2022

China's satellite activities on global Greenhouse observation

Presented to CGMS-53 Plenary session

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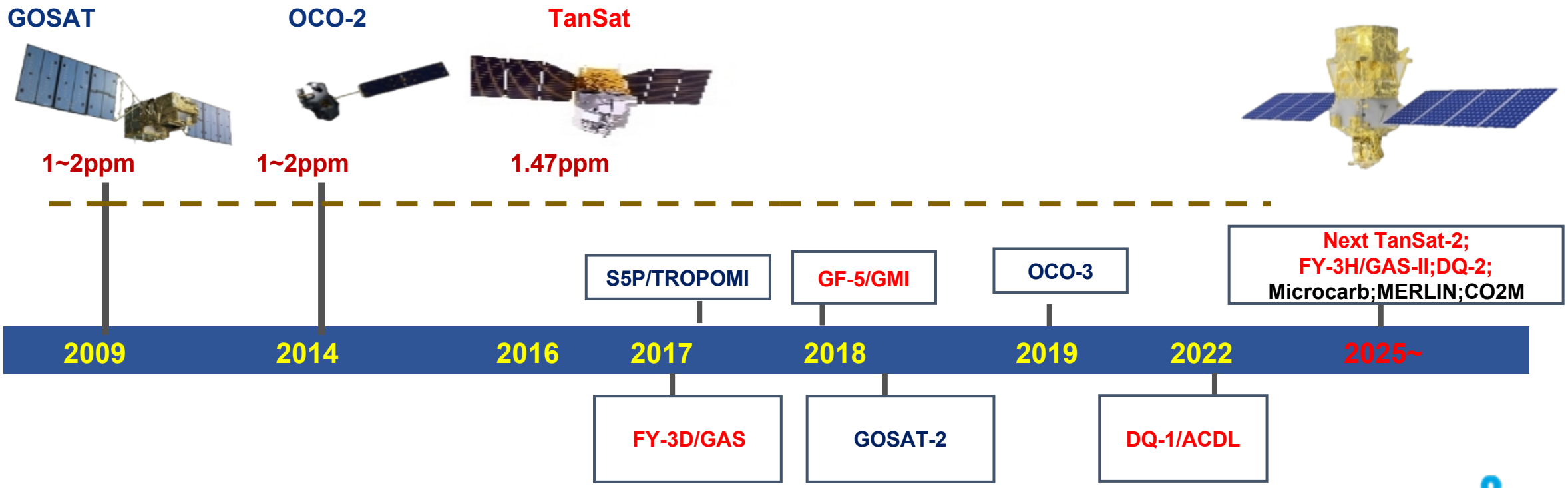
NSMC/CMA

Coordination Group for Meteorological Satellites

Overview



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The methane point source detection satellite was not on display

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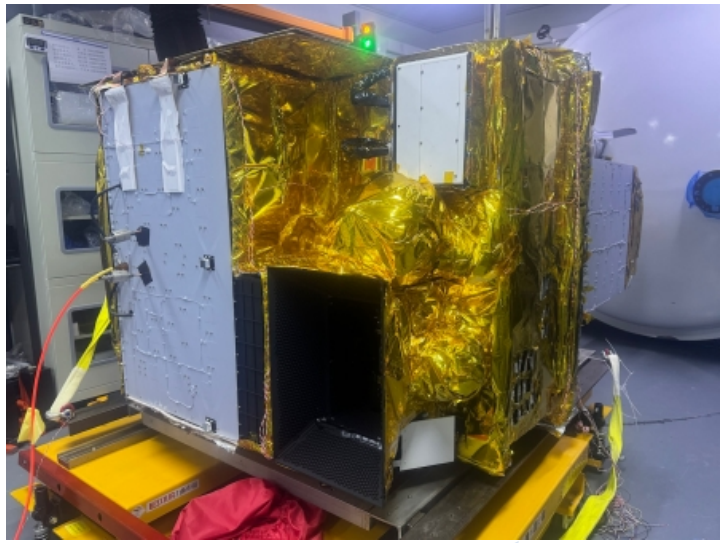
Brand-new Instruments onboard FY-3H satellite - GAS

