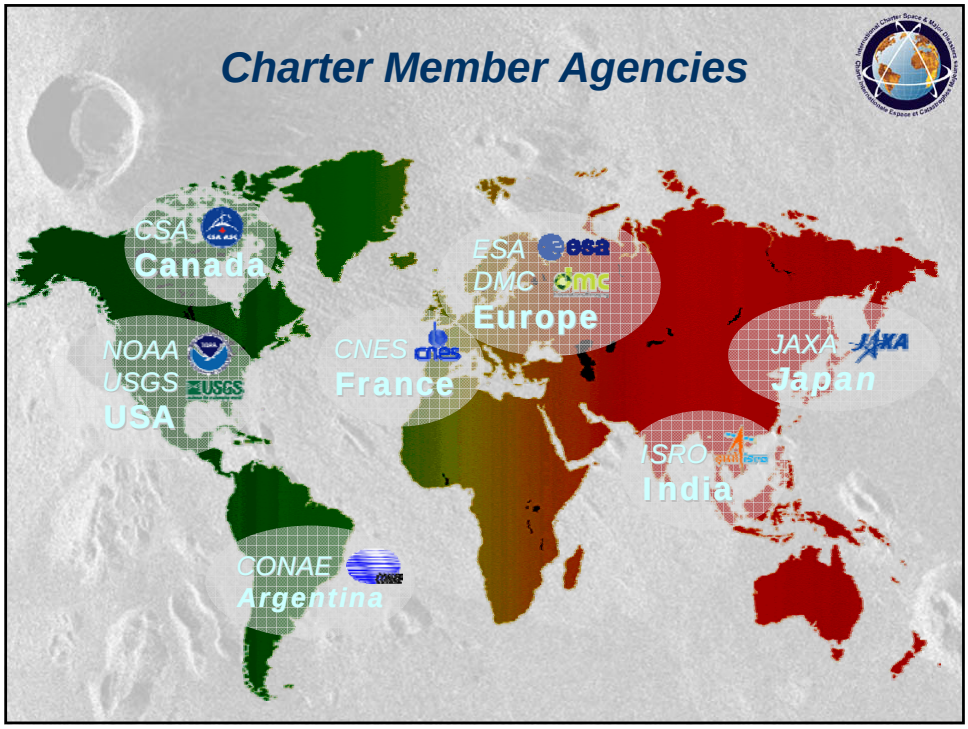
Sentinel Asia Flood Monitoring

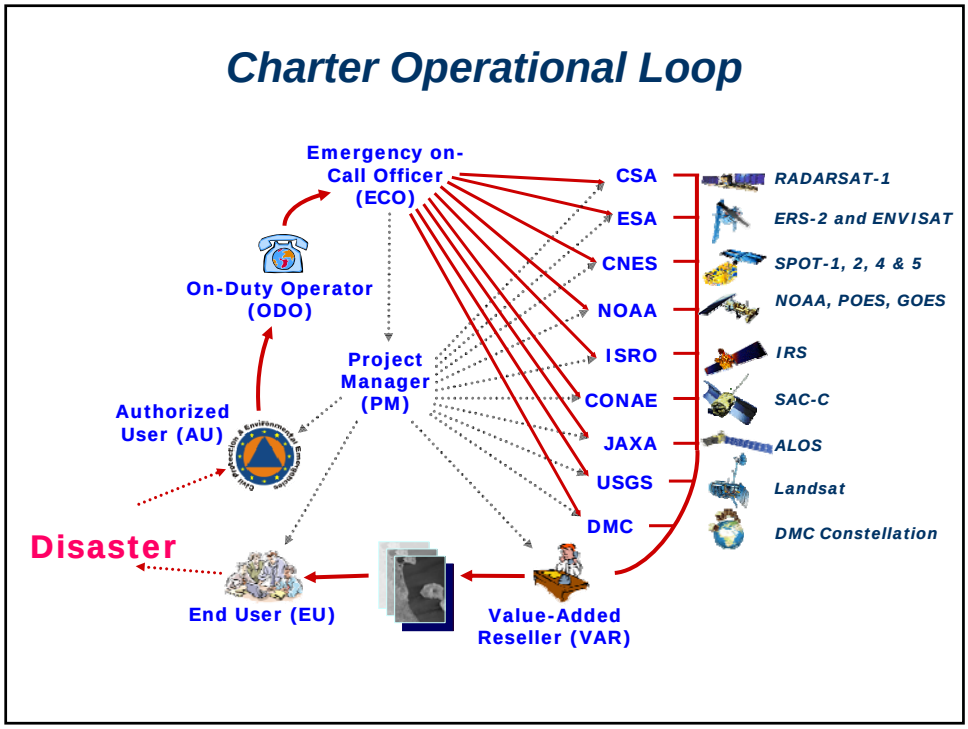
	Observation		*Processing*		*Integration*
Rainfall Monitoring & Flood Forecasting	Rainfall Measurement by Satellite TRMM, GPM, AMSR-E...	・Rainfall Data	Downscaling in Time and Space GFAS*, IFAS**...	・Precipitation Map ・Heavy Rainfall Information ・Flood Forecasting Information	Sentinel Asia - Social Economic Data - Map Data
Flood Detection & Situation Analysis	Land Observation by Satellite ALOS, MODIS, AMSR-E....	・Land Image	Image Analysis JAXA, ICHARM, Dartmouth University...	・Flood Inundation Map ・Damage evaluation map	・Monitoring of Heavy Rainfall and Flood Inundation Area ・Precipitation and Flood Inundation on Web GIS ・Flood Alert for Specific River Basins ・Flood hazard (risk) map ・Flood disaster damage map

Users

Residents in Flood-prone Area ・Planning ・Warning ・Evacuation ・Rescue ・Remediation Disaster Management Organizations

