



# China High-resolution Earth Observation System & the “Belt and Road” Space Information Corridor

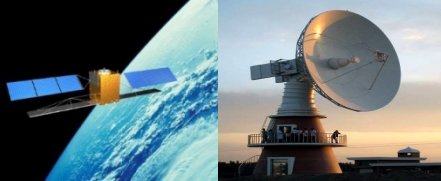
Earth Observation System and Data Center , CNSA  
Haikou,China, Nov 15th 2019



# Outlines



- 1. Current Status**
- 2. Typical Solution**
- 3. Future Perspective**



# 1. Status of China EO System



## Development Road map

**Forming EO system regional and global capacity**



Sustainable development

Belt and Road Initiative  
Space Information Corridor



Systematic growth

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



Capacity building

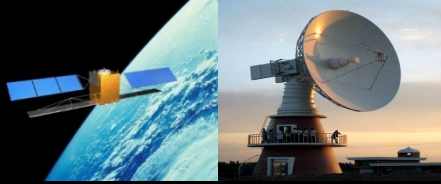
National Space Development  
5years Plan(1998);  
National Medium- and Long-Term  
Science and Technology Plan  
(2006-2020)  
High-resolution Earth observation  
system (launched since 2010);



Facility construction

Recoverable satellite(1975);  
Ground station (1986);  
FY-1A (1988).....

**CHEOS**



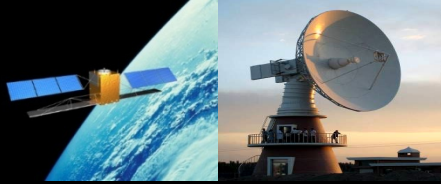
# 1. Status of China EO System



## 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 **40 satellites** on orbit)
  - GF satellite series (GF-1/2/3/4/5/6/7...)
  - Resources satellite series (CBERS-01/02/03/04, ZY-1-02C/ZY-3...)
  - Disaster mitigation satellite constellation (HJ-1A/1B/HJ-2)
  - .....

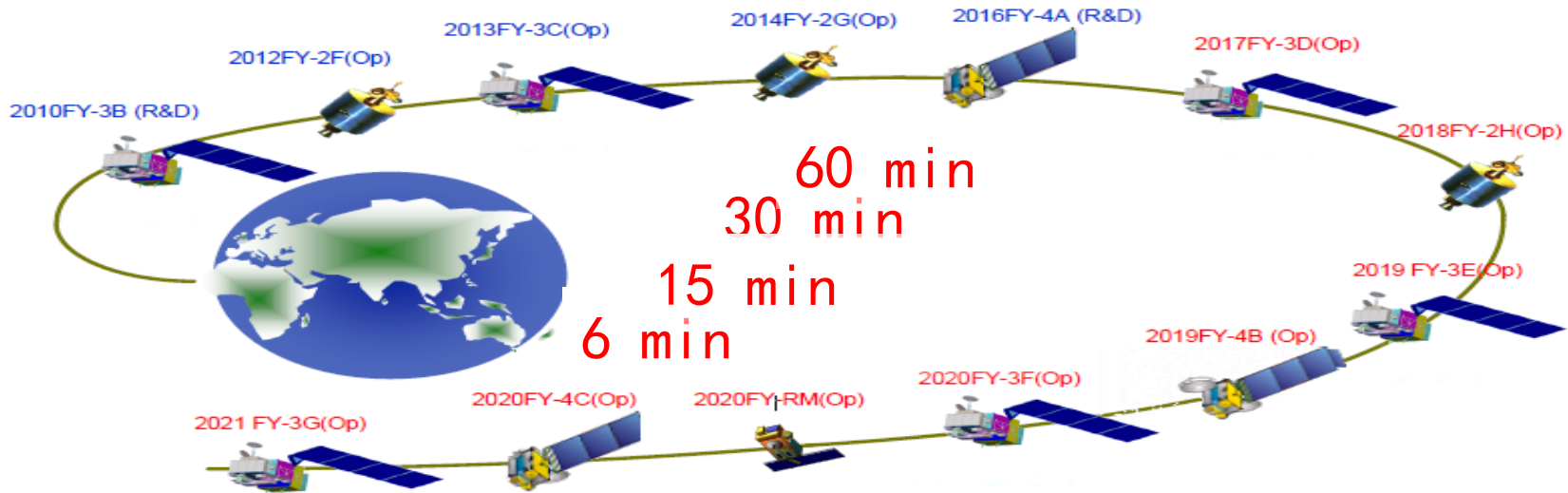
**Providing stable services for sustainable development**



# 1. Status of China EO System



## Meteorological Satellites



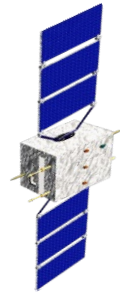
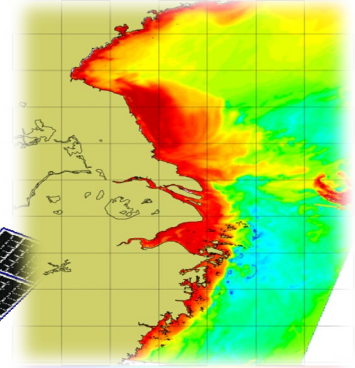
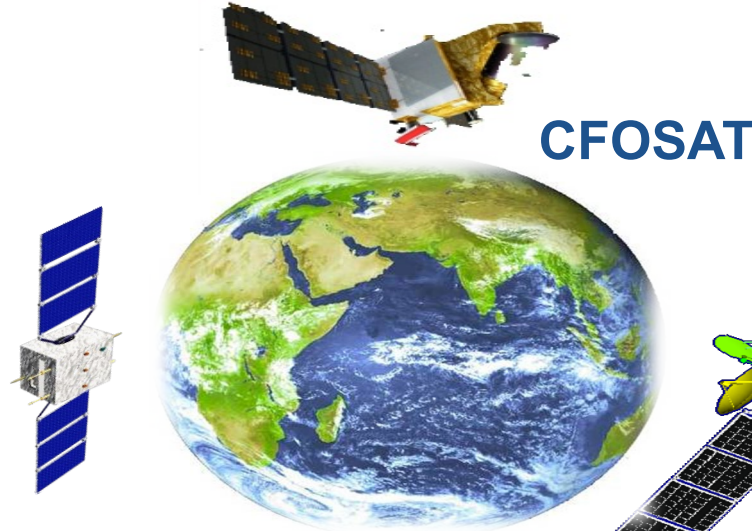
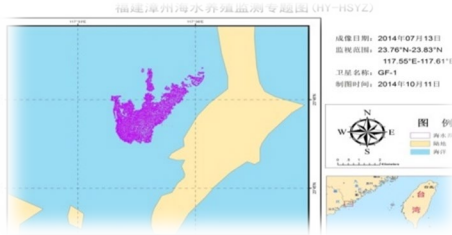
Providing global weather, climate change, atmospheric composition, etc.



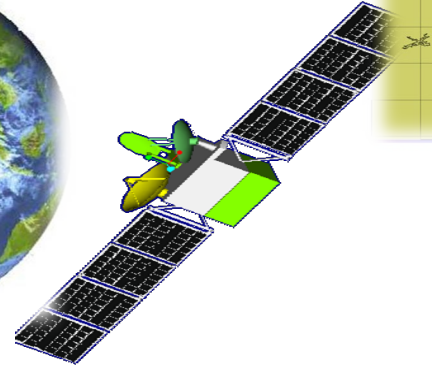
# 1. Status of China EO System



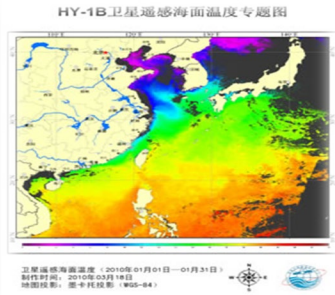
## Ocean Satellites



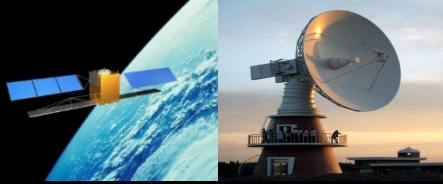
HY-1



HY-2



For the marine environment, ocean tide forecast, marine economy, marine ecology, etc.



