



ESA - MOST Dragon 2 Programme

2011 DRAGON 2 SYMPOSIUM

中国科技部-欧洲空间局合作“龙计划”二期

“龙计划”二期2011年学术研讨会

Chinese EO Missions and Future Programme

Peng Zhang *on the behalf of NRSCC*

National Remote Sensing Center of China/MOST

(National Satellite Meteorological Center/CMA, Beijing 100081)

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1. Earth Observation Missions in China

Mission	Chinese	Purpose	Abbr.
■ recoverable remote-sensing satellites		Land satellite	
■ DongFangHong	东方红	Telecommunications and broadcasting satellites	DFH Series
■ BeiDou	北斗	navigation and positioning satellites	BD Series
■ ShiJian	实践	scientific research and technological experiment satellites	SJ Series
■ ShenZhou	神舟	Experimental spacecraft	SZ Series
■ FengYun	风云	Meteorological satellites	FY Series
■ HaiYang	海洋	Marine Satellites	HY Series
■ ZiYuan	资源	Earth resource satellites	ZY Series CBERS
■ HuangJing	环境	Environment and disaster monitoring and forecasting	HJ Series

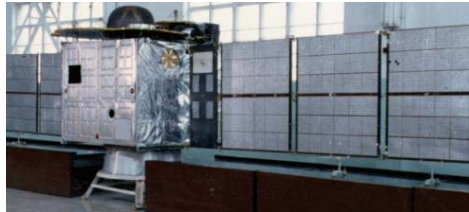
Launched satellites in China

☐ Meteorological Satellite	
Polar Orbit FY-1 A/B/C/D; FY-3A/B	6
Geo-stationary FY-2A/2B/2C/2D/2E	5
☐ Marine Satellite HY-1A,1B	2
☐ Resource Satellite (CBERS 01,02,02B;ZY-,YG-)	10
☐ Environment and disaster Satellite HJ-1A,1B	2
☐ Communication Satellite	8
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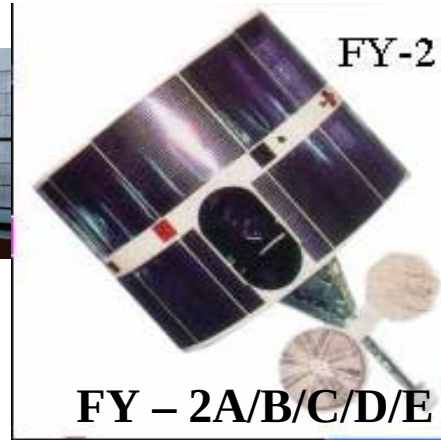
Overview of Chinese Remote Sensing Satellites



Recoverable satellite



FY - 1A/B/C/D



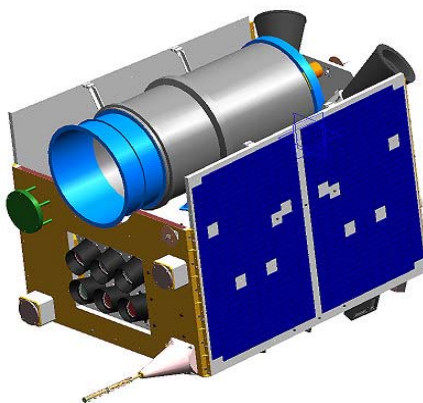
FY - 2A/B/C/D/E



FY - 3A/B



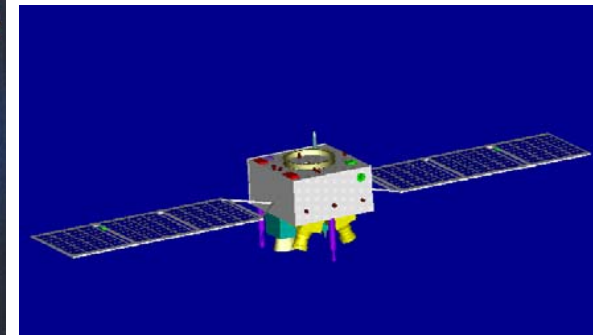
CBERS - 1,2,02B



BJ-1



SZ - 1-7



HJ-1/A.B

2. Marine Satellites: HY Series



NSOAS belong to State Oceanic Administration

Launched Satellite

HY-1A: 2002

HY-1B: 2007

Mission

**Monitoring of red tide, oil spill, fisheries, sea ice
and sea surface temperature**

Satellite and Orbit Characteristics:HY-1A

Orbit type	Near Circular and near sun-synchronous
Equator crossing time	8:53-10:10am(descending code)
Altitude	798km
Period	100.8 minute
Mass	367kg
Payload	COCTS and CCD
Attitude control	3 axis stabilized
Design life	2 years
Downlink frequency	X-band
Inclination	98.8deg

HY-1A/COCTS Sensor

COCTS bands and detecting object

Wavelength Range	Application Targets
0.402 ~ 0.422μm	yellow substance, water pollution
0.433 ~ 0.453μm	Chlorophyll absorption
0.480 ~ 0.500μm	chlorophyll, marine optics, sea ice, pollution, shallow sea topography
0.510 ~ 0.530μm	chlorophyll, water depth, pollution, low concentration sediment
0.555 ~ 0.575μm	chlorophyll, low concentration sediment
0.660 ~ 0.680μm	fluorescence peak, high concentration sediment, atmospheric correction, pollution, aerosol
0.730 ~ 0.770μm	atmospheric correction, high concentration sediment
0.845 ~ 0.885μm	atmospheric correction, water vapor amount
10.30 ~ 11.40μm	SST, sea ice
11.40 ~ 12.50μm	SST, sea ice

Main characteristics

Nadir Resolution	Radiometric Precision
1100 m	10% (Visible) ±1K (Infrared))
Sensor	Cycle
COCTS	3 day
Samples Per Line	Qualification Levels
1024	10 bits

HY-1A/CCD Sensor

CCD bands and detecting objects

Wavelength Range	Application Targets
0.42 ~ 0.50μm	Suspended sediment, pollutant, sea ice
0.52 ~ 0.60μm	pollutant, vegetation, ocean color, sea ice
0.61 ~ 0.69μm	Soil, Atmospheric correction, water vapor
0.76 ~ 0.89μm	Soil, Atmospheric correction, water vapor

Main characteristics

Nadir Resolution	Radiometric Precision
0.25 km	10% (Visible) ±1K (Infrared))
Sensor	Cycle
CCD	7 day
Samples Per Line	Qualification Levels
2048	12 bits

HY1-B Satellite and Orbit Characteristics

Orbit type	Circular and near sun-synchronous
Equator corssing time	10:30 Am $\pm$ 30 min
Altitude	798km
Period	100.83 minute
Mass	< 400 kg
Payload	COCTS and CCD
Size	1.2m×1.1m×0.996m
Design life	3 years

HY-1B v.s. HY-1A

Unchanged:

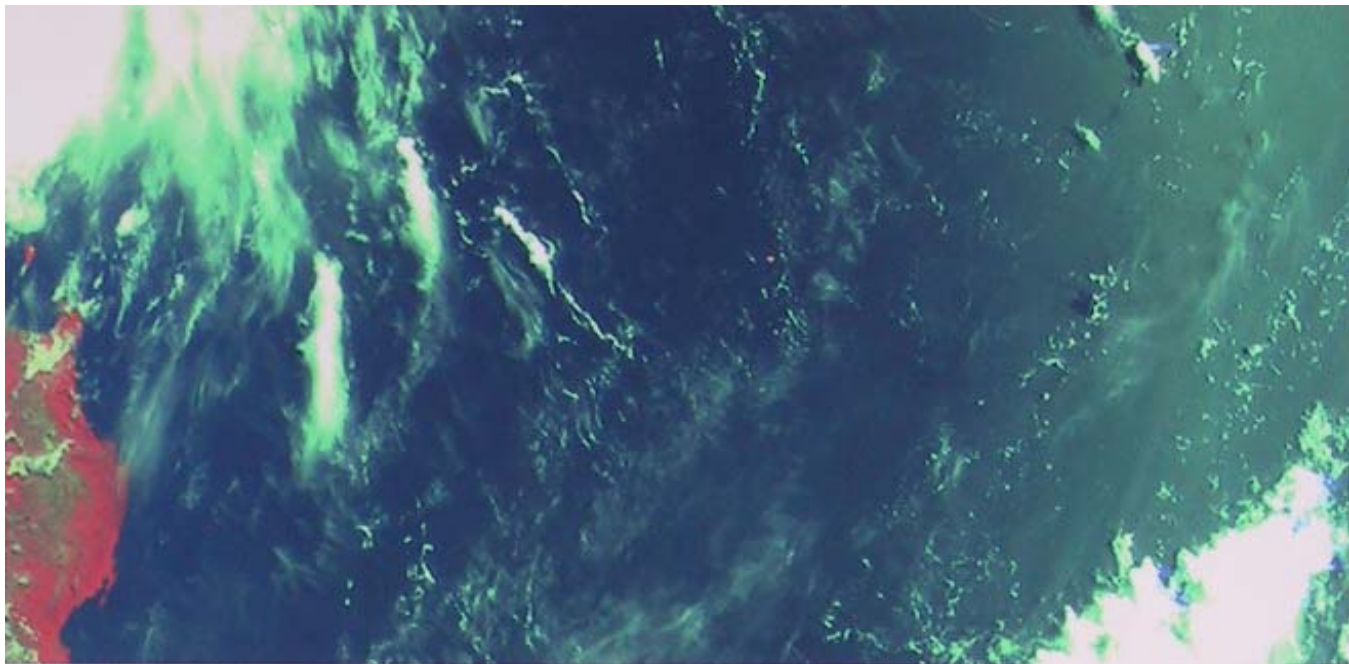
- Overall technical condition remains unchanged
- Continue to use the HY1-A satellite platform
- Payloads are COCTS and CCD

Improvements:

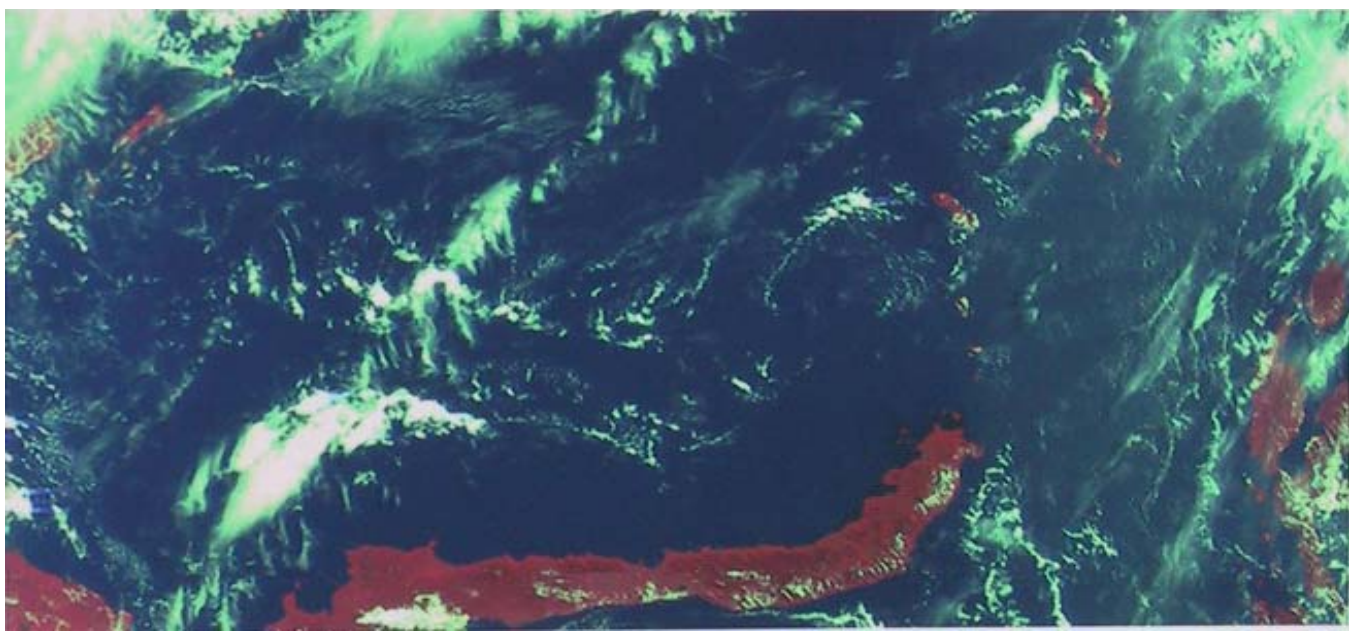
- Satellite service life extended to three years
- Coverage cycle reduced to one day
- Light conditions improved greatly

Image from HY-1

菲律宾
吕宋岛东北海域
(Philippine)



印尼
苏拉威西北部海域
(Indonesia)

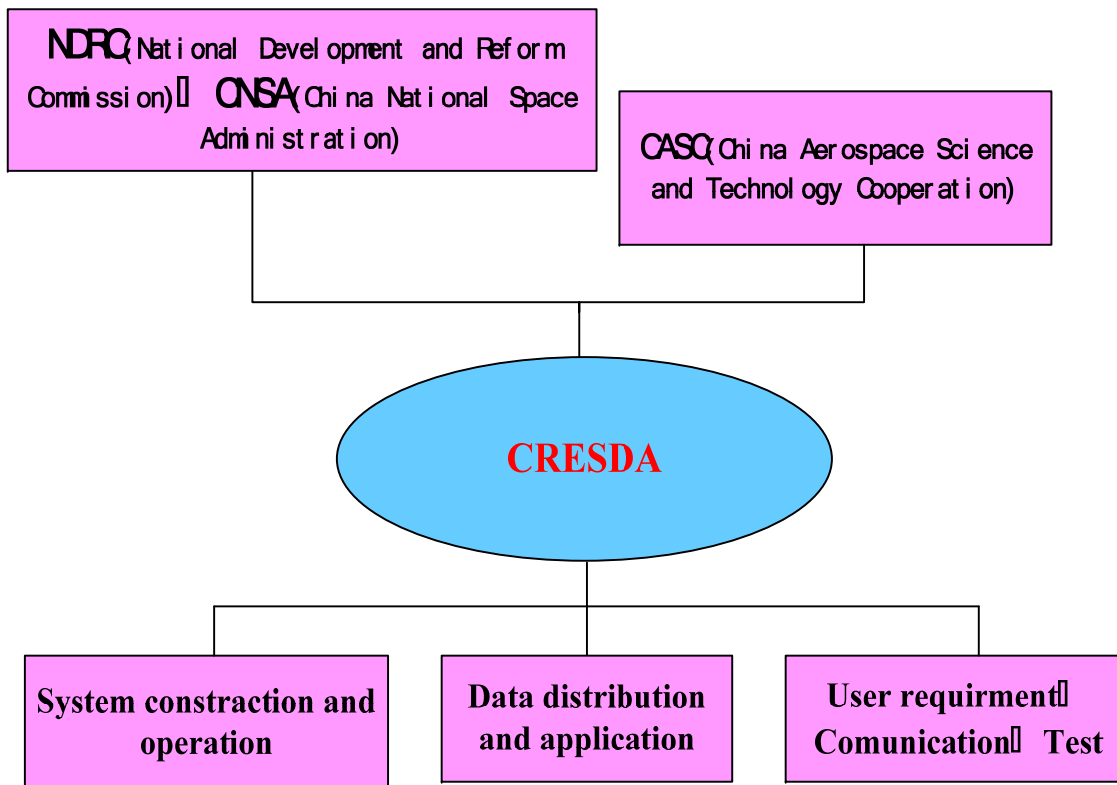


Future Programme

Year	HY-1 Satellites Series	Launched or not
2002	HY-1A	yes
2007	HY-1B	yes
2012	HY-1C	no
2012	HY-2A	no

HY-1 series focus on ocean color, HY-2 series focus on ocean dynamics with altimeter, MW radiometer, scatterometer

3. Earth Resource Satellites & Environment and Disaster Monitoring Satellites: CBERS Series HJ Series



launched:

CBRES-01: 1999/10~2003/08
(out of date)

CBRES-02: 2003/08~ now
(on-orbit, overtime)

CBRES-02B: 2007/09

HJ-1-A 2008.9

HJ-1-B 2008.9

CBERS Satellites

CBERS is the acronym for **China-Brazil Earth Resources Satellite**.
CBERS was jointly developed by China and Brazil.

Mission: national land、agriculture、forest、hydrology、mapping、environment and disaster etc

CBERS satellite orbit parameters

Orbit: sun-synchronous recurrent and frozen orbit

Mean altitude: 778Km

Inclination angle: 98.5°

Local time at descending node: 10:30 AM

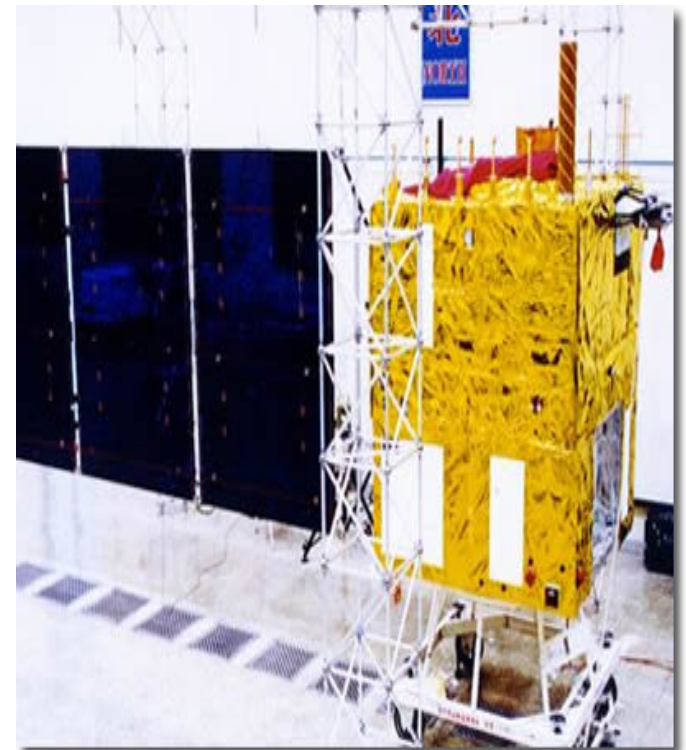
Orbital period: 100.26 minutes

Repeat cycle: 26 days

Revolution per day: $14 + \frac{9}{26}$

Inter-track distance: 107.4 Km

Time interval between adjacent track: 3 days



CBERS Satellites

CBERS-01/02 Sensors

CCD Charge Coupled Device	WFI Wide Field Imager	IRMSS Infrared Multi-Spectral Scanner
5 Bands	2 Bands	4 Bands (One is Thermal)
113km Swath (Can be $\pm 32^\circ$ from Track)	890km Swath	119km Swath
5812 Pixels (of 6144)	3456 Pixels	1536 Pixels (768 Thermal)
19.5m Resolution	258m Resolution	77.8m Resolution (156 m Thermal)

Payload	CCD	IRMSS	WFI
Sensor Type	Push-broom	Electro-mechanic	Push-broom
Visible and near infrared bands	1: 0.45~0.52 μ m 2: 0.52~0.59 μ m 3: 0.63~0.69 μ m 4: 0.77~0.89 μ m 5: 0.91~0.93 μ m	6: 0.50~0.90 μ m	10: 0.63~0.69 μ m 11: 0.77~0.89 μ m
Short wave infrared bands		7: 1.55~1.75 μ m 8: 2.08~2.35 μ m	
Thermal infrared bands		9: 10.4~12.5 μ m	
Resolution	19.5m	Band 6、7、8: 78m Band 9: 156m	258m
Side-looking	-32°~+32°		
Viewing angle	8.32°	8.80°	59.6°
Swath wide	113km	119.5km	890km

CBERS Satellites

CBERS-02B Sensors

Payload	Band No.	Spectrum (μm)	Resolution (m)	Swath width (km)	Side -looking	Repeat cycle (day)
CCD Camera	1	0.45~0.52	20	113	$\pm 32^\circ$	26
	2	0.52~0.59	20			
	3	0.63~0.69	20			
	4	0.77~0.89	20			
	5	0.51~0.73	20			
High Resolution Camera (HR)	6	0.5~0.8	2.36	27	$\pm 4^\circ$	104
Wide Field Image (WFI)	7	0.63~0.69	258	890	No	5

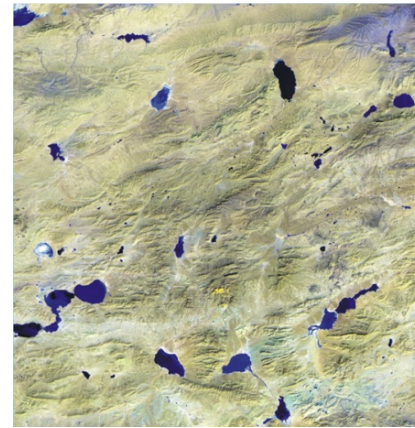
CCD, IRMSS and WFI



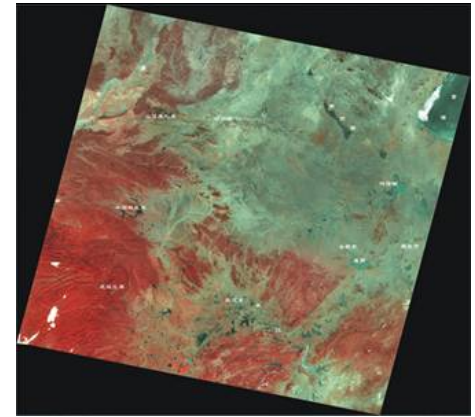
CCD image of
Beijing, R4G3B2
false color
composite



Mosaic image of
Beijing with 5
scenes of CCD
images, R3G4B2
pseudo color
composite



IRMSS image of
Mani, Tibet
R7G6B8 false
color composite



WFI image of
middle-east China,
acquired on Nov.1,
2003.

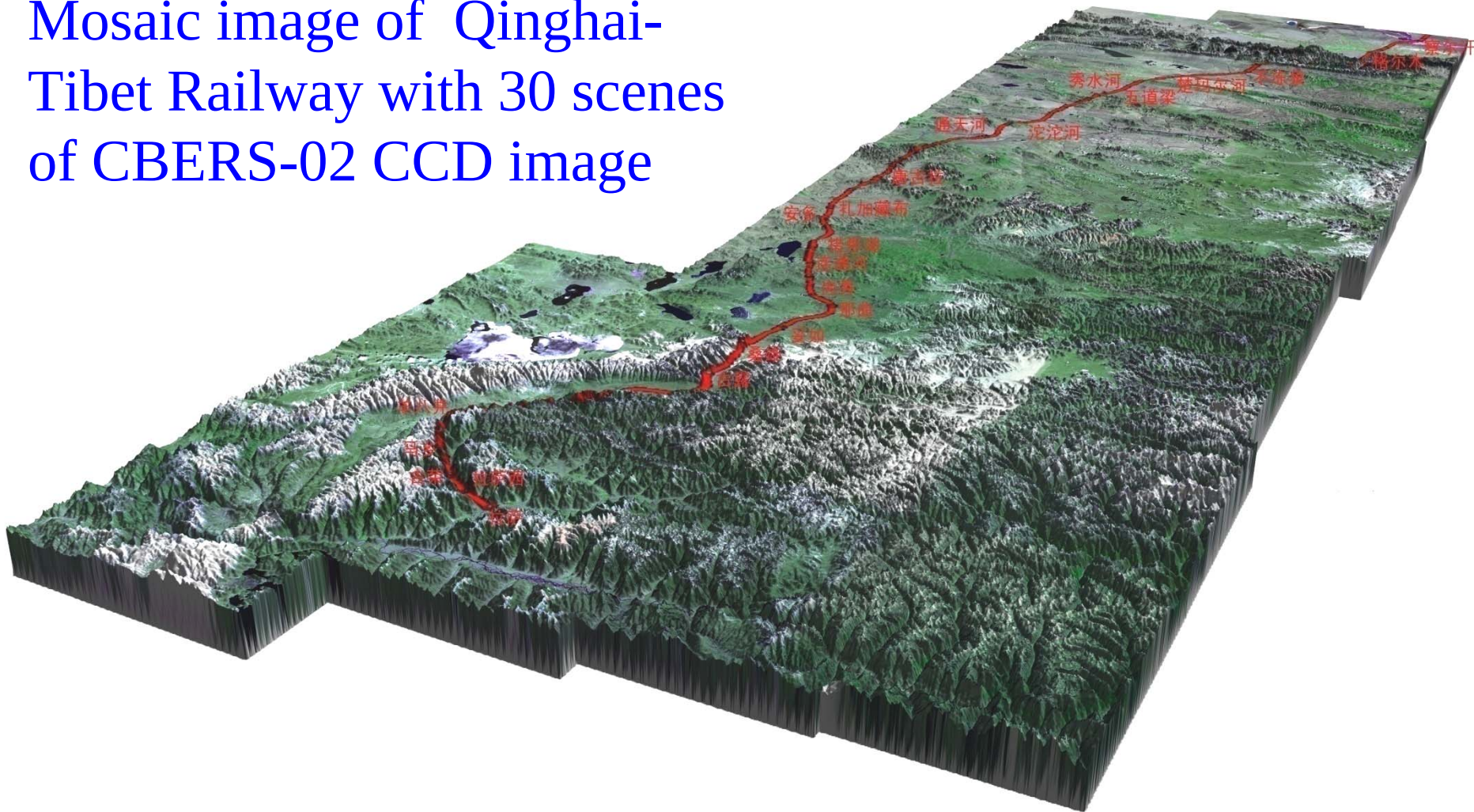
CBERS-02B
HR image of
San Francisco
airplane





CBERS-02B HR
image of 2008
Olympic Games
stadiums

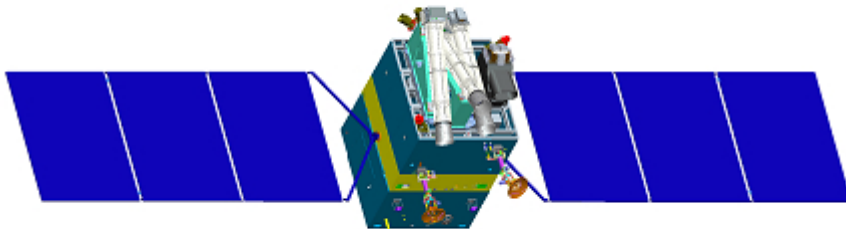
Mosaic image of Qinghai-Tibet Railway with 30 scenes of CBERS-02 CCD image



Earth Resource Satellite Plan in Two Years

2011 : ZY-1-02C、ZY-3、 SJ-9

2012 : CBERS-03



ZY-3



SJ-9

ZY-3&ZY-1-02C Satellite

	ZY-3	ZY-1-02C
Orbit	Sun synchronous recurrent frozen orbit	
Altitude (km)	506	778
Eccentricity	0	0.0011
argument of perigee (degree)	90	90
Nodal period (min)	97.7	100
Inclination (degree)	97.4	98.5
Descending node (Local time)	10 : 30	10 : 30
Repetition cycle (days)	59	55
Interval (km)	44.7	51

