

# Status report on the current and future satellite systems by CMA

Presented to CGMS46-CMA-WP-01, Plenary session, agenda item D.1

Overview - Planning of CMA satellite systems

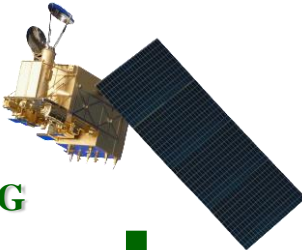
# FengYun Meteorological Satellites

## Polar System

**First Generation**  
FY-1 A, B, C, D



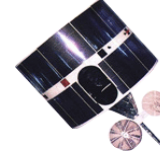
**Second Generation**  
FY-3 A, B, C, D, E, F, G



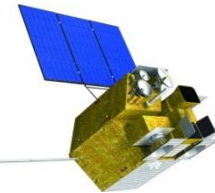
Expected until 2025

## Geostationary System

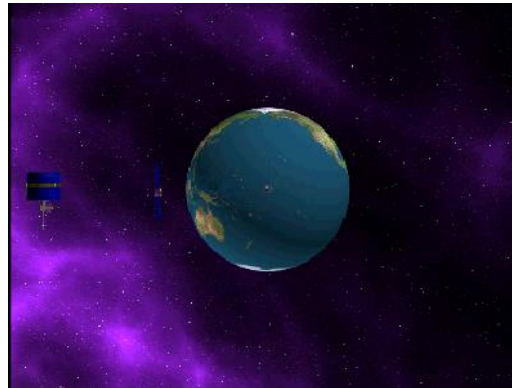
**First Generation**  
FY-2 A, B, C, D, E, F, G, H



**Second Generation**  
FY-4 A, B, C, D, E

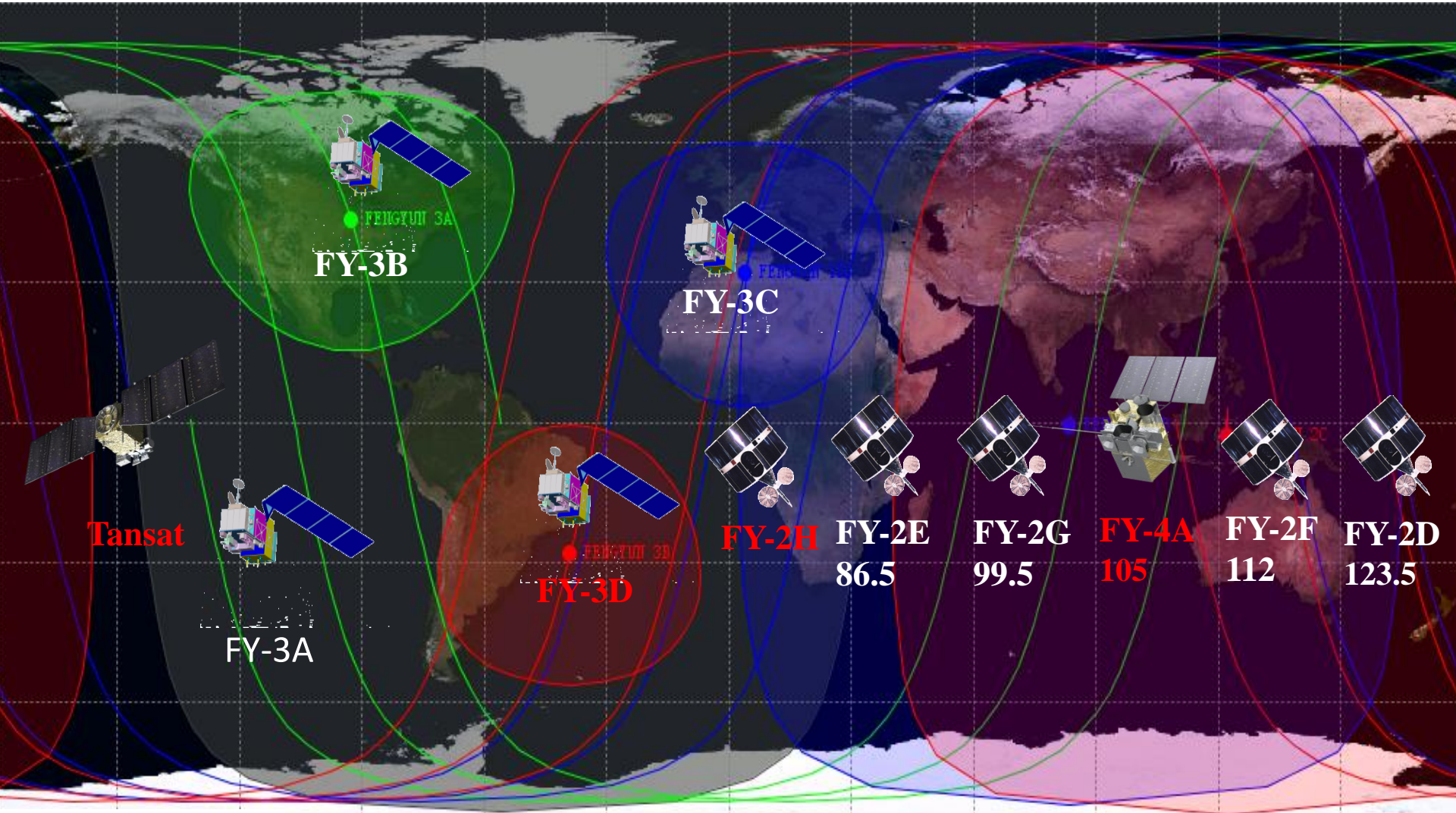


Expected until 2030



# Current FengYun satellites in orbit

10 on the orbit, 7 in operation, 1 in commission test(FY-3D)



# Update on satellite status

## 1. FY-4A

- The post launch test for satellite was finished on Dec.31,2017
- FY-4A has been operational from May.8, 2018

## 2. FY-2H

- Lunched on June.5. 2018

## 3. FY-3D

- Launched on Nov.15, 2017, the commissioning test started from Dec. 2017

## 4. TANSAT

- Data has been opened to international users

## 5. GF-5

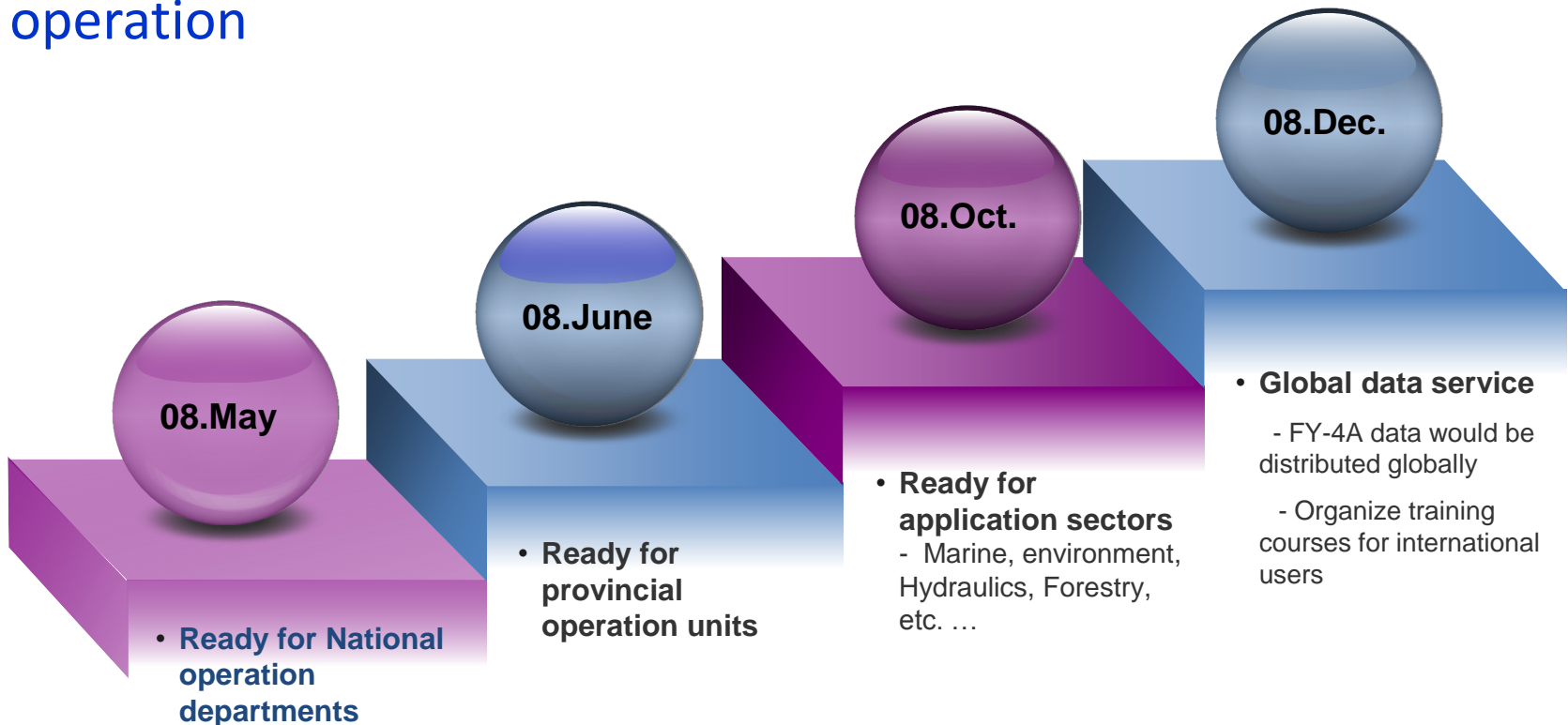
- GF series, by CNSA+CMA+MEP+MLR
- Lunched on May.9. 2018



