



Committee on Earth Observation Satellites

# Updated Status of CMA Satellite Programs

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National Satellite Meteorological Center, CMA

CEOS Plenary 2017

Agenda Item # 4.15

Rapid City, South Dakota, USA

19 – 20 October 2017



## GEO Programs

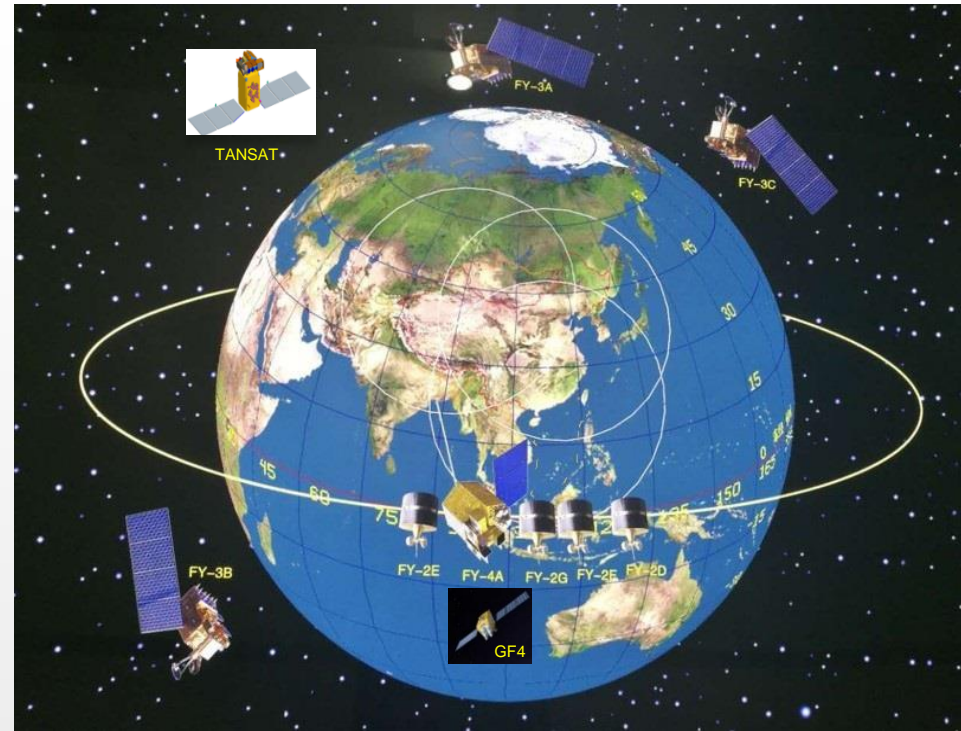
- FY-2D/E/F/G(op.)
- **FY-4A(R&D), new generation!**

## LEO Programs

- FY-3A/B(R&D)
- FY-3C(op.), AM
- **FY-3D(op.), PM, coming soon!**

## Others (cooperative missions)

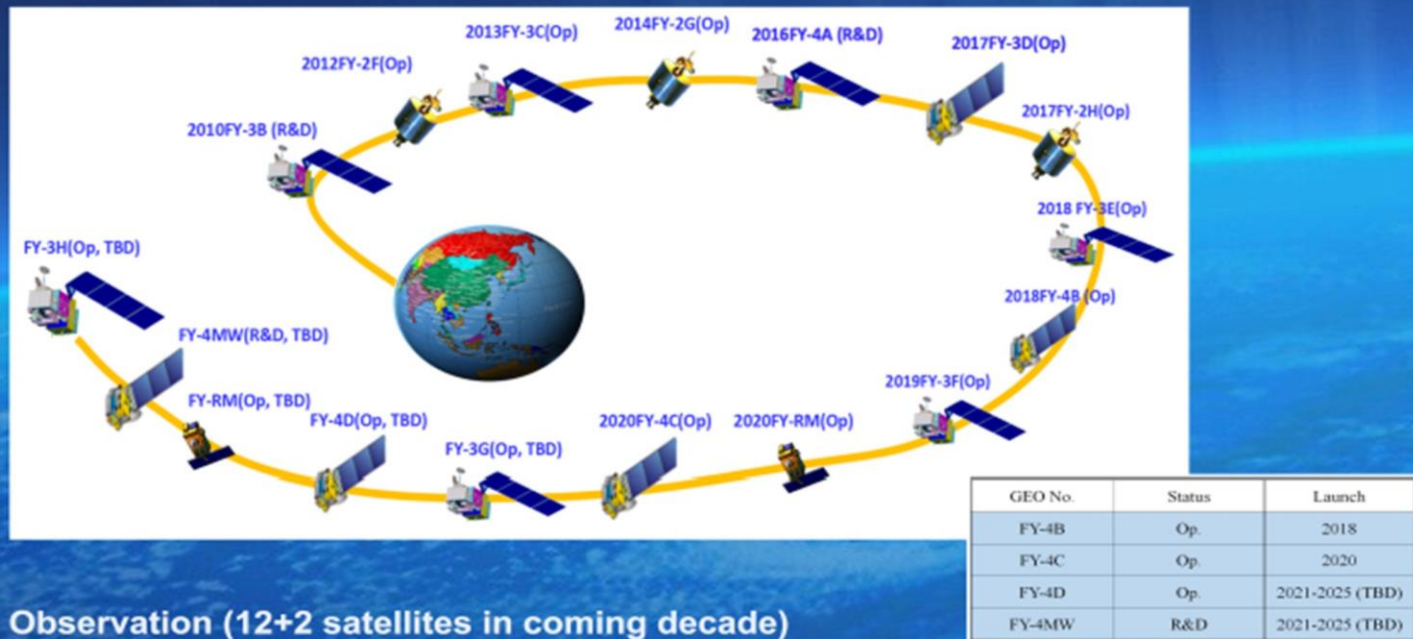
- **TANSAT(R&D), CO<sub>2</sub> & aerosol led by MOST**
- **GF-4 (R&D), High Spatial Res. Imaging In GEO led by CNSA**





## Future Plan: National Space Infrastructure Plan (NSIP)

In 2015, the Chinese government has approved an extensive plan called NSIP, which will cover a number of earth observation satellite series including atmosphere, land, and ocean satellites in period of 2015-2025.



## Atmosphere Observation (12+2 satellites in coming decade)

- Climate & Environment Monitoring Satellite series: FY-3 low earth orbit series (7)
- Weather Monitoring Satellite series: FY-4 geostationary orbit series (5)
- Air Quality Monitoring Satellite series : New Series (2)

LEO No.	Orbit	Status	Launch
FY-3D	PM	Op. planned	2017
FY-3E	EM	Op. planned	2018
FY-3F	PM	op. planned	2019
FY-RM	Inclined	R&D, Planned	2020
FY-3G	TBD	Op. planned	TBD
FY-3H	TBD	Op. planned	TBD



## 1. FY-4A

- The first GEO. meteorological satellite of new generation
- Launched on Dec.11, 2016

## 2. FY-3D

- A new operational afternoon orbit LEO. satellite, will co-work with FY-3C in morning orbit.
- Launch date is scheduled in coming Nov. 2017!

## 3. TANSAT

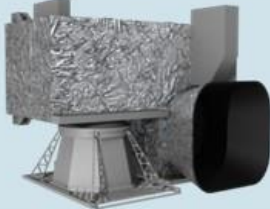
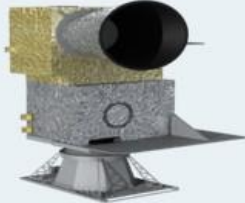


- A joint R&D satellite program initiated by MOST, and supported by CMA which is responsible for data reception, processing and distribution, taking advantage of current FY-3 ground segment resources.
- Launched successfully on Dec.22, 2016

## 4. GF-4

- The 4<sup>th</sup> satellite in High res. Earth Obs. Satellite Project led by CNSA, while CMA is responsible for data reception, transmission and preprocessing of MET mode.
- Launched in Dec. 29,2015
- Commissioning test finished and handover declared on June 1<sup>st</sup>, 2016

# FY-4A: The First CMA New-generation Geostationary Meteorological Satellite

Launched on Dec.11,2016,Located at 105E , will be ready for operation soon!