# 1. Status of China EO System



## China High-resolution Earth Observation satellites(CHEOS):

- (1) High spatial resolution
- (2) High time resolution
- (3) Hyper spectral resolution
- (4) Integration of Air-borne and Ground system

Already forming globalization and regional observation capacity



**CHEOS**

国家国防科技工业局重大专项工程中心



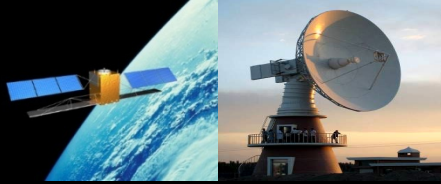
# 1. Status of China EO System



## Space-borne system of CHEOS

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

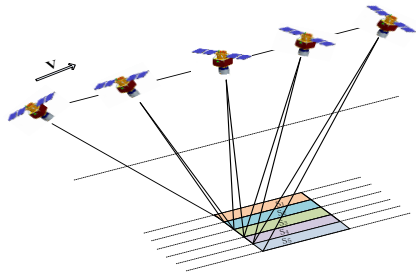




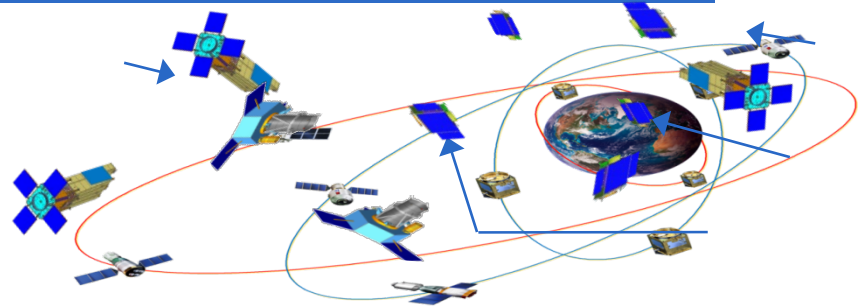
# 1. Status of China EO System



## Commercial Earth observation satellite series



**SuperView(16+4+4+X)**



**JILIN No. 1(13 satellites in orbit)**



**TripleSat(DMC3)**

**CHEOS**

国家国防科技工业局重大专项工程中心



**Pakistan RS, Venezuelan RS**

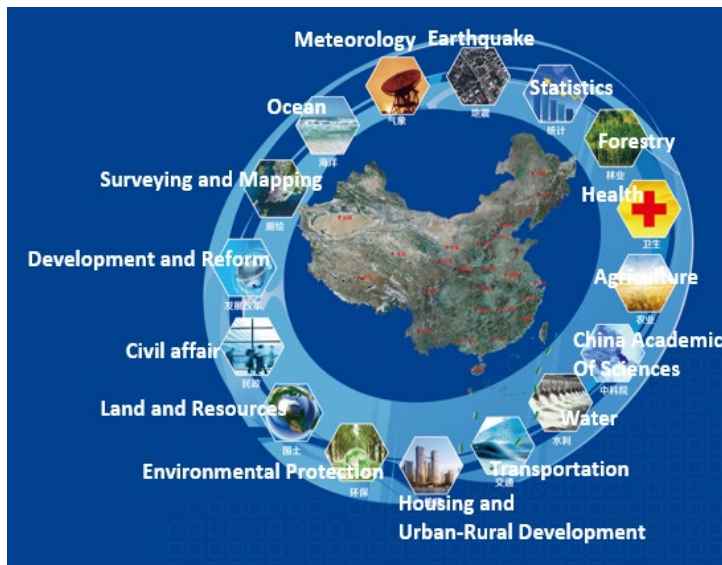


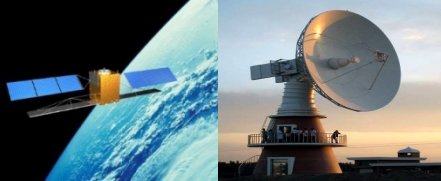
# 1. Status of China EO System



GF satellite data distributed and used by:

- ◆ **16 Government Departments** more than **20 industries**.
- ◆ **30 provinces**, cities and autonomous regions.
- ◆ approximately **100 “Belt and Road”** countries and International Organizations.

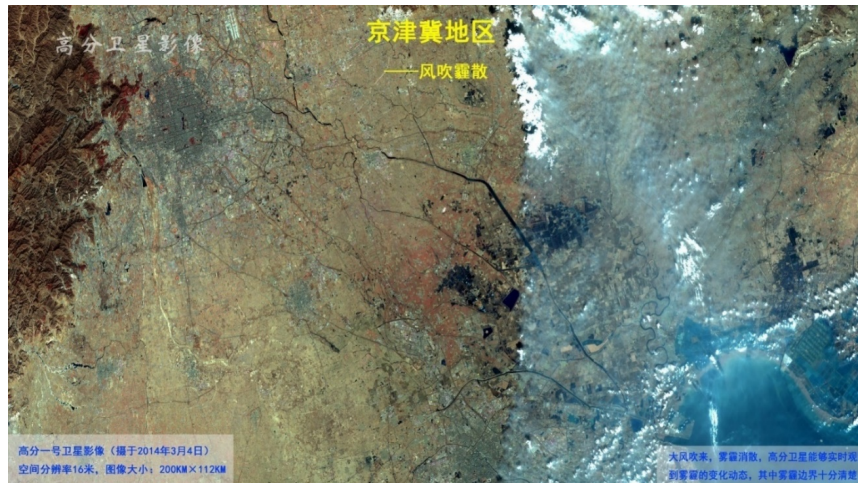
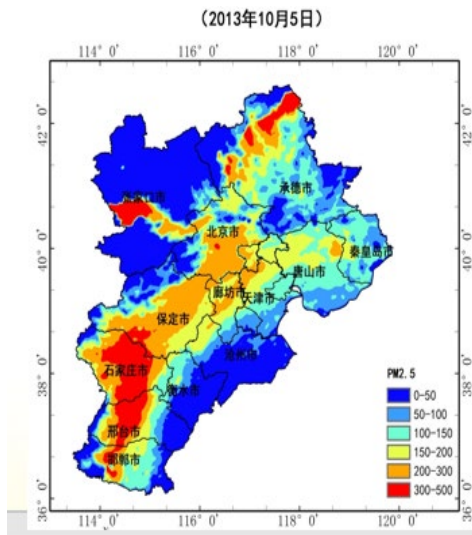




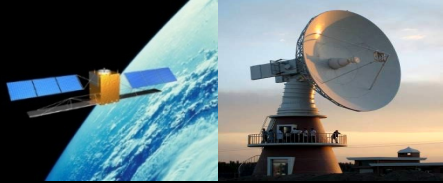
# 1. Status of China EO System



## Application Examples:



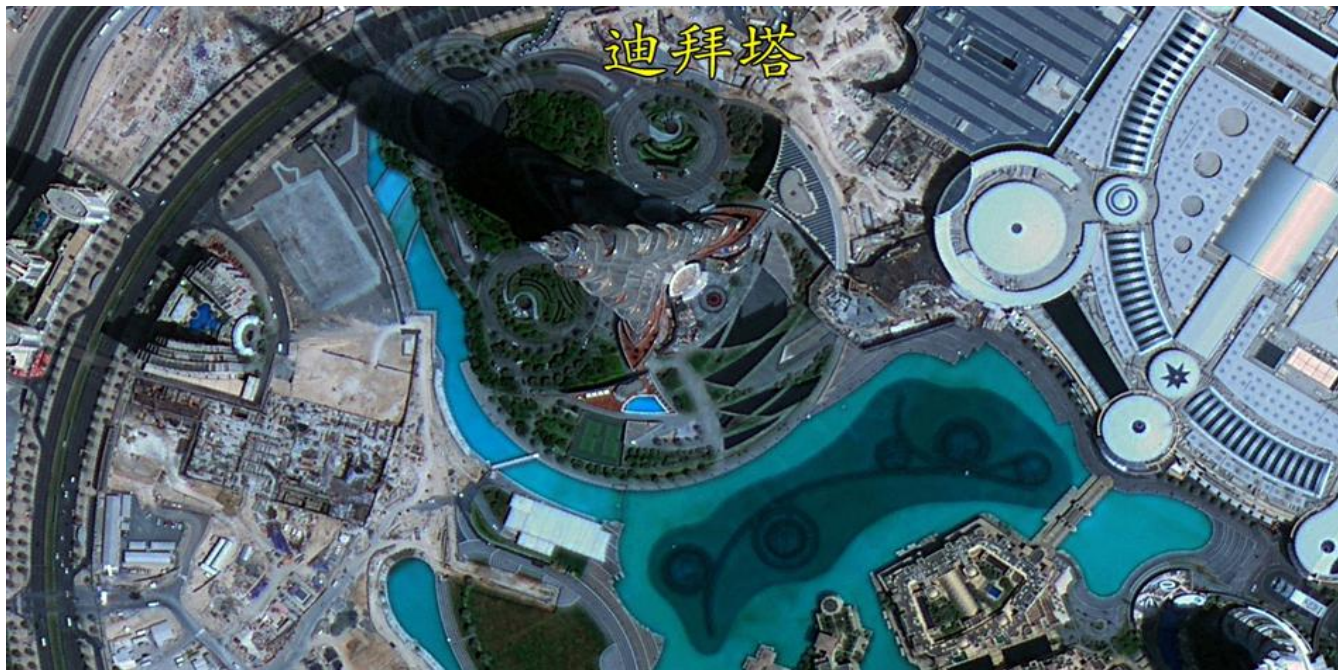
Constant monitoring of PM2.5 in the Beijing-Tianjin-Hebei region was carried out based on GF-1 satellite images.