ZY-1-02C payloads

	Panchromatic Camera	Multi-Spectral Camera
Spectrum (μm)	B1 : 0.51~0.85	G (B2) : 0.52~0.59 R (B3) : 0.63~0.69 NIR (B4) : 0.77~0.89
Resolution (m)	5	10
Swath (km)	60	60
Quantized value (bit)	8	8
Data Compress	4 : 1	/

ZY-3 payloads

	Orthographic Camera	Forward/Backward Camera	Multi-Spectral Camera
Spectrum (μm)	0.5~0.8	0.5~0.8	B (B1) : 0.45~0.52 G (B2) : 0.52~0.59 R (B3) : 0.63~0.69 NIR (B4) : 0.77~0.89
Resolution (m)	2.1	3.5	5.8
Swath (km)	51	52	51
Quantized value (bit)	10	10	10
Data Compress	2 : 1 or 4 : 1	2 : 1 or 4 : 1	/

SJ-9

Item	Parameter
Camera Type	TDICCD (Push)
Spectrum	PAN : 0.45μm ~ 0.89μm B (B1) : 0.45μm ~ 0.52μm G (B2) : 0.52μm ~ 0.59μm R (B3) : 0.63μm ~ 0.69μm NIR (B4) : 0.77μm ~ 0.89μm
Pixel Resolution	PAN > 2.5m(Altitude:645km) Multi-Spectrum >10m(Altitude:645km)
Swath	30km(Altitude:645km)

Item	Paramter
Camera Type	LWIR (Push)
Spectrum	8um±0.5um ~ 12um+1um
Pixel resolution	≤73m(Altitude:645km)
Swath	≥18km

CBERS-03/04 payloads

Payload	Band No.	Spectrum (μm)	Resolution (m)	Swath Width (km)	Repeat Cycle (day)
Panchromatic Camera (PAN)	1	0.51~0.85	5	60	52 (Side-looking $\pm 32^\circ$)
	2	0.52~0.59	10		
	3	0.63~0.69	10		
	4	0.77~0.89	10		
Multi Spectral Camera (MUX)	5	0.45~0.52	20	120	26
	6	0.52~0.59	20		
	7	0.63~0.69	20		
	8	0.77~0.89	20		
IRMSS	9	0.50~0.90	40	120	26
	10	1.55~1.75	40		
	11	2.08~2.35	40		
	12	10.4~12.5	80		
Wide Field Image (WFI)	13	0.45~0.52	73	866	5
	14	0.52~0.59	73		
	15	0.63~0.69	73		
	16	0.77~0.89	73		

HJ-1 small satellite constellation

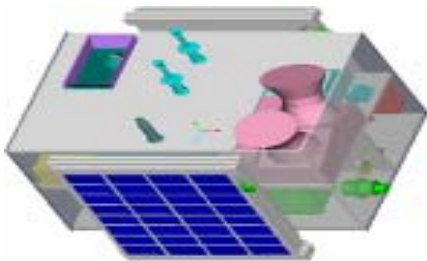
Environmental and Disaster Monitoring Small Satellite Constellation

HJ-1A: CCD, hyper-spectral imager (2008 launched)

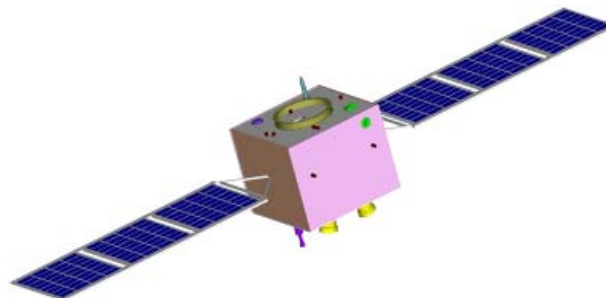
HJ-1B: CCD, IRMSS (2008 launched)

HJ-1C: SAR (2012 in schedule)

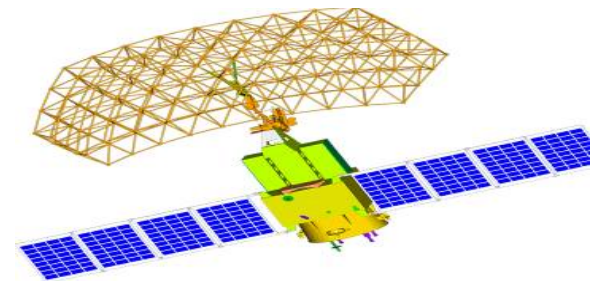
Mission: Disaster monitor and forecast, Environment monitor and forecast



HJ-1A



HJ-1B



HJ-1C

Payloads Specification

Sat.	Payload	Band No.	Spectrum (μm)	Resolution (m)	Swath Width (km)	Repeat Cycle (day)
HJ-1-A	CCD Camera	1	0.43-0.52	30	720	4
		2	0.52-0.60	30		
		3	0.63-0.69	30		
		4	0.76-0.9	30		
	hyper-spectral Image	—	0.45-0.95 (110-128 bands)	100	50	4-31, (Side-looking $\pm 30^\circ$)
HJ-1-B	CCD Camera	1	0.43-0.52	30	720	4
		2	0.52-0.60	30		
		3	0.63-0.69	30		
		4	0.76-0.9	30		
	IRMSS	5	0.75-1.10	150 (NIR)	720	4
		6	1.55-1.75			
		7	3.50-3.90			
		8	10.5-12.5	300 (10.5-12.5 μm)		
HJ-1-C	SAR	—	S Band	20 (4 Looks) 5 (1 Looks)	100	4-31

Orbit

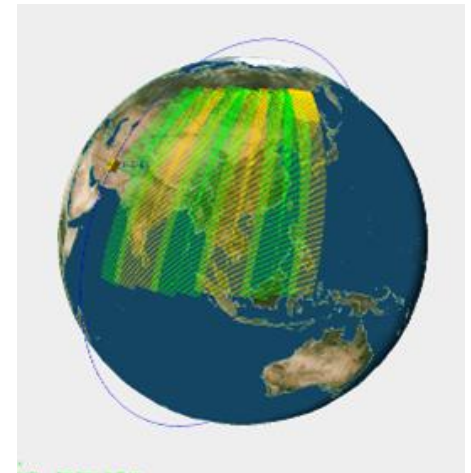
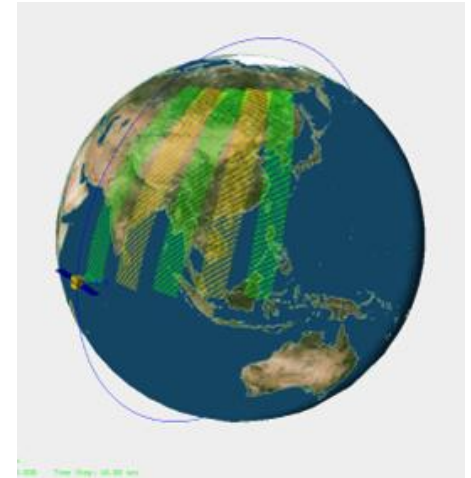
The optical satellite:
650km/
10:45AM sun
synchronous orbit

The SAR satellite:
500km/
6:00AM
sun
synchronous orbit

Emergency Response of Natural disaster using HJ-1-A/B

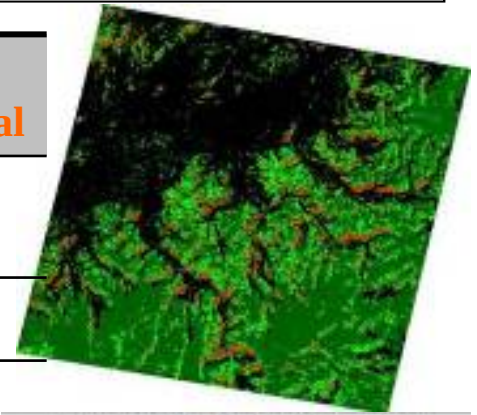
- Using the wide coverage and high revisit characters of HJ-1-A/B to access image within 48 hours for disaster emergency response.
 - For domestic , first, ensure a regular revisit of two days, once disaster happened, images can be obtained in time. Such as 7.1 magnitude earthquake occurred in Qinghai Province at 7:49 am Apr. 14,2010, and HJ-1-B quickly obtained semantic image at 12:29 Apr. 14.
 - For natural disasters happened abroad, adjust imaging plan timely to ensure accessing image within 48 hours. Such as the magnitude 8.8 earthquake happened in Chile at 3:34 (Beijing time at 2:34 P.M) on the Feb. 27, 2010. Through emergency planning arrangements, the first valuable remote sensing images obtained just 8 hours after earthquake.

Coverage Capability of
the HJ-1-A/B
(Left- one day 80% ,
Right- two days 100%)

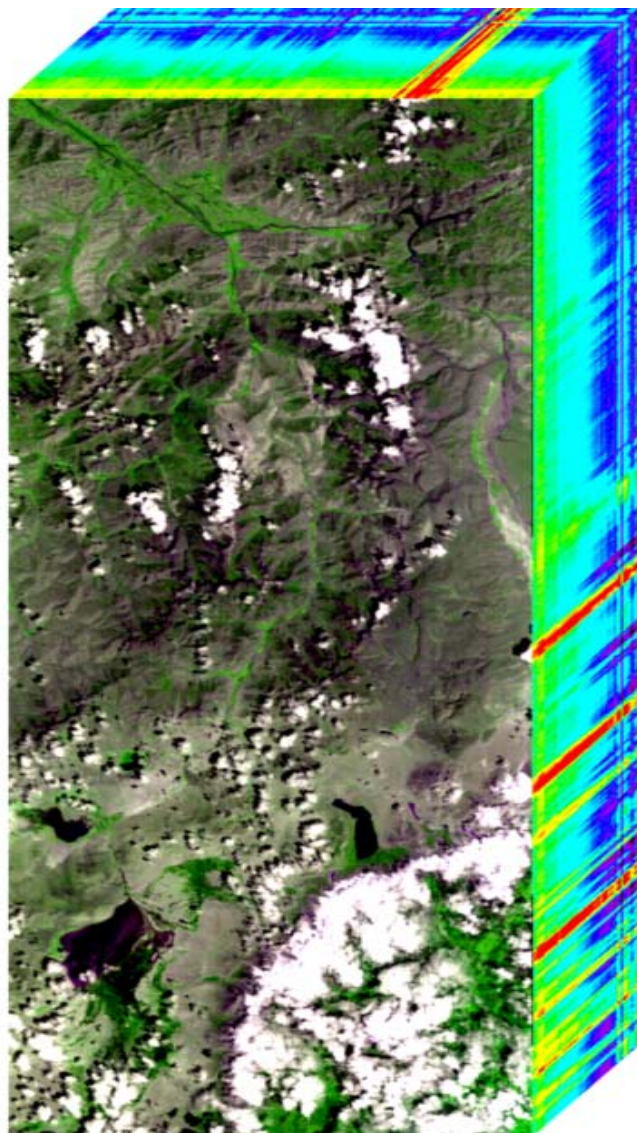


Application Areas of HJ1A/1B

Application Area	CCD	Infrared	Hyper Spectral
Disaster background parameter monitoring	√	√	√
Flood monitoring and evaluation	√		
Drought risk, monitoring and evaluation	√	√	
Landslide and Debris monitoring and evaluation	√		
Earthquake restoration and reconstruction monitoring	√		
Snow risk, monitoring and evaluation	√	√	
Forest and grassland fires monitoring	√	√	
Ice flood and Sea ice monitoring	√		
Ecological disaster monitoring			√
Crop diseases and pests monitoring	√		√
Wind and hail damage to crops loss	√		√



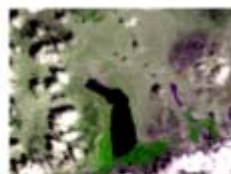
HJ-1A HSI image, Tibet



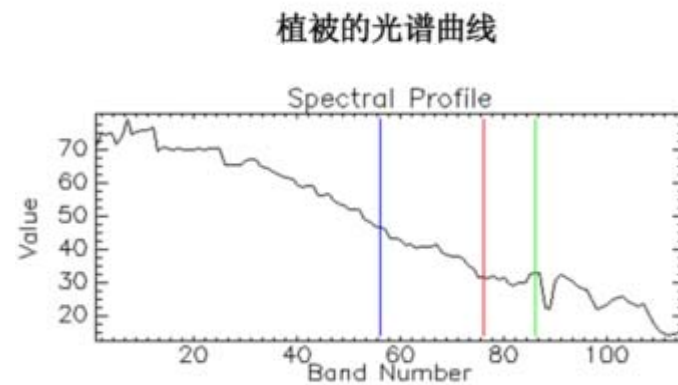
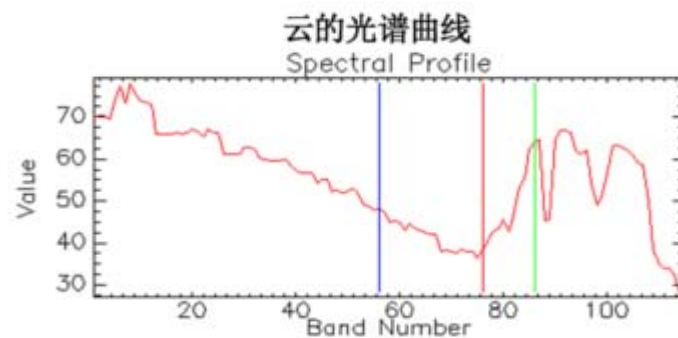
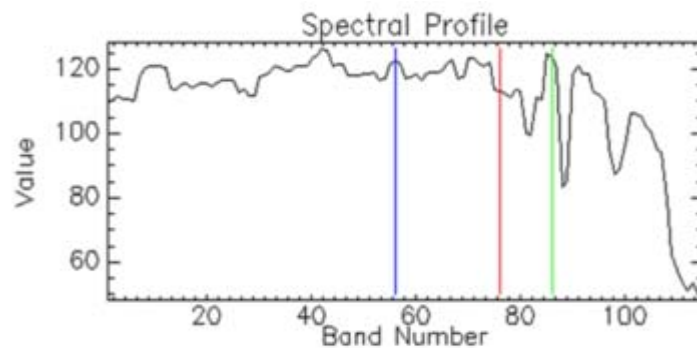
云



植被



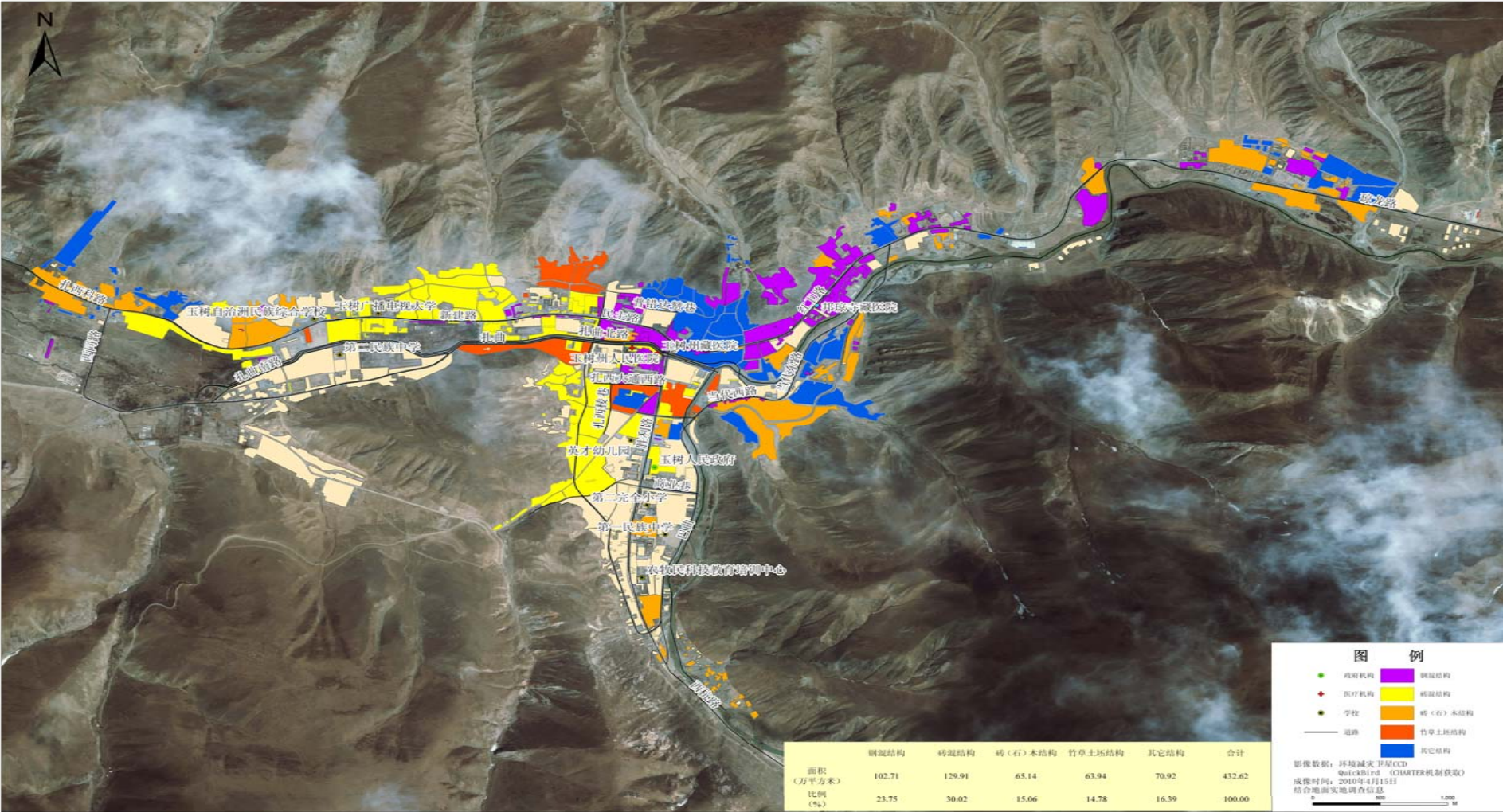
水体



水体的光谱曲线

Earthquake Disaster Evaluation with HJ-1A/B CCD Image

青海省玉树县结古镇房屋结构分布图

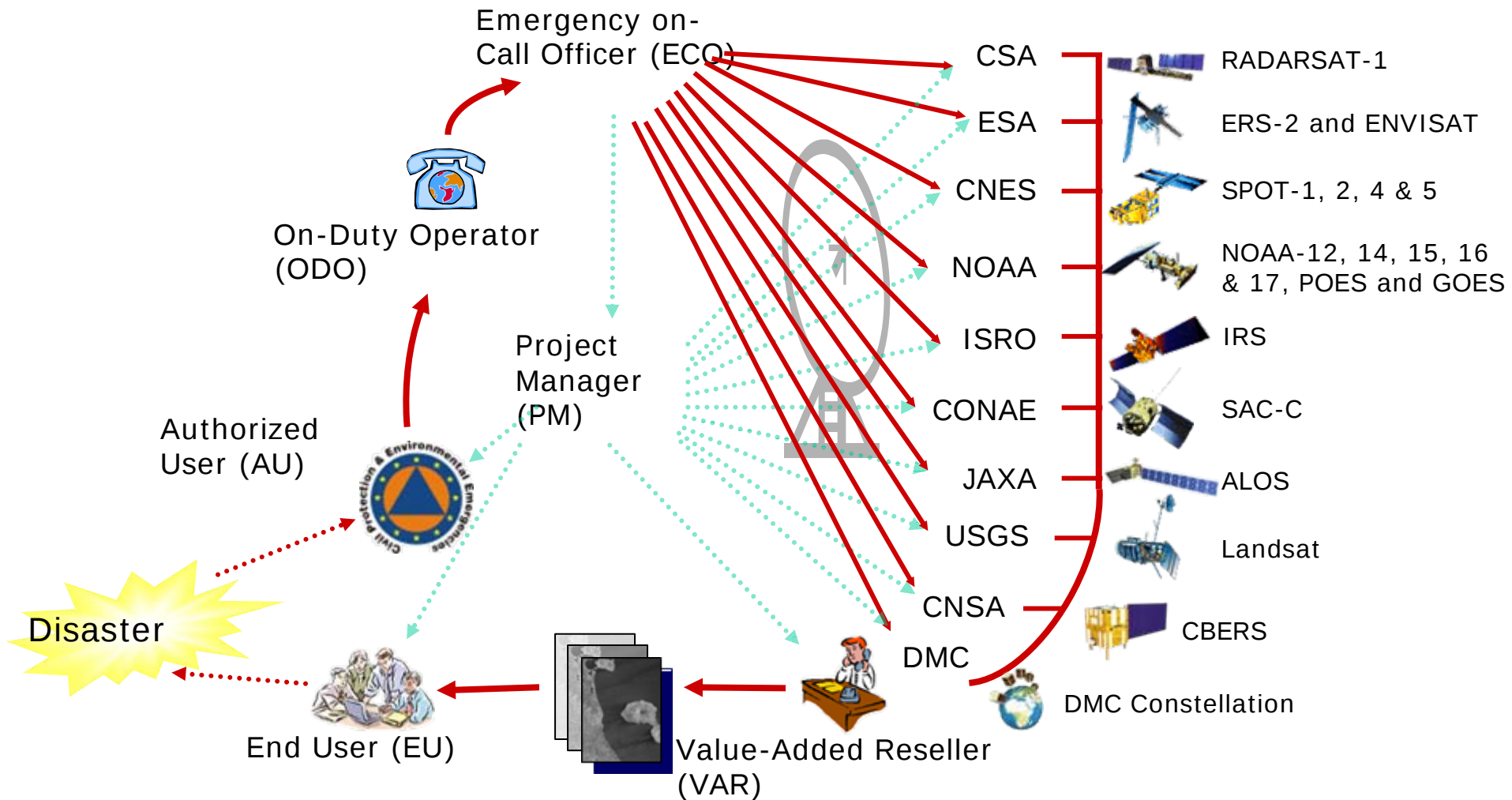


Charter

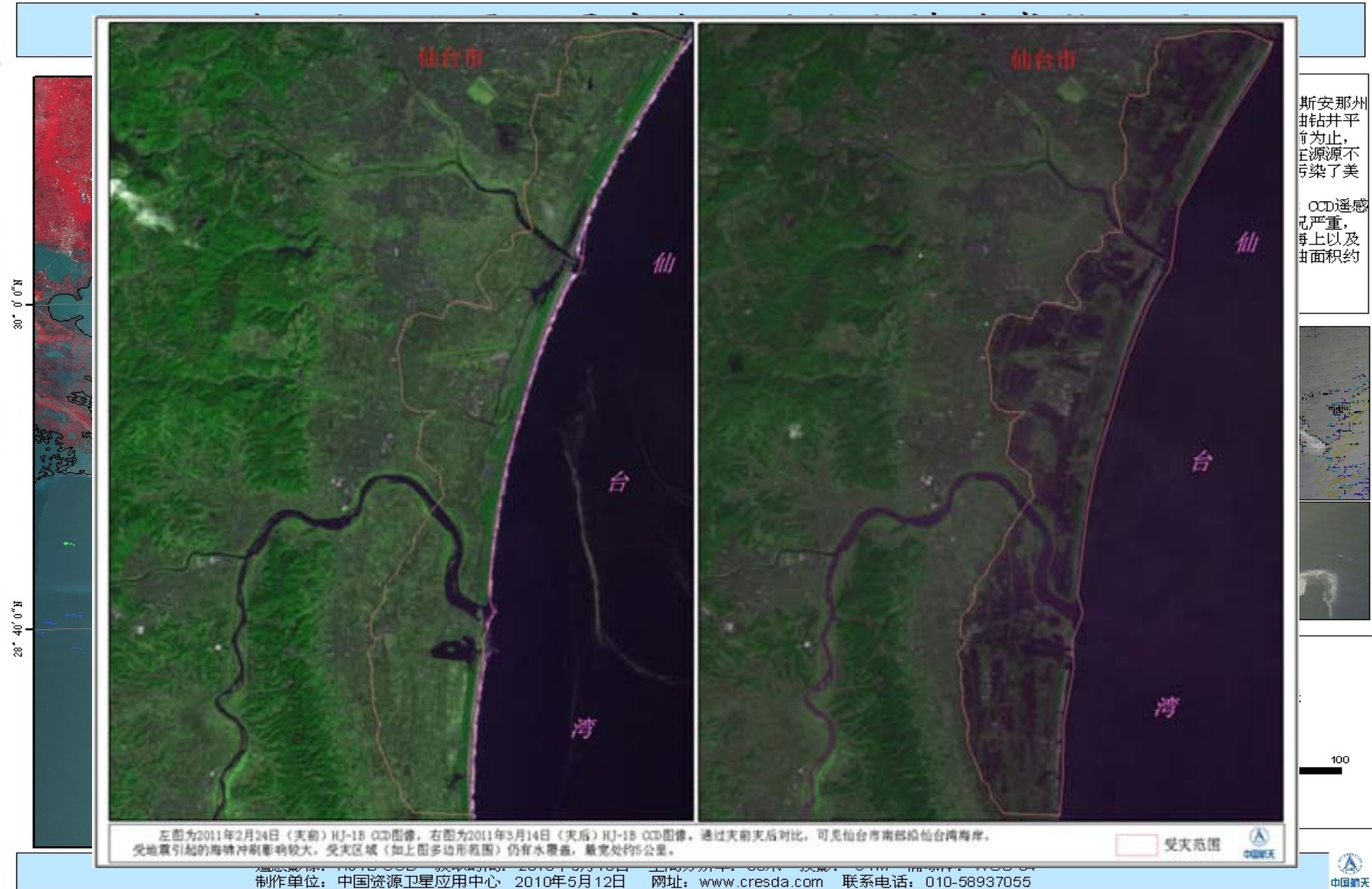
CNSA joined the International Charter in May 2007.

CRESDA has been authorized to provide space data to those disaster-affected areas.

CBERS becomes a kind of space resources of Charter.

