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Asian Conference on Disaster Reduction 2013

Utilization of Satellite for Disaster Management with a Focus on the Sentinel Asia

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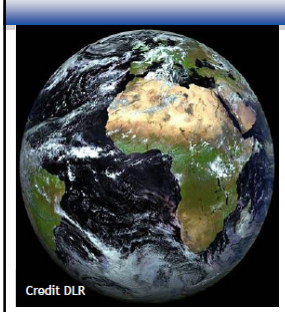
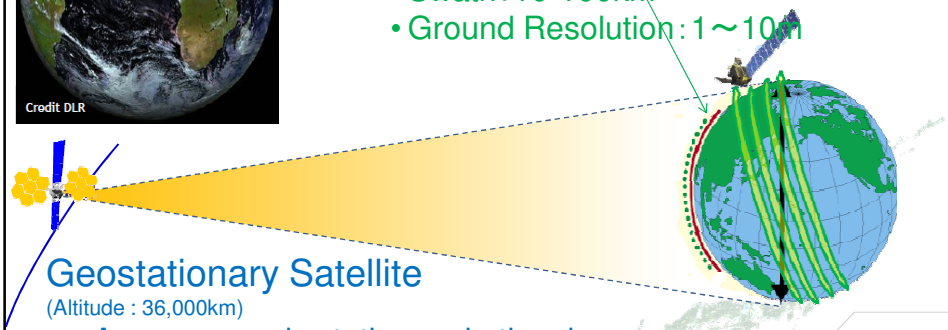
Disaster Management Support Systems Office

Features of Earth Observation Satellite



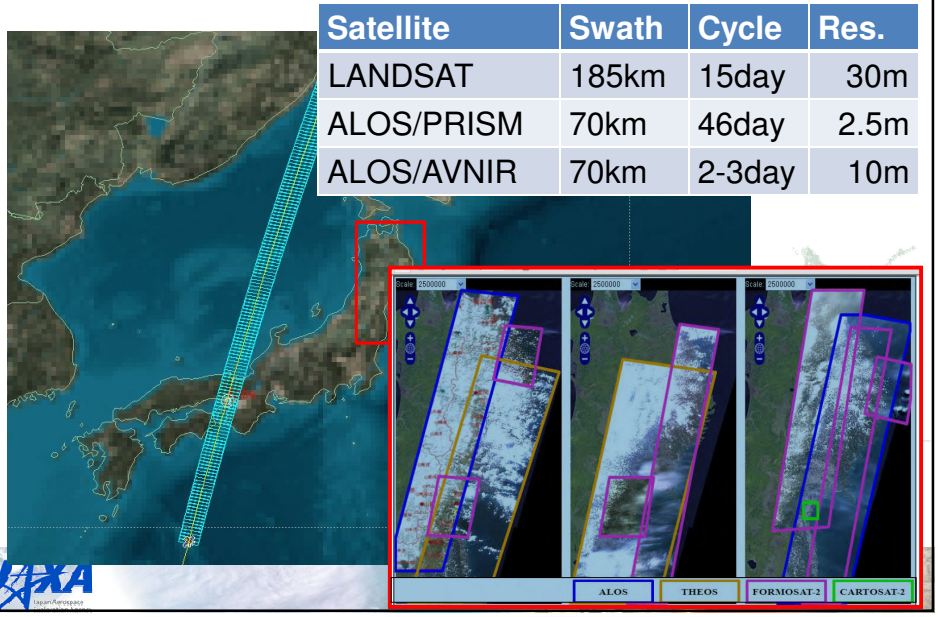
Earth Observation Satellite
(Altitude: 200km – 1000km)
- Long revisit interval : 14～60days
- Swath : 10-100km
- Ground Resolution : 1～10m



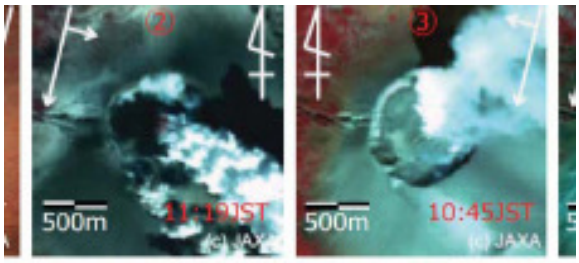
Geostationary Satellite
(Altitude : 36,000km)
- Appears nearly stationary in the sky
- 40 percent of the earth's surface continuously
- Ground Resolution : 1～10km