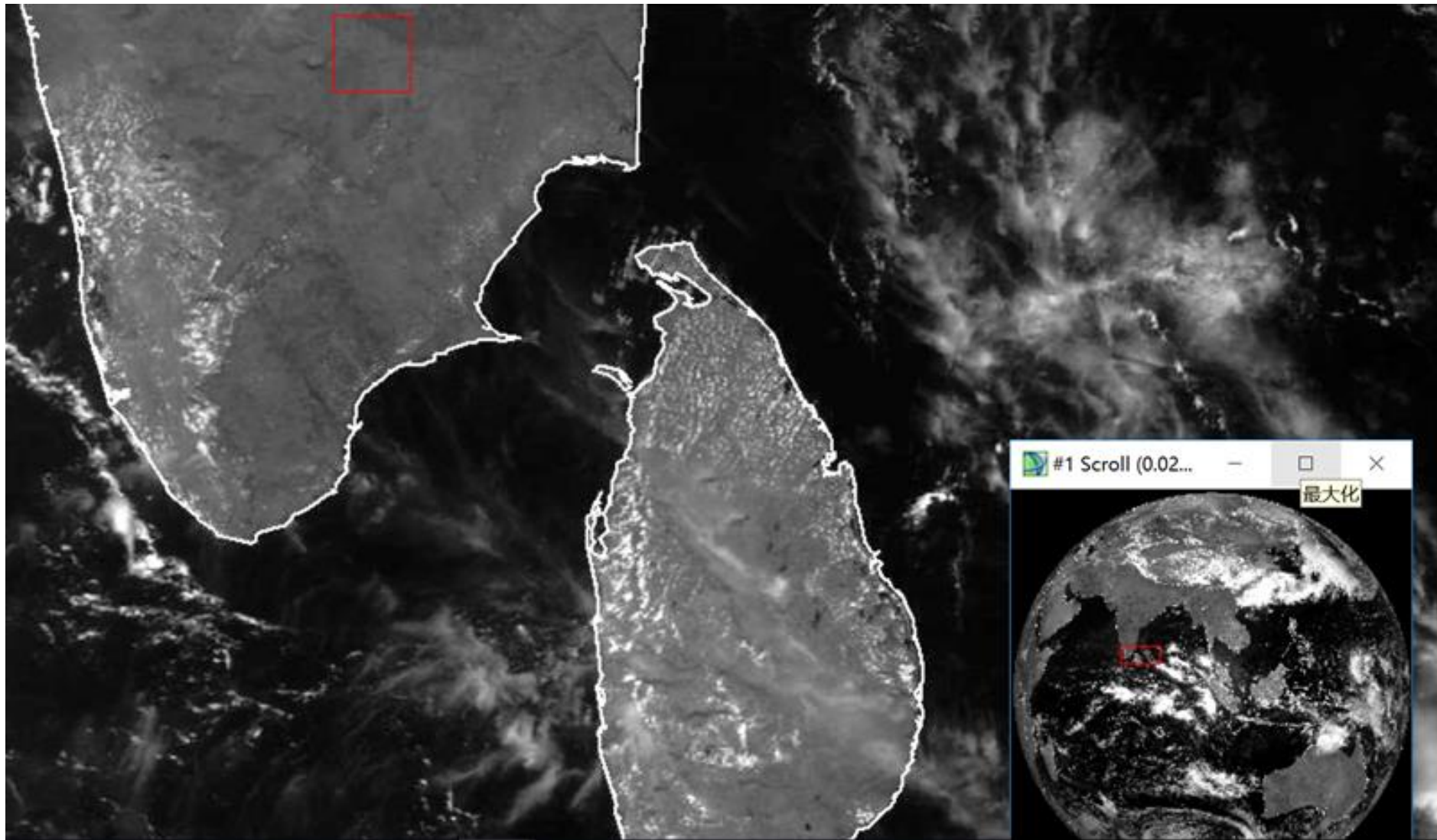
## CURRENT GEO SATELLITES

# FY-4A

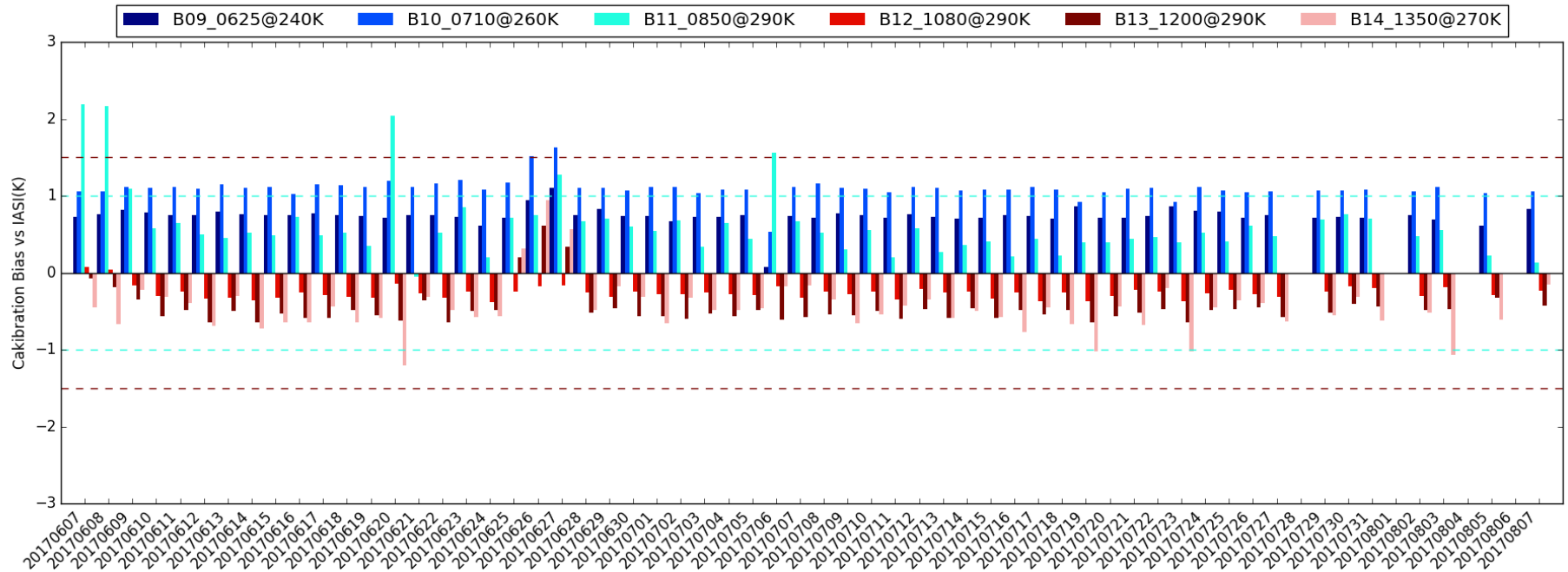
----- Post launch test has been finished and is being put into operation



