RESEARCH ON CHINESE NATURAL DISASTER REDUCTION SYSTEM OF SYSTEMS (CNDRSS)

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OUTLINE

- 1 Why build CNDRSS?
- 2 How to build CNDRSS?
- 3 Case analysis
- 4 CNDRSS program plan
- 5 Final remarks

1 Why build CNDRSS?

1.1 The Relationship Between Natural Disasters and Human Beings

primitive society

Agricultural society

industrial society

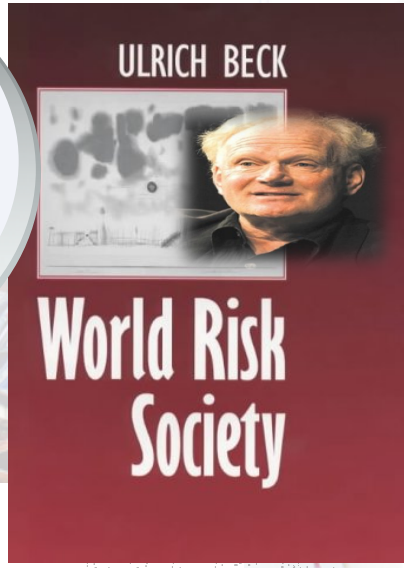
post-industrial society

Risk Society

History of the development of human

◆How to better respond to natural disasters has been an important social issue and the main task of GEOSS .

human development.



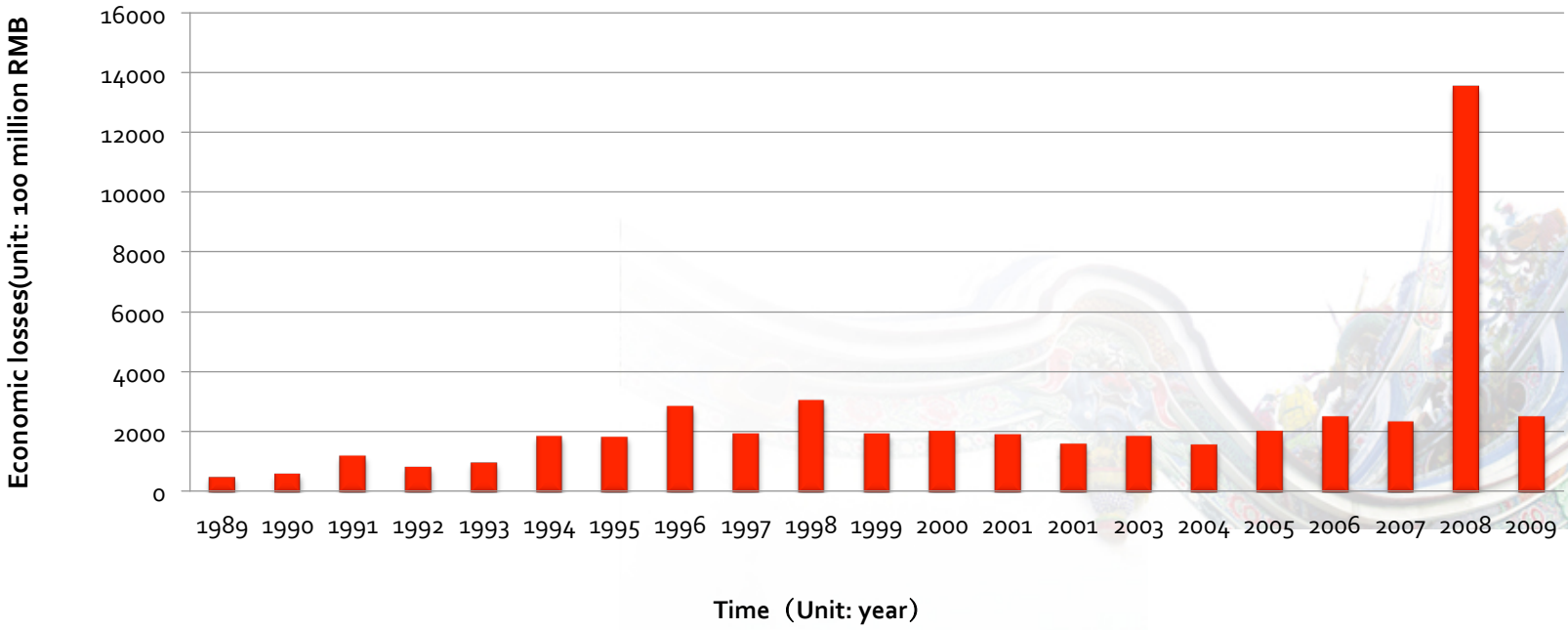
1.1 The Relationship Between Natural Disasters and Human Beings - Disaster trends

- Global change leads to higher frequency of natural disasters.
- Active tectonic plates movements cause the increasing frequency and intensity of solid earth disasters
- Tremendous pressure on the global ecological environment, caused by economic globalization, which is beyond its carrying capacity, has also led to frequent disasters.

1.2 The Characteristics of Chinese Natural Disasters - Heavy Losses

During 1990 and 2008, natural disasters in China annually caused that about 300 million people were affected and that the direct economic loss was more than 200 billion RMB. In 2008, as a result of great snow disaster in the South and earthquake in Wenchuan, the direct economic loss was over 1200 billion RMB.

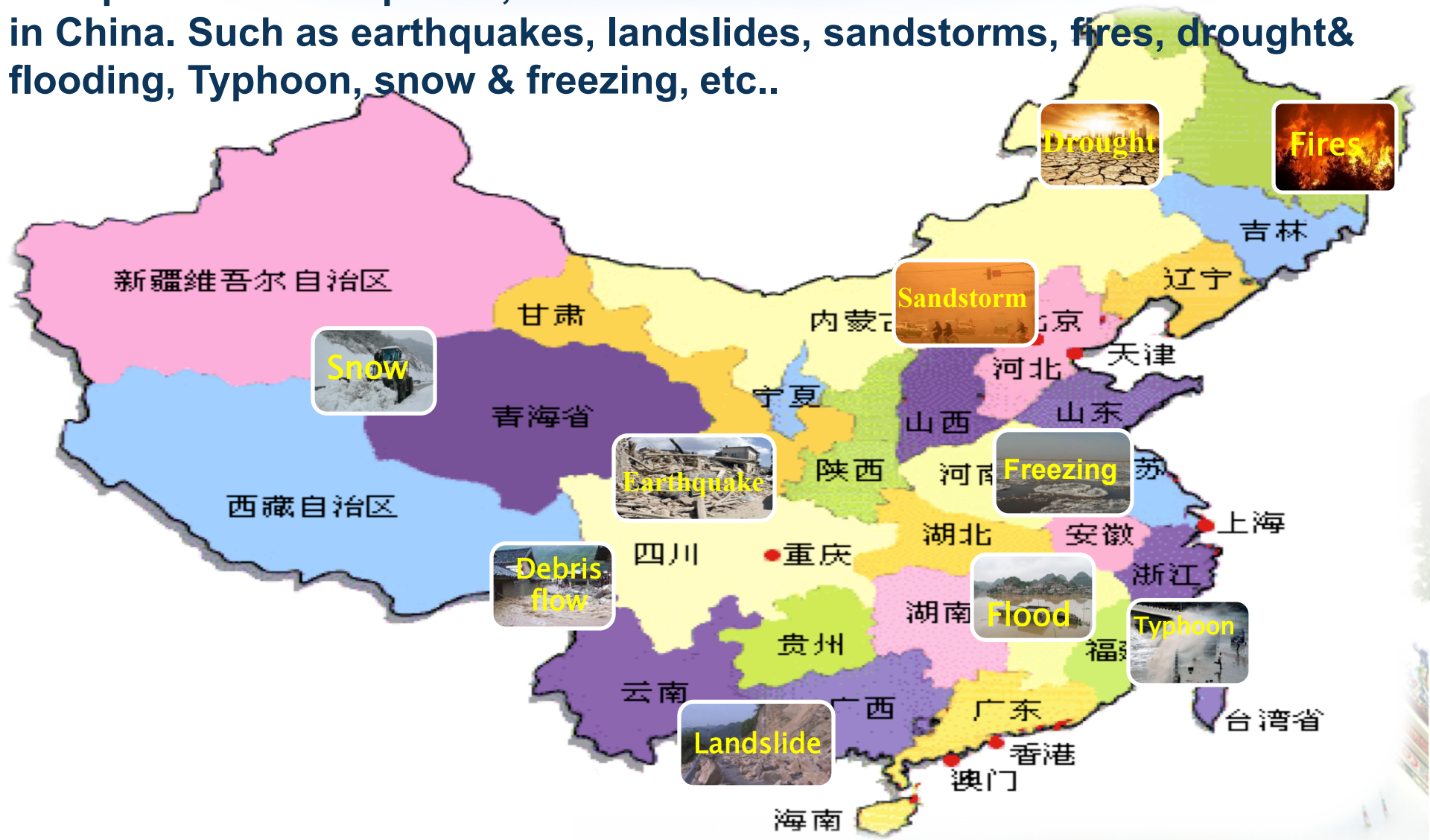
China's direct economic losses of natural disasters in recent years



Data source: National Ministry of Civil Affairs

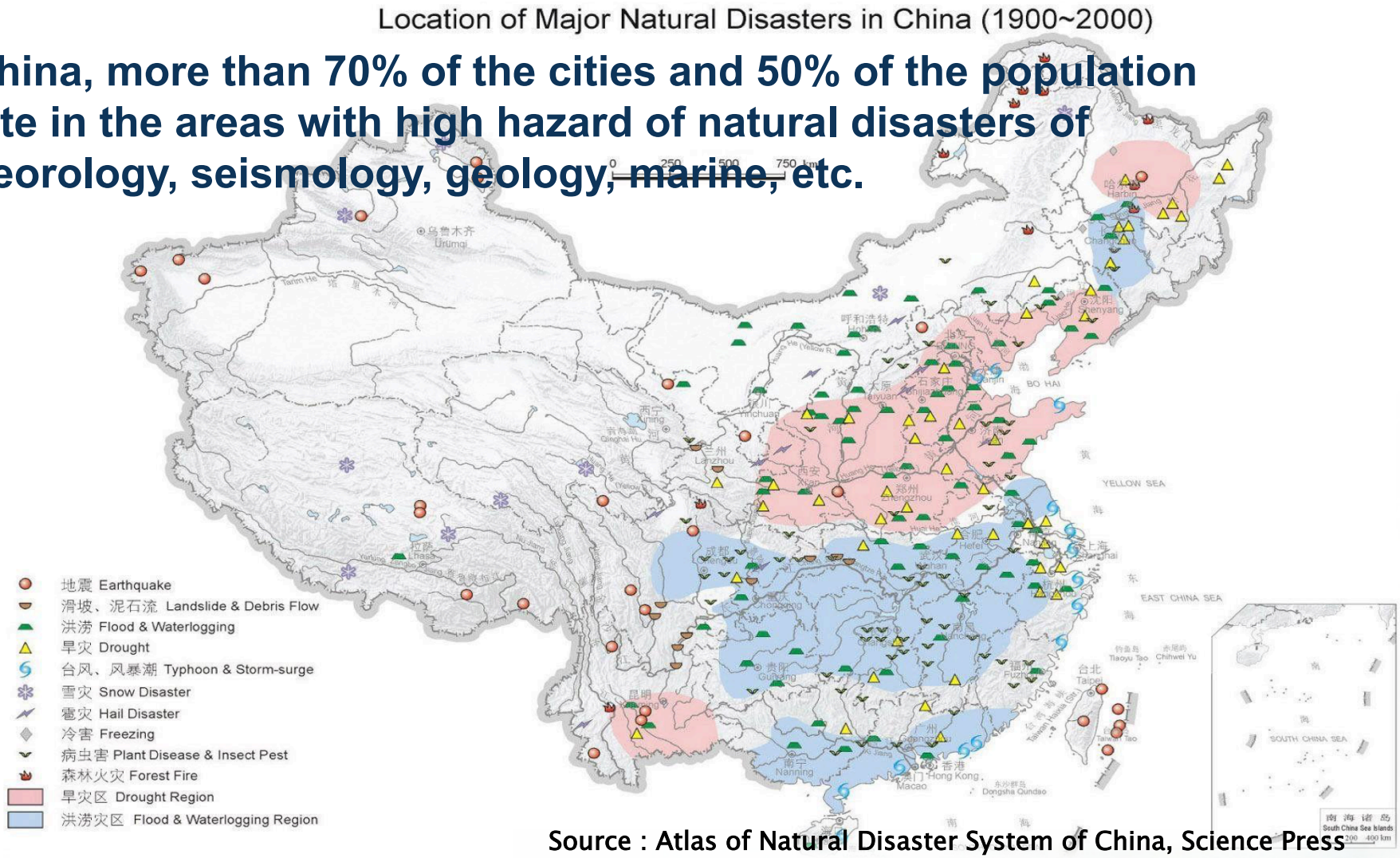
1.2 The Characteristics of Chinese Natural Disasters - Disasters diversity

Except volcanic eruptions, all kinds of natural disasters have occurred in China. Such as earthquakes, landslides, sandstorms, fires, drought& flooding, Typhoon, snow & freezing, etc..



1.2 The Characteristics of Chinese Natural Disasters - Wide geographic distribution

In China, more than 70% of the cities and 50% of the population locate in the areas with high hazard of natural disasters of meteorology, seismology, geology, ~~marine,~~ etc.

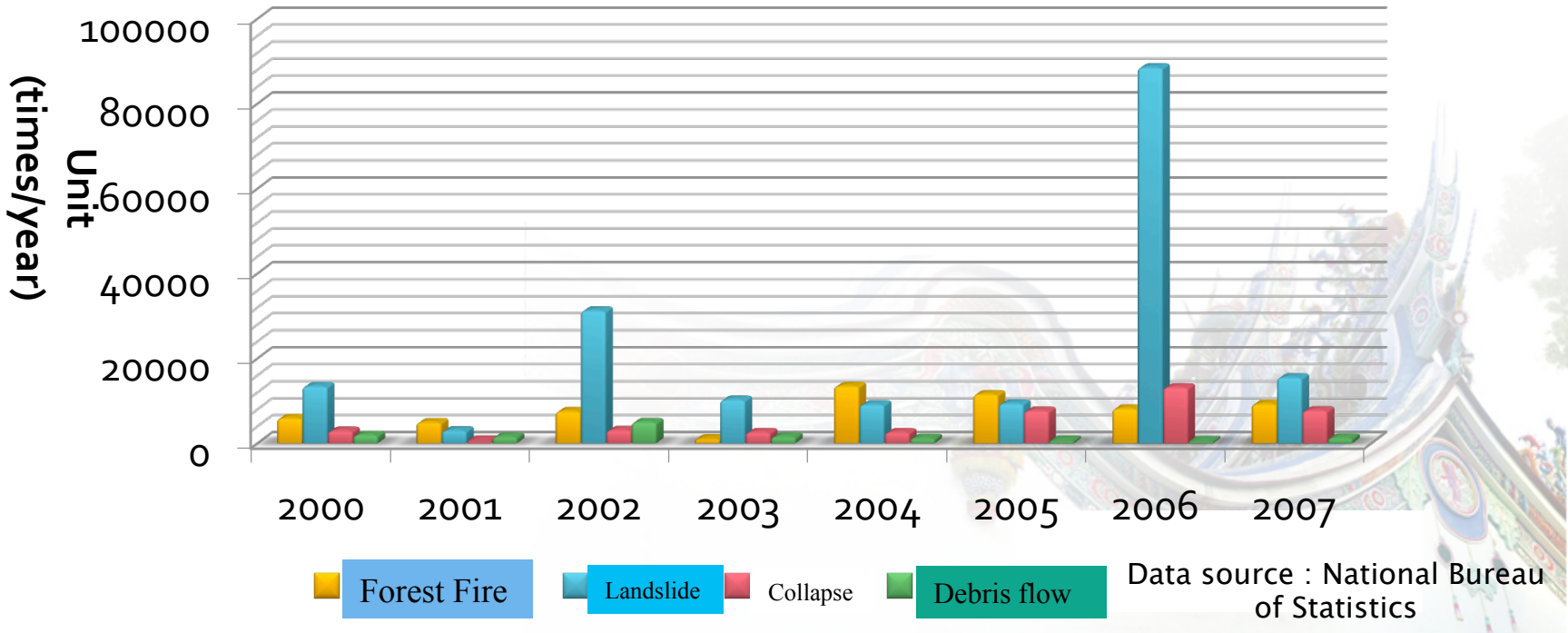


Source : Atlas of Natural Disaster System of China, Science Press

1.2 The Characteristics of Chinese Natural Disasters - High Frequency

Due to the influence of monsoon, meteorological disasters occur frequently in China. In addition, China is also the country with most mainland earthquake. Especially, in 2006, landslides occurred over 80,000 times in China.

The frequency of several natural disasters in China from 2000-2007



1.3 The Current Situation of Chinese Disaster Reduction - The available operational systems

The 12 Twelve Integrated Observation Systems

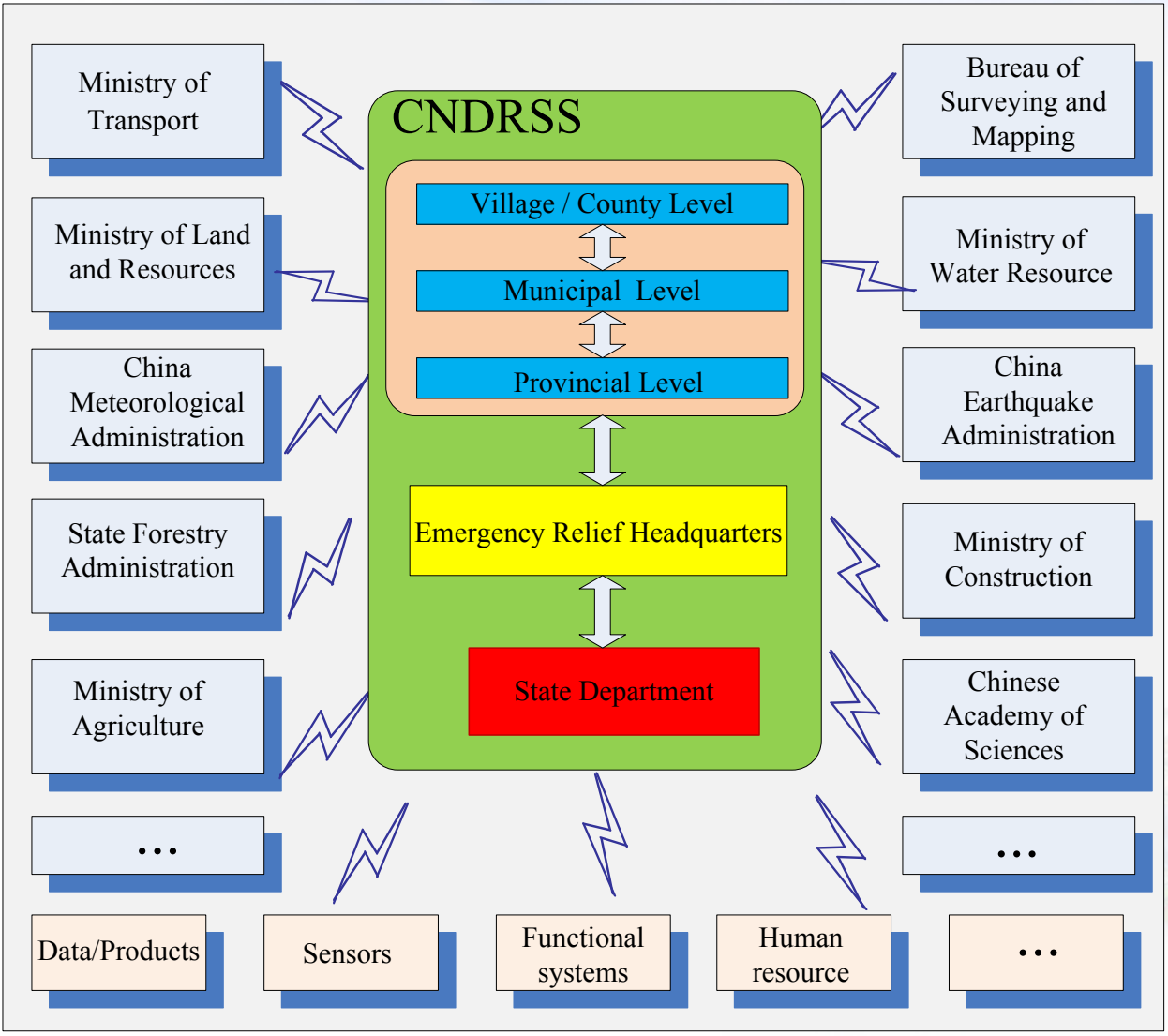
- Comprehensive Information on Disaster & Obs.System
- Integrated agricultural observing system
- Integrated hydrological monitoring system
- Integrated land observing system
- Integrated observing system in cities/townships
- Integrated meteorological monitoring systems
- Seismological &Geophysical monitoring system
- Integrated environment monitoring system
- Integrated forest &Ecological monitoring system
- Basic ocean monitoring system
- Integrated surveying and mapping information platform
- Scientific research-oriented monitoring system

1.3 The Current Situation of Chinese Disaster Reduction - The Existing problems

- Sensors, data and information cannot be shared and integrated sufficiently
- "Rich of data, barren of information, lack of knowledge"
- Collaboration among different ministries/institutions is insufficient.
- Stable and efficient channel for disaster information transmission among stricken areas, related ministries and headquarters cannot be guaranteed.

We need to integrate multiple disaster related systems among different ministries/institutions by federated databases and interoperability and to use the sensor web to integrate airborne, space borne and in-situ observations through a web service.

