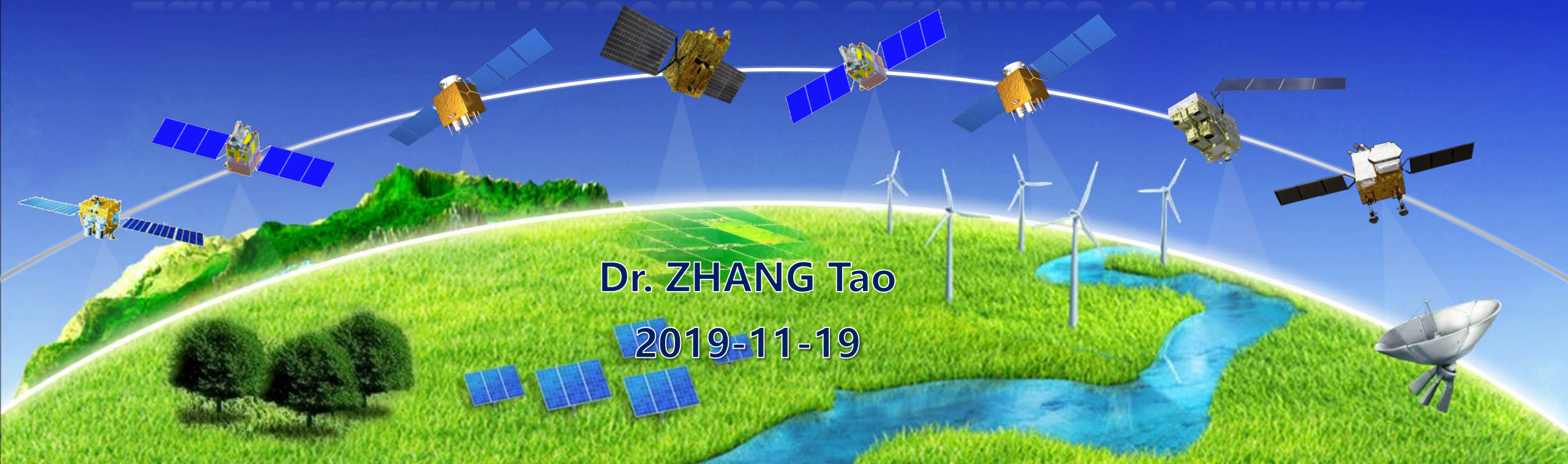
自然资源部国土卫星遥感应用中心
Land Satellite Remote Sensing Application Center , Ministry of Natural Resources of P . R .China

ESA-MOST China Dragon 4 Cooperation

Application and Prospective of Land Natural Resources Satellites of China



Dr. ZHANG Tao

2019-11-19

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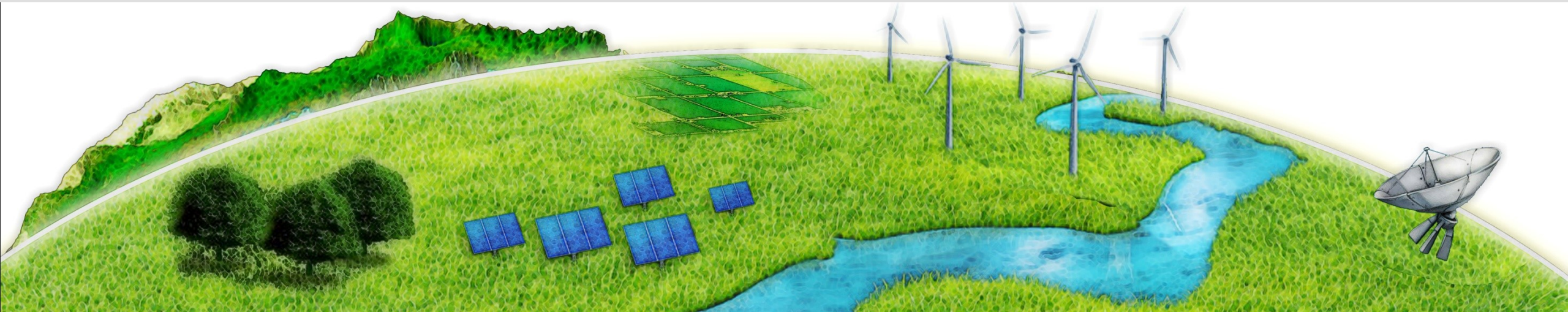
01

Introduction of LASAC

Land Satellite Remote Sensing Application Center(LASAC)



Introduction of LASAC

LASAC mainly undertakes the following duties: overall planning the development of land satellite remote sensing, acquiring and producing of the remote sensing basic information , providing remote sensing technical support to natural resource management, and coordinating the demands of Ocean, forestry and grassland on remote sensing.

1

Overall planning for the development of Land satellite remote sensing

-Development Planning for Natural Resource Satellites

-Construction, operation and management of natural resources satellite projects and the application systems

-Research and development on satellite remote sensing projects and application technologies.

2

Acquiring and producing of RS basic information

-Observation plans, task management and control of Land Satellite management and data management

-RS data acquisition, calibration and validation; Production and quality control of Basic products

-Construction and operation of Natural resource RS Data and product sharing platform

3

Supporting RS demand on natural resources management

-Production of RS data information and products needed by natural resources management

-RS application promotion

-Technical training

-International cooperation and exchanges

Formation of LASAC

LASAC

Administrative Section

- General Affairs Office
- Division of Human Resource
- Division of Science and Technology
- Division of Foreign Affairs

Technical Section

- Division of Satellite Planning
- Division of Operation Management
- Division of Datum and Calibration
- Division of Data Processing
- Division of Quality Inspection
- Division of Resource Survey and Monitoring
- Division of Ecology Survey and Monitoring
- Division of Comprehensive Survey and Monitoring
- Division of Service and Application

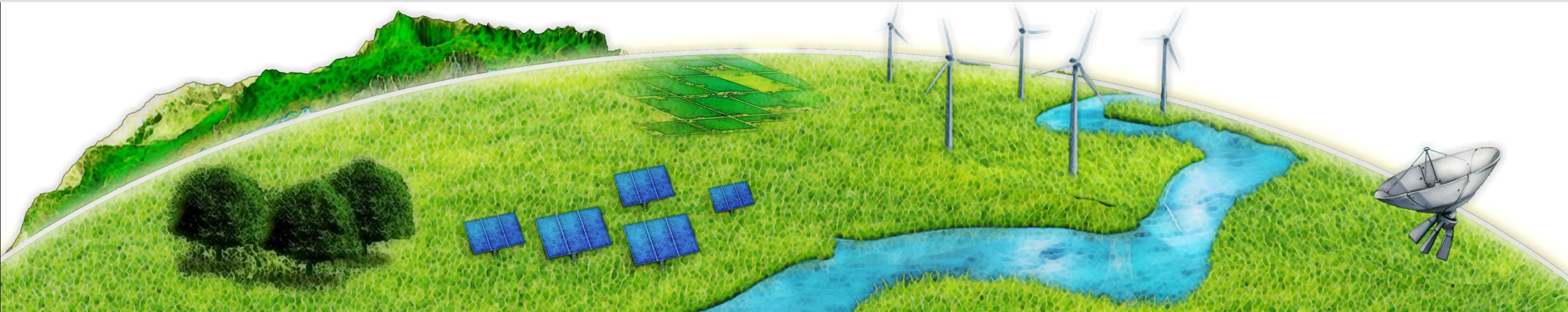
Whole chain business process

Development Platform

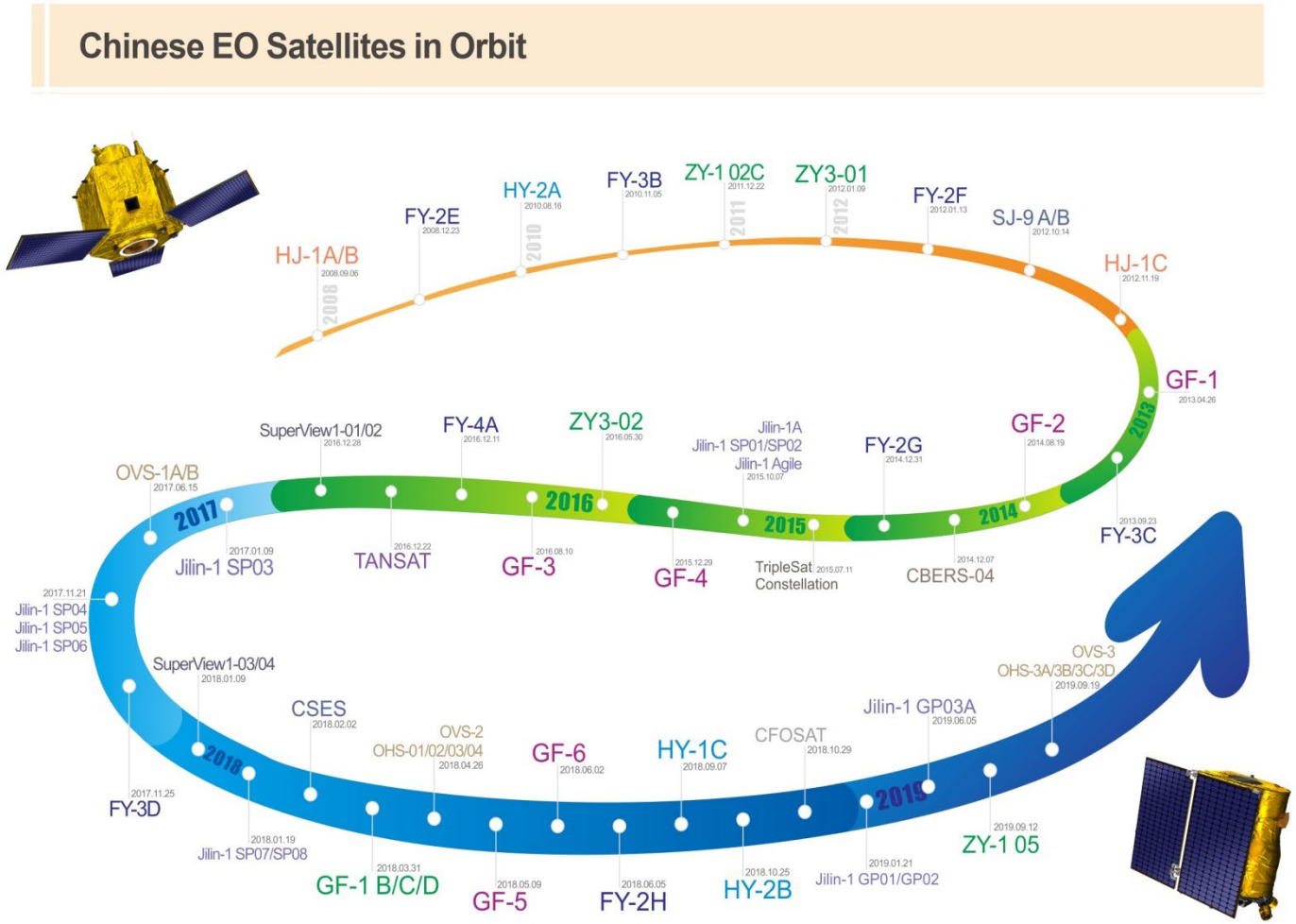
- National innovation team of satellite surveying
- High tech company
- National key lab
- International cooperation center of MOST
- Post-doctoral research center