## AGRI INR performance (<1 IR pixel)

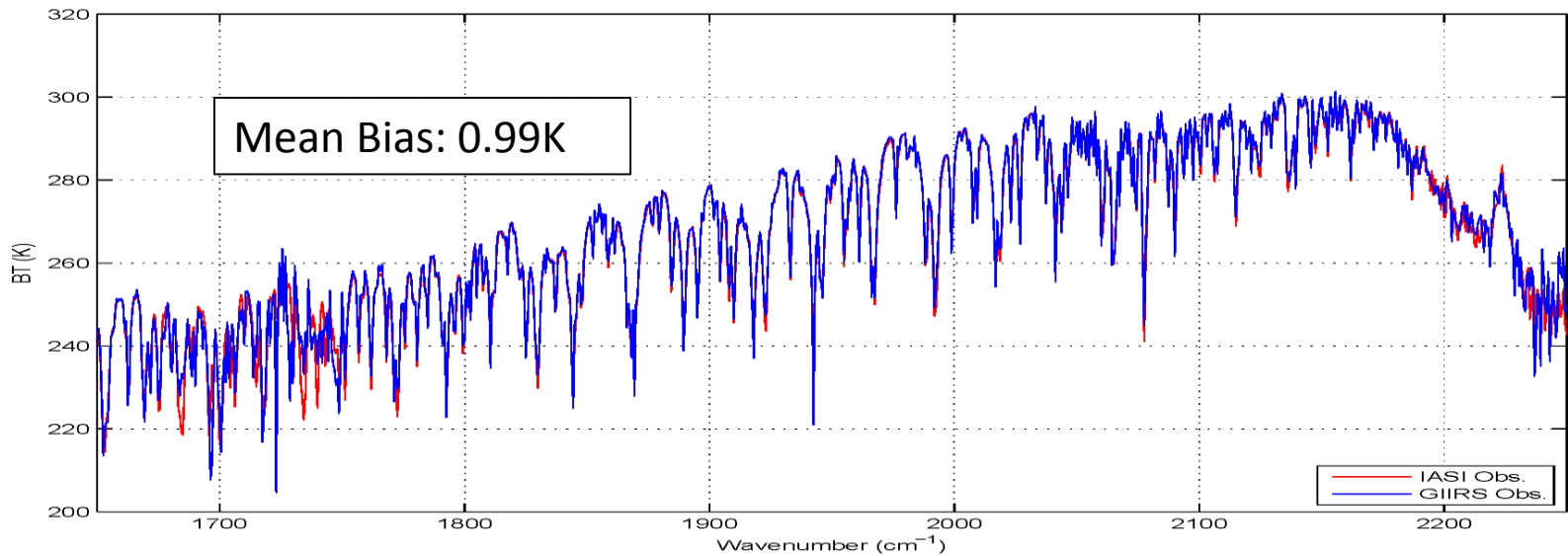
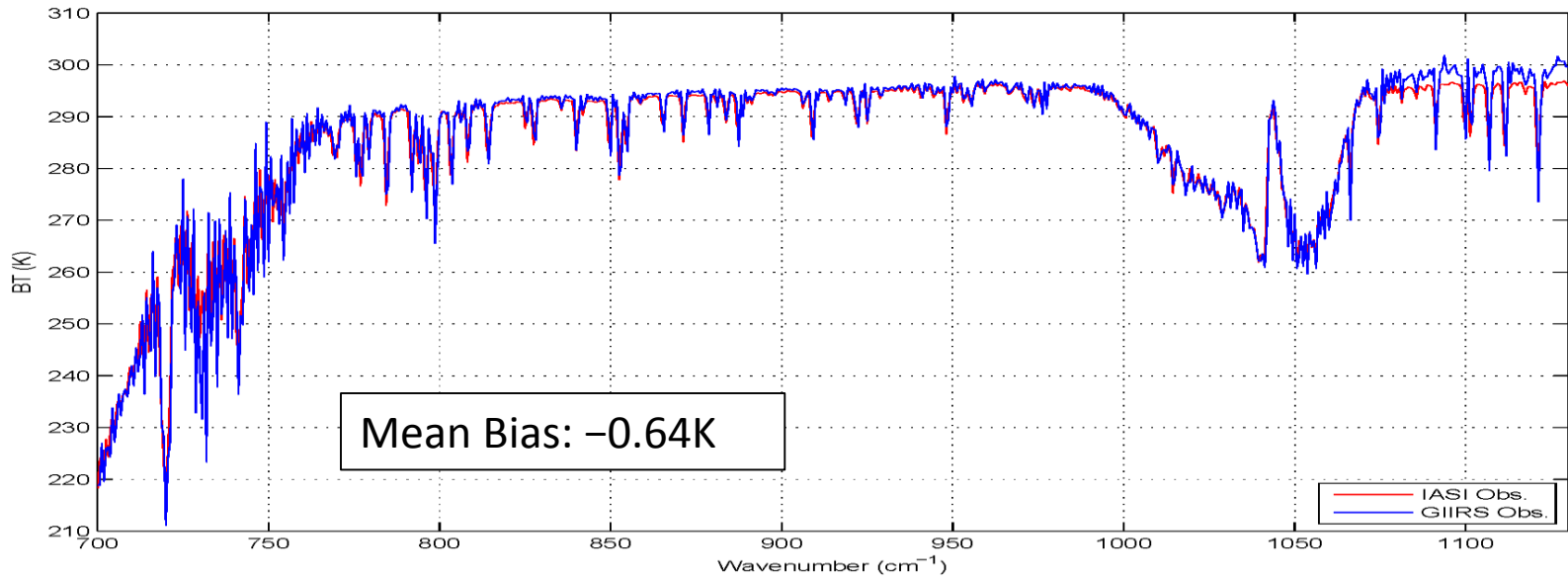


## AGRI Calibration status



- Full optical-path & aperture blackbody with a space-ground combined calibration method is adopted;
- Under the complex thermal environment of GEO orbit, the daily calibration biases for all TEBs are less than 1K;
- The daily calibration bias of 10.3μm band is perfect (<0.3K).

# GIIRS Calibration status





# FY-4A observation mode

## AGRI:

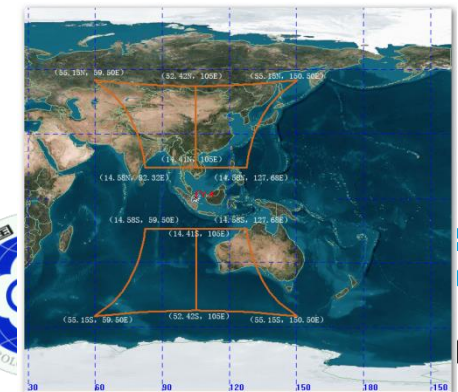
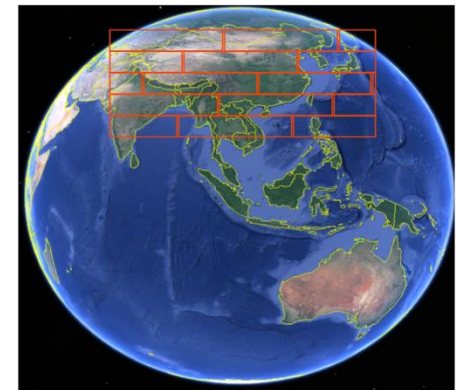
- Every hour: Full disk (00:00/01:00/02:00...23:00)
- Every 3 hour: 3 continuously Full disk(Eg.23:45-00:00-00:15)
- Rest: China area

## GIIRS:

- Every 3 hour: Full disk clear sky observation
- Every 15 minutes: China area clear sky observation

## LMI:

- 500 frames per second
- 21 Mar.-22 Sep: Northern Hemisphere
- 22.Sep-Next 21 Mar: Southern Hemisphere



