Activities of ADRC in the Sentinel Asia, and the effectivity of satellite images on the Great East Japan Earthquake

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In Oct 2005, APRSAF*-12, approved the plan to initiate the **Sentinel Asia** to assist disaster management in the Asia-Pacific region and it aims to:

> **Improve safety in society by ICT and space technology**
> **Improve speed and accuracy of disaster preparedness and earlywarning**
> **Minimize the number of victims and social/economic losses.**

* : Asia-Pacific Regional Space Agency Forum
Concept of Sentinel Asia

Collaboration between space agencies and disaster management agencies

Observation

Space Agency

Earth Observation Satellite

Value-added Information

Disaster Information

Utilization

Communication Satellite

Transmission

Disaster Management Organization

User Expansion

Governmental Organization (ADRC members)

Local Governmental Organization

End User

Sharing (Web)

Human Network

Capacity Building - Outreach
Main Activities

1. **Emergency observation**
   Member agency request emergency observation to data providers via ADRC

2. **Monitoring**
   Provide precipitation, hotspot data for Flood, Wildfire and GLOF

3. **Outreach**
   Capacity building and human resource development for promotion of utilization
Constellation for disaster observation

- IRS (India)
- THEOS (Thailand)
- KOMPSAT (Korea)
- FORMOSAT 2 (Taiwan)
- ALOS (Japan)
- WINDS (Japan)

Users
- Tsunami
- Earthquake
- Flood
- Volcano eruption
- Wildfire

Sentinel Asia
Disaster Management Support System in the Asia-Pacific Region
Data Analysis Nodes (DAN)

A framework of satellite data analysis to provide analyzed products
Number of Emergency Observation

- Request
- Observation

<table>
<thead>
<tr>
<th>Year</th>
<th>Request</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>2008</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>2009</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>2010</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>2011</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

Sentinel Asia
Disaster Management Support System in the Asia-Pacific Region
Flood Monitoring

Observation
- Rainfall Monitoring & Flood Forecasting
  - Rainfall Measurement by Satellite
    - TRMM, GPM, AMSR-E...
- Flood Detection & Situation Analysis
  - Land Observation by Satellite
    - ALOS, MODIS, AMSR-E...

Processing
- Downscaling in Time and Space
  - Precipitation Map
    - GFAS*, IFAS**...
- Image Analysis
  - Flood Inundation Map
    - JAXA, ICHARM, Dartmouth University...

Integration
- Heavy Rainfall Information Flood Forecasting Information
- Damage Evaluation Map
  - Sentinel Asia Web-GIS

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

NB
*GFAS : Global Flood Alert System (by IFNet)
**IFAS : Integrated Flood Analysis System (by ICHARM)
Capacity Building and Human Network

The 5th Training by JAXA, hosted by MoDM in Sri Lanka, in February 2010

Human Network
the most fundamental
underpinning of
the project

The 6th Training by JAXA, hosted by GISTDA in Thailand, in July 2010
Next Step

1. Contribution remote sensing and ICT in Asia-Pacific region by APRSAF.

2. Accumulating more contributions and strengthen role(function) sharing to promote Joint steering of SA project.

3. To cover all phases, add pre-disaster phase and recovery phase to our range of work, in addition to emergency observation.

4. Promote regionally or “bi” cooperation aiming to utilize SA more deeply.
the Great East Japan Earthquake

On March 11, 2011
the Great East Japan Earthquake
the Great East Japan Earthquake

Pre-Disaster

ALOS AVNIR2
November 6 2010

ALOS AVNIR2
March 14 2011

Post-Disaster

Floating Debris
the Great East Japan Earthquake

Pre-Disaster

Post-Disaster

Inundated Area

Formsat-2
January 16 2011

Formsat-2
March 19 2011

Tsunami Inundated Areas
2011 Sendai, Japan

Data source
Formosat-2 multispectral images displayed in RGB Band combination:
R - Near infrared, G - Red, B - Green

Image 1 acquired on January 16, 2011 (pre-disaster)
Image 2 acquired on March 19, 2011 (post-disaster)

Map Projection: UTM zone 54N
Datum: WGS 84

Legend
Inundated Area

Description
The tsunami due to the Tohoku Earthquake of March 11, 2011 caused widespread inundation in the Sendai area. Here we show the inundated area in a coastal strip which extends from Sendai city to the southern end of Miyagi Prefecture.

Severely inundated areas are obtained by thresholding the NIR band in the post-disaster image, as the NIR reflectance in water is extremely low. The sea, rivers and large bodies of water are removed from the displayed inundated area as these regions are under water in both images.

The inundated area is indicated on the pre-disaster image in blue. It covers a total area of 58.03 sq km.
<table>
<thead>
<tr>
<th>Situation</th>
<th>Condition</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood</td>
<td>Tideland</td>
<td>Sendai City (Gamo Tideland)</td>
</tr>
</tbody>
</table>

Pre-Disaster  Feb/23/2011

Prost-Disaster Apr/10/2011
<table>
<thead>
<tr>
<th>Situation</th>
<th>Condition</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changes in the ground</td>
<td>Land subsidence</td>
<td>Kesennuma City</td>
</tr>
</tbody>
</table>

### Pre-Disaster Mar/18/2009

![Pre-disaster image](https://example.com/pre_disaster_image)

### Prost-Disaster Mar/24/2011

![Post-disaster image](https://example.com/post_disaster_image)

ALOS Pan-sharpen Image ©JAXA
Field survey

Fish market
<table>
<thead>
<tr>
<th>Situation</th>
<th>Condition</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural</td>
<td>Damage</td>
<td>Ishinomaki City</td>
</tr>
<tr>
<td>Damage</td>
<td>Flood damage by incursion</td>
<td>(Kitakami River)</td>
</tr>
</tbody>
</table>

Pre-Disaster Mar/18/2009  Prost-Disaster Mar/14/2011

[Map Image with marked Broken Dike]
Field survey

During recovery

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②
ADRC promotes disaster reduction through multi-national/multi-stakeholder/multi-lateral cooperation in the Asian region.

Thank you for your attention.