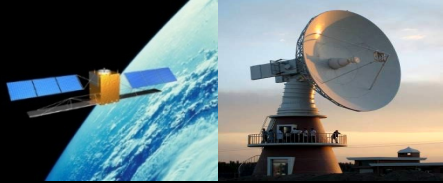
# 1. Status of China EO System



## Application Examples:



0.8m image, GF-2, burj Dubai,



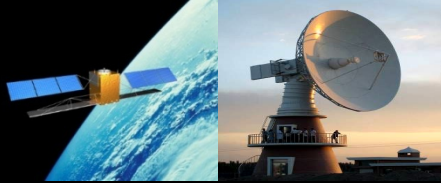
# 1. Status of China EO System



## Application Examples:



GF-3, 1m image, Wuhan, China

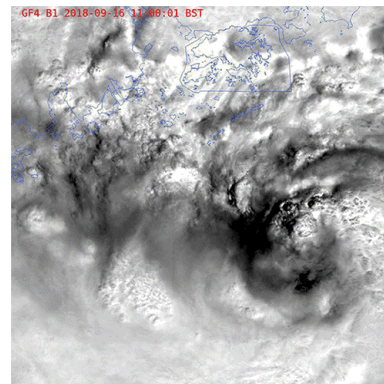
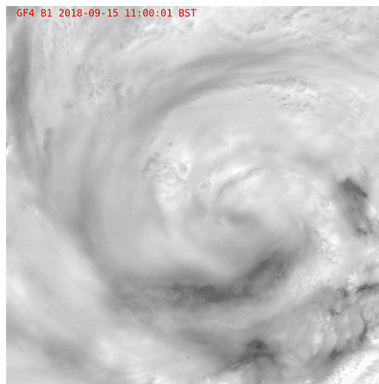
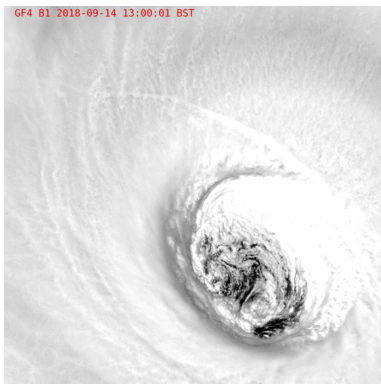


# 1. Status of China EO System



## Application Examples:

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”.



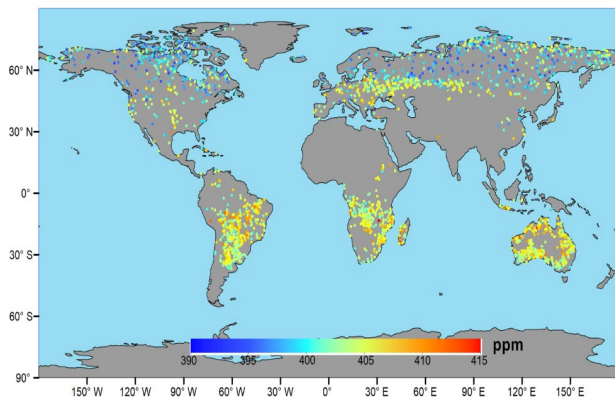
The Typhoon Mangkhut dynamic was constantly monitored



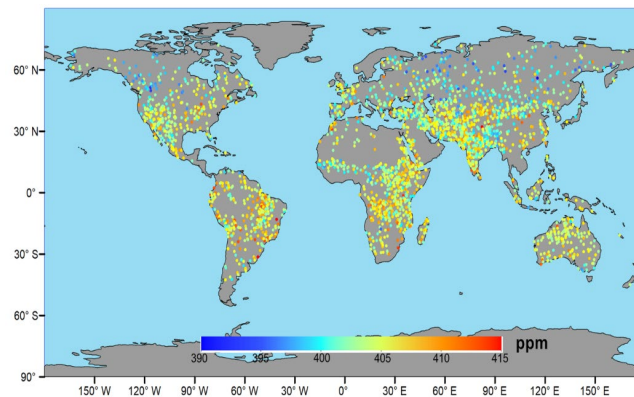
# 1. Status of China EO System



## Application Examples:

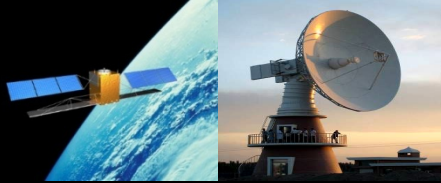


2018年8月



2018年9月

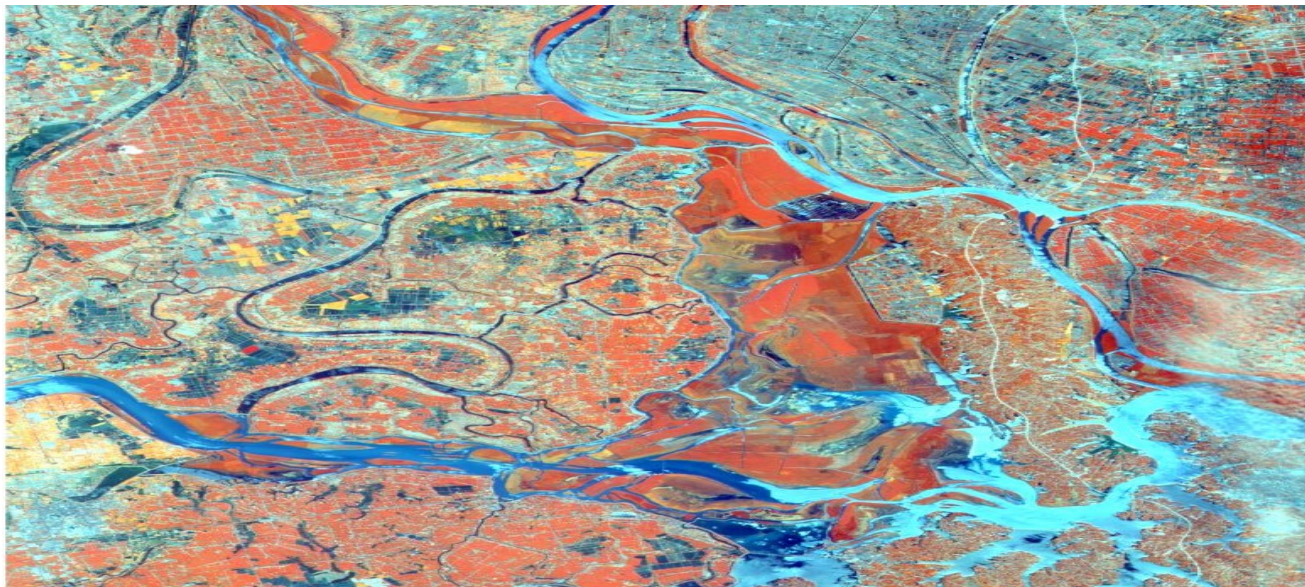
GF-5 monitoring results of global atmospheric methane ( $\text{CH}_4$ ) in August and September 2018 can clearly reflect the characteristics and trends of spatial distribution. The spatial distribution of methane ( $\text{CH}_4$ ) in low latitudes is higher than that in high latitudes.