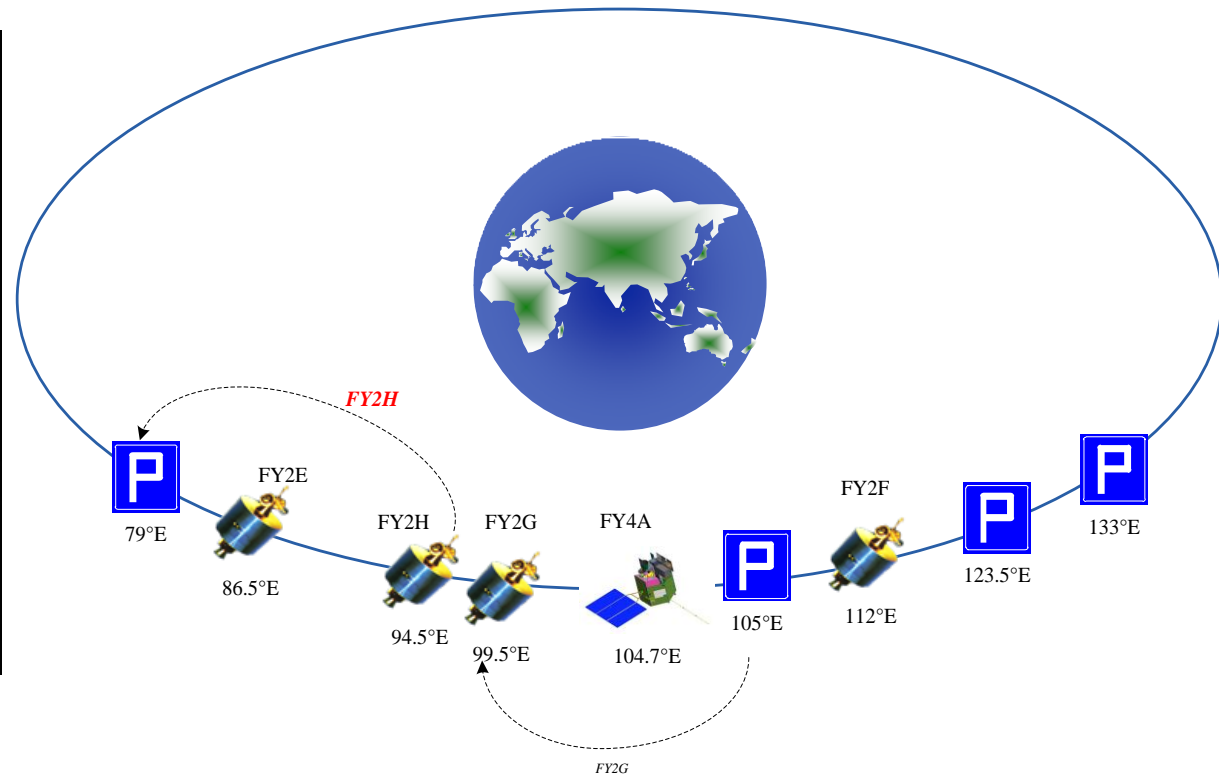
# FY-4A Baseline products

\* CSR will online in 4Q 2018

	FY-4A	FY-2
<b>Cloud</b>	Cloud Mask Cloud Top Temperature Cloud Top Height Cloud Top Pressure Cloud Type Cloud Phase Daytime cloud optical and microphysical properties Nighttime cloud optical and microphysical properties	Cloud Mask Cloud Top Temperature Cloud Classification Cloud Cover Ratio Cloud Total Amount
<b>Atmosphere</b>	Quantitative Precipitation Estimate Layer Precipitable Water Atmosphere Motion Vector Atmospheric Temperature Profile Atmospheric Humidity Profile Cloudy Vertical Temperature Profile Cloudy Vertical Moisture Profile Aerosol Detection Atmosphere Instability Index Convective Initiation Tropopause Folding Turbulence Prediction Total Ozone Amount Ozone Profile	Precipitation Index Quantitative Precipitation Estimate Clear sky Total Precipitable Water Atmosphere Motion Vector Cloudy Vertical Moisture Profile Upper Tropopause Humidity
<b>Radiance</b>	Outgoing Long wave Radiation Surface Solar Irradiance Downward Longwave Radiation Upward Longwave Radiation Reflected Shortwave Radiation	Outgoing Long wave Radiation Surface Solar Irradiance
<b>Surface</b>	Sea Surface Temperature (Skin) Land Surface Temperature Snow Cover Land Surface Albedo Land Surface Emissivity Evapotranspiration products	Sea Surface Temperature (Skin) Land Surface Temperature Snow Cover
<b>Environment</b>	Dust Smoke Detection Fire/Hot Spot Characterization Fog Detection	Dust Index Fire/Hot Spot Characterization Heavy Fog Detection
<b>Lightning</b>	One Minute Lightning Quantitative Product (including flash group event) Lightning Jump Identification Product Flash Daily Density	
<b>Space</b>	High-energy particle distribution Magnetic Field Intensity Space Environment Effect	

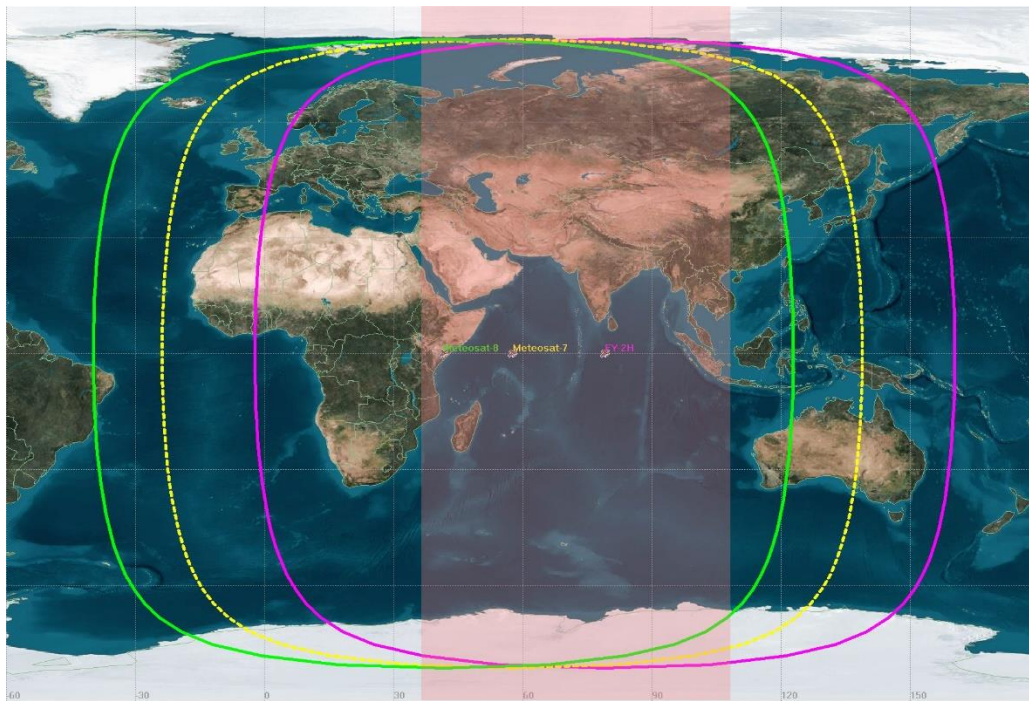
# FY-2H

## --New baby of FY-2 series



- On June 5, FY-2H has been launched and then located at 94.5°E;
- From July to September, FY-2H is on-orbit testing & commissioning;
- During October, FY-2H is re-orbited from 94.5°E to 79°E;
- From November, FY-2H provides operational service over the Indian Ocean.

## Superiority support to IODC



- ❑ FY-2H at 79°E owns the **reasonable coverage** over the Indian Ocean (defined by CGMS as 36°E – 108°E) .
- ❑ FY-2H will perform the **flexible regional observations** about **6-min** interval over the Indian Ocean when required, which is secured by the **"Emergency Support Mechanism for International Users of Fengyun Meteorological Satellites in Disaster Prevention and Mitigation"** announced in 24 April, 2018

Coordination Group for Meteorological Satellites



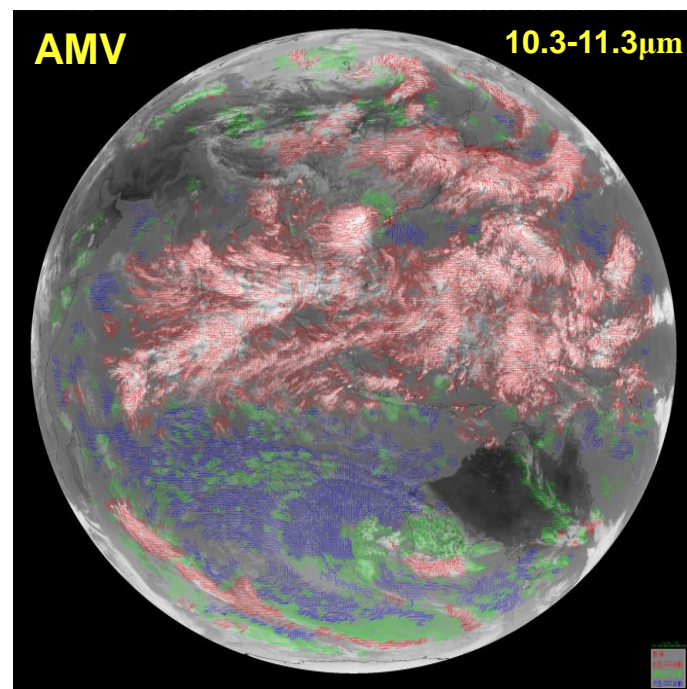
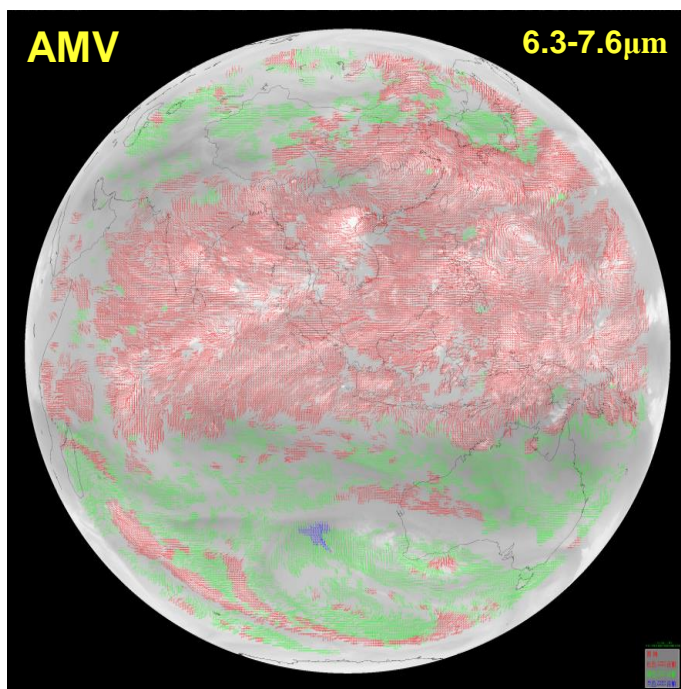
CGMS