1.4 Integration of Multiple Systems is the Resolution - The Task of CNDRSS



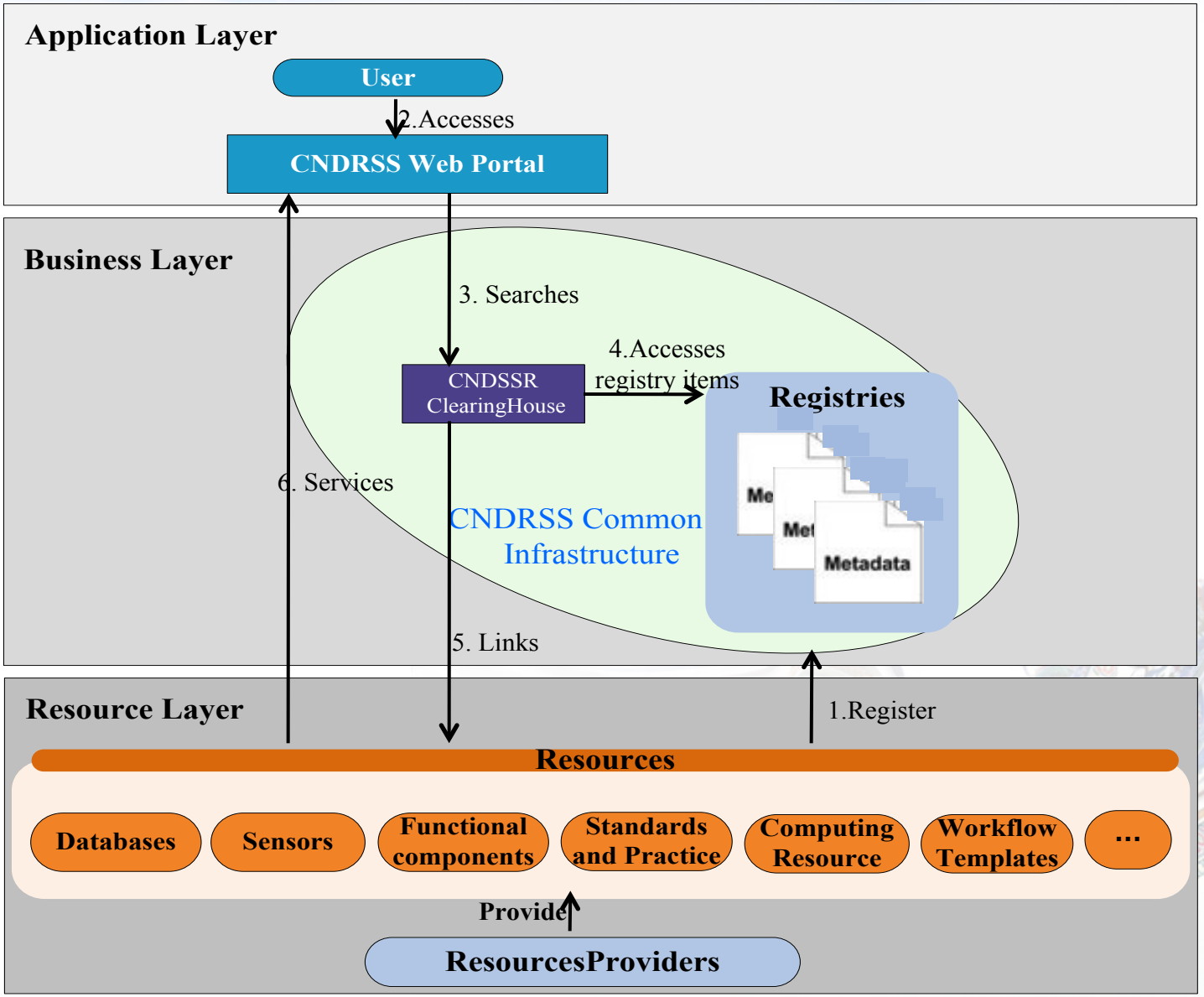
- Sensor web available for real-time or near real-time use.
- Full and open exchange of data, service and other resources;
- Effective mechanism and platform for the collaboration of various ministries;
- Timely and rapid delivery of disaster data and information;

2 How to build CNDRSS?

2.1 The Design Consideration of CNDRSS - Integration among different ministries through federal database and interoperability

- ✓ Geographic Distribution
- ✓ Interoperability
- ✓ Independence
- ✓ Flexibility

2.2 The Architecture of CNDRSS



Earth observation satellites in China

- Meteorological Satellite
  - Polar Orbit FY-1 A,B,C,D FY-3A,3B 6
  - Geo-stationary FY-2A,2B , 2C,,22E 5
- Marine Satellite HY-1A,1B ,HY 2A 3
- Resource Satellite (CBERS 01,02A,B,;ZY-2a,b c; RS1-26) 32
- Communication Satellite 11
- Navigation Satellite Beidou 19
- Return Land Satellites 17
- Scientific experiment Satellites 18
- Spacecraft SZ –1,2,3,4,5,6 ,7,8,9 9
- HJ satellites A ,B,C 3
- Mapping Satellite ZY3， High Resolution GF-1,2,3 4

Four EO satellite series in China

Satellite Type	Satellite	Payload	Spectral ranges	Spatial resolution (m)	Swath width (km)	Revisit rate (d)	Launch time
Resource -Series	CBERS-1-01 /02	CCD/WFI	VIS/NIR	20/258	120/890	26/5	14.10.1999/ 21.10.2003
		Infrared Scanner	VIS/SWIR/TIR	78/156	120	26	
	CBERS-1-01 /02B	CCD/WFI	VIS/NIR	20/258	113/890	26/5	29.10.2007
		High-Resolution Camera	VIS	2.36	27	104	
	ZY-3-01	CCD	VIS/NIR	6/2.1	52/51	59/5	09.01.2012
		Forward/Back-looking Camera	VIS	3.5	52	59/5	
Environment -Series	HJ1-1A	CCD/Hyperspectral Imager	VIS/NIR	30/100	700/50	4	06.09.2008
	HJ1-1B	CCD	VIS/NIR	30	700	4	
		Infrared Multispectral Camera	IR	150/300	720	4	
	HJ-1C	Synthetic Aperture Radar	-	5 (single look) * 20 (4 looks)	40-strip mode/ 100-scan mode	4	-
Meteorological - Series	FY-1A/B	MVISR	VIS/NIR/TIR	1100/4000	2860	-	06.09.1988/03.09.1990
	FY-1C/D	MVISR	VIS/IR	1100/4000	3100	12	10.05.1999/15.05.2002
		HEPD	-	-	-	-	
	FY-2A/B/C/	VISSR	VIS/IR	1250/5000/5760	-	30/25.5	10.06.1997/25.06.2000/
	FY-3A/B	IRAS/VISSR/MERSI	VIS/IR	17km/1100/250-1000	2800	5.5	27.05.2008/ 04.11.2010
		MWTS	EHF/U-band	15km/50-75km	2700	-	
		MWRI	X/Ku/K/Ka/W-band	15-85km	1400	-	
		ERM/SIM	UV/VIS/IR	-	-	-	
		SBUS/TOU	UV	200km/50km	-	-	
		Space Environment Monitor	-	-	-	-	
Ocean-Series	HY-1A/B	COCTS/CZI	VIS/IR/NIR	1100/250	1600/3000/500	3/1/7	15.05.2002/11.04.2007
	HY-2	Radar Altimeter	C/Ku-band	-	-	14	16.08.2011
		Microwave Scatterometer	Ku-band	-	1350/1700	1	
		SMR/CMR	C/X/K/Ka-band	-	1600	1	

Note: VIS: Visible; SWIR: Short-wave Infrared; IR: Infrared; NIR: Near Infrared; TIR: Thermal Infrared; EHF: Extremely High Frequency; UV: Ultraviolet; WFI: Wide Field Imager; IRMSS: Infrared Multispectral Scanner; MVISR: Multichannel Visible and IR Scanning Radiometer; HEPD: High Energy Particle Detector; VISSR: Visible and Infrared Spin Scan-Radiometer; IRAS: Infrared Atmospheric Sounder; MERSI: Medium Resolution Spectral Imager; MWTS: Microwave Temperature Sounder; ERM: Earth Radiation Measurement; SIM: Solar Irradiation Monitor; SBUS: Solar Backscattering UV Sounder; TOU: Total Ozone Unit; COCTS: Chinese Ocean Color and Temperature Scanner; CZI: Coastal Zone Imager; SMR: Scanning Microwave Radiometer; CMR: Calibrated Microwave Radiometer.

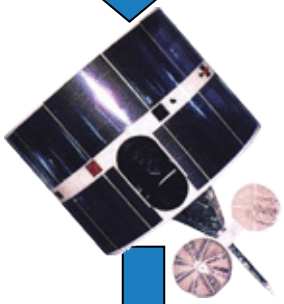
Chinese Meteorological Satellite: FY Series

Polar Orbits

Geostationary Orbits

First Generation

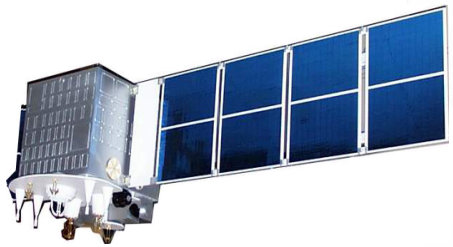
FY
- 1A
- 1B
- 1C
- 1D

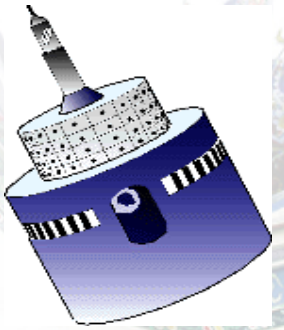


FY
- 2A
- 2B
- 2C
- 2D
- 2E

Second Generation

FY
- 3A
- 3B
- 3C
- ↓
- 3H

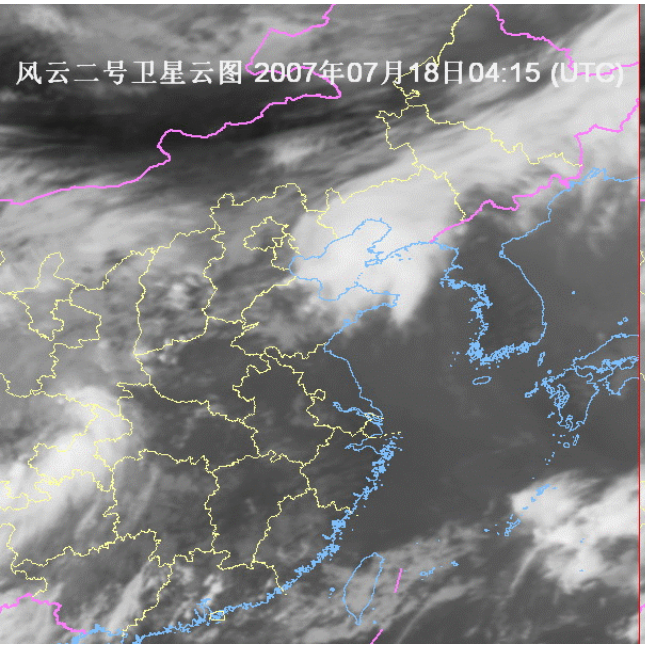




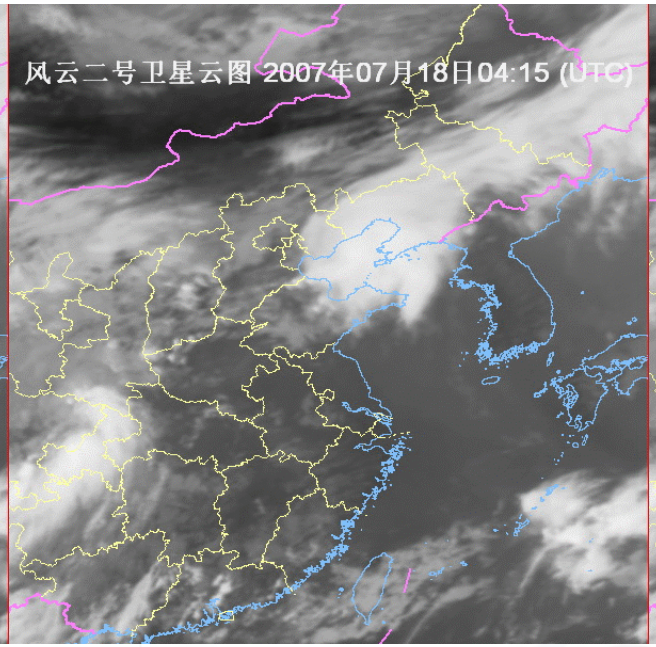
FY
- 4

FY-3A launched on May 27, 2008

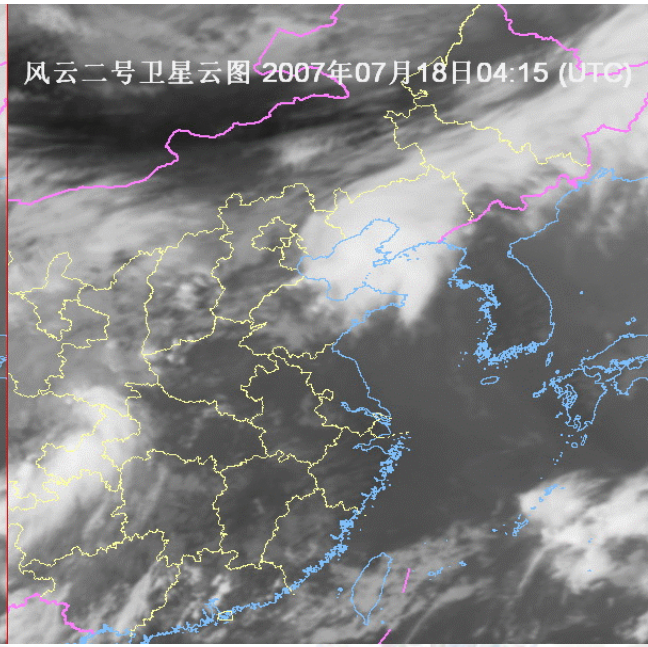
Two FY-2s observe to acquire images every 15 minutes



One hour image loop

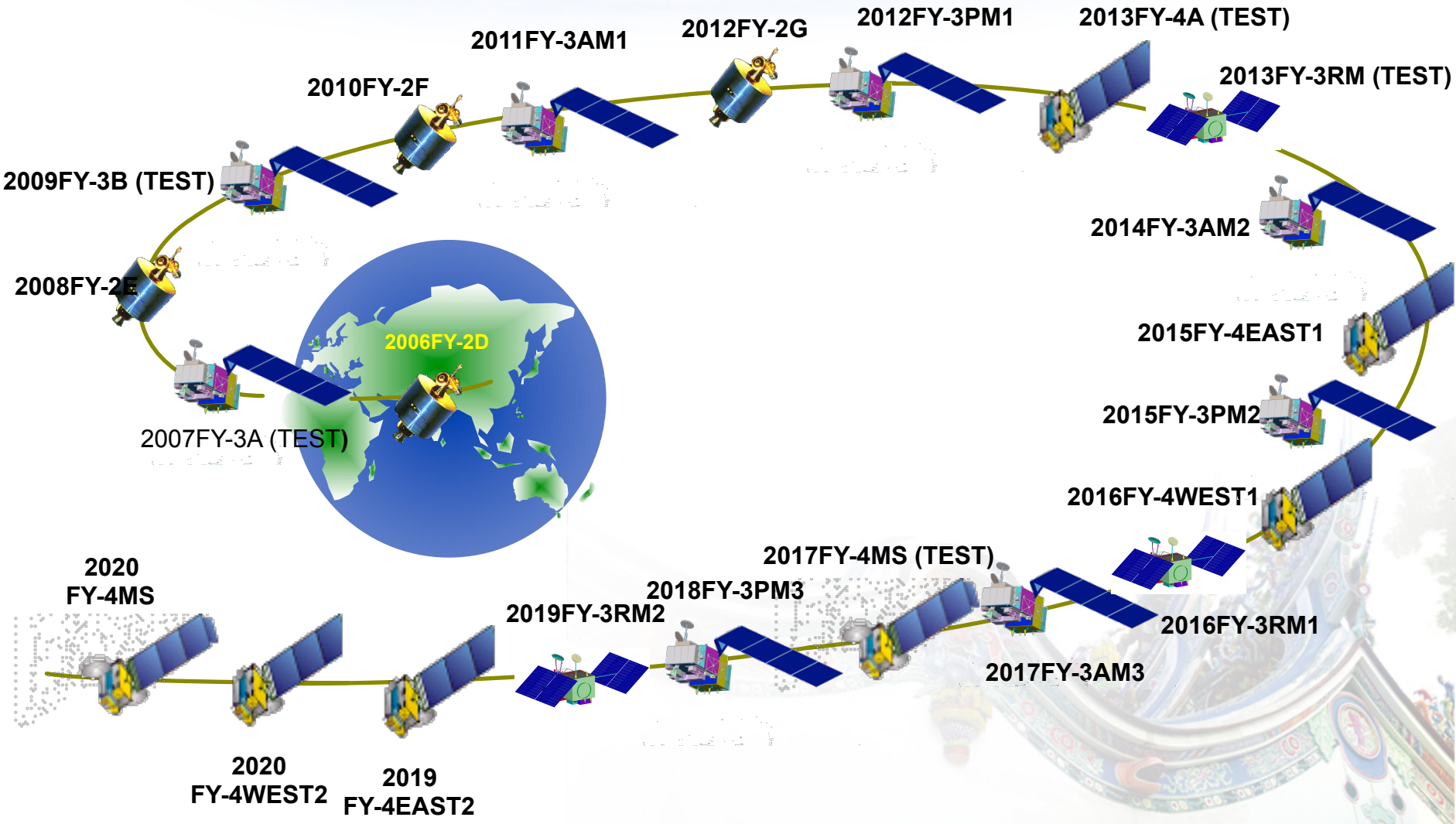


Half hour image loop



15 min image loop

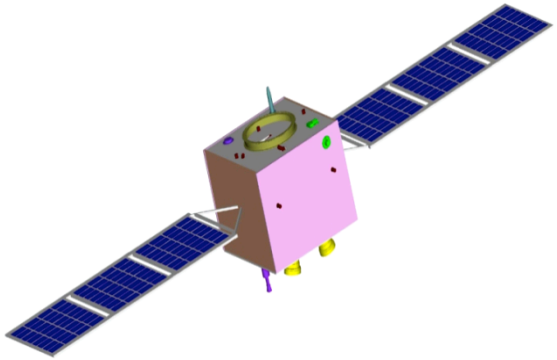
The route for future development of FY series



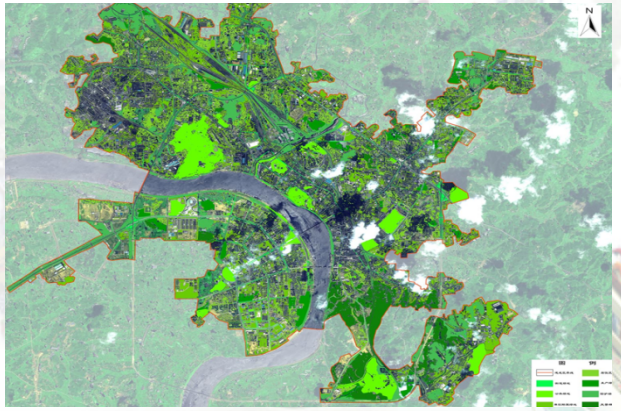
Chinese Earth Observation systems

Disaster mitigation satellite constellation

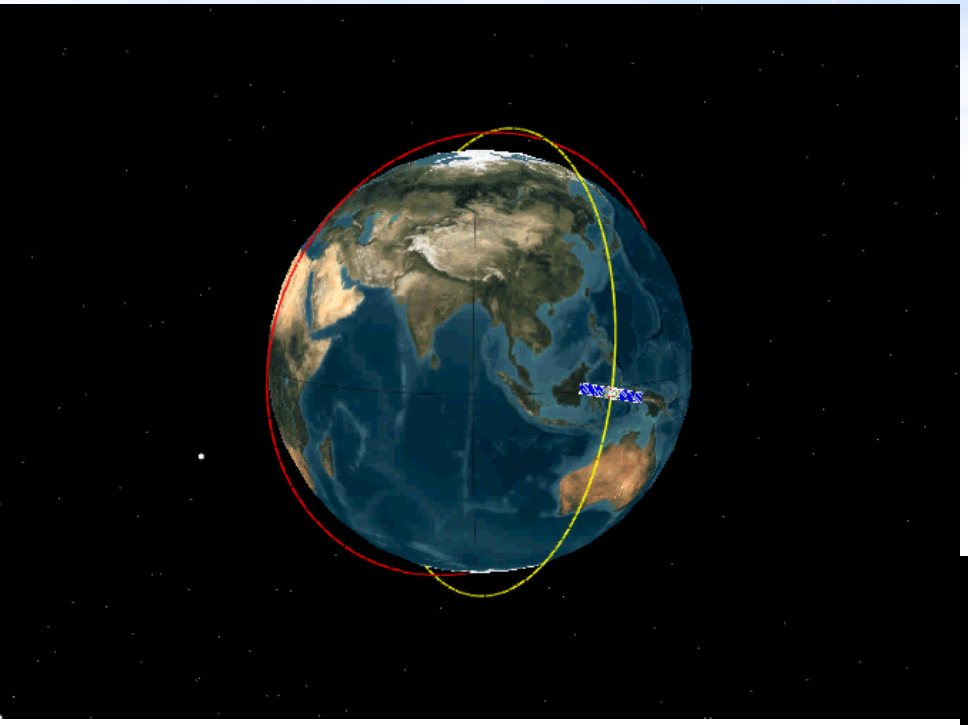
- HJ-1A （2008.09）
- HJ-1B （2008.09）
- HJ-1C （2012.09）



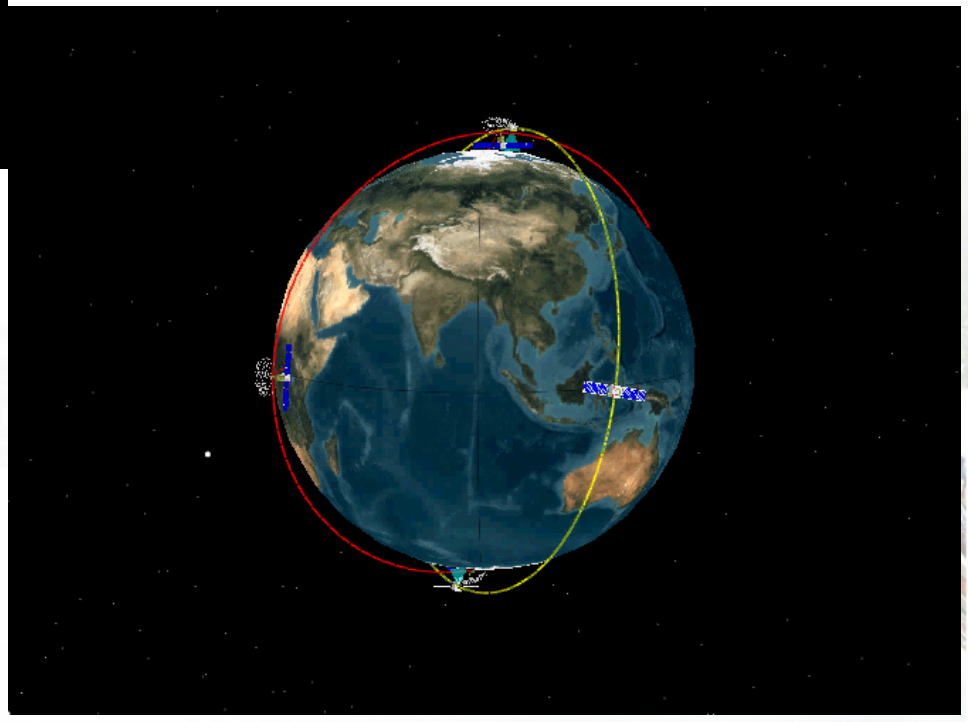
- Surface water quality and atmosphere environment monitoring
- Disposal of major environmental pollution event
- Monitoring, assessment, and emergency response of major natural disaster



