



Development of Satellite Ocean Products by CMA



Feng LU

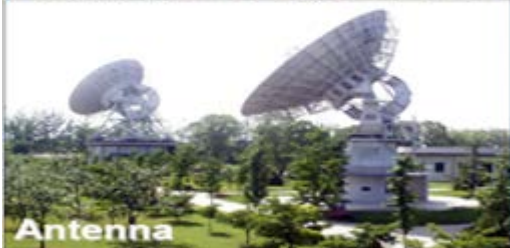
Office of System Development
National Satellite Meteorological Center
China Meteorological Administration
(NSMC/CMA)





- **Brief view of CMA Satellite**
- **Satellite Oceanography products used CMA**
- **Forword look**

NSMC responsibilities

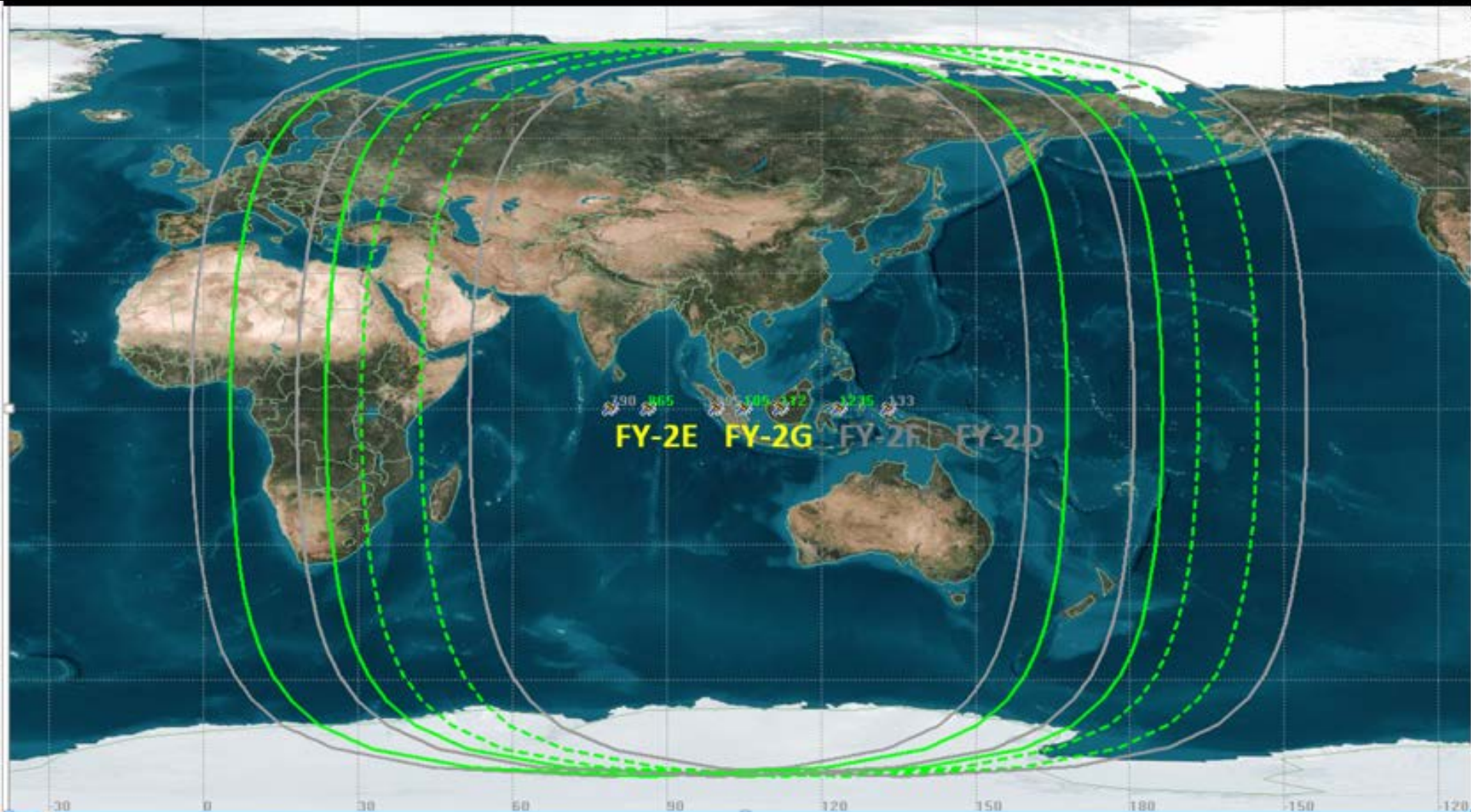


NSMC was created in 1971 as an auxiliary organ of the China Meteorological Administration for the objective of establishing the Chinese meteorological satellite systems, operating the satellite, and delivering satellite data and derived products to end users.

1. Study and draft strategy and development program for China's meteorological satellites.
2. Development and construction ground segment for Chinese meteorological satellites.
3. Acquisition, process, dissemination meteorological satellite data.
4. Provision of nationwide services of satellite data, information and product.

CMA Geo.