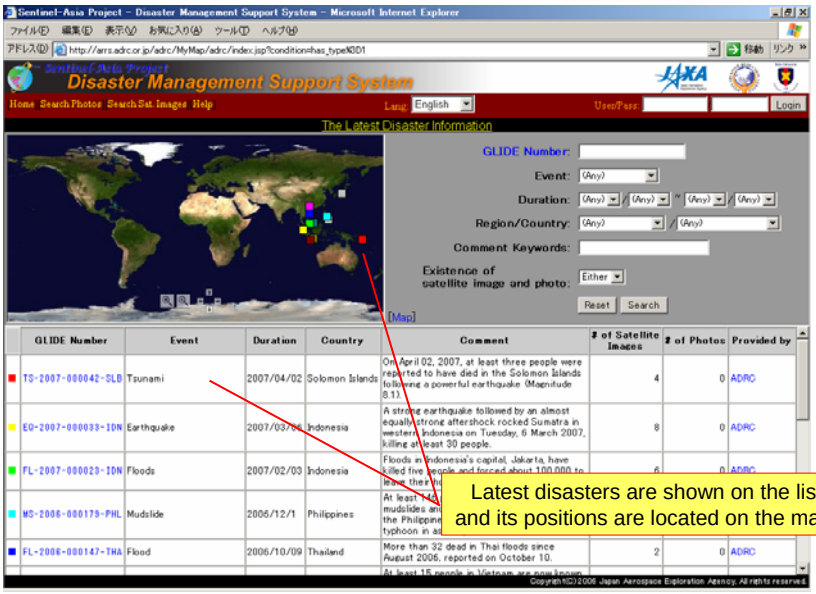
*GFAS : Global Flood Alert System (by IFNet)
**IFAS : Integrated Flood Analysis System (by ICHARM)


Charter Member Agencies
CSA
Canada
NOAA
USGS
USA
CNES
France
ESA
DMC
Europe
JAXA
Japan
ISRO
India
CONAE
Argentina


Charter Operational Loop
Emergency on-Call Officer (ECO)
On-Duty Operator (ODO)
Project Manager (PM)
Authorized User (AU)
Disaster
End User (EU)
Value-Added Reseller (VAR)
CSA
ESA
CNES
NOAA
ISRO
CONAE
JAXA
USGS
DMC
RADARSAT-1
ERS-2 and ENVISAT
SPOT-1, 2, 4 & 5
NOAA, POES, GOES
IRS
SAC-C
ALOS
Landsat
DMC Constellation

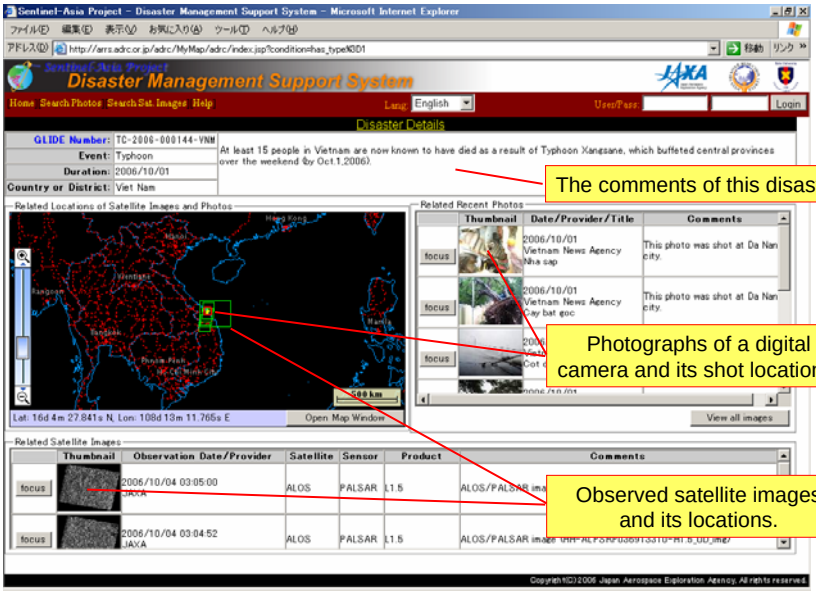
Sentinel Asia Website Top Page

Disaster List Page

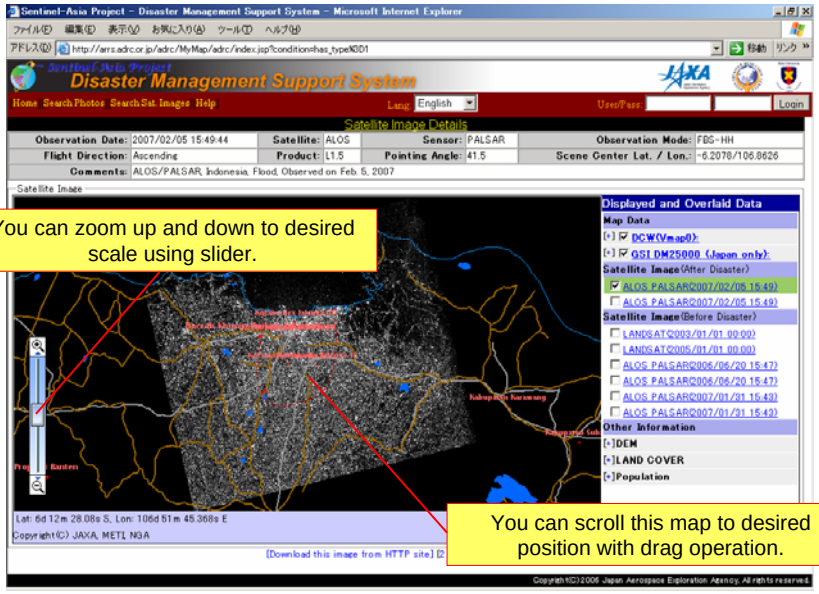


Latest disasters are shown on the list and its positions are located on the map.