- **The Greenhouse gases Absorption Spectrometer (GAS) is a push-broom imaging grating spectrometer designed to measure global CO2 and CH4 consentrations (XCO2 and XCH4) with sufficient accuracy.**
- **The GAS flight model is currently undergoing pre-flight test.**

Band	O2A	Weak CO2	Strong CO2	CH4, CO
Center (um)	0.76	1.61	2.06	2.3
Band (nm)	757.5~772.5	1595~1625	2040~2080	2275~2325
FWHM (nm)	⩽0.04	⩽0.07	⩽0.09	⩽0.1
SNR	350	340	230	200
dynamic range(Wm-2sr-1um-1)	0.03~370.00	0.007~60.67	0.003~16.39	0.002~11.20
radiometric accuarcy	5%			
Relative radiometric accuarcy in band	1%			
Relative radiometric accuarcy in channel	0.1%			
soectral accuracy	<dlambda/10			
ILS accuarcy	1%			
sample	⩾3			
spatial resolution	3km			
stability	0.5%			
swath	100km			



High SNR
Wide Swath
CO2, CH4, CO

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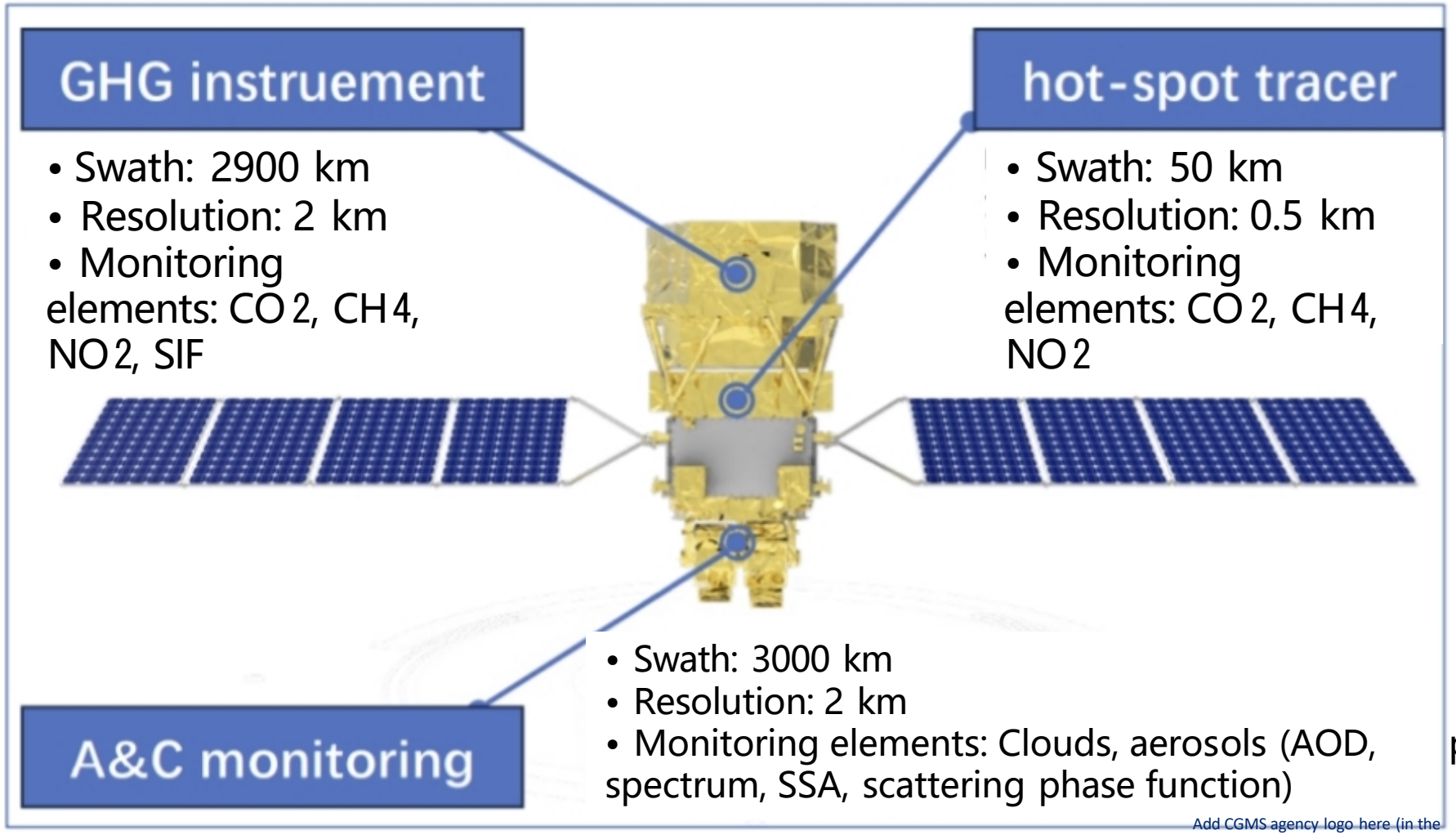
FY3D GAS and FY3H GAS-II