Instrument	Purposes	
 A 3D rendering of the AGRI instrument, showing a large, rectangular, metallic structure with a complex internal structure and a black cylindrical component on the right side.	<b>AGRI: Advanced Geosynchronous Radiation Imager</b>	14 -channel Earth images
 A 3D rendering of the GIIRS instrument, showing a rectangular metallic structure with a large black cylindrical component on the right side.	<b>GIIRS: Geostationary Interferometric InfraRed Sounder</b>	Clear-sky atmospheric temperature and humidity profiles
 A 3D rendering of the LMI instrument, showing a rectangular metallic structure with two large black cylindrical components on the right side.	<b>LMI: Lightning Mapping Imager</b>	Lightning distribution map in China area
 A circular inset showing three small electronic components, likely part of the SEP instrument.	<b>SEP: Space Environment Package</b>	Space electric and magnetic environment information



## FY-4A GEOSTATIONARY METEOROLOGICAL SATELLITE

The First Colour Composite Image of FY-4A AGRI



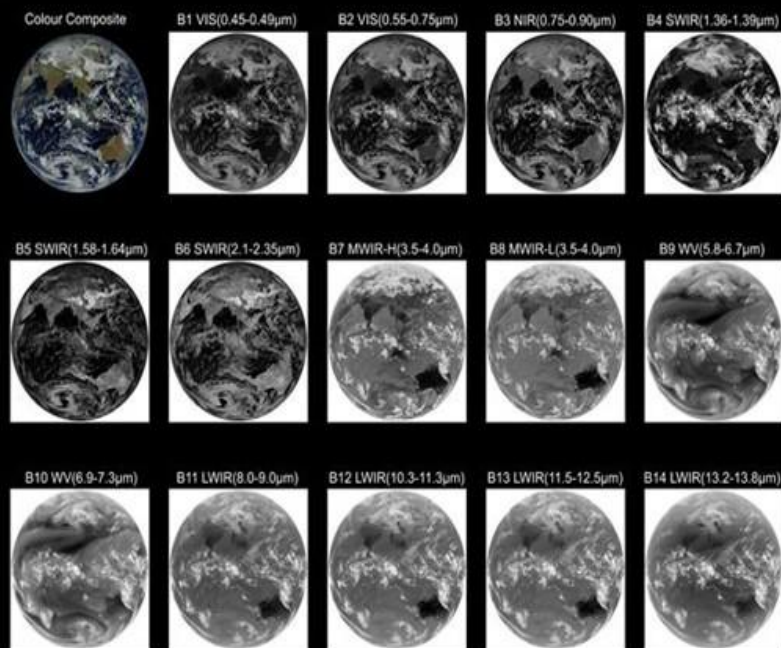
February 20th, 2017 05:15 (UTC)



Processed by NSMC

## FY-4A GEOSTATIONARY METEOROLOGICAL SATELLITE

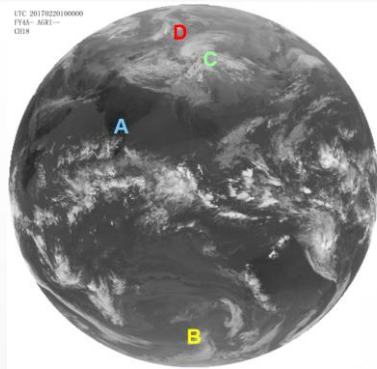
The First Images of FY-4A AGRI



February 20th, 2017 05:15(UTC)