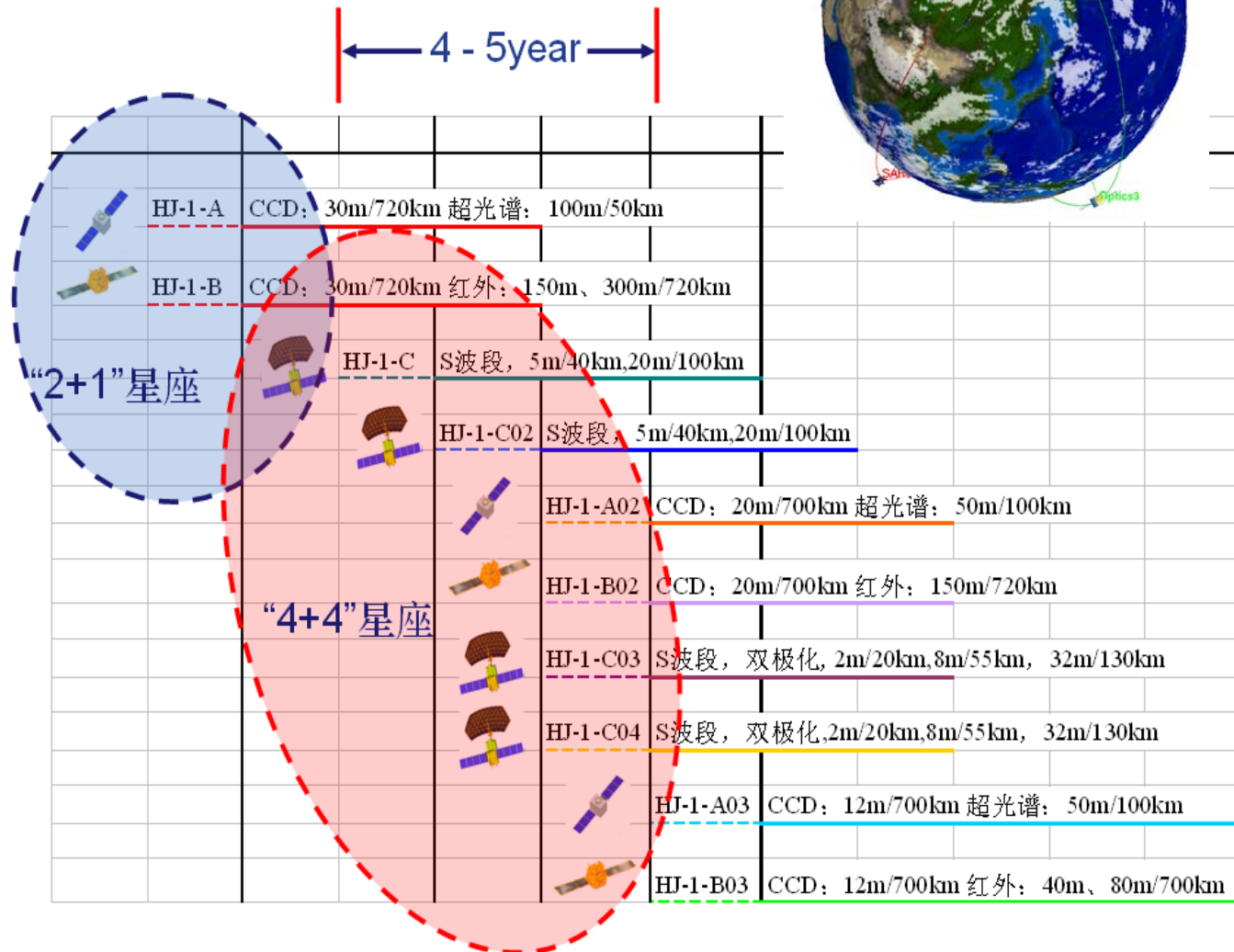


CHARTER



Planning of HJ-1 Constellation

Currently two optical satellites of the "2 +1" phase is in orbit, and small SAR satellite will be launched in 2011, the "2 +1" constellation will be formally established. In next four-five years, with the follow-satellites be launched, the constellation will realize the "4 +4" satellites in orbit

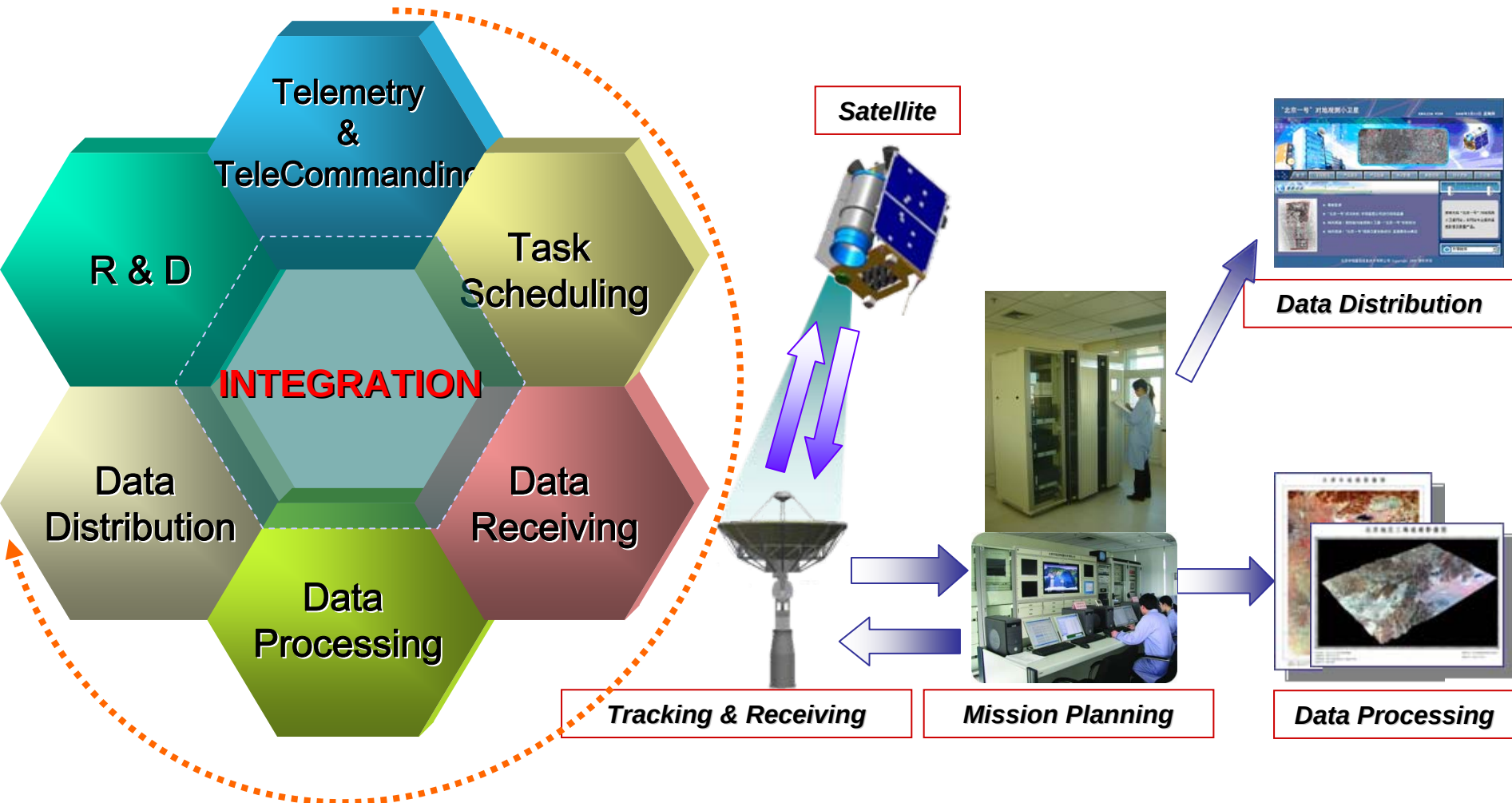


Beijing-1 Micro-Satellite

- **November 2002:** Approved and Supported by MoST of China
- **July 2003:** Contract Signed with SSTL, UK
 - R&D of the Satellite Undertaken by SSTL, UK
 - Ground Segments Manufactured by China Domestic Partners
- **27 October 2005 (06:52 UTC) :**
Launch of the Satellite at Plesetsk Cosmodrome , Russia
(Launcher: COSMOS-3M Rocket)
- **October 2005 – 27 February 2006:** In Orbit Commissioning
- **March 2006:** Full Operation of Satellite and Ground Station
- **June 2006:** Commercial Data Distribution

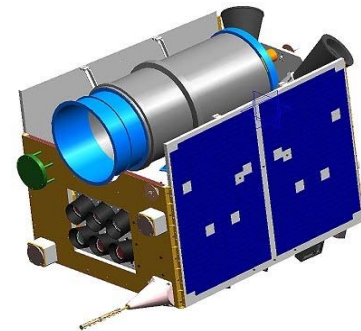
BLMIT

First Company in China to integrate Satellite, Data Receiving, Data Processing, Data Distribution and Data Application



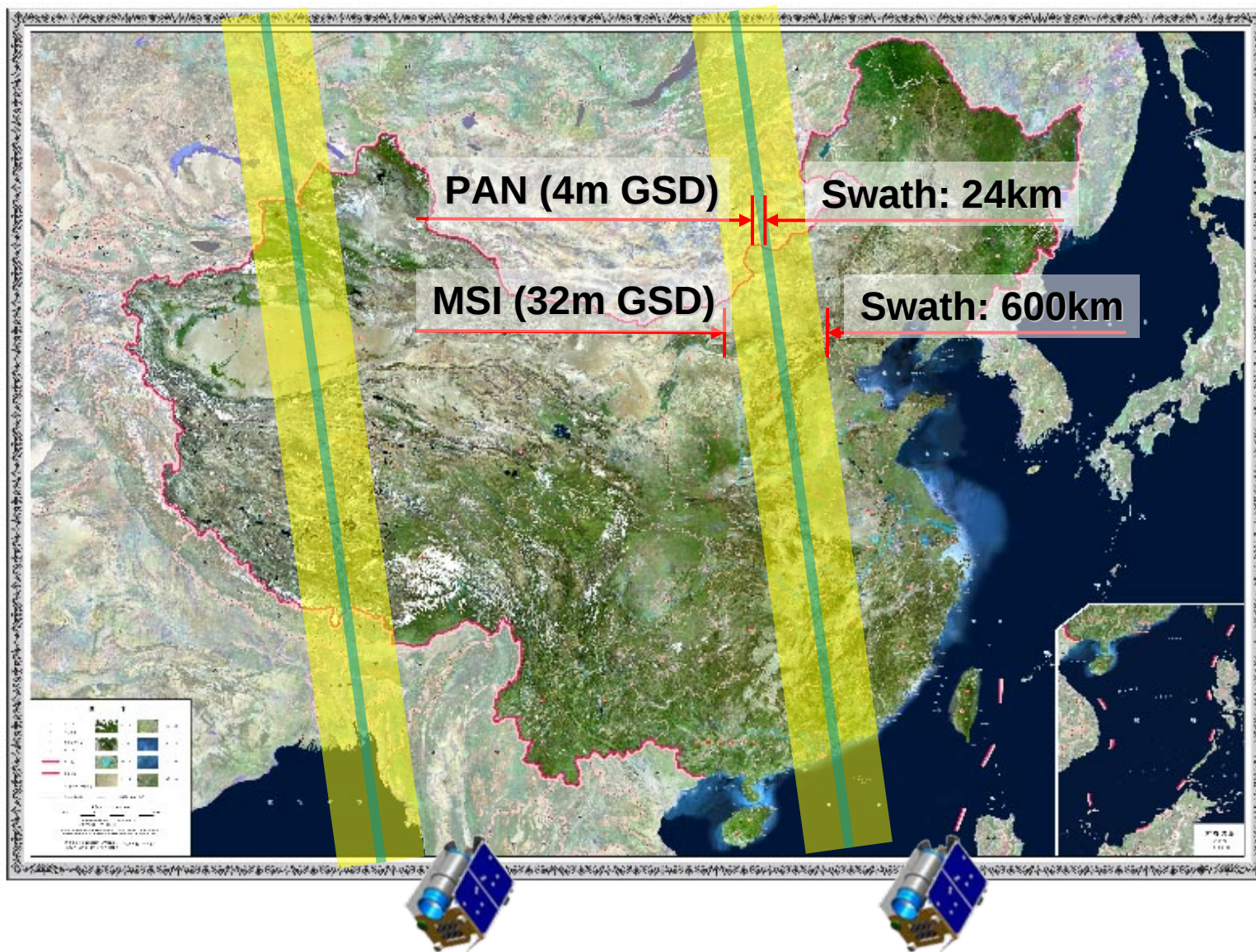
General Specifications

- **Mass:** Around 166.4 kg
- **Average Altitude:** 686 km
- **Passes over Beijing Ground Station:** Average 5 times per Day
- **Cross Equator at LTAN (Local Time on Ascending Node):** 1045 Hours
- **Imaging Sensors:**
 - 32 m GSD Multi-Spectral Imager (MSI) with A Swath Width of 600 km, including 3 Bands (NIR: 760-900nm / Red: 630-690nm / Green: 520-620nm)
 - 4 m GSD Panchromatic Camera (PAN) with A Swath Width of 24 km
- **Revisit Period:** 3-5 Days for MSI, 5-7 Days for PAN
- **Storage Units:** HDDR (2 x 120GB) + SSDR (2 x 0.5GB + 1 x 1GB + 1 x 2GB)
- **Data Transmission Rate :**
 - X-Band: 40Mbps/20Mbps
 - S-Band: 8Mbps
- **Life Expectancy :** 5 Years (For Propulsion System: 7 Years)
- **Off-Pointing Capability :** 30°



Swath of PAN and MSI

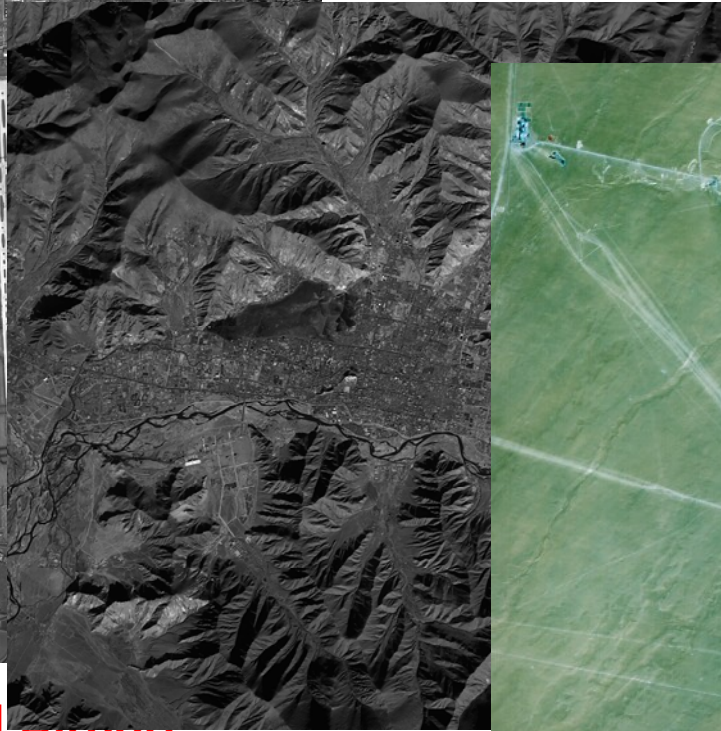
北京一号卫星影像图



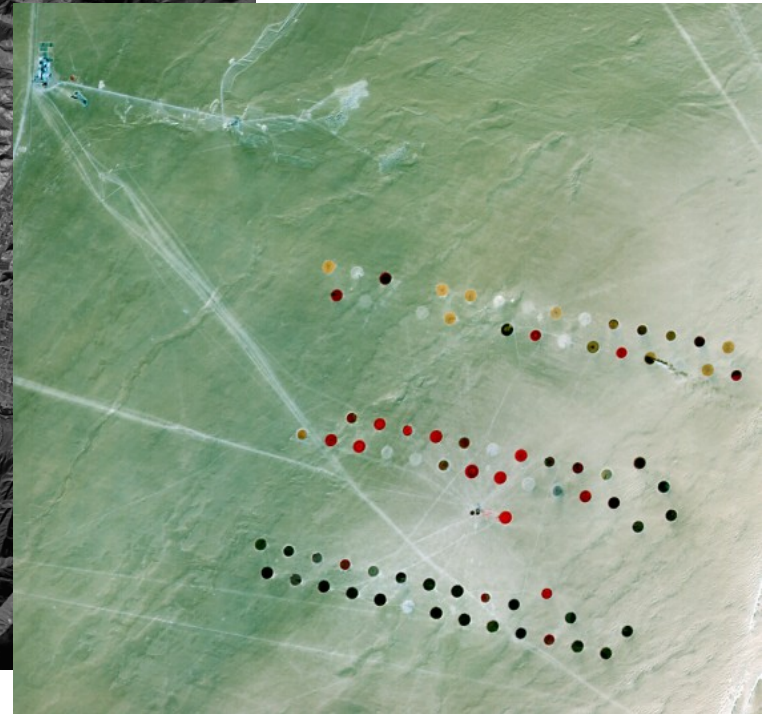
Images of Beijing-1



Beijing Capital Airport

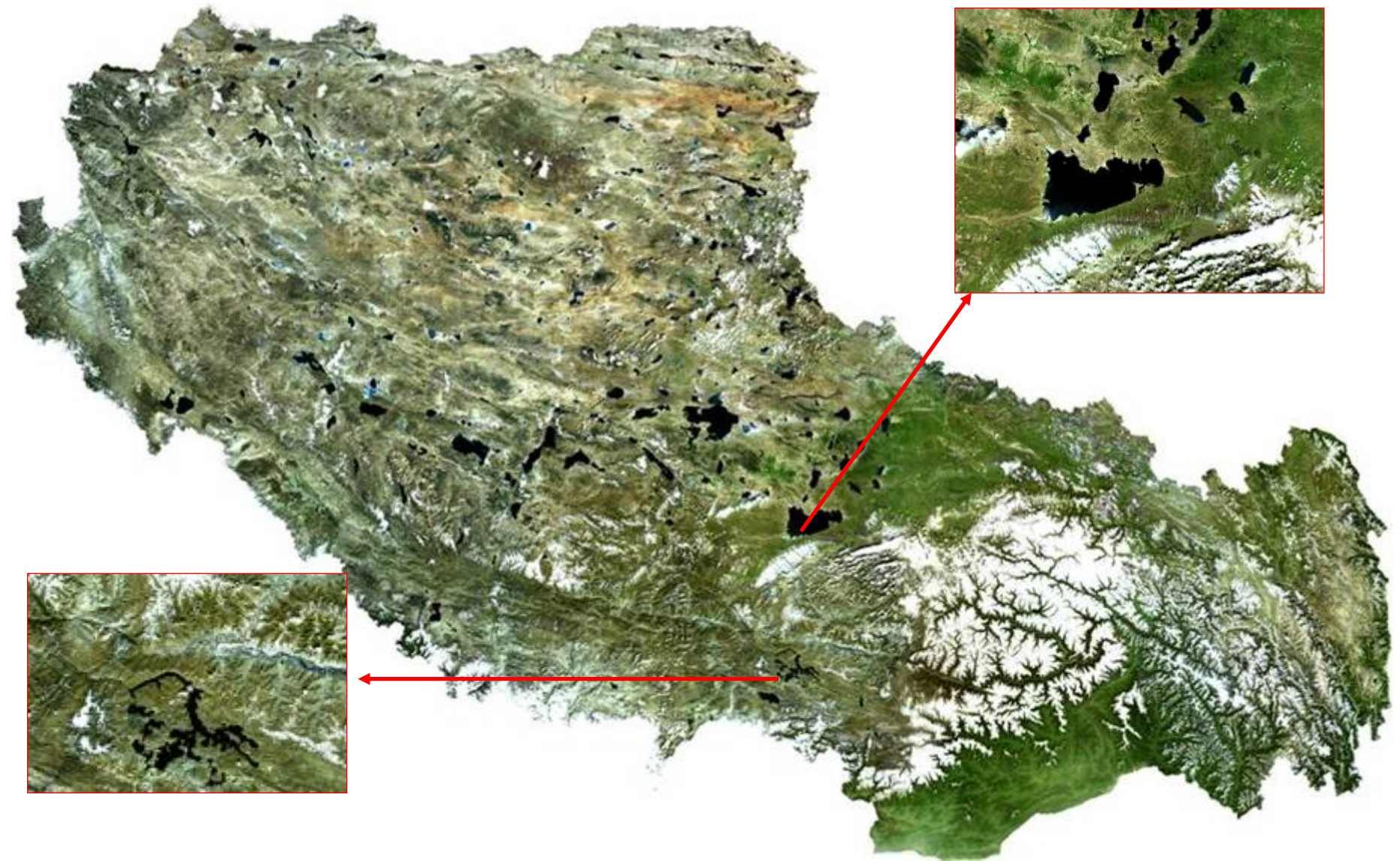


Lhasa City



Desert Agriculture in Liberia

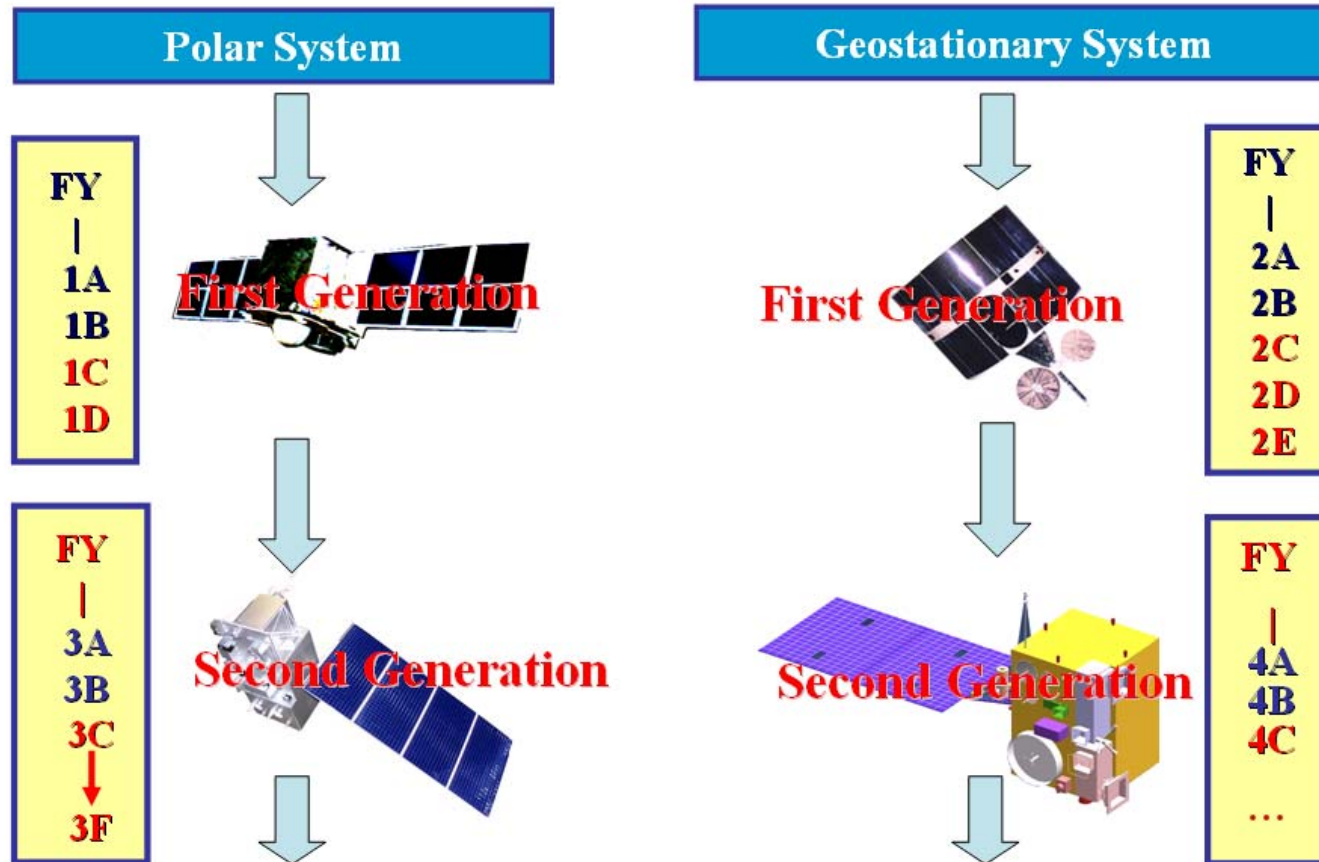
32m GSD Multi-Spectral Image: Tibet



4m GSD Panchromatic Image: New York, USA



4. Meteorological Satellites: FY Series

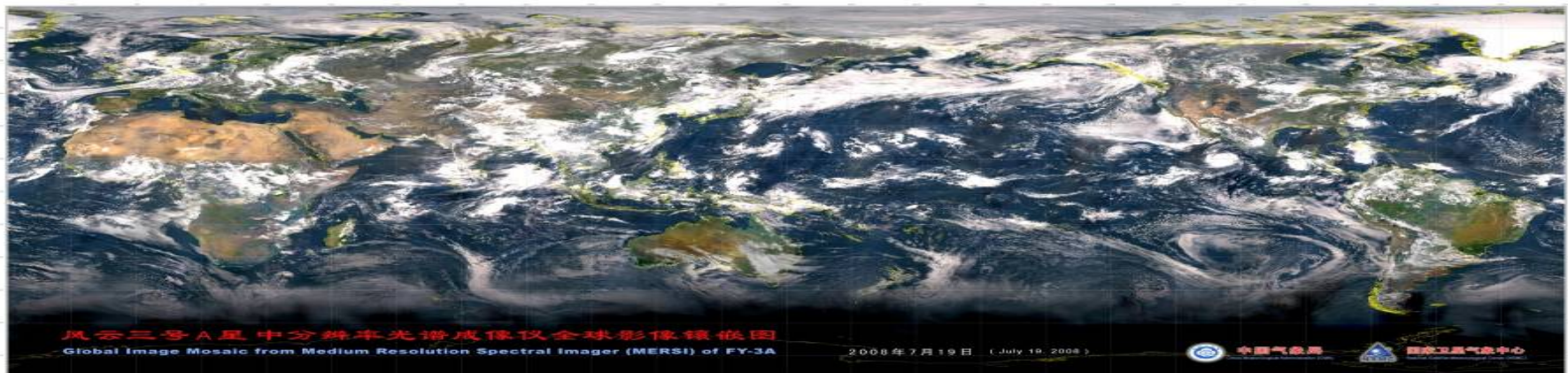


The Chinese meteorological satellite is named 'Fengyun', the Wind and Cloud in English. The odd number series is the polar-orbiting series, the even number is the geo-stationary. The satellites in a series are labeled in alphabetic order according to the launching sequence in time.