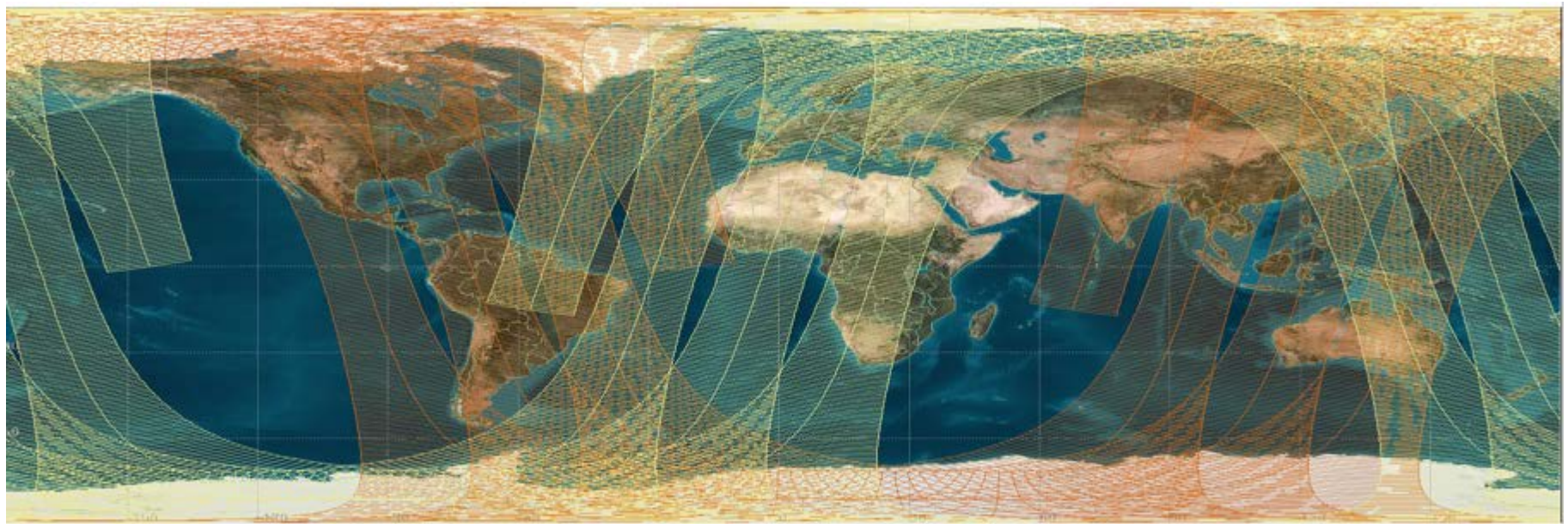
Current operational satellite FY-2E(86.5E) FY-2E(104.5E)



CMA Leo constellation

(FY-3C:Morning ,FY-3B:Afternoon)

- Decommission: FY-1D
- To be decommission: FY-3A
- In operation: FY-3B + FY-3C **global coverage 4 times per day**



■ FY-3C LTC 10:30 AM

■ FY-3B LTC 13:40 PM



□ Brief view of CMA Satellite

□ Satellite Oceanography products used CMA

- 1) Satellite SST Products
- 2) Satellite Ocean Winds products
- 3) Satellite Sea ice products

□ Forword look

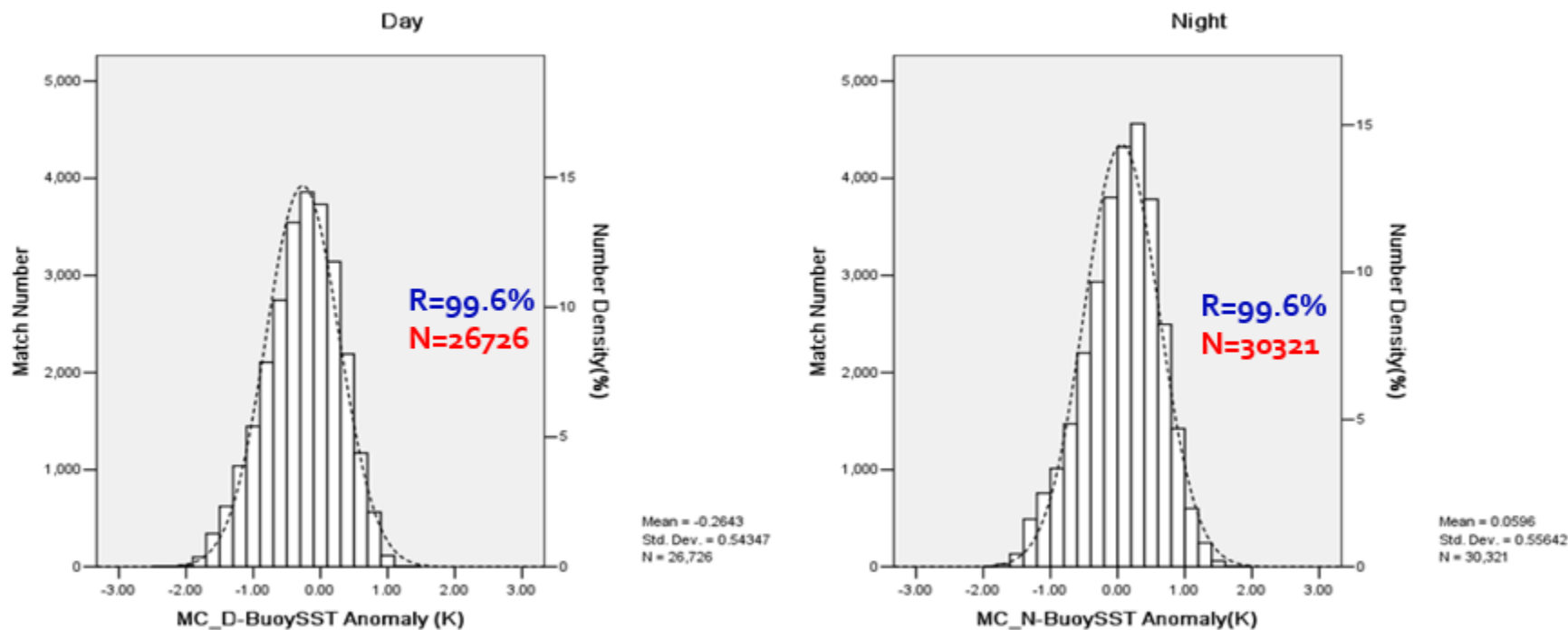
1) Satellite SST Products

Satellite used : FY-2D/E/F/G FY-3A/B/C

products derived : SST

QC : comparison vs in situ data from the iQUAM

Validate FY-3C/VIRR SST against in situ data (matchup analyses 2014.5~7)