02

Data & Products

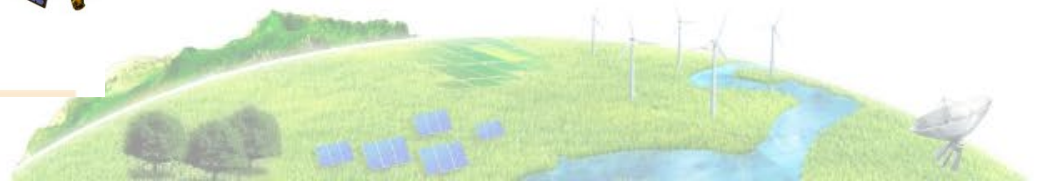


Introduction of Chinese Satellites



Land Natural Resource Satellites

- ZY Series
- GF Series
- LT Series
- Gravity …



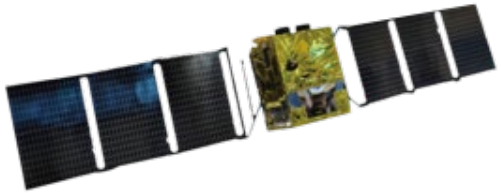
In-orbit Satellites

Type	Resolution	Satellites
Optical	2m	ZY1-02C/02D
		ZY3-01/02 (stereo)
		GF-1
		2m/8m (3 satellites) Optical satellite constellation
		GF-6
	sub-meter	GF-2 GF-7
Hyper-spectral	30m	GF-5
SAR	1m	GF-3

Satellite Resources

■ ZY-1 02C

ZY-1 02D launched in Sept.12,2019



Features	ZY-1 02 C / D
Launch Time	Dec.22, 2011(02C)
Orbit type	Sun-synchronous
Altitude	780 km
Band	Pan, MUX (B, G, R, NIR) HR
Spatial Resolution	5 m (pan) 10 m (mux) 2.36m (HR)
Swath	60km(pan &mux) 54km(HR)
Revisit time	3 days

■ Mainly used in agriculture，forestry，environment, and other important national projects.

✓ 2 Cameras: Pan and multispectral

✓ 2 Cameras :HR cameras

Satellite Resources

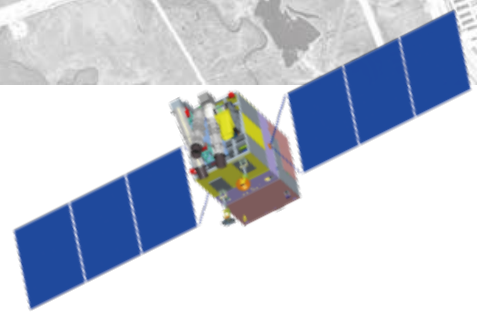
■ ZY-1 02D

Features	ZY-1 02D
Launch Time	Sept.12,2019
Orbit type	Sun-synchronous
band	Pan MUX Hyperspectral
Spatial Resolution	2.5 m (Pan) 10 m (MUX) 30m(Hyperspectral)
Swath	60km 115km
Revisit time	3day

✓ Mainly used provide observation data for natural resources asset management, ecological monitoring, disaster prevention and control, environmental protection, urban construction, transportation and contingency management.

Satellite Resources

- ZY-3,is the first Chinese civil satellite for stereo mapping



Features	ZY3-01	ZY3-02
Launch Time	Jan. 9, 2012	May. 30, 2016
Orbit type	Sun-synchronous	Sun-synchronous
Altitude	506 km	506 km
Band	Pan (nadir, fwd, bwd), MUX (B, G, R, NIR)	Pan (nadir, fwd, bwd), MUX (B, G, R, NIR)
Spatial Resolution	2.1 m (pan @ nadir) 5.8 m (mux) 3.5 m (Fwd/bwd)	2.1 m (pan @ nadir) 5.8 m (mux) 2.7 m (Fwd/bwd)
Swath	Pan: 50km (nadir); 52km (f/b) Mux: 52km	Pan: 50km (nadir); 52km (f/b) Mux: 52km
Revisit time	3 days	

4 Cameras:

- ✓ Panchromatic-Nadir
- ✓ Panchromatic-Forward
- ✓ Panchromatic-Backward
- ✓ Multispectral

Satellite Resources

- GF-1, is the first satellite of Chinese high resolution EO system.

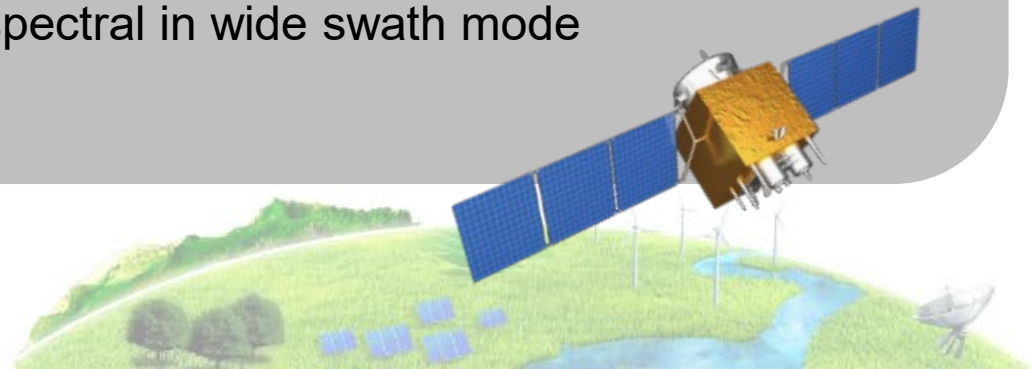
Features	GF1	
Launch Time	Apr. 26, 2013	
Orbit type	Sun-synchronous	
Altitude	645 km	
Band	Pan, MUX (B, G, R, NIR)	
Spatial Resolution	2 m (pan) 8 m (mux)	16 m (mux) Wide swath
Swath	60km (2 cameras)	800 km (wide swath)
Revisit time	4 days	

- Mainly used in Land monitoring, forestry, agriculture industries.

Cameras:

✓ Pan and multispectral

✓ multispectral in wide swath mode

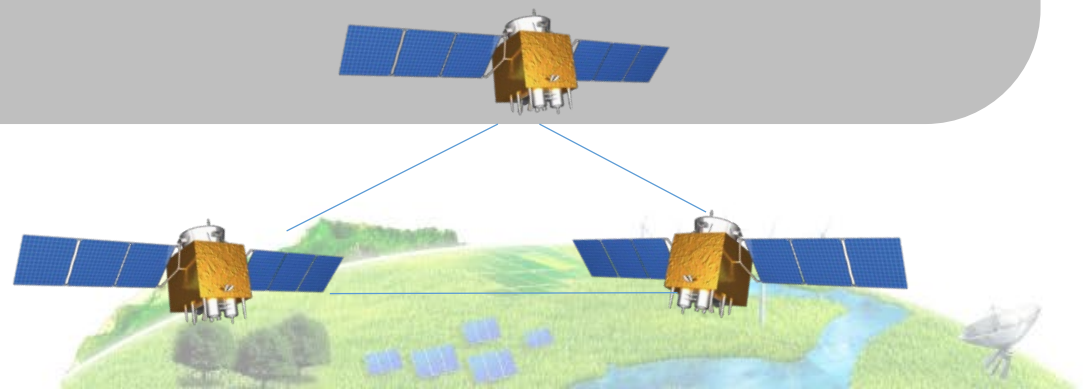


Satellite Resources

■ GF-1 B/C/D—2m/8m Natural Resources Satellite Constellation

Features	GF-1 B/C/D
Launch Time	Mar. 31, 2018
Orbit type	Sun-synchronous
Altitude	645 km
Band	Pan, MUX (B, G, R, NIR)
Spatial Resolution	2 m (pan) 8 m (mux)
Swath	60km (2 cameras)
Revisit time	1 day

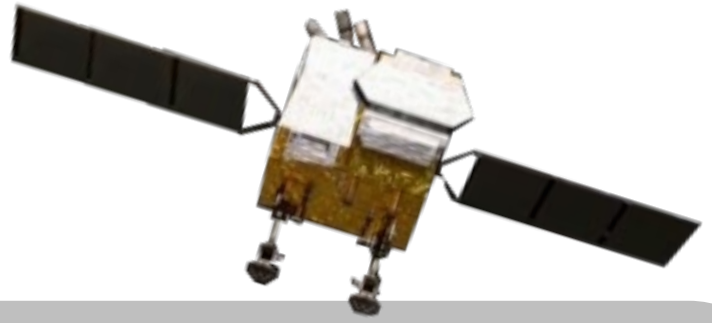
- ✓ GF-1 B/C/D is the first operational satellite constellation is formed.
- ✓ Coverage cycle is reduced from 41 days to 15 days, Revisit cycle from 4 days to 1 day.



Satellite Resources

■ GF-6

Features	GF-6	
Launch Time	Jun. 2, 2018	
Orbit type	Sun-synchronous	
Altitude	645 km	
Band	Pan, MUX (B, G, R, NIR)	
Spatial Resolution	2 m (pan) 8 m (mux)	16 m (mux) Wide swath
Swath	>60km (1 camera)	800 km (wide swath)
Revisit time	4 days	



- ✓ Mainly used in agriculture and countryside
- ✓ The red edge band has been added for agro-ecological applications.

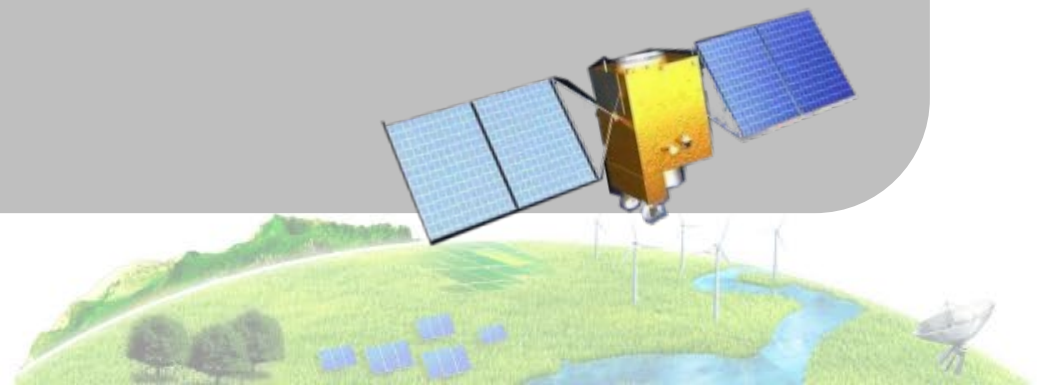
Satellite Resources

- GF-2, is the 2nd satellite of Chinese high resolution EO system; the first sub-meter civil satellite in China.

Features	GF2
Launch Time	Aug.19, 2014
Orbit type	Sun-synchronous
Altitude	631 km
Band	Pan, MUX (B, G, R, NIR)
Spatial Resolution	0.8 m (pan) 3.2 m (mux)
Swath	45km (2 cameras)
Revisit time	5 days

- Mainly used in urban planning, land management.