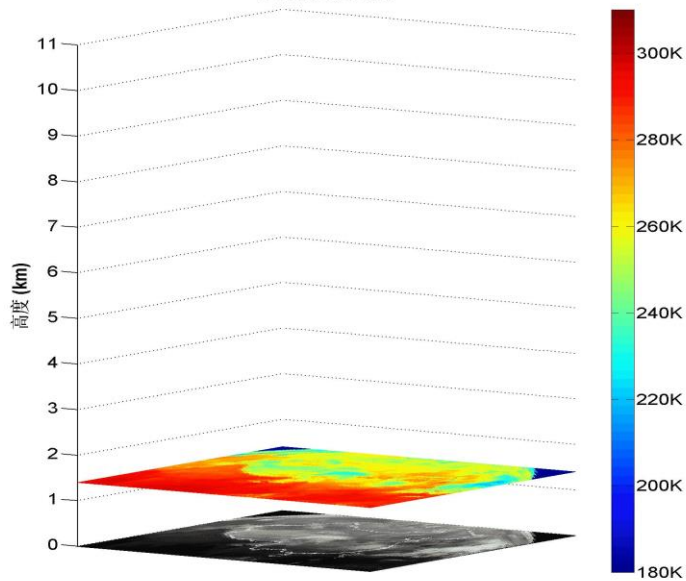


Processed by NSMC

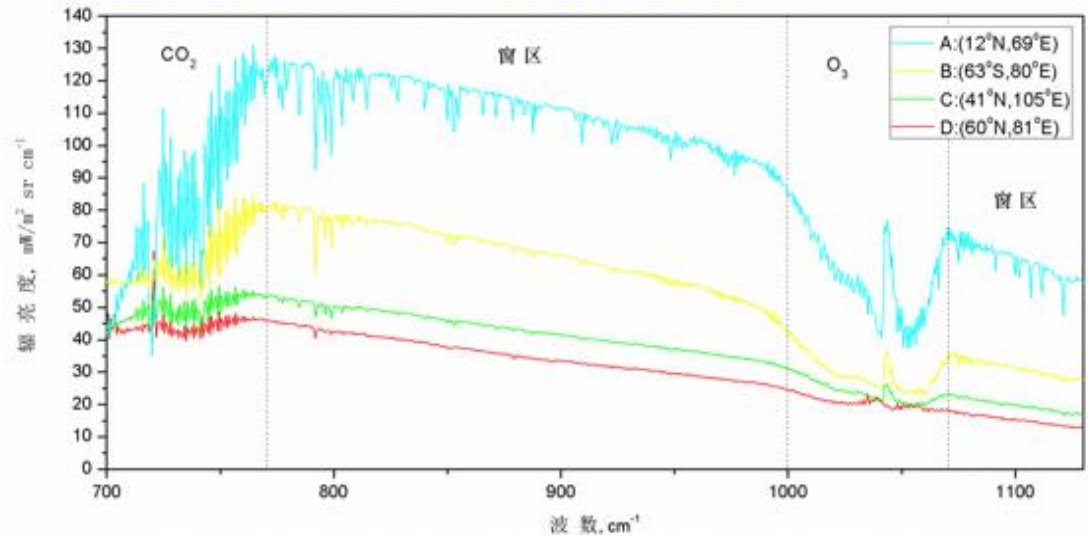


Spatial resolution: 16km,  
Spectral resolution 0.625

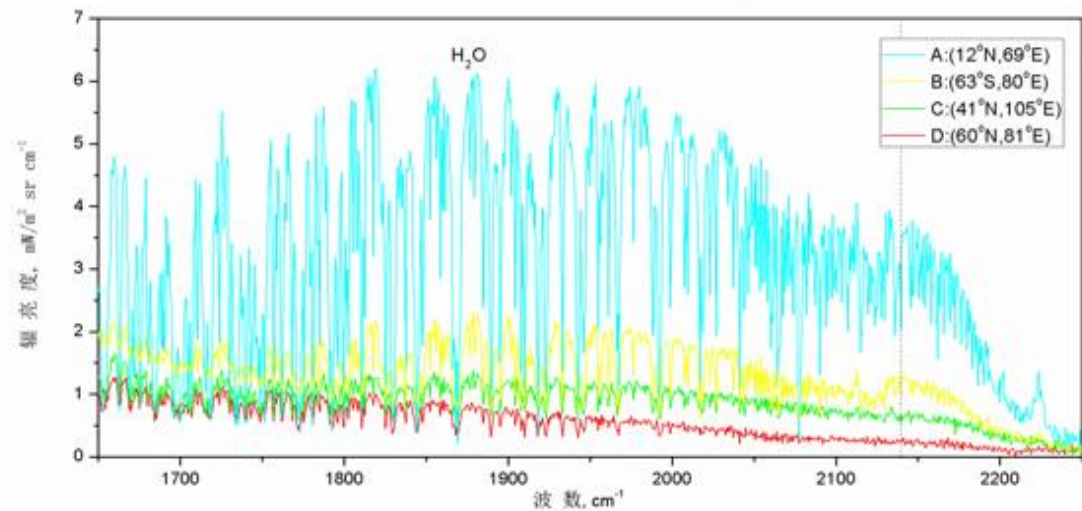
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Longwave IR 700-1130 $\text{cm}^{-1}$ , 8.85-14.29 $\mu\text{m}$



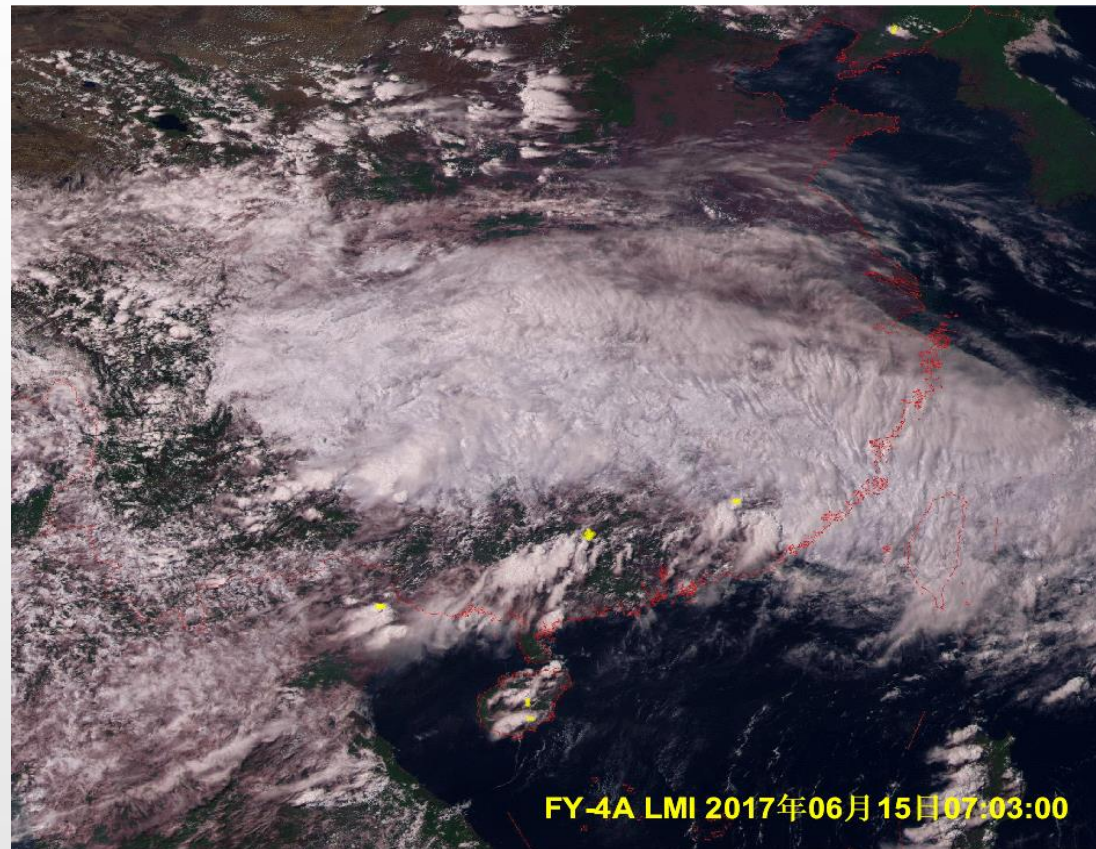
Middle Wave IR ( 1650-2250 $\text{cm}^{-1}$ , 4.44-6.06 $\mu\text{m}$ )





## LMI

Acquire lightning distribution maps over china region

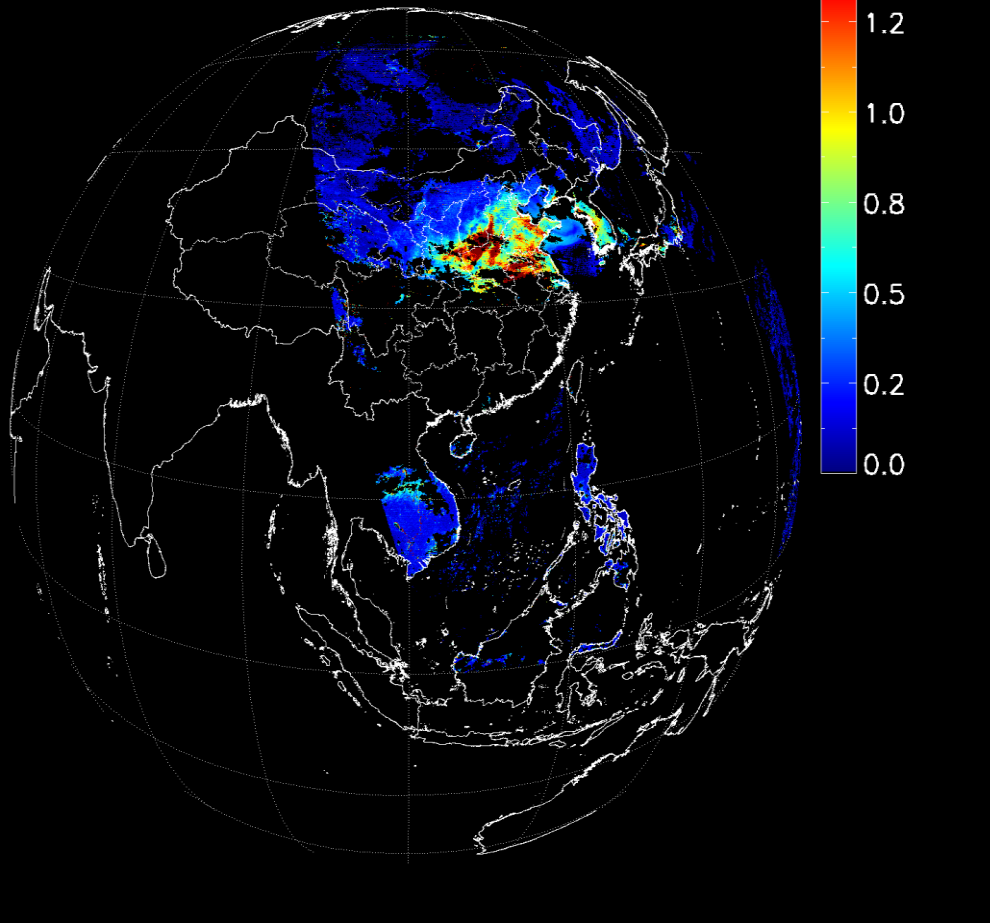


Spatial resolution	about 7.6 km at SSP
Wave-length at center	777.4nm
Band-width	1nm±0.1nm
Detection efficiency	>90%
False-alarm ratio	<10%
Dynamic range	>100
SNR	>6
Frequency of frames	2ms (500 frames per sec.)
Quantization bits	12
Measurement error	10%