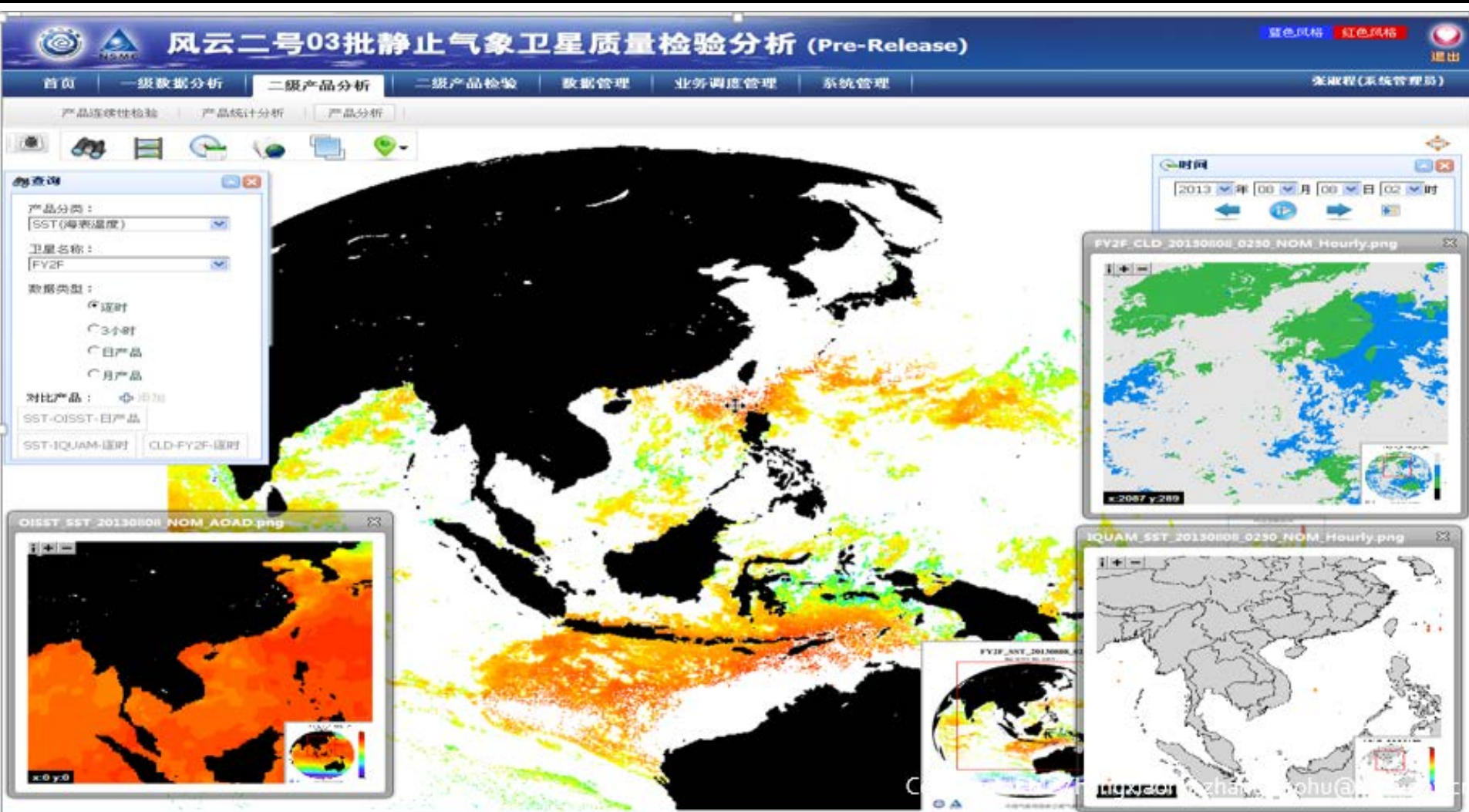


■ MC_D bias: -0.26K STD:0.54K

■ MC_N bias: 0.06K STD:0.56K

1) Satellite SST Products (cont.)

A SST products validation system have be operational since 2014



1) Satellite SST Products (cont.)

SST Algorithms used in NSMC

night	day	MCSST(D/N)	$T_s = a_0 + a_1 T_{11} + a_2 (T_{11} - T_{12}) + a_3 (T_{11} - T_{12})(\sec \theta - 1)$
		QDSST(D/N)	$T_s = a_0 + a_1 T_{11} + a_2 (T_{11} - T_{12}) + a_3 (T_{11} - T_{12})^2 + a_4 (\sec \theta - 1)$
	NLSST(D/N)	$T_s = a_0 + a_1 T_{11} + a_2 T_{FG} (T_{11} - T_{12}) + a_3 (T_{11} - T_{12})(\sec \theta - 1)$	
	TCSST(N)	$T_s = a_0 + a_1 T_{11} + a_2 T_4 + a_3 T_{12} + a_4 (T_4 - T_{12})(\sec \theta - 1) + a_5 (\sec \theta - 1)$	
	DNSST(N)	$T_s = a_0 + a_1 T_{11} + a_2 T_{FG} (T_4 - T_{11}) + a_3 (\sec \theta - 1)$	

T_s : satellite-derived SST

T_{FG} : first-guess SST

θ : satellite zenith angle

$a_0 \sim a_4$: coefficients

T_4 , T_{11} , T_{12} : brightness temperature in $3.7\mu\text{m}$ 、 $10.8\mu\text{m}$ 、 $12\mu\text{m}$ bands