# Capability support to IODC: Products

## Essential 10 Products (via CMACast)

- |                                     |  |
|-------------------------------------|--|
| ▪ Surface incidence solar radiation | ▪ <b>Atmospheric Motion Vectors</b>            |
| ▪ Outgoing long wave radiation      | ▪ Black body brightness temperature            |
| ▪ Cloud Type                        | ▪ Cloud Total Amount                           |
| ▪ Snow Cover                        | ▪ Total precipitation Water for clear sky      |
| ▪ Precipitation Estimate            | ▪ Humidity Profile derived from cloud Analysis |



CMA FY-2E Atmospheric Motion Vectors have been assimilated experimentally



## FY-3D

-- Launched on 15, Nov. 2017 and in orbital checking out now

### 10 instruments on board FY-3D:

#### □ 5 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

#### □ 2 Improved instruments:

**MERSI-II:** Improved from MERSI

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

IRAS

#### □ 3 New Instruments:

**GAS:** Greenhouse gases Absorption Spectrometer

**WAI:** Wide-angle Aurora Imager

**IPM:** Ionospheric Photometer

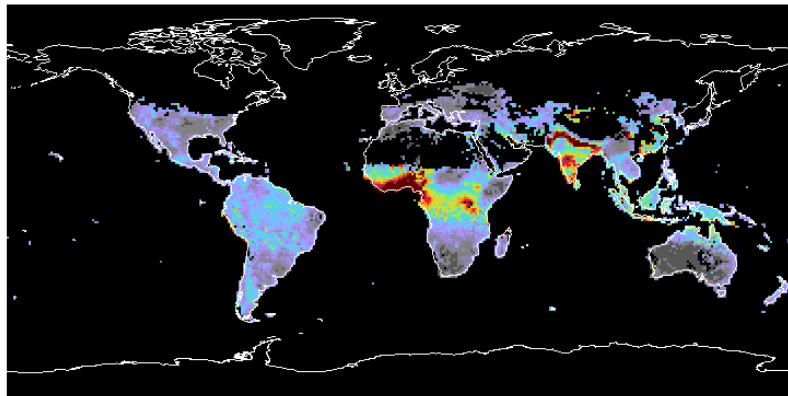


# Update of FY-3D status

- ✓ Orbital test began on the 12nd of December 2017;
- ✓ Tests for satellite platform have been finished, the results show the functions and performances meet the requirements;
- ✓ All 10 instruments except for HIRAS and GAS have finished the first-round tests following the outline and rules of the test, now proceed with the second-round tests for the key indexes.
- ✓ 7 instrument payloads, i.e. MERSI, GNOS, MWTS, MWHS, MWRI, SEM, and IPM have begun with L1 data application test.

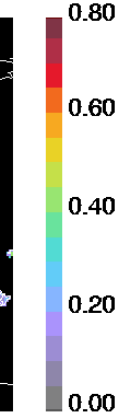
# Global 8-day-mean product : MERSI II and MODIS land aerosols in comparison

Aerosol\_Optical\_Depth\_Land\_Mean\_Mean



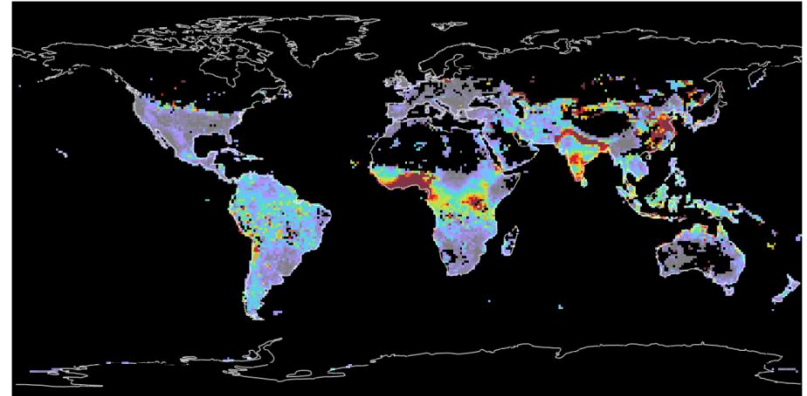
MODIS/Aqua MYD08\_E3.A2018001.006.2018011145021.hdf

01Jan2018



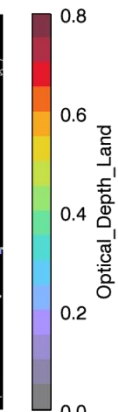
none

Aerosol\_Optical\_Depth\_Land\_Mean\_Mean



MERSI2/FY3D FY3D\_MERAOD\_E1d.201801.Beta.hdf

Jan2018

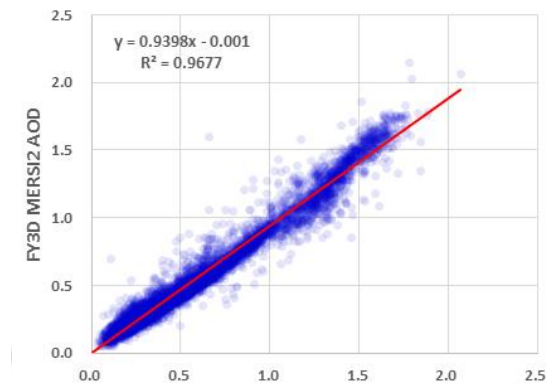


MODIS/Aqua

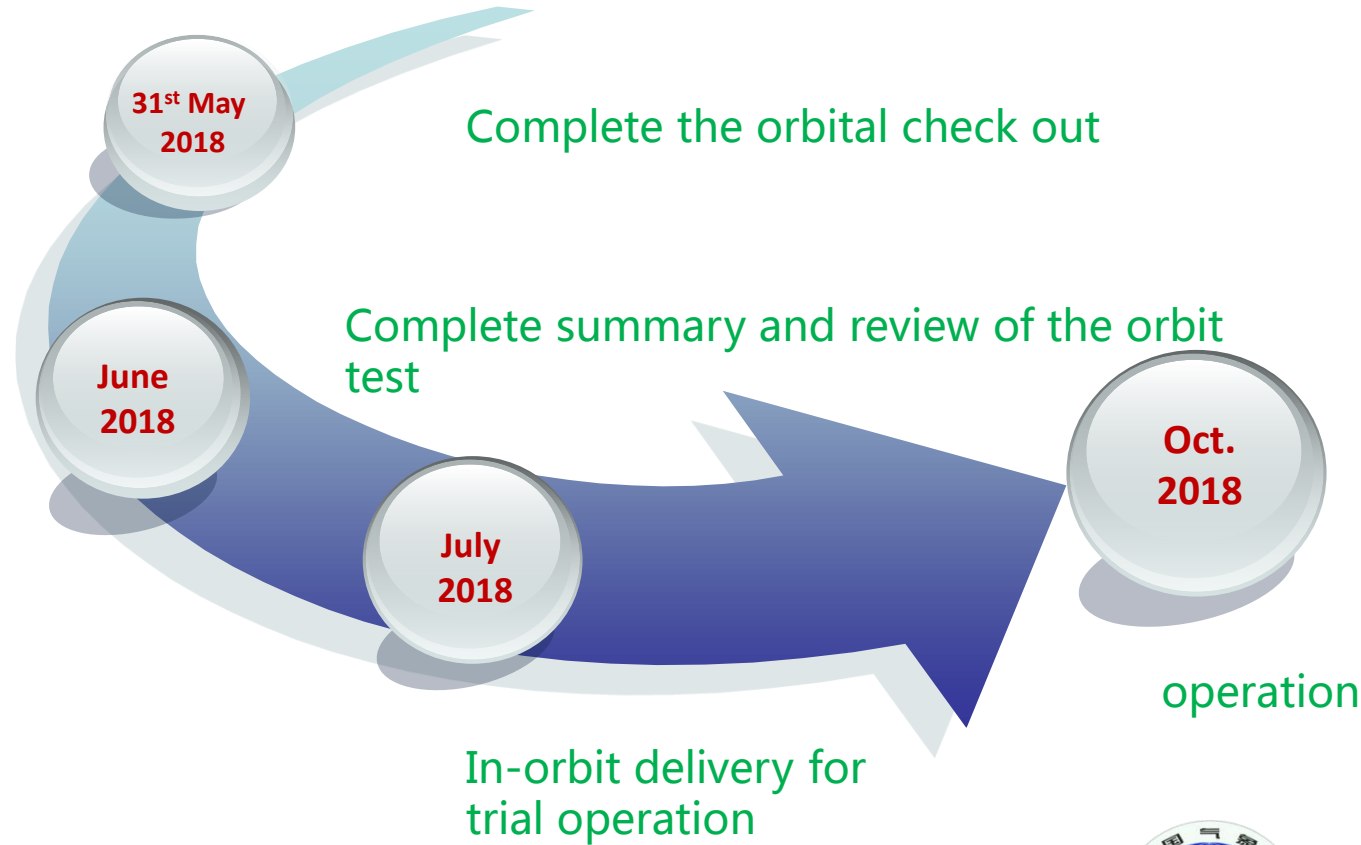
MERSI2/FY3D

Good consistency in global distribution and AOD of pollution sources; MERSI algorithm is better for heavy pollution areas.