Features of Earth Observation Satellite

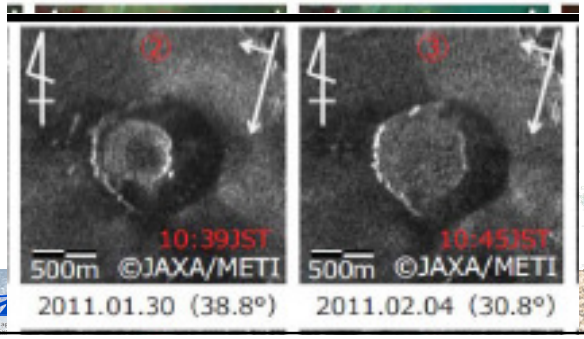
Satellite	Swath	Cycle	Res.
LANDSAT	185km	15day	30m
ALOS/PRISM	70km	46day	2.5m
ALOS/AVNIR	70km	2-3day	10m



Optical Camera vs. Rader from Satellite

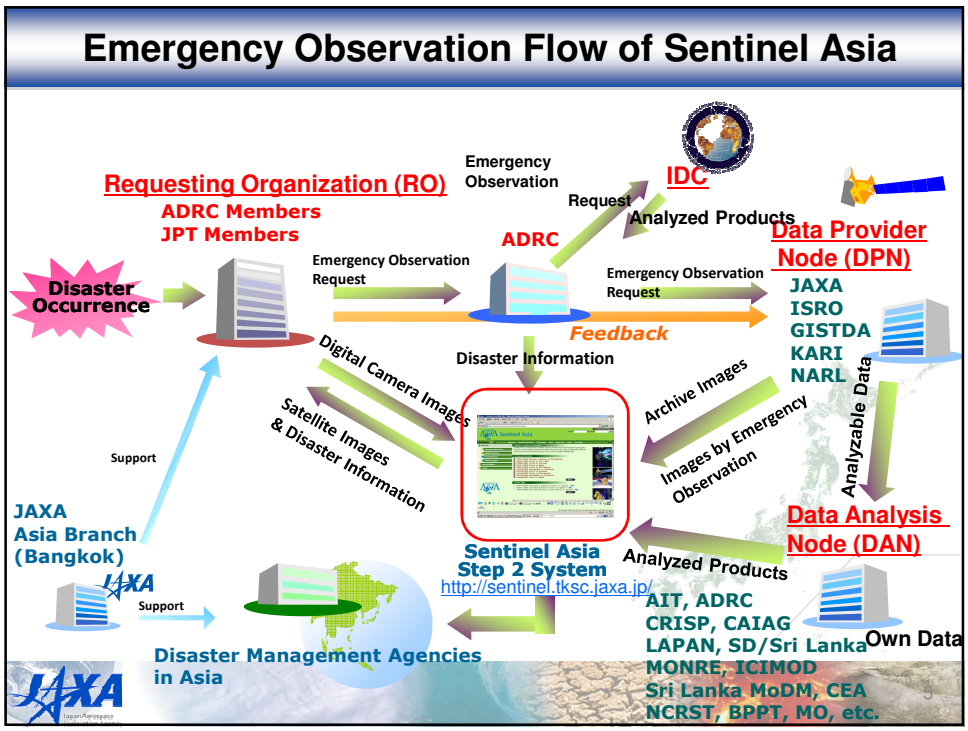


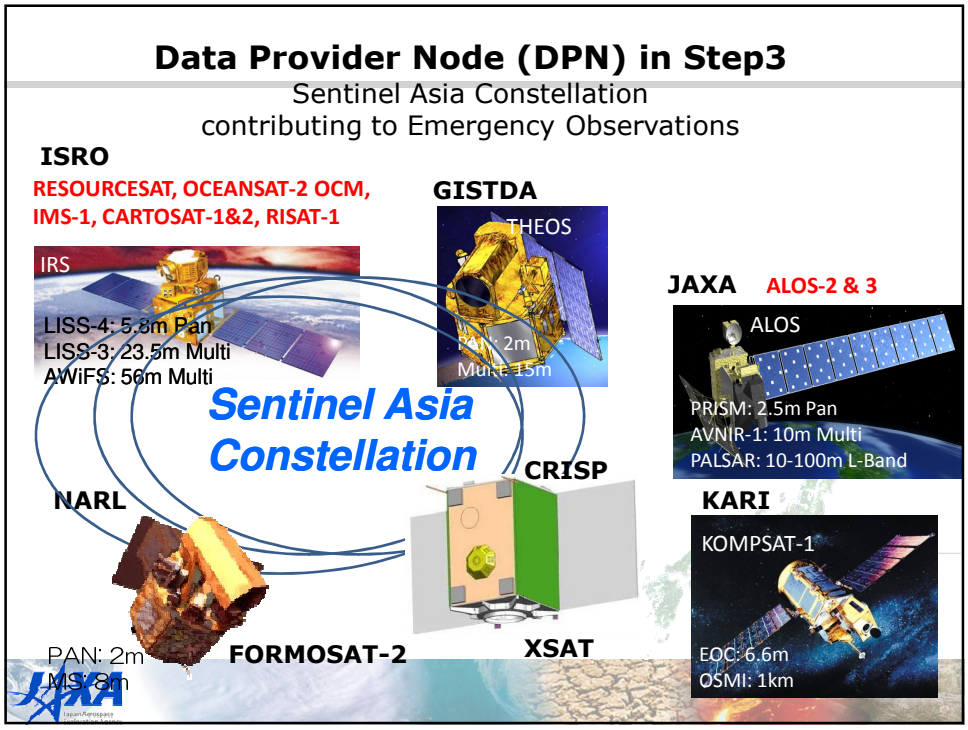
Optical Camera



Radar Image

4


Emergency Observation Flow of Sentinel Asia
Requesting Organization (RO)
ADRC Members
JPT Members
Emergency Observation
Request
IDC
Request
Analyzed Products
ADRC
Data Provider Node (DPN)
JAXA
ISRO
GISTDA
KARI
NARL
Disaster Occurrence
Emergency Observation Request
Emergency Observation Request
Feedback
Disaster Information
Digital Camera Images
Satellite Images & Disaster Information
Archive Images