Environmental & Disaster Monitoring Satellite Constellation

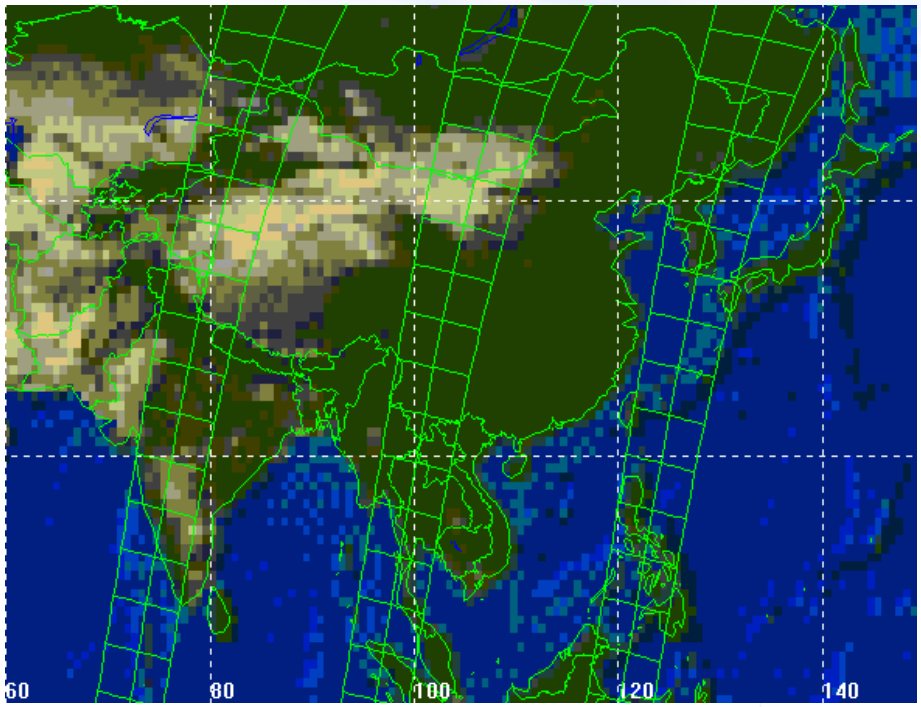


The “2+1” project includes three satellites and ground system, 2 optical and 1 SAR



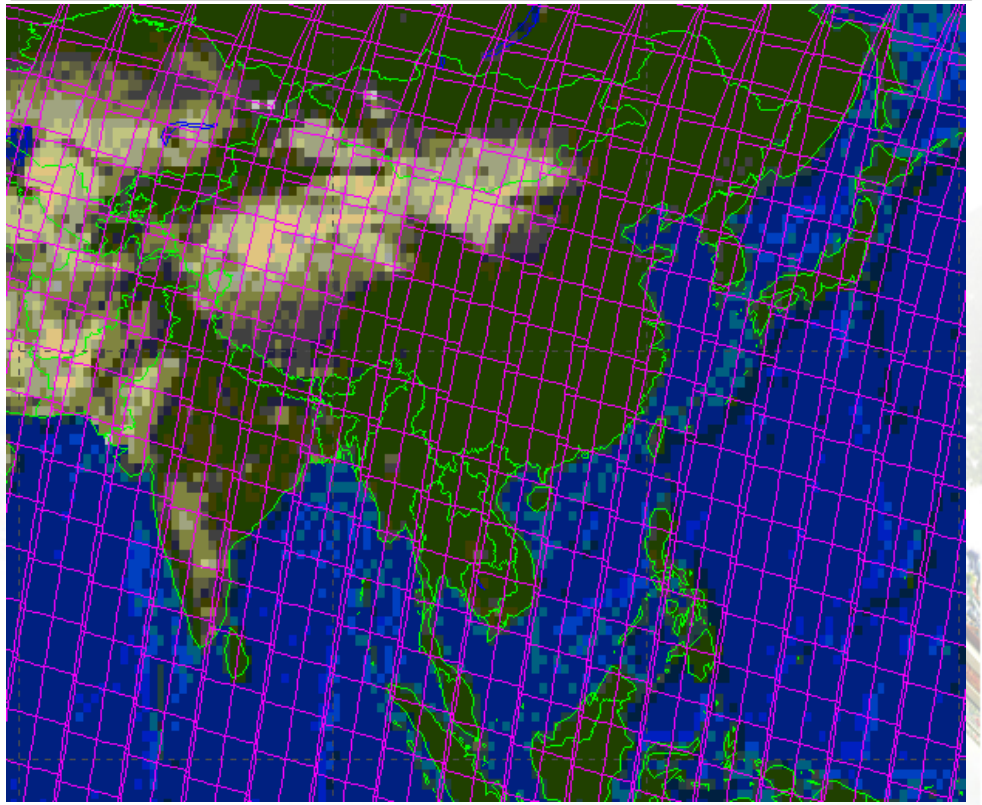
And it is expected to expand to “4+4” project. The second stage is proposed to be constructed through international cooperation

Environmental & Disaster Monitoring Satellite Constellation



24 hours coverage by 1 optical satellite

24 hours coverage by 4 optical satellites



High Resolution EOS of China

(Up to 2020)

High spatial Resolution;:

Up to 0.3m for optical and SAR Satellites;

High spectral Resolution:

Up to few nm in high spectral RS;

High temporal Resolution:

Up to 20m in Geo- stationary satellite for interested area (Staring satellite)

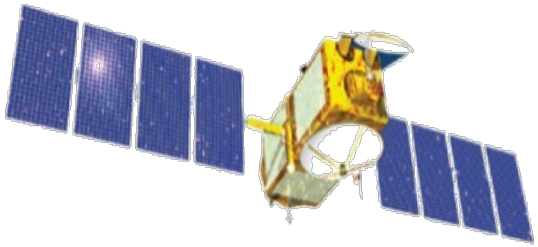
High Resolution Mapping Satellites:

Up to 0.6/2.4m three linear array CCD sensors

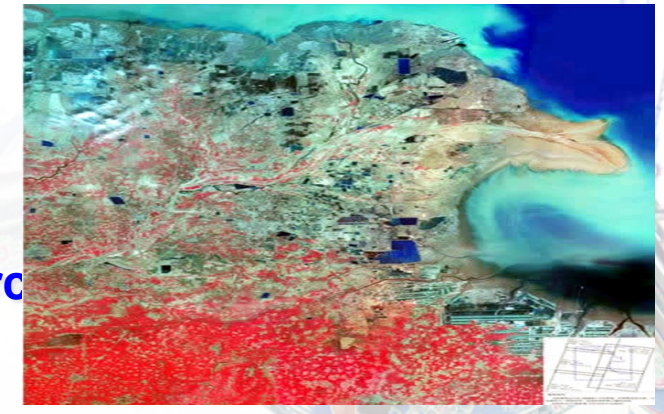
Chinese Earth Observation systems

Resources Satellite（ZY）

- ZY-1-02C （2011.12 ）
- ZY-3 （2012.01）



- Land resource survey
- Mineral resource survey
- Cities Delicacy Management
- Agriculture, forestry, water resourc monitoring
- Topographic Mapping



General Information of ZY3

ZY3 is the first Chinese high resolution, mapping satellite, mainly used for stereo mapping production in 1:50,000 scale and updating of fundamental geographic product in 1:25,000 scale and land resource investigation and change detection.

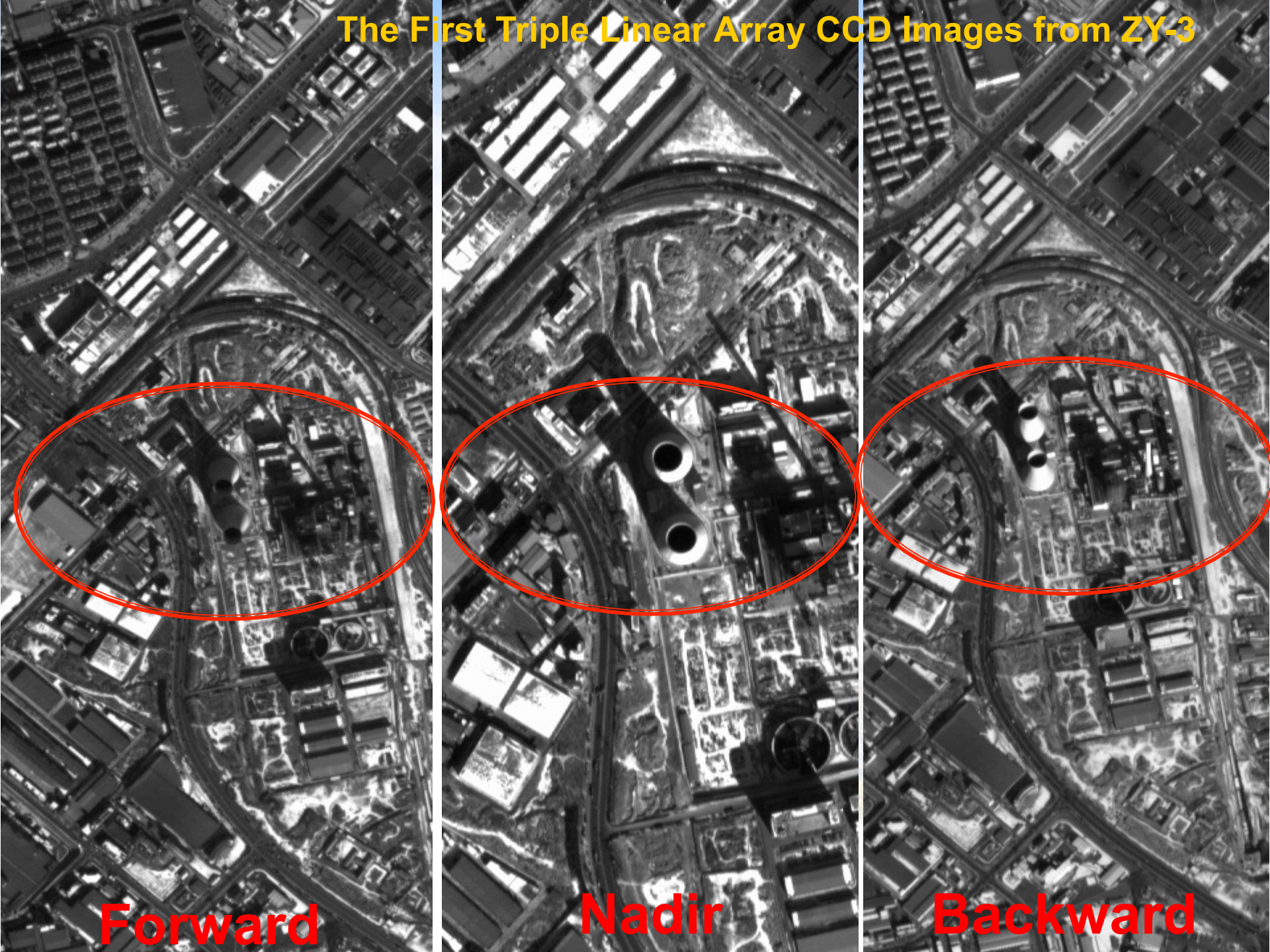
ZY3 Satellite Platform Characteristics:

- ✓The gross weight is 2,640 Kilogram;
- ✓The onboard storage is 1TB;
- ✓Average orbit altitude 505.984 Kilometer
- ✓Orbit inclination 97.421 Degree；
- ✓Local time of descending node 10:30；
- ✓Orbit period 97.716 Minutes
- ✓Revisit period 59 Days

Taiyuan Satellite Launch Site, China, Jan. 9,2012

Sensor & Parameter：Triple Linear Array CCD Sensor Parameters

Sensor Parameter	Triple linear Array Camera	Multi-spectral Camera
Spectral Range	0.5~0.8um	Blue：0.45-0.52um Green：0.52-0.59um Red：0.63-0.69um Near Infrared：0.77-0.89um
GSD	Nadir ： 2.1m Forward & Backward：3.5m	5.8m
Focus Length	1700mm	1750mm
bit number of quantization	10bit	10bit
Pixel size	Nadir : 24576PixelX7um; Forward & Backward:16384Pixel X10um	9216Pixel X 20um
Static MTF	Better than 0.2	Better than 0.2
Swath	52km	52km
Field of View	6 Degree	6 Degree


The First Triple Linear Array CCD Images from ZY-3
Forward
Nadir
Backward

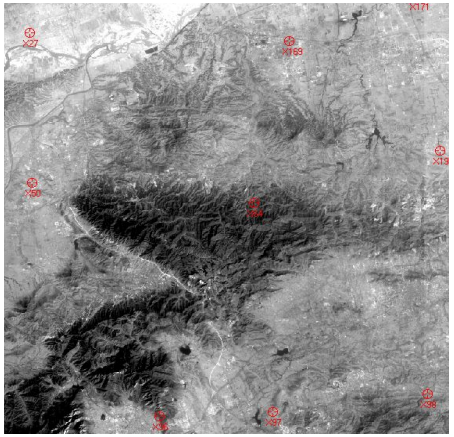
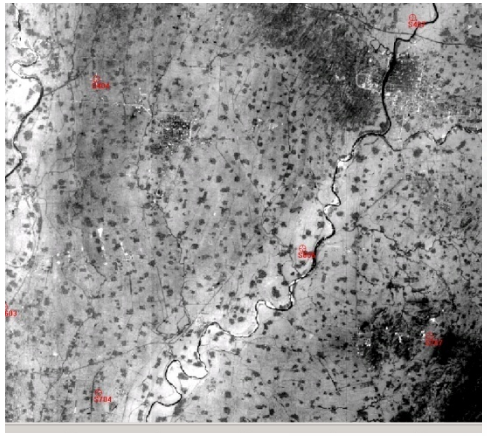
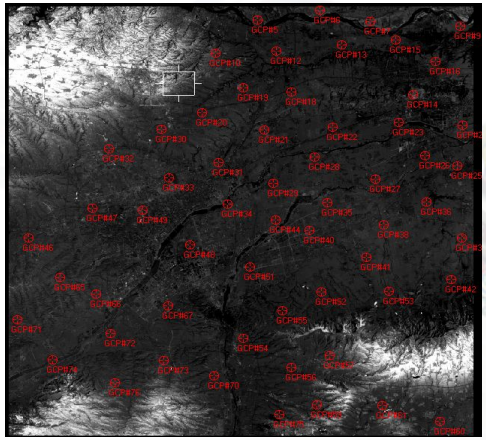
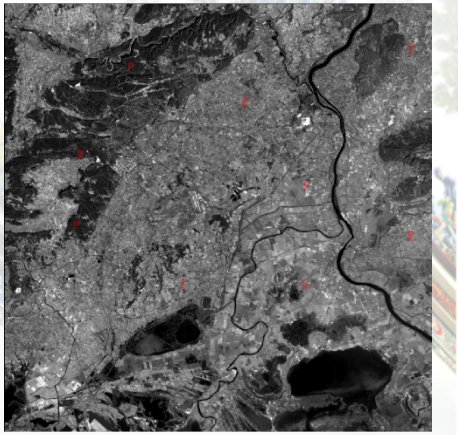

Dalian Harbor fusion image
of panchromatic and multi
spectral image 2.1m

ZY3 Image -棕榈岛- Isle of Palms

Positioning accuracy without GCP (After Calibration)

Checked by Ground GPS Control Points

No.	Aera	No. Check Points	Acquisition Date	RMSEX(m)	RMSEY(m)	RMSE(m)
1	嵩山	24	2012-02-03	5.332	5.193	7.443
2	南阳	8	2012-02-03	2.322	7.749	8.090
3	洛阳	24	2012-01-24	10.009	10.337	14.389
4	法国	9	2012-02-29	7.866	4.309	8.969

High Accuracy Geometric Processing for Optical Remote Sensing Satellite

Evaluation from Germany

DSM accuracy produced by ZY-3

Satellite	Area	RMSE in m	Mean in m	STD in m	NMAD in m
ZY-3	Gars	2.0	-1.1	1.7	1.5
	Prien	1.9	-0.1	1.9	1.6
HRS	Gars	3.5	-1.5	3.2	2.5
	Prien	3.4	-1.5	3.0	2.3

Test on Prien and Gars test areas

Euclidean distance between DSM and LIDAR reference

Good accuacy values for both sensors

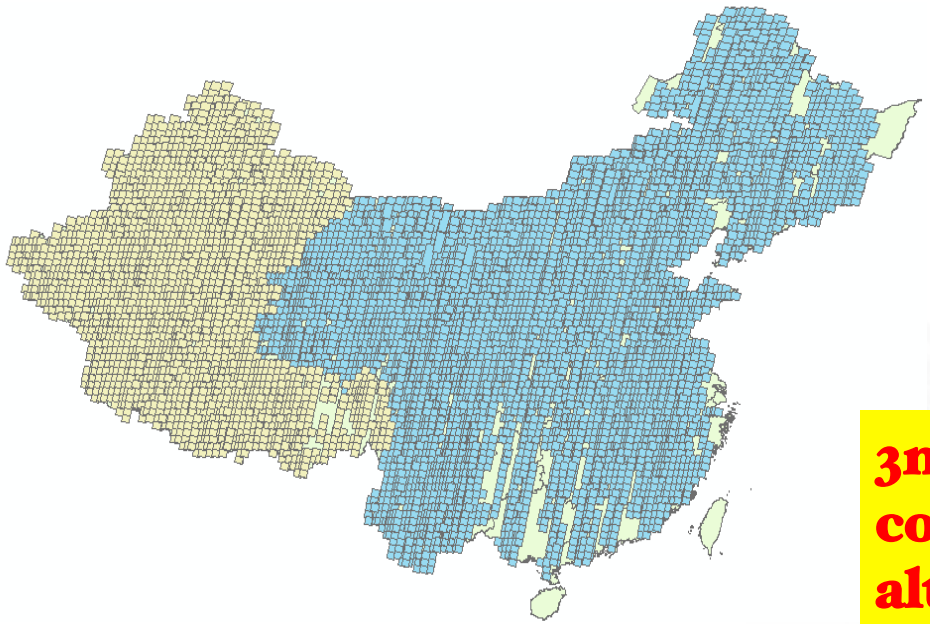
ZY-3 DSM contains detailed forest structure.

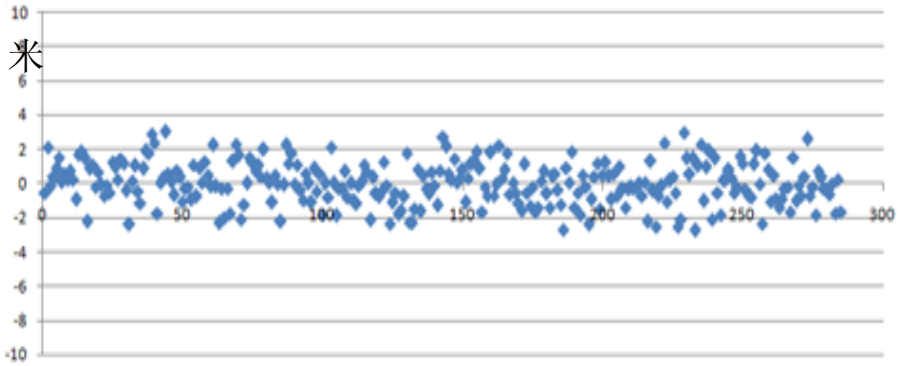
Peter Reinartz，DLR – German Aerospace Center Remote Sensing Technology Institute Photogrammetry and Image Analysis

Huge Block adjustment without GCP

Using ZY-3 three-line CCD Data（8810 Frame，20TB）

3 Million robust tie points are automatic selected from **2 Billion matched points** for adjustment. The accuracy can reach to 4-5m，which can meet the needs of global mapping with 1:50,000 scale.