Specific Disaster Page

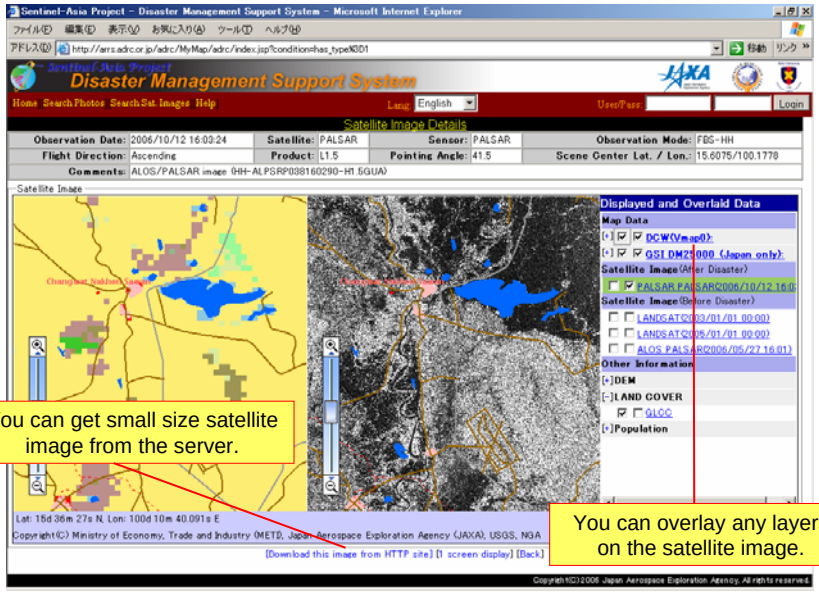


Web GIS Page

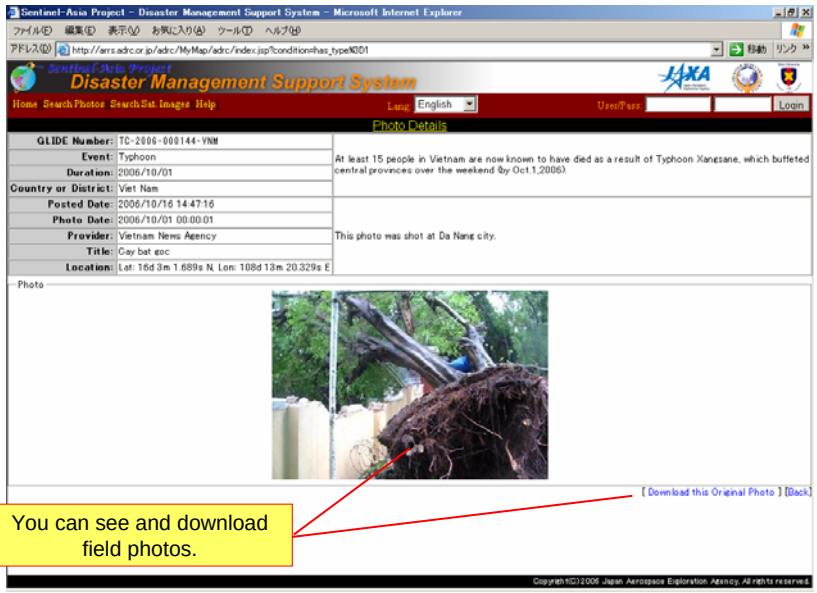


Web GIS Page (cont.)

Web GIS Page (cont.)

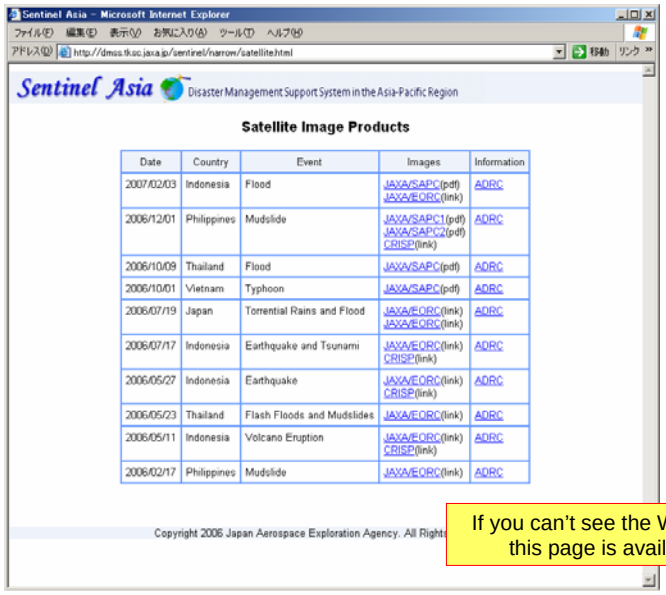


Digital Photo Page



You can see and download field photos.

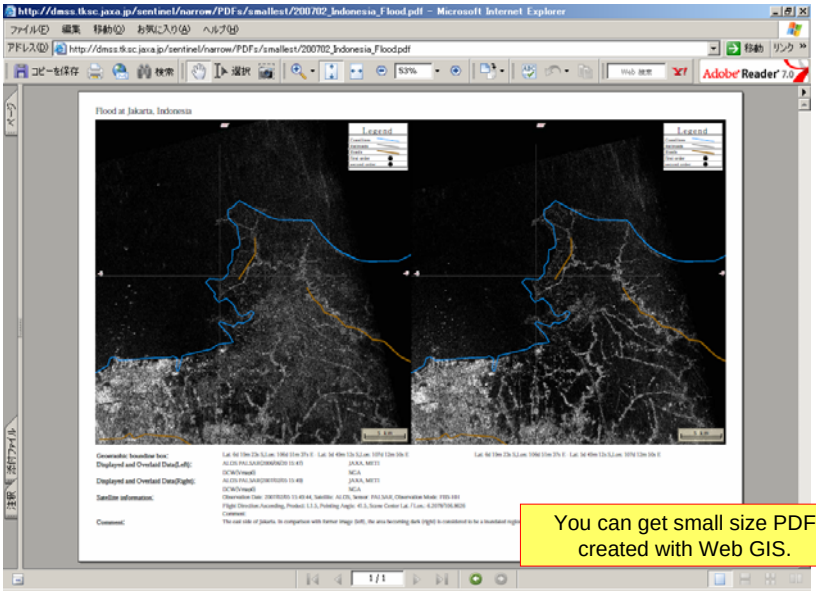
Simplified List Page (for Narrowband Users)



Date	Country	Event	Images	Information
2007/02/03	Indonesia	Flood	JAXA/SAPC(pdf) JAXA/EORC(link)	ADRC
2006/12/01	Philippines	Mudslide	JAXA/SAPC1(pdf) JAXA/SAPC2(pdf) CRISP(link)	ADRC
2006/10/09	Thailand	Flood	JAXA/SAPC(pdf)	ADRC
2006/10/01	Vietnam	Typhoon	JAXA/SAPC(pdf)	ADRC
2006/07/19	Japan	Torrential Rains and Flood	JAXA/EORC(link) JAXA/EORC(link)	ADRC
2006/07/17	Indonesia	Earthquake and Tsunami	JAXA/EORC(link) CRISP(link)	ADRC
2006/05/27	Indonesia	Earthquake	JAXA/EORC(link) CRISP(link)	ADRC
2006/05/23	Thailand	Flash Floods and Mudslides	JAXA/EORC(link)	ADRC
2006/05/11	Indonesia	Volcano Eruption	JAXA/EORC(link) CRISP(link)	ADRC
2006/02/17	Philippines	Mudslide	JAXA/EORC(link)	ADRC