Images by Emergency Observation
Analyzable Data
Support
JAXA Asia Branch (Bangkok)
Sentinel Asia Step 2 System
http://sentinel.tksc.jaxa.jp/
Data Analysis Node (DAN)
Analyzed Products
AIT, ADRC
CRISP, CAIAG
LAPAN, SD/Sri Lanka
MONRE, ICIMOD
Sri Lanka MoDM, CEA
NCRST, BPPT, MO, etc.
Own Data
Support
Disaster Management Agencies in Asia


Data Provider Node (DPN) in Step3
Sentinel Asia Constellation
contributing to Emergency Observations
ISRO
RESOURCESAT, OCEANSAT-2 OCM,
IMS-1, CARTOSAT-1&2, RISAT-1
IRS
LISS-4: 5.8m Pan
LISS-3: 23.5m Multi
AWiFS: 56m Multi
GISTDA
THEOS
PAN: 2m
Multi: 15m
JAXA
ALOS-2 & 3
ALOS
PRISM: 2.5m Pan
AVNIR-1: 10m Multi
PALSAR: 10-100m L-Band
Sentinel Asia Constellation
NARL
CRISP
KARI
KOMPSAT-1
EOC: 6.6m
OSMI: 1km
PAN: 2m
MS: 8m
FORMOSAT-2
XSAT