	O2-A	Weak CO2	Strong CO2	CO/CH4/N2O
FY3D GAS	Point measurements			
Aim	O2, aerosol	CO2,CH4	CO2,H2O	CO,CH4,N2O
Center wavelength	0.76μm	1.6μm	2.00μm	2.3μm
Wave range	0.75-0.77μm	1.56-1.72μm	1.92-2.08μm	2.20-2.38μm
Spectral sampling per FWHM	20nm	160nm	160nm	180nm
Spatial resolution	0.6cm-1	0.27cm-1	0.27cm-1	0.27cm-1
Coverage	--			
Spatial resolution	10km			
FY3H GAS-II	**Spatial coverage >100km with better resolution**			
Center wavelength	0.76μm	1.61μm	2.06μm	2.3μm
Spectral width	>15nm	>30nm	>40nm	>50nm
Spectral resolution	0.04nm	0.07nm	0.09nm	0.1nm
Spectral sampling per FWHM	≥3			
Coverage	**>100km**			
Spatial resolution	<3km			

High SNR
Wide Swath
CO2, CH4, CO

The payloads onboard TanSat-2



TanSat-2 (passive) will launch in May 2026, undergoing instrument test

TANSat and TANSat-2

	O2A	WCO2	SCO2	CH4
TanSat				
Spectral range(nm)	758-778	1594-1634	2042-2082	
Spectral resolution(nm)	0.033-0.047	0.120-0.142	0.160-0.182	
Spectral resolving(λ/Δλ)	~19000	~12800	~12250	
SNR @ (ph/sec/m2/sr/μm)	360@5.8 X 1019	250@2.1 X 1019	180@1.1 X 1019	
Swath	**20km**			
TanSat-2	**Wide swath with better resolution, additional CH4 observation**			
Spectral range(nm)	757-771nm	1590-1620nm	2042-2082nm	1635-1670nm,
Spectral resolution(nm)	≤0.04nm	≤0.13nm	≤0.13nm	≤0.13nm
SNR @ (ph/sec/m2/sr/μm)	500:1 @ 6.4 * 1019 photo/sec/m2/sr/μm;	400:1@2.1×1019 photo/sec/m2/Sr/m ;	400:1@1.8×1019 photo/sec/m2/Sr/m;	400:1@2.1×1019 photo/sec/m2/Sr/m ;
Swath	**2900km**			