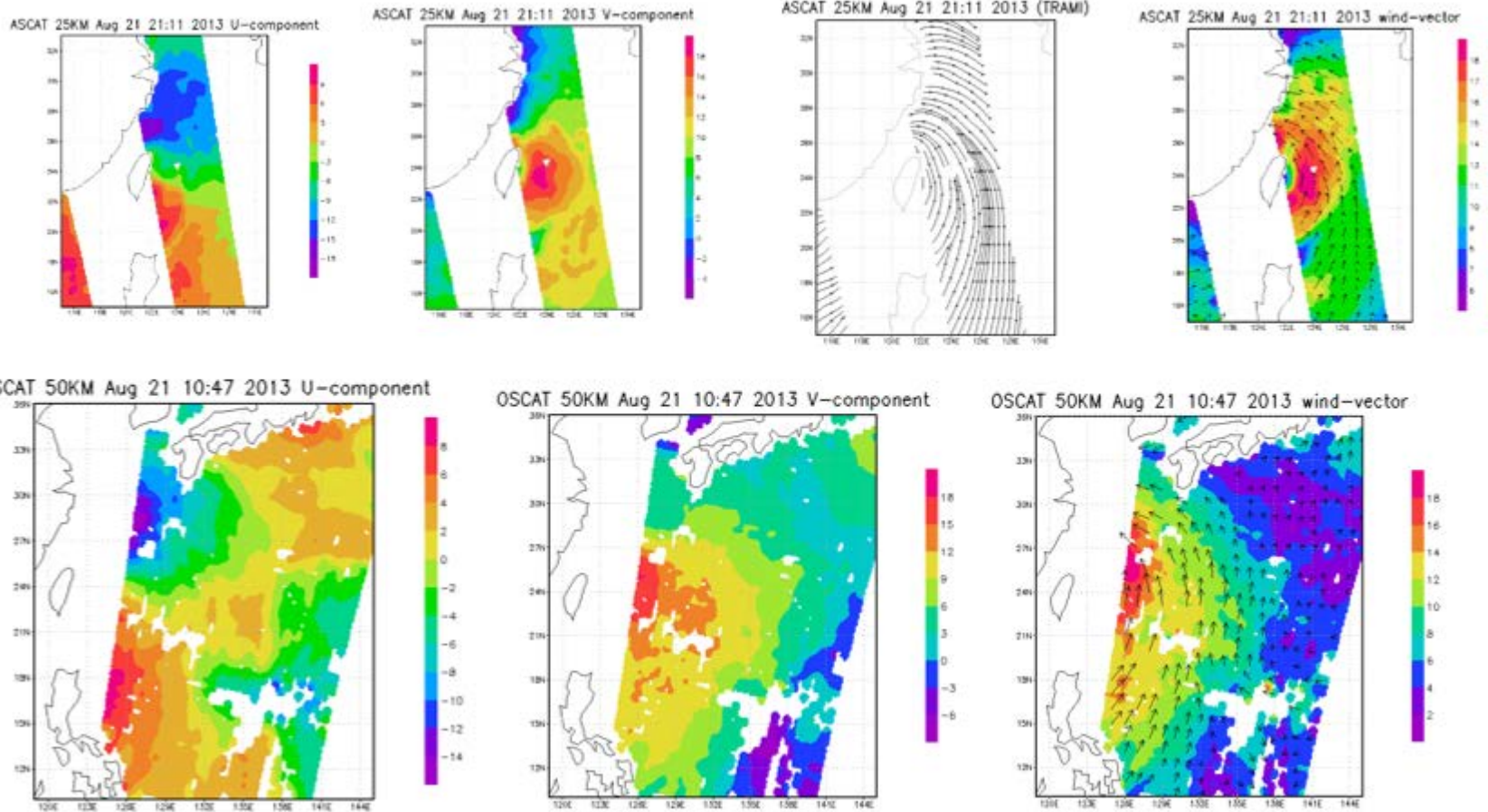
The $3.7\mu\text{m}$ band is very transparent and is available for SST retrievals at night, while during daytime it is contaminated by solar reflectance.

$3.7\mu\text{m}$ only used for FY -3 at present

2) Satellite Ocean Winds products

Satellite used : ASCAT, OSCAT

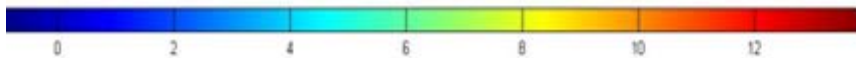
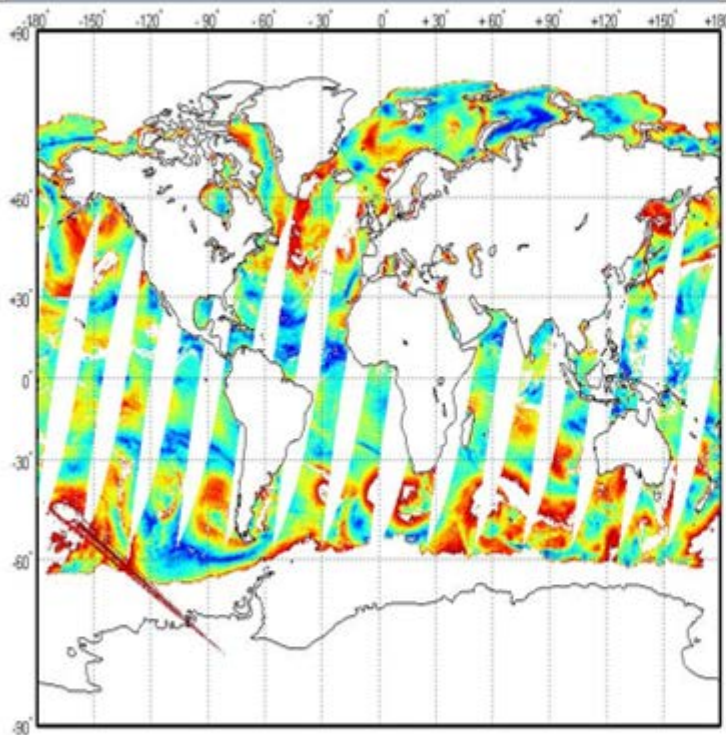
Data source: EumetCast



