Present status and future perspective of global and regional earth observation system in China

Earth Observation System and Data Center, CNSA
April 25th, 2019
1. Current Status

2. Typical Solution for SSDG

3. Future Perspectives for Win-Win Cooperation
1. Status of China EO System

Development Roadmap

Forming EO system regional and global capacity

- Facility construction
  - Recoverable satellite (1975)
  - Ground station (1986)
  - FY-1A (1988)

- National Space Development 5 years Plan
- National Medium- and Long-Term Science and Technology Plan (2006-2020)
- High-resolution Earth observation system (launched since 2010)

- Systematic growth
  - Medium and long term plan for National Space Infrastructure (2015-2025)

- Sustainable development
  - Belt and Road Initiative Space Information Corridor

National Space Development 5 years Plan;
National Medium- and Long-Term Science and Technology Plan (2006-2020)
High-resolution Earth observation system (launched since 2010);
Civil earth observation satellite series

- Meteorological satellite series (FY-1/2/3/4, 8 satellites on orbit)
- Oceanic satellite series (HY-1/HY-2/CFOSAT, 3 satellites on orbit)
- Land satellite series (more than 30 satellites on orbit)
  - GF satellite series (GF-1/2/3/4/5/6/7, GF-1 02/03/04…)
  - Resources satellite series (CBERS-01/02/03/04, ZY-1-02C/ZY-3…)
  - Disaster mitigation satellite constellation (HJ-1A/1B/HJ-2)
  - …..

Providing stable services for sustainable development
1. Status of China EO System

Meteorological Satellites

- 60 min
- 30 min
- 15 min
- 6 min

Providing global weather, climate change, atmospheric composition, etc.
1. Status of China EO System

Ocean Satellites

CFOSAT

HY-1

HY-2

For the marine environment, ocean tide forecast, marine economy, marine ecology, etc.
China High-resolution Earth Observation satellites (CHEOS):

(1) High spatial resolution

(2) High time resolution

(3) Hyperspectral resolution

(4) Integration of aerospace and earth

Already forming globalization and regional observation capacity
1. Status of China EO System

## Space-borne system of CHEOS

<table>
<thead>
<tr>
<th>Time</th>
<th>Resolution</th>
<th>Swath width</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GF-1</strong> Apr. 26, 2013</td>
<td>2m panchromatic 8m multispectral</td>
<td>≥60km(2m/8m); ≥800km(16m)</td>
</tr>
<tr>
<td><strong>GF-2</strong> Aug. 19, 2014</td>
<td>0.8m panchromatic 3.2m multispectral</td>
<td>more than 45km</td>
</tr>
<tr>
<td><strong>GF-3</strong> Aug. 10, 2016</td>
<td>1m to 500m C band SAR images, with 12 working models.</td>
<td></td>
</tr>
<tr>
<td><strong>GF-4</strong> Dec. 29, 2015</td>
<td>50m panchromatic/ multispectral, and 400m infrared spectrum images with array starring imaging from geostationary orbit, 400Km width.</td>
<td></td>
</tr>
<tr>
<td><strong>GF-5</strong> May 9th, 2018</td>
<td>6 payloads of including Advanced Hyper-Spectral Imager(AHSI), a Visual and Infrared Multi-spectral Imager(VIMI).......</td>
<td></td>
</tr>
<tr>
<td><strong>GF-6</strong> June 2nd, 2018</td>
<td>Similar with GF-1</td>
<td></td>
</tr>
<tr>
<td><strong>GF-7</strong> will be launched in 2019</td>
<td>get &lt;1m stereo images and &lt;1m laser altimetry data.</td>
<td></td>
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</tbody>
</table>
1. Status of China EO System

Commercial Earth observation satellite series

SuperView (16+4+4+X)

JILIN No. 1 (12 satellites in orbit)

Pakistan RS, Venezuelan RS

TripleSat (DMC3)
1. Status of China EO System

In 2015, the State Council officially issued the National Civil Space Infrastructure Plan.