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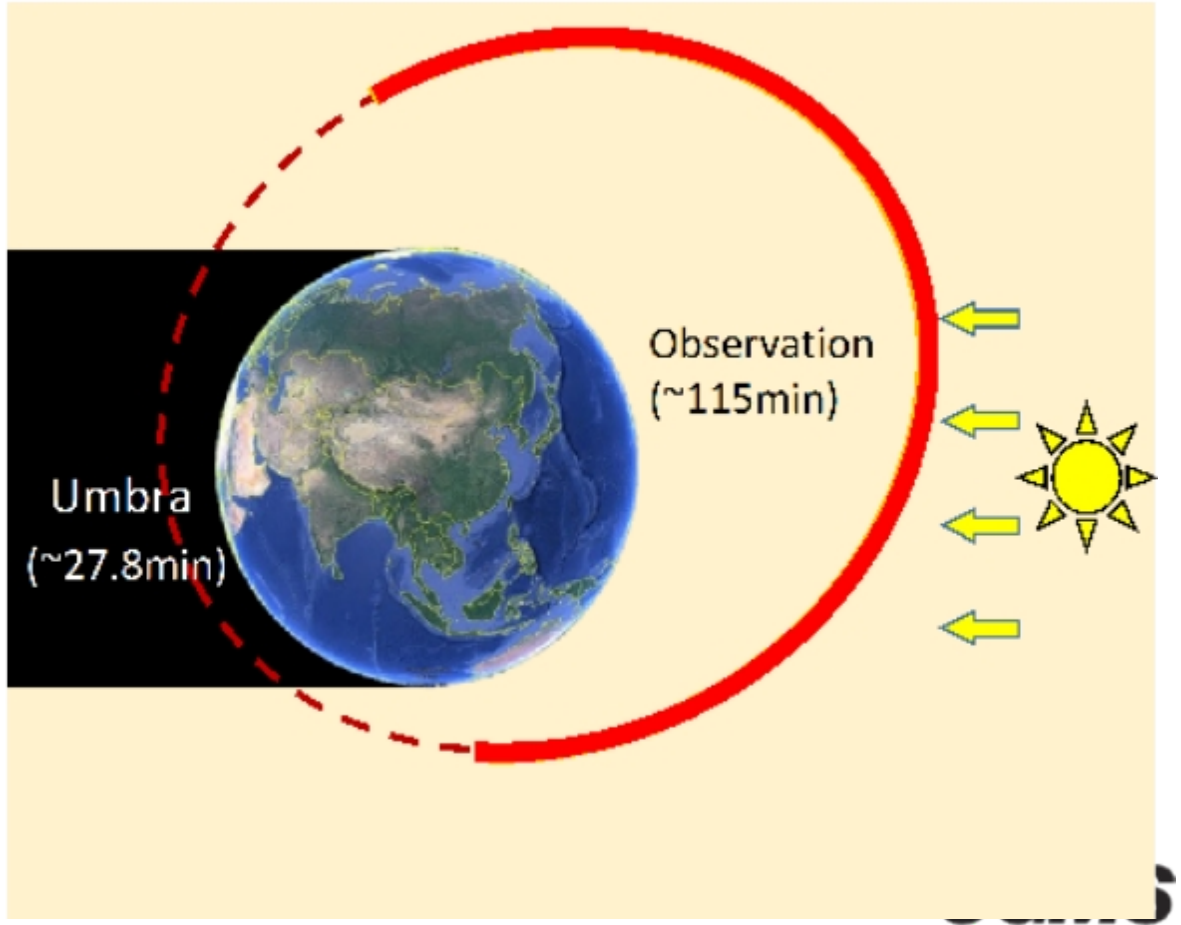
Orbit type: Critically Inclined, Sun Synchronous

Parameters	Value
Perigee altitude	~522km
Apogee altitude	~7840km
Inclination	116.565°
Latitude at Apogee	35°N
Argument of Perigee	210°
Revisit Period	1 day



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Difference between TanSat-1 and TanSat-2

		TanSat-1	TanSat-2
Mission		CO2	Global stocktake
Approach		Inversion of Co2	Assimilation inversion of Flux, fossil CO2 emissions, Eco-Sinks
Satellite	Spatial scale	Global	Global,Cities,Hotspot
	Temporal resolution	120Days	1-3day
	Geophysical products	CO_2,SIF	CO_2,CH_4,NO_2,SIF
	Accuracy	1.47ppm	1.0ppm