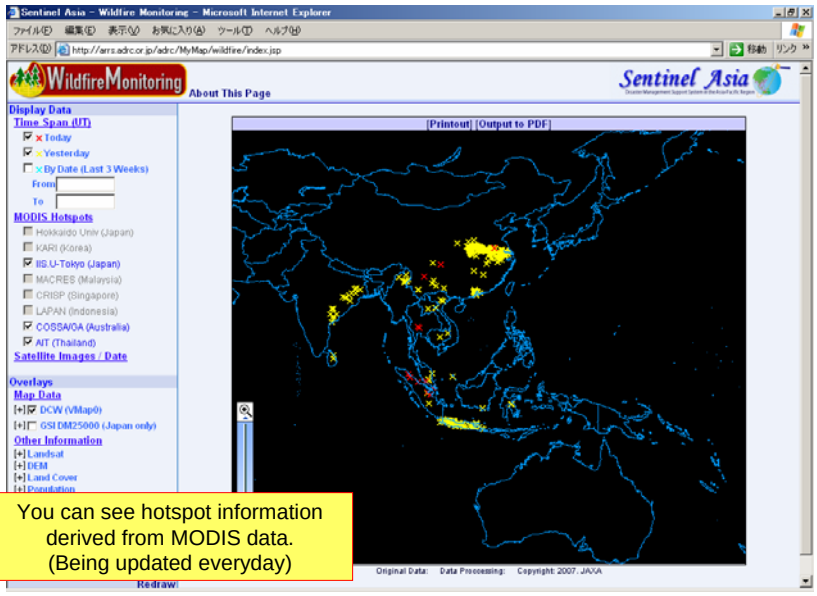
If you can't see the Web GIS, this page is available.

PDF Page (for Narrowband Users)



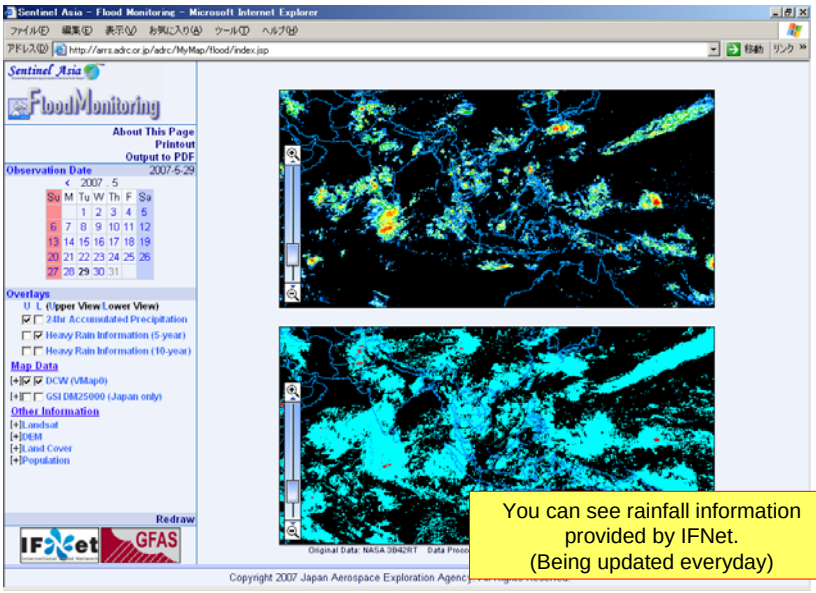
You can get small size PDF created with Web GIS.

Wildfire Monitoring Page



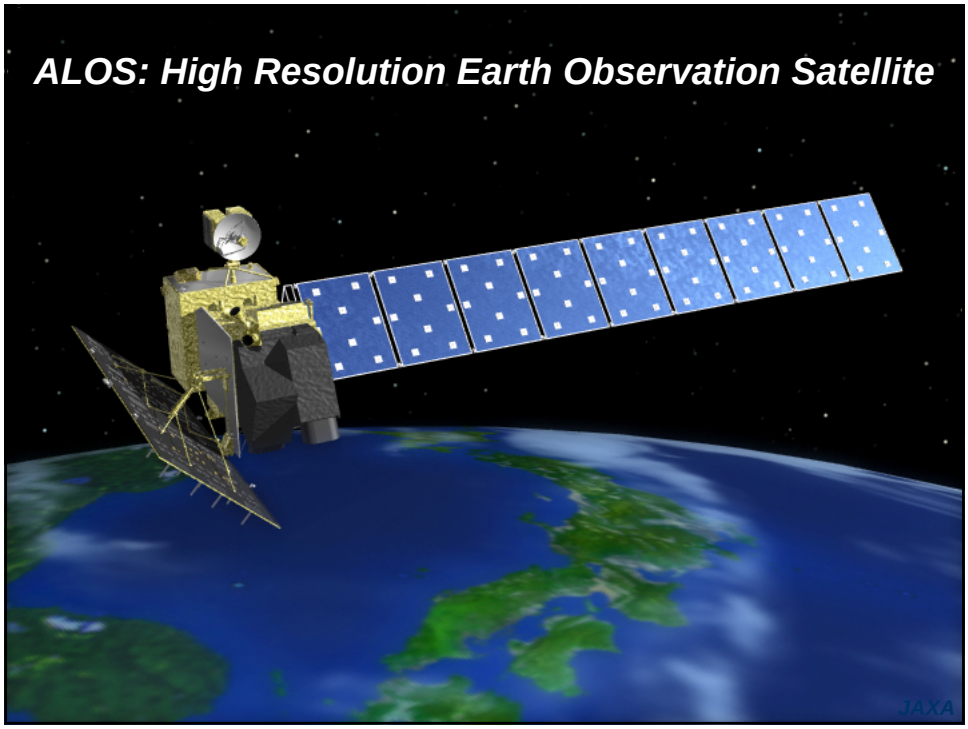
You can see hotspot information derived from MODIS data. (Being updated everyday)

Flood Monitoring Page

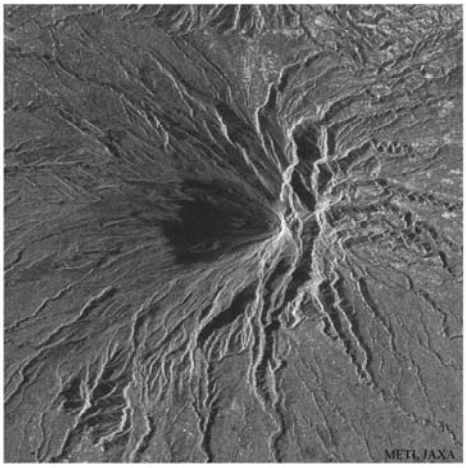


You can see rainfall information provided by IFNet.
(Being updated everyday)