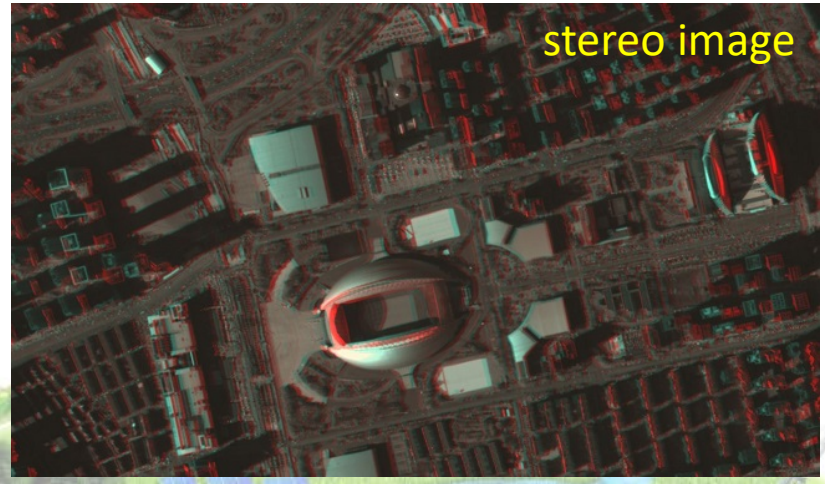
✓ 2 Cameras: Pan and multispectral



Satellite Resources

- GF-7 is the first Chinese civil satellite for sub-meter stereo mapping.

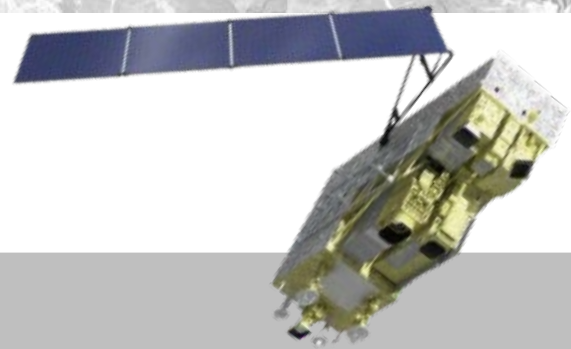
Features	GF7
Launch Time	Otc. 3, 2019
Orbit type	Sun-synchronous
Band	Pan, MUX (B, G, R, NIR)
Spatial Resolution	0.8 m (pan) 3.2 m (mux)
Swath	20km



Satellite Resources

■ GF-5

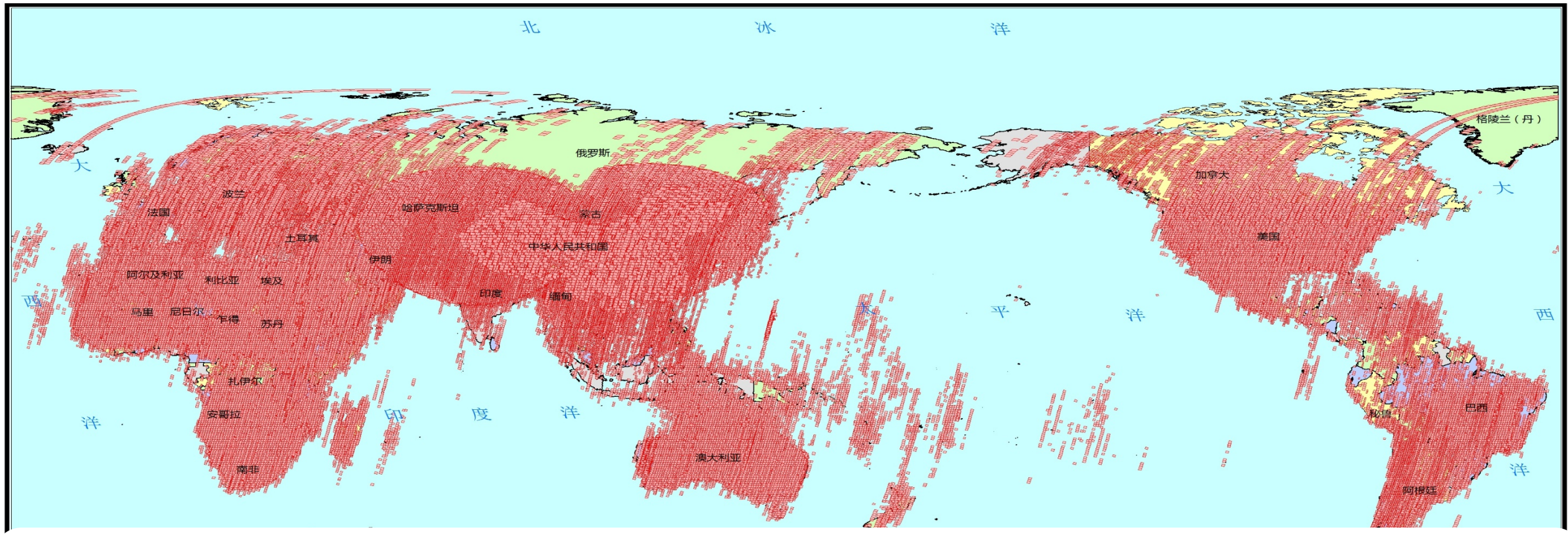
Features	GF-5
Launch Time	May. 9, 2018
Orbit type	Sun-synchronous
Altitude	705 km
band	0.45μm-12.5μm
Spatial Resolution	20-40m, AHSI:30m
Swath	60km



- ✓ The world's first comprehensive observational full-spectrum hyperspectral satellite for atmospheric and terrestrial application
- ✓ The highest spectral resolution satellite in China Contains 2 land loads (hyperspectral load and full spectrum load)
- ✓ Mainly used in inland water body, land surface ecological environment, mineral ,rock mine category detection

Data Coverage -2m Resolution

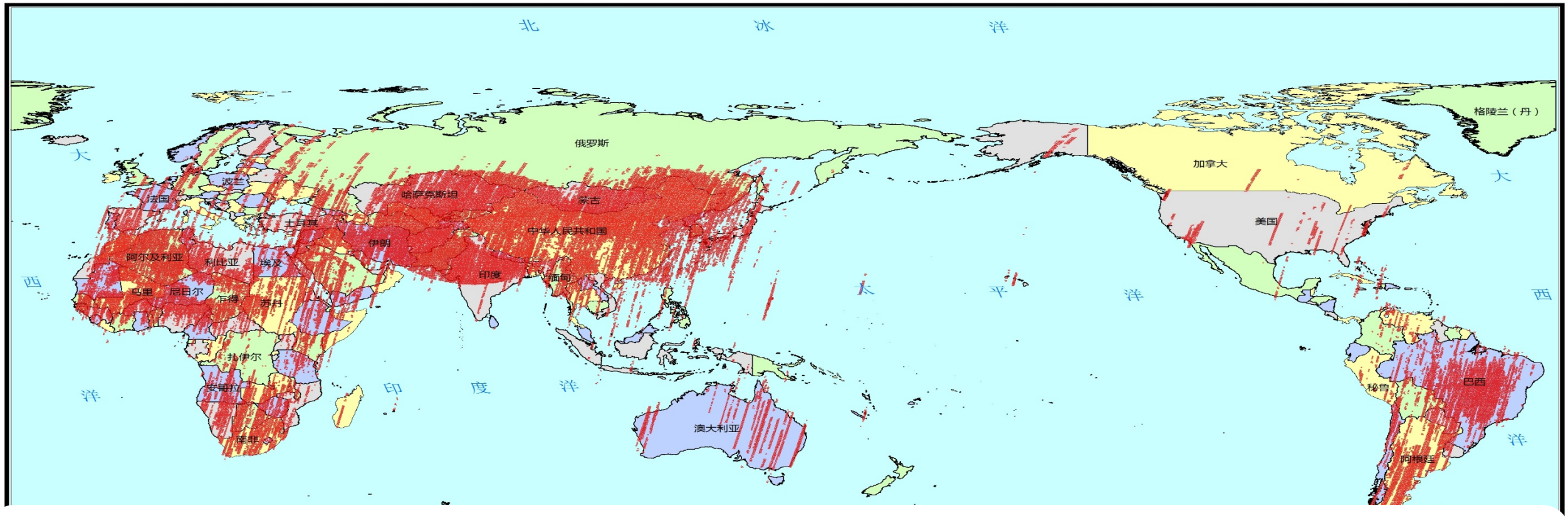
As of October， 2019



Global Data Coverage of 2m Resolution Satellites : 164.62 million km² Valid data(cloudage below 20%)

Data Coverage–Sub-meter Resolution

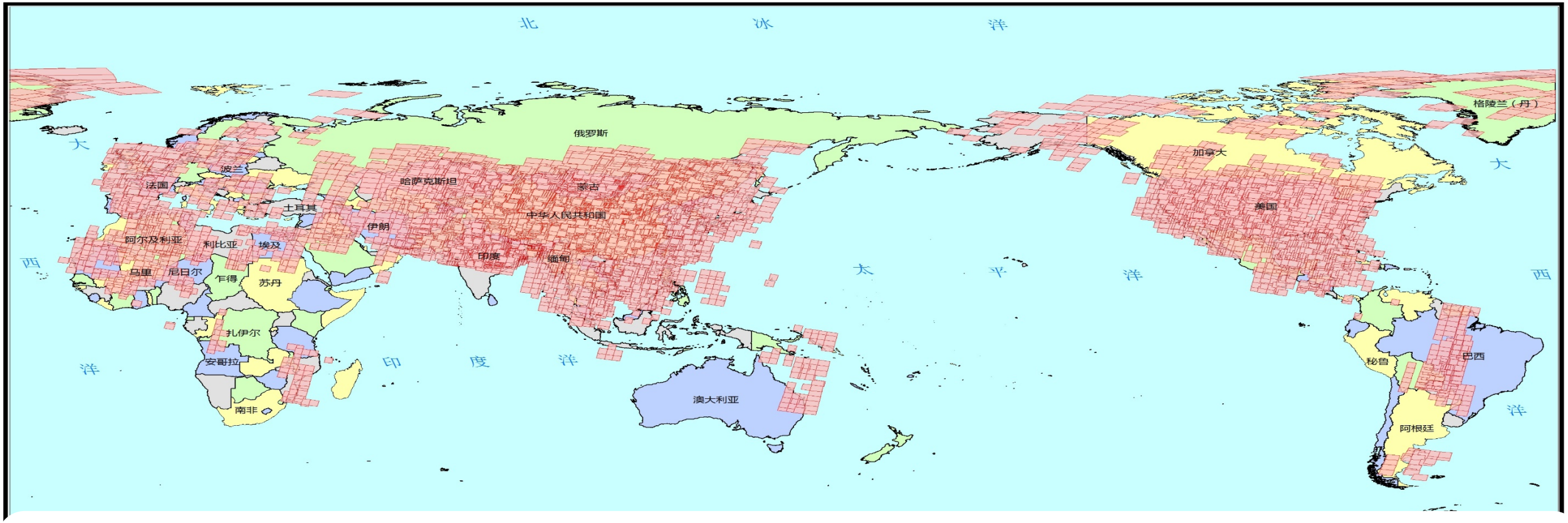
As of October, 2019



Global Data Coverage of GF-2 Satellites : 46.67 million km² Valid data(cloudage below 20%)