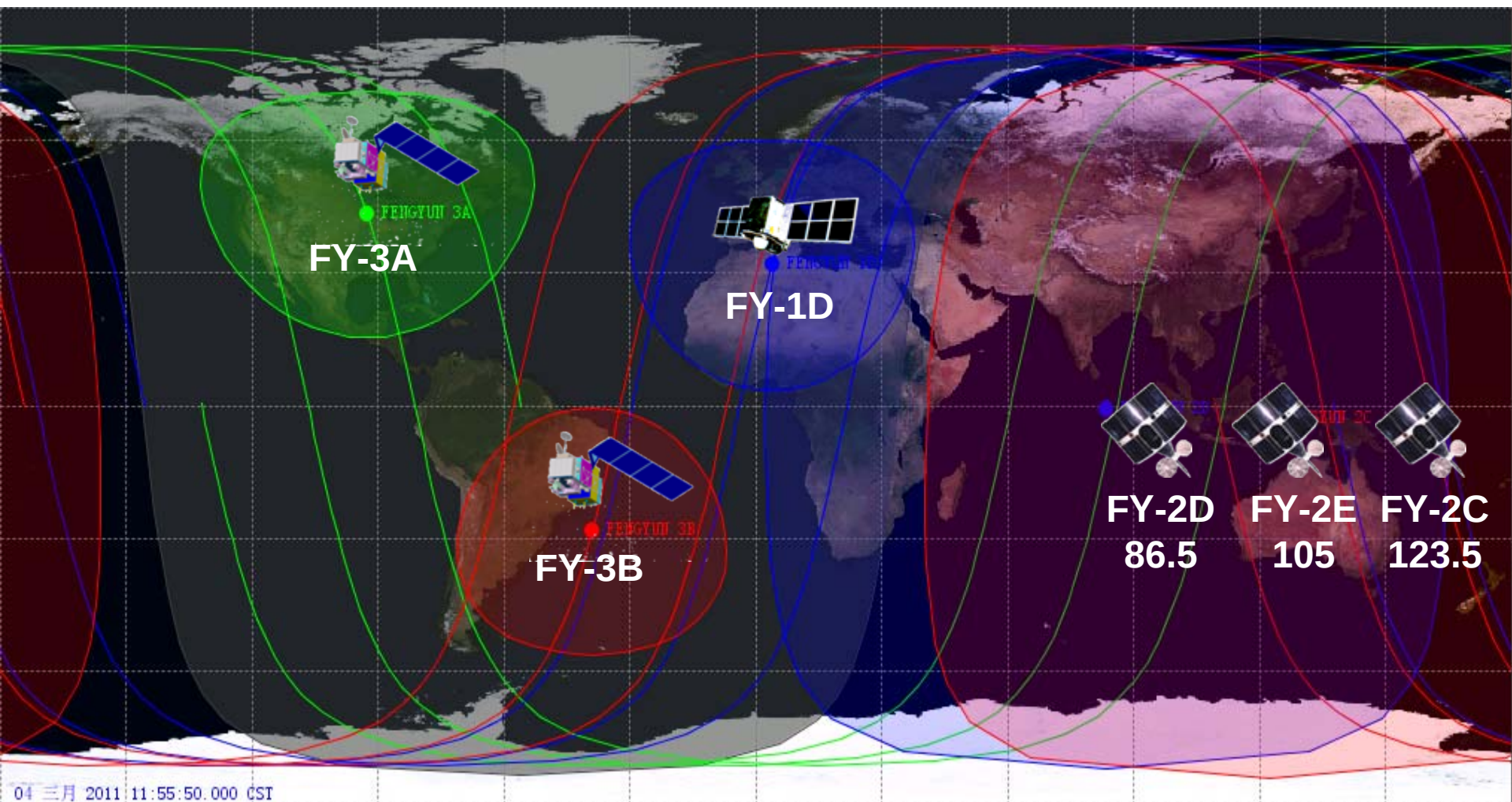
Launched Satellites

Since Jan. 1969, China began to develop his own meteorological Satellite

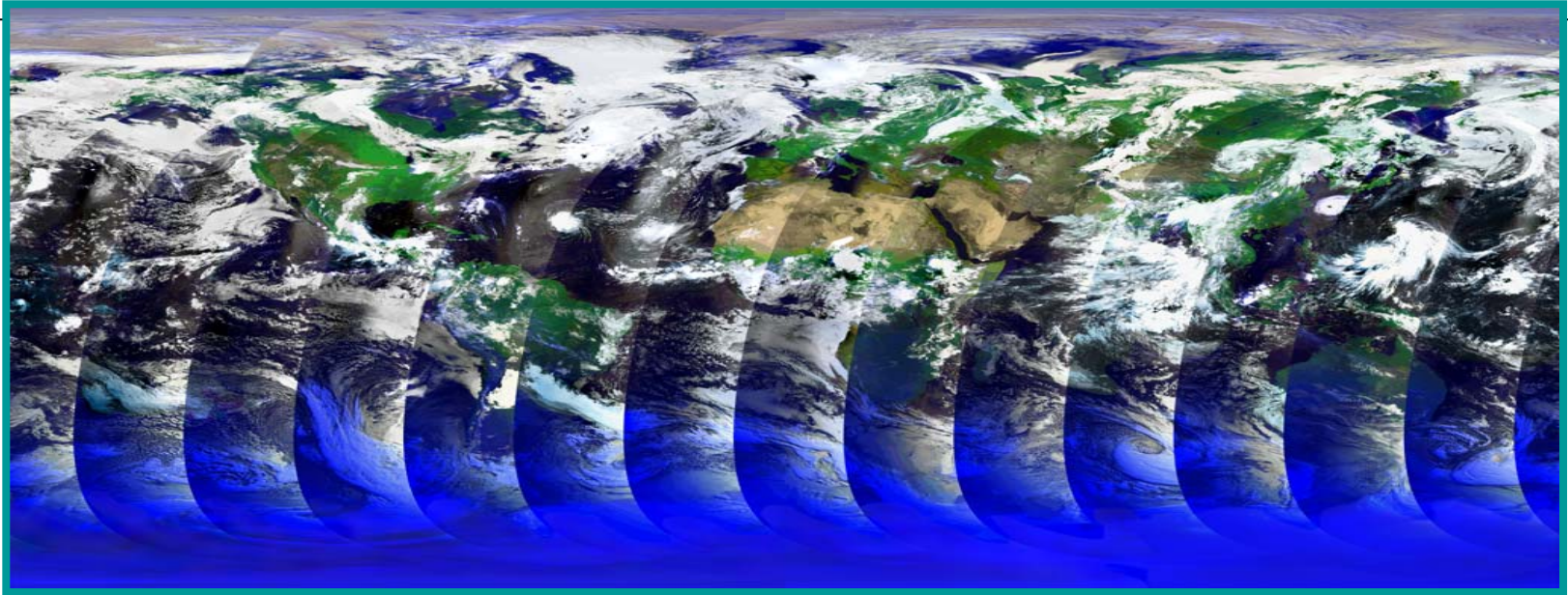
Leo	Launch Data		Geo	Launch Data
FY-1A	Sept. 7, 1988		FY-2A	Jun. 10, 1997
FY-1B	Sept. 3, 1990		FY-2B	Jun. 25, 2000
FY-1C	May 10, 1999		FY-2C	Oct. 18, 2004
FY-1D	May 15, 2002		FY-2D	Dec. 8, 2006
FY-3A	May 27, 2008		FY-2E	Dec. 23, 2008
FY-3B	Nov 5, 2010			



On-orbit Satellites



FengYun LEO. Satellites: FY-1



Instruments:

✓ 10 chl. Visible and Infrared radiometer.

✓ Space Environment Monitor

Transmission:

✓ HRPT: 1.3308Mbps (DB)

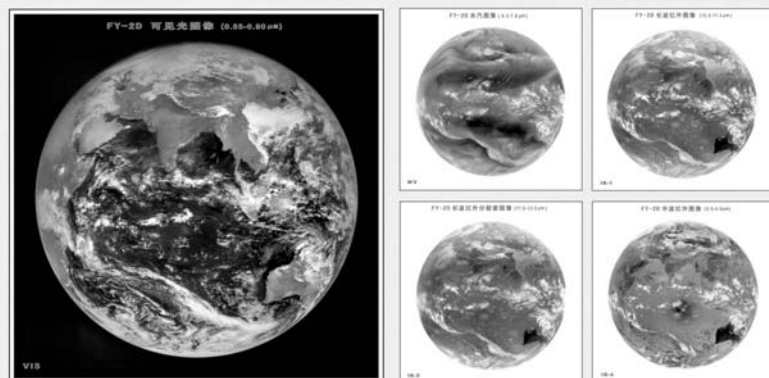
✓ GDPT: 1.3308Mbps

No.	Status	Launch	Druation
FY-1A	Exp. (dead)	Sept.7, 1988	6 months
FY-1B	Exp. (dead)	Sept.3, 1900	8 months
FY-1C	Op. (dead)	May 10, 1999	>7 years
FY-1D	Op. (working)	May 15, 2002	>7 years

FengYun GEO. Satellites: FY-2

风云二号 D 星第一套图像
THE FIRST IMAGES OF FY-2D SATELLITE

2007 年 1 月 12 日 14:00 (北京时间)
January 12, 2007 06:00(UTC)



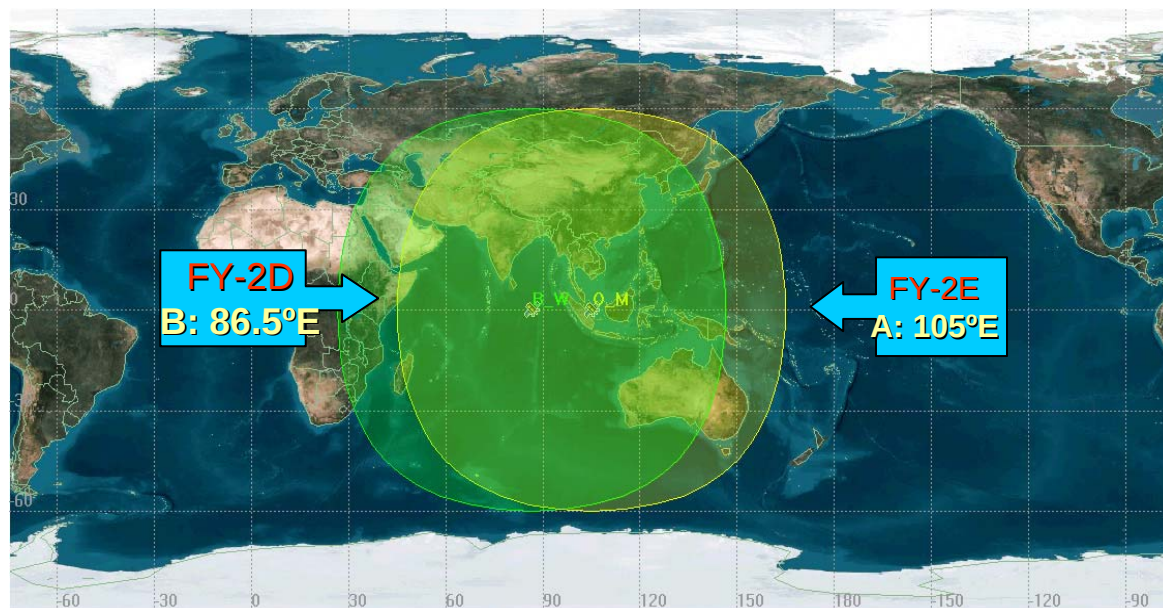
No.	Pos.	Status	Launch
FY-2A	105E	Exp. (dead)	Jun.10, 1997
FY-2B	105E	Exp. (dead)	Jun.20, 2000
FY-2C	105E	Op. (working)	Oct.18, 2004
FY-2D	86.5E	Op. (working)	Dec.8, 2006
FY-2E	105E	Op. (Stored)	Dec.23,2008

Platform: Spin stabilization

Payload: 5 chl. VISSR

Full Disc: every 30 min. at most

- ✓ FY-2E & FY-2D are working together to implement 15 min. interval obs.
- ✓ FY-2E takes over FY-2C in DEC., 2009!

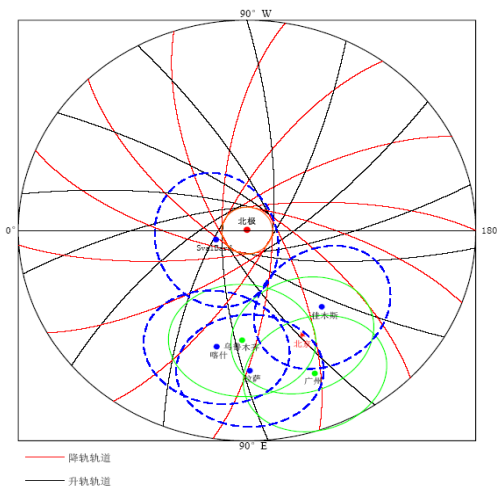


FengYun LEO. Satellites: FY-3



11 instruments on board FY-3A/B, including:

VIRR: Visible and Infra-Red Radiometer
 MERSI : Medium Resolution Spectral Imager
 IRAS : Infrared Atmospheric Sounder
 MWTS : MicroWave Temperature Sounder
 MWHS: MicroWave Humidity Sounder
 MWRI: MicroWave Radiation Imager
 SBUS: Solar Backscatter Ultraviolet Sounder
 TOU: Total Ozone mapping Unit
 SIM: Solar Irritation Monitor
 ERM: Earth Radiation Monitor
 SEM: Space Environment Monitor



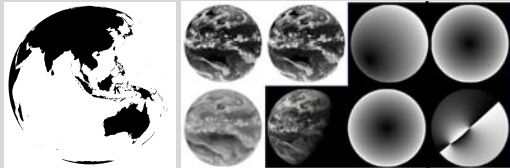
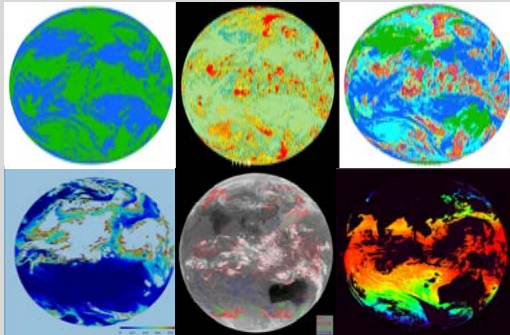
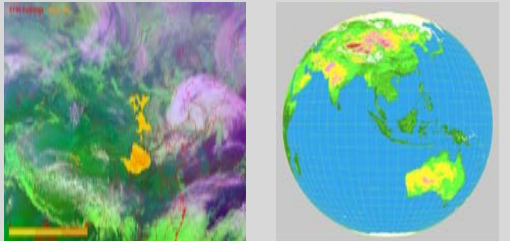
Station Name	Longitude	Latitude
Beijing Station	116° 16' 36" E	40° 03' 06" N
Guangzhou Station	113° 20' 20" E	23° 09' 52" N
Wulumuqi Station	87° 34' 08" E	43° 52' 17" N
Jiamusi Station	130° 22' 48" E	46° 45' 20" N
Kiruna Station	21° 02' E	67° 32' N

FY-3A/B Instruments Specification

Name of Instrument	Number of Channels	Spectral range	Swath Width (Km)	Spatial Resolution at Sub point (Km)
VIRR	10	0.43 – 12.5μ m	2800	1.1
MERSI	20	0.41 – 12.5 μ m	2800	0.25 ~ 1
MWRI	10	10 – 89GHz	2800	15 ~ 85
IRAS	26	0.69 – 15.5 μ m	2250	17
MWTS	4	50 – 57 GHz	2200	50 ~ 75
MWHS	5	150 – 183 GHz	2700	15
SBUS	12	0.16 – 0.4μ m	---	200
TOU	6	0.3 ~ 0.36μ m	3000	50
ERM	4	0.2 ~ 50 μ m	2300	28
SIM	1	0.2 ~ 50 μ m	---	---
SEM	---	---	---	---

- atmospheric sounding
- Microwave Imaging
- Optical Imaging from Km to 250m
- Atmospheric composition: Ozone
- Radiation budget for earth system

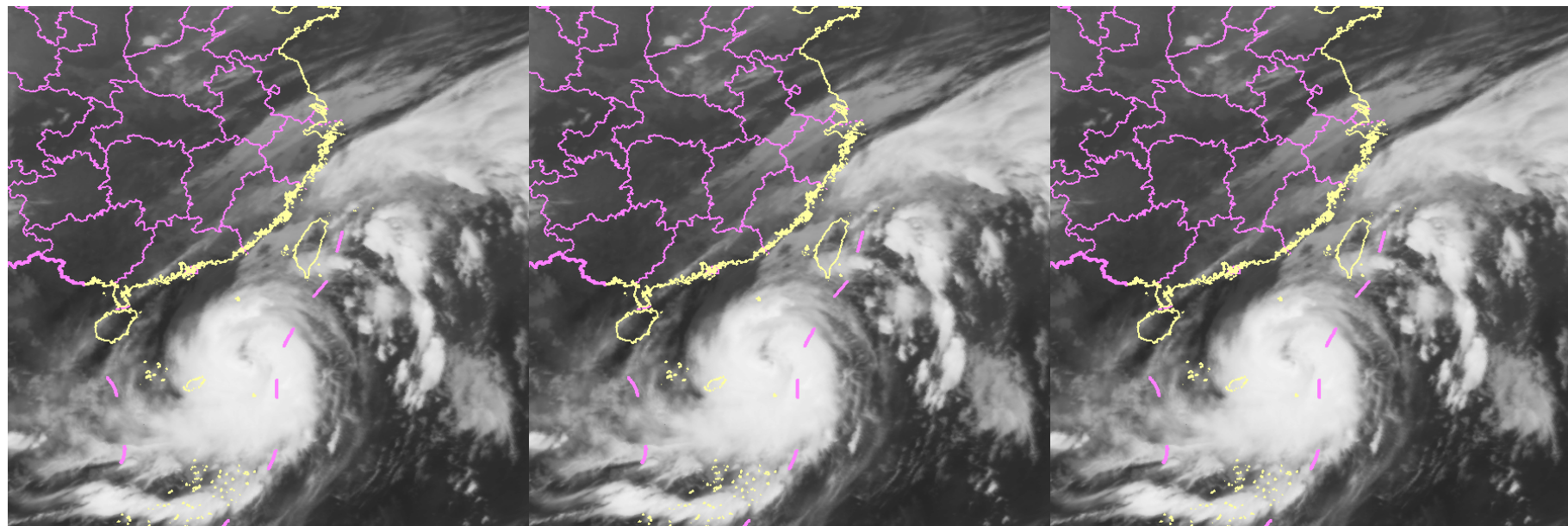
FY-2 Products: 25 Products+6 Parameters

Discipline	Measurement	
Basic Dataset(L1)	Calibrated and Navigated dataset(NOM) S-VISSR(SVS)	
Automatic derived product (L2+)	Cloud Classification/Amount Cloud Motion Winds Precipitation Estimation/Index Outgoing Long wave Radiation SST TBB Upper Troposphere Humidity Humidity Profile from Cloud Perceptible Water (Clear Sky) Solar Irradiance ISCCP dataset	
Monitoring Product (L2+)	Sand Storm Monitoring Snow Cover Monitoring Fog Monitoring Sea Ice Monitoring Fire Monitoring Flood Monitoring Soil Moisture Monitoring Tropical Cyclone /Typhoon Position and Intensity	
Images	Segment image Multi-Sat Mosaic	

FY-3 Products: 10 L1 + 21 L2

No.	Atmosphere & Cloud	Ocean	Land	Atmos-Chemistry	Space Enviornment
1	Cloud Mask	Sea Ice	LST	Ozone Amount	high energy particles radiation dose
2	Cloud Classification	Ocean Color	NDVI	Ozone profile	
3	Cloud Height	SST	Fire		
4	Fog		Flood & Drought		
5	Water Vapor		Snow		
6	T/Q profile				
7	Radiance Budget				
8	Precipitation				
9	Aerosoal				
10	OLR				

2010年13号热带气旋---鲇鱼 (Megi)



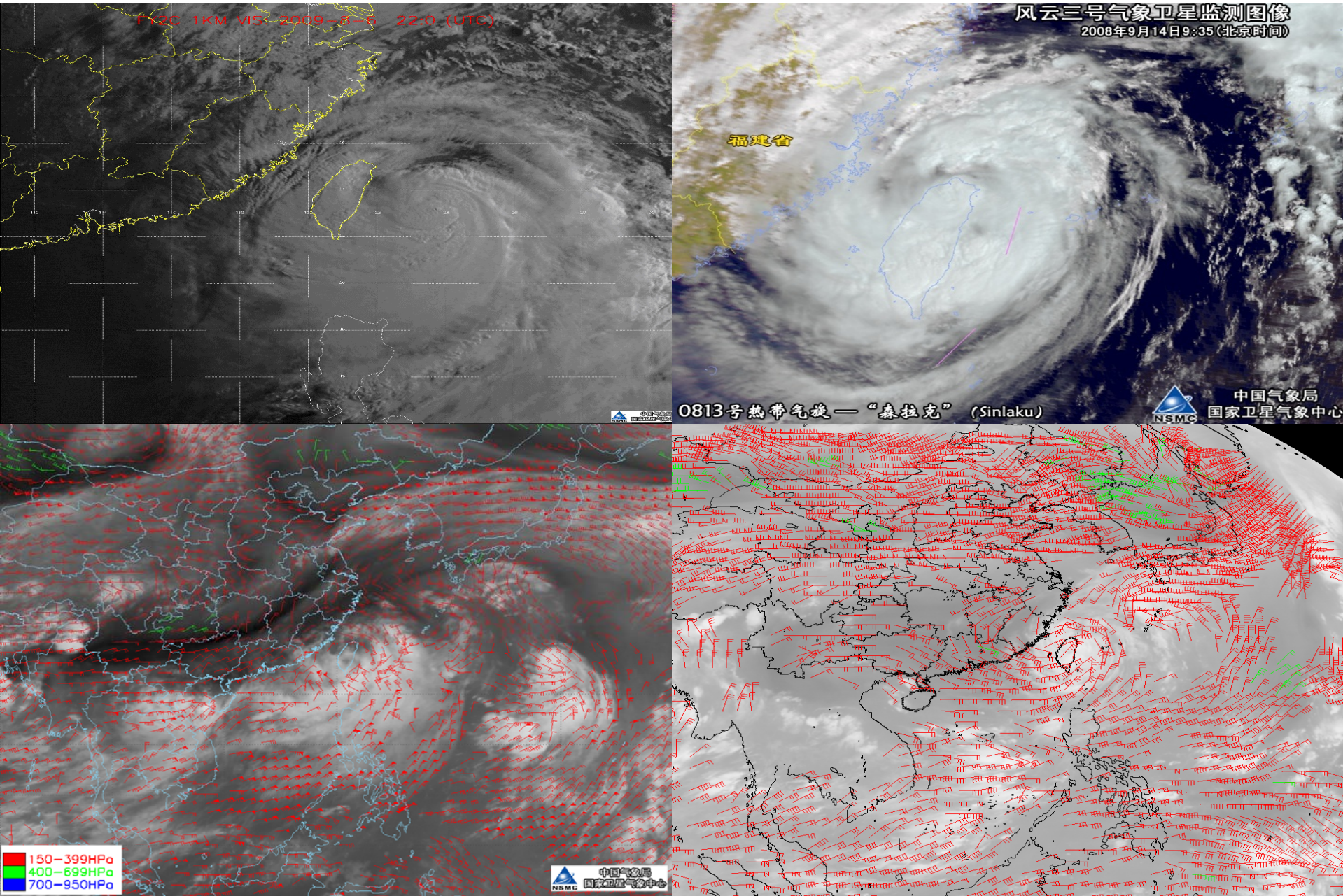
60min. interval

30min. interval

15min. interval

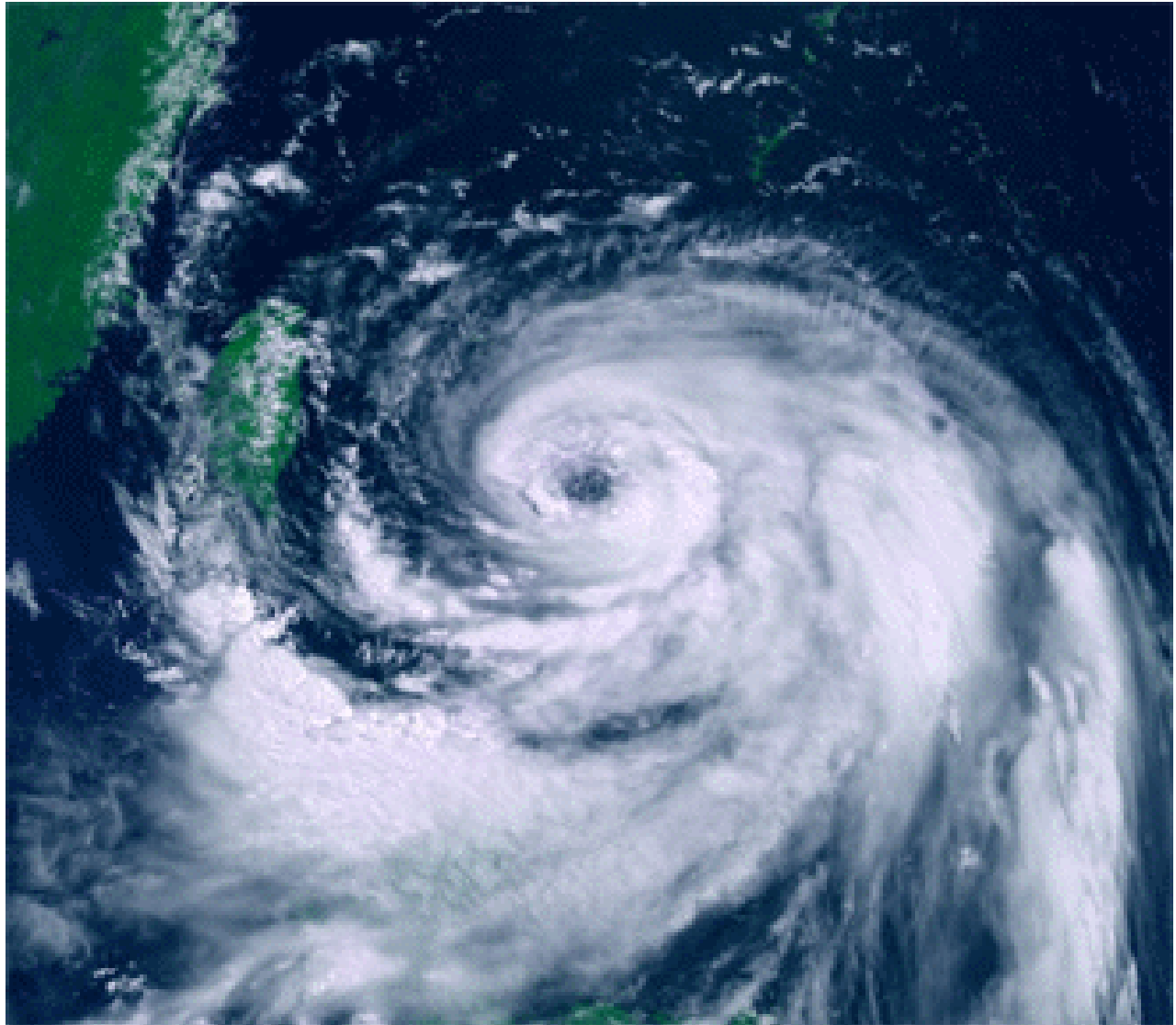
13th tropical cyclone 'Megi' (108 Hours)