3m accuracy can be reached when combining LCESat/GLAS laser altimetry data (15cm accuracy)

The Parameter of GF-1 Satellite

Launched on April 26, 2013

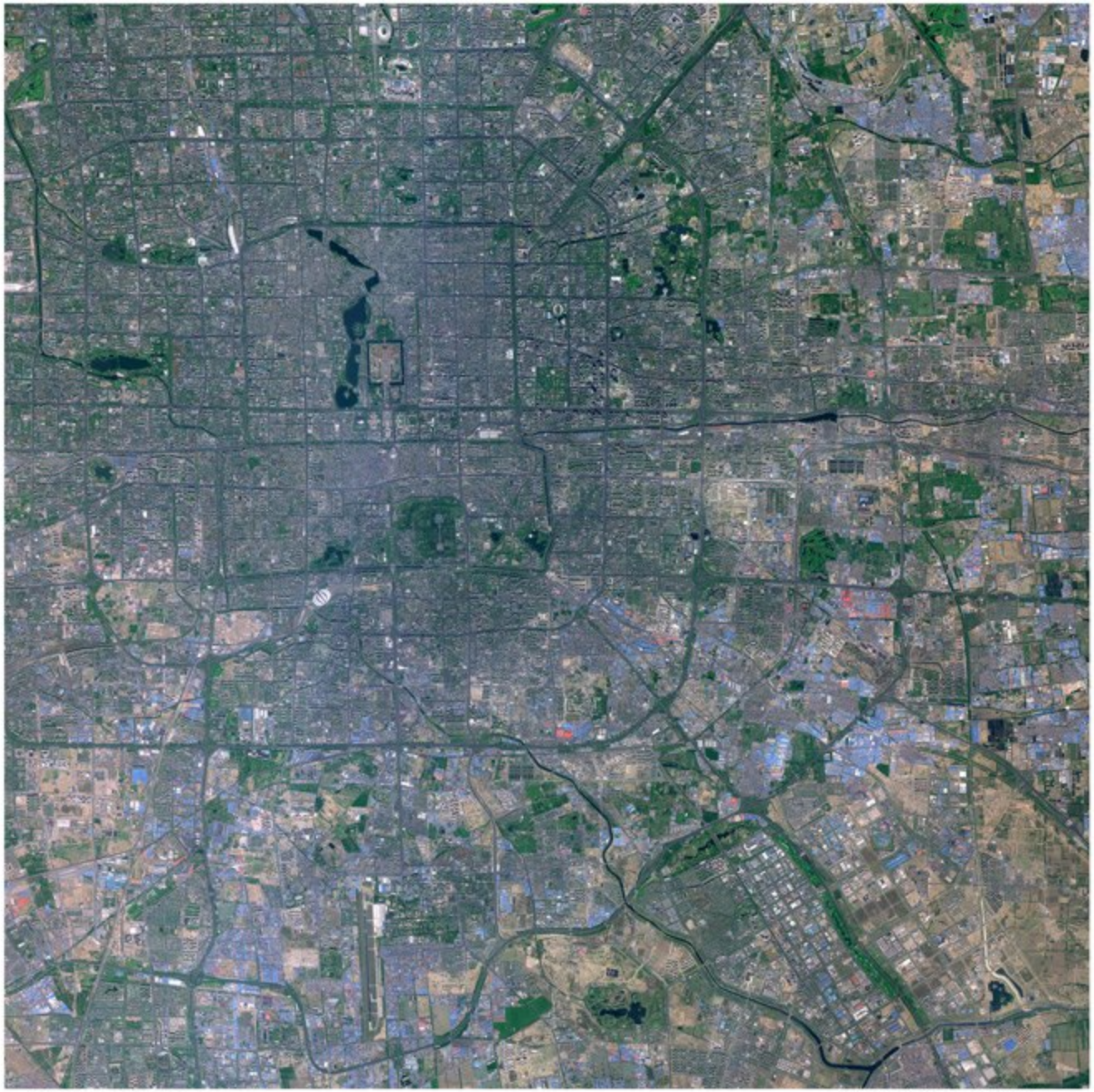
	Payload	Band No	Wave Length(μm)	Spatial Resolution(m)	Swath(km)	Orbit altitude（km）
GF 1	PAN/MUX	B01	0.50～0.80	2	60（Single） 120（Twin）	651
		B02	0.45～0.52	8		
		B03	0.52～0.60	8		
		B04	0.63～0.69	8		
		B05	0.76～0.90	8		
	MUX	B02	0.45～0.52	16	200（Single） 800（Four）	
		B03	0.52～0.60	16		
		B04	0.63～0.69	16		
		B05	0.76～0.90	16		

The main characteristics are high resolution and large swath(800KM) .It can be used in Land Resource, Environmental Protection, Agriculture, Water Resource, Forest Resource, Ocean and Disaster Management

高分一号卫星北京影像

采集日期：2
空间分辨率：

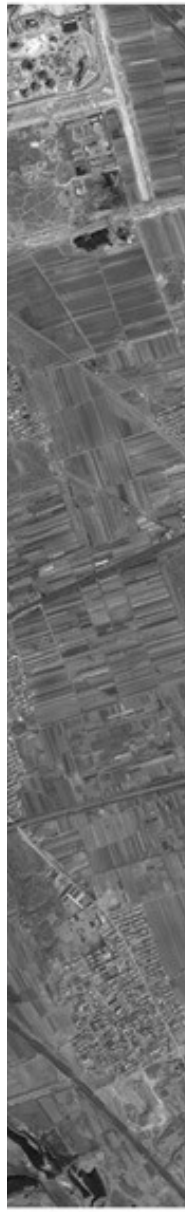
采集日期：2013年05月01日
空间分辨率：2米



采集日期：2013年05月01日
空间分辨率：8米

比例尺 1： 47 200

国防科工局重大专项工程中心
中国资源卫星应用中心 制作



大专项工程中心
星应用中心 制作

General Information of GF02

GF02 is the second high civilian remote sensing satellites, mainly used for land resources survey, monitoring and mapping, agriculture resource monitoring, disaster recovery and reconstruction, ecological testing and environment monitoring.

- **The basic parameters of platform**
  - ✓Satellite weight 2200 kg
  - ✓The average orbit altitude of 631km;
  - ✓Orbital inclination of 97.9 degrees;
  - ✓Local time of descending node 10 a.m ;
  - ✓Revisit period 69 days

Taiyuan Satellite Launch Site,China

China Taiyuan Satellite Launch Center in Long March 4B carrier rocket successfully launched remote sensing satellite, satellite into orbit, at 11:15 on August 19, 2014。

GF02 carrying load and parameters

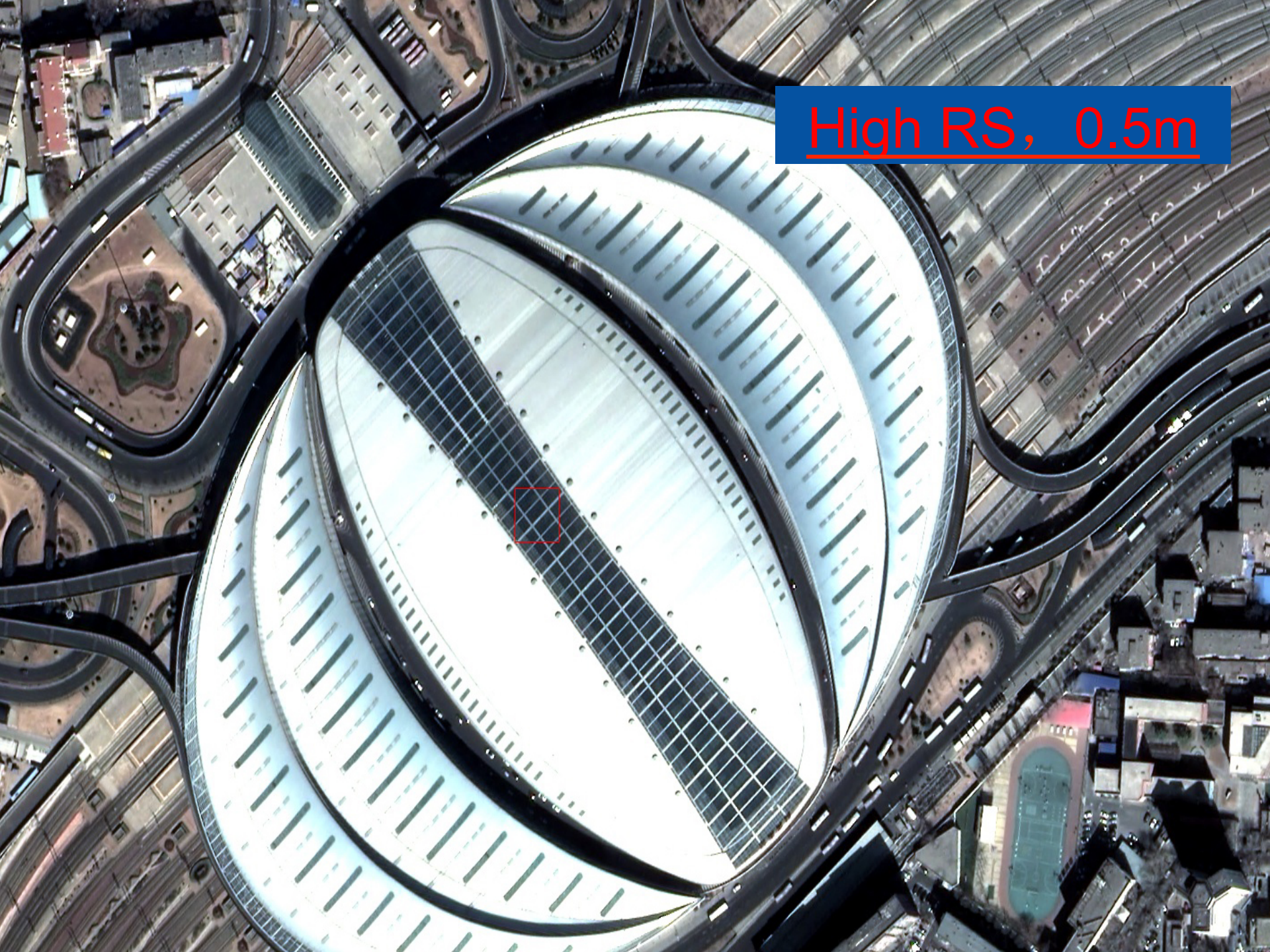
Sensor Parameter	Panchromatic camera	Multi-spectral camera
spectral range	0.45~0.90um	Blue： 0.45-0.52um Green：0.52-0.59um Red： 0.63-0.69um near-infrared：0.77-0.89um
The ground pixel resolution	0.81m	3.24m
Focal length	7785mm	7785mm
Number of quantization bits	10bit	10bit
Pixel size	30720X10um;	7680X40um
Static transfer function	Better than 0.12	Better than 0.2
Width of cloth	Single camera 23 km, 45 km dual camera	Single camera 23 km, 45 km dual camera
Angle of view	2.1 degrees(single camera)	2.1degrees(single camera)


Paris


Washington,DC


High RS， 1m


#1 (R:Band 3,G:Band 2,B:Band 1):Fusion.img
Window
0.5m/2.0m，25km


High RS，0.5m

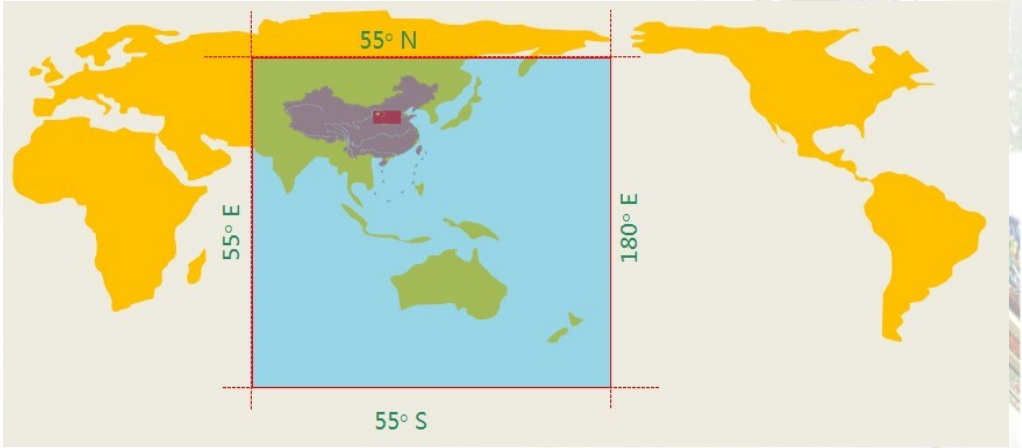
Chinese Beidou system begins to run and provides services

- Positioning accuracy: 10 meters (both in horizontal and vertical directions)
- Speed measurement precision: >0.2 m/s
- Timing Accuracy: 50 ns (one-way)
- Short message communication
- Wide Area Differential & ground-based enhancement

★ In Dec 27, 2012, Chinese Beidou system begins to run and provides services for China and the surrounding countries.

★ The State Council Information Office held a conference for Beidou system, officially announced the space control signal interface file.

Service covering area



The demo validation of Beidou ground-based enhancement system

- **Overall objective:**
  - To provide high-precision navigation and positioning service capabilities by the ground-based enhancement system.
- **Detailed objectives:**
  - Establish 6 frame network reference stations that uniformly distribute in Hubei, with an average side length of 220km.
  - Establish 24 regional reference stations, with an average side length of 60km, to provide the regional tri-band centimeter-level precision positioning service.
  - Establish a precise positioning service system to provide services for surveying/mapping, meteorology and transportation industries.

Performance analysis of real-time precise positioning

Positioning model	Ambiguity fixing success rate	Initialization time (in seconds)	Inner precision / m (Average)		Out precision / m (Average)	
			Plane	Height	Plane	Height
GPS double frequency +BDS triple frequency	100%	5.76	0.004	0.018	0.010	0.036
GPS double frequency +BDS triple frequency	80%	27.46	0.003	0.015	0.011	0.042
BDS triple frequency	83%	16.40	0.007	0.020	0.013	0.052
BDS double frequency	40%	50.78	0.003	0.015	0.014	0.045
GPS double frequency	44%	40.28	0.006	0.021	0.012	0.048

Accuracy analysis of Thailand Beidou ground enhancement system

Accuracy and performance of Beidou is better than that of GPS in the low latitude area of ASEAN such as Thailand.

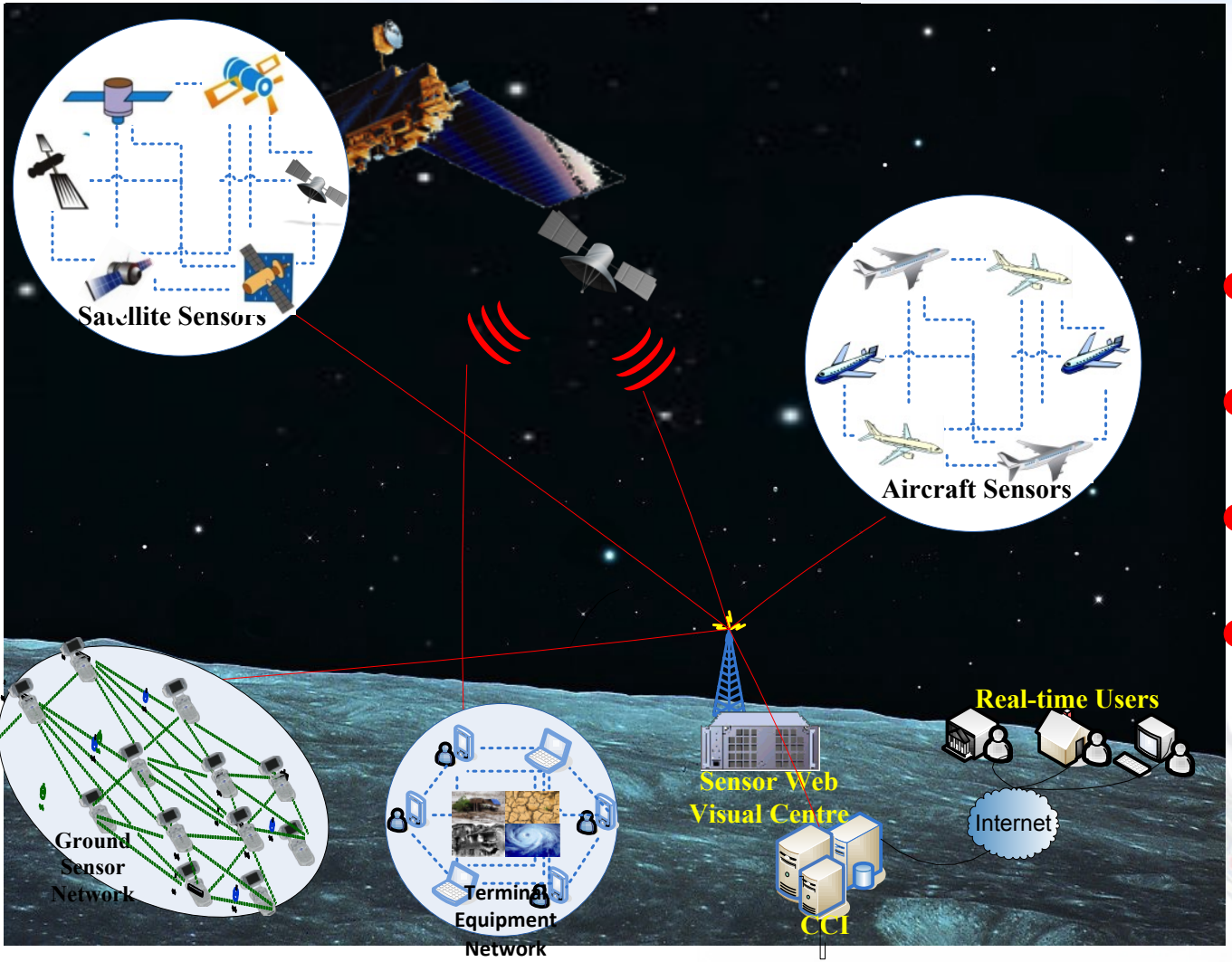
In Nov. 2013, the center has built the first oversea Beidou CORS station at Chonburi, Thailand.

Accuracy analysis of Thailand Beidou CORS station

		GPS	Beidou	GPS +Beidou
Test in one station	Available satellites	6-8	13-14	19-22
	Satellites in use	6-8	13-14	19-22
	HRMS（m）	3.55	1.65	1.60
	RMS（m）	7.84	3.44	3.03

	Content	Target
Test in three stations	Carrier	Car, max speed: 80km/h
	Positioning accuracy	Plane 2cm, Height 5cm
	Navigation accuracy	Plane 0.5m（Lane-level accuracy navigation）

2.3 The Key Technologies - Use of Sensor Web to integrate ground-air-spaceborne sensors



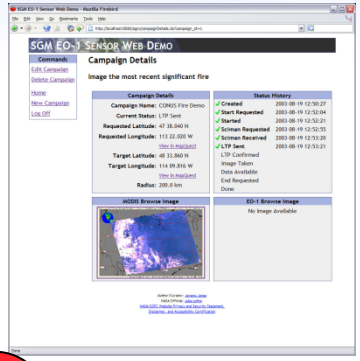
- Satellite Sensors;
- Aircraft sensors;
- In-situ sensors;
- Terminate equipments;

Sensor Network Applied in Disaster Management

Identify NIFC-tracked Wildfire Incidents

1

Science Goal Monitor



Fire location confirmed and selected for imaging

3

3

SGM adds target to EO-1 ground & on-orbit planning & scheduling systems and tasks EO-1

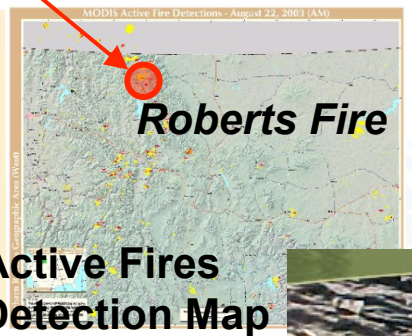
4

EROS Data Center

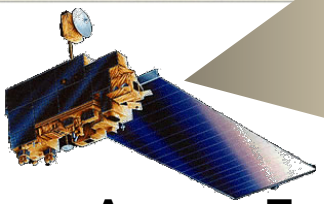
5 L1 Data

2

Correlate latest fire location information with MODIS imagery



Active Fires Detection Map

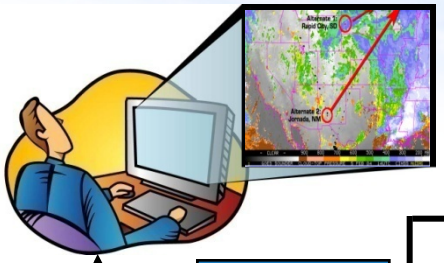


Aqua or Terra MODIS data

UMD Natural Hazards Investigation Team

6

Reference Architecture for an Inter-Operable Sensor Web



Three ways for Client to access data – through a Sensor Web Model, direct feed from a sensor, or retrieval of a data product

Get Feasibilities

Register

Register

Register

Discover

Web Map Service

Map

"Thin" Web Client (blog, wiki, IM,

Task

Discover

Catalog Service for Web (CSW)

(Features/Capabilities)

Data Processing Node

SensorML Capabilities Documents

Web Coordinate Transformation Service (WCTS)

Web Processing Service (WPS)

Web Coverage Service (WCS)

Execute

Sensor Web Database

Optimizing Scheduler

Sensor Web Model

Workflow Editor

Workflow Sequencer Interface

Decision Support System

Business Processing Execution Language

XML SCRIPT

Service Chain Workflow Sequencer

Execute

SensorML

SensorML

In-situ Sensor Data Node

UAV Sensor Data Node

EO-1 Satellite

SensorML Capabilities Documents

Web Feature Service

Satellite sensor data product

Sensor Planning Service

Sensor Alert Service

Sensor Observation Service

Satellite Data Node

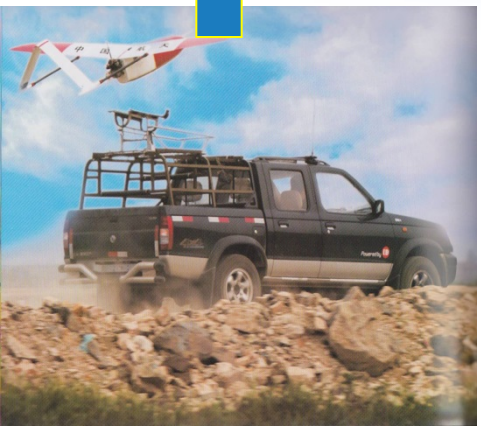
GMSEC

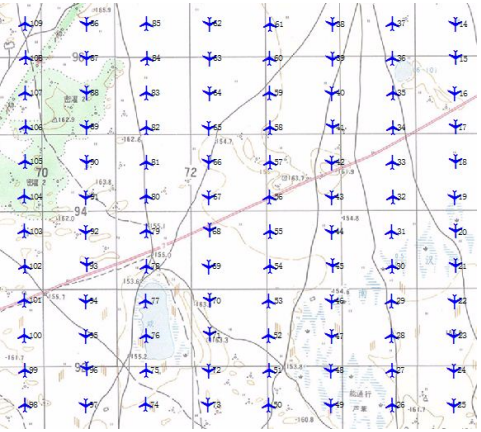
IRC

Analysis/Simulation

Sensor

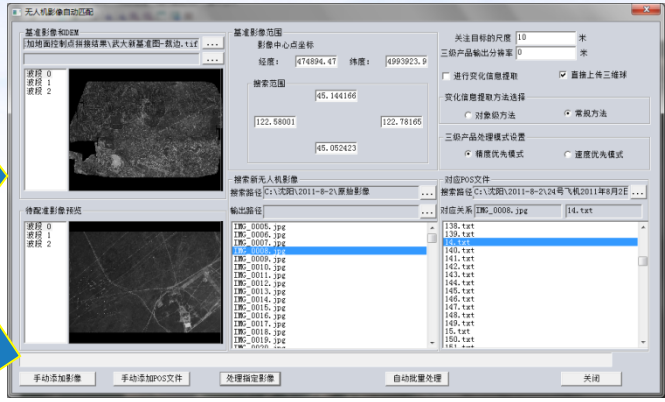
Real Time Change Detection with UAV Data

