We memorialize many people damaged 15 years ago.

And we hope all the people have damaged yet will become fortunate enough.
Confusion in the Disaster

- Life save within 72 hours, by self/mutual/public help.
- So, it’s important to know what’s matter, who does, how doing.
- We should collect, send, share information and make communication each other.
- Multilateral cooperation and collaboration with not only public disaster management agencies, but also private company, university/researchers, NGO/NPO, mass media, residents, and so on.

Characteristics of artificial satellite

- **Wide coverage**
  - Like a bird view from higher position.
- **Simultaneously**
  - Like a higher broadcasting tower to share information in wide area
- **Robust against disaster**
  - Not on the ground
  - Maintenance free for several years
JAXA promotes satellite application to disaster management

- Space asset will become to global and inevitable infrastructure which has no border.
- JAXA has obtained space technology through original research/development, so as a next phase, should utilize these technology for application contributing to secure and prosperous society; it’s not only for JAPAN, but also for ASIA.
- In Japan as well as Asia, natural disaster occurs frequently. For the sake of mitigation and prevention disaster, we must share the information as for disaster beyond border.
- JAXA promotes Sentinel Asia using with various satellites, toward realization of information system which supports mitigation and prevention activities.
- Observation satellites are characterized by wide view revolving around the world, communication satellites are characterized by broad coverage connecting unconnected simultaneously, and they are robust under disaster.
- Nevertheless, space crafts are just only infrastructure dealing with information. Otherwise, mitigation and prevention activities have needed valuable information so called ‘intelligence’ or "solution", which are created by multilateral collaboration with various organizations besides space agencies.
- JAXA as a secretariat of Sentinel Asia has expected UNESCAP assists to coordinate the collaboration.

UNESCAP: 国連アジア太平洋経済社会委員会

Trilateral Joint Statement on Disaster Management Cooperation

The heads of government agencies of JAPAN, CHINA, and KOREA held first Trilateral Meeting on Disaster Management in Kobe, Japan on 31st October 2009

4.(3)
Considering the information sharing on the current efforts by the three countries to utilize satellite technologies for disaster management, and, from the viewpoint of humanitarian concern in the wake of disasters, discussing the possibility of cooperation for more efficient and effective operations of utilizing satellite images.
Role of Earth obs. satellite against disasters

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 addition to aviation photos and heli-TV, satellite images help.

<table>
<thead>
<tr>
<th>Info. based on satellite images</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damaged houses, roads, railroads; flooded or fire area (all-weather, day &amp; night, wide)</td>
<td>Rescue work, evacuation route, ensure helicopter landing area, traffic control</td>
</tr>
<tr>
<td>Restoration status, volcanoes monitor, land cover change (wide, repeat)</td>
<td>Prevention disaster aftermath, restoration plan</td>
</tr>
<tr>
<td>Volcanic activities, land slide hazards, topographic maps update (wide, repeat)</td>
<td>Disaster mitigation plan, update of hazard maps</td>
</tr>
</tbody>
</table>

Disaster Prevention/ Mitigation Cycle

Advanced Land Observing Satellite (ALOS)

ALOS (Daichi) Satellite System

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Launch Date</td>
<td>24 Jan. 2006</td>
</tr>
<tr>
<td>Launch Vehicle</td>
<td>H-IIA</td>
</tr>
<tr>
<td>Spacecraft Mass</td>
<td>4,000kg</td>
</tr>
<tr>
<td>Orbit</td>
<td>Sun Sync.</td>
</tr>
<tr>
<td>Altitude</td>
<td>691.65km</td>
</tr>
<tr>
<td>Repeat Cycle</td>
<td>46 days</td>
</tr>
</tbody>
</table>

PRISM : Panchromatic Remote-sensing Instrument for Stereo Mapping
AVNIR R-2: Advanced Visible and Near Infrared Radiometer type 2
PALSAR: Phased Array type L-band Synthetic Aperture Radar
Satellite Communication for information and data transmission

Engineering Test Satellite VIII (ETS VIII)

Wideband Internetworking engineering test and Demonstration Satellite <WINDS>

Mobile communication via satellite

Handheld terminal

Portable terminal

High data rate communication via satellite in Asia and Pacific region

Promotion Activities
**Advanced Land Observing Satellite (ALOS)**

- Optical (panchromatic)
- Three optical systems in order to obtain terrain data
- Spatial resolution: 2.5m
- Sensor field of view: 35km/70km
- Cross track pointing capability: -1.5°~1.5°
  → Basically, 1 time/46 days observation.