AOD over Land



# Follow-up work for FY-3D

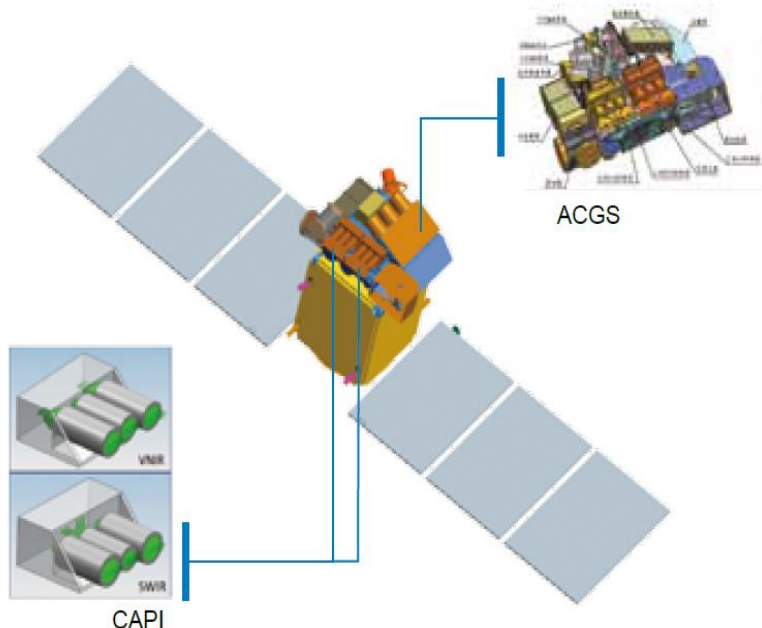


# TANSAT

-- Data has been opened to world users

**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 CO2 dry air mole fraction (XCO2).



## Instruments:

1. ACIS(Atmospheric CO2 Grating Spectrometer) is mainly used to measure atmospheric CO2. 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

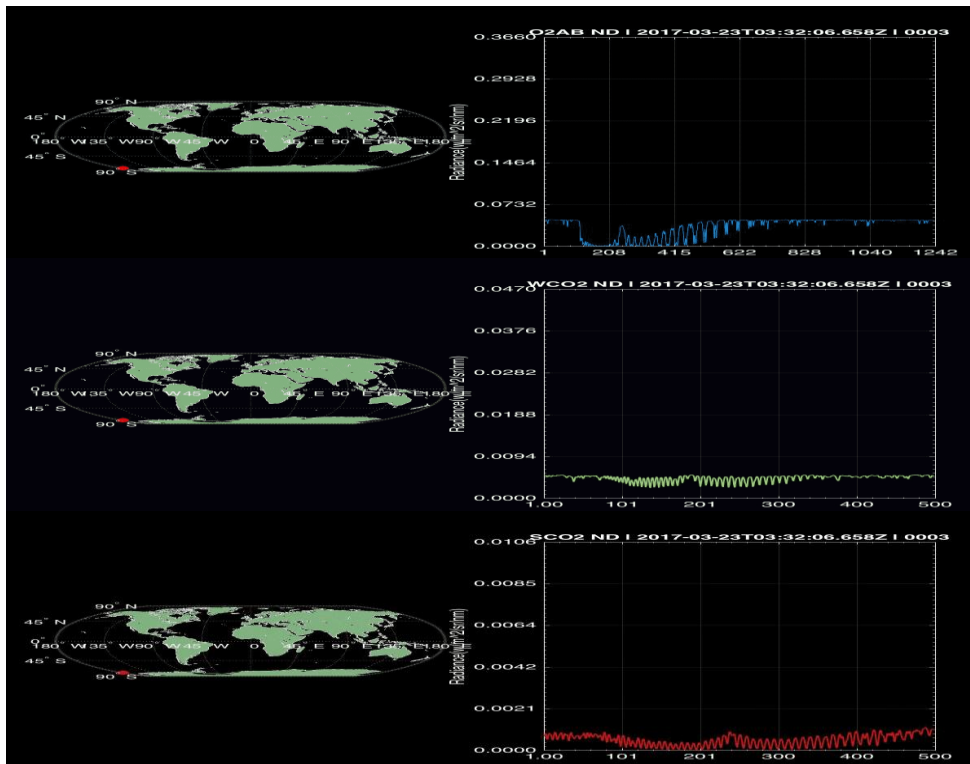
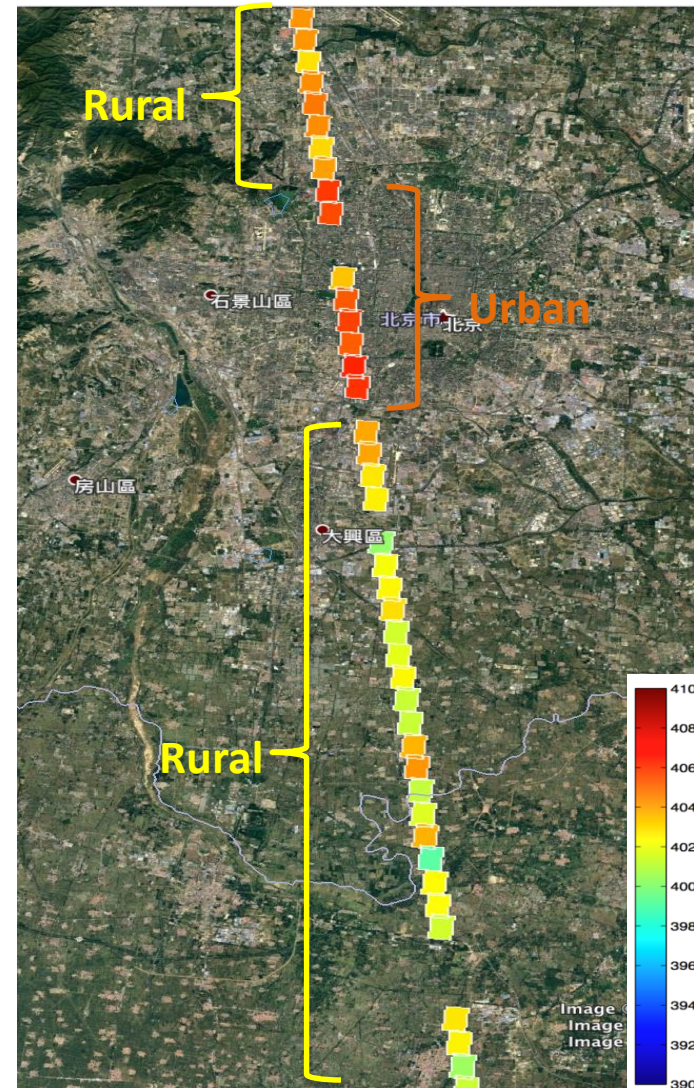


**CGMS**



## Current Status of TANSAT

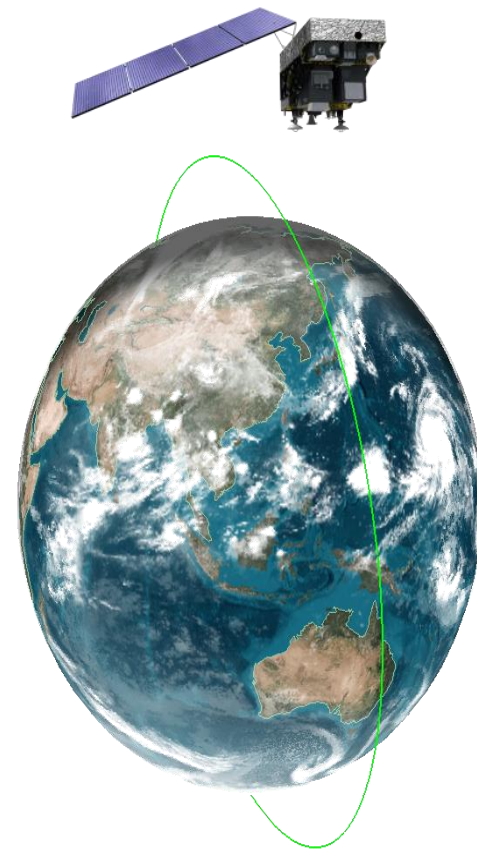
- TANSAT was successfully launched on Dec. 22, 2016.
- Commissioning test has been finished by June 30, 2017, and the Satellite was handed over to NSMC/CMA for operation in Oct. 2017
- Data are available for world-wide users .