ALOS: High Resolution Earth Observation Satellite

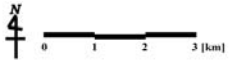


Mt. Merapi volcano, Indonesia observed by PALSAR and AVNIR-2 on April 29, 2006
2:43 (UT), RSP96, 34.3 deg. of off-nadir angle



PALSAR

AVNIR-2



Flooding area detection by ALOS in northern Thailand

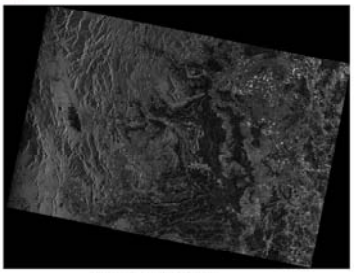


Fig.1 PALSAR

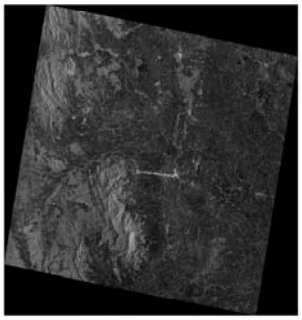


Fig.2 JERS-1

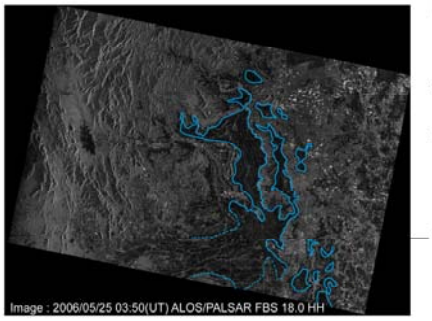
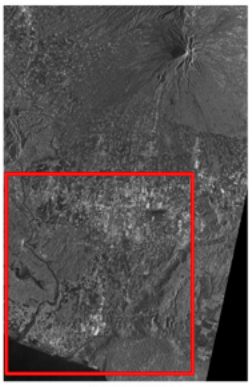


Fig.1: The northern Thailand observed by PALSAR on May 25, 2006

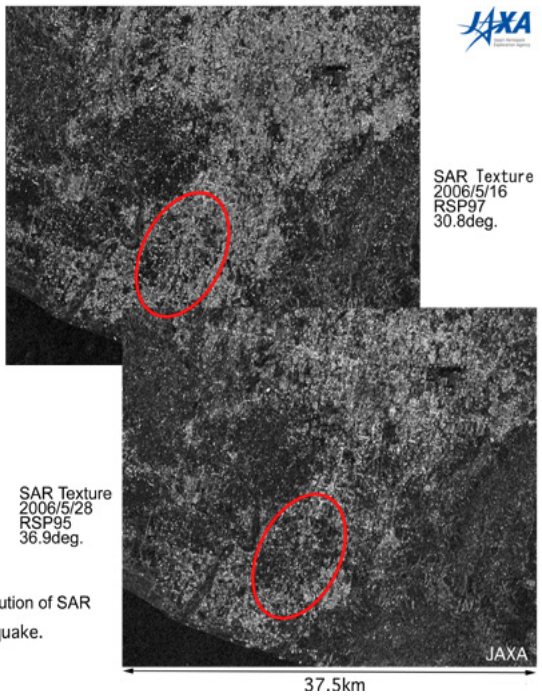
Fig.2: The northern Thailand observed by JERS-1 on Jun. 5, 1997

The area expected to be a flood

Disaster area in Yogyakarta Observed by "Daichi"



SAR image

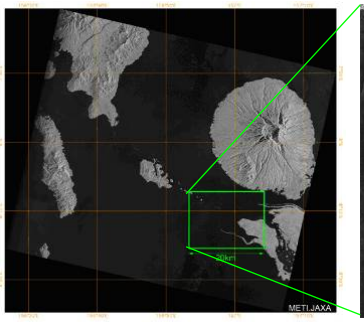


SAR Texture
2006/5/28
RSP95
36.9deg.

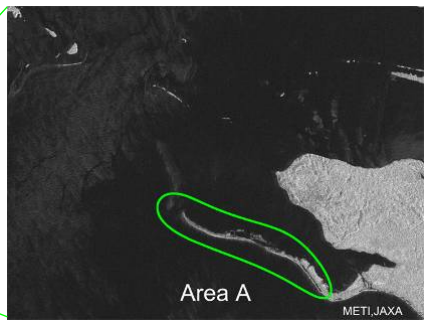
37.5km

Because of collapse of buildings, amplitude distribution of SAR image (Texture) become small after the earthquake.
(See right two figures)

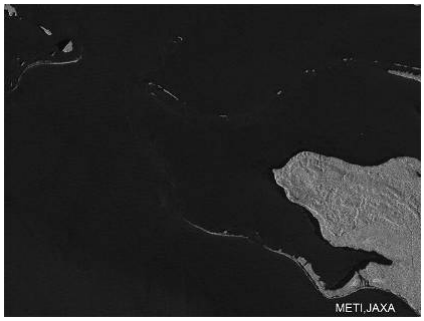
M8.1 Earthquake in Solomon Islands (Apr. 2, 2007)



PALSAR amplitude image (FBS 36.9deg off nadir angle).



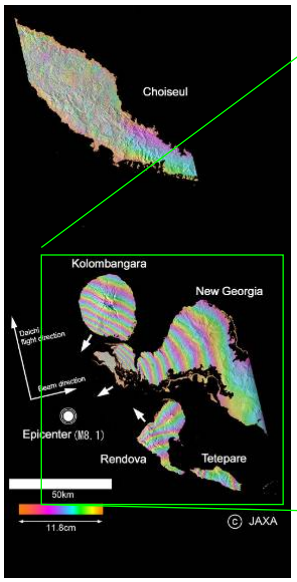
After earthquake
Apr. 8, 2007
FBS 36.9deg.
Off-nadir angle

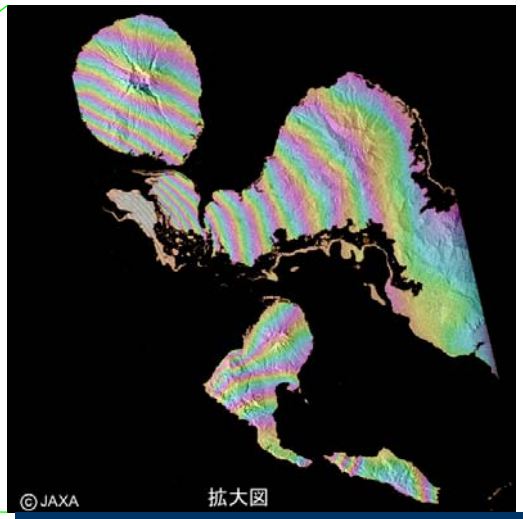


Before earthquake
Jan. 31, 2007
FBS 34.3deg.
Off-nadir angle

ALOS was activated to monitor this area as emergency observation. PALSAR could be identified fault movement due to the earthquake compared with the image acquired before disaster. This is not sea tide effects.