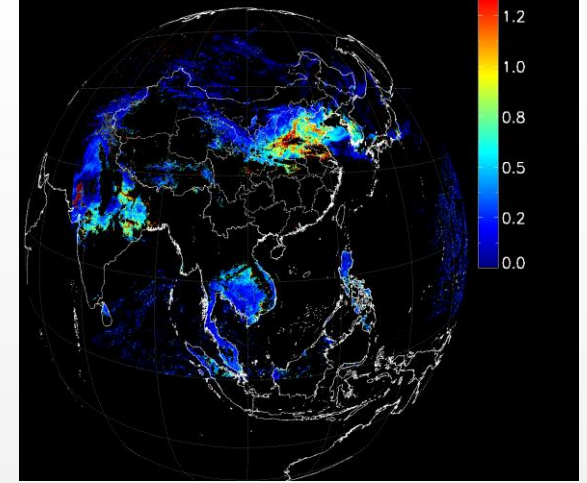




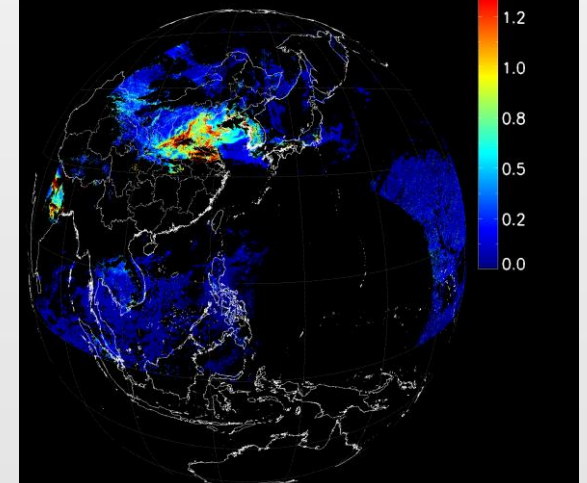
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FY-4A\_Aerosol\_Optical\_Depth  
UTC\_20170616\_0200 [BJT\_20170616\_1000]

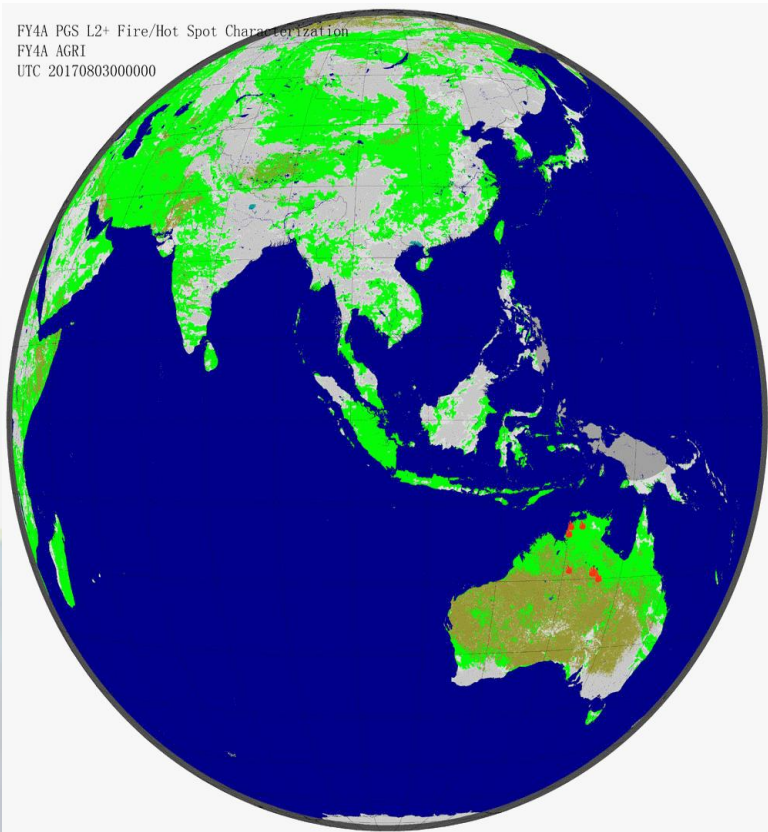


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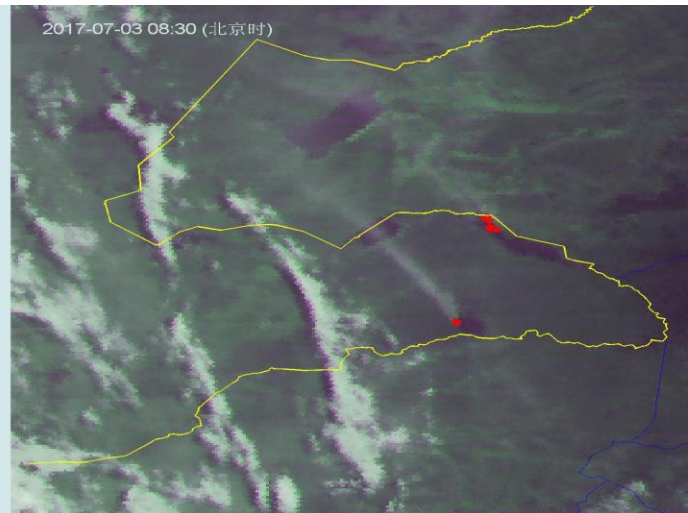




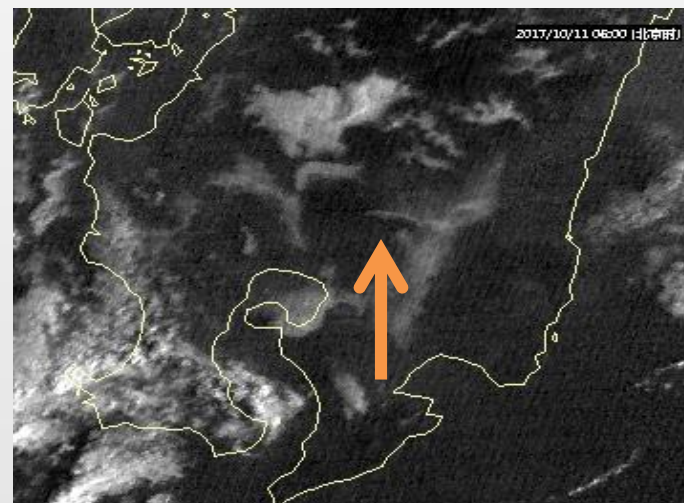
FY4A PGS L2+ Fire/Hot Spot Characterization  
FY4A AGRI  
UTC 20170803000000