## GF-5

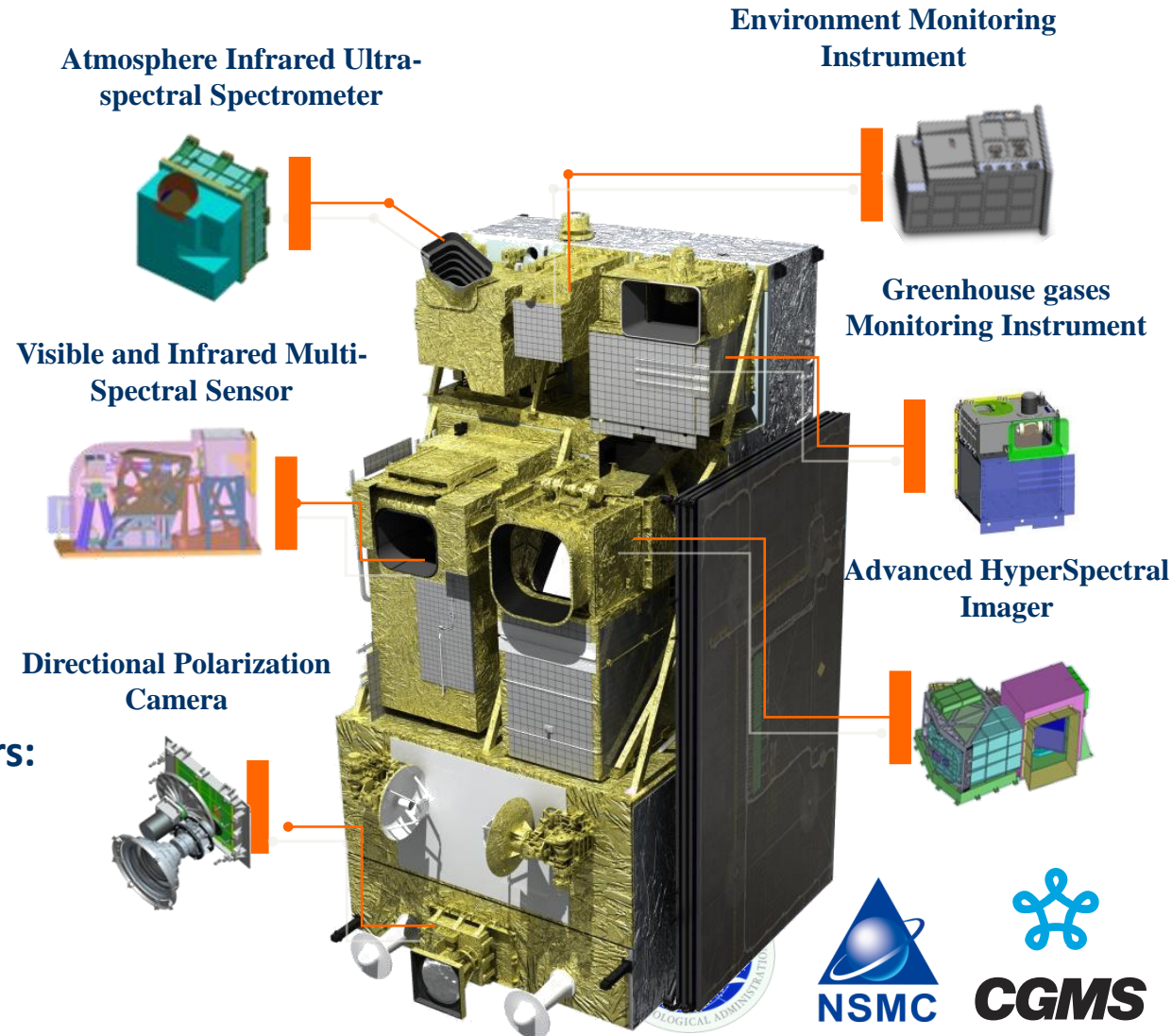
-- Launched on 9, May. 2018

- Ecological environment monitoring over inland water and land surface;
- Monitoring the atmospheric concentration of  $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{O}_3$ ,  $\text{NO}_2$ ,  $\text{SO}_2$  and aerosol;
- Obtain information for mineral resource prospecting;
- Monitoring service for agriculture, disaster mitigation and urban construction etc.



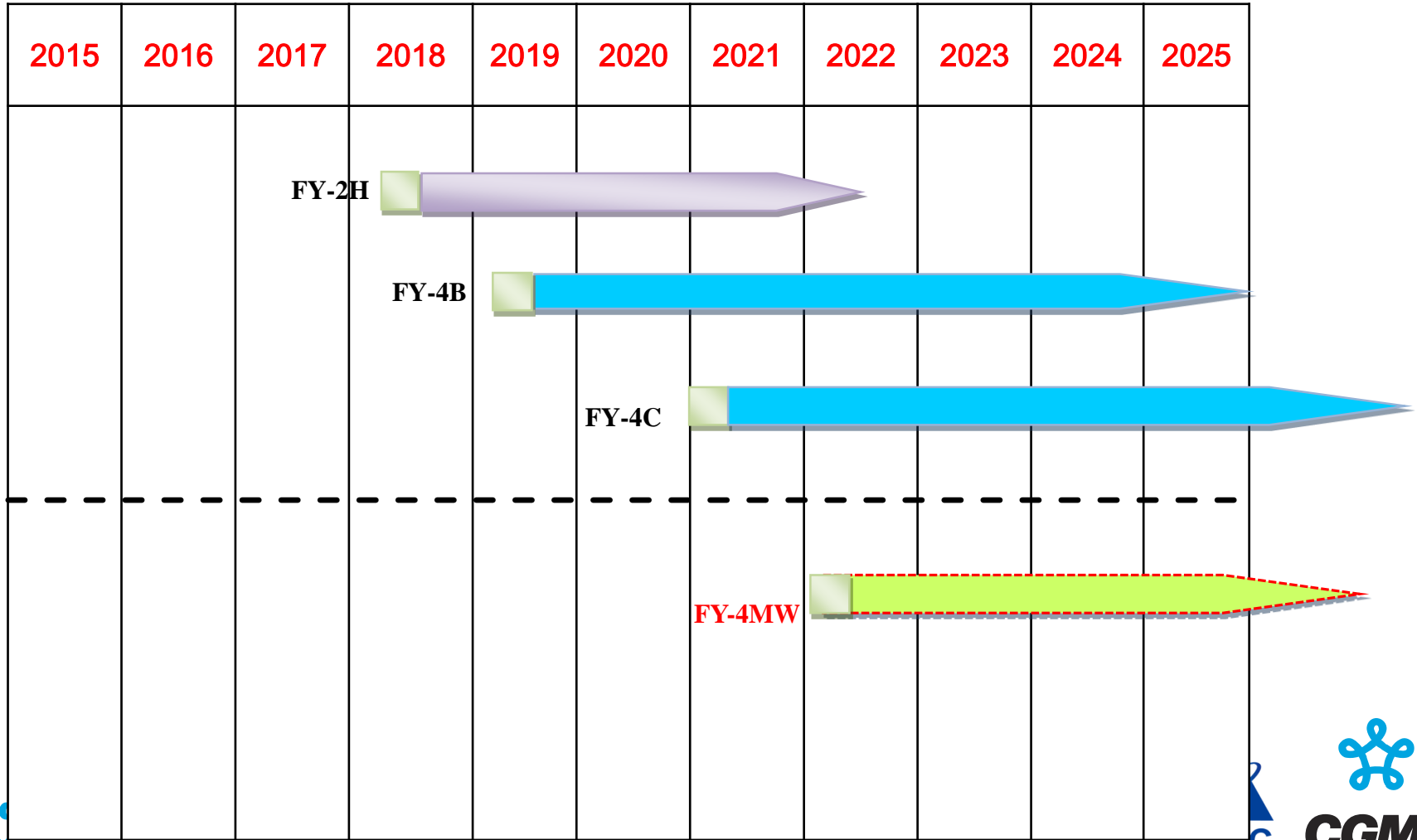
## Overview of GF-5 Mission

- **SAST-ML1** Satellite Platform;
- Sun-synchronous Orbit Altitude **705km**;
- Local Time of Ascending Node **13:30**;
- **SIX PAYLOADS**
  - Two Land Imagers:  
**AHSI and VIMS**
  - Four Atmospheric Sounders:  
**EMI, GMI, AIUS and DPC**