- Optical ~ infrared (4 band)
- Cross track pointing capability
- for disaster monitoring: -44°~44°
- Spatial resolution: 10m
- Sensor field of view: 70km

- Synthetic Aperture Radar (L band(1.27GHz))
- Cross track pointing capability: 10°~51°
- Spatial resolution: 10m, 100m (Scan mode)
- Sensor field of view: 70km, 350km (Scan mode), etc...
- All-weather, day-and-night observation

---

**JAXA’s Activity in Disaster Monitoring Program**

1. **Domestic Ministries and Agencies**
2. **Sentinel Asia**
3. **International Charter on Space and Major Disasters**

Data

Observation

Disaster Operation Users

Disaster Information
### List of Emergency Observations by ALOS for Disasters Abroad


<table>
<thead>
<tr>
<th>Country</th>
<th>Frequency</th>
<th>Disaster Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>5</td>
<td>Earthquake (3), Flood (2)</td>
</tr>
<tr>
<td>Australia</td>
<td>4</td>
<td>Flood (1), Wildfire (1), Oil Spill (2)</td>
</tr>
<tr>
<td>USA</td>
<td>4</td>
<td>Flood (4)</td>
</tr>
<tr>
<td>Vietnam</td>
<td>3</td>
<td>Flood (1), Typhoon (2)</td>
</tr>
<tr>
<td>Italy</td>
<td>3</td>
<td>Earthquake (1), Wildfire (2)</td>
</tr>
<tr>
<td>Philippines</td>
<td>3</td>
<td>Flood (2), Typhoon (1)</td>
</tr>
<tr>
<td>Nepal</td>
<td>2</td>
<td>Flood (2)</td>
</tr>
<tr>
<td>Other Countries</td>
<td>25</td>
<td>Flood (8), Earthquake (2), Tsunami (1), Volcano (4), Typhoon/Cyclone (3), Wildfire (5), Other (2)</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>Flood (12), Earthquake (6), Tsunami (1), Oil Spill (1), Volcano (3), Typhoon/Cyclone (5), Wildfire (7), Other (2)</td>
</tr>
</tbody>
</table>

### List of Emergency Observations by ALOS for Disasters in Japan


<table>
<thead>
<tr>
<th>Date</th>
<th>Place</th>
<th>Disaster Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2009/4/9</td>
<td>Sakurajima Island</td>
<td>Volcanic Eruption</td>
</tr>
<tr>
<td>2 2009/7/7</td>
<td>Wakayama Pref.</td>
<td>Flood</td>
</tr>
<tr>
<td>3 2009/7/21</td>
<td>Chugoku and Kyushu districts</td>
<td>Flood, Landslide</td>
</tr>
<tr>
<td>4 2009/7/28</td>
<td>Wakayama Pref.</td>
<td>Flood</td>
</tr>
<tr>
<td>5 2009/8/10</td>
<td>Sizuoka Pref.</td>
<td>Earthquake</td>
</tr>
<tr>
<td>6 2009/8/27</td>
<td>Ishigakijima Island</td>
<td>Driftwood</td>
</tr>
<tr>
<td>7 2009/8/31</td>
<td>Chiba Pref.</td>
<td>Flood</td>
</tr>
<tr>
<td>8 2009/9/18</td>
<td>Mie Pref.</td>
<td>Flood, Landslide</td>
</tr>
<tr>
<td>9 2009/10/7</td>
<td>Wakayama Pref.</td>
<td>Flood</td>
</tr>
<tr>
<td>10 2009/10/9</td>
<td>Gifu Pref.</td>
<td>Flood</td>
</tr>
</tbody>
</table>
### Activities for disaster prevention