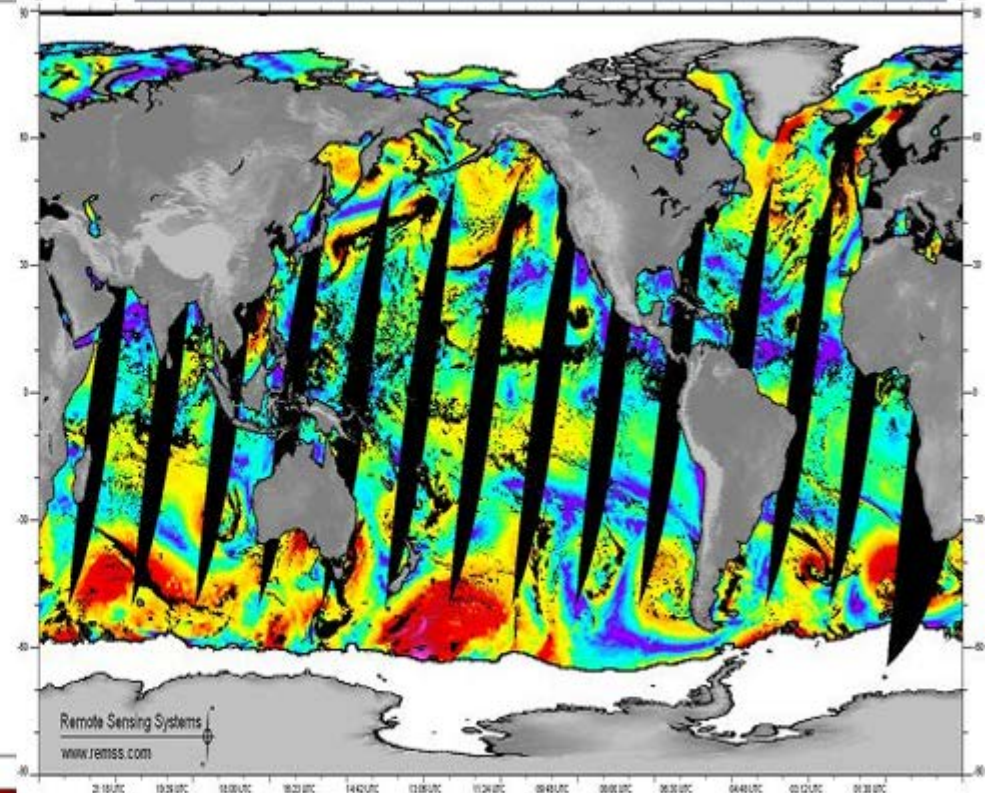
2) Satellite Ocean Winds products

Satellite used : FY-3 MWRI(Microwave Radiometric Imager)
products derived: Sea Surface wind speed

FY-3 MWRI surface wind speed



AMSR-E MWRI surface wind speed

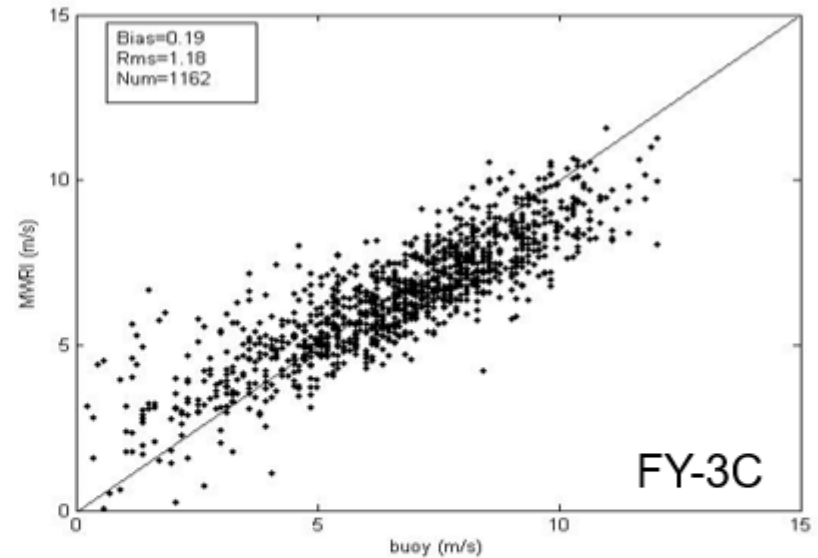
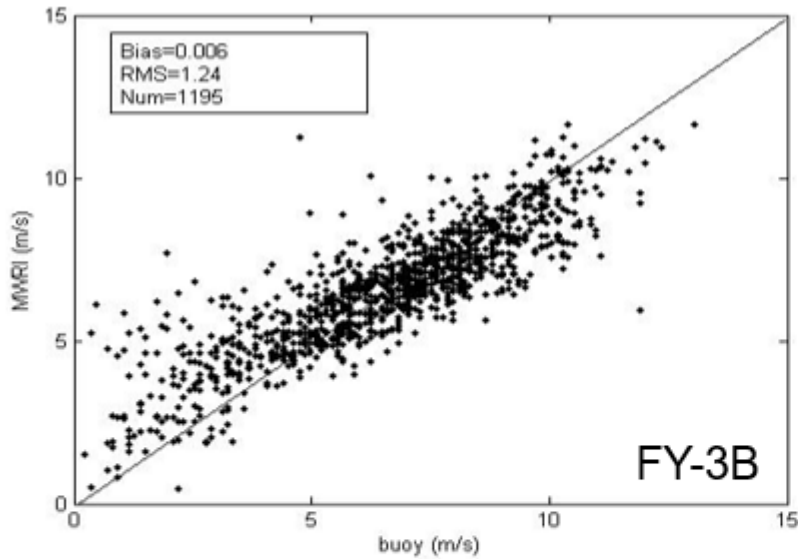