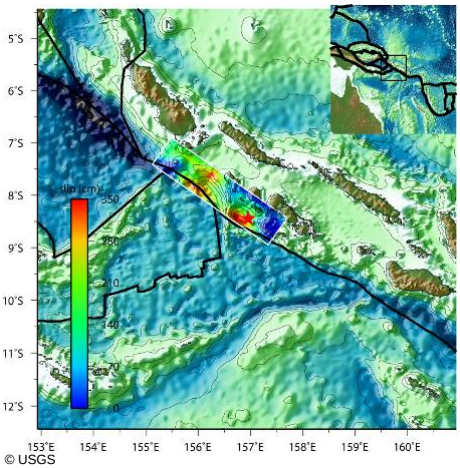
M8.1 Earthquake in Solomon Islands (Apr. 2, 2007)





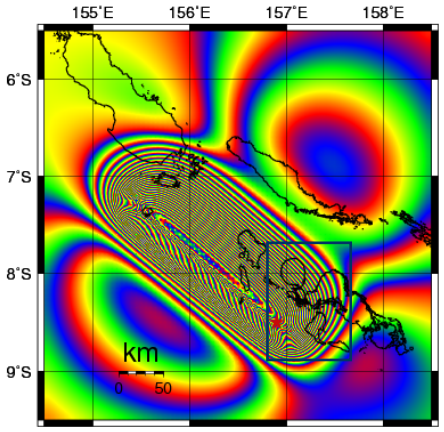
PALSAR interferometric analysis using acquired data on Mar. 1, 2007 and Apr. 16, 2007.
34.3 deg. off-nadir angle, FBS HH pol.
The maximum uplift to satellite direction was measured 2.2m.

M8.1 Earthquake in Solomon Islands (Apr. 2, 2007)



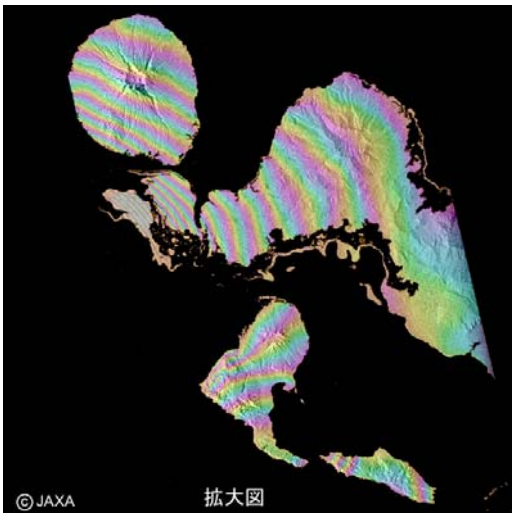
© USGS
http://earthquake.usgs.gov/eqcenter/eqinthenews/2007/us2007aqbk/result/solomon_position.jpg

Fault model of the Solomon Island earthquake estimated by USGS after earthquake.

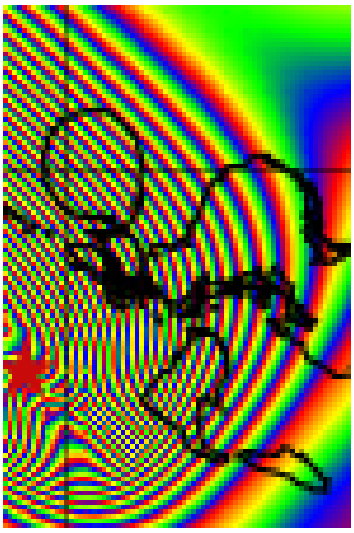


Simulated interferogram (fringe) using surface deformation model inputted USGS fault model.

M8.1 Earthquake in Solomon Islands (Apr. 2, 2007)

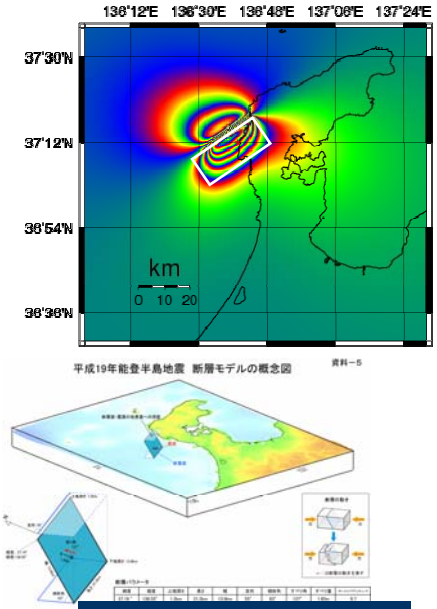


PALSAR interferometric analysis using acquired data on Mar. 1, 2007 and Apr. 16, 2007.
34.3 deg. off-nadir angle, FBS HH pol.

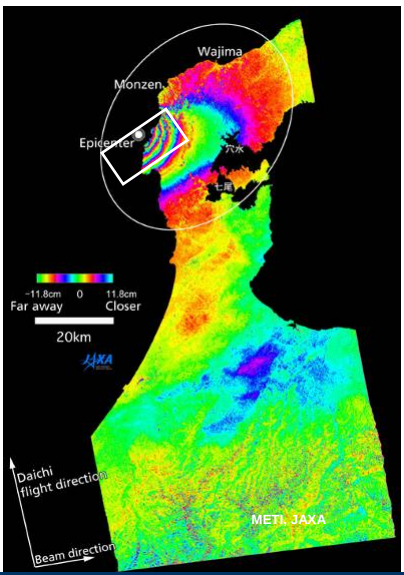


Simulated interferogram (fringe) using surface deformation model inputted USGS fault model.

M6.9 Earthquake in Noto Peninsula (Mar. 25, 2007)



Fault model estimated by Geographical Survey Institute (GSI), Japan.