Typhoon Warning

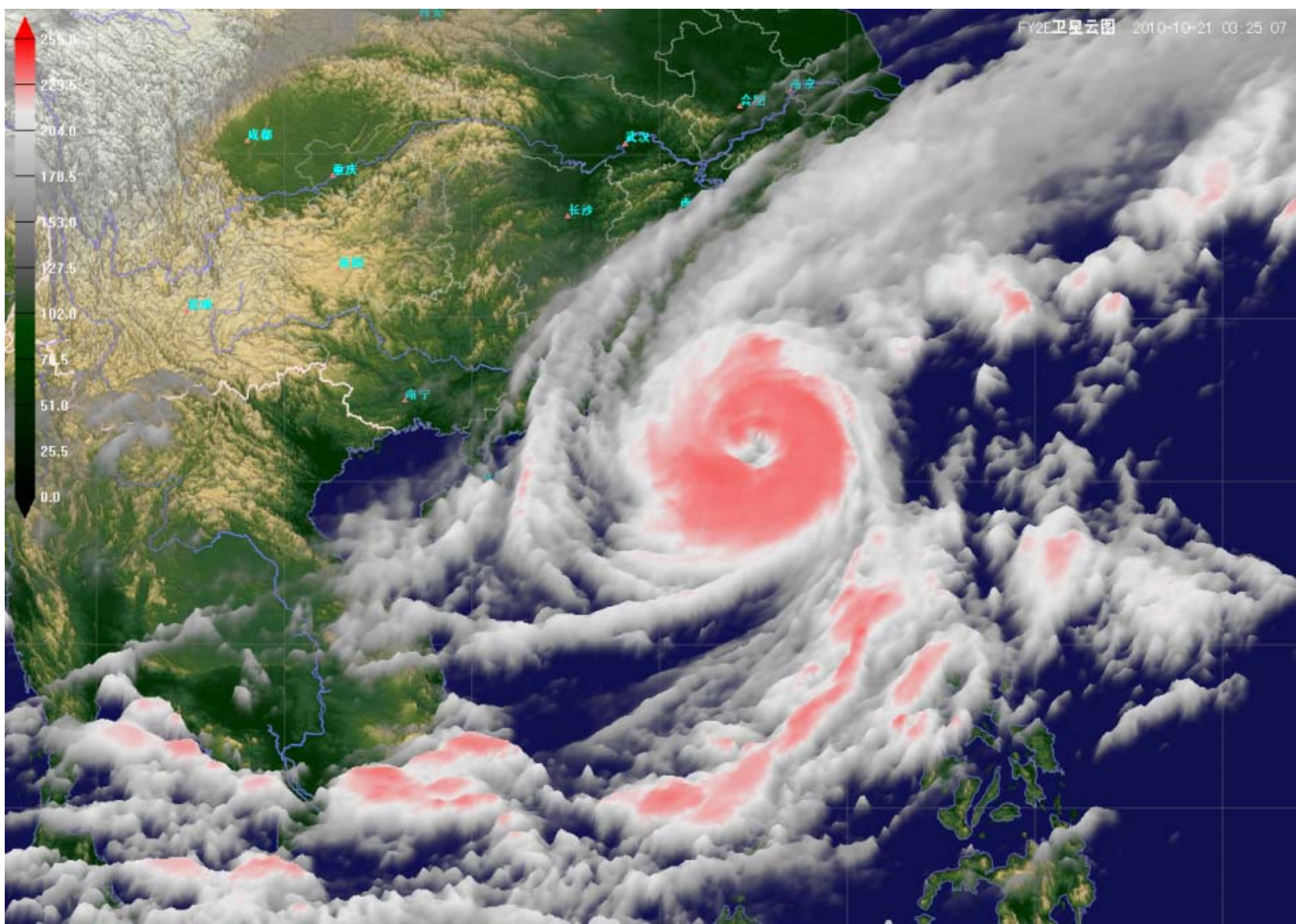


Optical Imaging (km $\rightarrow$ hundred meters)

台风凤凰
20080727



Better Typhoon Center Location



The 3D Structure of the Typhoon “Megi” with Microwave data

$$\Delta T_i = T_i - \bar{T}_i \text{ (MV+IR)}$$

From Satellite

MEGI(鲇鱼)

2010-10-18-1755(UTC)

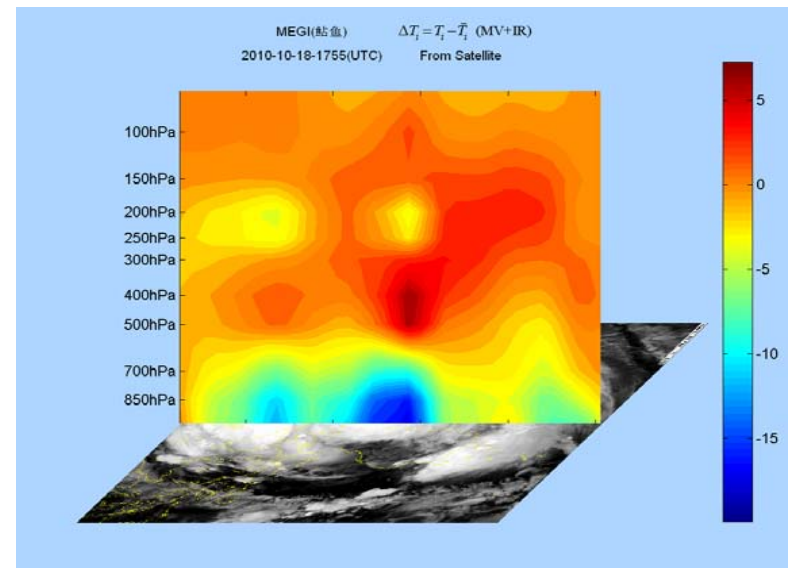
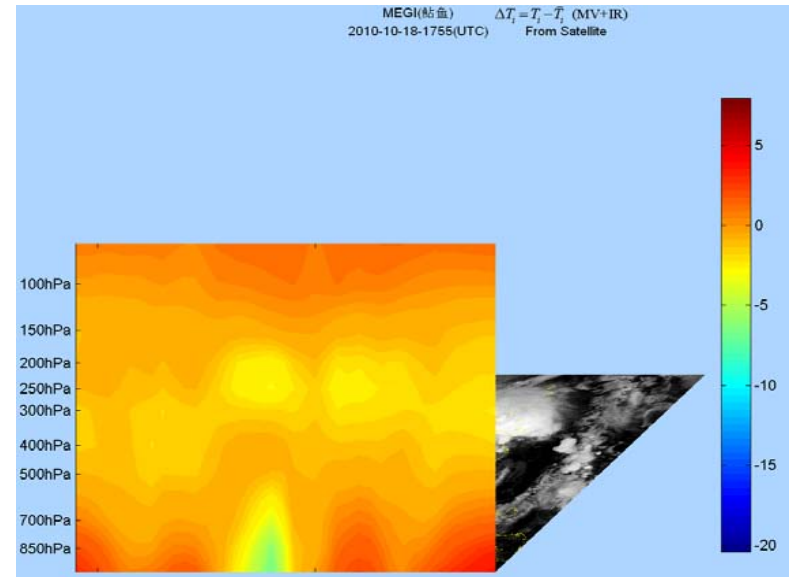
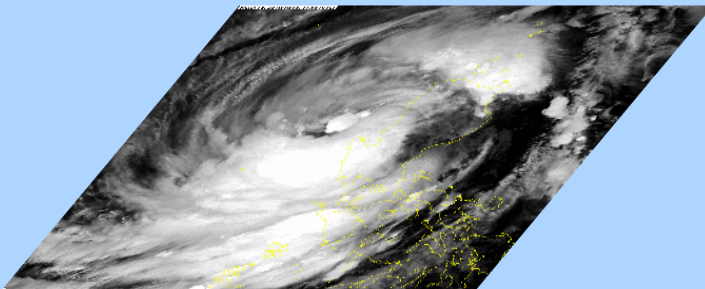
100hPa

150hPa

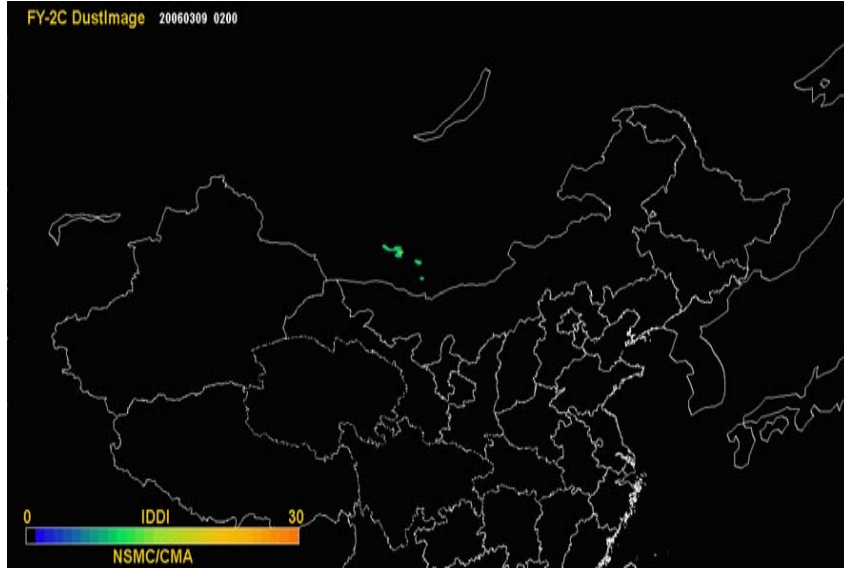
250hPa

500hPa

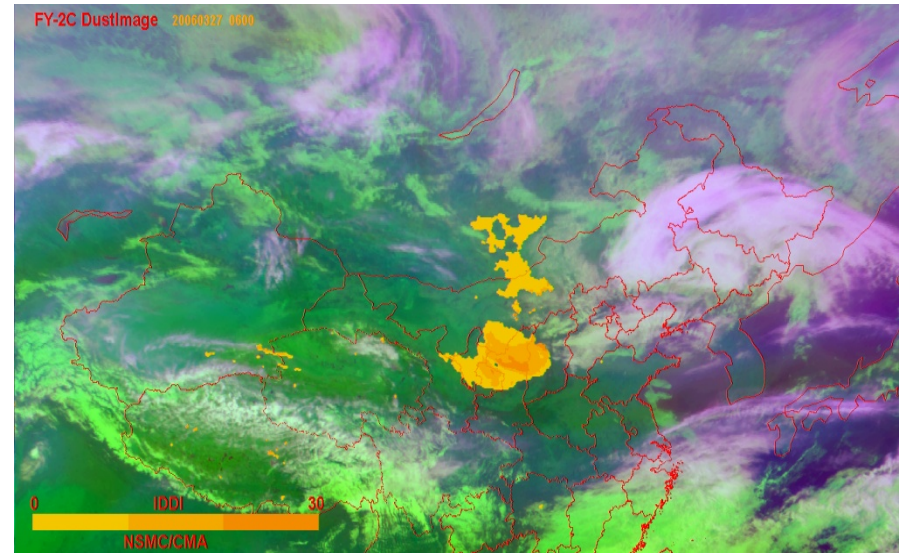
850hPa



Dust Storm Warning

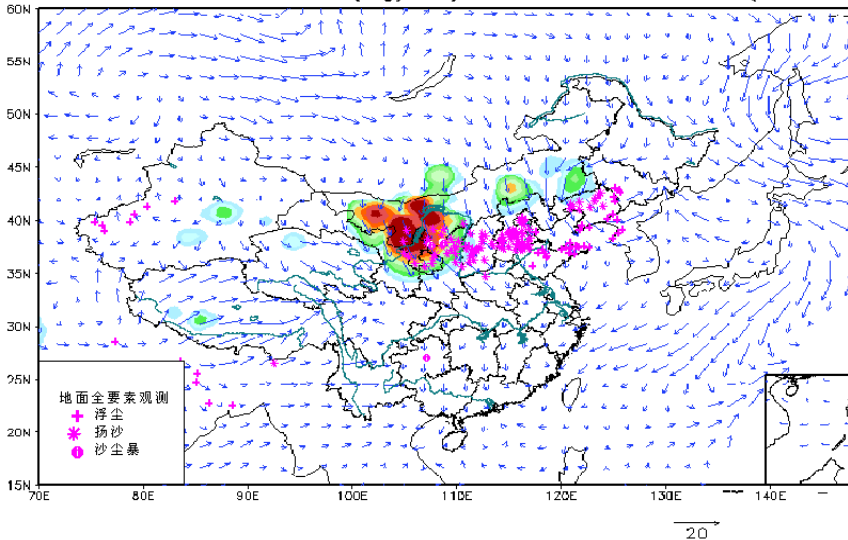


without FY-2 data assimilation

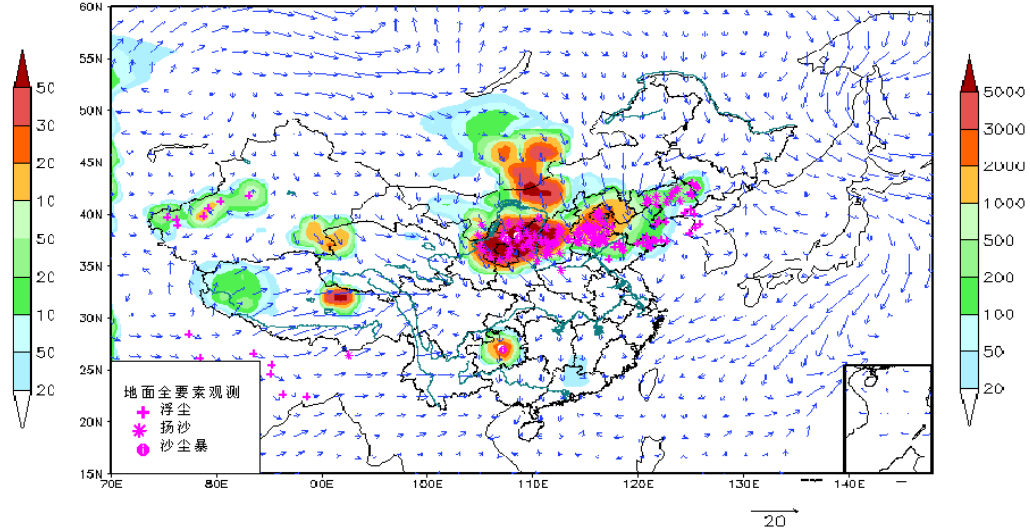


with FY-2 data assimilation

Surface Wind & Dust ($\mu\text{g}/\text{m}^3$) 06-03-27 14:00 (CAWAS)



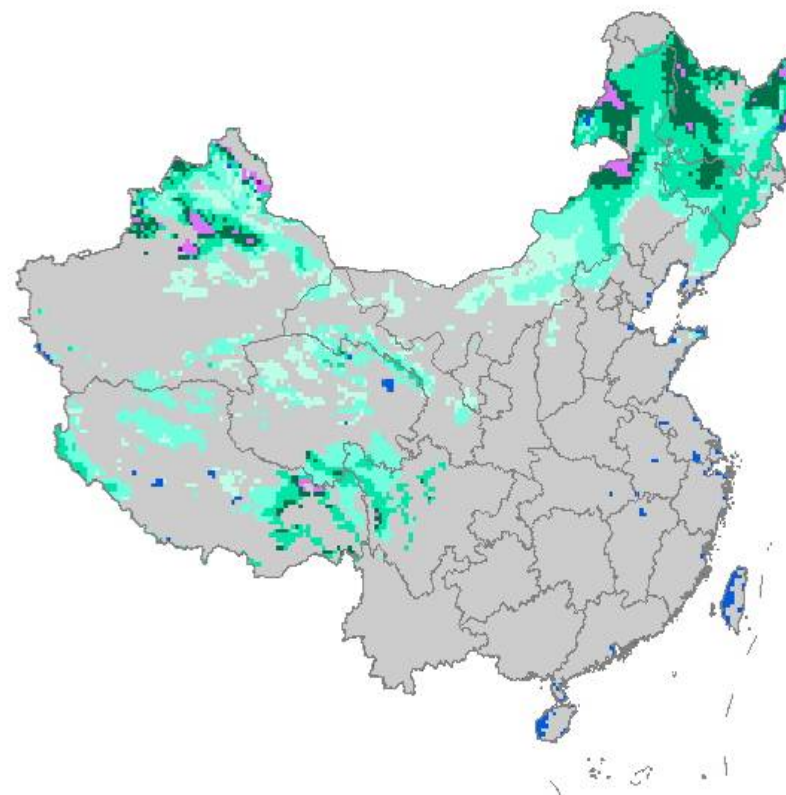
Surface Wind & Dust ($\mu\text{g}/\text{m}^3$) 06-03-27 14:00 (CAWAS)



New Product: Snow Depth from MWRI

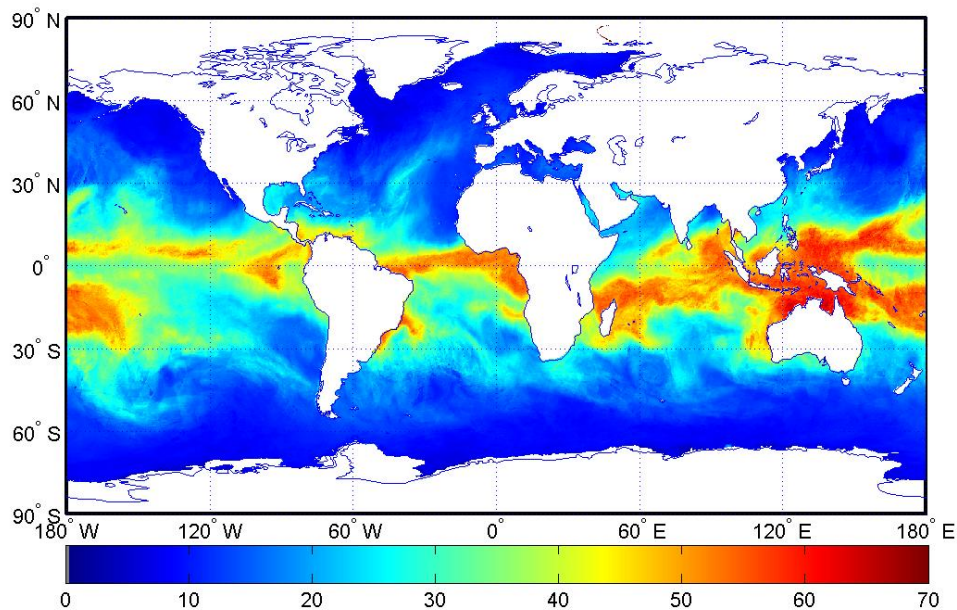


MODIS雪
盖

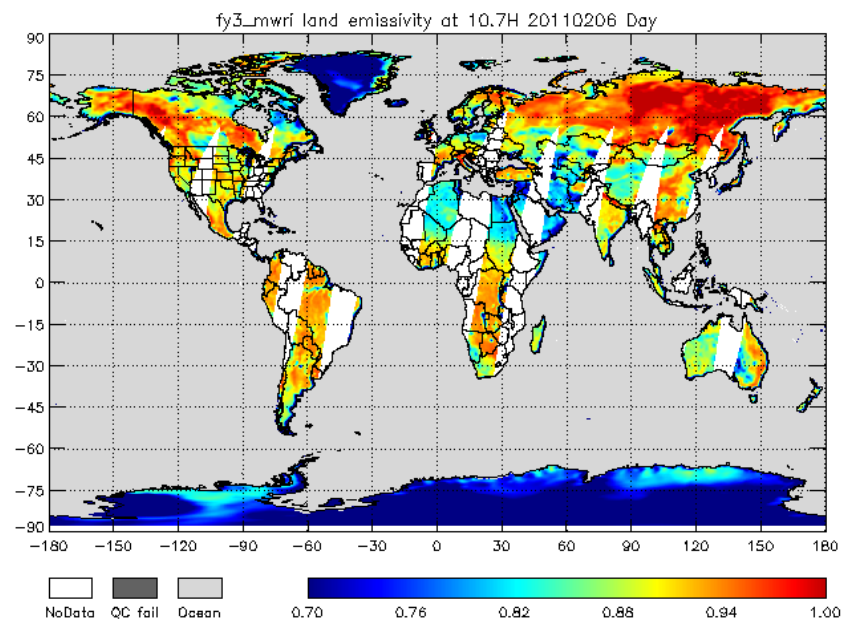


FY3B-MWRI雪
深

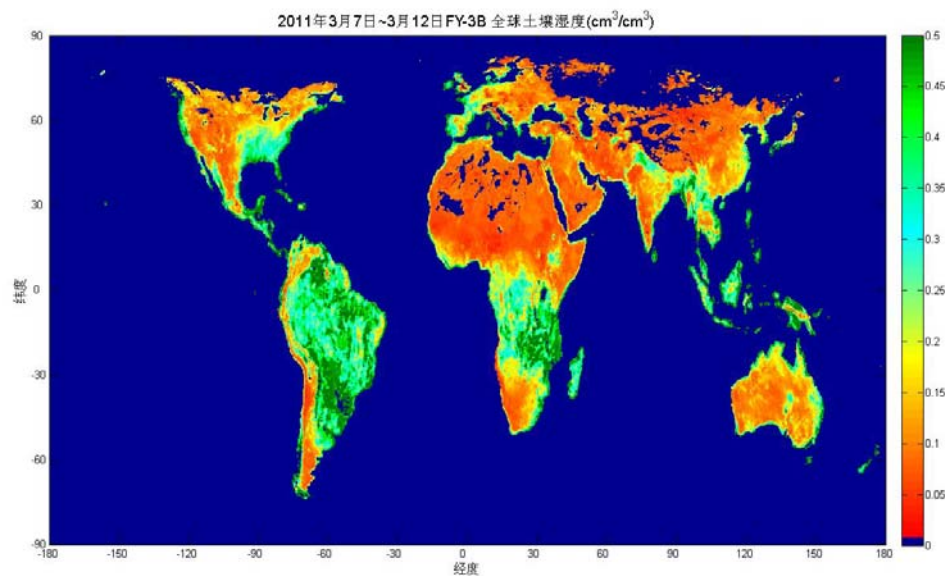




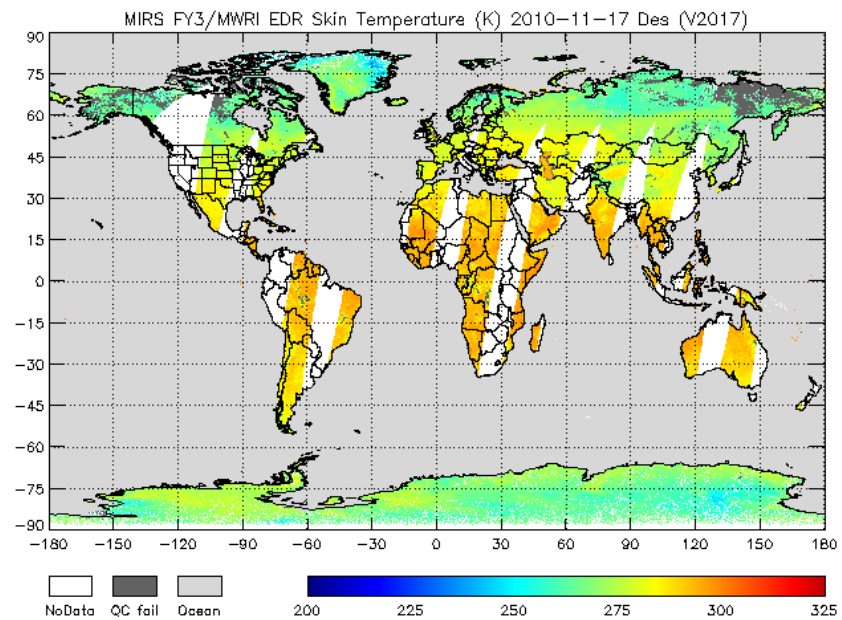
Precipitable Water from MWRI



Land Emissivity from MWRI



Soil Moisture from MWRI

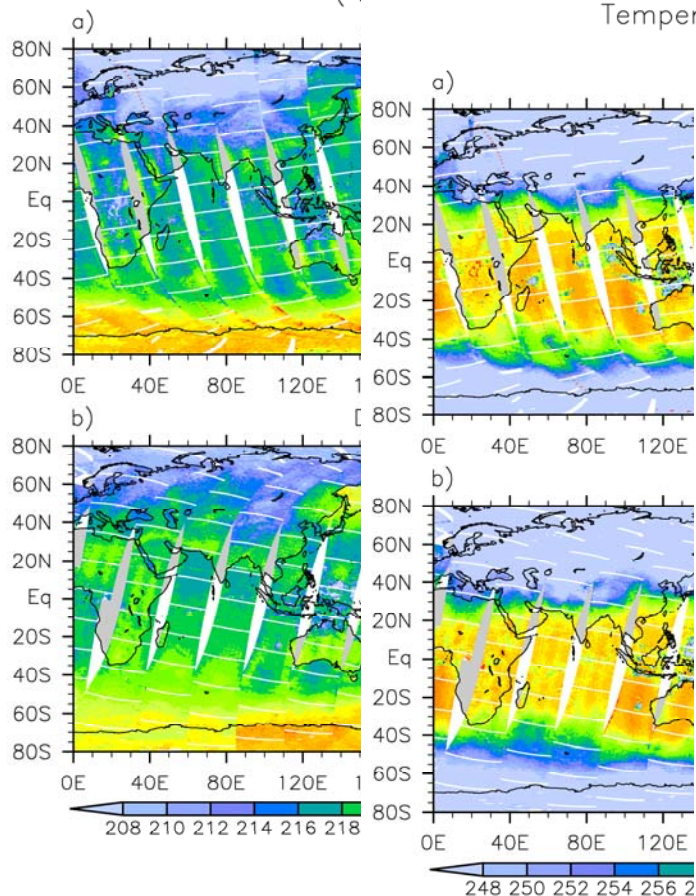


Land Surface Temperature from MWRI

New Product: Global Temperature Profile from IRAS/MWTS/MWHS of FY-3B (20110224)

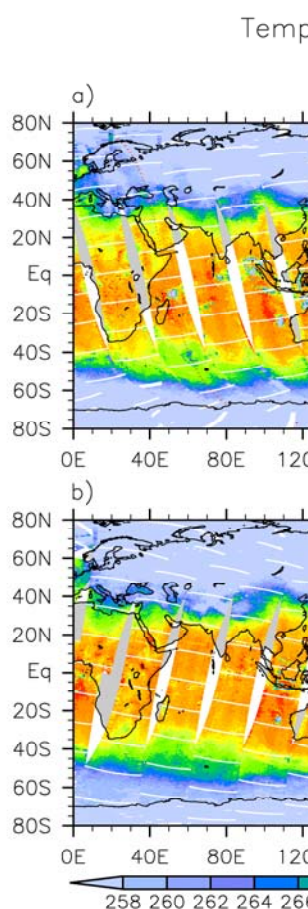
Temperature at 200 hPa

(



Temperature at 500 hPa

(20110224)



Temperature at 700 hPa

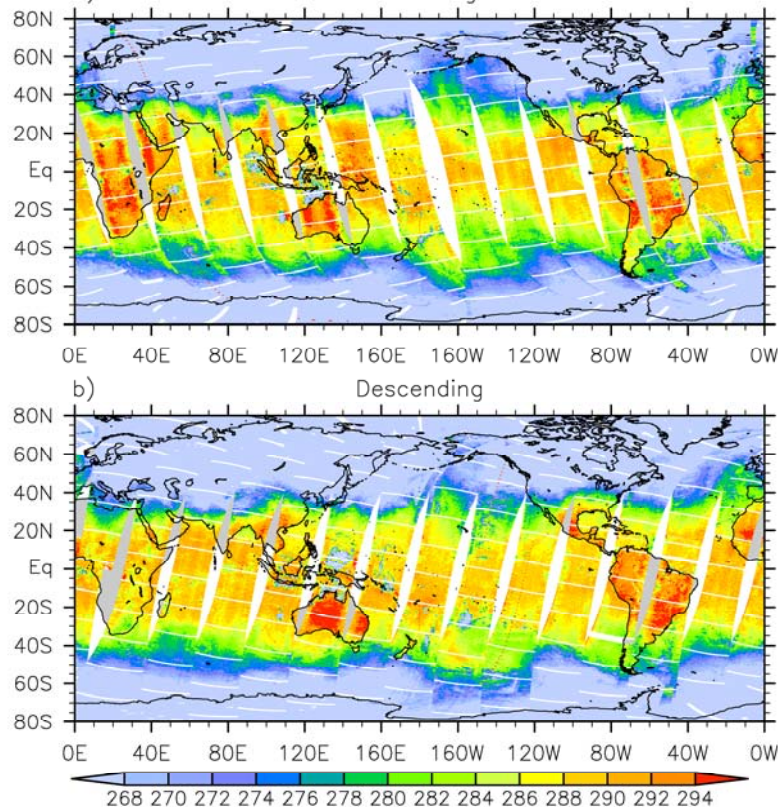
(20110224)