# 1. Status of China EO System



## Application Examples:



GF-6, June 2018, dongting lake farmland, orange, yellow and dark red, respectively represents early rice, vegetable growing area and reed

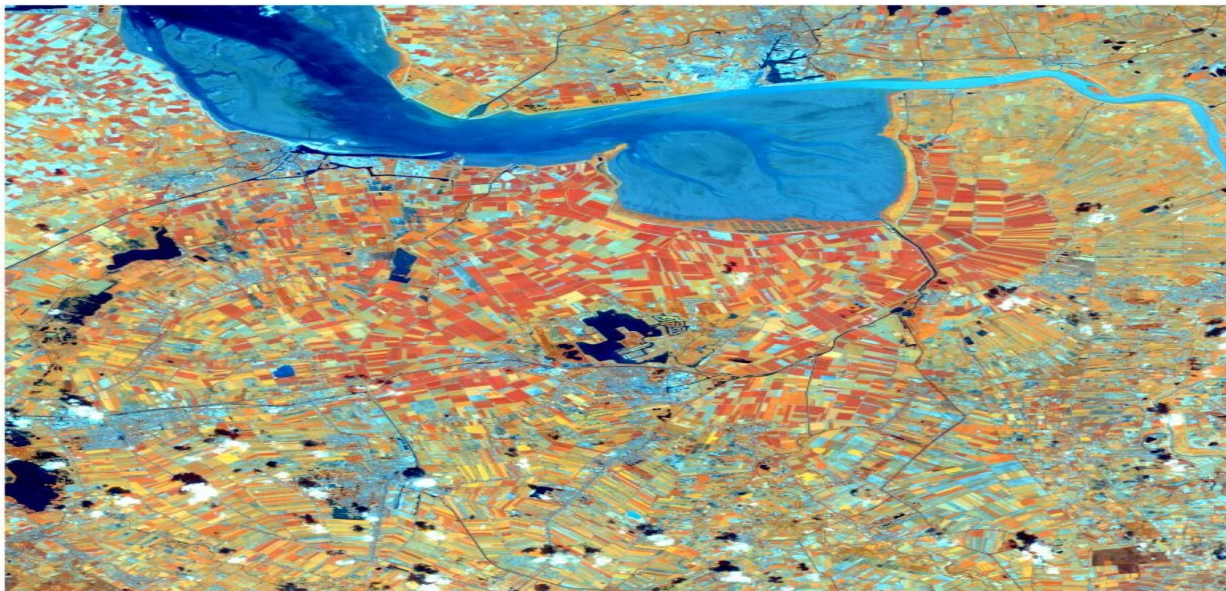




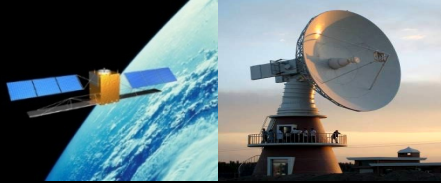
# 1. Status of China EO System



## Application Examples:



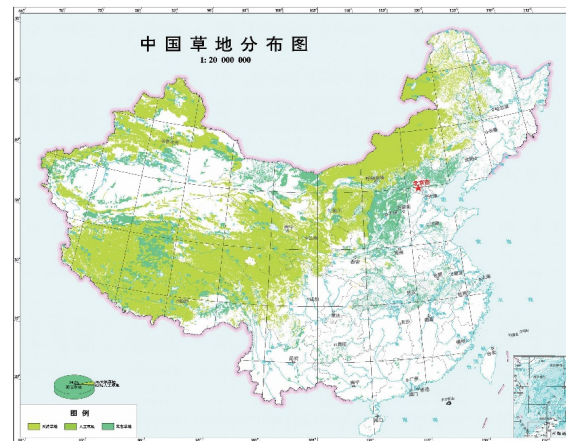
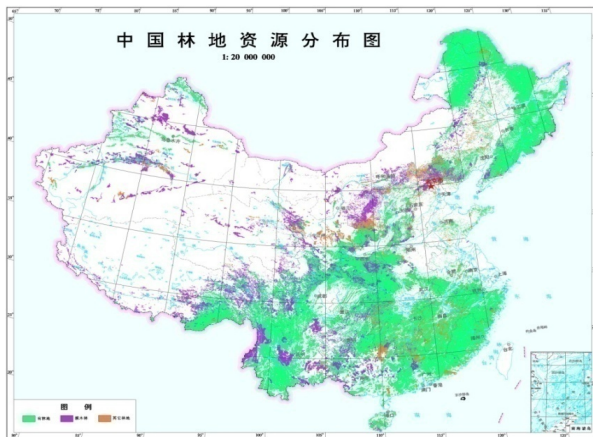
GF-6, June 2018, agricultural fields at the border of the Netherlands and Germany, in which red and yellow represent crops and flower growing areas respectively.



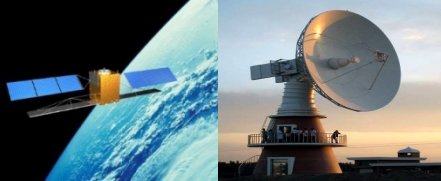
# 1. Status of China EO System



## Comprehensive Application Examples:



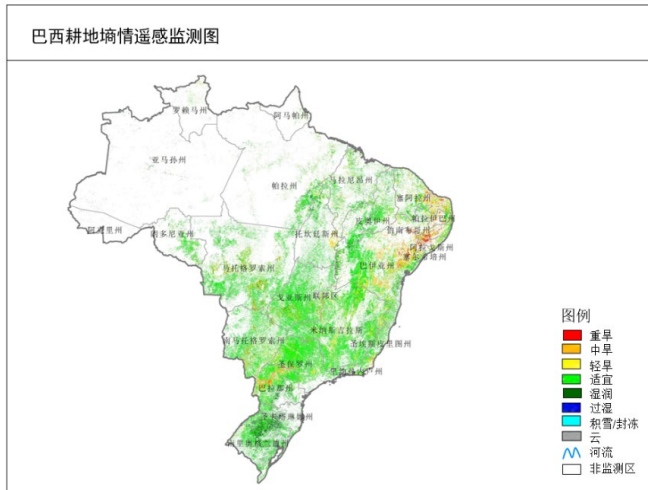
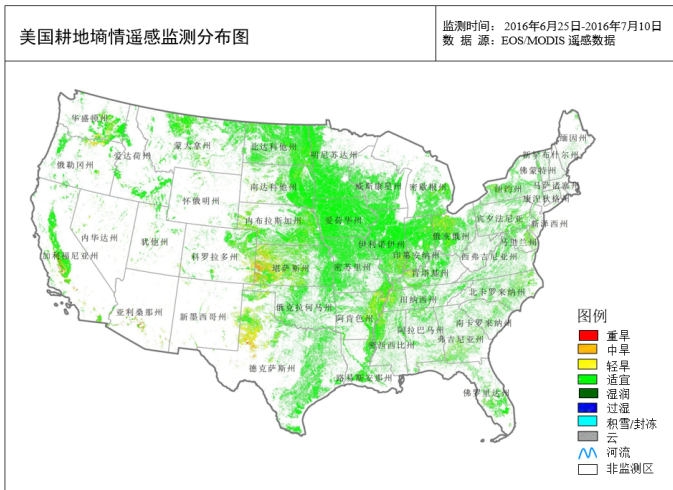
In 2016, the distribution maps of forestland and grassland were completed by using GF satellite and other satellite data.



# 1. Status of China EO System



## Comprehensive Application Examples:



GF-1/2/6 satellites were used to monitor crop acreage, growth, yield and disaster situation in major grain-producing areas around the world, such as the United States and Brazil.





# Outlines



1. Current Status
2. Typical Solution
3. Future Perspective



## 2. Typical Solution



# 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

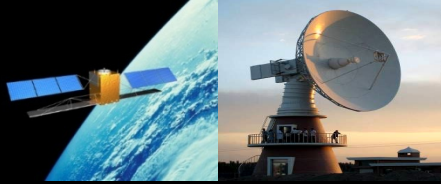
**13** CLIMATE ACTION

**14** LIFE BELOW WATER

**15** LIFE ON LAND

**16** PEACE, JUSTICE AND STRONG INSTITUTIONS

**17** PARTNERSHIPS FOR THE GOALS



# 2. Typical Solution

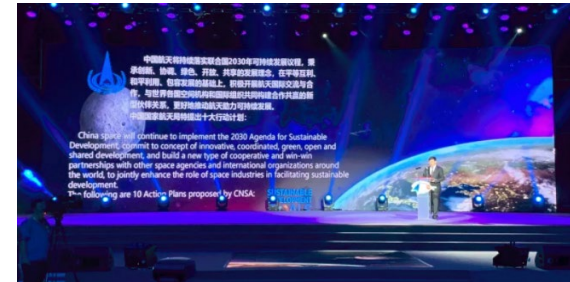


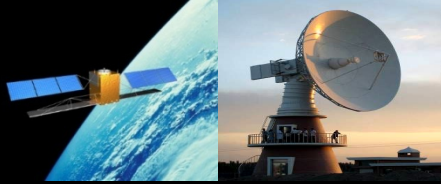
## Through implementing 10 action plans for realization of SDGs

**EO technology and application**



**Supporting**





## 2. Typical Solution



### Serving the Regional Development

#### Sustainability facing issues:

- Shortage of resources;
- Environmental degradation;
- Environmental pollution;
- Marine development;
- Climate change;
- .....



#### China Sustainable program :

- Integrated observation capacity;
- RS application technology system;
- Full-chain spatial service;
- Resource sharing of information;
- Demonstration application
- .....

**China's Solutions under the globalization pattern!**





## 2. Typical Solution



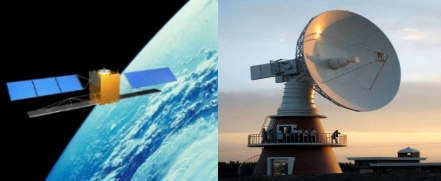
### Contribution to UN-RCSSTEAP

- 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 Centers
- ...