PALSAR differential interferometric (DInSAR) analysis using acquired data on Feb. 23, 2007 and Apr. 10, 2007.
The maximum uplift was measured 45cm.

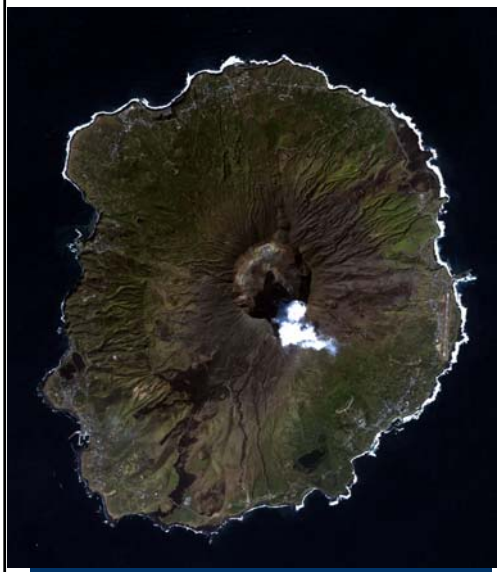
M6.9 Earthquake in Noto Peninsula (Mar. 25, 2007)

Pan-sharpened image by PRISM and AVNIR-2 acquired on Mar. 28, 2007.

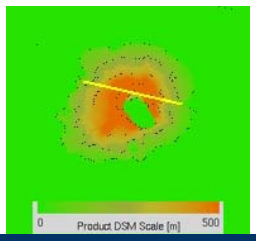
After earthquake
Mar. 28, 2007

Before earthqua
Aug. 10, 2006

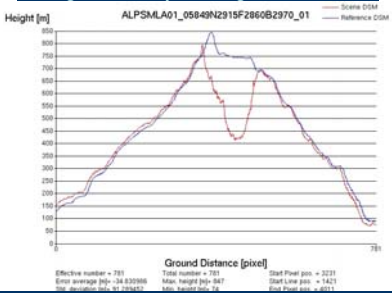
Miyakejima Island Volcano, Japan



Pan-sharpened image using PRISM and AVNIR-2 acquired on Mar. 1, 2007.



Generated digital surface model (DSM) using PRISM triplet image



Validation of generated DSM (red line) compared with existing DSM (blue line) by GSI, Japan.

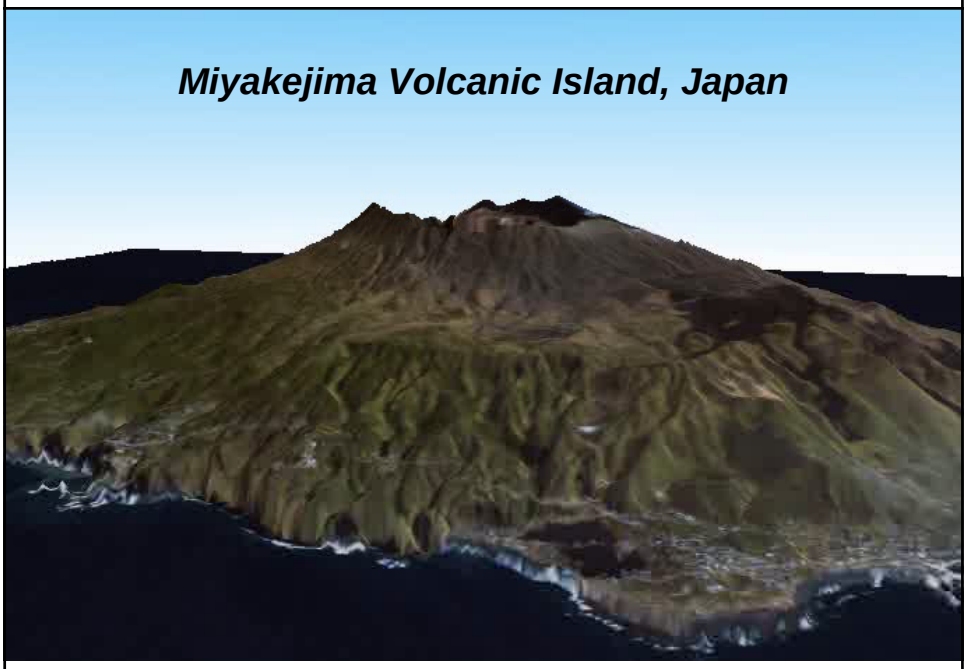
Miyakejima Volcanic Island, Japan

Mt. Oyama located center part of Miyakejima Island was erupted in 2000, and it is one of active volcano in Japan. We can see lava area due to eruption, and mud-control dam. The northern part of crater could not generated DSM due to shadow of smoke. This kinds of image will be useful as a hazard map and restoration.

3D view of Miyakejima Island generated by overlaying PRISM DSM with pan-sharpened image of PRISM and AVNIR-2.
Mar. 1, 2007.

3D view of Miyakejima Island before 2000 created from geographical map by Geographical Survey Institute of Japan.

Miyakejima Volcanic Island, Japan

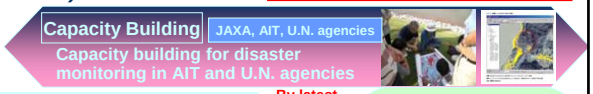


Disaster and Risk Management System in Asia

1.Disaster monitoring (earth observation satellites)
2.Direct delivery (communication satellites)
3.Updating of disaster information
4.Educational training

Integration with Space Communication System

Capacity Building JAXA, AIT, U.N. agencies
Capacity building for disaster monitoring in AIT and U.N. agencies



Observation System
Disaster monitoring system in cooperat with some countries

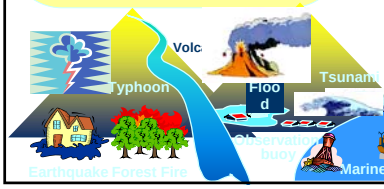
Data

Disaster Information Sharing Platform
By latest information
Extraction of latest information
Digital Asia (Web GIS)
JAXA, ADRC