Remote Sensing Systems
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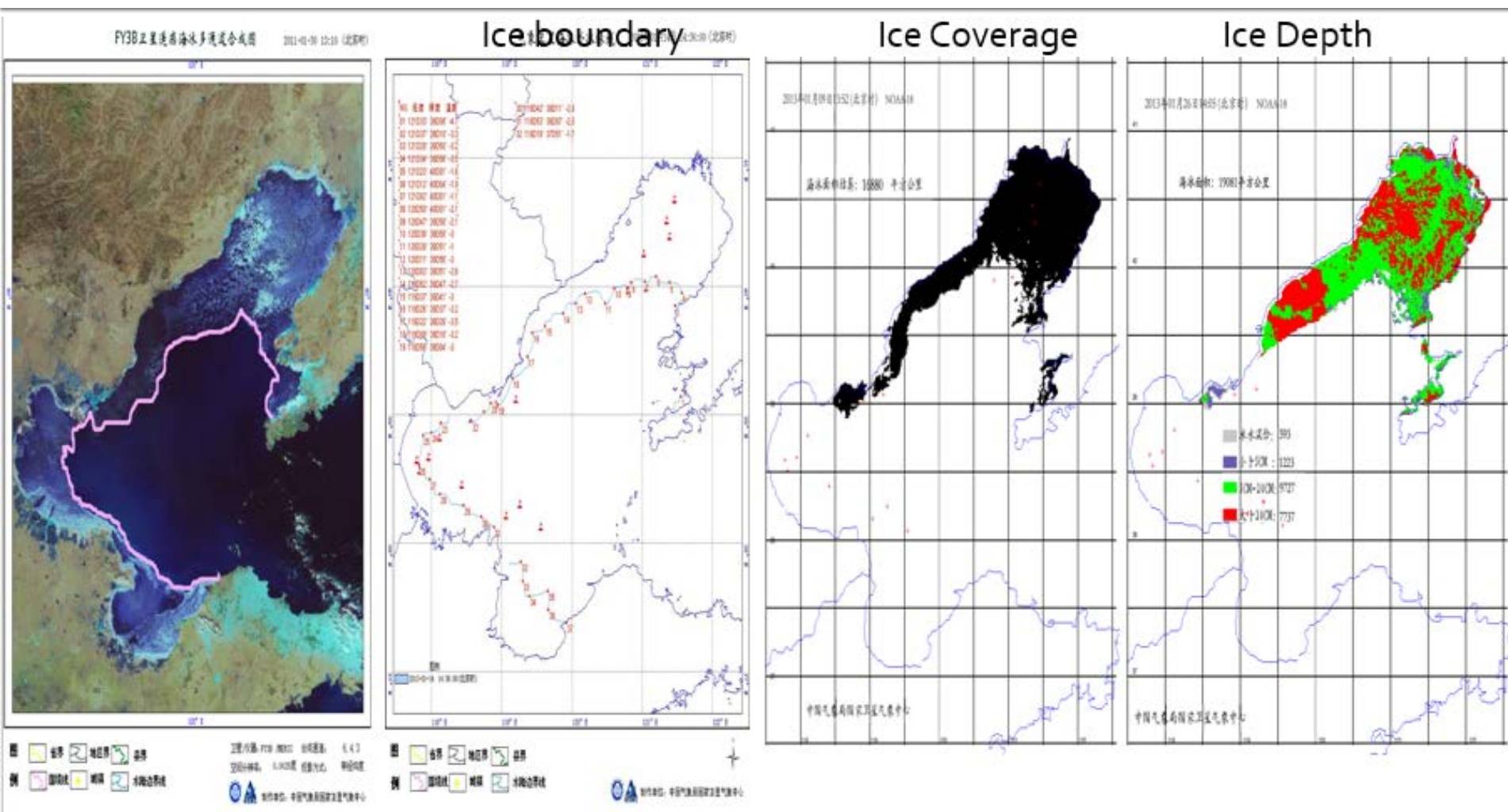


DATA	BIAS (m/s)	RMS (m/s)
FY3C	-0.0017	1.18
FY3B	0.4	1.24

$$WS = C_0 + C_1 T_B(10.65V) + C_2 T_B(10.65H) + C_3 T_B(18.7V) + C_4 T_B(23.8V) + C_5 T_B(36.5V) + C_6 T_B(36.5H)$$

3) Satellite Sea ice products

Satellite used : FY-3/B/C





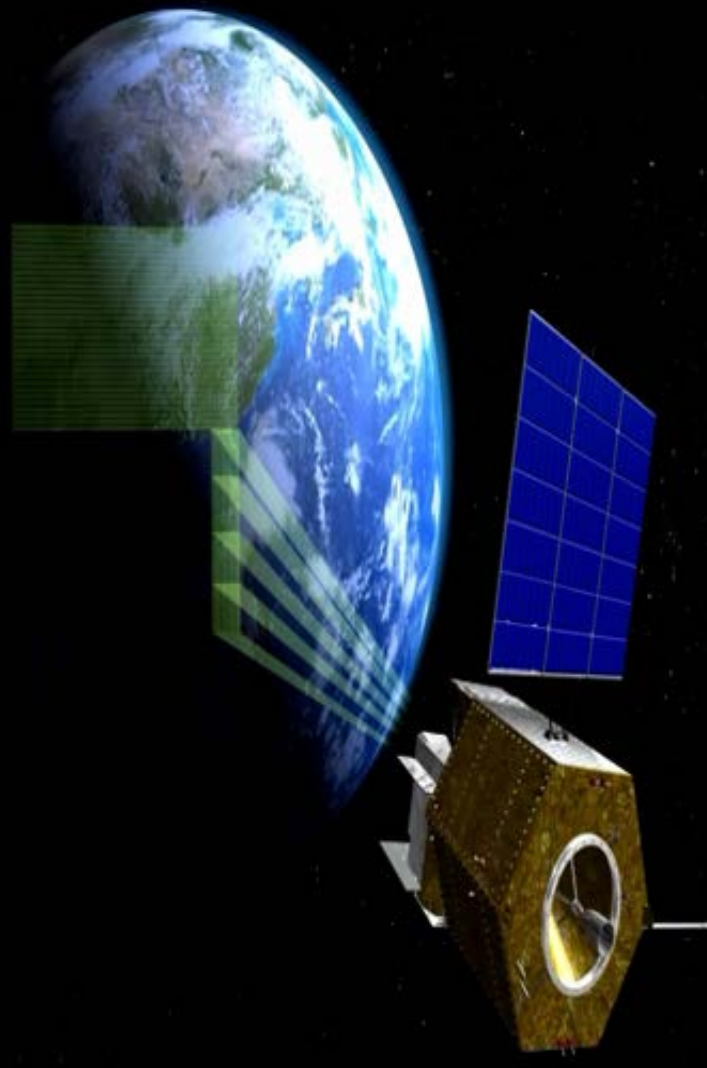
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Summary

- CMA/NSMC focuses on operational satellite meteorological applications and capacity building. In-depth research and demonstration efforts are encouraged for the applications of new data in weather analysis, NWP, etc., Current CMA Oceanographic application focal point is SST and Sea surface wind.
- CMA will keep its commitment to open data policy for Fengyun data. Engagement of regional and global users in the application of Fengyun data are welcome.
- **International partnerships are essential. Satellite Oceanography Users community is a very important value added benefit to CMA satellite applications.**

New capabilities form CMA Geo.

