Integrated Application of Earth Observations for Disaster Risk Reduction

The international cooperation project and how it supports the SFDRR monitoring

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Natural disasters are a common challenge facing all countries in the world. Asia is the most serious affected region of high risk of disasters and heavy losses. In China, according to statistics, natural disasters affected 94.9 million people, 792 people are missing or lost life in the past three quarters of 2021. (Source: website of Ministry of Emergency Management, PRC)

Source: Asia-Pacific Disaster Report 2021 | ESCAP (unescap.org)
Sendai Framework for Disaster Risk Reduction 2015-2030 was endorsed by member countries of UN as one of the most important global frameworks, and disaster reduction becoming a priority area for international cooperation.

**Expected outcome**: significant reduction disaster risk and loss

Source: [Sendai Framework for Disaster Risk Reduction 2015-2030 | UNDRR](https://www.unisdr.org/senderas/)

- Decrease: Deaths and missing persons, Affected people, Economic loss
- Increase: countries that adopt and implement DRR, International support, Damage to critical infrastructure, Early warning systems
Space-based technology play an important role in supporting disaster risk reduction, response and relief efforts. At present, EO data acquisition, processing, product development, and related service mechanism have been developed and operational to support the entire process of disaster management.
## Chinese EO satellites and the main parameters for Charter

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Sensor</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBERS-02B</td>
<td>CCD</td>
<td>20m</td>
</tr>
<tr>
<td></td>
<td>Wide field imager (WFI)</td>
<td>258m</td>
</tr>
<tr>
<td>SJ-9A</td>
<td>Multi-spectral camera</td>
<td>2.5m (Pan)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10m (Multi-spectral)</td>
</tr>
<tr>
<td>GF-1</td>
<td>Multi-spectral camera (PMS)</td>
<td>2m (Pan)</td>
</tr>
<tr>
<td></td>
<td>Multi-spectral camera (WFV)</td>
<td>8m (Multi-spectral)</td>
</tr>
<tr>
<td>GF-2</td>
<td>Multi-spectral camera (PMS)</td>
<td>0.8m (Pan)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2m (Multi-spectral)</td>
</tr>
<tr>
<td>GF-3</td>
<td>SAR</td>
<td>1-500m</td>
</tr>
<tr>
<td>GF-4</td>
<td>Multi-spectral camera (Geostationary Orbit)</td>
<td>50m (VNIR)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>400m (MWIR)</td>
</tr>
</tbody>
</table>

**Disaster Monitoring Satellite 2A and 2B**

Multi-spectral CCD (16m), hyper-spectral imager and infrared camera
Objectives

Project: Integrated Application of Earth Observations for Disaster Risk Reduction

(Collaborate with UN-SPIDER, Funded by MOST, PRC)

Form an index system of using earth observation to support Sendai framework
Form an approach of index monitoring
Strengthen capacity of institutional capacity at national level

- An index system
- An technical system
- Application platform
- Demonstration application in 3 countries

Source: Sendai Framework for Disaster Risk Reduction 2015-2030 | UNDRR
Expected outcome

- An index system
  - 3 types of disaster, flood, typhoon and earthquake
  - 5 target indexes, dead and missing persons, people affected by disasters, direct economic losses, damage to infrastructure, and evaluation on disaster risk monitoring and early warning application

- An technical system
  - Element extraction based on artificial intelligence
  - Assessment of loss indicators for disaster reduction

- Application platform
  - 12 types of data collection and 5 integrated methods
  - 2/3 dimensional display and comprehensive analysis

- Demonstration application in 3 countries
  - Laos, Sri Lanka and Nepal
Project:
Integrated Application of EO technology for Sendai Framework for Disaster Risk Reduction
Approach

1. Demand and capacity analysis
2. Index optimization
3. Element extraction using AI technology
4. Comprehensive analysis using big data
5. Deduction for incomplete data
6. Data aggregation and model integration
7. Application system development
8. Flood risk and loss index monitoring (Laos)
9. Typhoon risk and loss index monitoring (Sri Lanka)
10. Earthquake loss index monitoring (Nepal)

Research on monitoring indexes of using earth observation to support Sendai framework
Research on technical system
Establish an application platform
Demonstration application

Research on technical system
Establish an application platform
Demonstration application
Work basis

-- Data: EO data; other open source data

Disaster Monitoring Satellite 2A and 2B
Multi-spectral CCD(16m), hyper-spectral imager and infrared camera

Date: 20211201-20211215

GF series images
-- EO technology for SFDRR **Index analysis**: available EO resources; form an index system of using EO to support Sendai framework

<table>
<thead>
<tr>
<th>Index sequence</th>
<th>Name of Index</th>
<th>Typhoon</th>
<th>Earthquake</th>
<th>Flood</th>
<th>Support</th>
<th>Remark</th>
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</thead>
<tbody>
<tr>
<td>B-3a</td>
<td>Number of damaged dwellings attributed to disasters</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Yes(Direct)</td>
<td></td>
</tr>
<tr>
<td>B-3</td>
<td>Number of people whose damaged dwellings attributed to disasters</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Yes(Indirect)</td>
<td>B3=B3a*A0H, A0H=Pop/No.Family</td>
</tr>
<tr>
<td>E</td>
<td>Countries with national and local disaster risk reduction strategies by 2020</td>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>
**Work basis**

---**Elements:** Extraction of 10 elements using AI from EO images for damage and loss assessment

---E 1: Structures
---E 2: Vegetable greenhouse
---E 3: Farmland
---E 4: Forest
---E 5: Oil tank
---E 6: Coal-fired power plant
---E 7: Outdoor track-and-field ground
---E 8: Airport
---E 9: Bridge
---E 10: Hydropower station
--Prototype: Design for service platform
Next step

Collaborate with UN-SPIDER to leverage Integrated Application of Earth Observations for Disaster Risk Reduction and support SFDRR indexes monitoring
Thank you