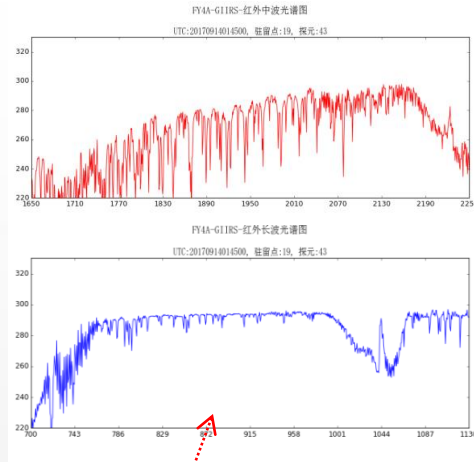
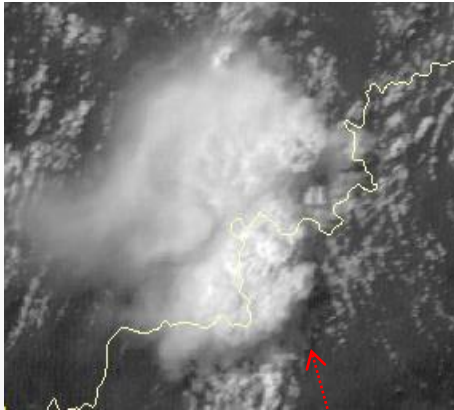


2017-07-03 08:30 (北京时间)

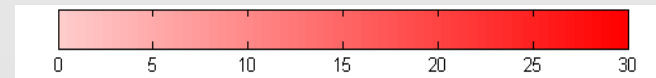
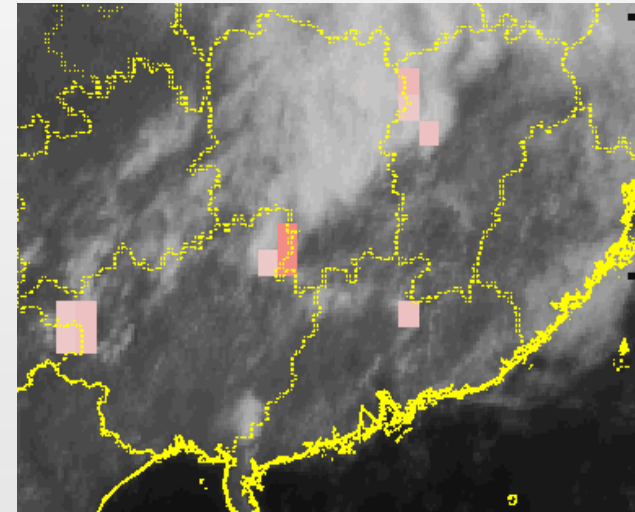
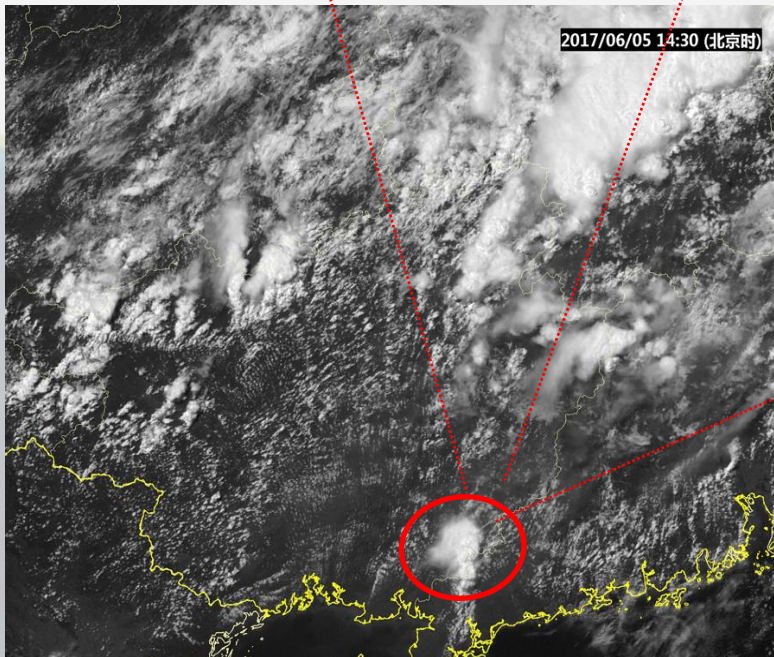


2017/10/11 06:00 [北京时间]





1. FY-4A lightning frequency map: strong convective cloud clusters often accompany with obvious lightnings.
2. FY-4A high spatial resolution imager: finer structure and texture of strong convective cloud cluster; and clearer small scale cumulus line.
3. Cloud free atmospheric profile acquired from GIIRS can be used for nowcast warning.



## 10 instruments on board FY-3D:

### ▣ Successive instruments:

**MWTS-II:** Microwave Temperature sounder

**MWHS-II:** Microwave Humidity sounder

**MWRI:** Microwave Radiation Imager

**GNOS:** Global Navigation Occultation Sounder

**SEM:** Space Environment Monitor

### ▣ Improved instruments:

**MERSI-II:** Improved from MERSI

**HiRAS:** Upgraded from filter-type spectrometer

IRAS

### ▣ New Instruments:

**GAS:** Greenhouse gases Absorption Spectrometer

**WAI:** Wide-angle Aurora Imager

**IPM:** Ionospheric Photometer



# MERSI → MERSI-II

## continuity and Evolution



### MERSI-2 Improvement:

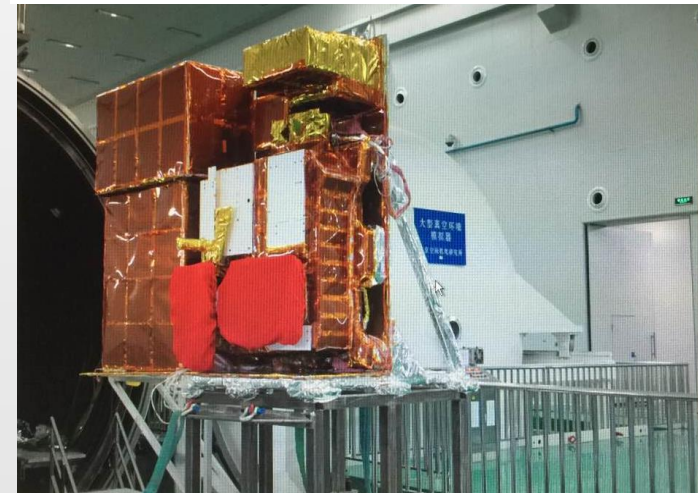
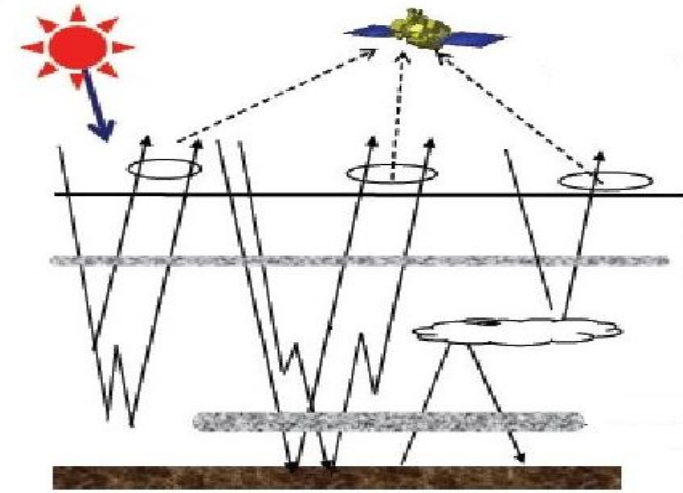
- Cover all bands in FY-3A/B/C MERSI
- Five more IR bands
- Cirrus cloud band 1.38um
- Water vapor bands In NIR and 7.2um
- Two IR split windows with 250m spatial resolution
- Higher accuracy from onboard calibration
- Lunar Calibration capability