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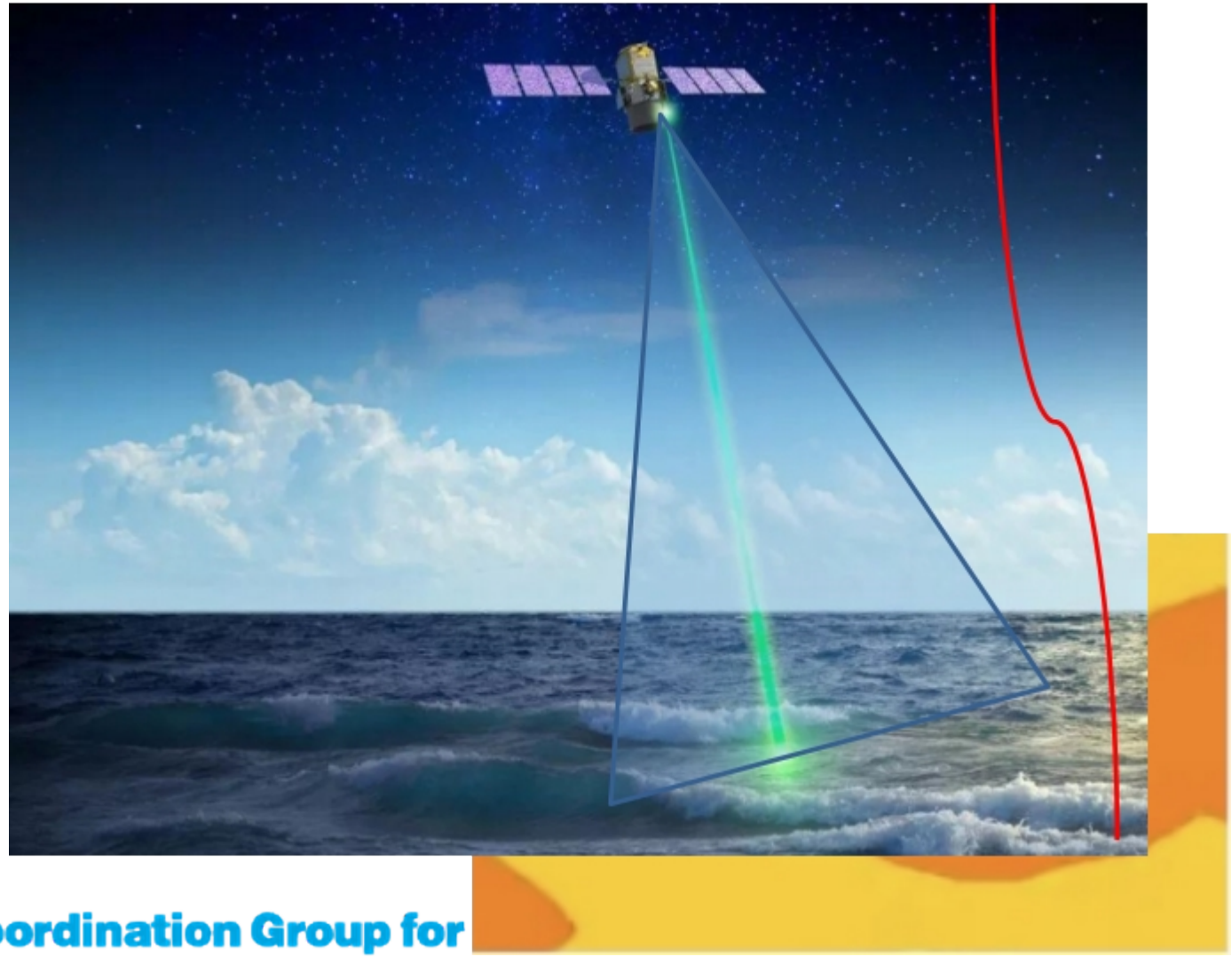
DQ-2: Active and passive collaborative XCO2 measurements