Utilization of Satellite

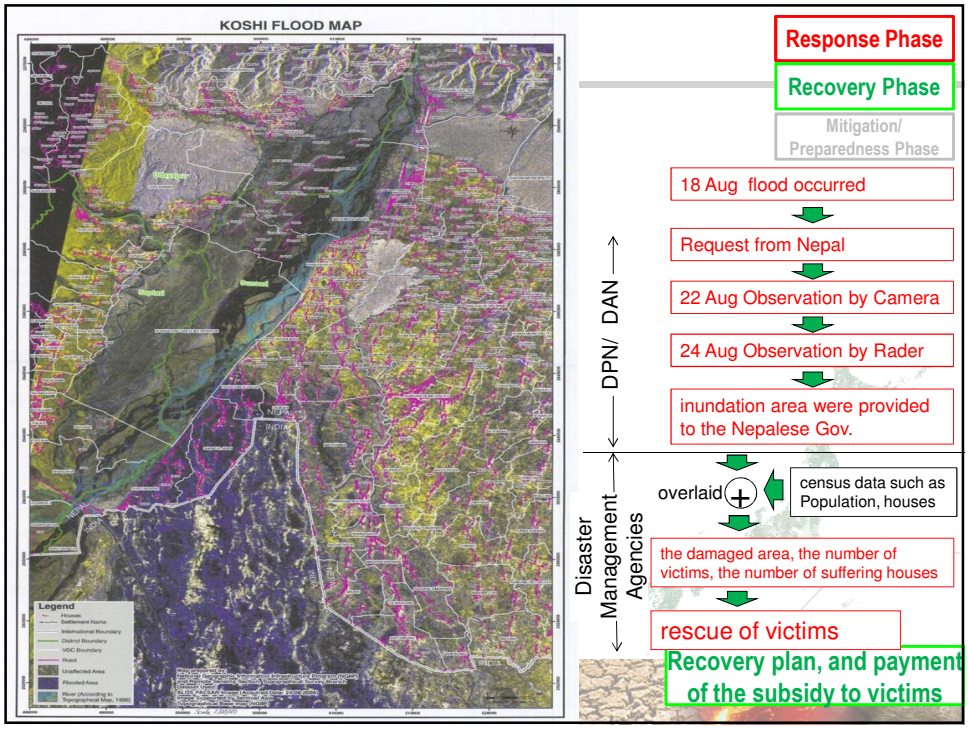
- **Examples of Utilization of Satellite data in each disaster phase**
  - **Sentinel Asia and others**
  - **from ALOS observation**

Disaster Management Cycle

A large-scale flood in Nepal on August 2008

- A large-scale flood occurred by burst of dike, in Sunsari district in southeastern Nepal on **18 August 2008**.
- JAXA made emergency observation with PRISM/AVNIR-2 aboard ALOS on **22 August** and by PALSAR on **24 August** by request of ICIMOD, Survey Department and Department of Water Induced Disaster Prevention through Sentinel Asia.
- Analyzed products **indicating inundation area are provided immediately** to the Nepalese government.
  - ICIMOD: International Centre for Integrated Mountain Development,
- Using these data overlaid with census data such as population, houses, map of damaged area and data such as damaged area, the number of victims, the number of suffering houses were made and **were utilized for rescue of victims, recovery plan, and payment of the subsidy to victims.**

8



The heavy rain in Vietnam on 30 October 2008

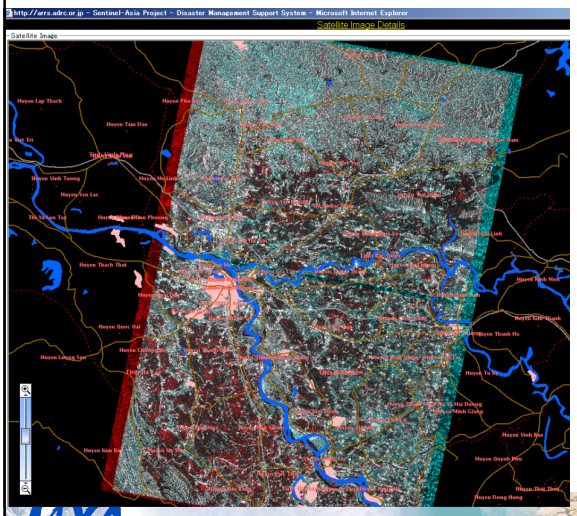
- The heaviest rains since 1984, which **continued for more than 72 hours from 30 October 2008**, occurred in the northern and central part of Vietnam.
- JAXA made emergency observation with PALSAR aboard ALOS **late at night on 5 November by request of Vietnamese Academy of Science and Technology (VAST)** through Sentinel Asia on 4 November. JAXA provided analyzed products to VAST via Sentinel Asia.
- In Hanoi city located lower than a river, the dike around a river is built and the water is drained away at the time of the flooding. But a large quantity of water overflowed by rainfall more than the ability of drainage facilities by this disaster.
- VAST made map of damage situation in the suburbs of Hanoi and estimated the ability of drainage system of pumping station from a displacement and was able to consider where to be improved.