To build three major systems, develop and launch more than 60 remote sensing satellites by 2025, realize the scale and commercial development of the space information industry.
Focus on the interconnection and intercommunication of ground facilities network, and aims at realizing integrated application of space information.

- Forming comprehensive operation and service capacity
- Providing information products along Belt & Road countries
- Promoting global sustainable development
Outlines

1. Current Status

2. Typical Solution for SSDG

3. Future Perspectives for Win-Win Cooperation
2. Typical Solution for Sustainable Development

SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals
2. Typical Solution for Sustainable Development

Through implementing 10 action plans for realization of SDGs

- 1. Advancing science and technology
- 2. Serving the Belt & Road Initiative
- 3. Eradicating poverty and hunger
- 4. Improving social security
- 5. Promoting disaster prevention and mitigation
- 6. Addressing Climate Change
- 7. Protecting ecological environment
- 8. Developing space economy
- 9. Supporting national governance
- 10. Safeguarding equity and justice

EO technology and application
2. Typical Solution for Sustainable Development

Serving the UN Sustainable Development Goals

Sustainability facing issues:
➢ Shortage of resources;
➢ Environmental degradation;
➢ Environmental pollution;
➢ Marine development;
➢ Climate change;
➢ ……

China's solution to sustainable development will be solved under the globalization pattern!

China Sustainable program:
➢ Integrated observation capacity;
➢ RS application technology system;
➢ Full-chain spatial service;
➢ Resource sharing of information;
➢ Demonstration application;
➢ ……

China's solution to sustainable development will be solved under the globalization pattern!
2. Typical Solution for Sustainable Development

Contribution to UN-RCSSTEAP

- Degree Programs. 2016-2017, 100 Candidates (Master’s Degree: 76, Doctoral Degree: 24)
- Non-degree Programs. 2015-2017, 15 short training
- Exchanges with other UN Regional Centres
- …
On July 18, 2018, the location of the H-Star of FY-2 was adjusted to 79 degrees east longitude, and it was capable of serving 50 Asian countries, 41 African countries, 39 European countries, and 9 Oceania countries;

In 2018, FY serves more than 2,600 users in nearly 100 countries.

Vietnam, the Philippines applied for the emergency protection mechanism for disaster prevention and mitigation of FY International users three times.

FY meteorological satellite formed nearly 100 kinds of business quantitative products

FY 2 on 471 typhoons (including 141 typhoon monitoring in China)
Adopting remote sensing monitoring technology, combined with spatial sampling technology.

Using satellite remote sensing data to extract acreage of different crops.

Preliminary monitoring of crop area in the world and in large regions of China, combined with sampling to calculate different crop areas.

Contribution to crop yield estimation.

Crop area estimation.
2. Typical Solution for Sustainable Development

EO satellite promoting social security

Remote sensing for global health

Spatial Distribution Model of Live Snail Density from 2004 to 2011

Legend
Not Significant
HH
HL
River
DongtingLake
Enhancing technical exchanges among developing countries in disaster management within the south-south cooperation framework through mechanisms such as UN-SPIDER.

GF satellites for the hydropower dam collapse in Laos on 23 July 2018, which caused 35 deaths and 99 missing.
CHEOS GF-4 Data for Disaster Monitoring

GF-4, with the “absolute” advantages of high spatial, temporal resolution and strong maneuverability, have been widely used in typhoon monitoring, such as “Mangkhut”, “Nepartak”, “Nida”, “Catfish”, “Sally” and “Hippocampus”.

The Typhoon Mangkhut dynamic was constantly monitored
Other land satellite series for SDGs

- Providing data to countries such as Israel, Egypt, Kenya, Nepal for emergency disaster reduction and smart city construction
- Providing ZY-3 images from dozens of countries to the United Nations Committee of Experts on Global Geographic Information Management
- Achieving cloud service platforms and international data push with 13 countries along the UK, Norway, Thailand, etc.
China EO contribution to global climate change

- To enhance the **atmospheric environment monitoring** and to support the study in international climatic changes (By Ecological Annals)
- To enhance the ability to investigate the **ground carbon dioxide** and to support the analysis of long-term climatic changes (By National Meteorological Bureau)
- To develop integrated observation of **environment changes in cold regions**, and to thoroughly grasp the key routine of global changes (CAS)
- To develop **marine environment monitoring** to give support to the analysis of the interaction between climatic changes and ocean (By Ocean Satellite Center)
- To enhance the **monitoring in extreme weather**, and to get better react to the climatic changes (By National Meteorological Bureau)
HY satellite series for SDGs

➢ Through HY satellite environment monitoring, research on the interaction between climate change and oceans.