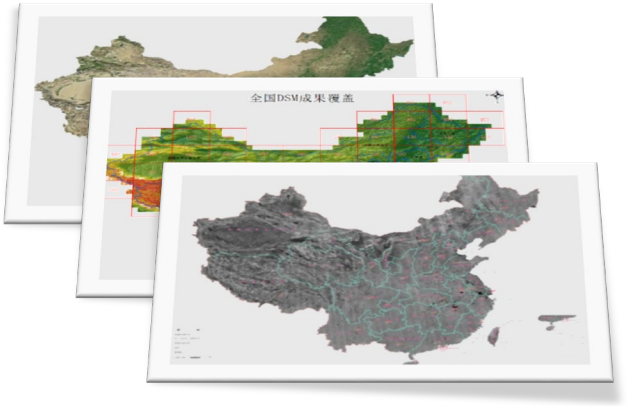
Data Coverage –Global(16m)

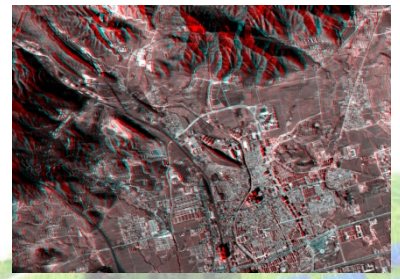
As of October, 2019



Global Data Coverage of GF-1 Satellites with 16m resolution ：91.23 million km² Valid data(cloudage below 20%)

Products System





Platform Construction

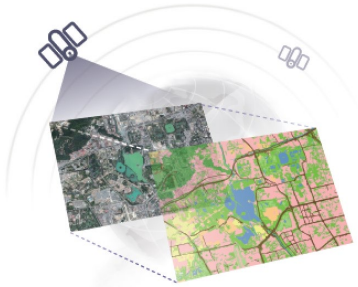
Sensor Correction

Satellite Imagery Map

Image SetTop Box

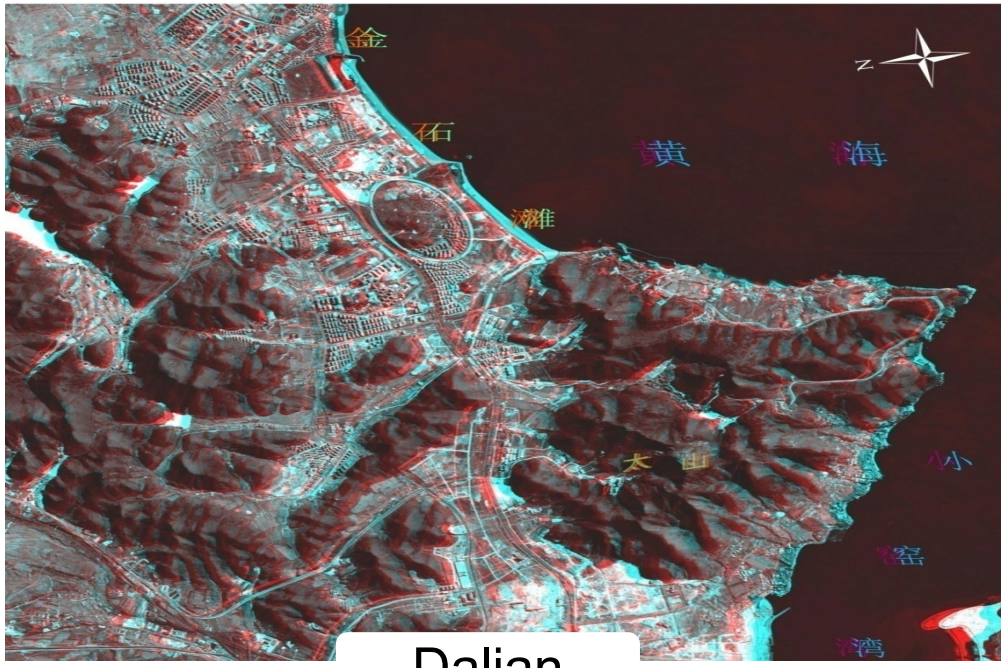
Stereo Image

Information Extraction Service



Data & Products

Stereo Image by ZY-3



Dalian

Image fusion by ZY-3

Dubai

Data & Products

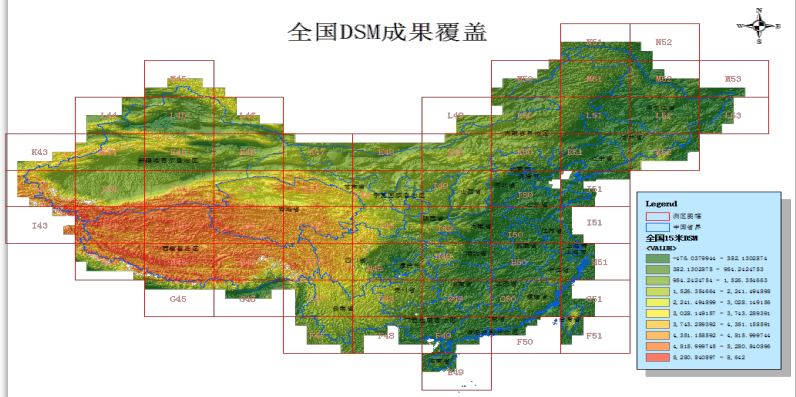
DOM

Digital orthography model

- Resolution 2m
- Precision better than 15m
- Updating every year
- Since 2014
- Source:ZY3

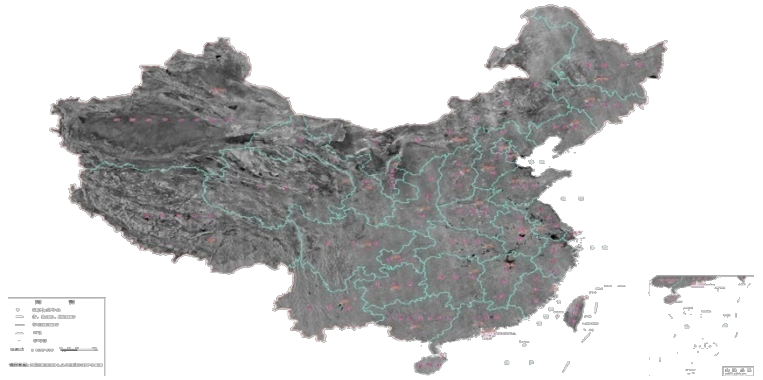
DSM

Digital surface model



- Grid：15m
- Precision better than 9m
- Updating every two years
- Since 2014
- Source:ZY-3 stereo images