A hyperspectral sounder on Geo, to be launched 2016



	FY-4A (R&D)	FY-4B (Operational)
Spectral Parameters (Normal mode)	Range Resolution Channels LWIR: 700-1130 Cm ⁻¹ 0.8 538 S/MIR: 650-2250Cm ⁻¹ 1.6 375 VIS : 0.55-0.75 μm 1	Range Resolution Channels LWIR: 700-1130 0.625 688 S/MIR: 650-2250 1.2 500 VIS : 0.55-0.75 μm 1
Spatial Resolution	LWIR/S/MIR : 16Km SSP VIS : 2Km SSP	LWIR/S/MIR : 8Km SSP
Operational Mode	China area 5000 × 5000 Km ² Mesoscale area 1000 × 1000 Km ²	China area 5000 × 5000 Km ² Mesoscale area 1000 × 1000 Km ²
Temporal Resolution	China area <1 hr Mesoscale area <½ hr	China area <1 hr Mesoscale area <½ hr
Sensitivity (mW/m²sr cm⁻¹)	LWIR: 0.5 -1.1 S/MIR: 0.1-0.14 VIS: S/N > 200 (ρ = 100%)	LWIR: 0.3 S/MIR: 0.06
Calibration accuracy	1.5k (3σ) radiation	1.0k (3σ)
Calibration accuracy	10 ppm (3σ) spectrum	5 ppm (3σ)
	Quantization Bits 13 bits	13 bits

Please note this sounder could provide more details on diurnal change information of SST.

New capabilities form CMA Leo.

A Improved imager on FY-3D, to be launched 2016



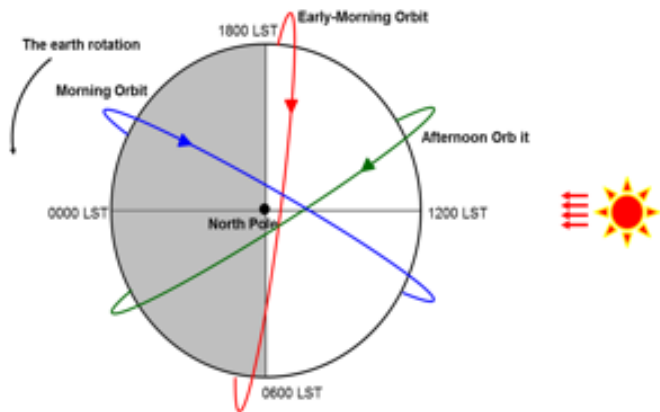
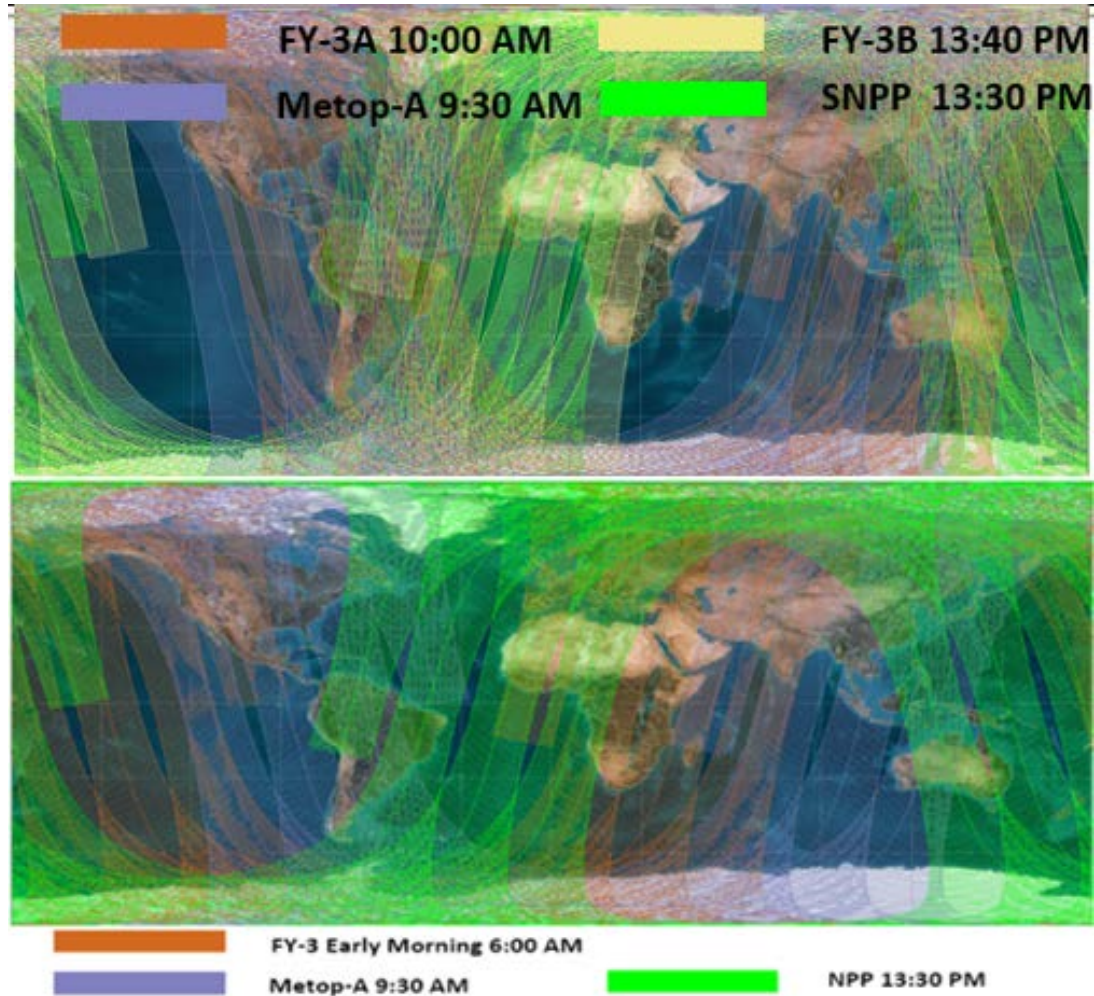
MERSI-II