The heavy rain in Vietnam on 30 October 2008

Response Phase

Recovery Phase

Mitigation/ Preparedness Phase



DPN/ DAN

heavy rains continued from 30 Oct.

4 Nov.: Request from VAST*1

late at night on 5 Nov.: Observation by Rader

provided analyzed products to VAST via Sentinel Asia

Disaster Management Agencies

VAST made map of damage situation

- estimated the ability of drainage system of pumping station
- was able to consider where to be improved

*1: Vietnamese Academy of Science and Technology

A large-scale flood in Sri Lanka on May 2010

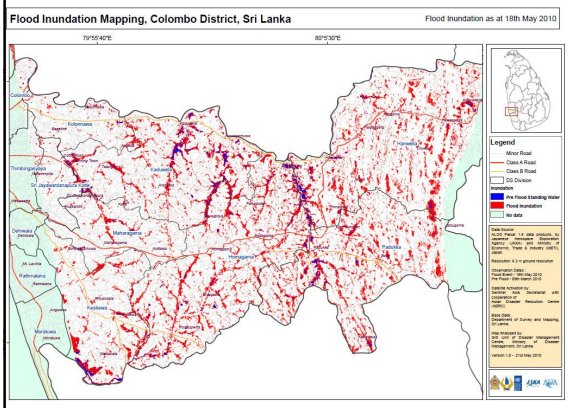
- On the occasion of the record-breaking flood that occurred around Colombo in May 2010, JAXA made **emergency observation with PALSAR aboard ALOS late at night on 18 May** by request of Disaster Management Centre (DMC), Sri Lanka through Sentinel Asia on the same day. Observed data were **provided to DMC in the morning of the next day**.
- **DMC made analyzed products indicating inundation area** in cooperation with Survey Department of Sri Lanka.
- DMC is a central organization in Sri Lanka for disaster management, and inundation maps were presented to and was **used for grasp of inundation area, detection of submerged roads, and plan of their detour**.

A large-scale flood in Sri Lanka on May 2010

Response Phase

Recovery Phase

Mitigation/ Preparedness Phase



DPN/ DAN

May 2010: flood occurred

18 May: Request from DMC*1

late at night on 18 May: Observation by Rader

19 May: provided to DMC in the morning

Disaster Management Agencies

DMC made analyzed products indicating inundation area

organizations concerned local prefecture,

grasp of inundation area
detection of submerged roads
plan of their detour

*1:Disaster Management Centre

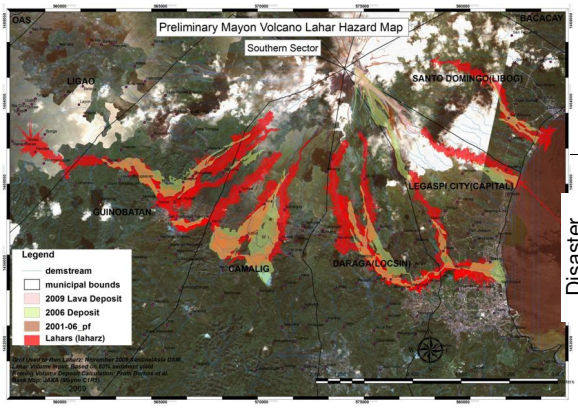
13

Volcanic activity in Philippines from 14 December 2009

- Mayon volcano in Luzon, the Philippines, activated volcanic activity from 14 December 2009, and the lava which **flowed out from the crater was confirmed on 20 December**. About 47 thousands people living near Mayon volcano evacuated according to warning by Province government. JAXA made **emergency observation with PRISM/AVNIR-2 aboard ALOS on 25 December** 2009 by request of Philippine Institute of Volcanology and Seismology (PHIVOLCS) through Sentinel Asia, and provided observed data to PHIVOLCS.
- PHIVOLCS made lava deposit map by the eruption using these ALOS imagery and others, **which was used to understand the situation and make decision** by National Disaster Coordinating Council (NDCC).
- Lava flow hazard map and lahar hazard map are prepared before hand using ALOS DEM with cooperation of JAXA and PHIVOLCS, which were used by updating with new lava deposit during eruption emergencies.