Band	SNPP VIIRS	FY-3D MERSI-II	FY-3A/B/C MERSI
1	DNB	0.470	0.470
2	√	0.550	0.550
3	√	0.650	0.650
4	√	0.865	0.865
5	×	1.03	11.25
6	√	1.64	1.640
7	√	2.13	2.130
8	√	0.412	0.412
9	√	0.443	0.443
10	√	0.490	0.490
11	√	0.555	0.520
12	√	0.670	0.565
13	√	0.709	0.650
14	√	0.746	0.685
15	√	0.865	0.765
16	×	0.905	0.865
17	×	0.936	0.905
18	×	0.940	0.940
19	√	1.38	0.980
20	√	3.8	1.030
21	√	4.05	
22	×	7.2	
23	√	8.550	
24	√	10.8	
25	√	12.0	

■ 250 m  
■ 1000 m



- **Objectives:** to measure CO<sub>2</sub> and CH<sub>4</sub> column density by using a SWIR Interferometer
- **Spectral res.:** 0.2 cm<sup>-1</sup>
- **Spatial res.:** 13km
- **Number of Bands:** 4

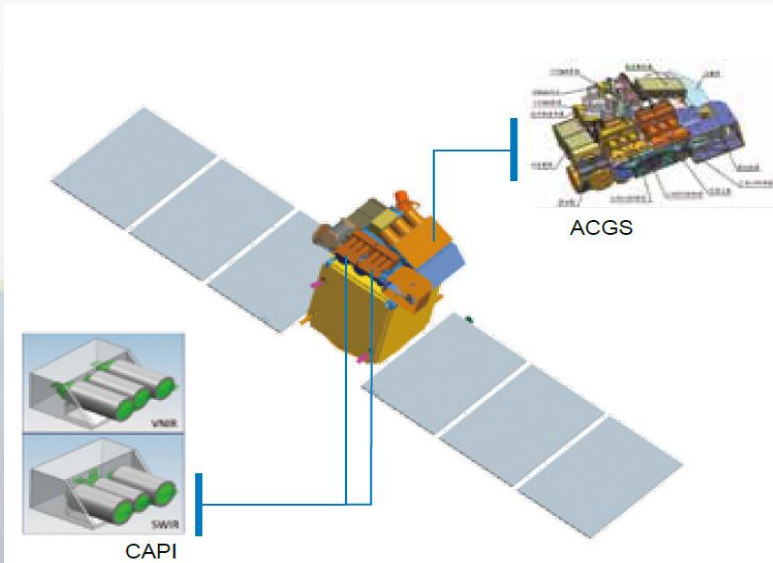


Specification	FY-3D GAS	FY-3G GAS-II	TanSat	OCO	
Spectral bands (μm)	0.76	√	√	√	√
	1.6	√	√	√	√
	2.0	√	√	√	√
	2.3	√	√	—	—
Spectral Resolution (nm) @1.6μm	0.073	0.07	0.12	0.0757	
Spatial Resolution (km)	13.2	< 3	2	1	
Swath(km)	----	>100	20	10	
Sample points	7	----	9	8	
Sample interval (S)	2.2	----	0.3	0.333	



TANSAT A joint mission by: **MOST**(Ministry Of Science and Technology), **CAS**(Chinese Academy of Science), and **CMA**.

*Mission objective: To retrieve the atmosphere column-averaged CO<sub>2</sub> dry air mole fraction (XCO<sub>2</sub>).*



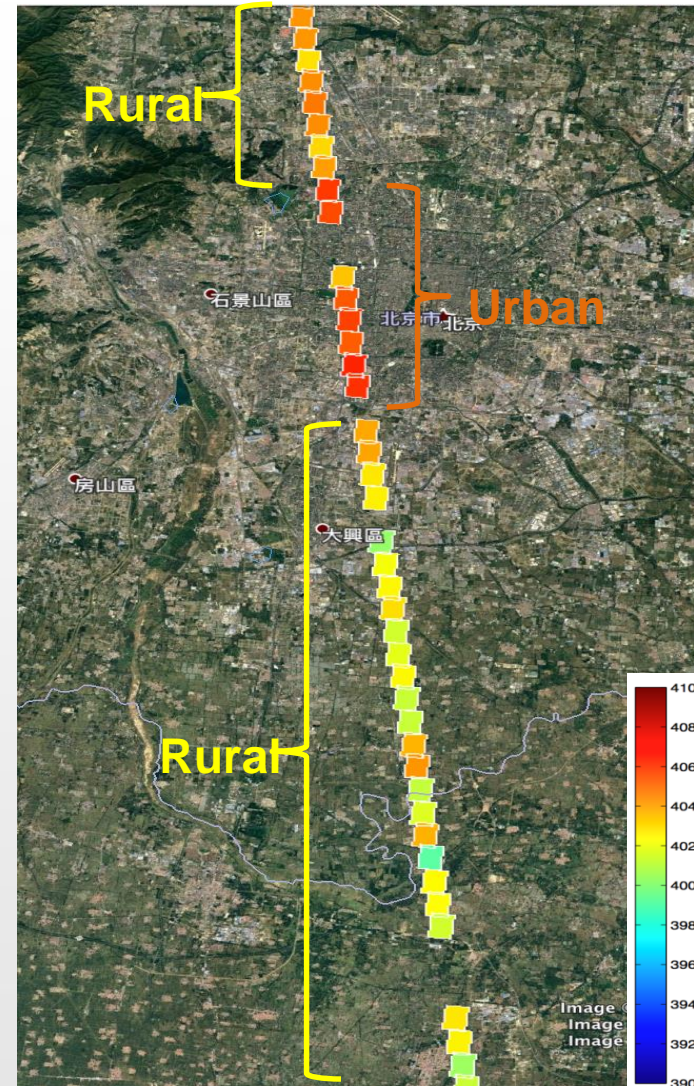
1)ACGS(Atmospheric CO<sub>2</sub> Grating Spectrometer) is mainly used to measure atmospheric CO<sub>2</sub>. It has three spectral bands. One is the oxygen A-band with a centroid wavelength of 760nm. The other two are weak and strong carbon dioxide absorbing bands with centroid of 1610nm and 2060nm.

2)CAPI(Cloud and Aerosol Polarization Instrument) is a 5-channel UV/VIS/ NIR/SWIR radiometer with three polarizations in two channels

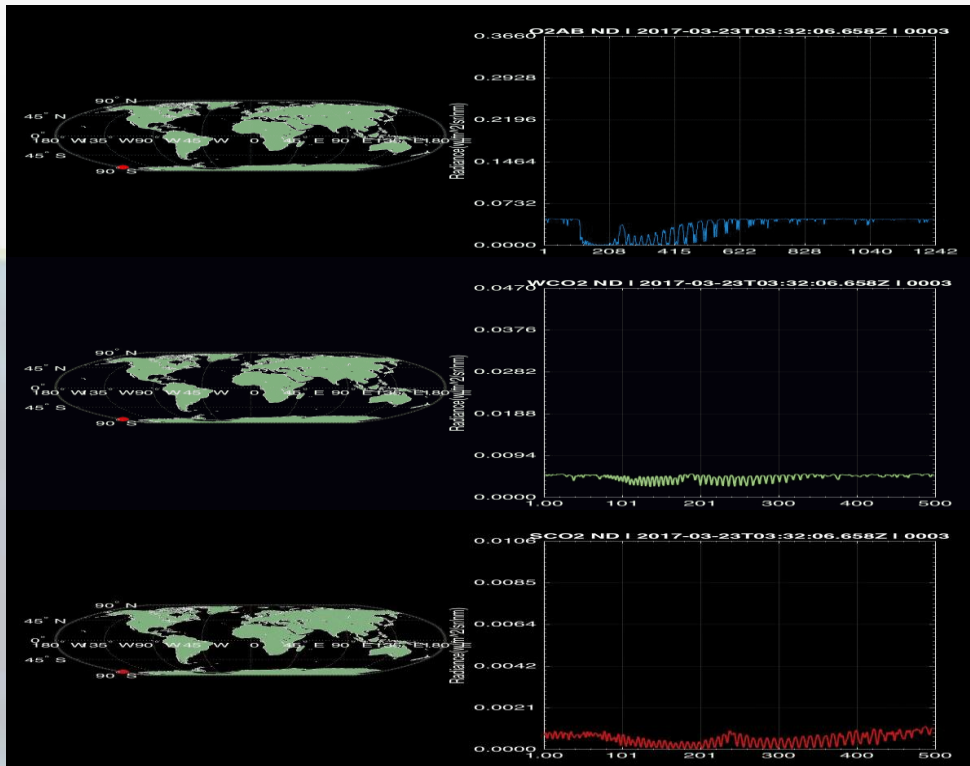
TANSAT satellite was  
successfully Launched in  
Dec. 22, 2016