Ascending

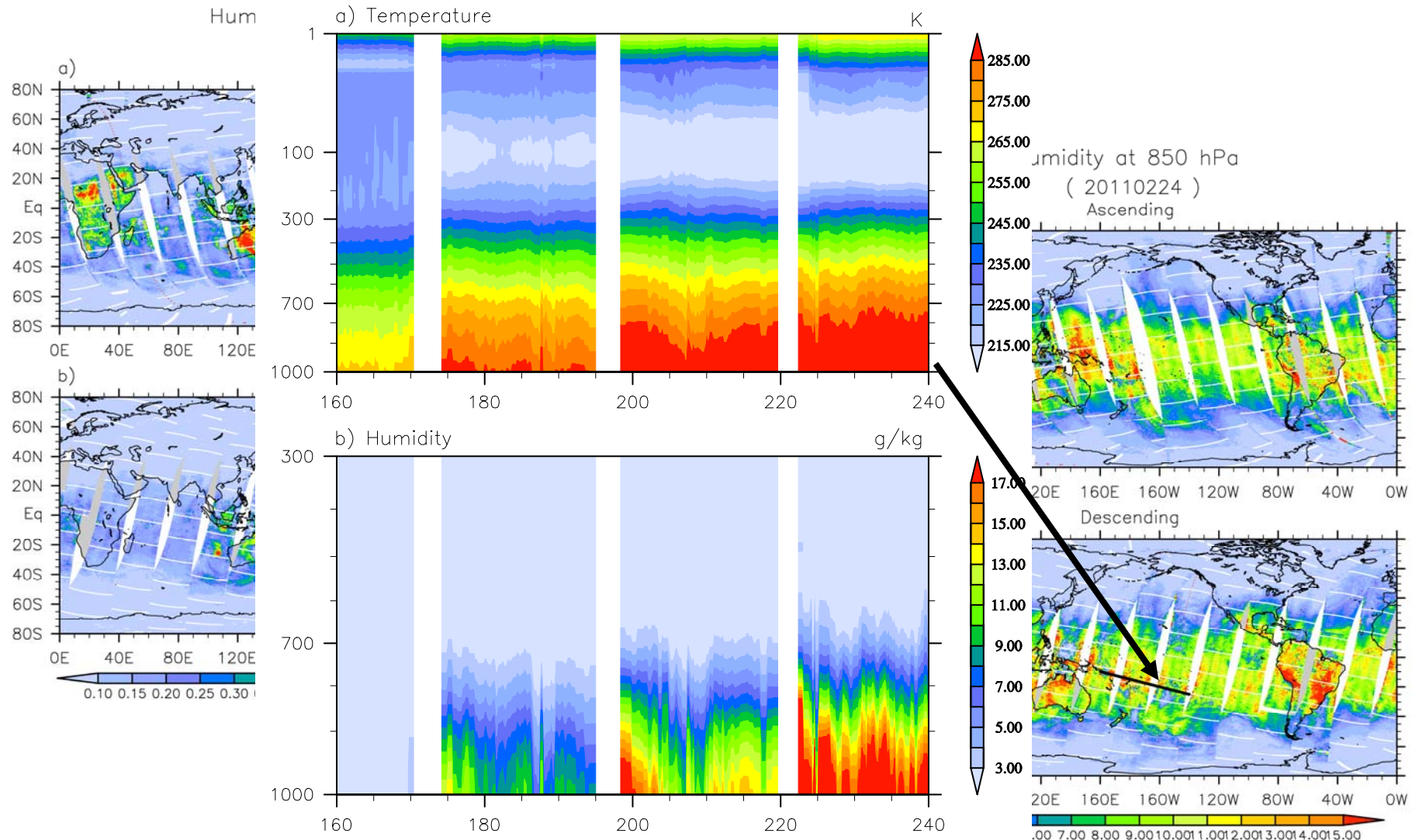
Temperature at 850 hPa

(20110224)

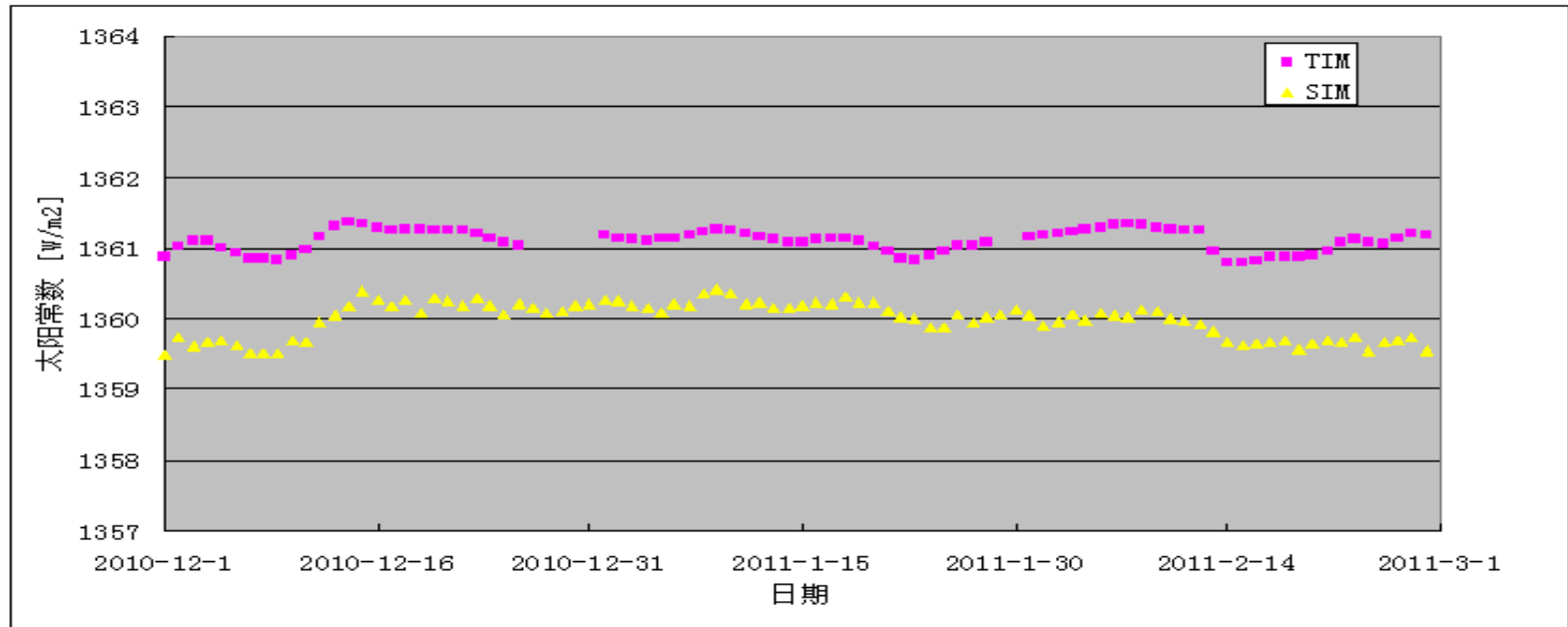
Ascending



New Product: Global Moisture Profile from IRAS/MWTS/MWHS of FY-3B (20110224)



New Product: Solar Constant from SIM/FY-3B



FY-3B/SIM观测平均日地距离上太阳辐射与美国宇航局SORCE/TIM观测对比

FY-3A/B Product Applications

- Synoptic weather map and typhoon
- Satellite data assimilation

Meteorology

- Ozone hole
- Ice shelf

Polar environment

- Air quality
- City hot island Monitoring

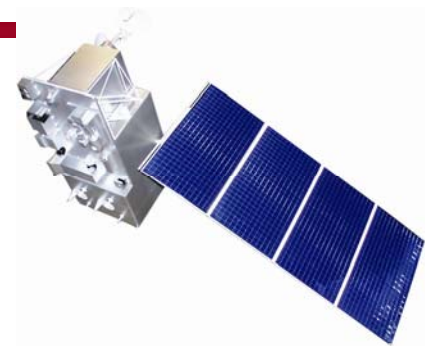
City environment

- Fire
- Snow
- **Sea and Inland water body Monitoring**

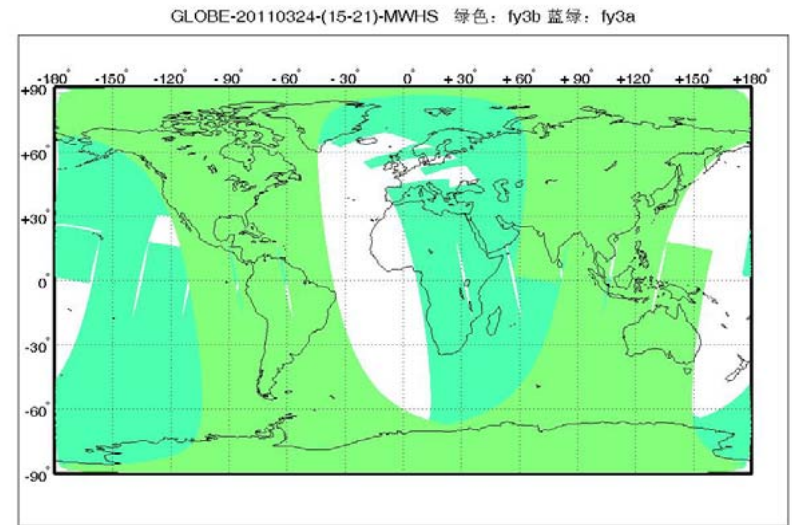
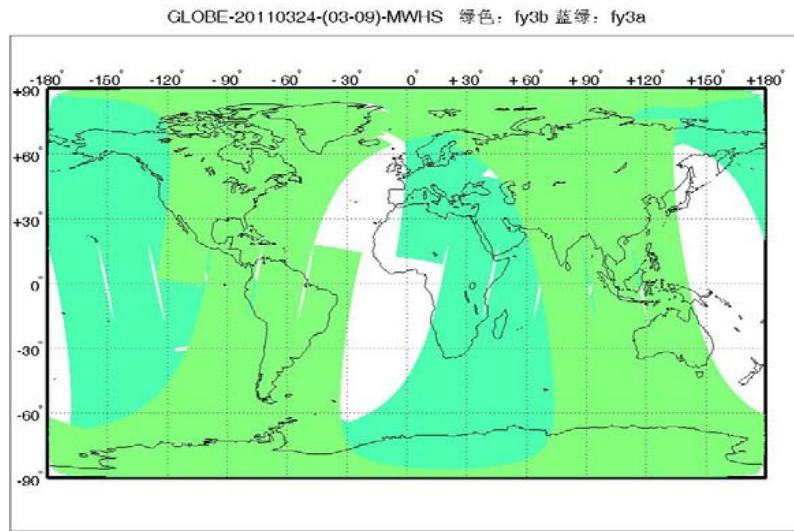
Disaster

- Space Environment

Outer Space

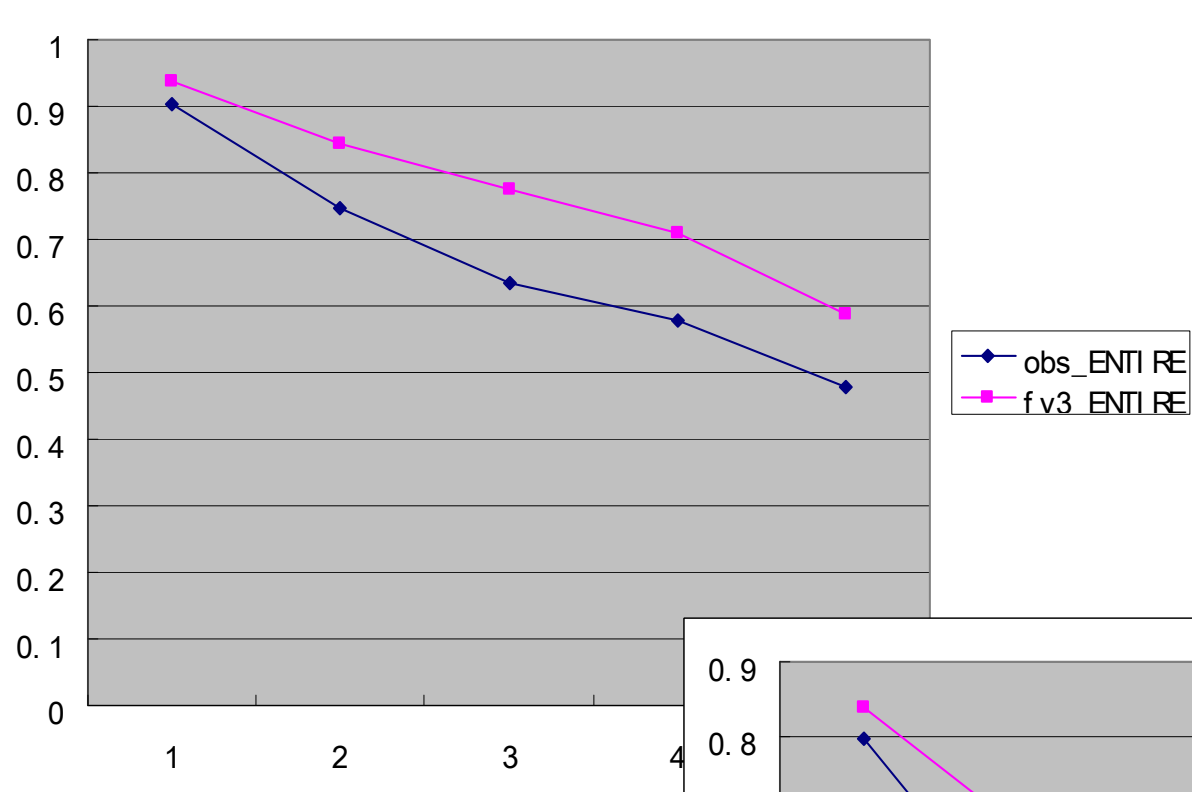


Converage for NWP data assimilate per 6 hours by FY-3A and FY-3B



On-orbit Commission Test for FY-3B Payloads (until this April)

Name	Test item	Test Number
VIRR	12	102
MERSI	14	1200
IRAS	10	249
MWTS	15	56
MWHS	11	62
MWRI	13	120
SBUS	6	50
TOU	8	30
SIM	4	10
ERM	4	20
SEM	6	39
Total	103	1938

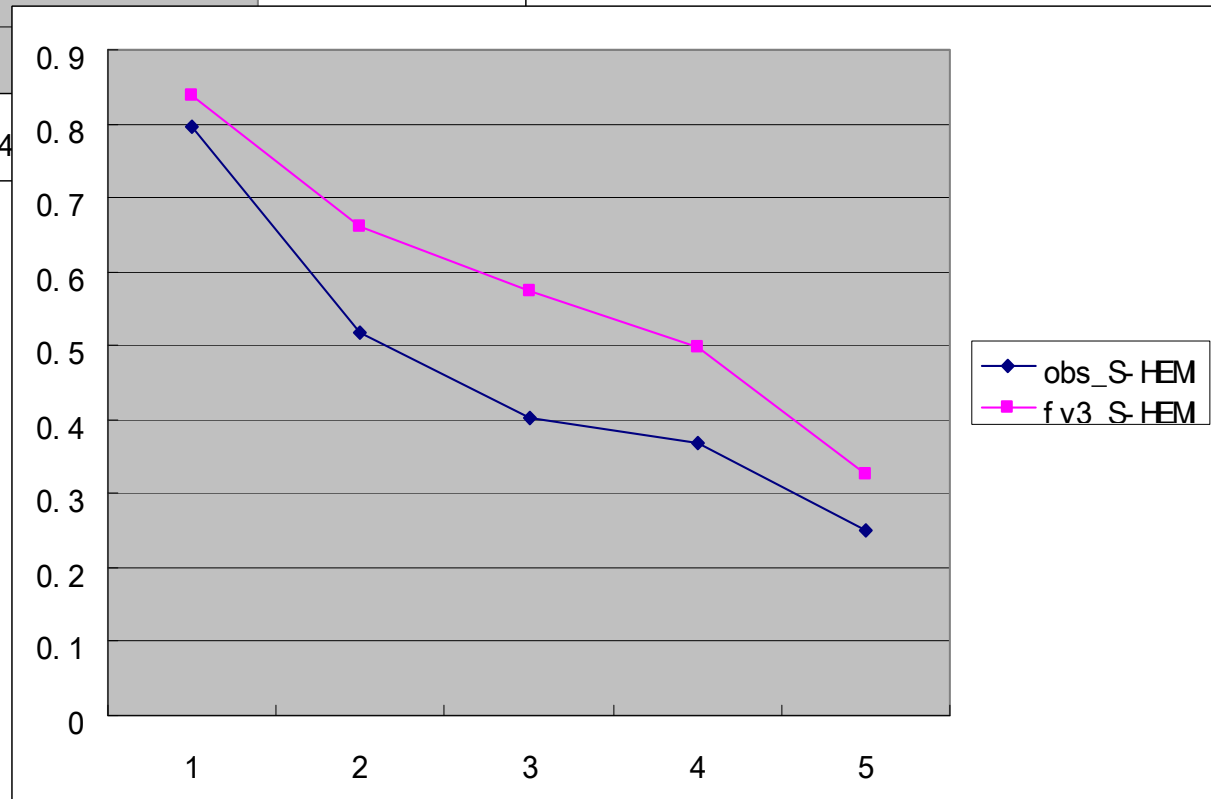


Upper: Northern Hemisphere

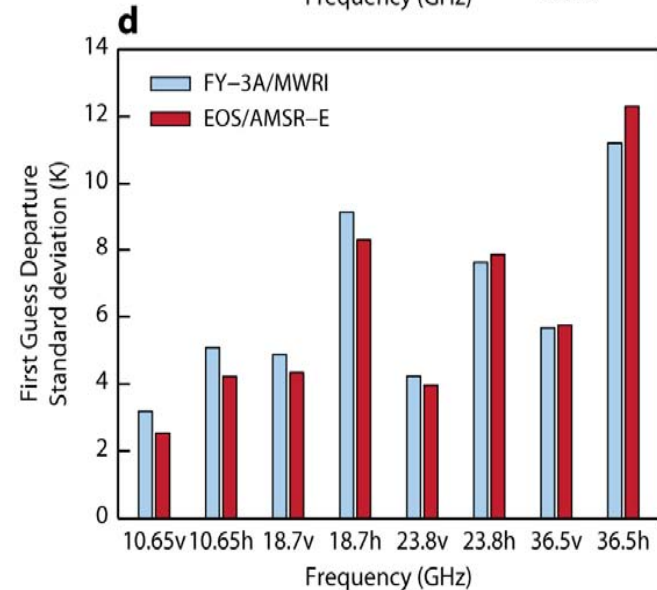
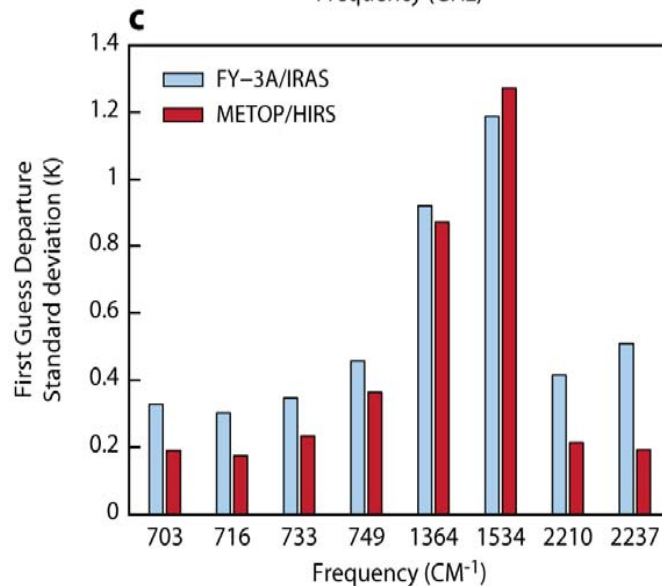
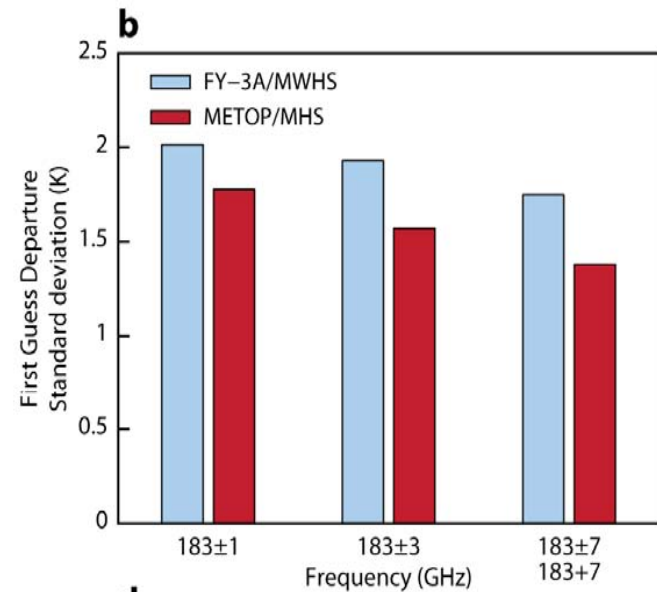
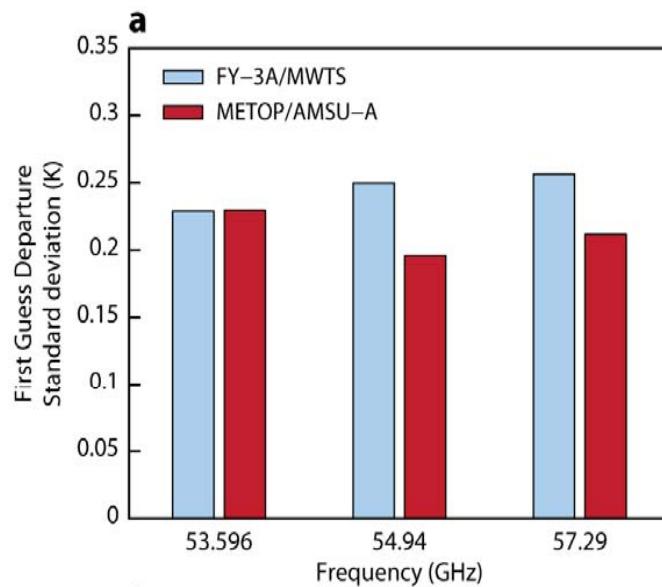
Lower: Southern Hemisphere

One month MWTs data assimilated into Global NWP Model

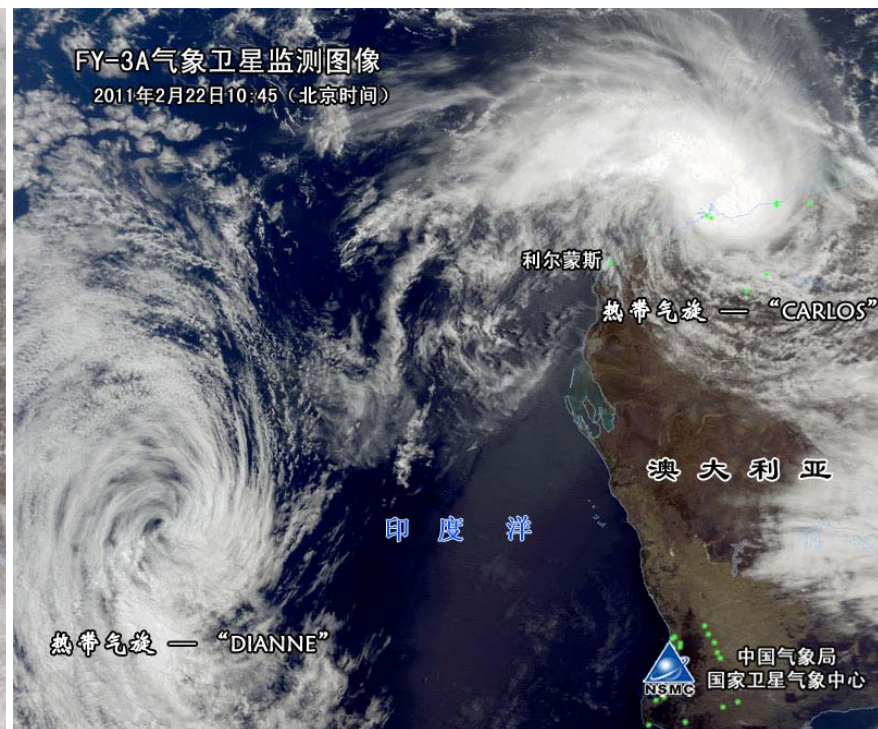
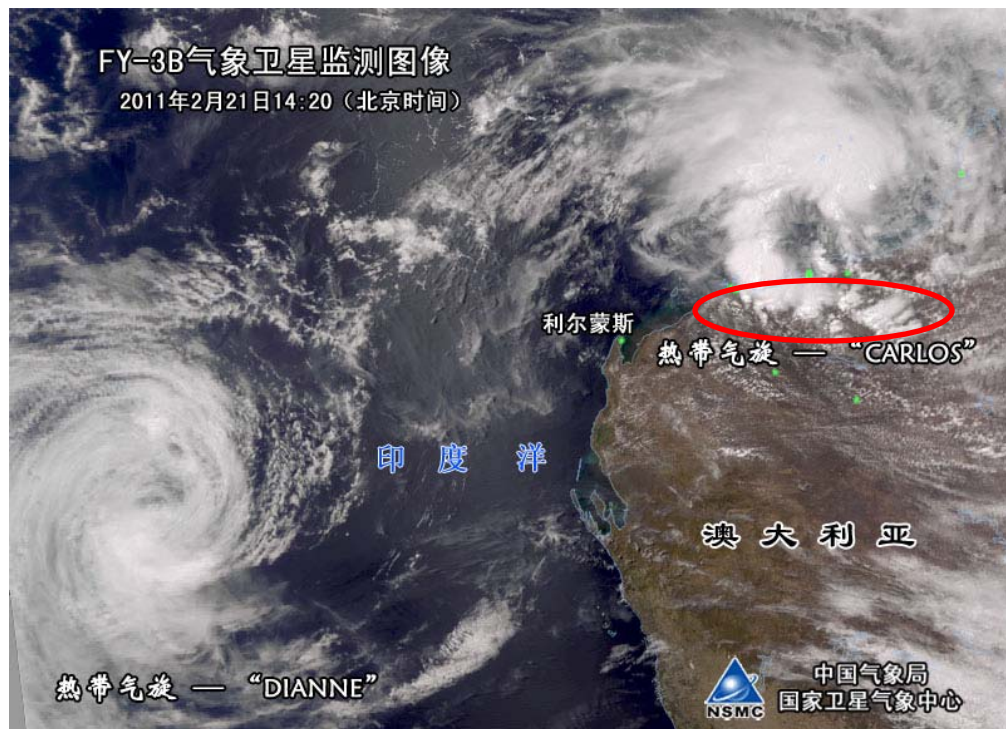
by National Meteorological Center of CMA