联合国附属空间科技教育亚太区域中心  
Regional Centre for Space Science and Technology Education in Asia and the Pacific (China)  
(Affiliated to the United Nations)





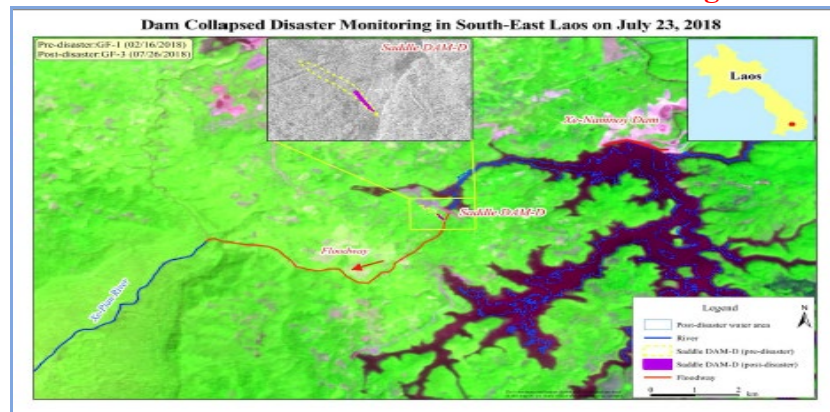
# 2. Typical Solution



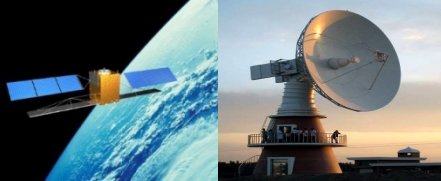
## Contribution to UNSPIDER

Enhancing technical exchanges among developing countries in disaster management within the south-south cooperation framework through mechanisms such as UN-SPIDER.

**Projects in Disaster Prevention and Mitigation**



GF satellites for the hydro power dam collapse in Laos on 23 July 2018, which caused 35 deaths and 99 missing.



## 2. Typical Solution



### Other land satellite series

- **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.



**Indonesian tsunami**



**Dam failure in southern Laos**

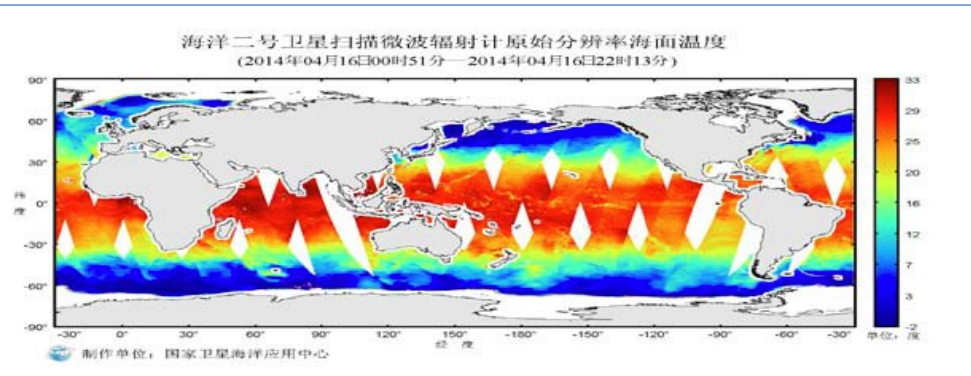


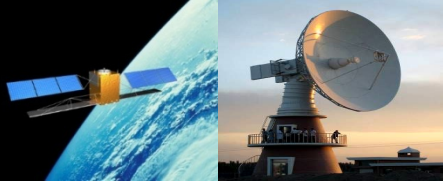
## 2. Typical Solution



### 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 China Meteorological Administration)



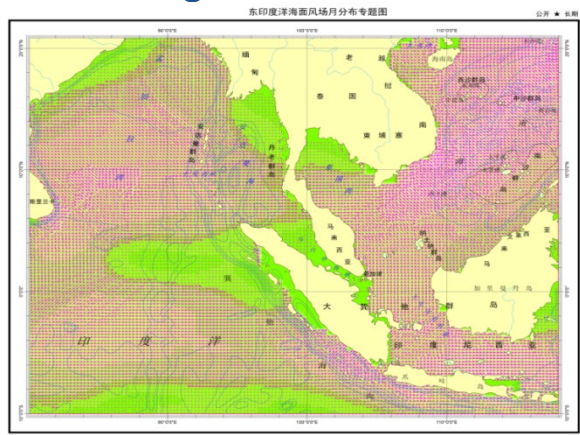


# 2. Typical Solution

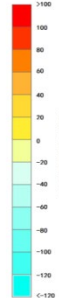
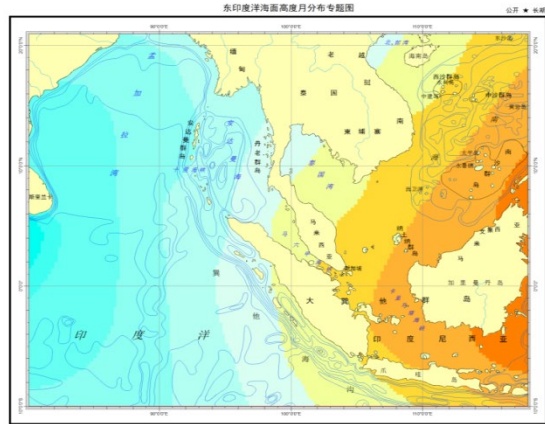


## HY satellite series

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



专题图的分幅率: 0.25° × 0.25°  
 数据源: HY-2A/GSAT  
 比例尺: 1:10,000,000  
 数据年份: 0000/0000  
 投影名称: 墨卡托投影  
 制图时间: 2013/01/01-2013/01/31  
 制图人员: 陈海  
 制图日期: 2015/01/27  
 制图单位: 国家卫星海洋应用中心  
 高程基准: 1985国家高程基准  
 审 核: 魏静雨

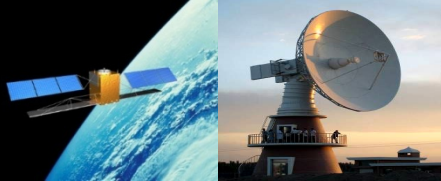


专题图的分幅率: 0.25° × 0.25°  
 数据源: Jason-1, Jason-2, HY-2  
 比例尺: 1:10,000,000  
 数据年份: 0000/0000  
 投影名称: 墨卡托投影  
 制图时间: 2013/01/01-2013/01/31  
 制图人员: 陈海  
 制图日期: 2015/01/27  
 制图单位: 国家卫星海洋应用中心  
 高程基准: 1985国家高程基准  
 审 核: 魏静雨



**China and France continue to promote cooperation in satellite engineering such as SVOM and CFOSAT.**

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

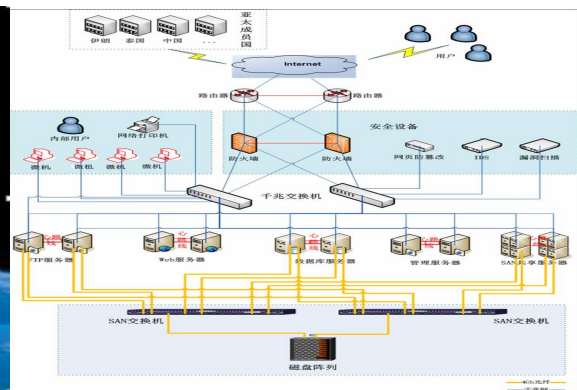
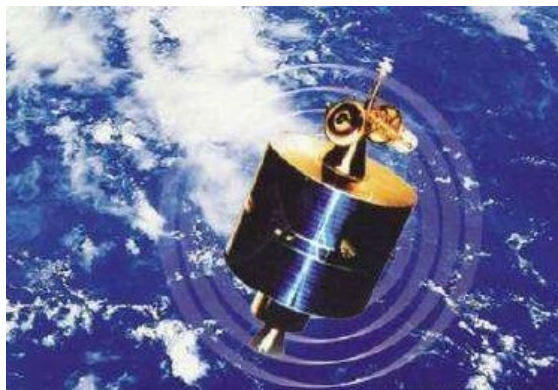


## 2. Typical Solution



### 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.
- APSCO **Joint Small Multi-Mission Satellite constellation(SMMS)**.
- “Zhang Heng No.1” provides seismic electromagnetic monitoring data for APSCO member countries.