The instrument onboard DQ-2

- ACDL LIDAR for XCO2
- SWIR for XCO2
- IR for profile of CO2

DQ-2 (active-passive combined) will launch in 2026

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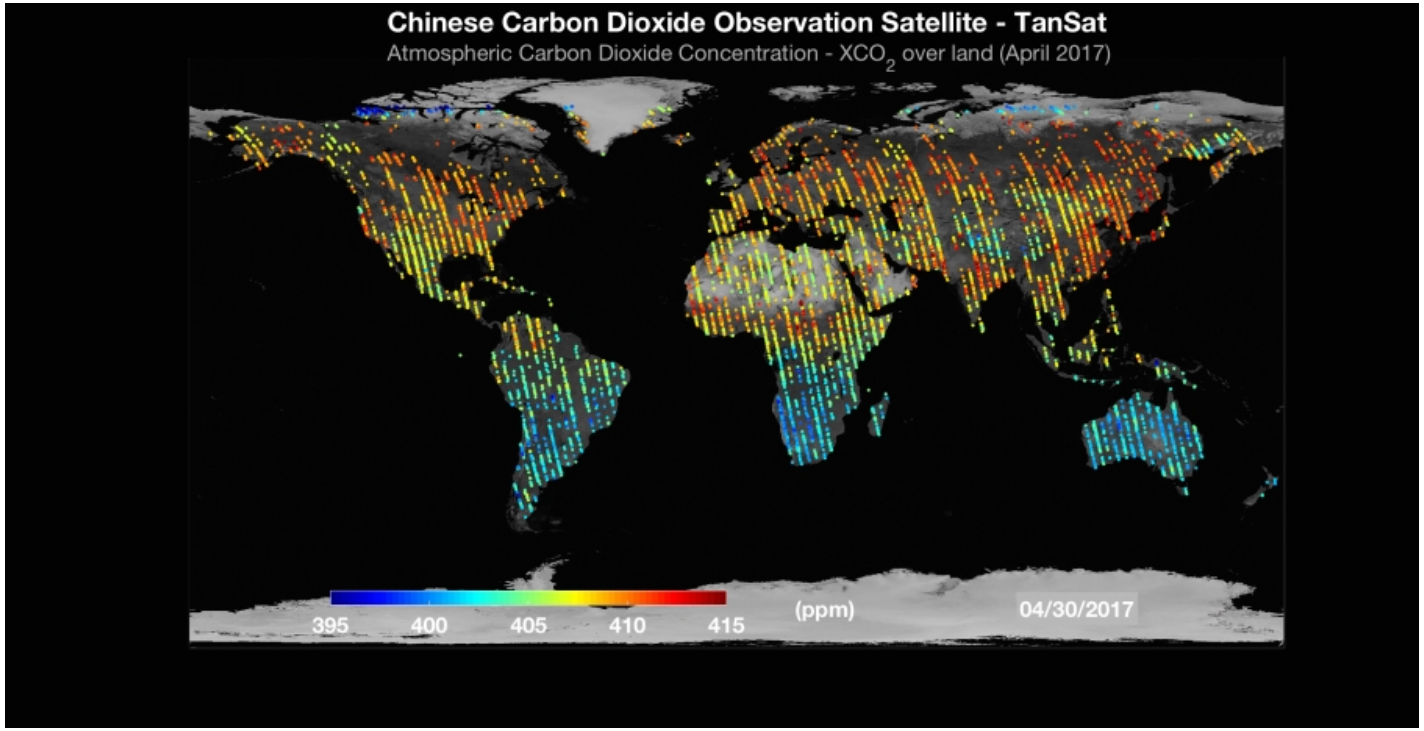
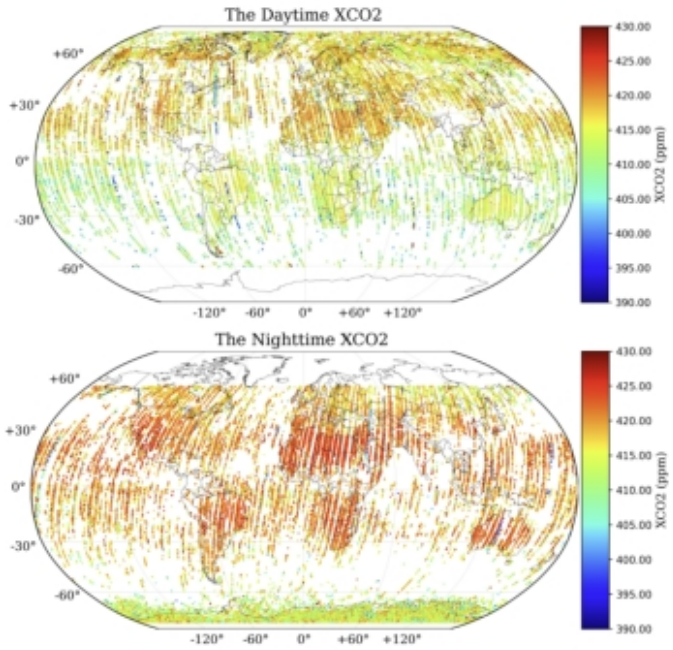
- Construct a multi-source satellite remote sensing greenhouse gas dataset (TanSat, GaoFen5, DQ-1)