<table>
<thead>
<tr>
<th>Activities</th>
<th>Theme</th>
<th>Disaster Management Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Satellite image map</td>
<td>-Preparation of “common geographical information” based on the standard maps and satellite images, in conjunction with the needs of disaster-operation organizations.</td>
<td>Cabinet Office, NPA (Police), FDMA (Fire), MOD (Defense), GSI (Geography), NIED (Disaster)</td>
</tr>
<tr>
<td>2 Emergency Observation</td>
<td>-Accept emergency observation request and observe disaster afflicted area by ALOS, and provides satellites imagery.</td>
<td>Cabinet Office, Local Government, Japan Coast Guard, etc.</td>
</tr>
<tr>
<td>3 Volcanic activity monitoring (WG)</td>
<td>-Investigation of satellite data applicability on volcano surveillance, through ALOS observation of Japanese major volcanoes.</td>
<td>CCPV/E (Coordinating Committee for Prediction of Volcanic Eruptions) organized by Japan Meteorological Agency (JMA)</td>
</tr>
<tr>
<td>4 Earthquake monitoring (WG)</td>
<td>-Investigation of satellite data applicability on ground distortion monitoring before and for after earthquake.</td>
<td>H.q. for Earthquake Research promotion, consist of GSI, AIST (Industrial), NIED, ERI (Academia)</td>
</tr>
<tr>
<td>5 Flood/Landslide monitoring (WG)</td>
<td>-Investigation of satellite data applicability on landslide and flood.</td>
<td>National Institute for Land and Infrastructure Management, etc.</td>
</tr>
</tbody>
</table>

To investigate the possibility of the utilization for disaster management, **These demonstration activities** were started in 2006

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### Satellite Image Map

- Developed as a geospatial information tool which everyone, familiar with the area or not, can intuitive understanding for the places.
- Indicate minimum required information such as major landmarks and roads.

![Satellite Image Map](image)

1/50,000 scale map using AVNIR-2.

1/25,000 scale map using pansharpen images of PRISM and AVNIR-2.
Today, this map is adopted in Hyogo memorial walk 2010.

Satellite Image Map

The estimation of the evacuation route, the identify the place for helicopter landing etc.
Torrential rain in yamaguchi Prefecture (July 21, 2009)

Heavy rainfall on 19-29 July has caused mud slide in Chugoku and northern part of Kyushu districts. 31 people are reported killed, 46 people injured, 48 houses totally destroyed. And Landslides were found to have occurred at 1757 locations.

Volcanic eruption of Mt. Asama (Feb. 2, 2009)

Observation around Hofu city by ALOS AVNIR-2.

Observation date: February 7, 2009
Observation date: March 8, 2009
Around the summit of Mt. Asama
(Left: after the eruption, Right: before the eruption)
Volcanic eruption of Mt. Asama (Feb. 2, 2009)

The part enclosed by the red frame is the place that appeared to be covered with volcanic ash. The area southeast of the crater looks gray with volcanic ash.

The part within the yellow circle is the shade created by the smoke from the crater.

Observation date: February 7, 2009

Iwate-Miyagi Nairiku Earthquake (June 14, 2008)

The Iwate-Miyagi Nairiku Earthquake occurred at 8:43 (JST) on June 14, 2008. The magnitude (M) indicating the scale of the earthquake was 7.2. A total of 30 homes were completely destroyed, and 2,523 more were severely damaged. Landslides were found to have occurred at 48 locations and river channels were blocked in 15 locations.
Iwate-Miyagi Nairiku Earthquake (June 14, 2008)

**Eastern slope of Mt. Higashikurikoma**
the landslides occurred at Dozouzawa on the eastern slope, and Prefectural Highway Route 42 blocked by the sediment.

**Bird’s-eye view of landslides**

Upstream area of the Ichihasama River
Damaged lakes formed as a result of landslides can be seen in a number of locations (indicated by arrows).

Aratozawa Dam area
In this figure, extensive landslides can be seen at Hyasawa to the northwest of the dam.

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**Left image:** crustal deformation by means of comparing two differential interferometrically processed images acquired from the same orbit on June 21, 2007 and on June 23, 2008, respectively.