Primary Usage	Band	Band Center(um)	Bandwidth(nm)	Spatial Resolution(m)
Land/Cloud/Aerosols Boundaries	1	0.470	50	250
	2	0.550	50	250
	3	0.650	50	250
	4	0.865	50	250
	5	1.24/1.03	20	1000
	6	1.64	50	1000
	7	2.13	50	1000
Ocean Color/Phytoplankton/ Biogeochemistry	8	0.412	20	1000
	9	0.443	20	1000
	10	0.490	20	1000
	11	0.555	20	1000
	12	0.670	20	1000
	13	0.709	20	1000
	14	0.746	20	1000
Water Vapor	15	0.865	20	1000
	16	0.905	20	1000
	17	0.936	20	1000
	18	0.940	50	1000
Cirrus Cloud	19	1.38	20/30	1000
Surface/Cloud	20	3.8	180	1000
Temperature	21	4.050	155	1000
Water vapor	22	7.2	500	1000
	23	8.550	300	1000
Surface/Cloud	24	10.8	1000	250
Temperature	25	12.0	1000	250

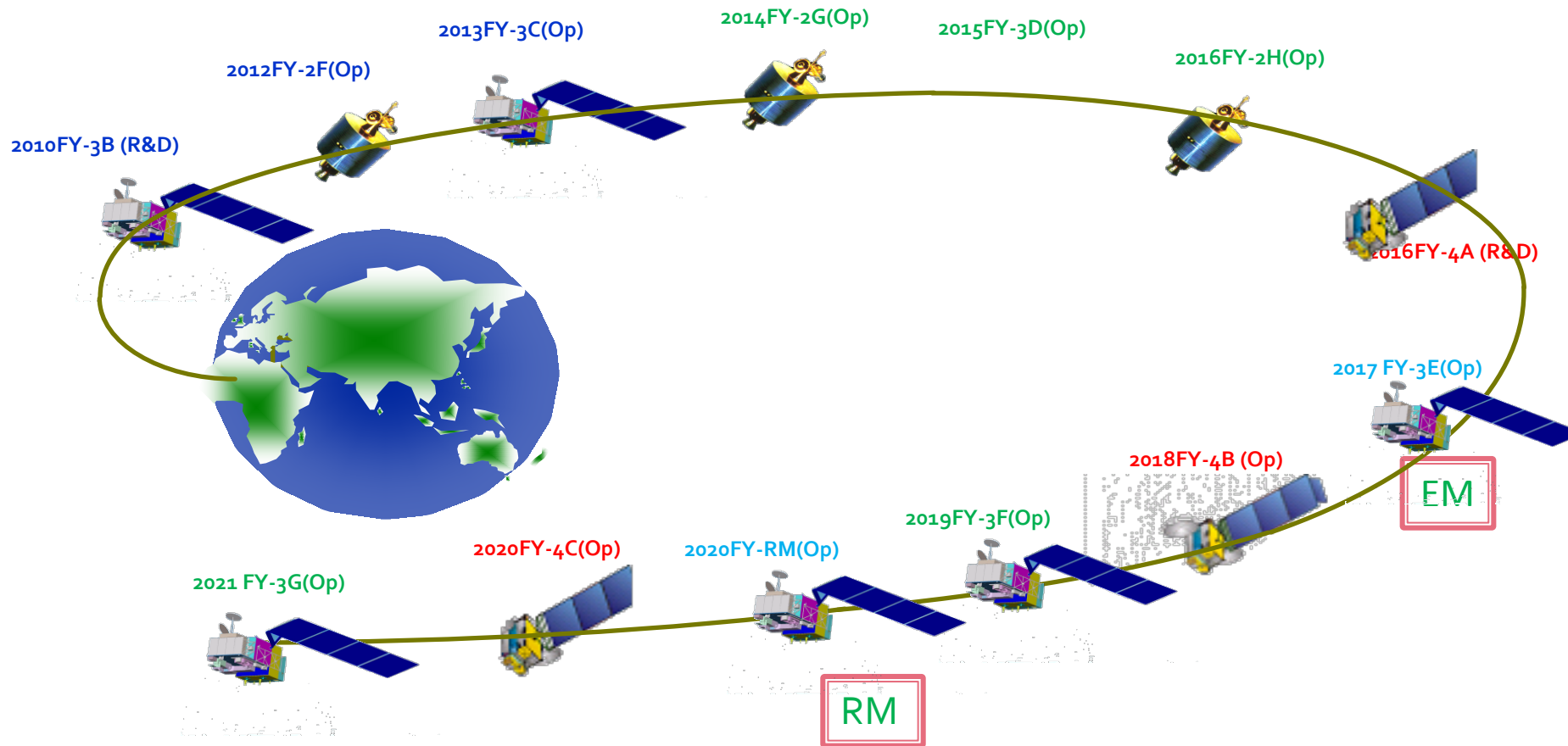
Please note the 250 meter resolution longwave infrared channel

New capabilities form CMA Leo. FY-3 Early-morning Orbit

- ◆ Studies have showed that deploying a FY-3 satellite in early morning orbit can bring positive effects on NWP model through filling up data gap.
- ◆ Now, FY-3 Early-morning orbit satellite has passed the feasibility analysis organized by CMA, and payloads onboard the satellite were also determined.



National Program for Fengyun Meteorological Satellite from 2011-2020



By 2020, CMA new generation Geo(FY-4) will be operational. FY-3 series satellites will form a constellation, which includes an early morning orbit satellite, a morning orbit satellite, an afternoon orbit satellite, and a Rainfall mission satellite.



**Thank you
for your attention**