China's First Carbon Satellite Reveals Global CO_2 Distribution



DQ-1 XCO2 Global Dataset

Carbon Peaking and Carbon Neutrality & Renewable Energy: Construction of Greenhouse Gas Dataset

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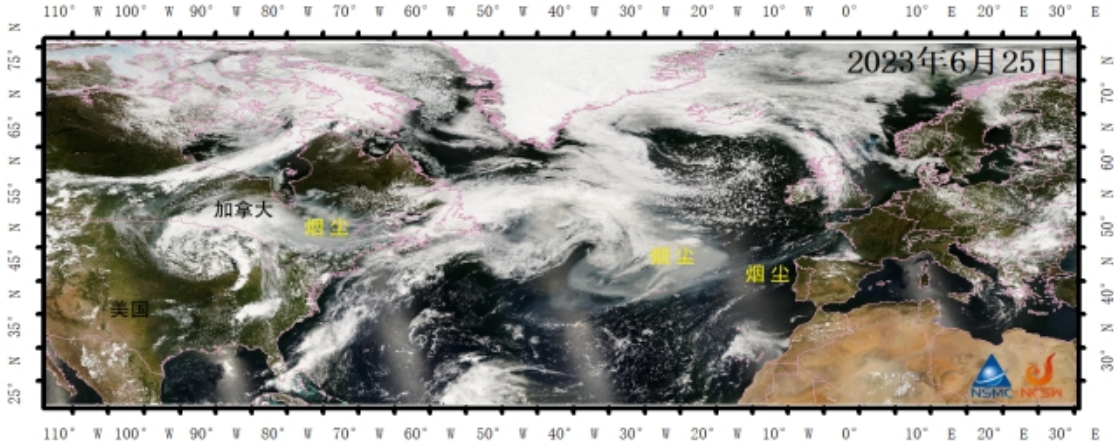
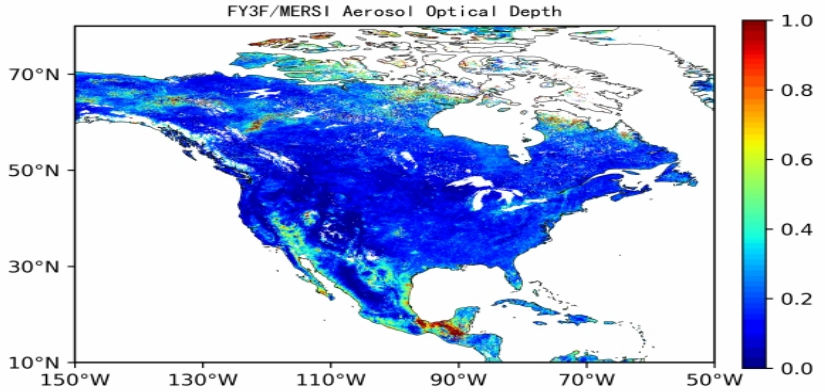
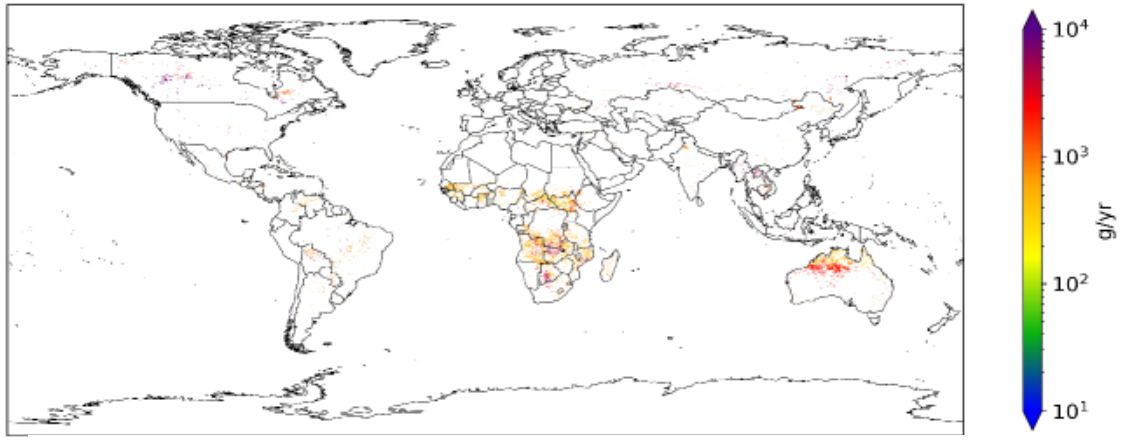
Global Wildfire Monitoring and Carbon Emission Estimation