**Right image:** an intensity image observed by PALSAR on June 23, 2008.
Iwate-Miyagi Nairiku Earthquake (June 14, 2008)

The two-dimensional color change in the image indicates the change in distance between “ALOS” and the ground surface. Clear interference fringes can be confirmed in the east-west direction of that area, indicating crustal deformation of 23.6 cm (two cycles) occurred in the direction toward the satellite, to the east of the epicenter, and 94.4 cm (eight cycles) in the direction away from the satellite, to the west of the epicenter.

Torrential rain in Gifu pef. (September 2-3, 2008)

Flood area (blue zone) was detected by space based radar.
Participation in rescue training

Rescue training at Wakayama prefecture, September 6, 2009

Under the simulation of regular communication traffic confusion
• Mega size image data transmission
• Internet connecting
• TV meeting communication

Receive mega size observation data before/after disaster

Satellite image map archive (before disaster)

Satellite observation data (after disaster simulation)

Broadband internet via satellite

WINDS

Sentinel Asia

What is Sentinel Asia

The Sentinel Asia initiative is the international cooperation led by APRSAF (Asia-Pacific Regional Space Agency Forum) to assist disaster management by Remote Sensing and Web-GIS technologies in the Asia-Pacific region.

To make effective activity, Sentinel Asia collaborates with Space Agencies and Disaster Management Agencies.

Sentinel Asia aims to:

> Improve safety in society by ICT and space technology
> Improve speed and accuracy of disaster preparedness and early warning
> Minimize the number of victims and social/economic losses.
Concept of Sentinel Asia

Space Agencies → Satellite Observation → Disasters → Information Provision → Data Utilization → Human Network

Framework of Sentinel Asia

SENTINEL ASIA
Joint Project Team (JPT)

Space Community
- APRSAF
- Satellite Image
- Promotion of Utilization
- Capacity Building

Disaster Reduction Community
- ADRC
- Member Countries
- Disaster Information
- Utilization (User)

International Community
- UNESCAP
- UNOOSA
- ASEAN
- AIT etc.

International Cooperation
Members of Sentinel Asia

Sentinel Asia organizes Joint Project Team (JPT), and JPT consists of **65 organizations** including **56 agencies from 22 countries** and **9 international organizations**. Also, Sentinel Asia cooperates with ADRC and **their members** (28 Member Countries, 5 Advisor Countries, 1 Observer) closely, and they are also member of Sentinel Asia as well.

Main activities of Sentinel Asia

- **Emergency Observation**
- **Wildfire Monitoring**
- **Flood Monitoring**
- **MTSAT Imagery**
- **Capacity Building**
**Latest List of Emergency Observation**

<table>
<thead>
<tr>
<th>Emergency Obs. ID</th>
<th>Occurrence Date (UTC)</th>
<th>Country</th>
<th>Disaster Type</th>
<th>Status</th>
<th>Product</th>
<th>WEB-GIS</th>
<th>Detail</th>
<th>Disaster Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERMPSD000002</td>
<td>2019/10/06</td>
<td>Nepal</td>
<td>Flood</td>
<td>Active</td>
<td>Pan</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000003</td>
<td>2019/10/04</td>
<td>Philippines</td>
<td>Flood</td>
<td>Active</td>
<td>Multi</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000014</td>
<td>2019/10/26</td>
<td>Indonesia</td>
<td>Earthquake</td>
<td>Active</td>
<td>Pan</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000010</td>
<td>2019/09/26</td>
<td>Vietnam</td>
<td>Flood</td>
<td>Active</td>
<td>Pan</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000004</td>
<td>2019/09/02</td>
<td>Indonesia</td>
<td>Earthquake</td>
<td>Active</td>
<td>Multi</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000001</td>
<td>2019/09/18</td>
<td>Nepal</td>
<td>Flood</td>
<td>Active</td>
<td>Pan</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000002</td>
<td>2019/09/08</td>
<td>Philippines</td>
<td>Typhoon</td>
<td>Active</td>
<td>Multi</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000004</td>
<td>2019/07/07</td>
<td>Vietnam</td>
<td>Flood</td>
<td>Active</td>
<td>Pan</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000011</td>
<td>2019/03/27</td>
<td>Indonesia</td>
<td>Flood</td>
<td>Active</td>
<td>Multi</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
<tr>
<td>ERMPSD000004</td>
<td>2019/03/11</td>
<td>Australia</td>
<td>Typhoon</td>
<td>Active</td>
<td>Multi</td>
<td></td>
<td></td>
<td>Link ADRC</td>
</tr>
</tbody>
</table>