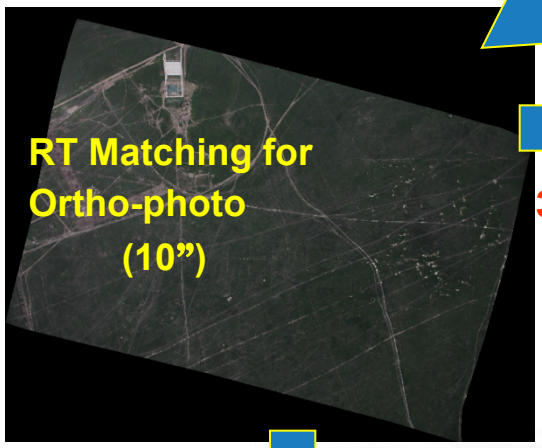




UAV take off

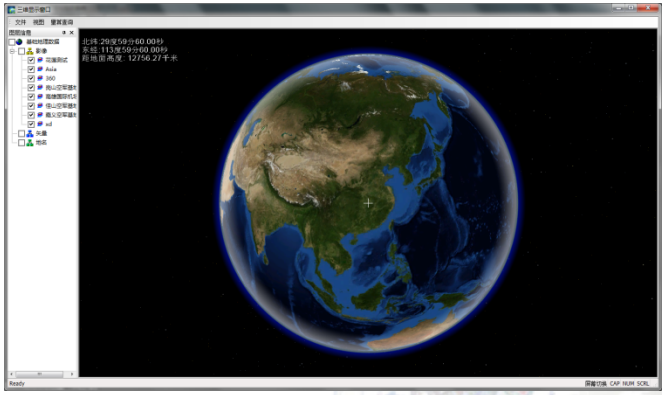
Real Time Date transmission

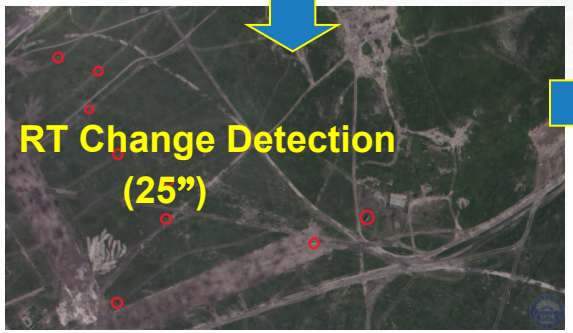




RT Matching for Ortho-photo (10”)

3D Display





RT Change Detection (25”)

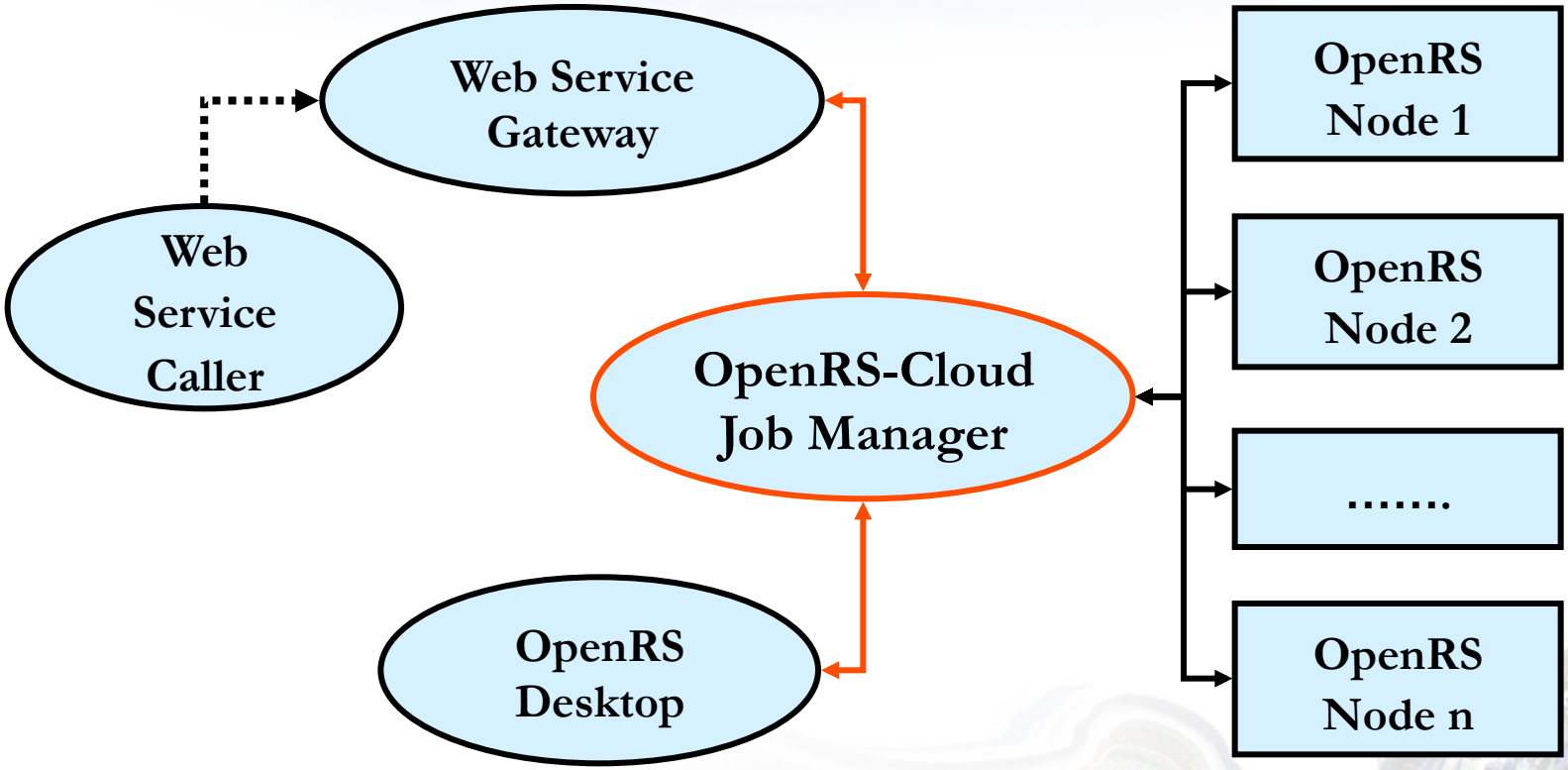
Results sending to Enduser

OpenRS Cloud —— An Open Software Platform for Remote Sensed Data Processing

Data → Information → Applicatons

Engine of Data Processing & Information Extraction

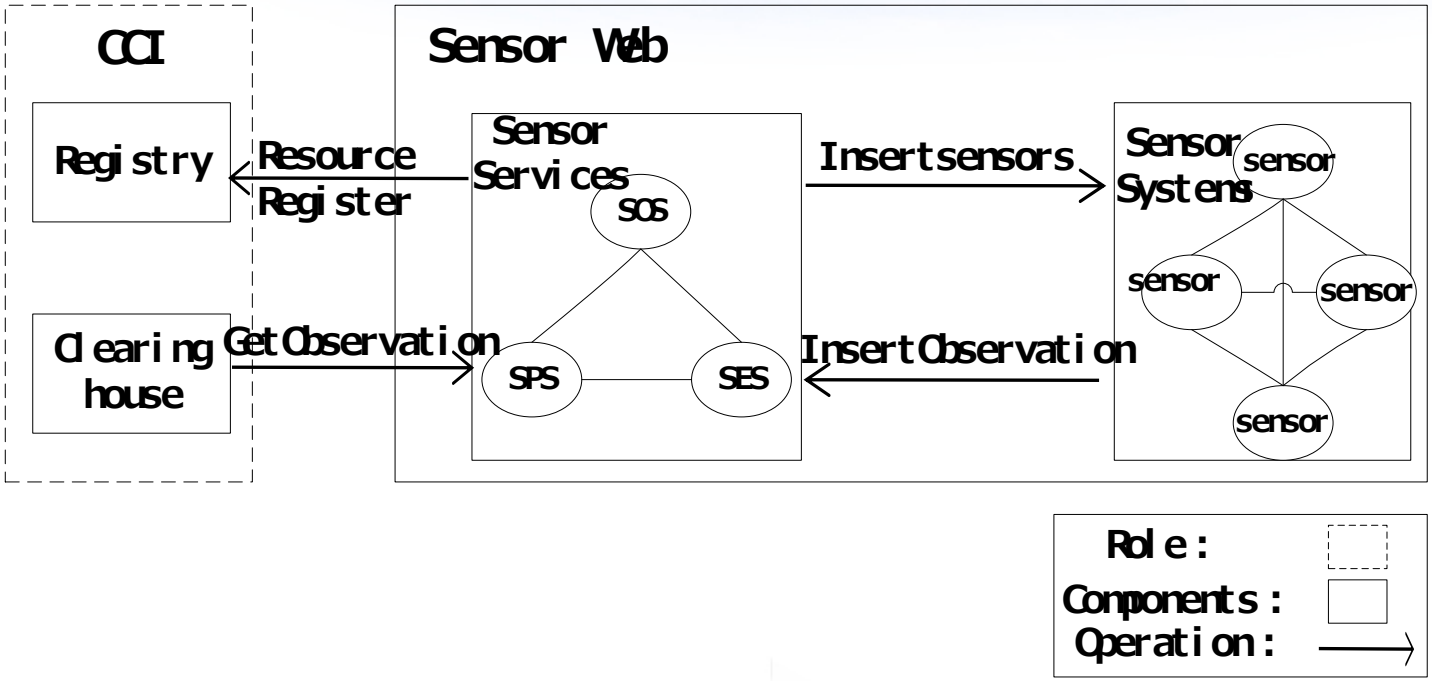
Integration of DP,DPP,WPS



Algorithm: Complied once, Run on desktop, cluster and for WPS

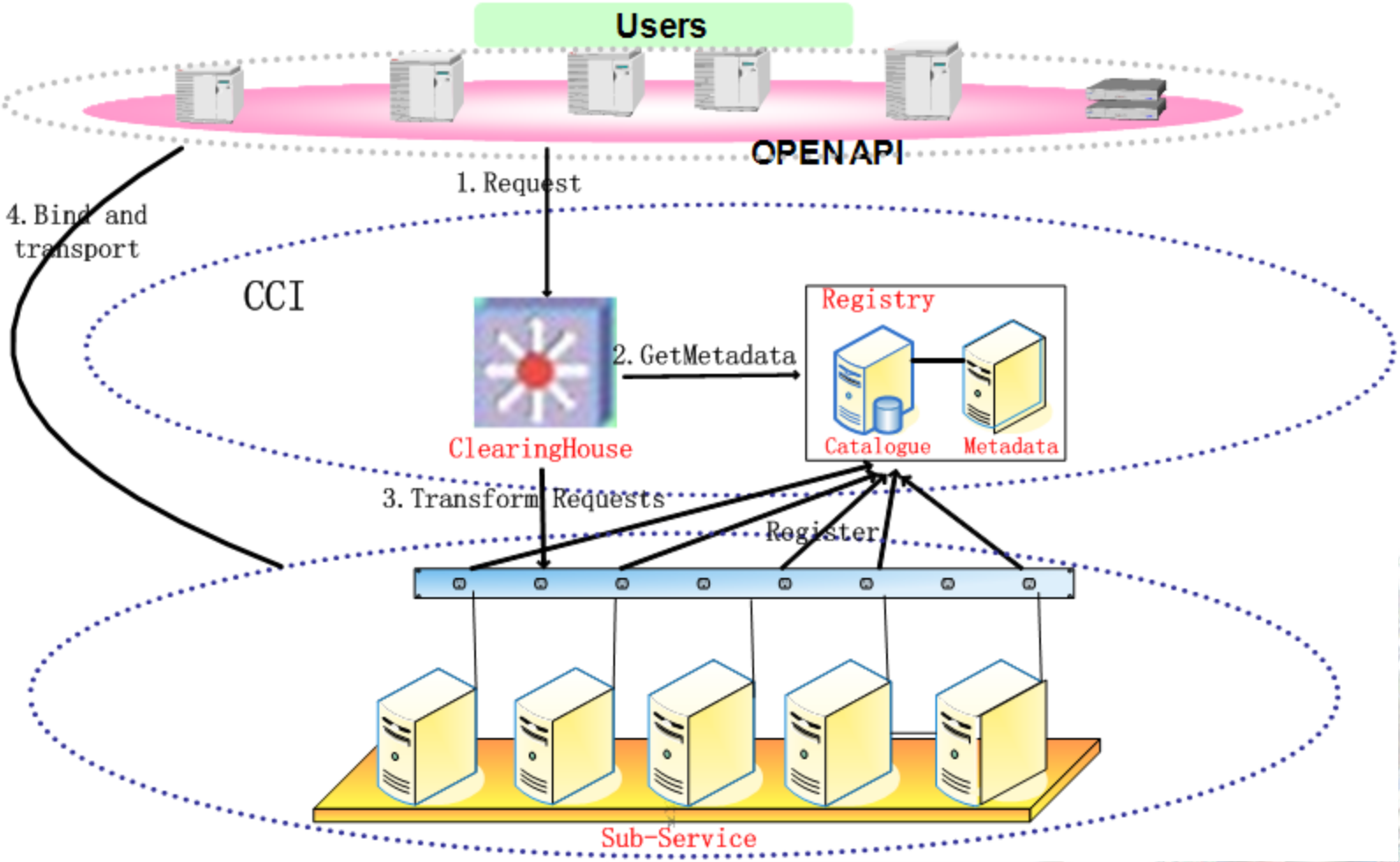
Platform: Providing UI, Paralleled Environment, WPS Wrapper

2.3 The Key Technologies – The Sensor Web in CNDRSS

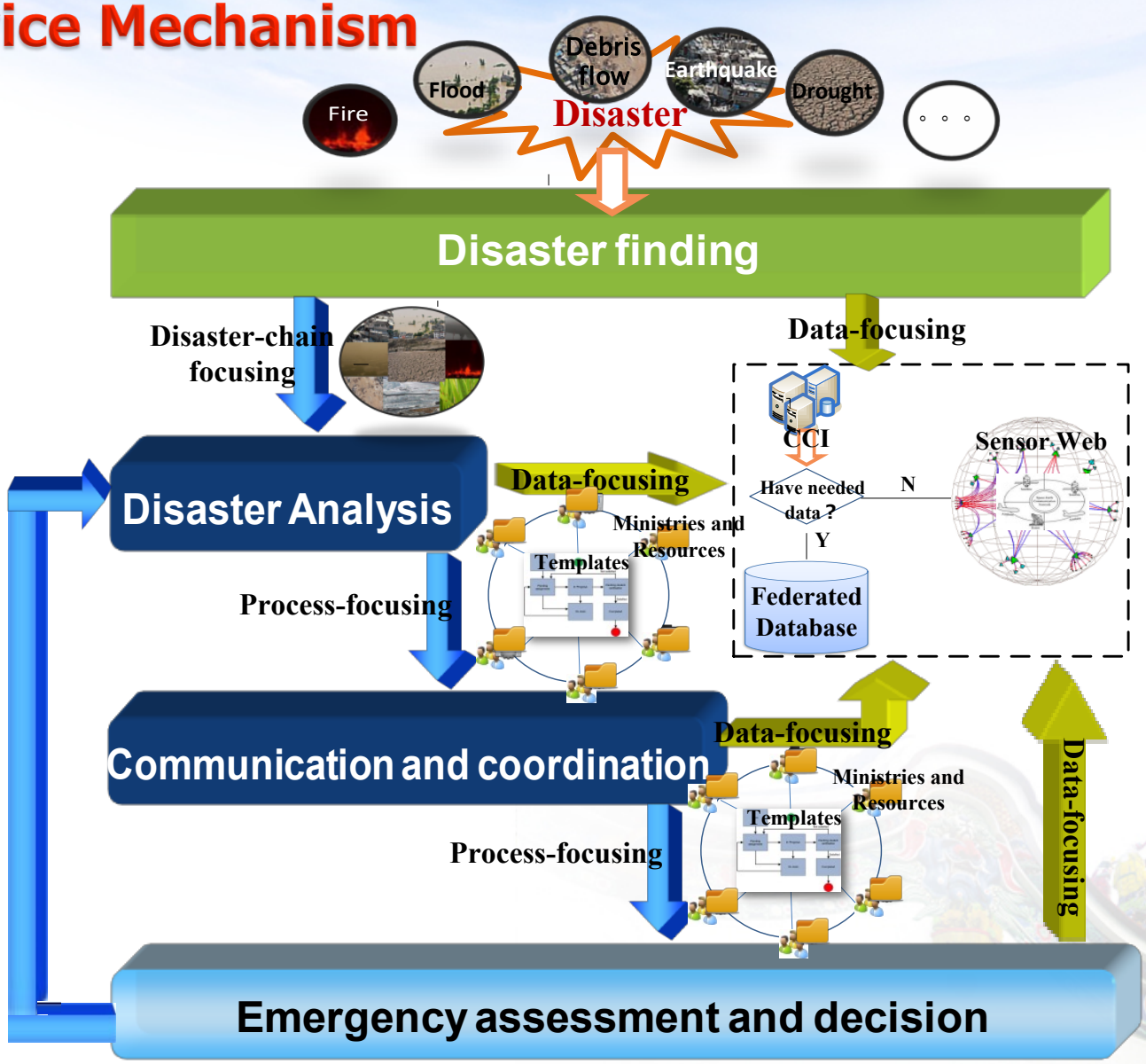


- According to the requests of the users, corresponding sensor observation services can be registered in the Registry centre of CCI, scheduled by the data and sensor planning service and discovered by the Clearinghouse of CCI for real-time or near real-time use.

2.3 The Key Technologies - Use of Federated Database

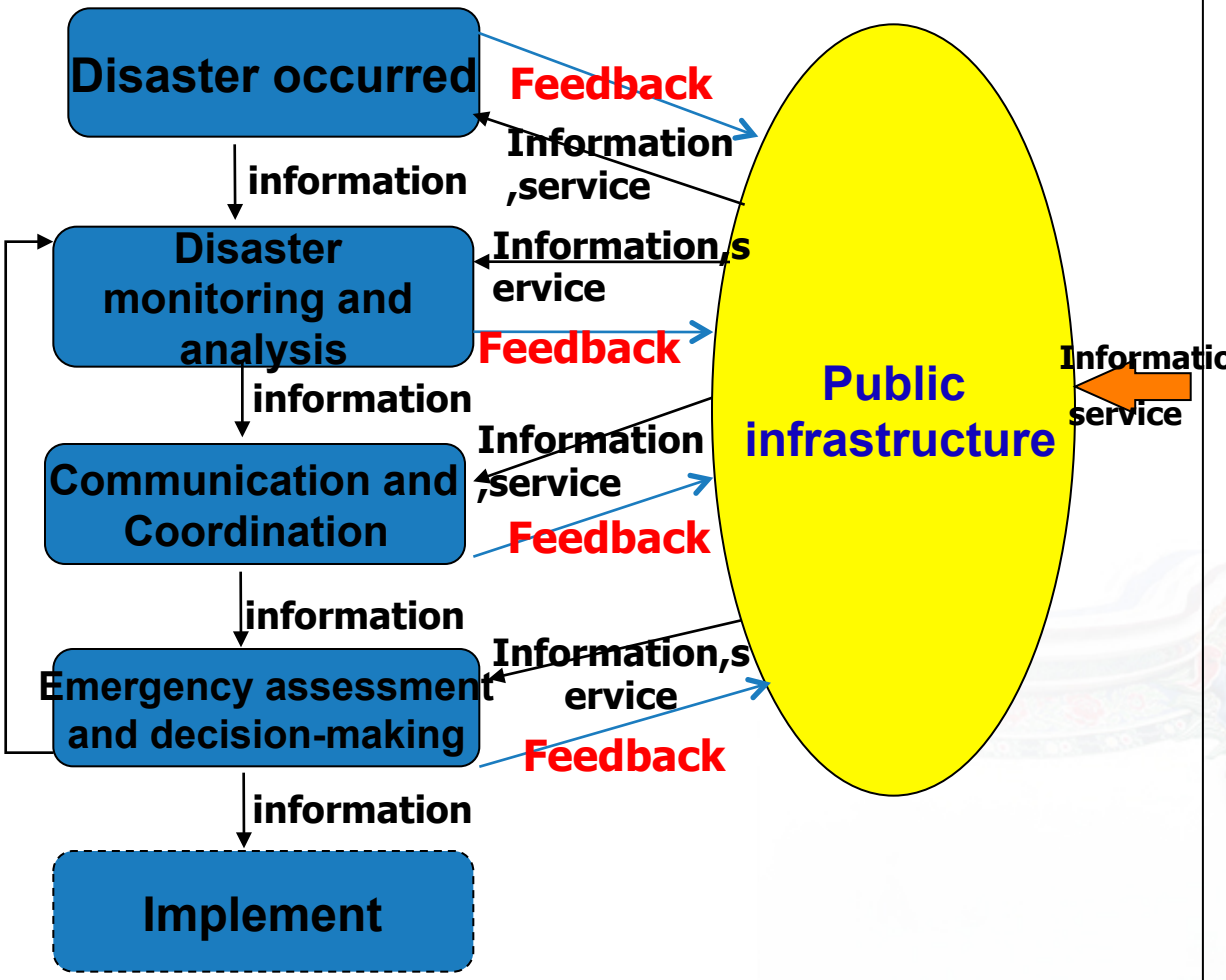


2.4 The Key Technologies - Event-driven Focusing-service Mechanism



Service-oriented multi-system integration mechanisms

- Members of the system can follow their own standards and have full autonomy
- Members of the system should follow uniform standards and rules



- Integrated disaster observing system
- Integrated agricultural observation system
- Integrated hydrological monitoring system
- Integrated land observation system
- City/town Integrated observation system
- Integrated meteorological monitoring system
- Seismic geophysical monitoring system
- Integrated environmental monitoring system
- Integrated forest and ecological monitoring system
- Integrated surveying and mapping information platform
- Marine monitoring system
- Scientific research monitoring system

Geospatial information Service Web

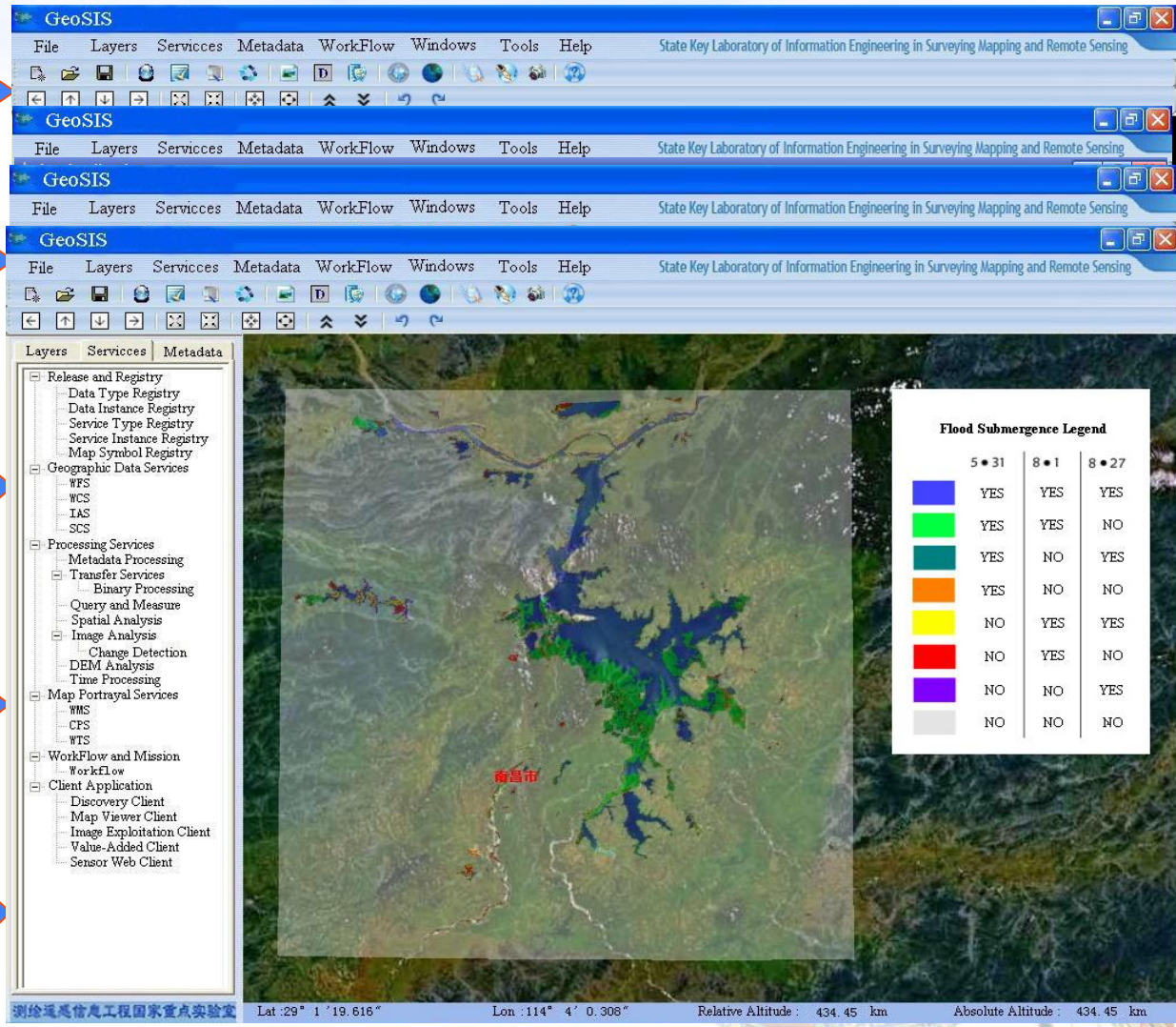
Service Reg.