SAR

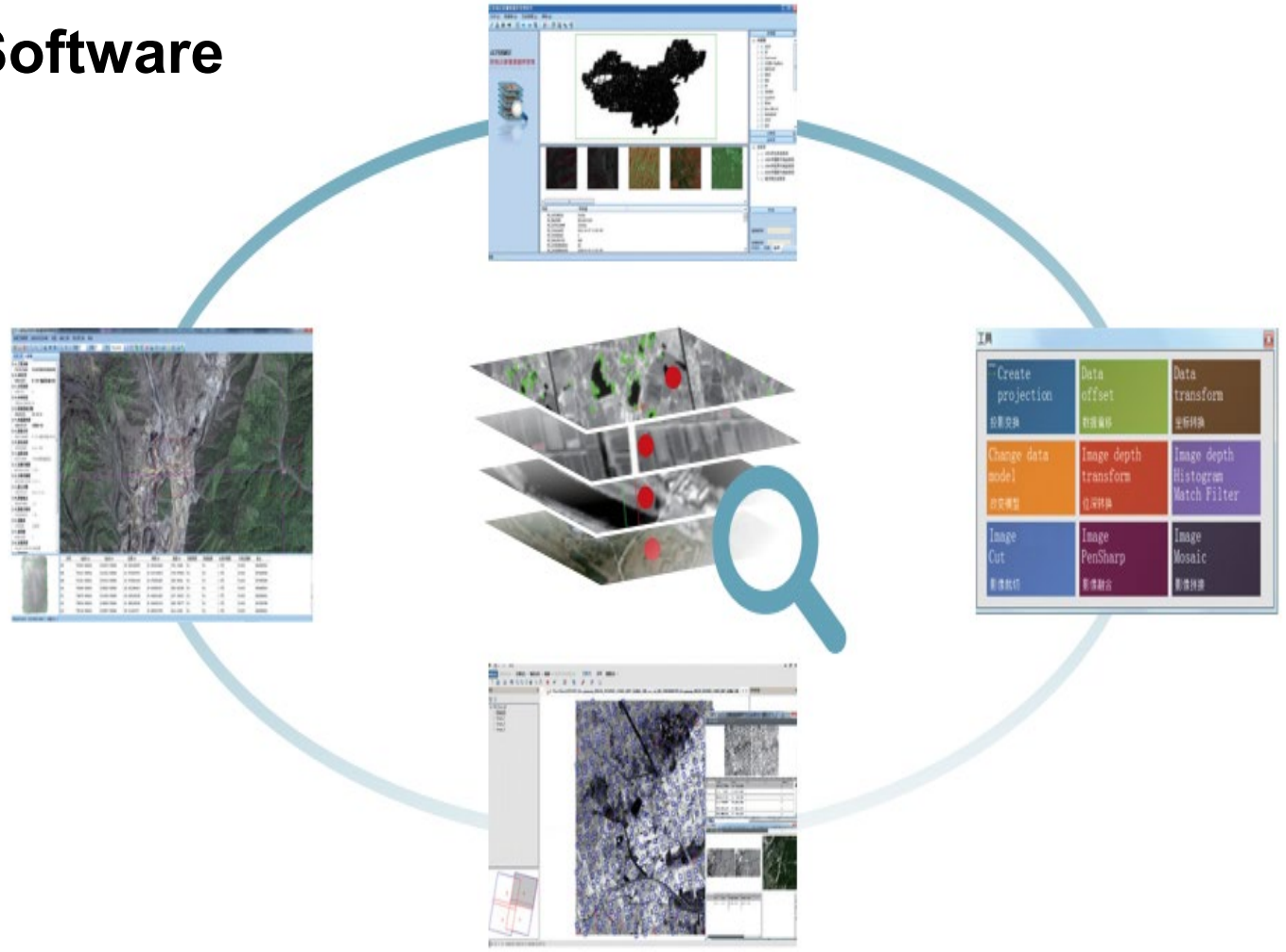


- Resolution：25 m
- Precision：27 m
- Data：GF-3
- Mode：FSII
- Version：2018.6

Data & Products

■ Image Fast Correction System Software

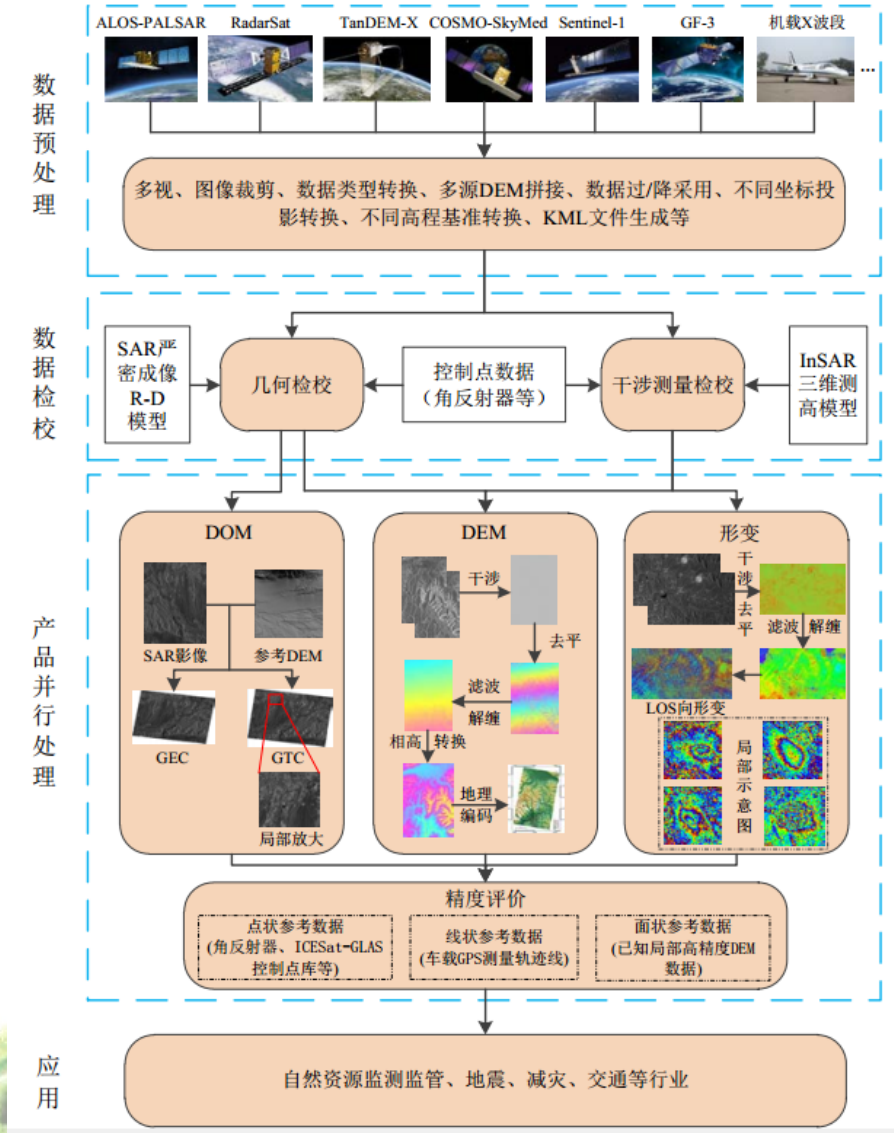
- ✓ Auto Selection of Control Points.
- ✓ Visualized Compensating Computation of Model Parameters.
- ✓ Convenient Precision Check.
- ✓ Image Data Fast Correction.



Data & Products

■ High-precision InSAR Topographic Mapping and Processing Software

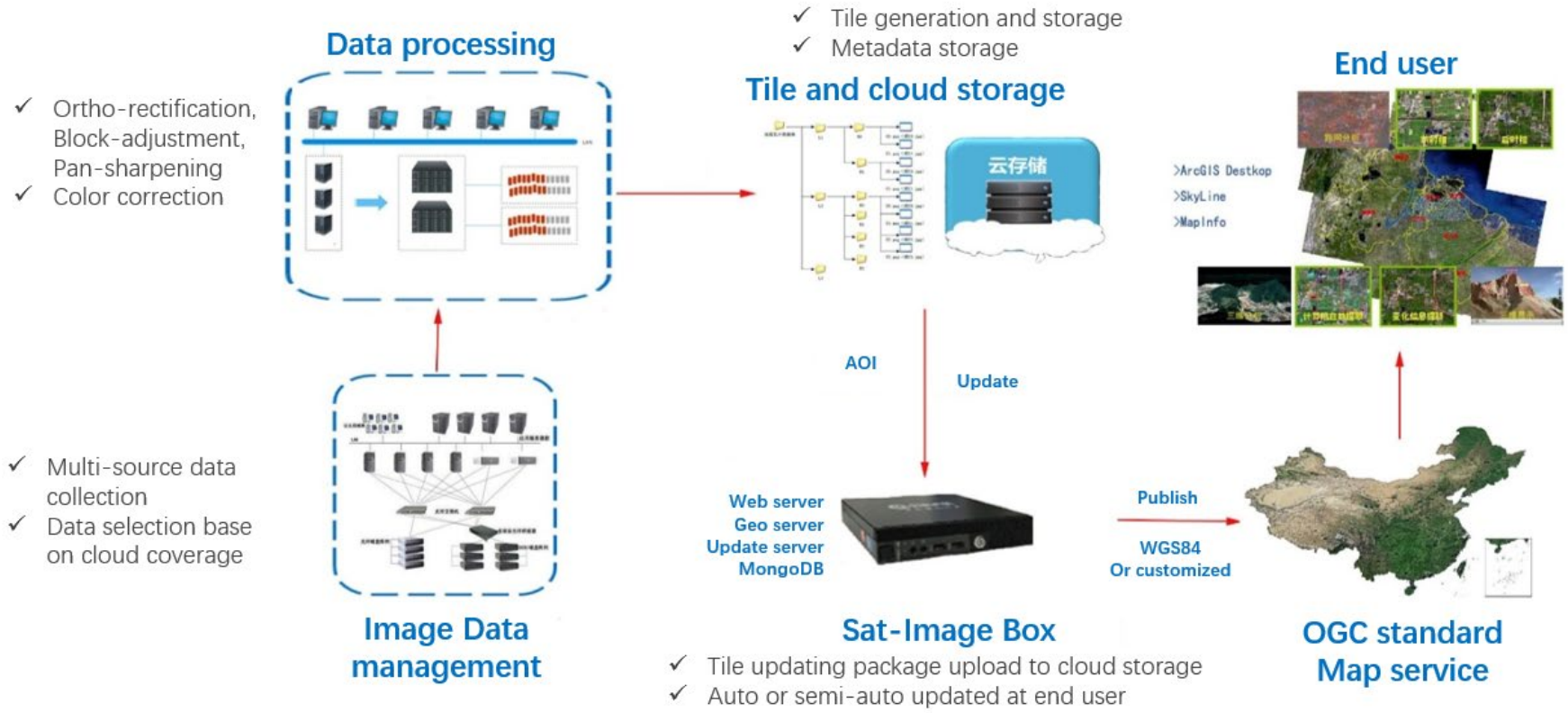
- ✓ Supporting Multi-source SAR Data.
- ✓ High Precision SAR Geometric Calibration, High Precision InSAR Interferometric Calibration.
- ✓ High- efficient parallel operational processing of differential products.
- ✓ Auto Consistent Processing ,Mosaic and Fusion of SAR Image Brightness.
- ✓ Natural resources-oriented applications on monitoring and management, earthquake, transportation and other industries.



Data & Products

■ SatImage Box v3.0

✓ **The system integrates satellite RS image base map and GIS service software and high-performance server.**



Latest images acquisition

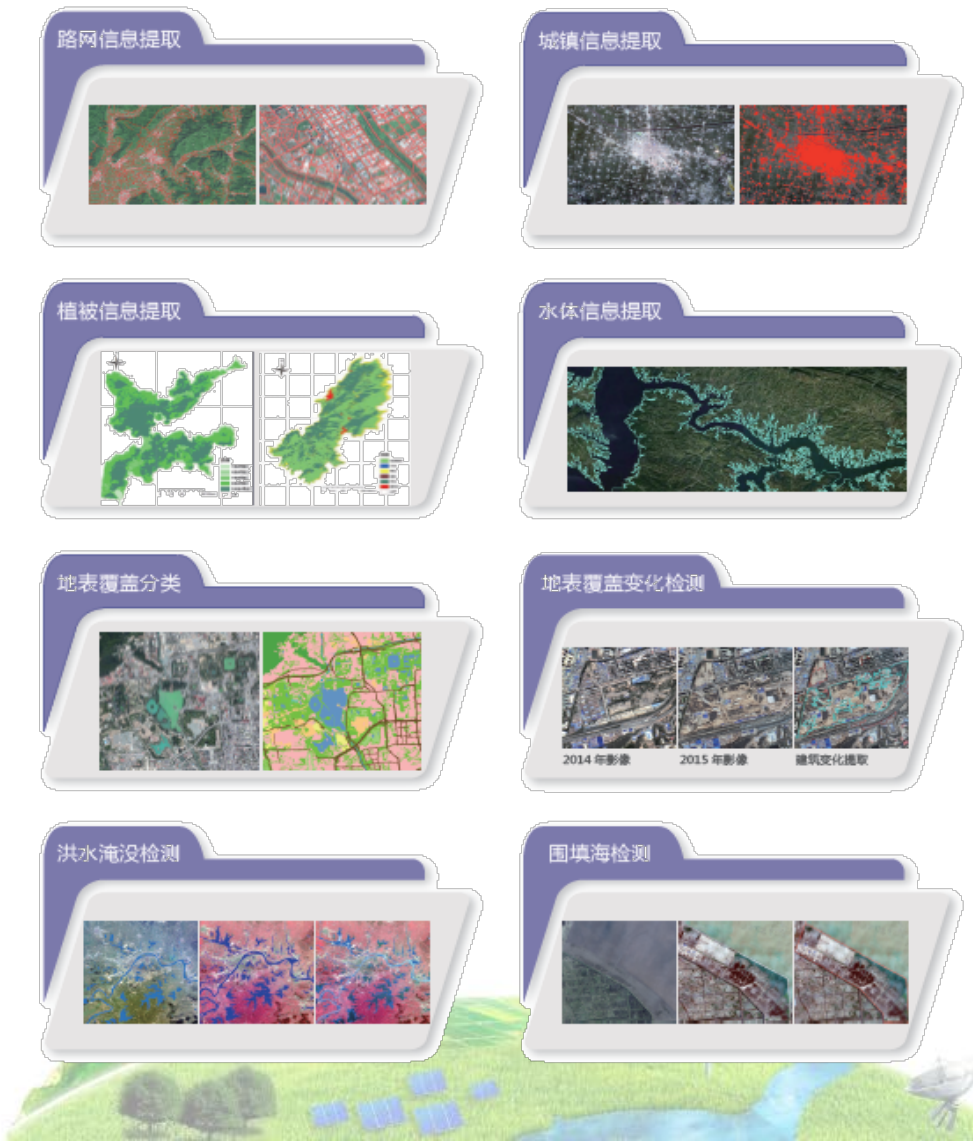
Data & Products

■ Information Extraction Service System

✓ The system could provide satellite remote sensing image information rapid extraction process solutions.