FUTURE GEO SATELLITES

# FengYun GEO Satellites Launch Plan by 2025

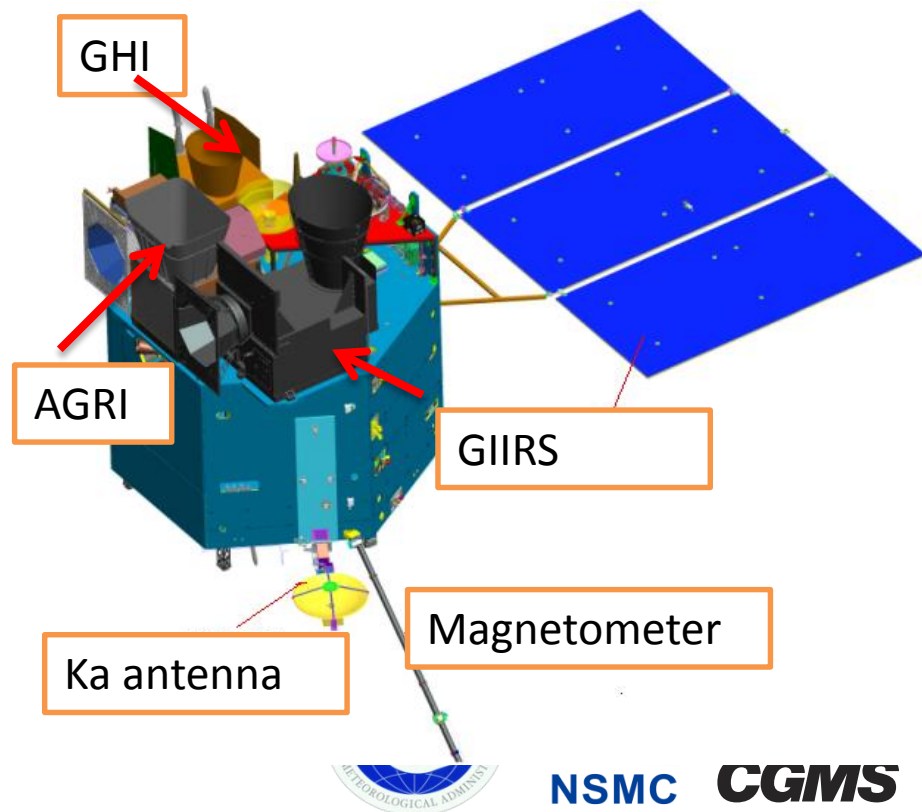




# FY-4B

FY-4B will inherit FY-4A technology. Geo High-speed Imager(GHI) will be the new payload, with regional high-speed high-resolution continuous observation capability.

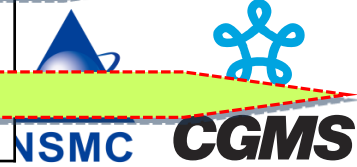
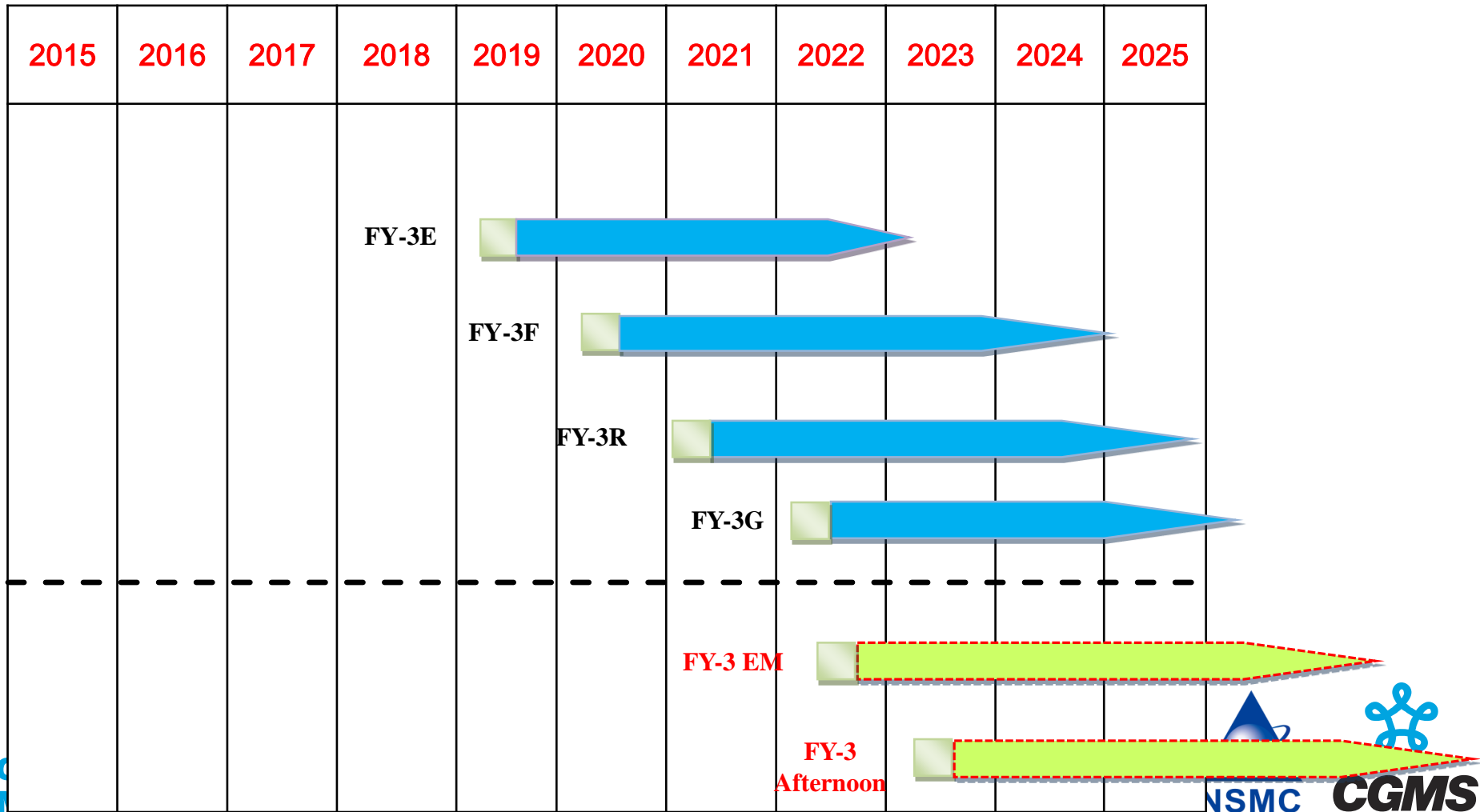
Payload	Upgrade
AGRI+	Add <b>7.24-7.60<math>\mu</math>m</b>
	2.1 $\mu$ m and 3.5 $\mu$ m spatial resolution upgrade to <b>2km</b>
GIIRS+	Wavelength range is extended to <b>680~1130cm<sup>-1</sup></b>
	Spatial resolution of visible channel upgrade to <b>1km</b>





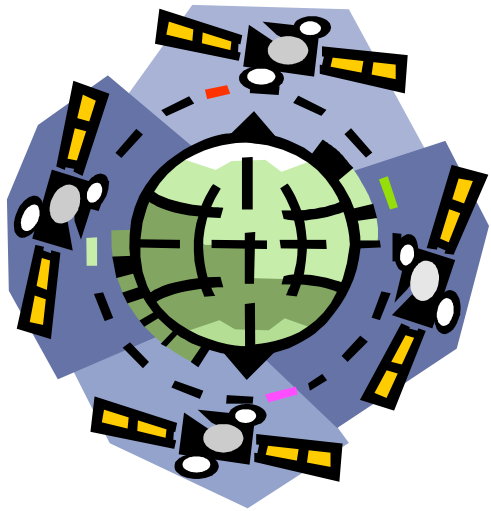
FUTURE LEO SATELLITES

# FengYun LEO Satellites Launch Plan by 2025



# Payloads Configuration for FY-3E/F/G and Rainfall Mission

NO.	Sensor Suite	Satellite		FY-3E (05)	FY-3F (06)	FY-3G (07)	FY-3R (08)
		Sensor	Scheduled Launch Date	EM Satellite	AM Satellite	PM Satellite	Rainfall Satellite
1	Optical Imagers	MERSI	2019	√ (LL)	√ (III)	√ (III)	√ (III-Simplified)
2	Passive Microwave Sensors	MWTS		√	√	√	
		MWHS		√	√	√	
		MWRI			√	√	√
3	Occultation Sounder	GNOS		√	√	√	√
4	Active Microwave Sensors	WindRAD		√	√		
		Rainfall RAD					√
5	Hyperspectral Sounding Sensors	HIRAS		√	√	√	
		GAS (Greenhouse Gases Absorption Spectrometer)				√	
		OMS (Ozone Mapping Spectrometer)			√		
6	Radiance Observation Sensor Suite	ERM			√		
		SIM		√	√		
		SSIM (Solar Spectral Irradiation Monitor)		√			
7	Space Weather Sensor Suite	SEM		√			
		Wide Angle Aurora Imager				√	
		Ionosphere photometer		√(Multi-angle)		√	
		Solar X-EUV Imager		√			



Thank you!