Service find

Service Chaining

Service Running

Result

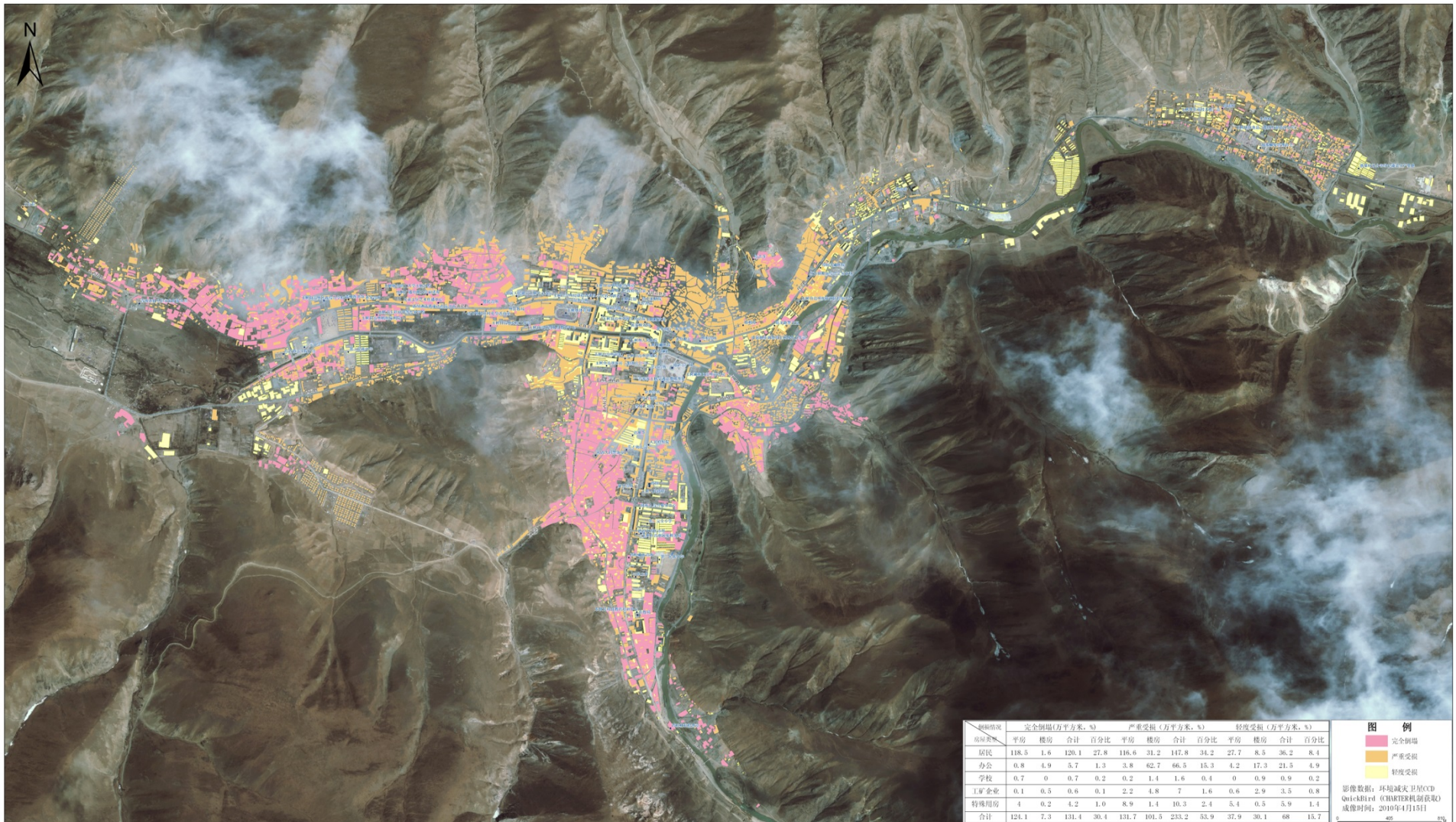


Visualizing geoprocessing result in GeoGlobe

3 Case Analysis

The monitoring and assessment of Yushu Earthquake, in Qinghai province (April 4,2010)

青海省玉树县结古镇房屋倒损评估图

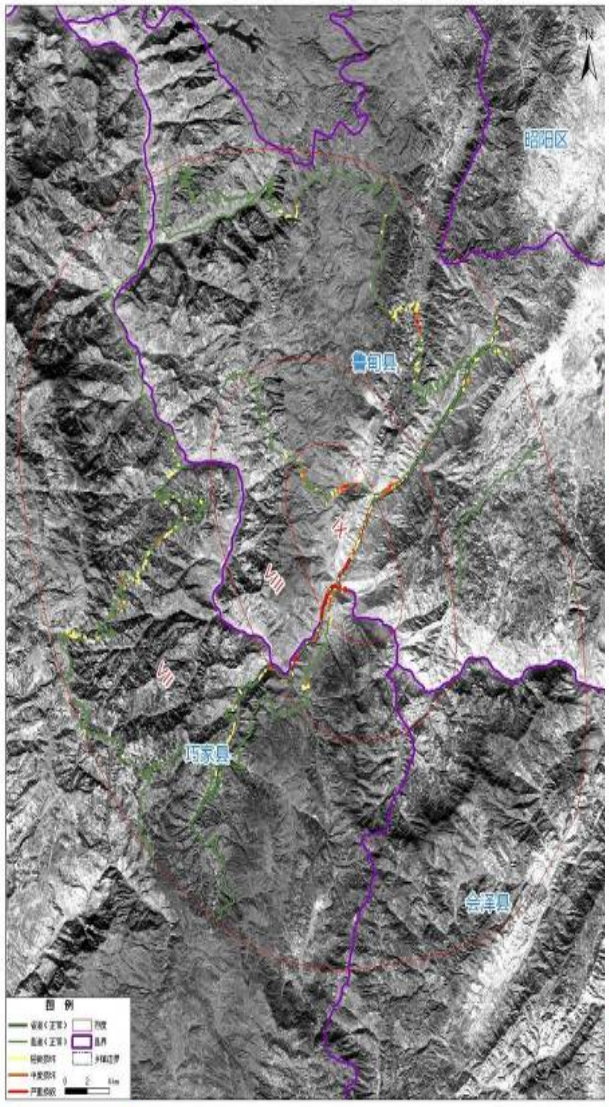


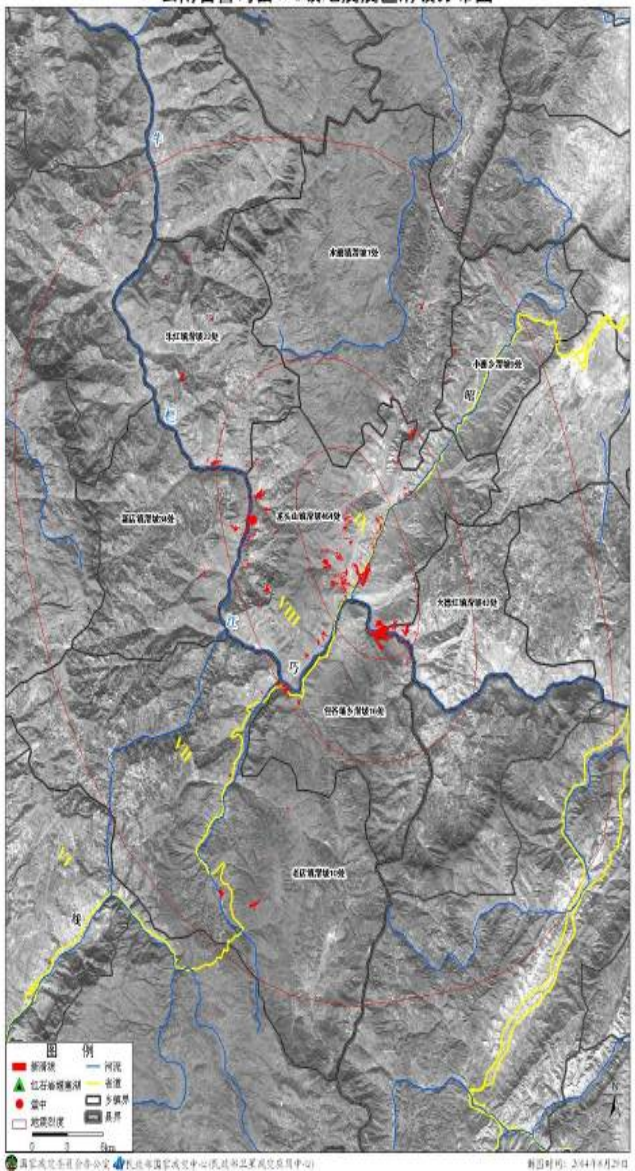
倒损情况 / 房屋类型	完全倒塌（万平方米，%）				严重受损（万平方米，%）				轻度受损（万平方米，%）			
	平房	楼房	合计	百分比	平房	楼房	合计	百分比	平房	楼房	合计	百分比
居民	118.5	1.6	120.1	27.8	116.6	31.2	147.8	34.2	27.7	8.5	36.2	8.4
办公	0.8	4.9	5.7	1.3	3.8	62.7	66.5	15.3	4.2	17.3	21.5	4.9
学校	0.7	0	0.7	0.2	0.2	1.4	1.6	0.4	0	0.9	0.9	0.2
工矿企业	0.1	0.5	0.6	0.1	2.2	4.8	7	1.6	0.6	2.9	3.5	0.8
特殊用房	4	0.2	4.2	1.0	8.9	1.4	10.3	2.4	5.4	0.5	5.9	1.4
合计	124.1	7.3	131.4	30.4	131.7	101.5	233.2	53.9	37.9	30.1	68	15.7

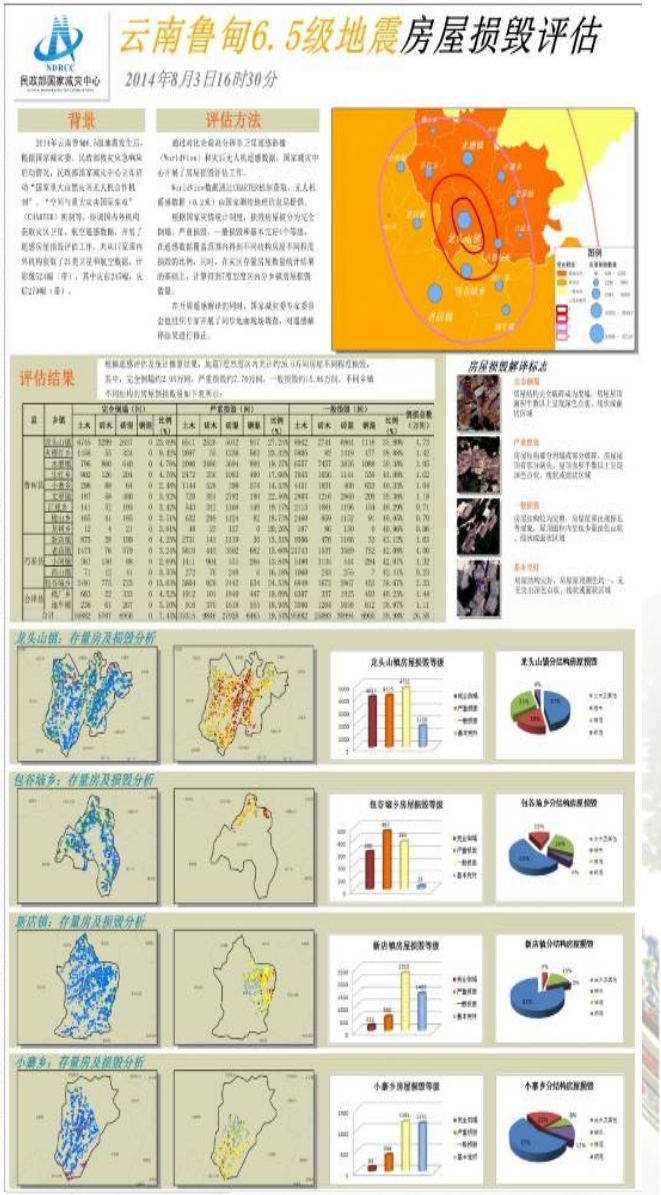
The monitoring and assessment of flood and debris flow disaster in Zhouqu county of Gansu province (Aug.8,2010)

The 6.1 magnitude earthquake in Yingjiang county of Yunnan province (May 30,2014)

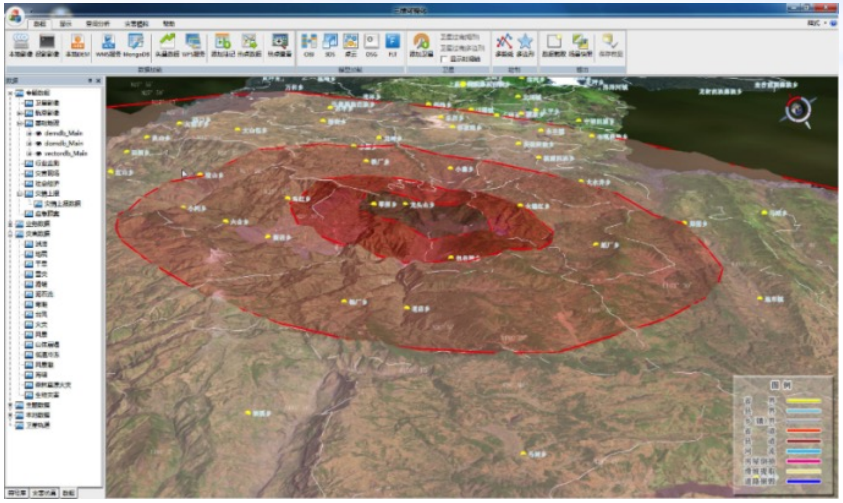
The monitoring and assessment of Ludian earthquake of Yunnan province(Aug.3,2014)



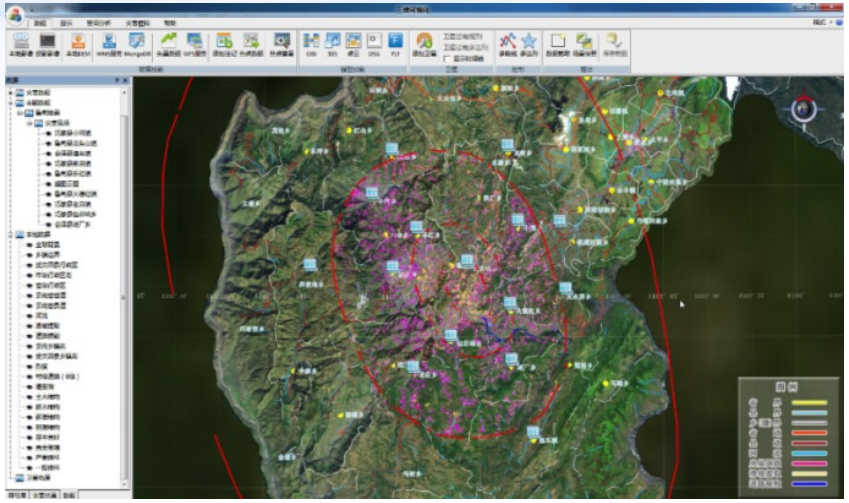




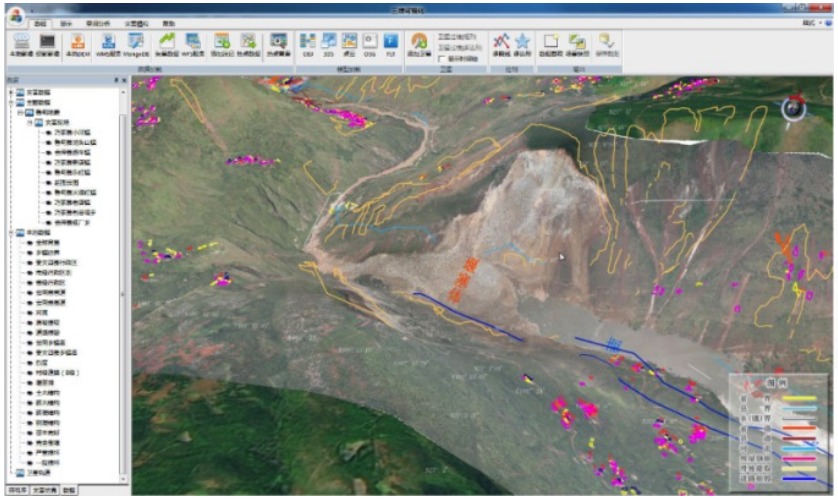
3D Visualization and Statistical Analysis of Ludian Earthquake



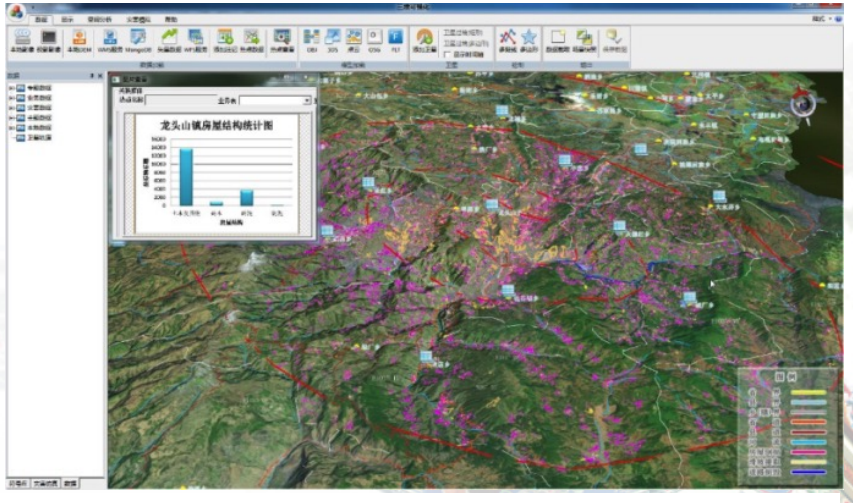
Earthquake intensity



Distribution of Damaged houses

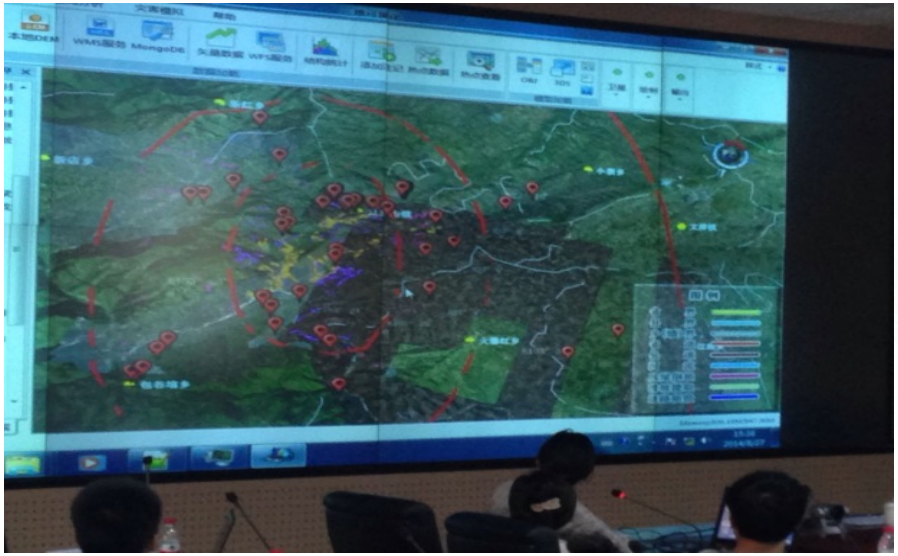


Damming objects of NiuLanjiang



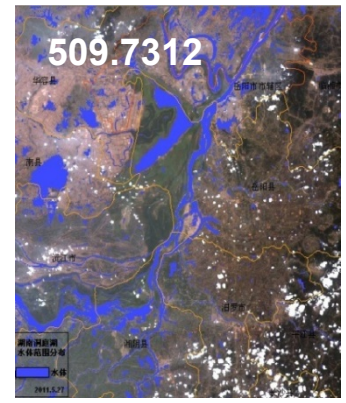
Loss statistics of Disaster

Expert decision for Ludian Earthquake disaster assessment based on remote sensing and GIS system



Flood monitoring in Dongting Lake of Hunan province using HJ-A satellite images

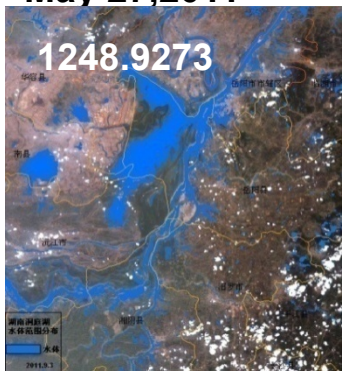
Daily water inundation area monitoring, early-warning for flood in Dongting Lake.