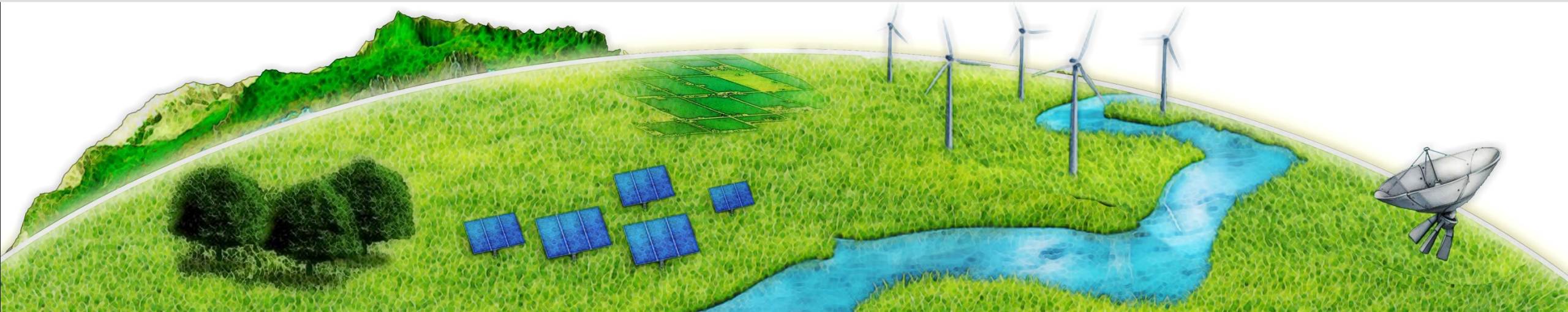
Which integrates the functions of

- ✓ Sample Collection and Management
- ✓ Expert Knowledge Base Construction
- ✓ Image Segmentation
- ✓ Feature Calculation
- ✓ Information Extraction
- ✓ Change Detection
- ✓ Statistical Analysis



03

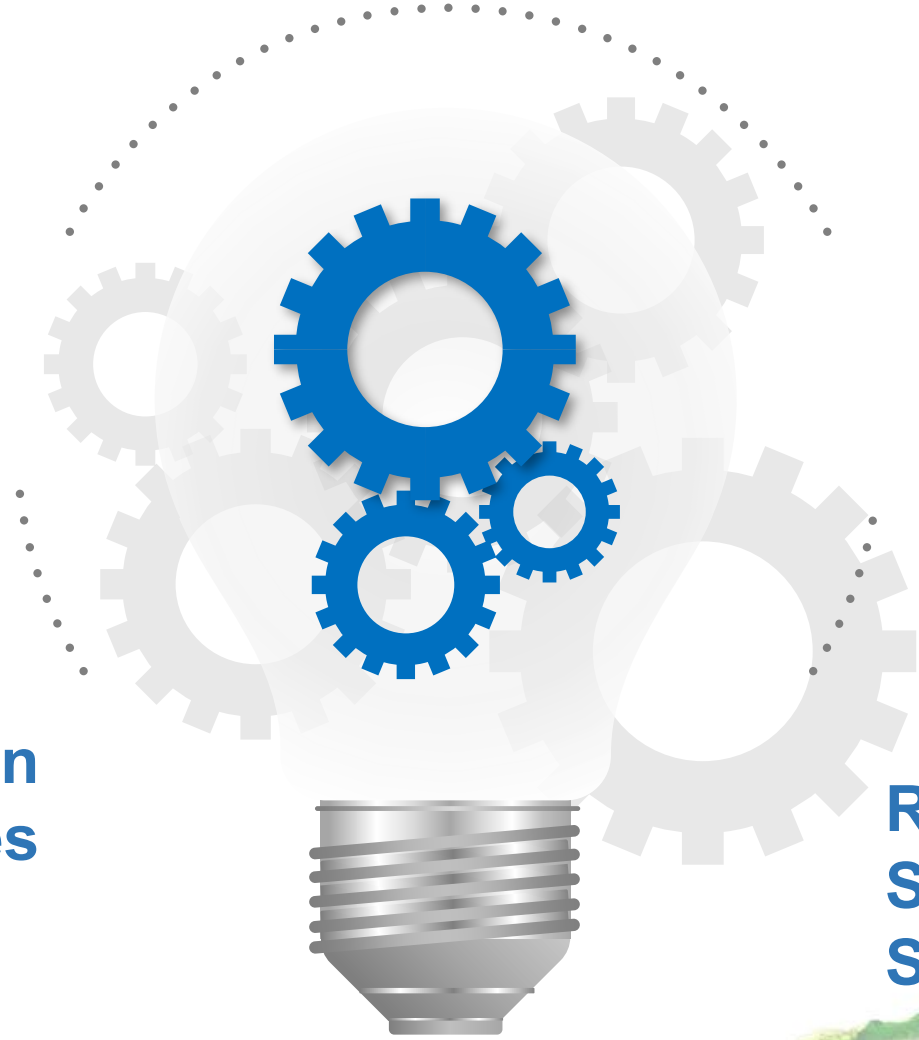
Natural Resources Satellites Application Services



Natural Resources Satellites Application Services

Regular Business Assurance

Key Projects



Industry Application Services

RS Monitoring and Supervision Support Service

Natural Resources Satellites Application Services

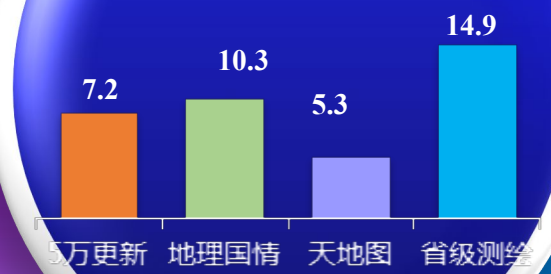
■ Regular Business Assurance

Basic Surveying and Mapping

- Update National basic geographic information database

Geography National Condition Monitoring

Quantity supplied
(10 thousand scene)



Map World

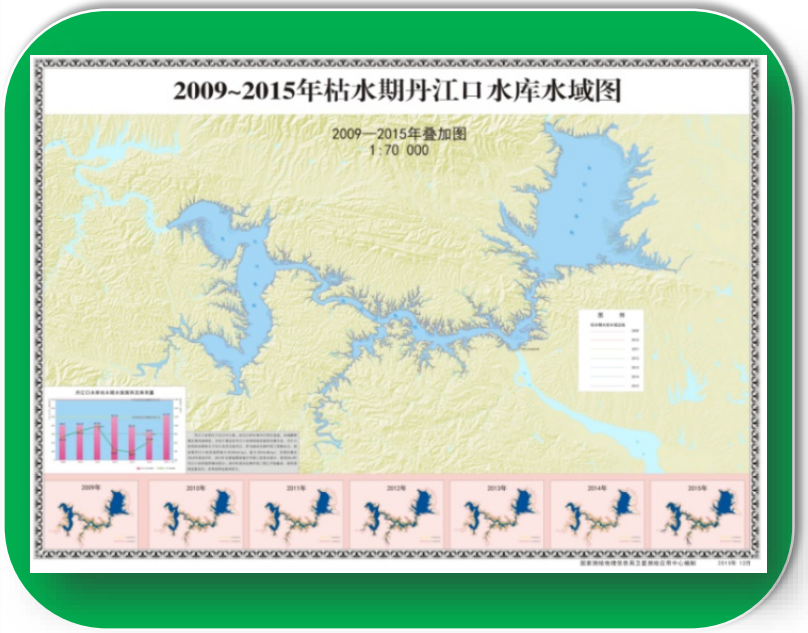
Domestic satellites images account for 90% of the total

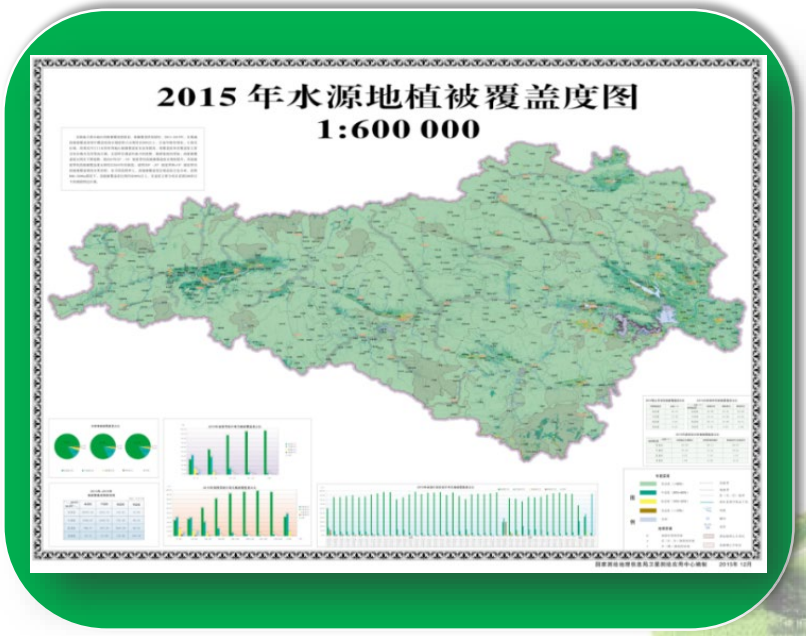
Provincial Comprehensive Application

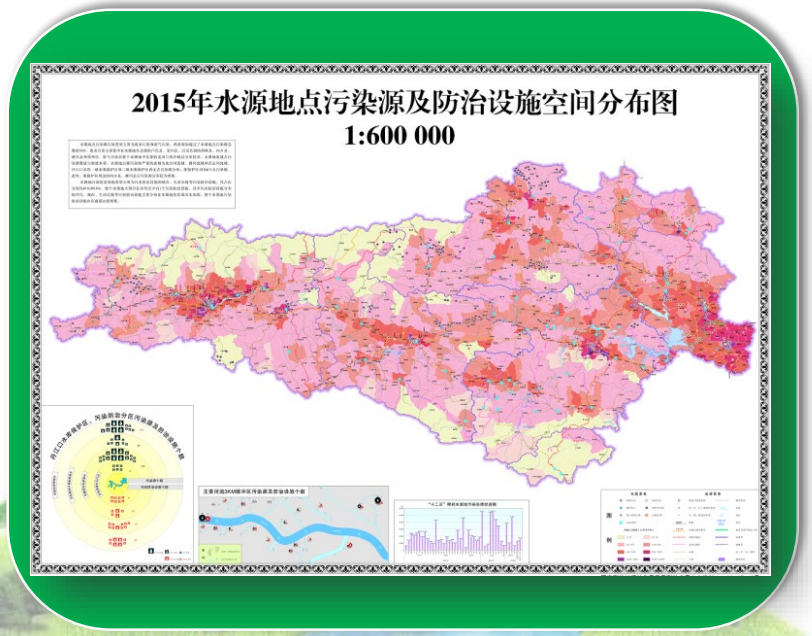
Natural Resources Satellites Application Services

■ Geography National Condition Monitoring

- ✓ Using ZY-3 and other satellite image data with the resolution above 2.5m.
- ✓ Monitoring on related area of key land cover, vegetation cover, infrastructures ,etc.
- ✓ Analyzing the change of spatial distribution of waters, vegetation cover of ecological zone, soil erosion, distribution of control facilities of pollution sources, etc.