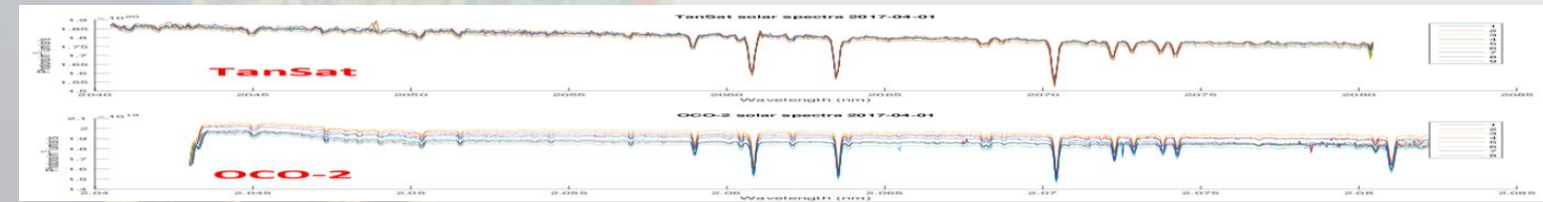
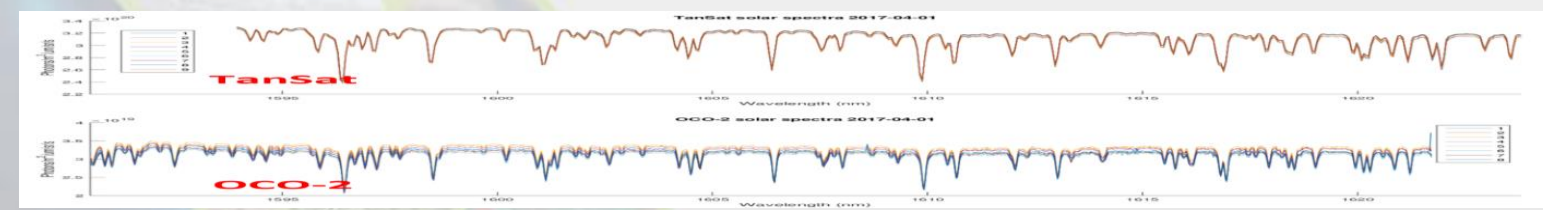
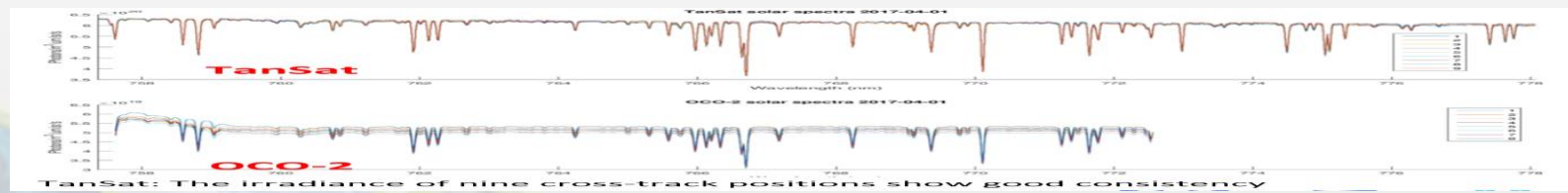
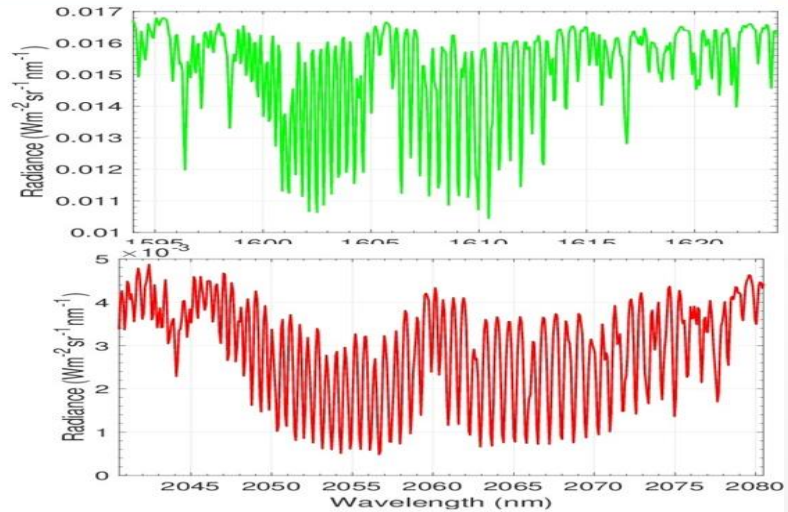
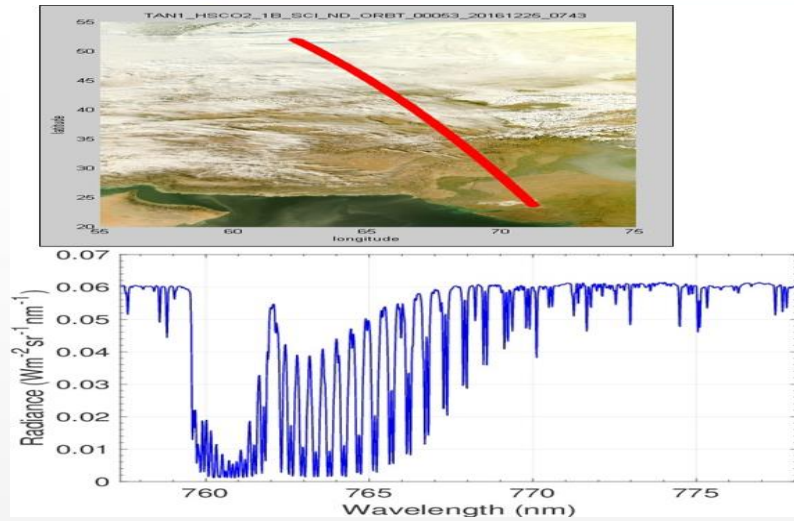
- TANSAT was successfully launched on Dec. 22, 2016.
- Commissioning test has been finished by June, 2017, and the Satellite was handed over to NSMC/CMA for operation
- All the data and products will be available soon.