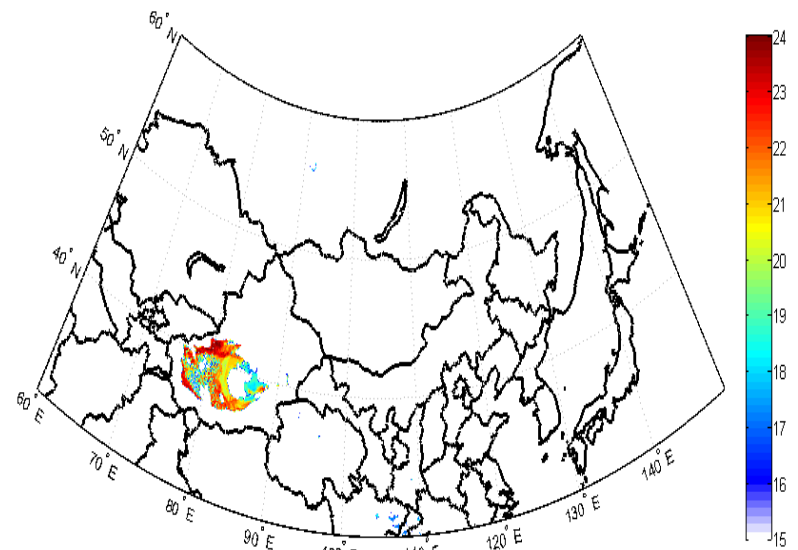
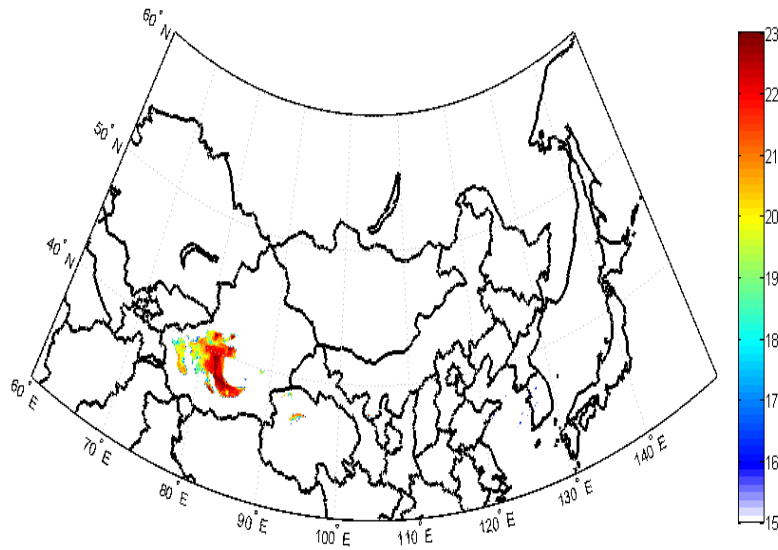
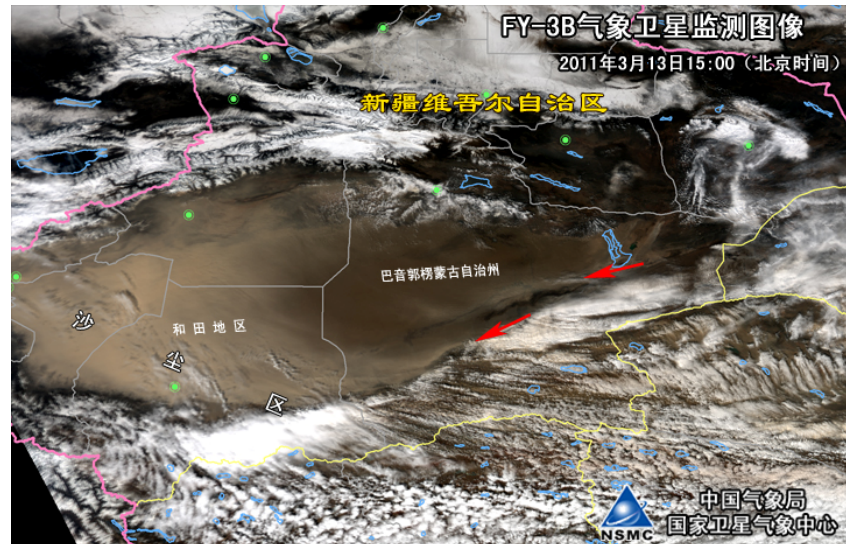
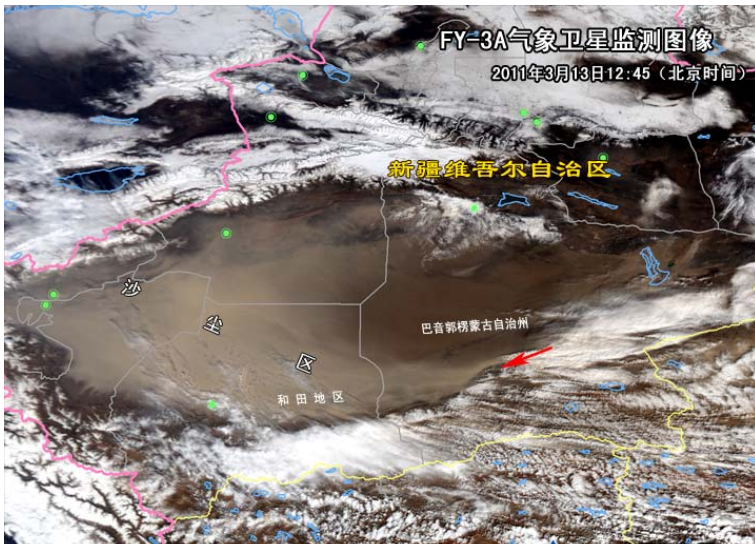
FY3 data (MWTS, MWHS, IRAS, MWRI) simulation bias by ECMWF IFS and comparison with EOS and Metop



Mesoscale convective clouds cluster monitoring by FY-3B afternoon comparing with FY-3A morning (along the tropical cyclone CARLOS)



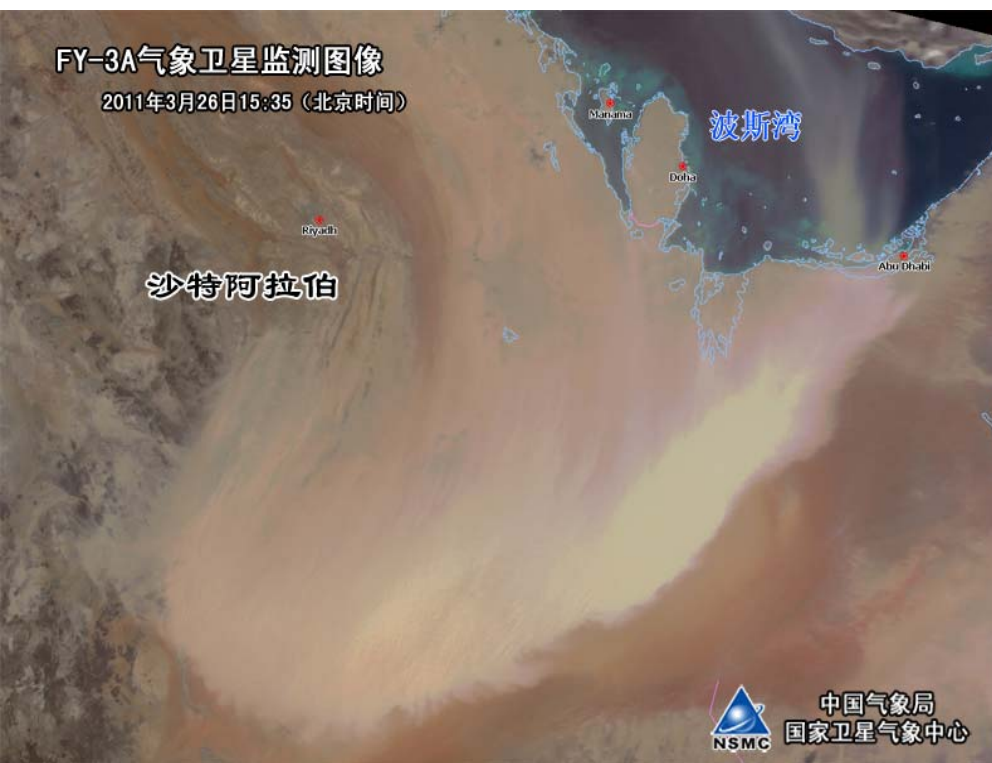
Dust Monitoring monitoring by FY-3B comparing with FY-3A



Dust spread its area in the afternoon

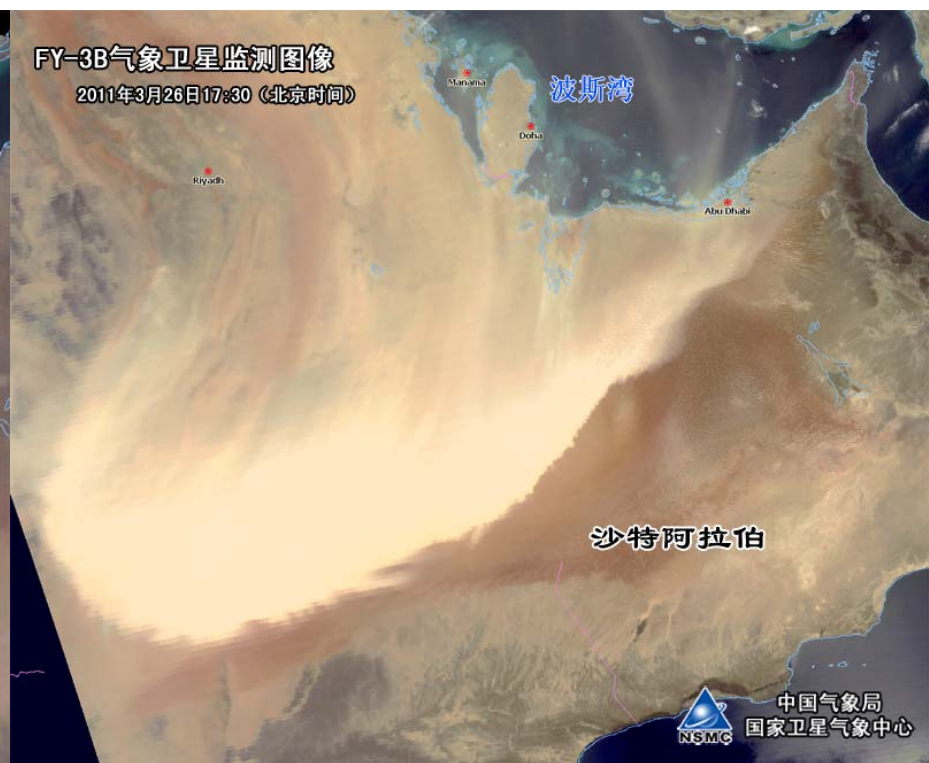
FY-3A气象卫星监测图像

2011年3月26日15:35 (北京时间)



FY-3B气象卫星监测图像

2011年3月26日17:30 (北京时间)



Dust monitoring in the Arabian Peninsula on 26, March 2011 by FY-3A and FY-3B

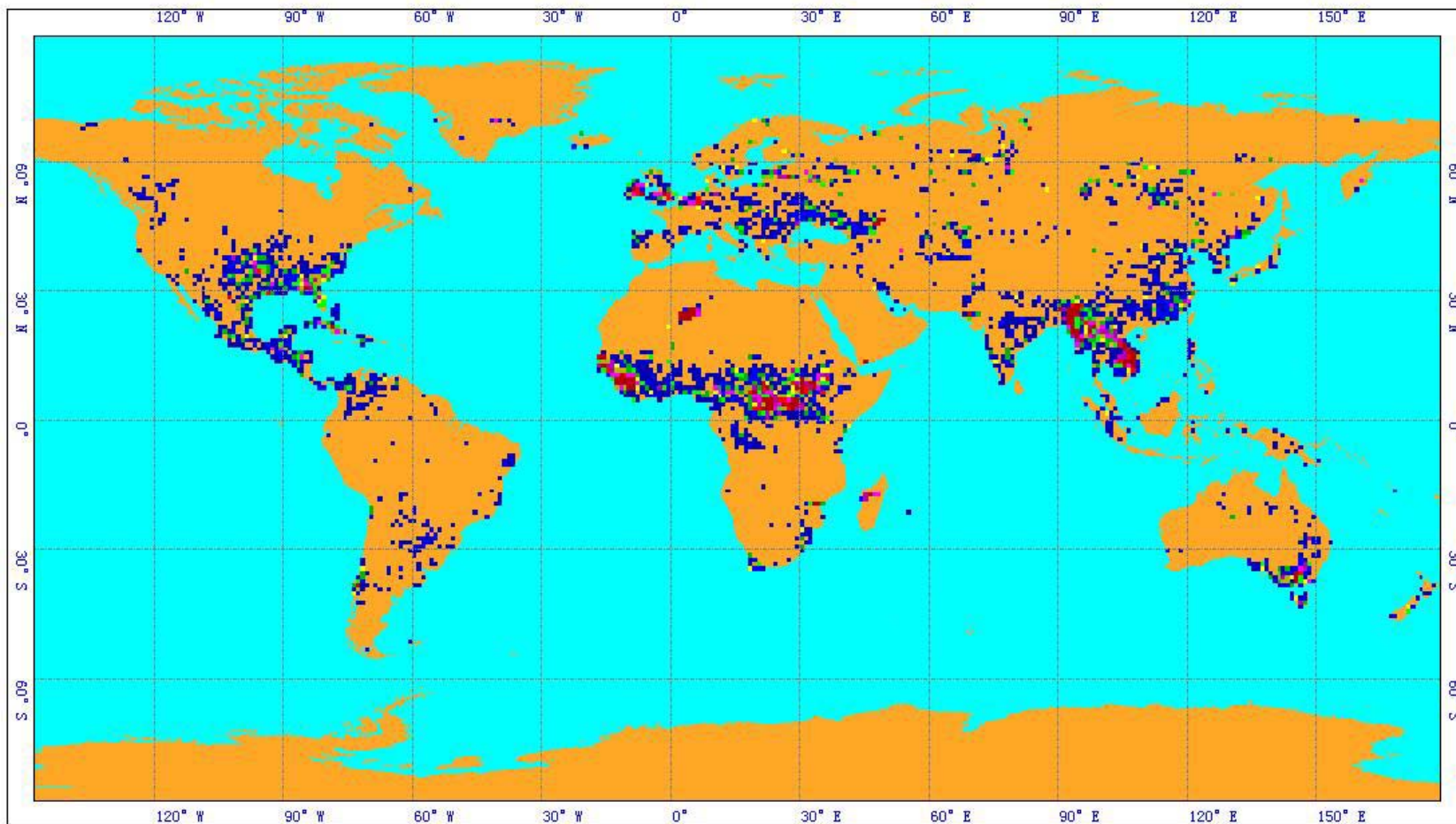
Global Image Per day



FY-3B全球观测图像：2011-05-22

Global Hot Spots Monitoring by FY-3B

FY3B/VIRR 全球火点像元累计格点图 (1度×1度) (2011年2月15日至3月29日)



图例 (单位: 像元数)

1	10	20	30	40	50	70	90	120	150
---	----	----	----	----	----	----	----	-----	-----

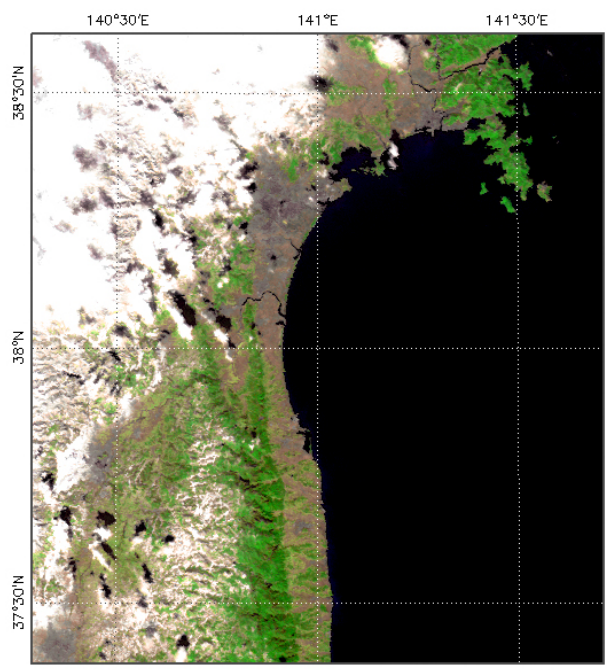


中国气象局

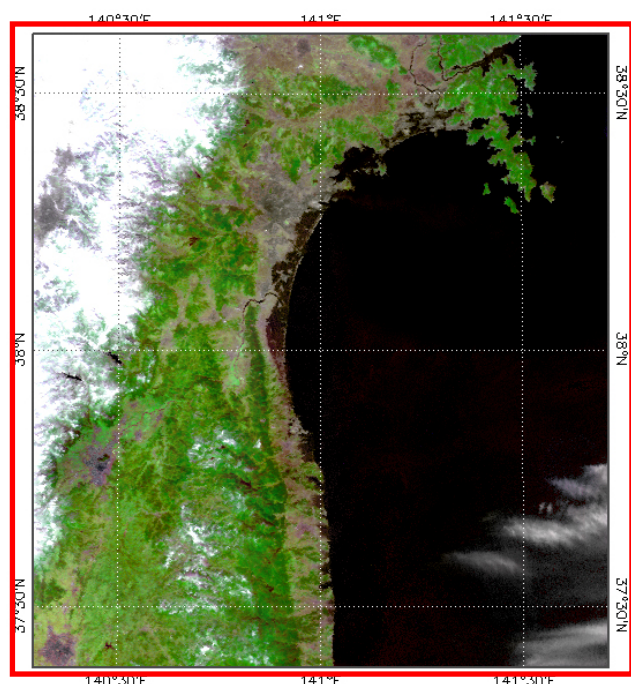


国家卫星气象中心

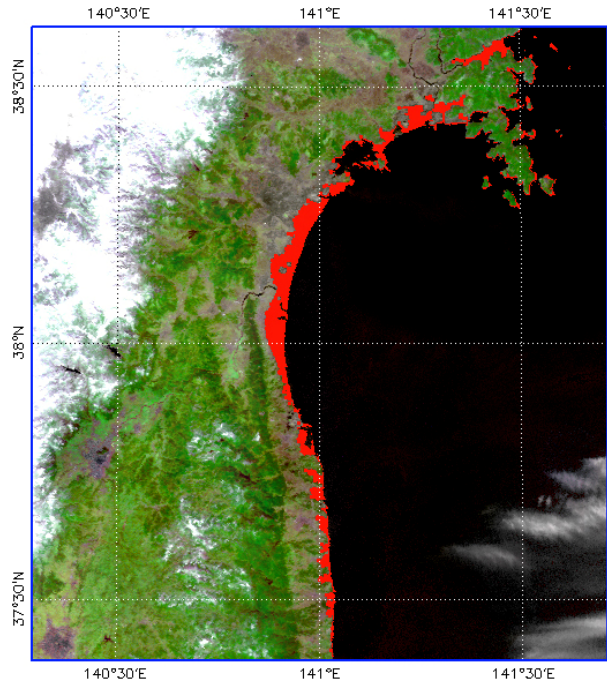
Before
Tsunami
3 Feb, 2011
by FY-3B



After
Tsunami
13 March,
2011 by FY-3B



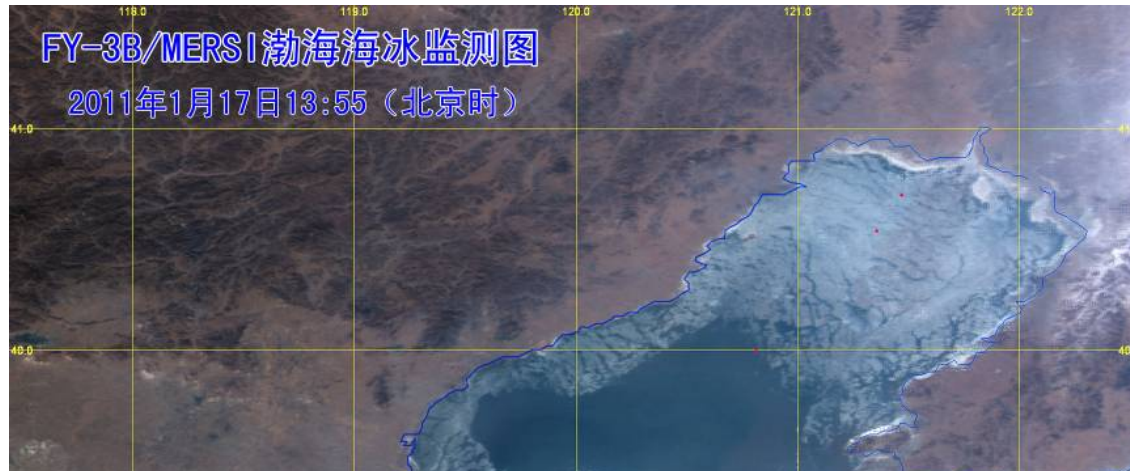
Effected Area



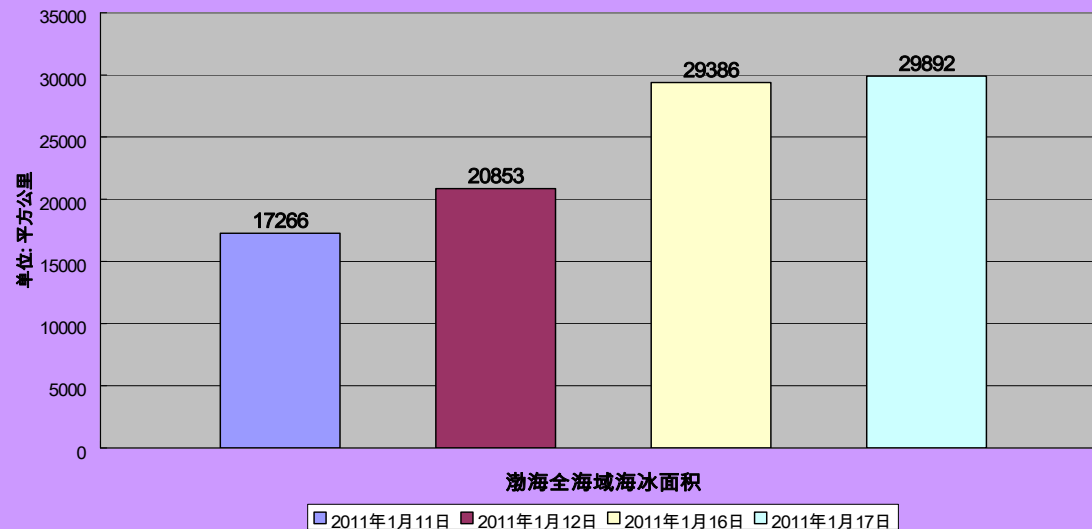
MODIS
image
16 March,
2011



Sea Ice Monitoring by FY-3B



气象卫星渤海全海域海冰面积统计
(2011年1月11日、12日、16日、17日)



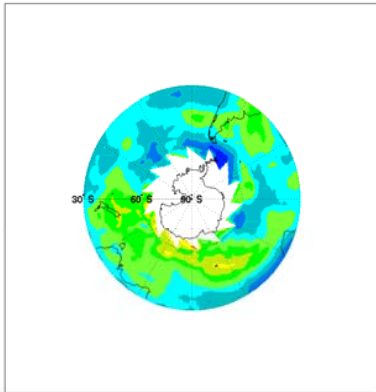
FY-3B星渤海海冰监测序列图

1月中旬以来，渤海海冰逐步扩大。1月17日全渤海海冰面积较11日扩大约7成。

Ozone hole in Antarctic monitored by TOU/FY-3

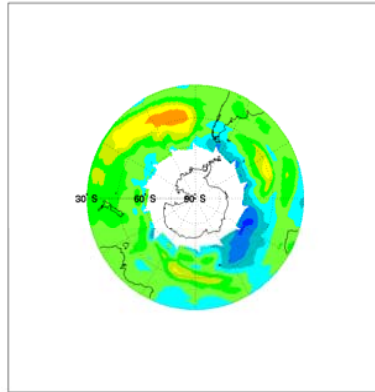
2008

FY-3/TOU Total Ozone(DU),20080803)



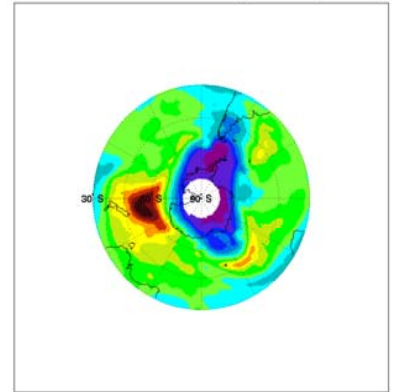
2009

FY-3A/TOU Total Ozone over South Pole (Dobson Units, 20090801)



2010

FY-3A/TOU Total Ozone over South Pole (Dobson Units, 20100917)



100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500

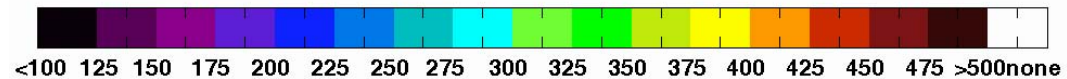
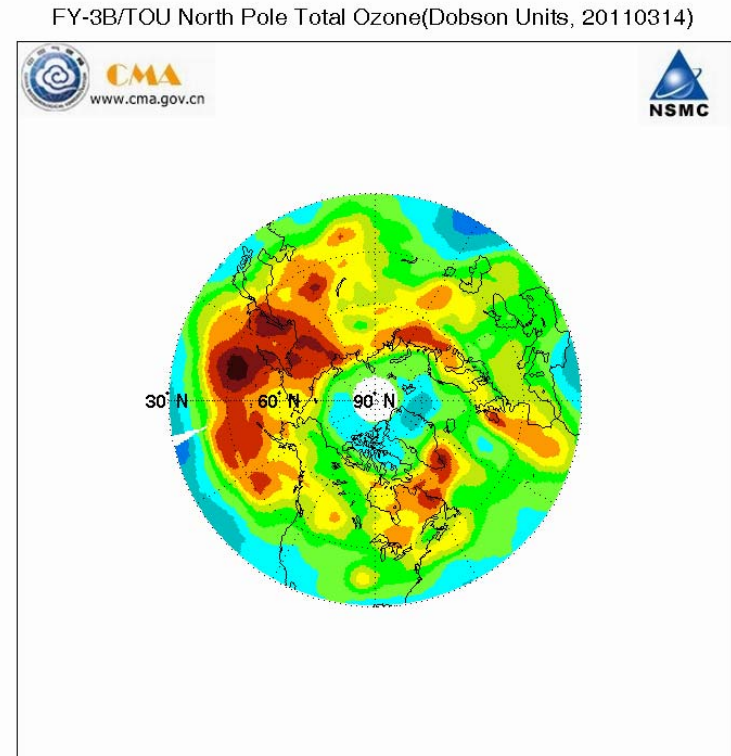
<100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 >500 none