**Current Participating EO Satellites**

- **ALOS**
  - PRISM: 2.5m Pan
  - AVNIR-1: 10m Multi
  - PALSAR: 10-100m L-Band

- **THEOS**
  - PAN: 2m Multi: 15m

- **KOMPSAT-1**
  - EOC: 6.6m
  - OSMI: 1km

- **Resourcesat-1**
  - LISS-4: 5.8m Pan
  - LISS-3: 23.5m Multi
  - AWIFS: 56m Multi
Typhoon hit Philippines, August 8, 2009

Flooded area detected from ALOS PALSAR RGB composite image R:G:B=pre,:post,:post disaster

Flood occurred in Nepal, August 18, 2008
Dear sir/Madame,

The field of work for Ministry of Water Resources (MOWR), Nepal is water, energy (Electricity) and water induced disaster management. Department of Water Induced Disaster Prevention (DWIP) is responsible for the implementation of field activities related to disaster management. MOWR is responsible for formulation of policy, making of programs, monitoring of activities etc in the sector. We had a big disaster caused by breaching of left embankment of Koshi. It caused great loss to Nepal and India. Sentinel Asia helped us very much by provide satellite pictures and data and other relevant materials. You have also provided much needed information in your web site. I, as a focal person from MOWR Nepal, would like to thank your team for helping us to address the mega-disaster.

The coffer dam for diversion of Koshi River to original course has just been completed and rehabilitation and strengthening of the embankment is also in progress and is expected to be completed by March 2009. We would like your continuous monitoring and cooperation in future, too. We would also like to open communication with you. Please inform us about activities/events/developments that are related to us.

Thanking you again for your kind cooperation.

Shital Babu Regme
Joint Secretary
Ministry of Water Resources
Singha Durbar, Kathmandu, Nepal

Earthquake occurred in Indonesia, January 4, 2009
Detect **Hotspot information** from satellite data (MODIS), and those Hotspot are disseminated via Sentinel Asia Website every day.

Calculate **Accumulated Precipitation information** from satellite data, and those data are disseminated via Sentinel Asia Website every 1 hour.
MTSAT Imagery

Provide weather satellite, MTSAT Imagery, and those imagery are disseminated via Sentinel Asia Website every 30 minutes.

Capacity Building

To enable utilization of earth observation images provided under the Sentinel Asia, we are providing several capacity building opportunities in terms of building capacity for interpretation of earth observation images and how to operate Sentinel Asia System as well.

(1) Sentinel Asia System Operation Training (3-5 days)
   > Organize 2 times / Year at South East Asia
   > Sentinel Asia System Operation hands on training
   > R/S data handling hands on training

(2) ALOS Mini Project (2 month)
   > Organize 1 time / Year at Asia Institute of Technology (AIT)
   > R/S data handling/analysis hands on training
   > Consultation for development of thematic map
Sentinel Asia

Utilization of WINDS in Sentinel Asia

Sentinel Asia will aim to be a reliable regional system for DRR, with cooperation and harmonization.

- Operational collaboration with international disaster charter (IDC), and AIT acts as a project manager for collection and exploitation.
- ADRC, key member of Sentinel Asia, acts as RSO of UNSPIDER.
- Now under arrangement, JAXA will make partnership with JICA for more spontaneous utilization of Sentinel Asia.

JICA: JAPAN international cooperation agency 国際協力機構
Contribution to the International Charter Space and Major Disasters

Huge earthquake in Haiti (January 13, 2010)

JAXA is the fastest provider!

- End of presentation -