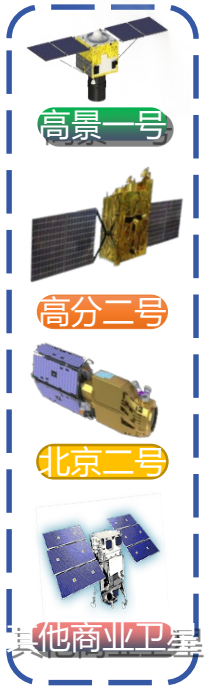


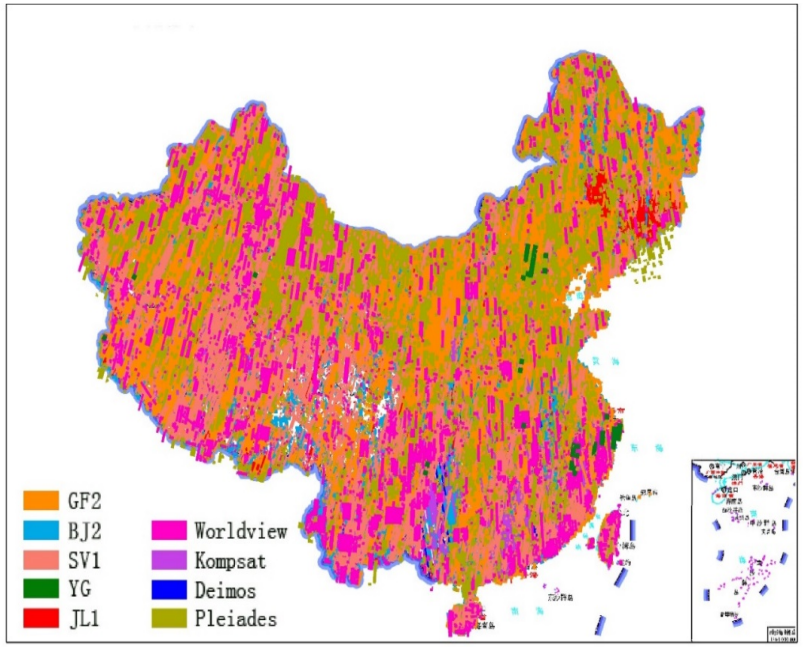




Natural Resources Satellites Application Services

■ 3rd National Land Survey



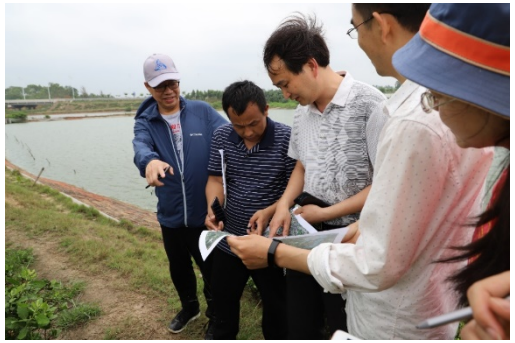


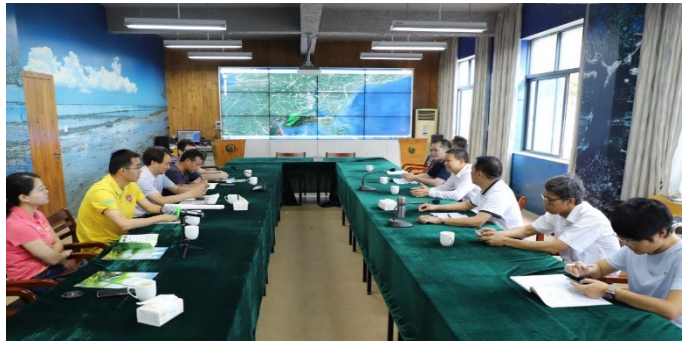
- ✓ In 2018, We have carried out that country-wide lands (islands included) images with Sub-meter image data.
- ✓ Image acquisition has covered over 9.4 million square kilometers, over 98% coverage rate of task area .

Natural Resources Satellites Application Services

■ Mangrove Forest Monitoring

- ✓ Regular monitoring of the mangroves in China.
- ✓ Realizing resource management of mangroves.
- ✓ Protection and restoration of mangrove ecosystems.





Natural Resources Satellites Application Services

■ Emergency Response

- ✓ **Post disaster-fast satellite data acquiring planning with more than 10 satellites**
- ✓ **Data processing under emergency mode emergency product system**
- ✓ **Quick response channel under emergency mode**
  - **6 hours to receive and 1 hours to provide(push)**
  - **Daily report mechanism**

卫星遥感应急工作日报

自然资源部国土卫星遥感应用中心

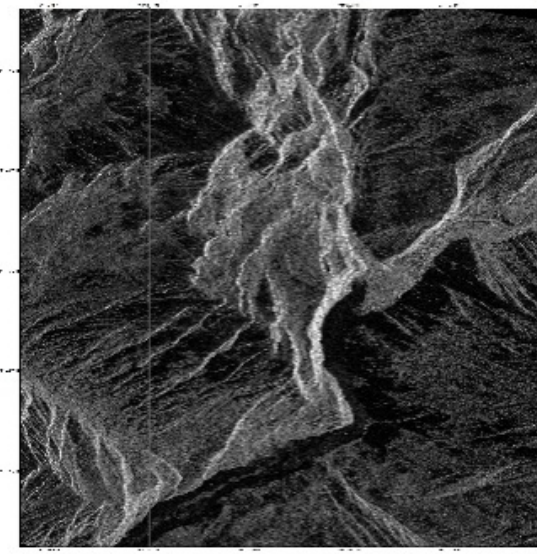
（截至2018年10月24日16:00）

任　务	2018年10月17日雅鲁藏布江西藏米林段山体滑坡卫星遥感应急服务
灾　情	林芝市米林县派镇加拉村下游5公里巴若于10月16日夜至17日凌晨发生山体滑坡堵塞雅鲁藏布江河道，形成堰塞湖，17日12时堰塞湖上游回水长度已达约15千米，蓄水体积约40米，蓄水量约1.5亿立方米，危及上下游安全。18、19日水位进一步上涨，截至10月20日9时，雅鲁藏布江堰塞湖坝前水位已下降56米左右，堰塞湖蓄水量约为1亿立方米，安全风险大大减轻，水将继续降低，至20日12时，雅鲁藏布江堰塞湖河段基本恢复至正常过流状态，下游墨脱河段基本恢复常态。

灾前信息服务

卫星数据源	获取时间	处理情况	报送情况
资源三号02星	2017.12.11	已处理出图☑	电子影像已报前线指挥部，网络推送到监遥中心和西藏测绘局，纸质图已报部相关司
高分一号	2018.01.08	已处理出图☑	电子影像已报前线指挥部，网络推送到监遥中心和西藏测绘局，纸质图已报部相关司
高景一号	2017.11.07	已处理出图☑	电子影像已报前线指挥部，网络推送到监遥中心和西藏测绘局，纸质图已报部相关司

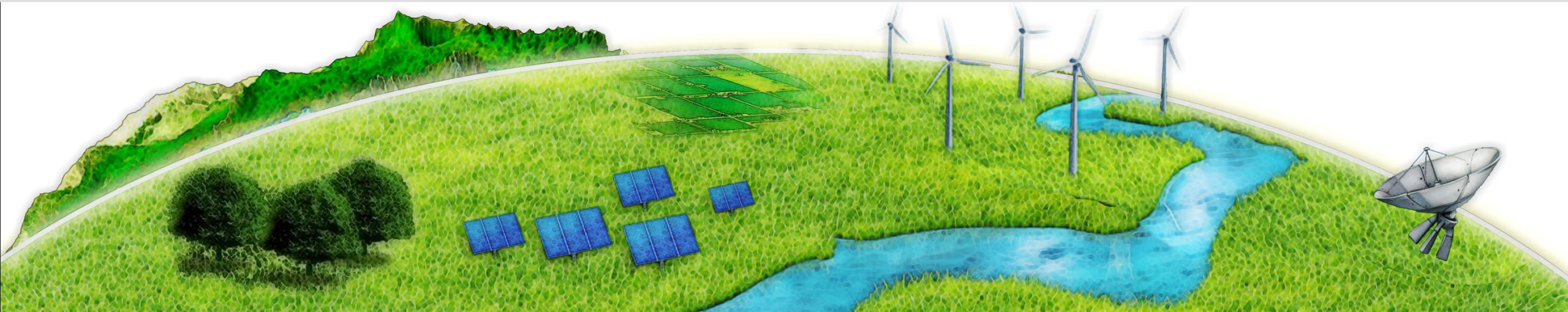
雅鲁藏布江灾后影像图



雅鲁藏布江灾后影像图

04

Data sharing

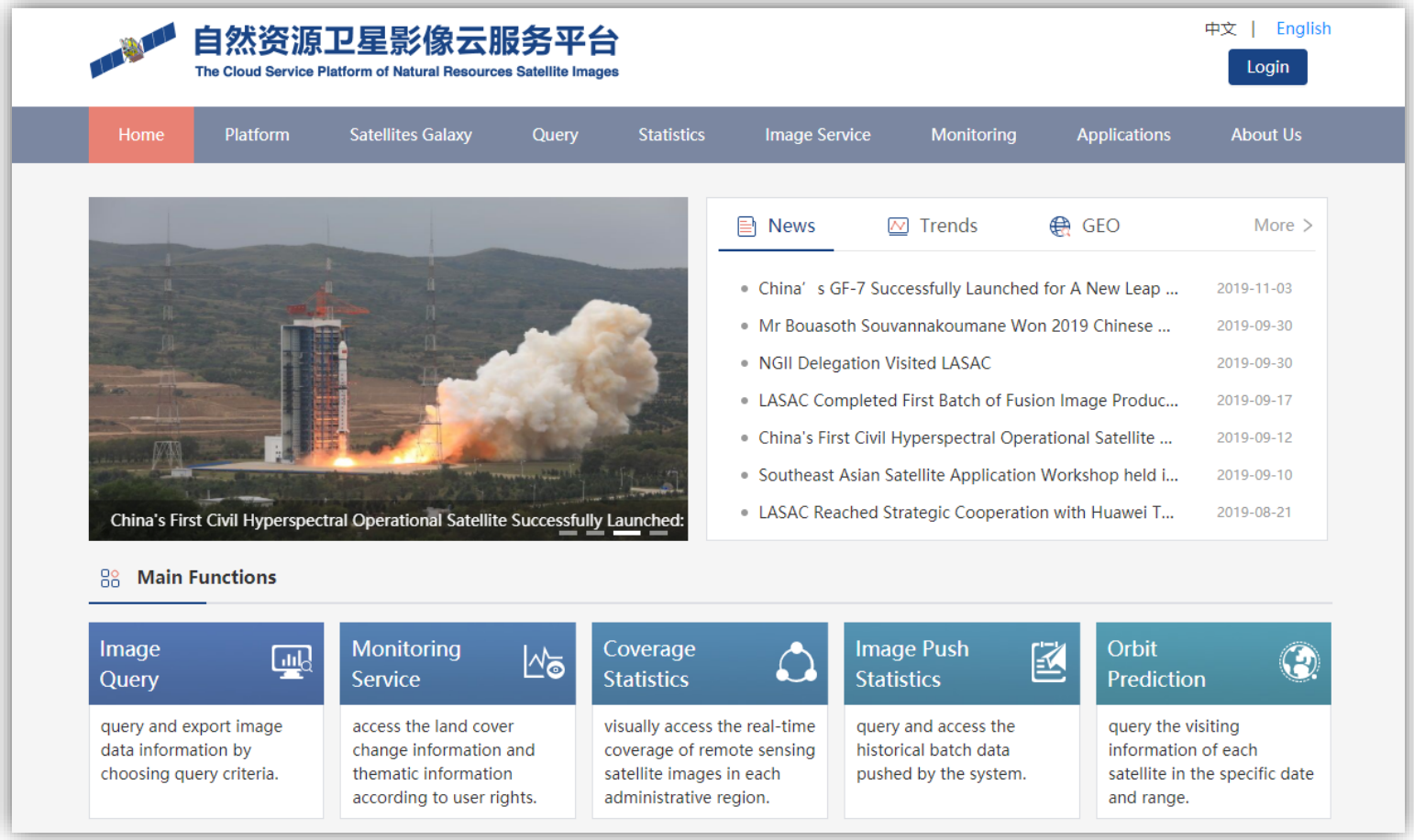


The Cloud Service Platform of Natural Resources Satellite Images

1. Various data resources — Integrate various satellites series
2. Various products — SC images, DOM, DSM Information services
3. Time efficiently — T+1 ; 7×24 Non-stop
4. Cost effective — Differ from traditional mode Reduce the cost for equipment, man power and time
5. Flexible customization — According to the needs to do secondary development