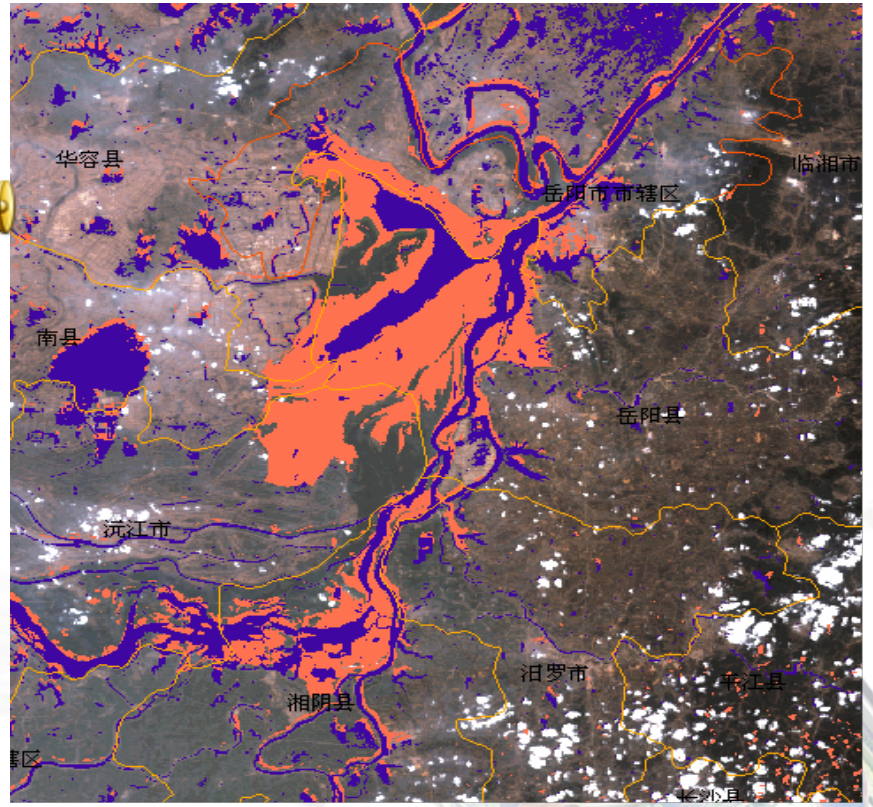
May 27,2011

June 26,2011

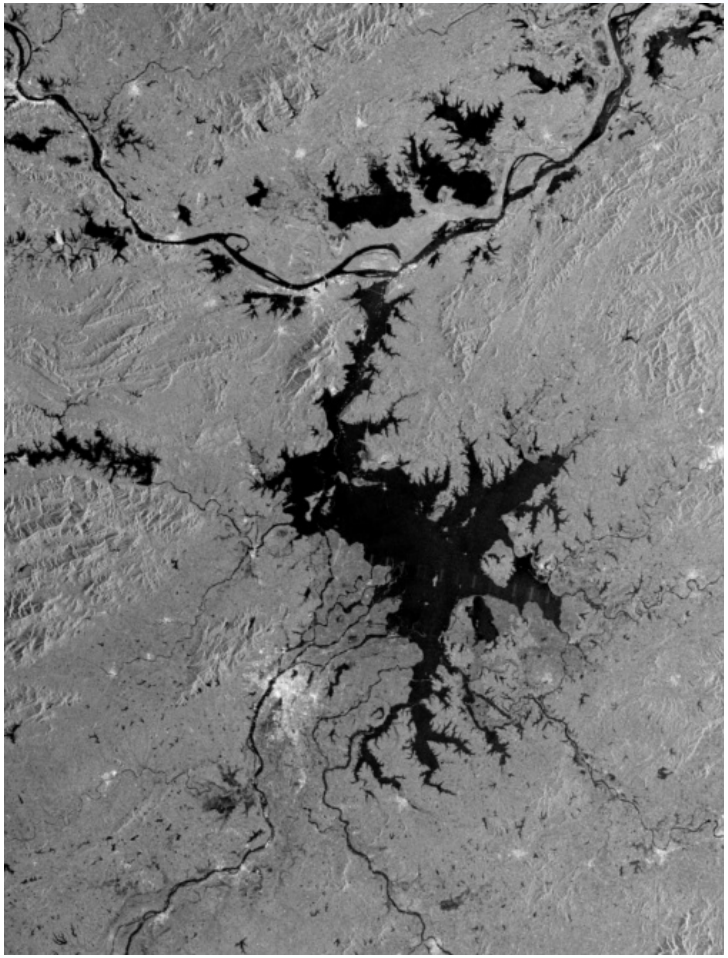
July 21,2011



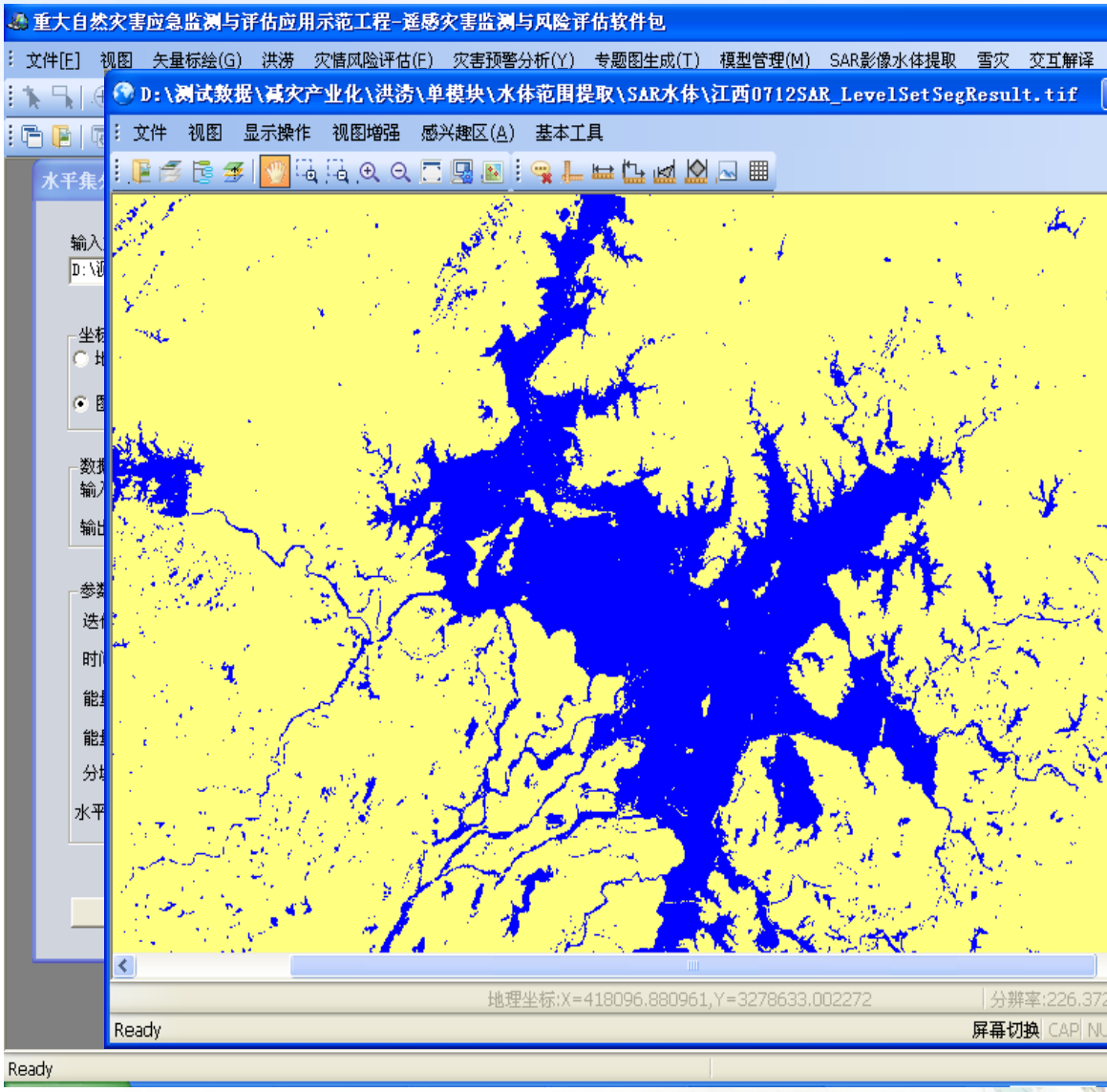
Sep.3,2011



Flood disaster monitoring of Poyang Lake of Jiangxi province based on SAR image

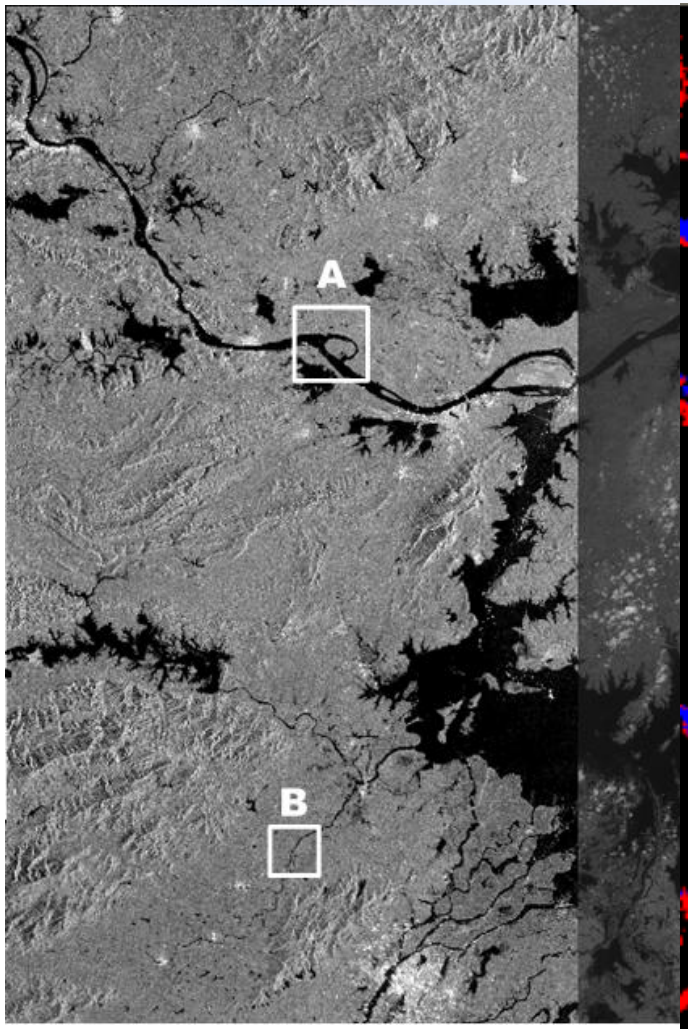


Radarsat-1 30 m

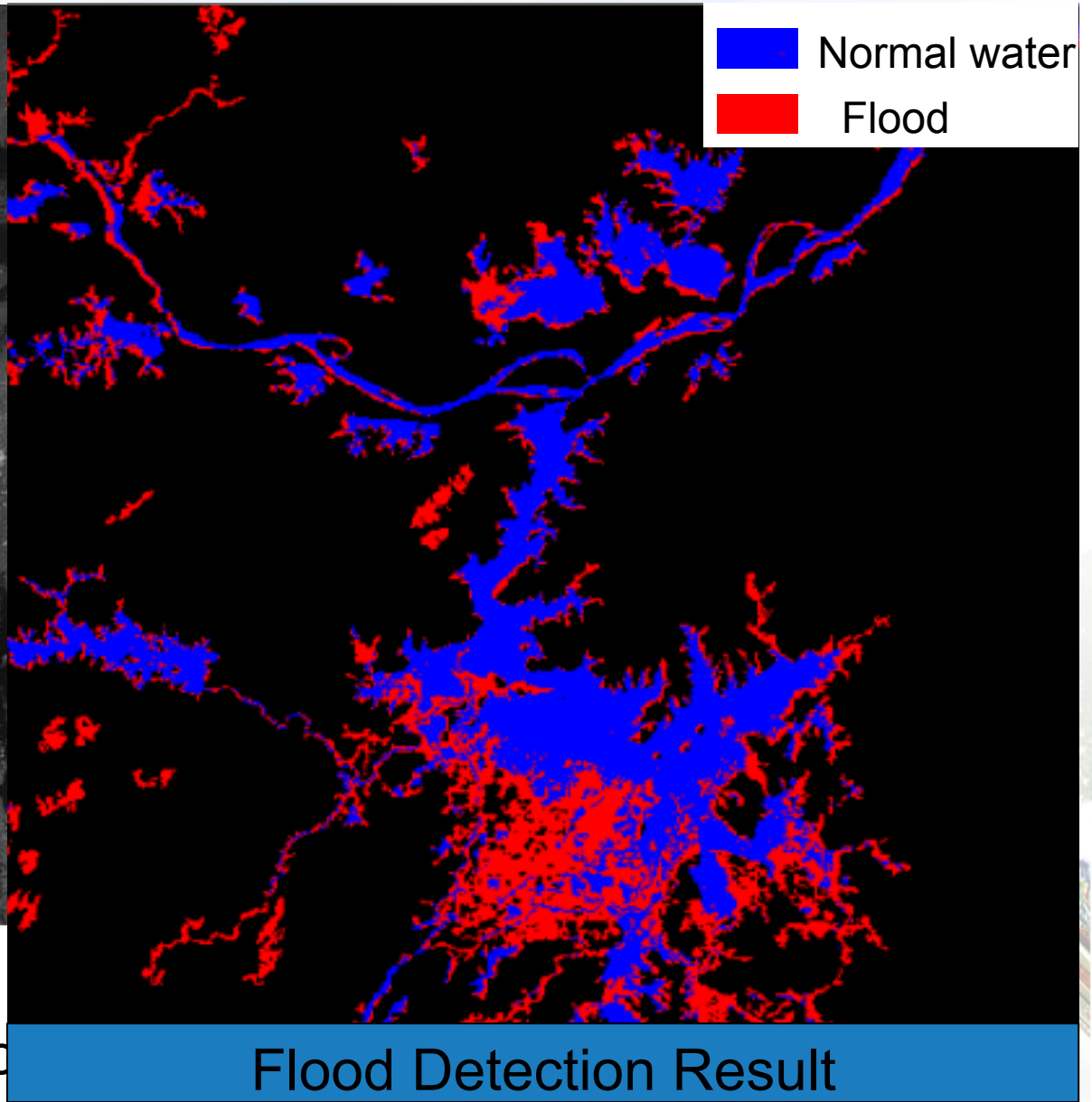


Water Extraction Result Based on Multiscale Level Set Method

Flood disaster monitoring of Poyang Lake of Jiangxi province based on SAR image



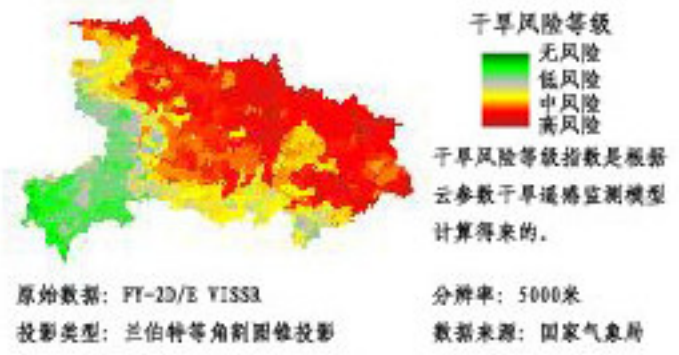
New SAR image
with old Optic



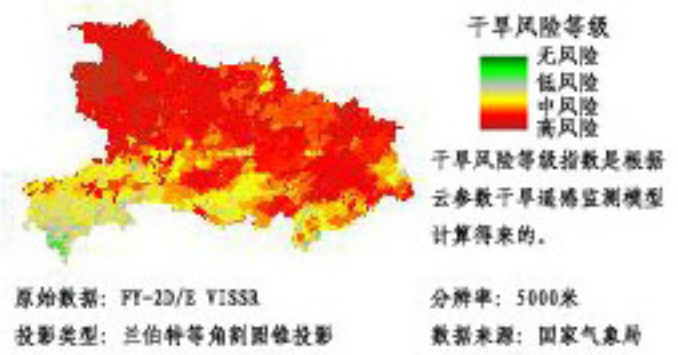
Flood Detection Result

Drought monitoring in Hubei province

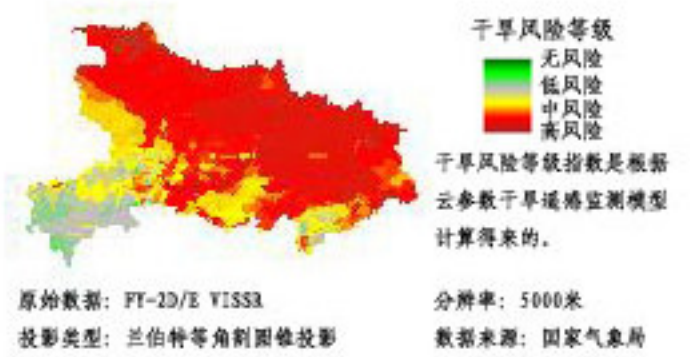
湖北省干旱风险等级分布图2011年4月中旬



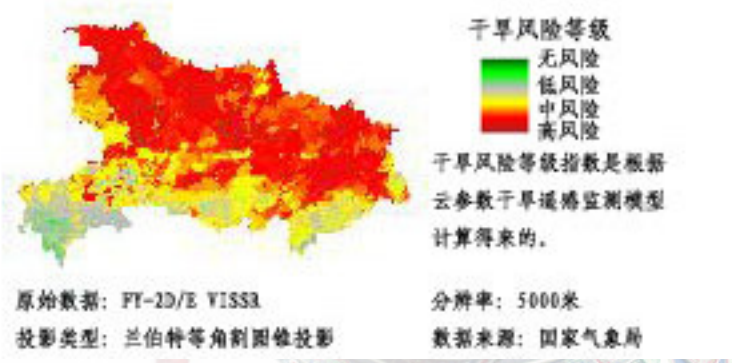
湖北省干旱风险等级分布图2011年5月上旬



湖北省干旱风险等级分布图2011年4月下旬

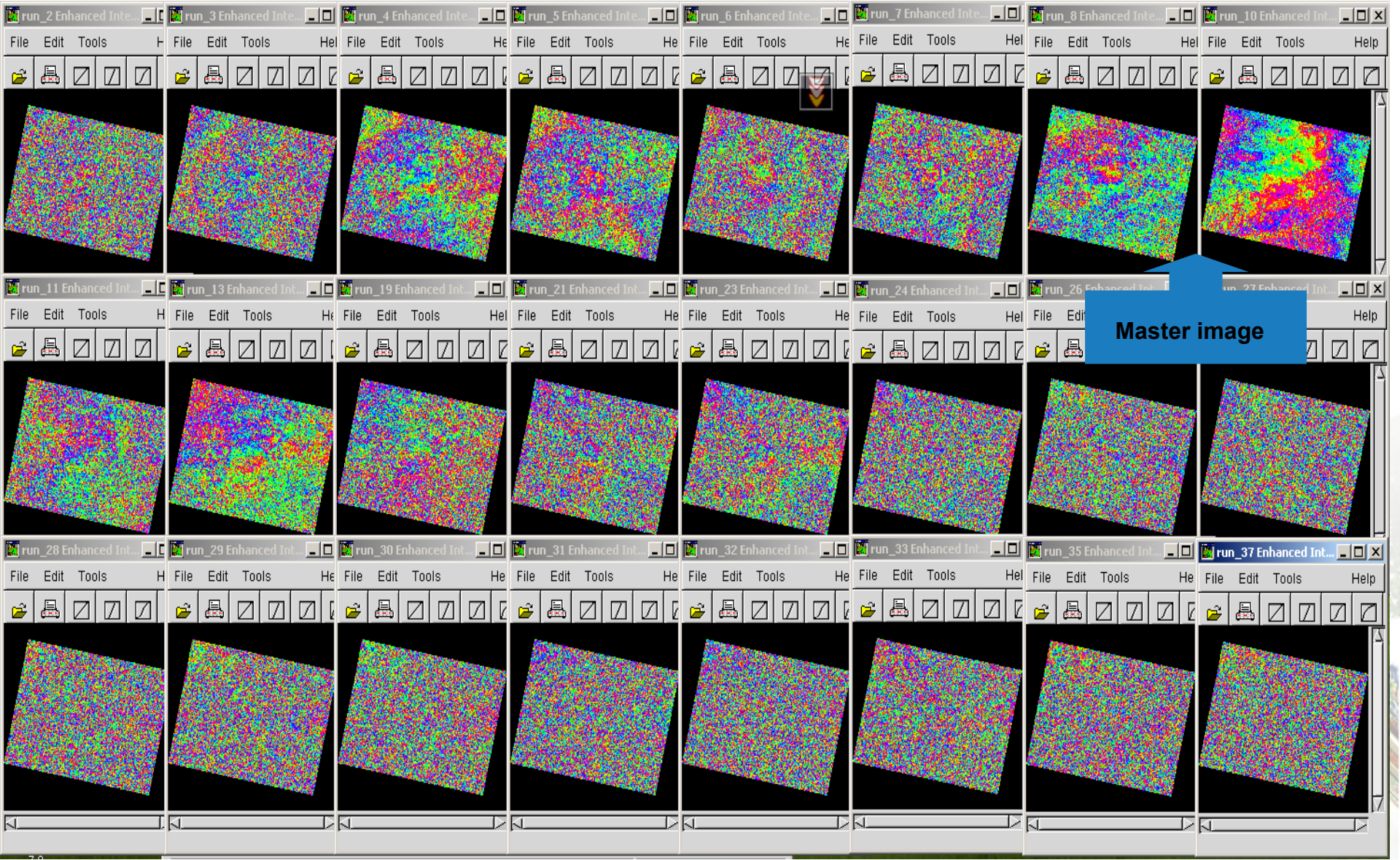


湖北省干旱风险等级分布图2011年5月中旬



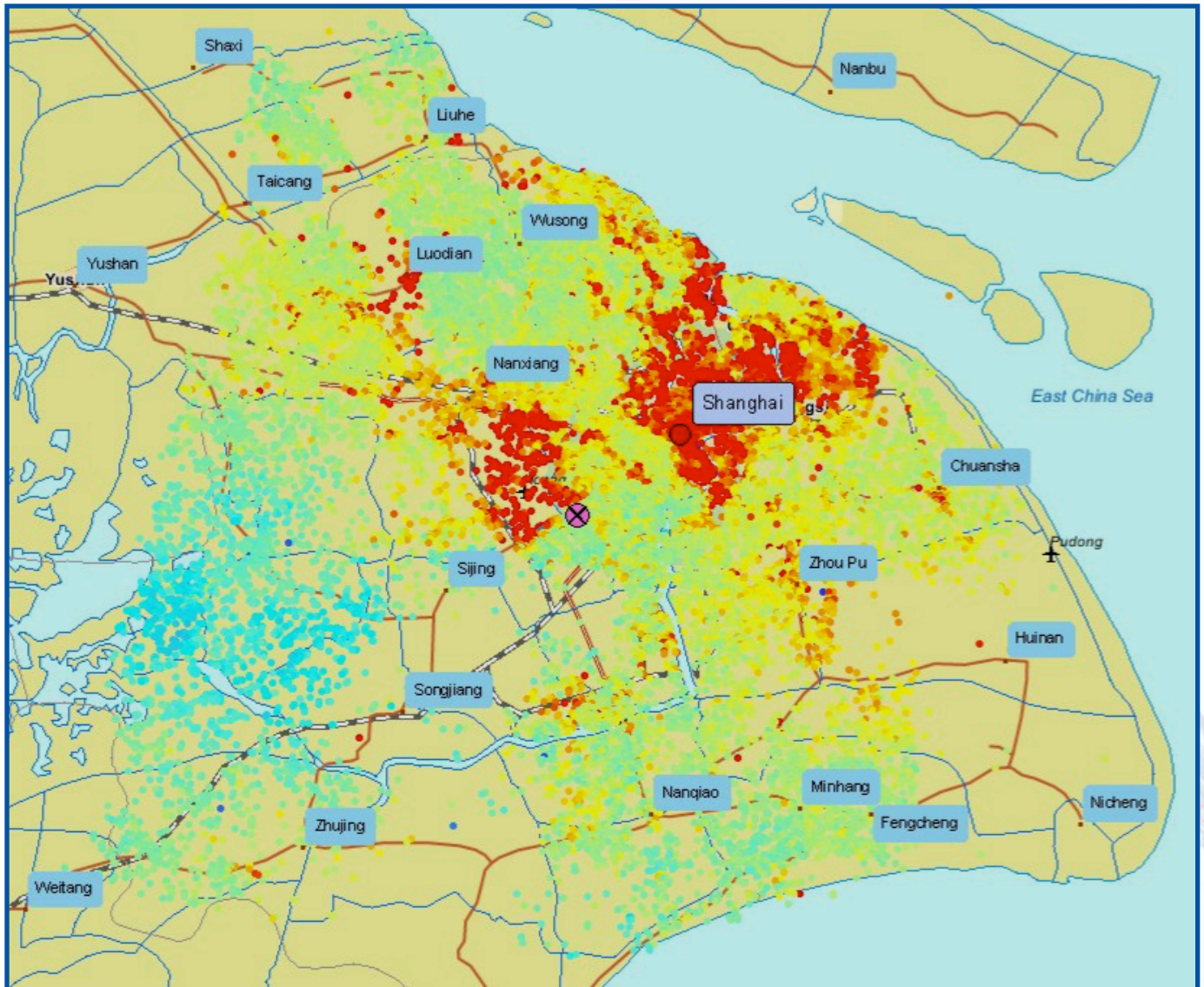
D-INSAR for Deformation Analysis

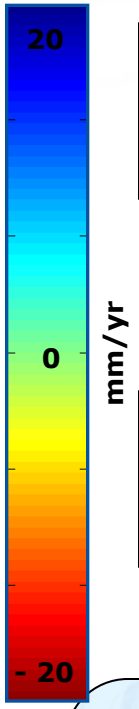
24 Interferograms from ERS images of Shanghai



Result of PS InSAR from Prof. Rocca

PS Technique: preliminary results – Wide view



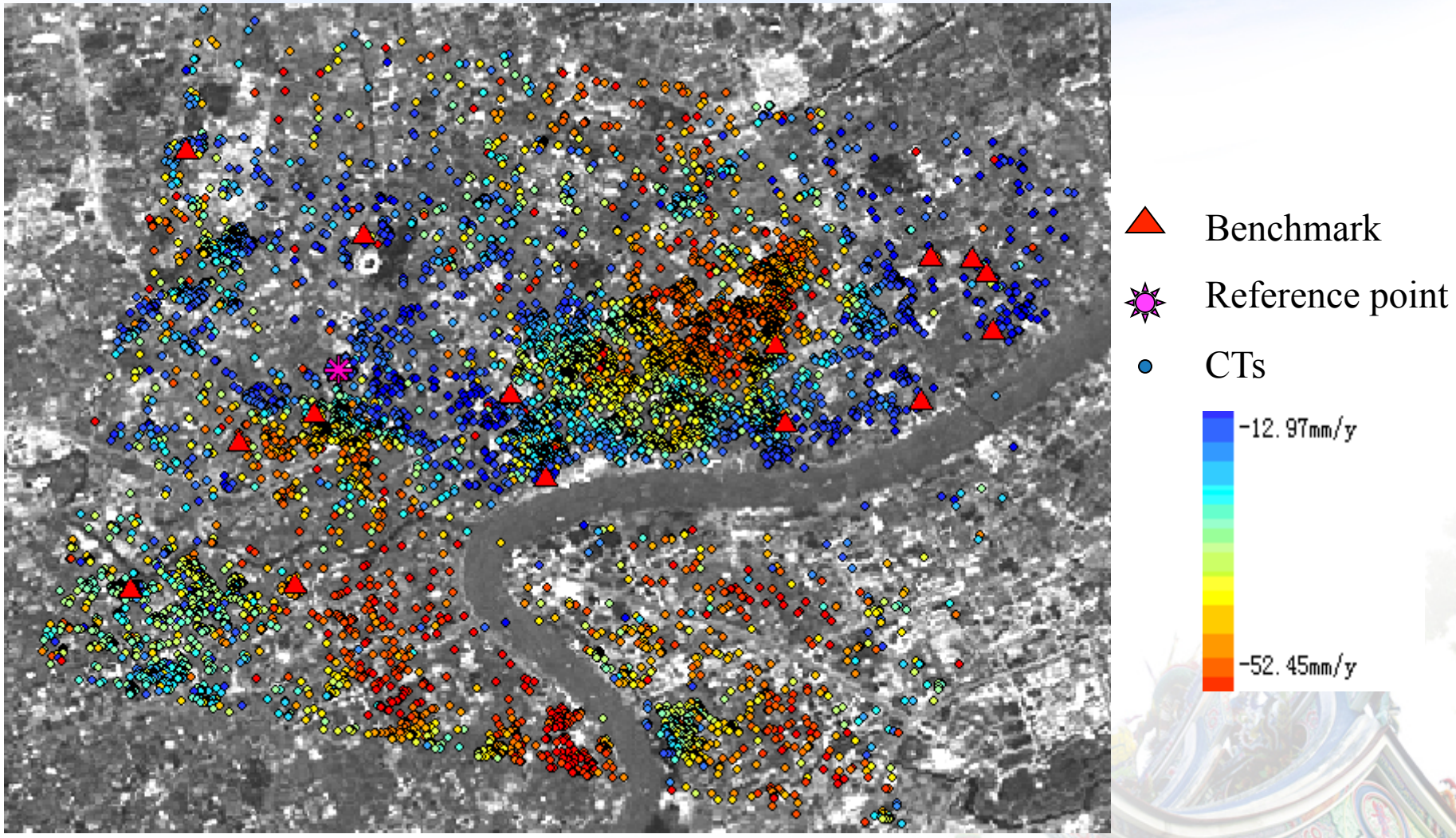


More than **20.000 PS** identified

Reference point, assumed motionless

Velocity has been saturated for visualization purpose. Much higher rates have been detected in Shanghai urban center.

Result of CTA (Coherent Target Analysis) in Shanghai



Distribution of benchmarks and CTs in the test site

Cross Validation of PS and CTA results

Benchmark	Leveling(mm/y)	CT(mm/y)	Diff. at CTs	PS (mm/y)	Diff. at PSs
0- 64	-39.13	-39.15	0.02	-32.43	-6.695
0-113A	-15.88	-12.61	-3.27	-20.02	4.145