Disaster Management Agency
Decision-making on disaste management activities

Checking damage conditio and disaster management activities

Communication System
Immediate delivery of ALOS data by WINDS
Data
WINDS



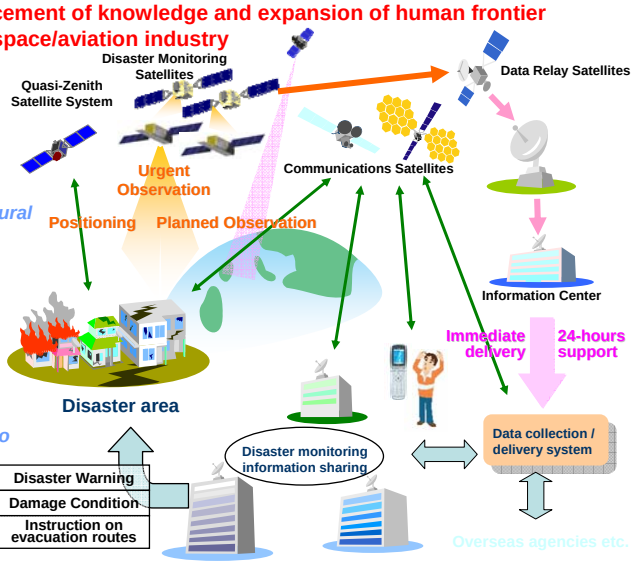
people in devastated areas

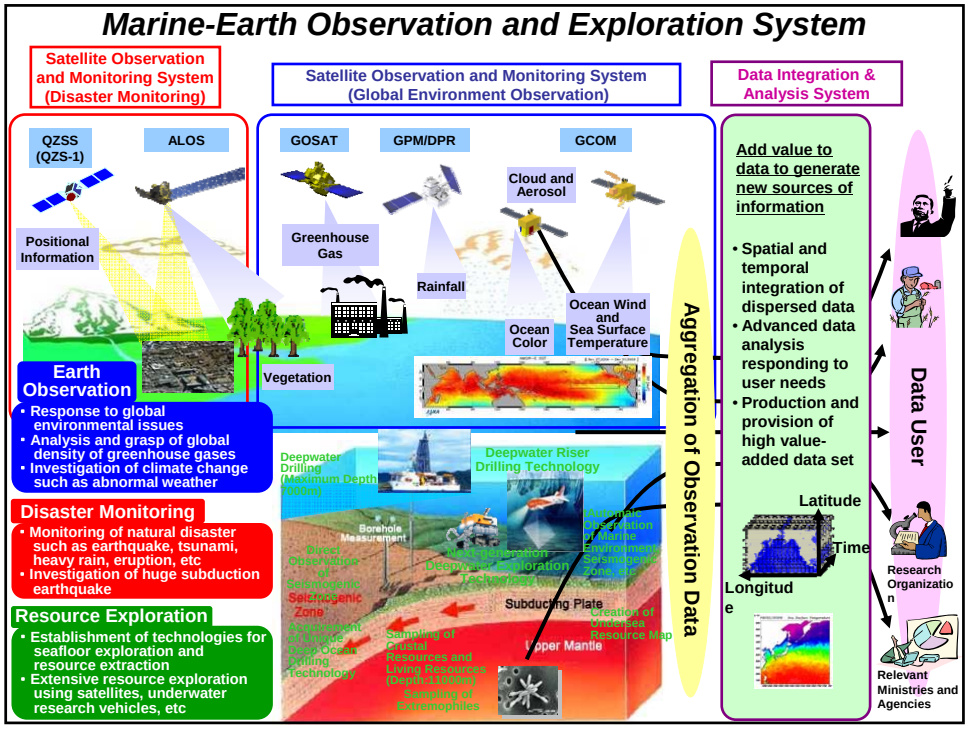
Disaster Management Activities

Space Application for Secure and Prosperous Society

- Contribution to building a secure and prosperous society
- Contribution to the advancement of knowledge and expansion of human frontier
- Facilitating the growth of space/aviation industry

- Space development which can contribute to a secure and prosperous society
  - *Building of system for natural disasters management*
  - *Building of system for the protection of global environment*
  - *International cooperation*
- Contribution to space industry
  - *Strengthening measures to seek for new business opportunities*

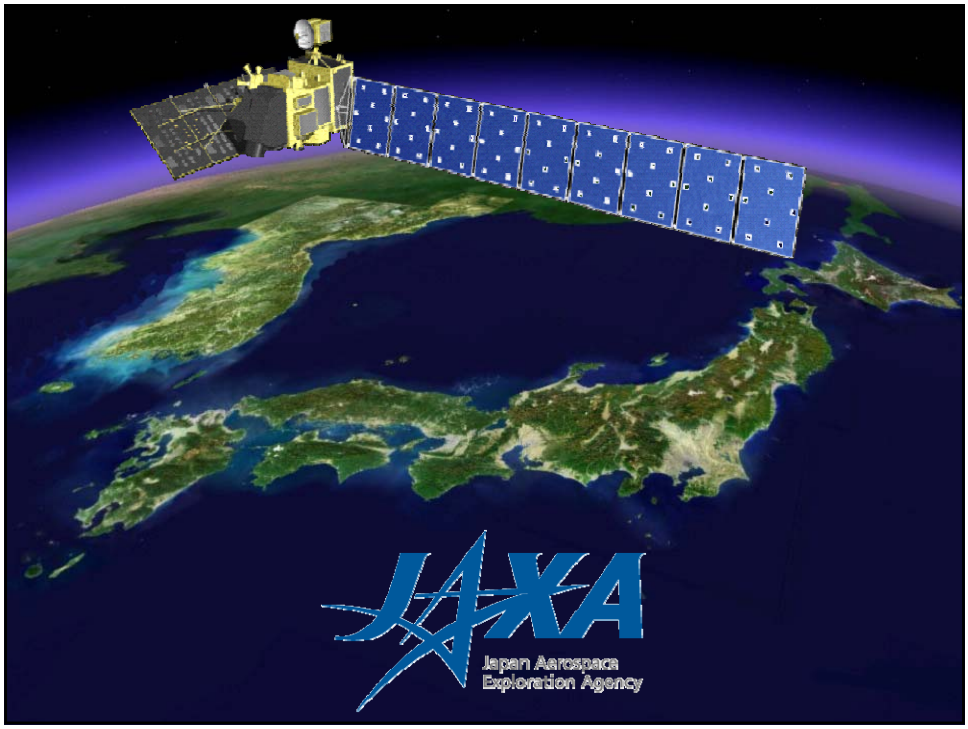




JAXA

Conclusion

- Contribution to a secure and prosperous society utilizing earth observation satellites and communications satellites in cooperation with Asian countries.
- Support for utilize disaster authorities in Asia pacific through Sentinel Asia.
- Support for education and capacity building to operate a total system.


JAXA
Japan Aerospace
Exploration Agency