The Cloud Service Platform of Natural Resources Satellite Images

- ✓ **Image query:** query and export image data information by choosing query criteria
- ✓ **Monitoring service:** access the land cover change information and thematic information according to user rights
- ✓ **Coverage statistics:** visually access the real-time coverage of remote sensing satellite images in each administrative region
- ✓ **Image push statistics:** query and access the historical batch data pushed by the system
- ✓ **Orbit prediction:** query the visiting information of each satellite int the specific data and range



http://sasclouds.com/english/home/

Data Sharing

■ The Cloud platform sharing data for other countries

Principles:

- ✓ **Principle of territorial management: only pushing its own territorial data to the associated partner country.**
- ✓ **Principle of non-profit: the data only being used in the national non-profit activities of the partner country.**
- ✓ **Pushing the archived data mainly based on the sensor-corrected image products of ZY-3-01 and ZY-3-02.**
- ✓ **Promising the data sharing free of charge within 5 years to achieve full coverage of territory of the associated partner country.**

Data Sharing

- Provided thousands of scene images for more than 60 countries
- Signed MOU and agreement with more than 20 countries

Sample data providing

- Iran
- Japan
- Korea
- Laos
- Thailand
- Mongolia
- Nepal
- Pakistan
- Malaysia
- Vietnam
- England
- U.S.A
- France
- German
- Turkey
- Italy
- Switzerland
- Sultan
- Brazil
- Israel
- GEO
- AOSIS

Exploration engineering

- Argentina
- Angola

Environmental monitoring

- Australia

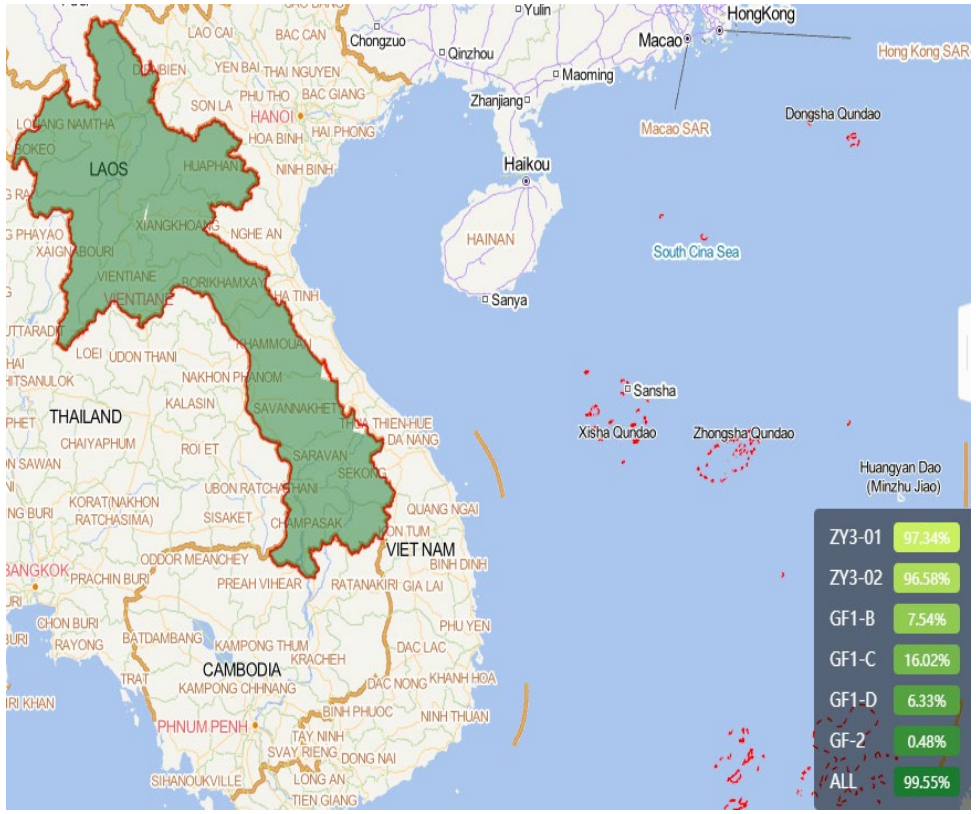
Data sharing

- 15 Nodes of the cloud service platform of Natural Resources satellite images as of now.
- Total volume of data delivered has been over 7TB, 17,000 scenes.

15 Nodes	
Austria	UK
Mongolia	Cambodia
Ghana	Jordan
Kenya	Laos
Bangladesh	Sri-Lanka
Thailand	Nepal
Uganda	Venezuela
Norway	

Data sharing

- **Platform Construction Application**

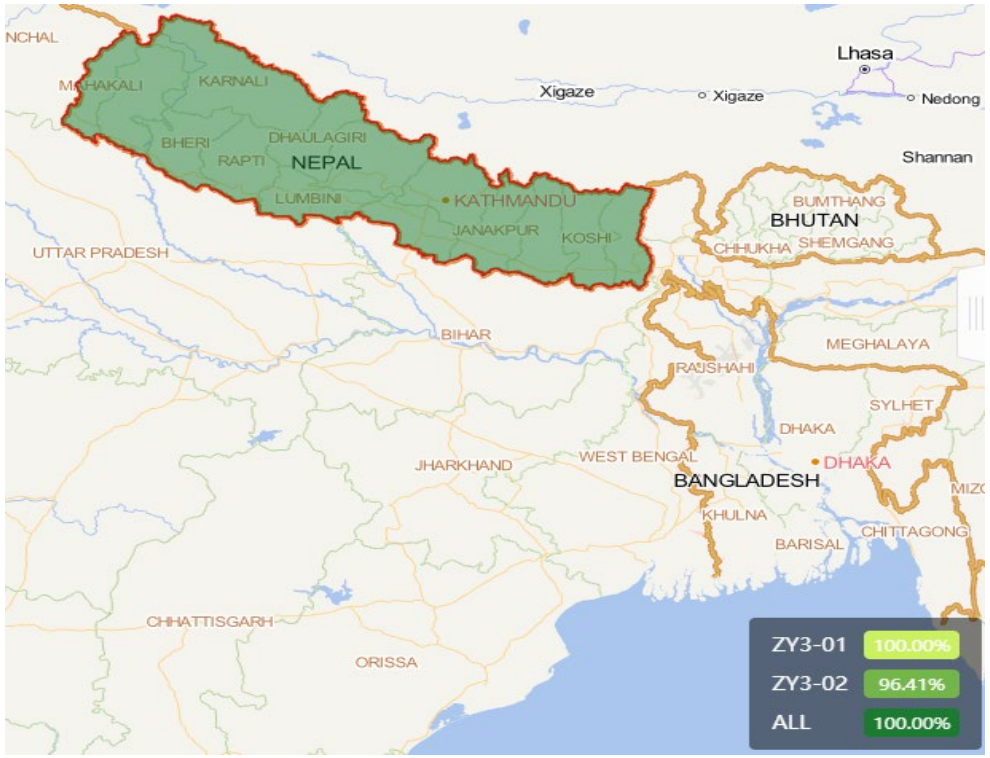


Laos

	Laos
Launch time	February , 2017
Image data	2675
Data size	1190.69G
Coverage rate	99.55%

Data sharing

- **Platform Construction Application**

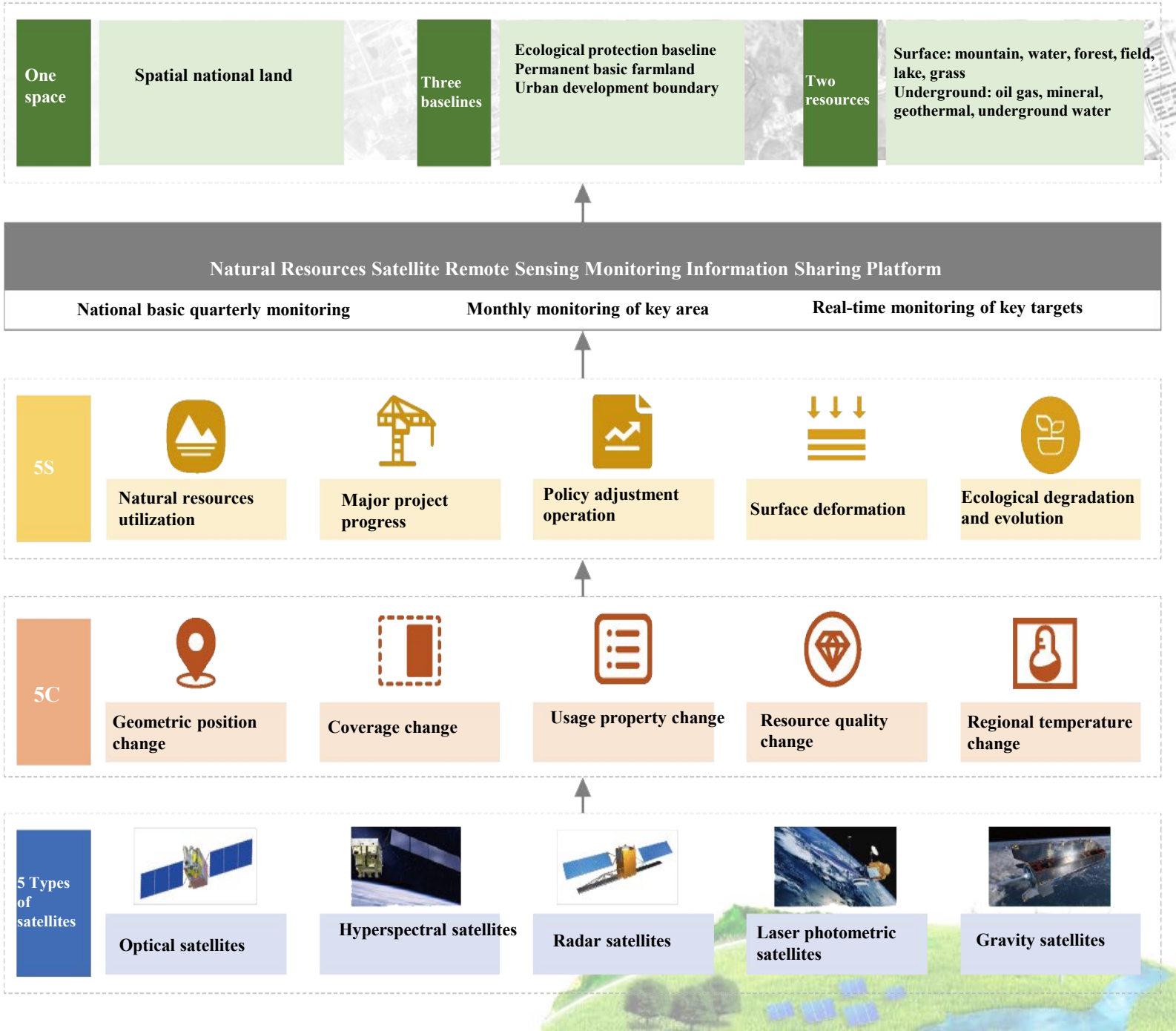


Nepal

	Nepal
Launch time	October, 2018
Image data	2698
Data size	1253.80G
Coverage rate	100%

Summary

Business Support Capacity



Thanks for your attention