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EXPERT TEAM ON SATELLITE UTILIZATION AND PRODUCTS

ITEM: 10

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Preparation for FY-4A

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Summary and Purpose of Document

This document gives a brief introduction of FY-4A, mainly including instruments, observation mode and products. FY-4A is scheduled for launch in 2016 and will provide data and products to users.

ACTION PROPOSED

The eighth session is invited to discuss developing the application tests of FY-4A data.

DISCUSSION

Introduction

1. As the first satellite of the China next generation geostationary satellite series, FY-4A is scheduled for launch in 2016. Compared with FY-2, there are significant improvements in instruments performance.

Table 1: Advancement of FY-4A compared with FY-2

	FY-4A(EXP)	FY-2(OP)
Stabilization	Three-axis	Spin
Designed Life	5~7 Years	4 Years
Observation efficiency	85%	5%
Observation Mode	Imaging +Sounding + Lightning Mapping	Imaging Only
Main Instruments	AGRI :14 channels SSP Resolution: 0.5~4Km Global imaging: 15min Flexible imaging : 2D	VISSR: 5 channels SSP Resolution: 1.25~5Km Global imaging: 30min Flexible imaging : 1D
	GIIRS:913 channels SSP Resolution:16Km Spectral Resolution: 0.8,1.6cm-1	N/A
	LMI SSP Resolution:7.8Km	N/A
	SEP High energy particles Magnetic field	SEM High energy particles Solar X ray fluxes

2. FY-4A has four observation instruments, including:

- 1) GIIRS: Geo. Interferometric Infrared Sounder
- 2) AGRI: Advanced Geosynchronous Radiation Imager
- 3) LMI: Lightning Mapping Imager
- 4) SEP: Space Environment Package

AGRI, the primary instrument of FY-4A, has 14 channels and two observation modes. The temporal resolutions are 1 - 5 minutes over regional domain and 15 minutes over full-disk domain. The specific parameters of AGRI are shown in table 2.

Table 2. The performance of AGRI onboard FY-4A

FY-4A AGRI				
Channel	Band	Spatial Resolution	Sensitivity	Main Application
Visible & Near-Infrared	0.45 ~ 0.49	1	S/N≥90 (ρ=100%)	Aerosol
	0.55 ~ 0.75	0.5 ~ 1	S/N≥200 (ρ=100%)	Fog, Cloud
	0.75 ~ 0.90	1	S/N≥5(ρ=1%)@0.5Km	Vegetation
Short-wave Infrared	1.36 ~ 1.39	2	S/N≥200 (ρ=100%)	Cirrus
	1.58 ~ 1.64	2	S/N≥200 (ρ=100%)	Cloud,Snow
	2.1 ~ 2.35	2 ~ 4		Cirrus,Aerosol
Mid-wave Infrared	3.5 ~ 4.0(High)	2	NEΔT≤0.7K(300K)	Fire
	3.5 ~ 4.0(Low) *	4	NEΔT≤0.2K(300K)	Land surface
	5.8 ~ 6.7	4	NEΔT≤0.3K(260K)	WV
Water Vapor	6.9 ~ 7.3	4	NEΔT≤0.3K(260K)	WV
	8.0 ~ 9.0*	4	NEΔT≤0.2K(300K)	WV,Cloud
Long-wave Infrared	10.3 ~ 11.3*	4	NEΔT≤0.2K(300K)	SST
	11.5 ~ 12.5*	4	NEΔT≤0.2K(300K)	SST
	13.2 ~ 13.8*	4	NEΔT≤0.5K(300K)	Cloud,WV

GIIRS can be used for vertical atmospheric sounding and it is the first high-resolution sounding sensor onboard the geostationary satellite. There are two observation modes of GIIRS. One mode is designed for China area, whose temporal resolution is 55 minutes and the coverage is 4500 * 4500 km. The other observation mode is Meso-Scale mode, whose temporal resolution is 30 minutes and the coverage is 1000 * 1000 km. The specific parameters of GIIRS are shown in table 3.

Table 3. The performance of GIIRS onboard FY-4A

FY-4A (R&D)			
Spectral Parameters (Normal mode)	Range Channels		Resolution
	LWIR: 700-1130 Cm ⁻¹	0.8	538
	S/MIR:1 650-2250Cm ⁻¹	1.6	375
	VIS : 0.55-0.75 μm	1	
Spatial Resolution	LWIR/S/MIR : 16Km SSP		
	VIS : 2Km SSP		
Operational Mode	China area		
	5000 × 5000 Km ²		
	Mesoscale area		
	1000 × 1000 Km ²		

Temporal Resolution	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%)
Calibration accuracy	1.5k (3σ) radiation
Calibration accuracy	10 ppm (3σ) spectrum
Quantization Bits	13 bits

Lighting Mapping Imager(LMI) can detect the present of space-based lighting, which is useful for early predictions of storms and severe weather events. The specific parameters of LMI are shown in table 4.

Table 4. The performance of LMI onboard FY-4A

Spatial resolution	about 6 km at SSP
Sensor size	400×300 ×2
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	12 bits
Measurement Error	10%

3. Products

FY-4A will provide 27 kinds of quantitative products, and the detail is illustrated in Table 5. All algorithm design and development have already completed. The next step plans to use simulation data to validate the reliability of each algorithm.

Table 5. All products of FY-4A

No .	Products	No.	Products
1	Clear Sky Masks	15	Legacy Vertical Moisture Profile

2	Cloud Top Height	16	Ozone Profile & Total
3	Cloud Top Temperature	17	Derived Motion Winds
4	Cloud Top Pressure	18	Lightning Detection
5	Cloud Optical Depth	19	Rainfall Rate/QPE
6	Cloud Liquid Water	20	Convective Initiation
7	Cloud Particle Size Distribution	21	Tropopause Folding Turbulence Prediction
8	Aerosol Detection	22	Sea Surface Temperature (skin)
9	Aerosol Optical Depth	23	Fire/Hot Spot Characterization
10	Downward Longwave Radiation: Surface	24	Land Surface (Skin) Temperature
11	Upward Longwave Radiation: TOA	25	Land Surface Emissivity
12	Upward Longwave Radiation: Surface	26	Snow Cover
13	Reflected Shortwave Radiation: TOA	27	Space weather products
14	Downward Shortwave Radiation: Surface		