HY-2 Data for East Indian Ocean wind farm, sea level

China and France continue to promote cooperation in satellite engineering such as SVOM and CFOSAT.
Contribution to International Community

➢ China has become one of the major participant of GEO, more and more contribution to the Global Earth observation system.

➢ Participating in international academic organization activities such as ICA, IAG

➢ Providing emergency response and satellite data for international disasters under CHARTER and WMO

2. Typical Solution for Sustainable Development

- Releasing "National Comprehensive Disaster Prevention and Mitigation Plan (2016-2020)"
- Establishing a “National Major Natural Disaster UAV Emergency Response Cooperation Mechanism”
- “Space-sky-ground" integrated with disaster three-dimensional monitoring system
GF satellite data have been broadly used by 16 government departments including agriculture, land and resource, water resources, environmental protection, marine, and so on. The data have also been utilized by 30 provinces, cities and autonomous regions, such as Beijing and Xinjiang. The data have also been widely provided and used by the “Belt and Road” countries.
GF-3, with 1m to 500m C band SAR images. On January 6, 2018, the Sangji oil tanker collided and caught fire in the East China Sea. GF-3 satellite made emergency observation in the accident area, which offered continuous monitor. The oil spill area was estimated to be about 58 square kilometers by GF-3 images.
CHEOS GF-5 Data for Water Monitoring

Image of Lake Taihu in China, June 1st — Taken by GF-5 Using Advanced Hyper-spectral Imager (AHSI) for Decision-making Support
Contribution to APSCO

- The APSCO data sharing and service platform (DSSP) provides access, retrieval, ordering and downloading of remote sensing satellite data to all member states.
- “Zhang Heng No.1” provides seismic electromagnetic monitoring data for APSCO member countries.
1. Current Status

2. Typical Solution for SSDG

3. Future Perspectives for Win-win Cooperation
Xi Jinping pointed out:

On the basis of equality, mutual benefit, peaceful use and inclusive development.

- Outer space is the common wealth of mankind.
- Working together to promote the building of a community of human destiny and adhere to the international exchanges and cooperation in the field of outer space.
- The promotion of the space industry for the benefit of all mankind.
3. Future perspectives

Virtual constellation to serve the global sustainable development

- Promoting the “Belt and Road” space information corridor
- Strongly supporting the development of APSCO
- Better serving UN, GEO, CHARTER, etc.

Serving global and regional areas!
3. Future perspectives

Open and convenient data sharing mechanism and platform

- Public welfare services (emergency response)
- Science and Basic research (University)
- Addressing globalization issues (climate change, disasters etc)
- Partnership resource co-share policy (Apsco, Brazil, France, Pakistan…)

Co-construction, sharing and win-win principle!
3. Future perspectives

Open and efficient data sharing mechanism and platform

- China-Germany EO cooperation
- Data exchange platform
- Project cooperation
- Co-construction of laboratories
- Personnel training

China-Germany

CFOSAT

China-Italy
3. Future perspectives

Expanding technical cooperation and training exchanges

- **RCSSTEAP** (China) (degree education and training, etc)
- **International Space Conference** (Space Day Events, Commercial Space Summit, etc.)
- **Joint Laboratory** (China-Italy Union, China-EU Joint, AIT Facilities Export)
- ......
3. Future perspectives

Full range commercial Option

➢ Joint Venture or Project Development
➢ Orbit (EO satellite) or AIT Delivery Package
➢ Data exchange and commercial distribution
➢ Ground facility Co-share and construction
➢ Product and Train services
➢ ……
China Space will firmly implement the 10 action plans

3. Future perspectives
Thanks for your attention!