Volcanic activity in Philippines from 14 December 2009

Response Phase
Recovery Phase
Mitigation/ Preparedness Phase



DPN/ DAN*

hazard maps were prepared with cooperation of JAXA and PHIVOLCS

20 Dec.: the lava was confirmed

25 Dec.: Observation by Camera

Disaster Management Agencies

PHIVOLCS made lava deposit map by the eruption using these ALOS imagery and others

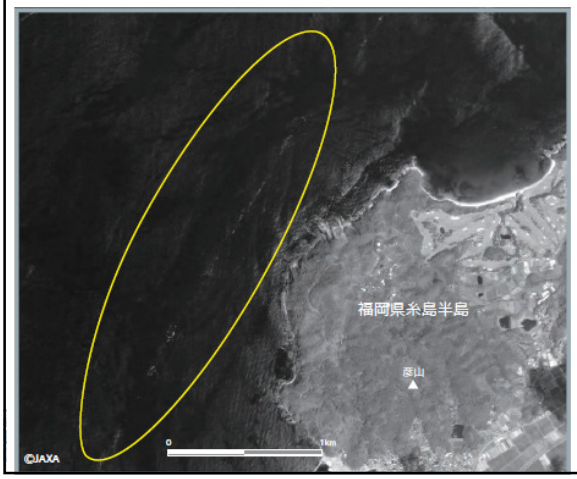
the maps were used to understand the situation and make decision by NDCC

*1: Philippine Institute of Volcanology and Seismology
*2: National Disaster Coordinating

driftwood drifted in the Sea on August 2006

Response Phase
Recovery Phase
Mitigation/ Preparedness Phase

- A large quantity of driftwood drifted in the Sea of Japan side of Kyushu in the nearshore waters from July through August 2006.



27 July: Observation by Camera

Disaster Management Agencies

Analyzed products to Japan Coast Guard (JCG).

JCG used the information as safe report to navigation ships.

This is not from Sentinel Asia

16

Summary

- Based on satellite's strong points, "all-weather", "day-and-night", "wide coverage" and "repeat monitoring" images and information are provided to related agencies.
- In order to use satellite image during a hazard, preparedness is important
  - to make hazard map, evacuation drill with residents
- Useful information will be obtained by using satellite analysis data with census data such as population or houses
  - the number of victims, the number of suffering houses
- ALOS-2 equipped with Radar sensor will be launched this year. it will contribute to Sentinel Asia.

Thank you for attention

What is Sentinel Asia ?

Backup

Sentinel Asia is

- a voluntary initiative
- collaboration between space agencies and disaster management agencies
- applying remote sensing and Web-GIS technologies

to assist disaster management in the Asia-Pacific region.

Main Activities are

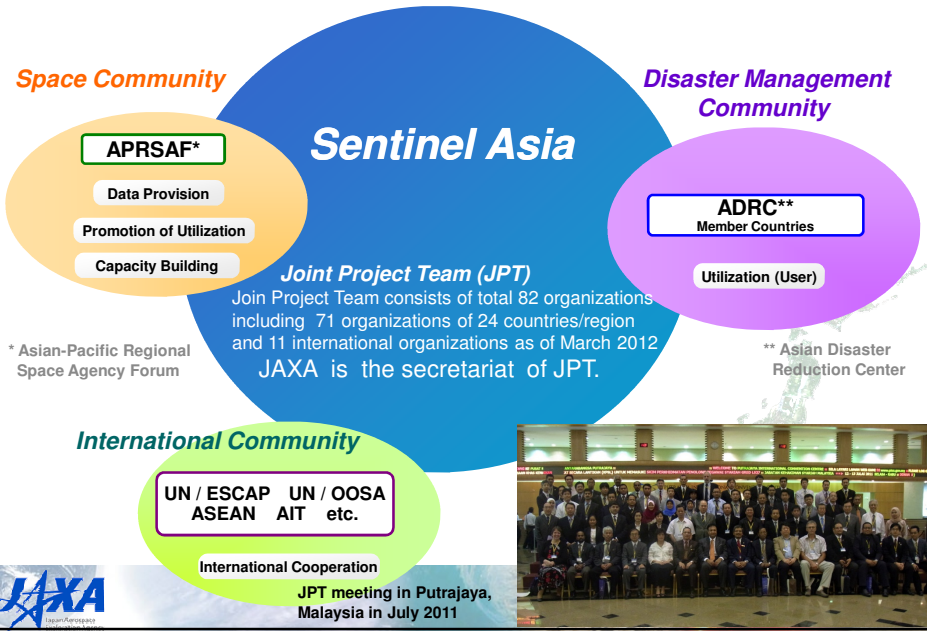
(1) Emergency observation
(2) Working Group (WG)
- Wildfire
- Flood
- Glacial Lake Outburst Flood (GLOF)
- Tsunami