## 2. Typical Solution

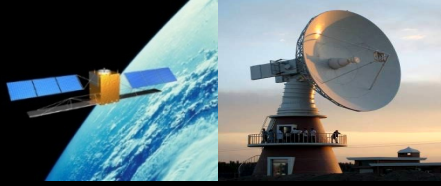


### Contribution to International Community

- 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



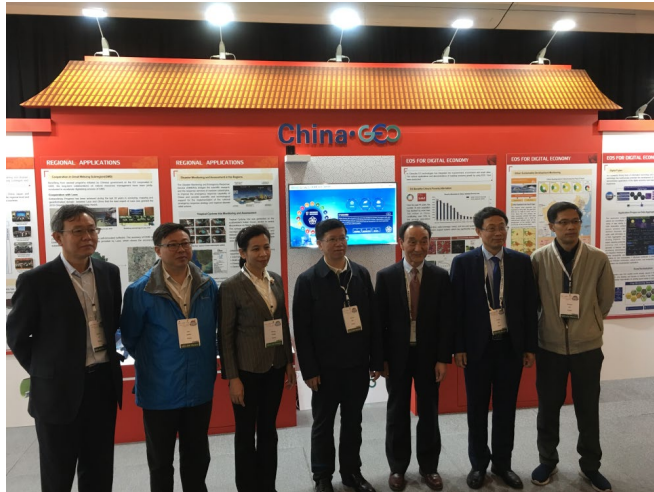
- Releasing "National Comprehensive Disaster Prevention and Mitigation Plan (2016-2020)"
- Establishing a "National Major Natural Disaster UAV Emergency Response Cooperation Mechanism"
- "Space-sky-ground" integrated with disaster three-dimensional monitoring system



## 2. Typical Solution



On November 9, GEO 2019, CNSA launched the "CNSA-GEO 16m data sharing Platform" and relevant Data Policy.



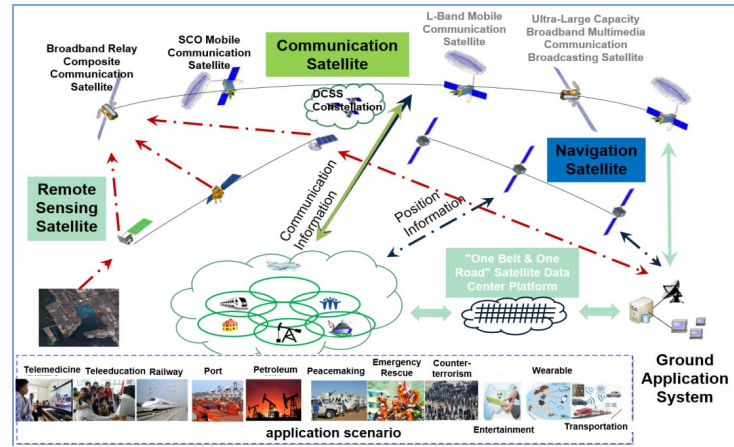


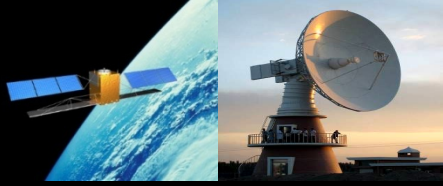


# 2. Typical Solution



China will share global data with 16-meter resolution from gf-1 and gf-6: archived data, daily updated WideFieldView (WFV) images and global coverage data.

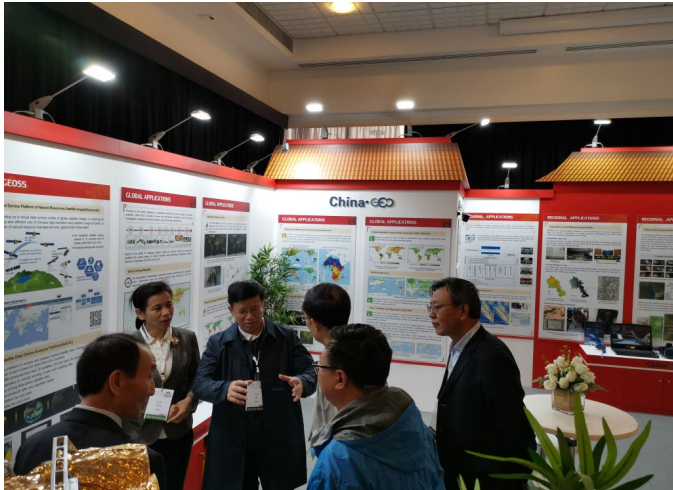




## 2. Typical Solution



The platform [www.CNSAGEO.com](http://www.CNSAGEO.com)(by Huawei Cloud) allows registered users around the world freely discover and download the WFV data .

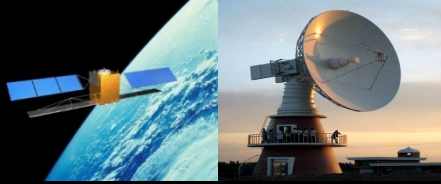




# Outlines



1. **Current Status**
2. **Typical Solution**
3. **Future Perspective**

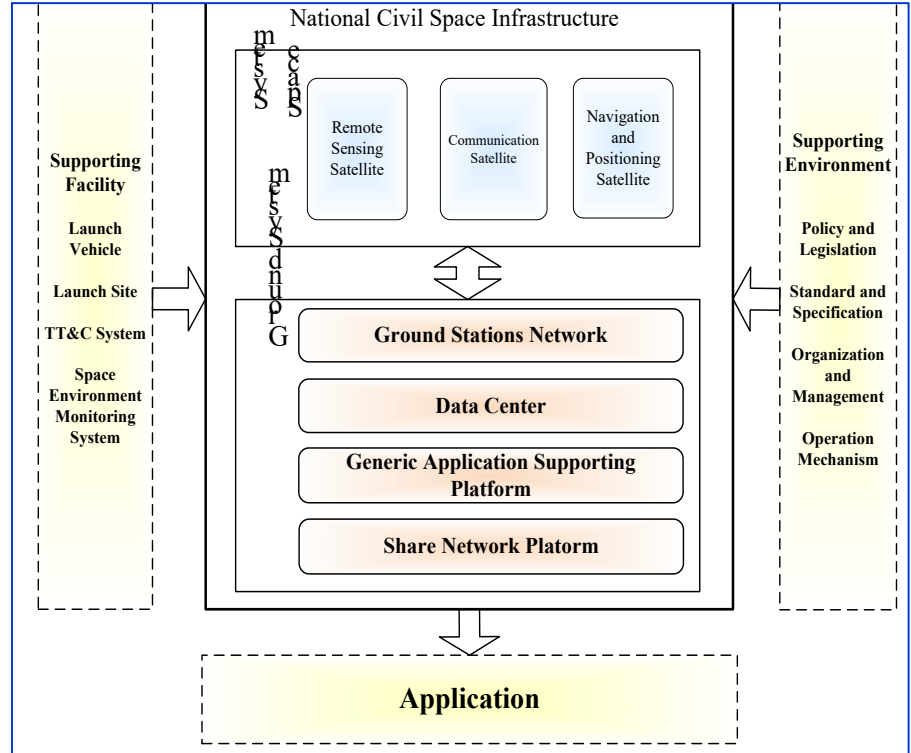


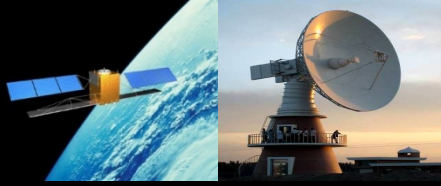
# 3.Future Perspective



## Civil Space Infrastructure

- ◆ In 2015, the State Council issued the National Civil Space Infrastructure Plan.
- ◆ To build three major systems, develop and launch **more than 60** remote sensing satellites by 2025





# 3.Future Perspective



**Including 66 Remote sensing satellites. The following satellites approved**

NO.	The name of the satellite	Performance and function
1	L-band differential interferometer SAR satellite	3-meter resolution SAR satellite
2	Terrestrial ecological carbon monitoring satellite	Vegetation biomass and atmospheric air solution distribution in terrestrial ecosystems were detected
3	Atmospheric environment monitoring satellite	Detection of atmospheric particles, aerosols, carbon dioxide, nitrogen dioxide, sulfur dioxide, ozone and other pollutants
4	High resolution multimode integrated imaging satellite	Multi-mode integrated imaging satellite whose panchromatic color is better than 0.5 meters and multi-spectral is better than 2 meters
5	High orbit 20-meter SAR satellite	Tilt geosynchronous orbit, 500km-3000km width, 20m-50m resolution
6	A new generation of ocean water color monitoring satellite	Monitoring Marine water color and temperature, AIS, coastal zone imager
...	The remaining satellites	

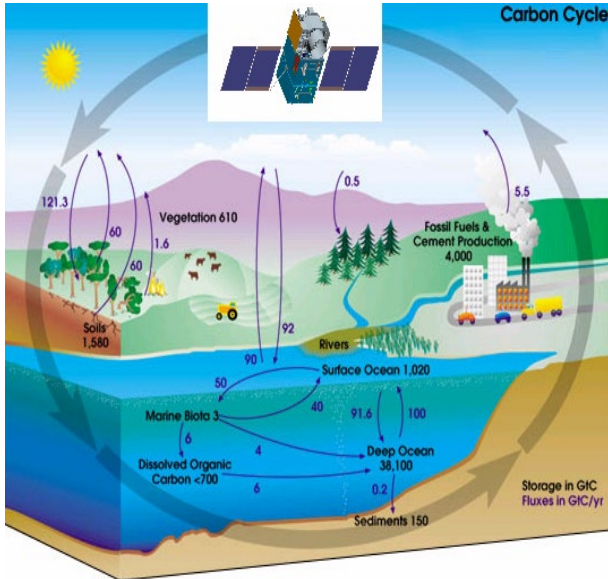


# 3.Future Perspective



## Terra Ecosystem Carbon Monitoring Satellite

Purpose: Evaluate the Forest Biomass and Aerosols Distribution for climate changing, launched before 2020.