<100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 >500 none

Ozone hole near the arctic area



Polar stratospheric clouds

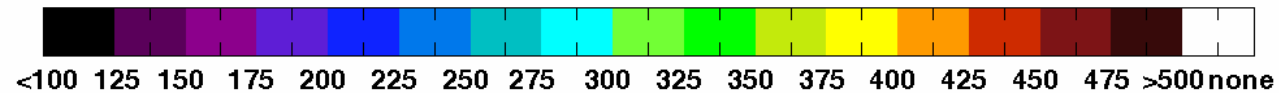
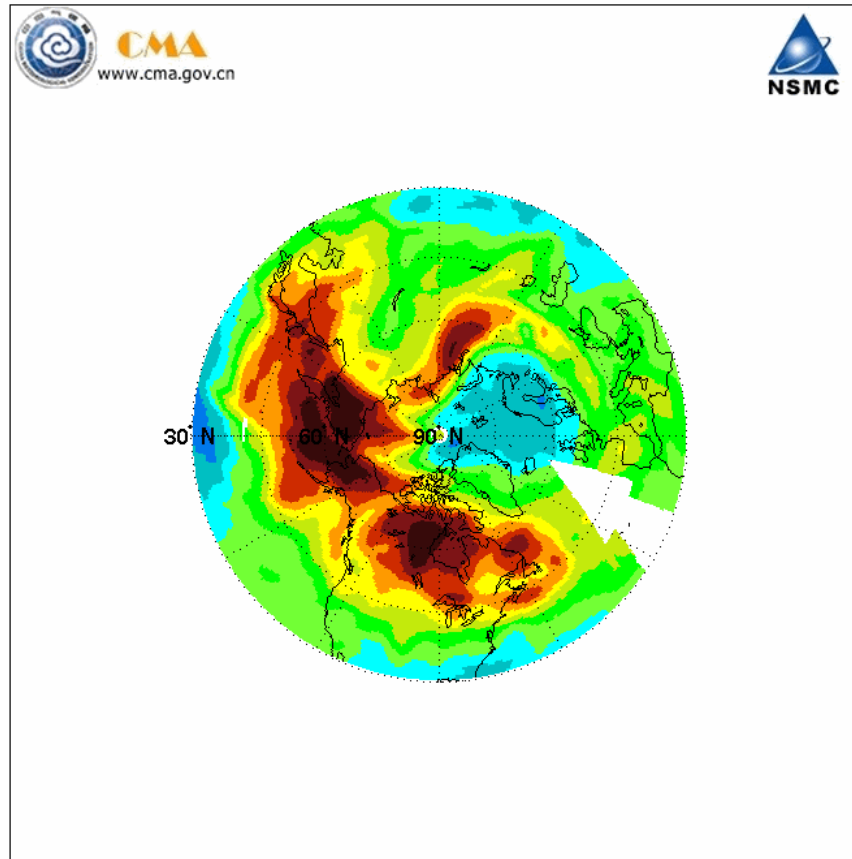


Total ozone amount

polar stratospheric clouds generated by polar vortex release **Halogen atoms**

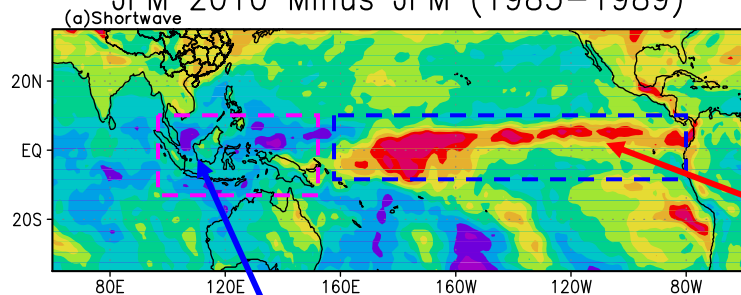
Ozone Amount from 27 March to 5 April, 2011 from FY-3

FY-3A/TOU Total Ozone over North Pole (Dobson Units, 20110327)

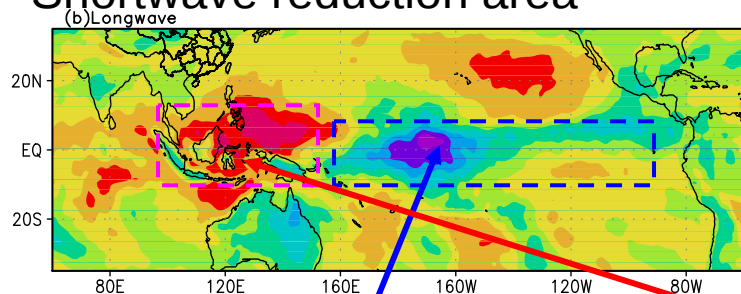


Radiance Pattern in Shortwave and Longwave derived from FY-3A and FY-3B in year El Niño(2010) and year La Niña(2011)

ERM-Derived ENSO Radiative Anomalies
JFM 2010 Minus JFM (1985-1989)

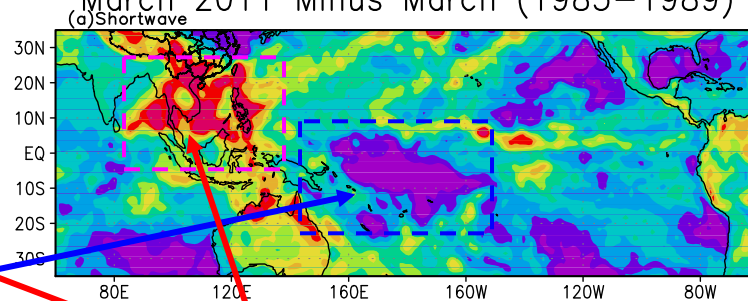


Shortwave reduction area

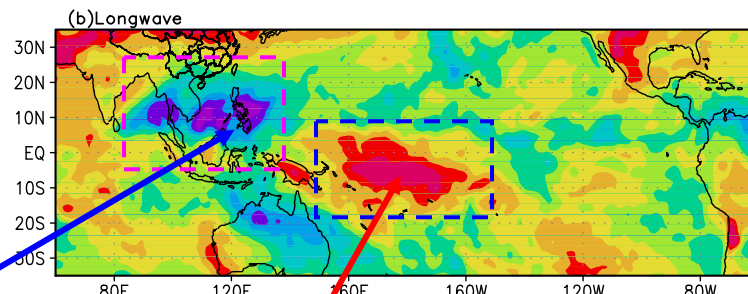


Longwave reduction area

FY3B ERM-Derived Radiative Anomalies
March 2011 Minus March (1985-1989)



Short wave increment area

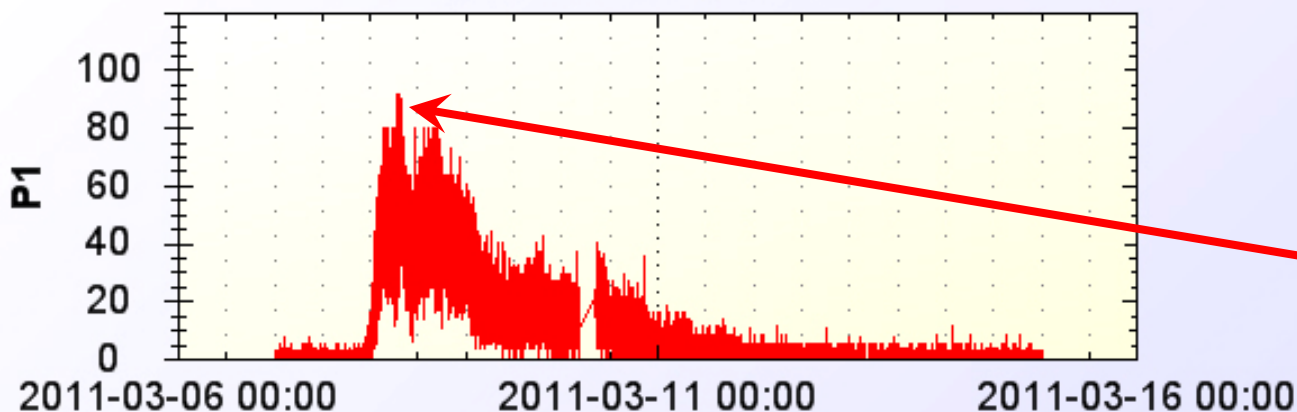


Longwave increment area

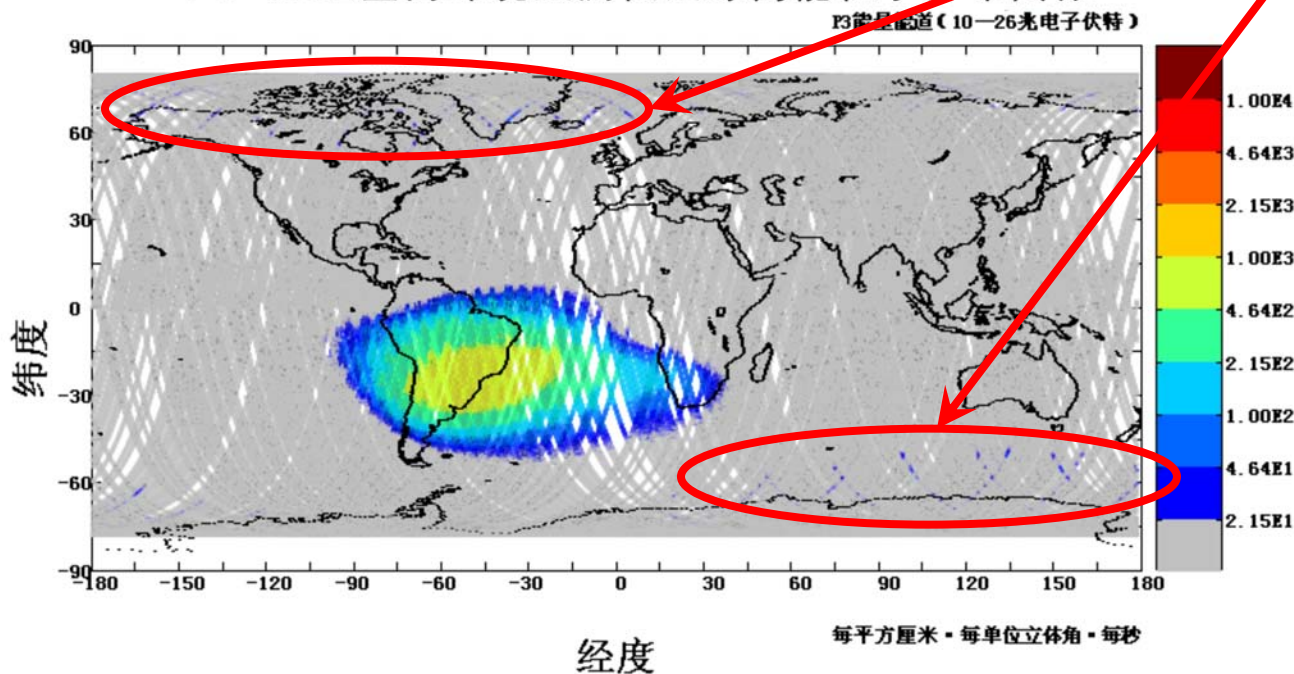


Solar proton event on 8 March, 2011 monitoring by FY-2D and FY-3B

FY-2D卫星高能质子流量 (10~30 MeV)



FY-3B星空间环境监测仪全球高能粒子分布图像



Data Delivery Service

1. Web-based Service (register user)
2. FTP Push (important user)
3. FTP Pull (register user)
4. Manual Service (emergency)
5. CMACAST (register user)

- WEB信息发布、订单处理、客户服务
- 海量遥感卫星数据时空一体化的空间数据库管理
- 遥感卫星产品多维可视化发布
- WebGIS发布



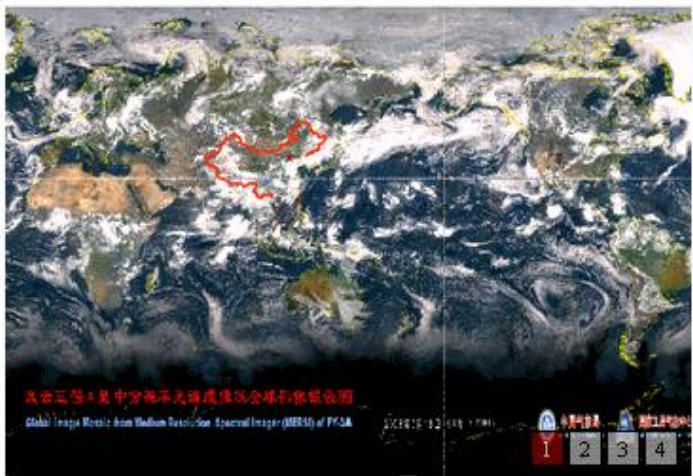

风云卫星遥感数据服务网

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2009-05-13 星期三

用户名: 密码: 验证码:



风云三号A星中分辨率光谱成像仪全球影像图
Global Image Mosaic from Medium Resolution Spectral Imager (MRSI) of FY-3A
2009-05-12 14:00:00

数据下载

[FY-3A](#) [FY-2C](#) [FY-2D](#) [FY-1D](#)

[Terra](#) [Aqua](#) [NOAA-17](#) [NOAA-18](#)

FY-1C MTSAT-IR
GOES-9 METEOSAT-5
GMS-5 NOAA-16

高级定制服务

时空一体化的可视化数据定制下载

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[FY-3A全球数据可视化定制下载](#)

[FY-3A全球影像三维可视化](#)

重点推介

 **FY-3全球影像**
应用WebGIS技术快速发布FY-3每日全球高分辨率卫星影像

专题信息


0704号热带气旋“万宜”
0704号热带气旋-“万宜”

系统信息

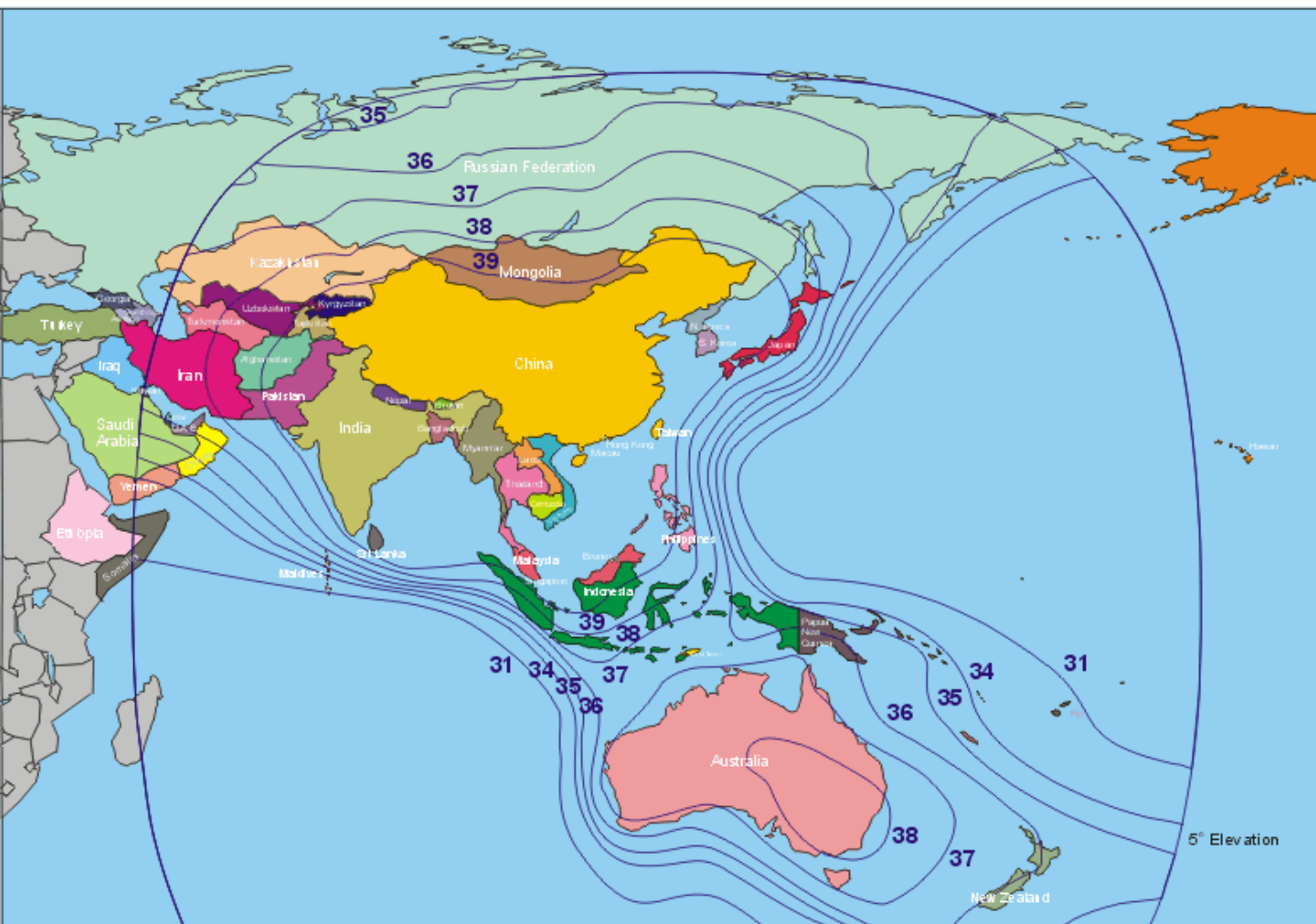
截止到2009年05月12日,国家卫星气象中心接收、处理、存档和提供共享服务的统计信息如下:

国内外 颗卫星

[http://FY3.satellite.cma.gov.cn\(10.24.16.14\)](http://FY3.satellite.cma.gov.cn(10.24.16.14))

CMACast Coverage and Antenna Aperture

AsiaSat 4 (122.2°E) C-Band EIRP (dBW)



Location

Iraq



**New
Zealand**

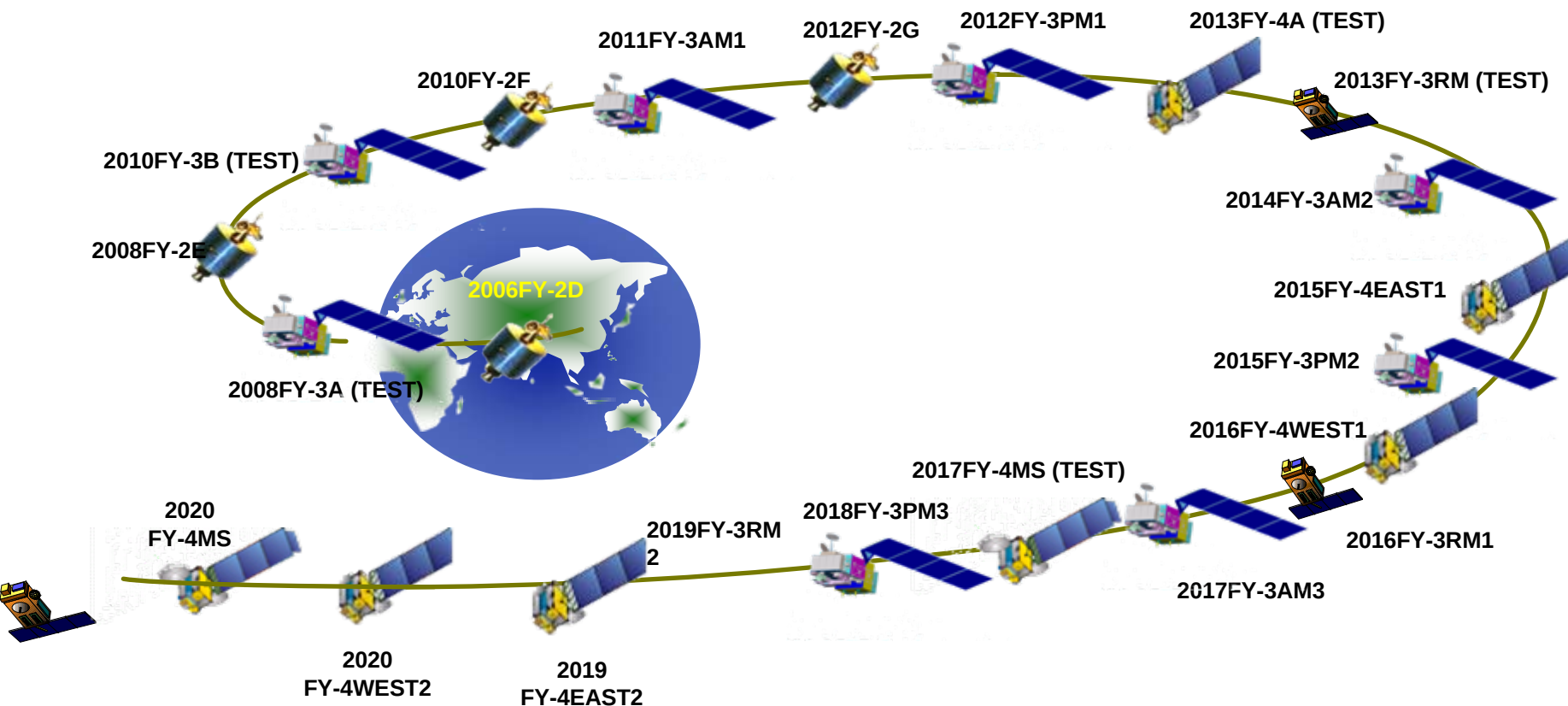
Antenna

1.8 m



2.4m

Tentative Schedule for Future FY Series



Enhanced Capabilities for FY-3 Operational Satellites

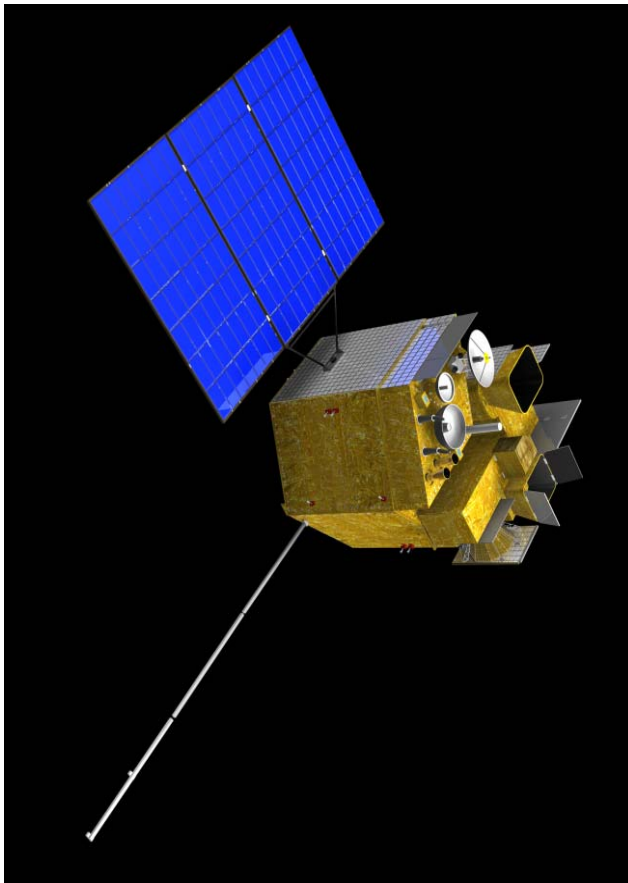
- Improve global optical imaging capabilities (MERSI II) ;
- Advanced Hyper-spectral sounding of atmosphere temperature and humidity profile (IRAS -> IHSAS) ;
- Atmosphere Chemistry sounding ;
- Sea surface wind microwave scatterometer

FY-3 OPERATIONAL SATELLITE INSTRUMENTS	FY-3C	FY-3D	FY-3E	FY-3F
MERSI – Medium Resolution Spectral Imager (I, II)	√(I)	√(II)	√(II)	√(II)
MWTS (to be Improved)	√	√	√	√
MWHS – Microwave Humidity Sounder (to be Improved)	√	√	√	√
MWRI – Microwave Radiation Imager	√	√		√
SWMR -Sea Wind Measurement Radar			√	
GGM - Greenhouse Gas monitor		√		√
IHSAS – Infrared Hyper-spectral Atmospheric Sounder		√	√	√
UHOMI – Ultraviolet Hyper-spectral Ozone Mapping Instrument			√	
GRO – GPS radio occultation	√	√	√	√
ERM – Earth Radiation Measurement	√(I)		√(II)	
SIM – Solar irradiation Monitor (Trace to the Sun)	√(I)		√(II)	
SES – Space Environment Suite	√	√	√	√
IRAS – Infrared Atmospheric Sounder	√			
VIRR – visible and Infrared Radiometer	√			
SBUS – Solar Backscattered Ultraviolet Sounder	√			
TOU – Total Ozone Unit	√			

FY-3C/D/E/F Payload Configuration

Next Generation of GEO satellite FY-4

4 main instruments



Advanced Geo. Radiation Imager

Geo. Interferometric InfraRed Sounder

Lighting Mapping Imager

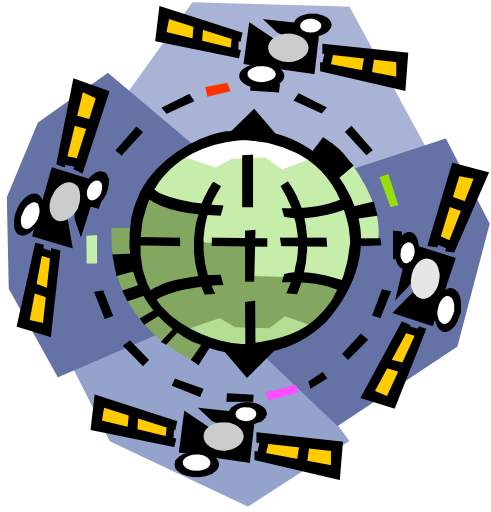
Solar X-EUV imaging telescope
(not available on 1st satellite)

No.	Plan Launch	Design Life	Status
FY-4A	2014	5 years	R&D
FY-4B	2017	7 years	Op.
FY-4C	2019	7 years	Op.

Prototype structure of FY-4A

5. Summarization

- China has established the ambitious space-based programme for HY marine series, HJ environmental series, ZY resource series and FY meteorological series.
- The great progress has been achieved for the data application of Chinese earth observation satellites not only on the image interpretation but also on the quantitative utilization, such as FY meteorological satellite data assimilation into NWP model to improve the global weather forecasting.
- **Chinese Earth Observation Satellites** have become the important components for global observing system. China is willing to strengthen the cooperation on space technology with other countries. China is willing to make more contributions to the international and global services.



..... *Stop Here*

Thank you!