(3) Capacity building
- human resource development
- human network

http://sentinel.tksc.jaxa.jp/

Framework of Sentinel Asia

Backup



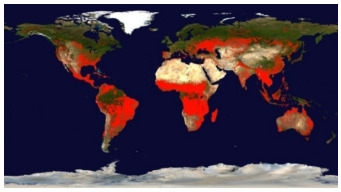
JPT meeting in Putrajaya, Malaysia in July 2011

Working Group Activities for Disaster Risk Reduction

Backup

- **Wildfire WG**
  - -To contribute to the Asia-Pacific region with wildfire management
  - -To contribution to REDD-plus
  - -JST-JICA(*) project for wildfire and carbon management in a peatland in Kalimantan, Indonesia

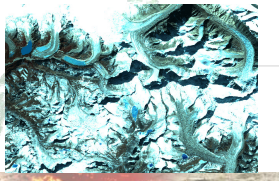
(*)JST: Japan Science and Technology Agency
JICA: Japan International Cooperation Agency



- **Flood WG**
  - -To contribute to the mitigation of flood disasters in Asia
  - -Flood analysis using IFAS

IFAS
Flood Forecasting Using Global Satellite Rainfall Information Based on
Integrated Flood Analysis System

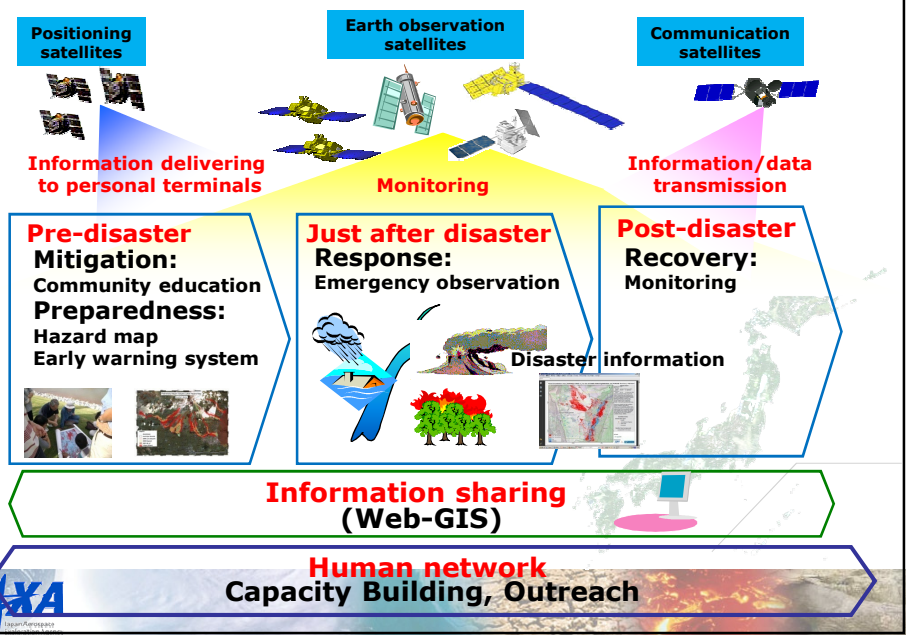
- **GLOF WG** (Glacial Lake Outburst Flood)
  - -Monitor and establish early warning system in the risk areas
  - -Local awareness and knowledge transfer through capacity building



- **Tsunami WG**
  - -Tsunami early warning system

Concept of Sentinel Asia Step3 (2013 onwards)

Backup



Concept of Sentinel Asia Step3 (APRSAF-18)

(1) Successor to Step2's activities, basically
(2) Expansion from response (in Step1 and 2) to cover mitigation/preparedness and recovery phase in the disaster management cycle
(3) Participation of various satellites:
EO satellites, Com satellites, and Nav satellites
(4) Further collaboration for operation
(5) Further utilization and human networking through capacity building and outreach