Payload	Purpose	Specification
Multi-Beam LIDAR	5 Beams for tree height measuring 1 Beam for aerosols detecting	Vertical Resolution: 0.15 m
Directional Multi-Spectral Camera	Obtaining forest images	Resolution: 8-12m Swath: 20km
Directional Polarization Camera	obtain horizontal distribution of aerosols.	Resolution: 3.5km

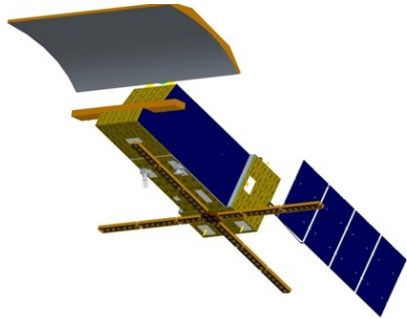


# 3.Future Perspective

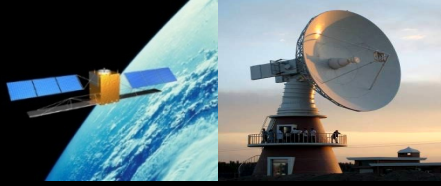


## Ocean Salinity Monitoring Satellite

Purpose: to monitor the ocean salinity for marine dynamic environment and global water cycle monitoring, to be launched by 2020.



<b>Payload</b>	<b>Specification</b>
<b>Microwave Imaging Radiometer using Aperture Synthesis</b>	<b>Resolution :50Km Swath:950Km</b>
<b>Passive-Active Microwave Sensor</b>	<b>Resolution:50m Swath:950Km</b>

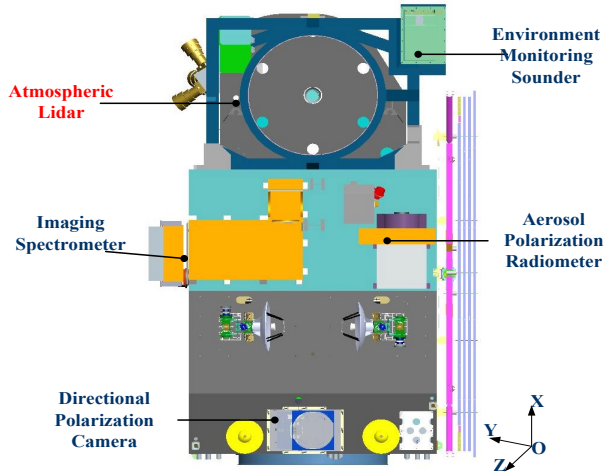


# 3.Future Perspective



## Atmospheric Environmental Monitoring Satellite

Purpose: Monitor atmospheric Environment through sounding and high accuracy CO2 sounding, to be launched by 2020.



Payloads including:

- Triple channel Lidar
- High accuracy polarimetry
- Wide swath imaging spectrometer
- Directional Polarization Camera
- Environment Monitoring Sounder



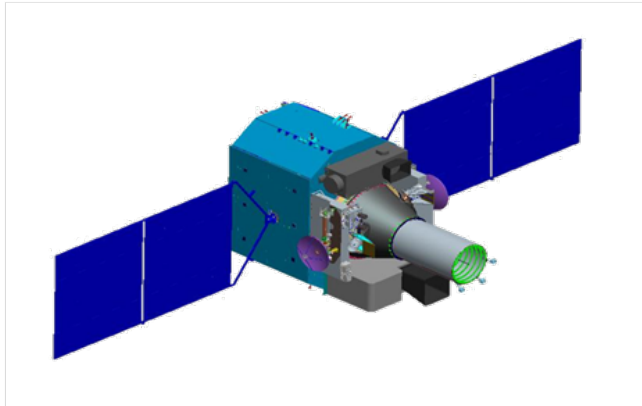


# 3.Future Perspective



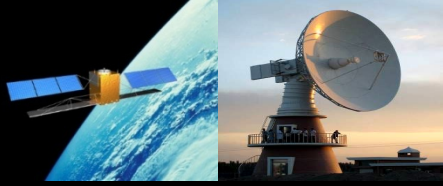
## Marine Environment Monitoring Satellite

Purpose: to monitor the marine environment in real-time with Geostationary satellite.



Payloads include:

- Coastal Zone Monitoring Imager
- Atmospheric Monitoring Spectrometer
- Ocean Oil Spill Detector

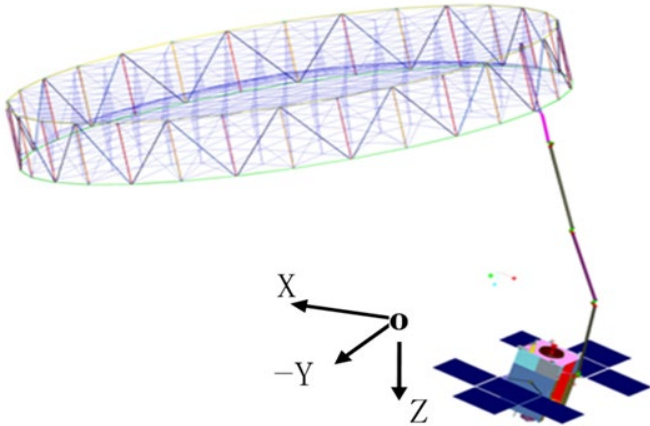


# 3.Future Perspective



## GEO SAR Satellite

Purpose: Geostationary SAR image Satellite to fulfill real-time monitoring.



Payload	Specification
C Band SAR	Resolution :20m Swath:400Km

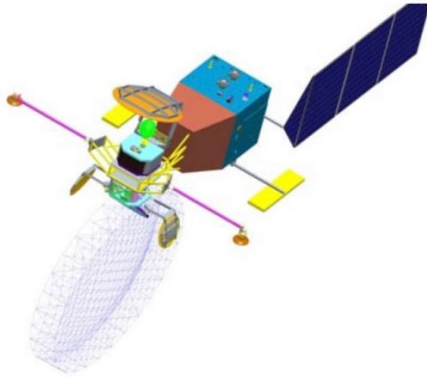


# 3.Future Perspective

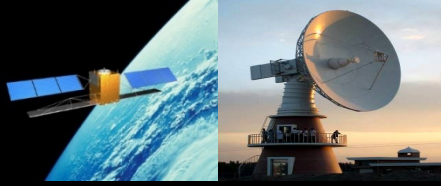


## New Generation Marine Dynamic Satellite

Purpose: a new generation marine dynamic satellite to comprehensively measure the surface altimeter, wind field and temperature.



<b>Payload</b>	<b>Specification</b>
<b>Interference Imaging Altimer</b>	<b>Height Resolution :5cm Swath:200Km</b>
<b>Dual Frequency high resolution microwave Scatterometer,</b>	<b>Resolution:5Km/20Km Swath:1700Km</b>
<b>Multi-Channel polarization Microwave Radiometer</b>	<b>Temperature Resolution: &gt;0.75K</b>

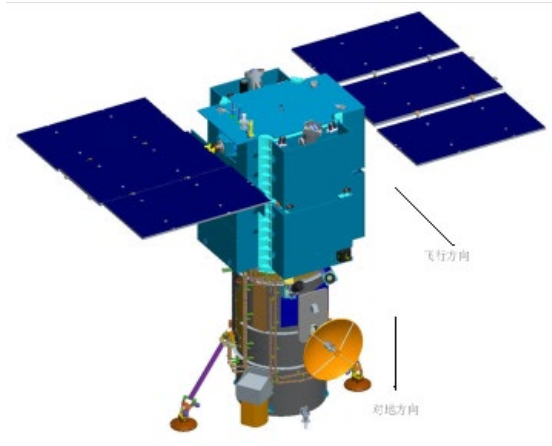


# 3.Future Perspective

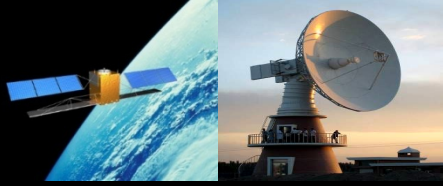


## High Resolution Multimode Imaging Satellite

Purpose: to meet the requirement of submeter level resolution and multi-band image data.