XCO<sub>2</sub>

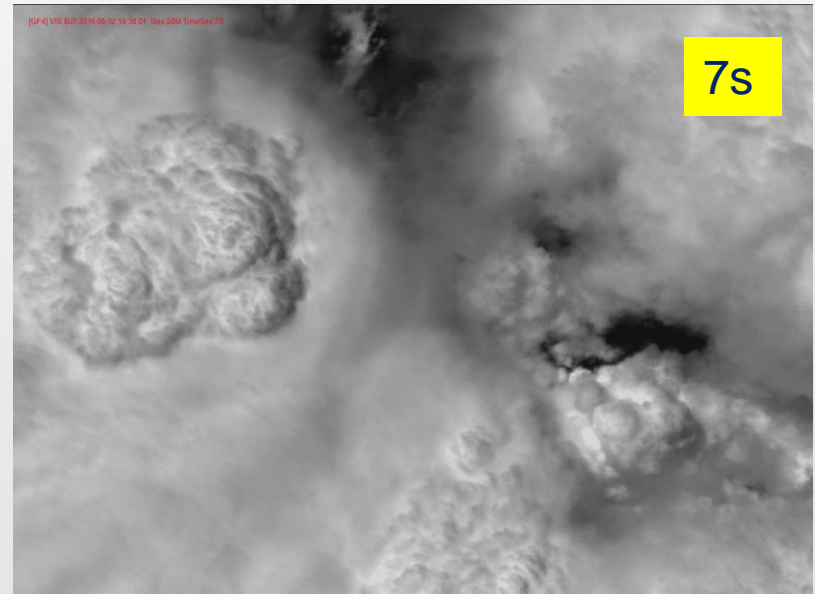
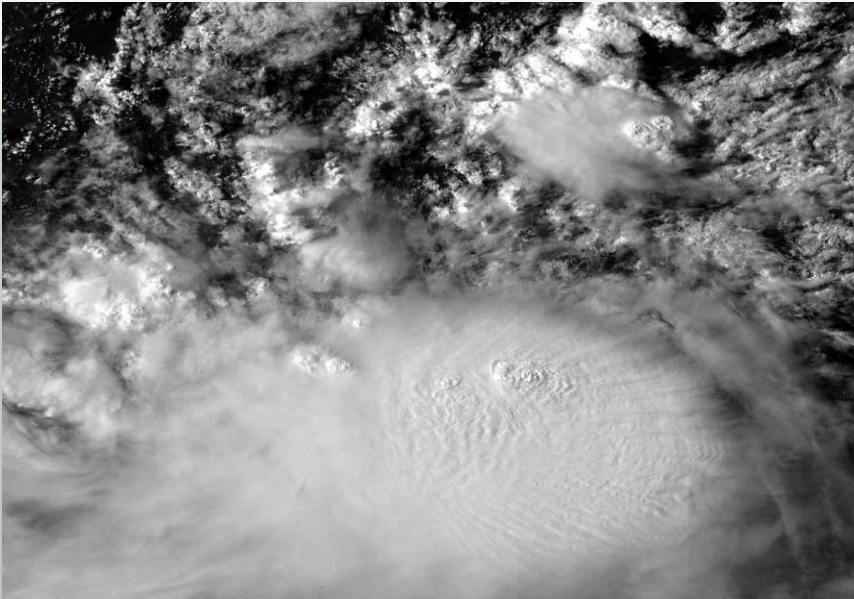








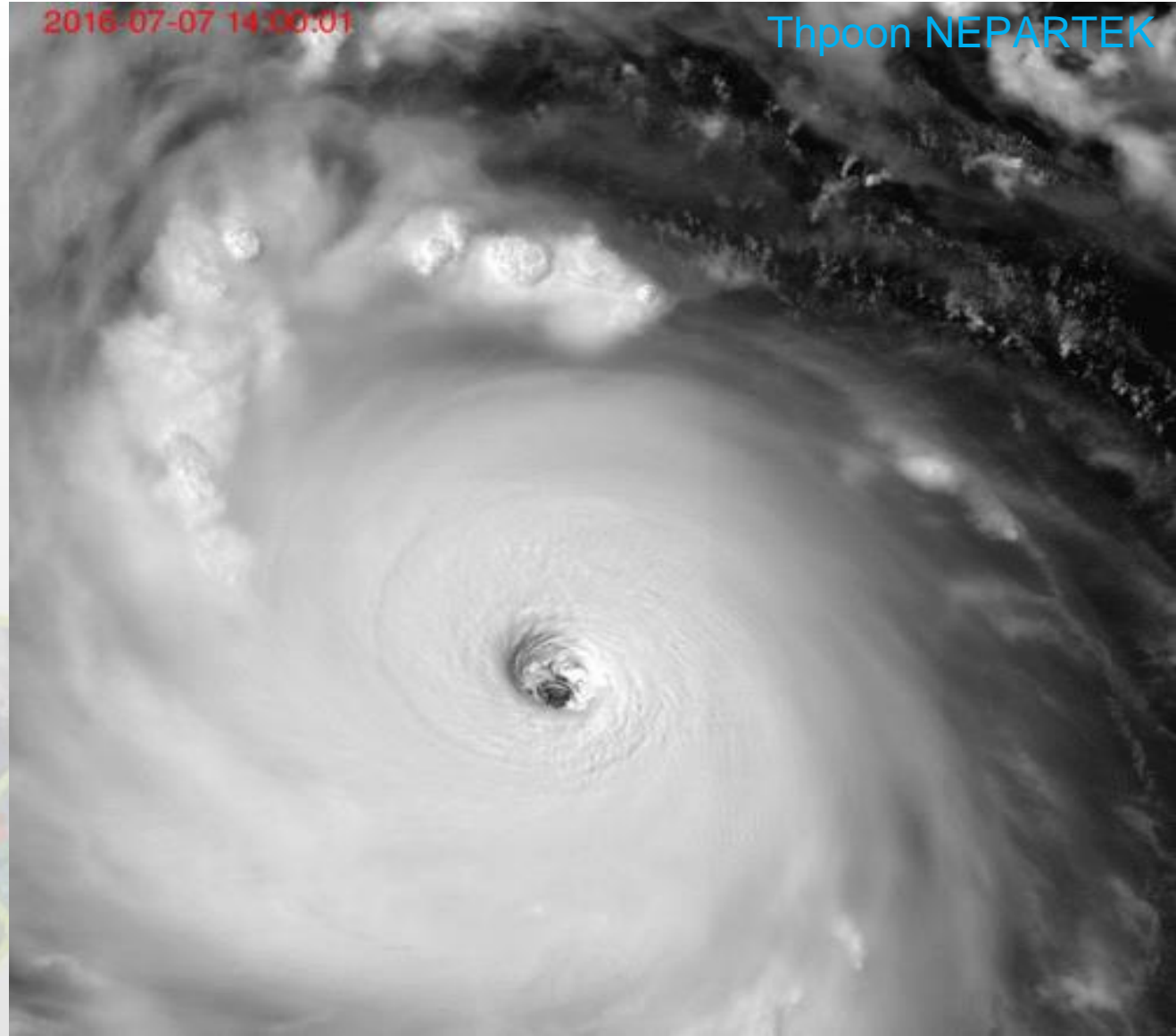
- Launched on 29 December 2015, Location at 105.6°E
- GF-4 is China's first high resolution geostationary satellite. Its spatial resolution is 50m at visible and near infrared band, and 400m at mid-infrared band. Its temporal resolution can reach several seconds.
- Useful for the monitoring of rapid growing meco-or small scale convective system.



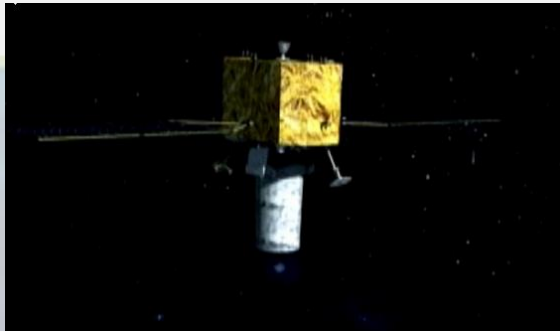


2016-07-07 14:00:01

Thphoon NEPARTEK



**Detector** 10,000X10,000  
**Spatial res.** 50 meters  
**Temporal res.** 10, 20, 60s





Thank you for your attention