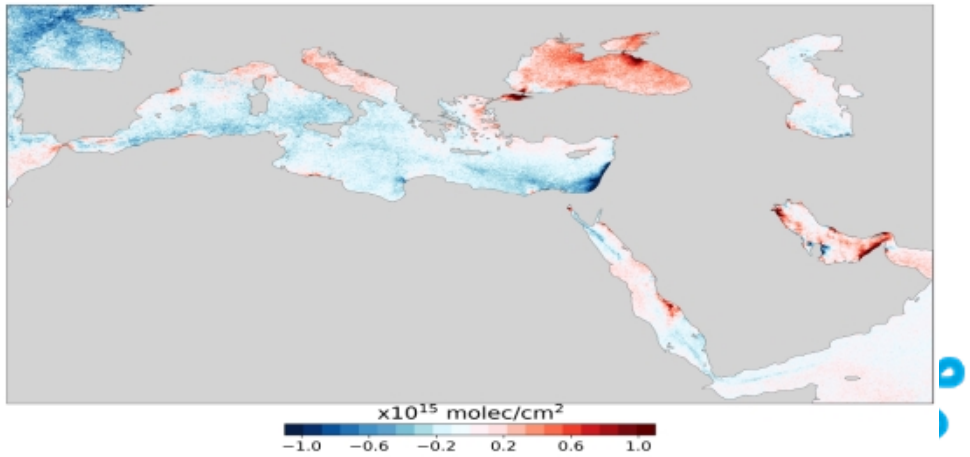
FY-3 detects the transmission of wildfire smoke from Canada to Europe by 2023



Aerosol products for monitoring wildfire smoke by FY-3



2024 Global Wildfire CO_2 Emissions Hit nearly 10 years Decadal High at 8.4 Pg



Using NO_2 as a CO_2 Proxy for Carbon Emission Estimation

Thanks for your attention

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