<b>Payload</b>	<b>Specification</b>
<b>High Resolution Camera</b>	<b>Resolution :0.5m Swath:15Km</b>
<b>Video Camera</b>	<b>Resolution:3m Scale: 15Km*11Km</b>
<b>Atmosphere Synchronous Corrector</b>	<b>7 Spectrum, Swath: 15Km</b>



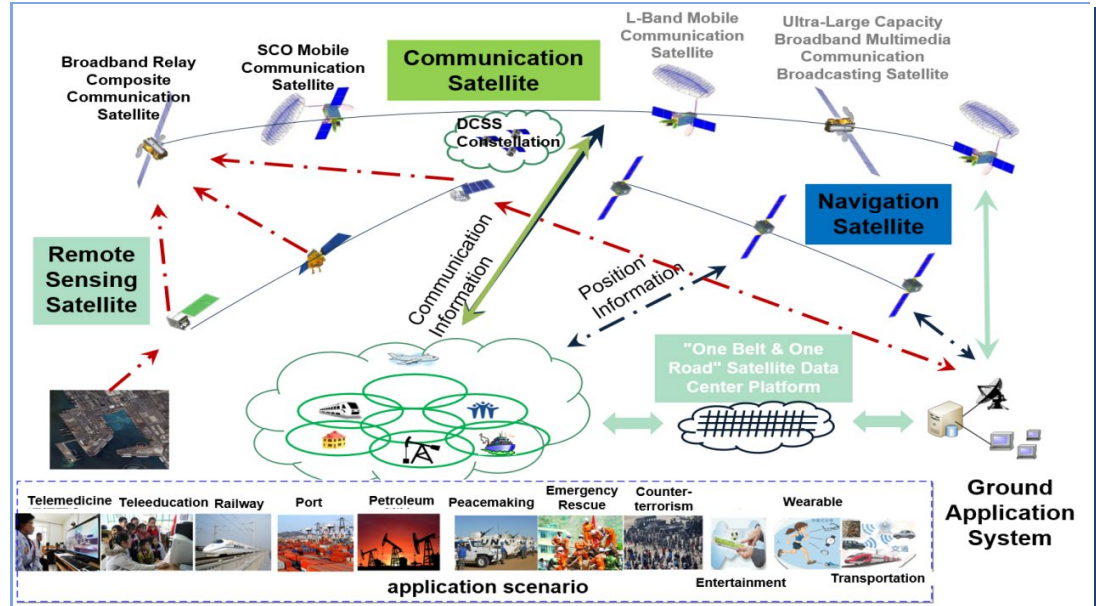
# 3.Future Perspective



## Space information Corridor

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





# 3.Future perspectives



## 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



Only one earth

Sharing one world

Connecting with destiny

Community of human destiny



## 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!**

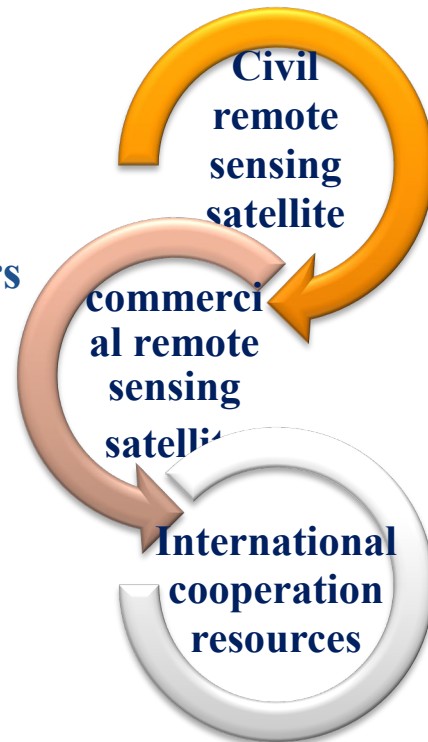


# 3.Future perspectives



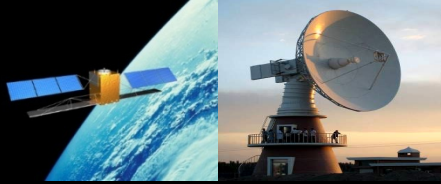
## Open and convenient data sharing mechanism and platform

- 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!**





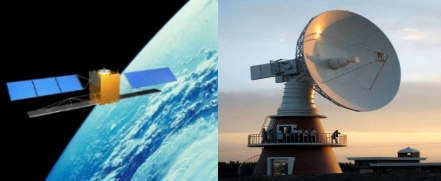
# 3.Future perspectives



## 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)
- .....





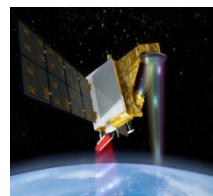
# 3.Future perspectives



## Open and efficient data sharing mechanism and platform

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

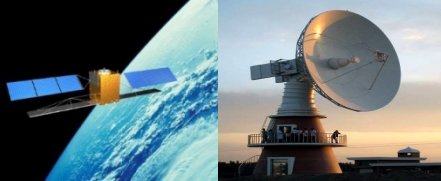
China-Germany .....



CFOSAT



China-Italy



# 3.Future perspectives



## 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
- .....

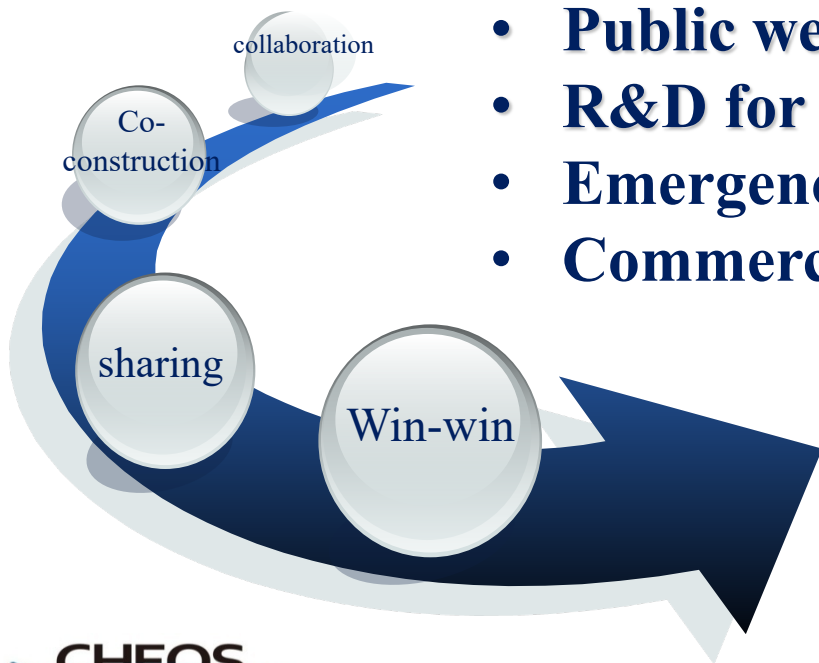




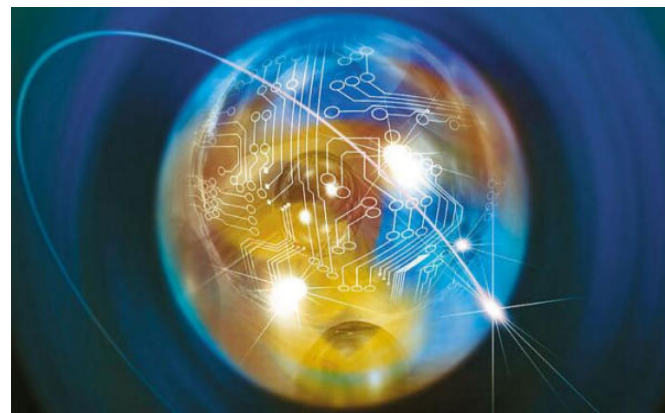
# 3.Future perspectives



## Win-Win Cooperation



- **Public welfare**
- **R&D for Universities**
- **Emergency Response**
- **Commercial Cooperation for EO industry**





**Thanks for your attention !**

**Wang Cheng**

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