0-120	-17	-17.18	0.18	-14.75	-2.25
0-139	-30.38	-29.25	-1.13	-25.43	-4.945
0-155					
0-192					
0-221					
0-222					
0-223					
0-225	-11.63	-7.3	-4.33	-6.53	-5.095
0-289	-6.63	-13.37	6.74	-1.77	-4.855

- ***Difference between leveling and PS***

  Average：4.088mm/year，STD.：3.73 mm/year

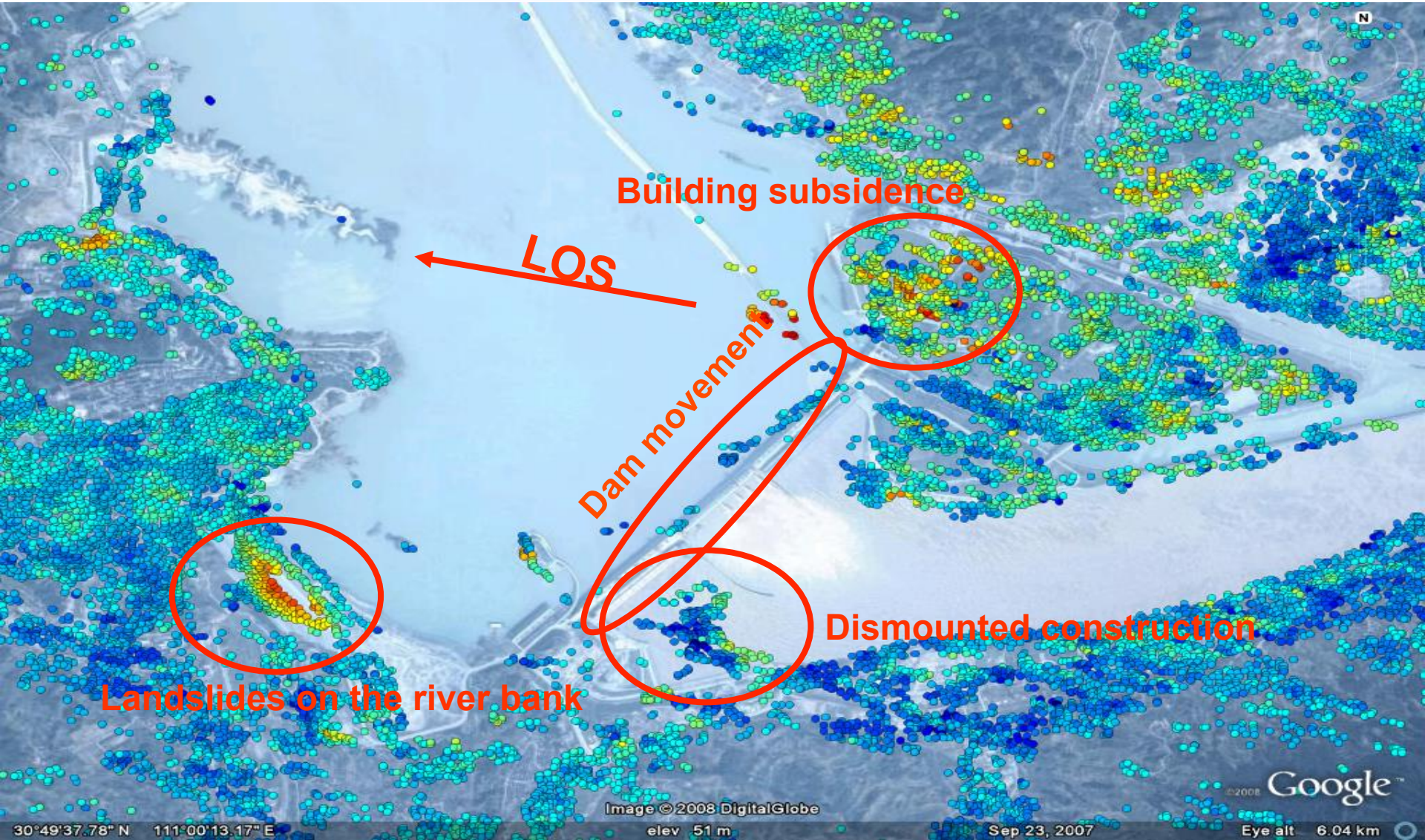
- ***Difference between leveling and CT***

  Average：2.315 mm/year，STD：2.50 mm/year

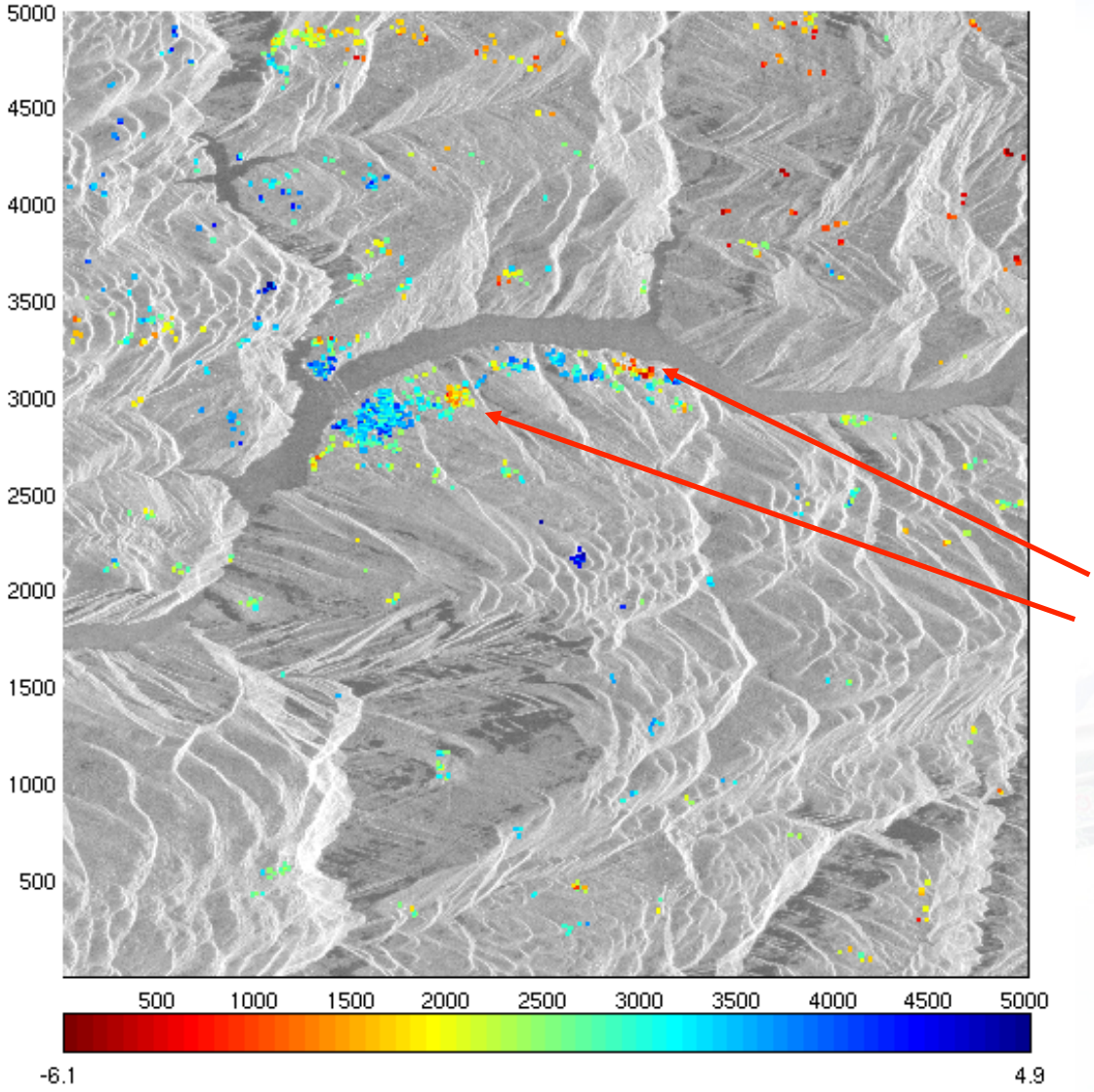
Comparison of results from PS-InSAR and CTA in the overlay area of Shanghai test site

Monitoring of Landslide & Dam

Preliminary results: deformation distribution at the Three Gorges Dam



Monitoring landslide in Badong, Three Gorges Area

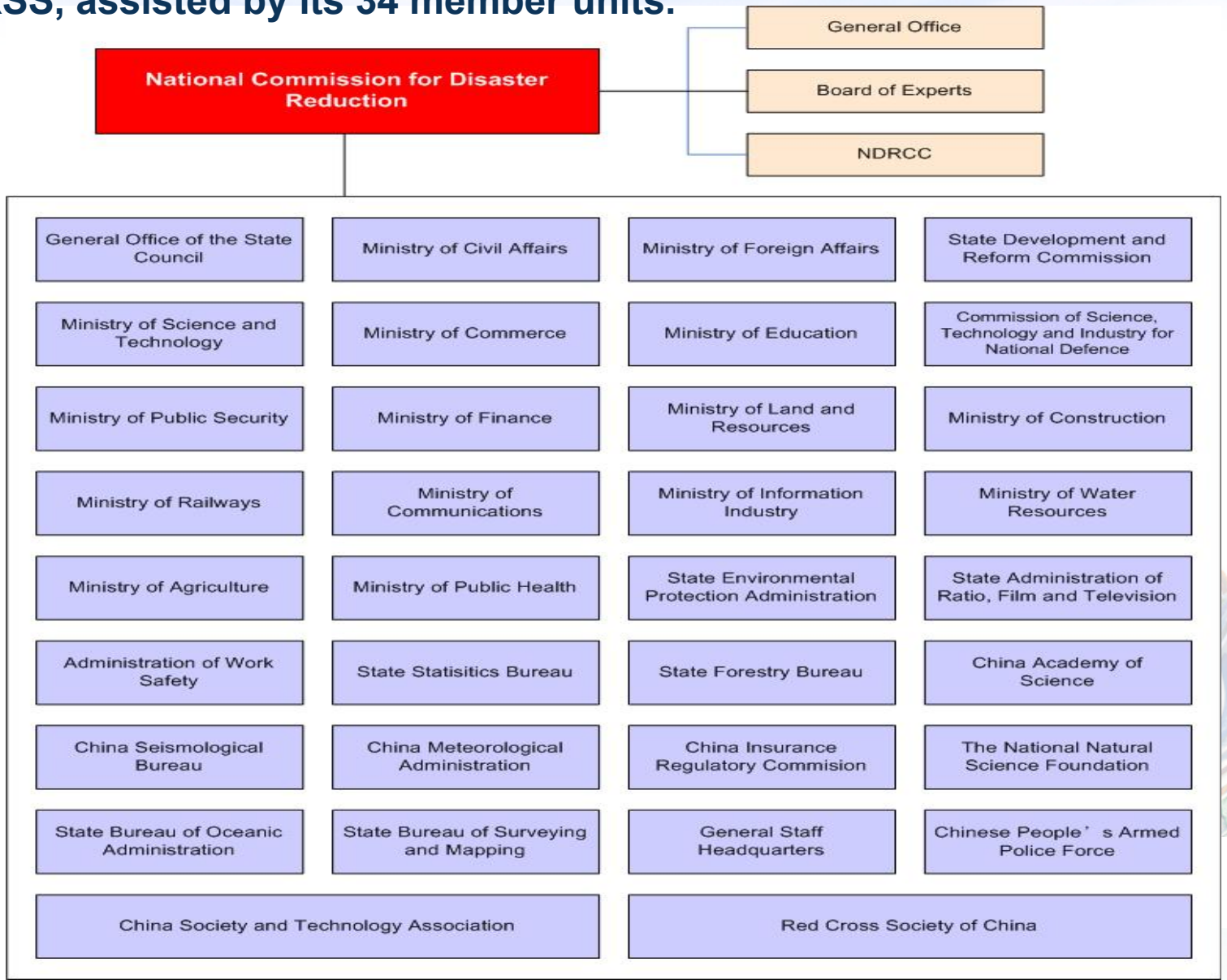


Data set:
Envisat images 34 scenes from Aug, 2003 to June, 2007

Two deformation regions are identified with PS-InSAR

4 CNDRSS Program Plan

National Commission for Disaster Reduction is in charge of the construction of NDRSS, assisted by its 34 member units.



4 The Road Map of CNDRSS

Step one

- To cover10 provinces, 12 ministries and 300,000 disaster messengers
- To invest 1.5 billion RMB

Step two

- To cover all provinces and all relevant ministries in China and 400,000 disaster messengers
- To invest 2 billion RMB

5. Final Remarks

- **In recent 30 years China has made big progress in earth observation and geospatial science.**

- **China needs to strengthen the spatial Data infrastructure construction.**

- **China needs to construct the rapid response system and mechanism in the national level (CNDRSS) and to strengthen the international cooperation in spatial information science and technology.**


Thank You