The Status of Chinese Meteorological Satellites

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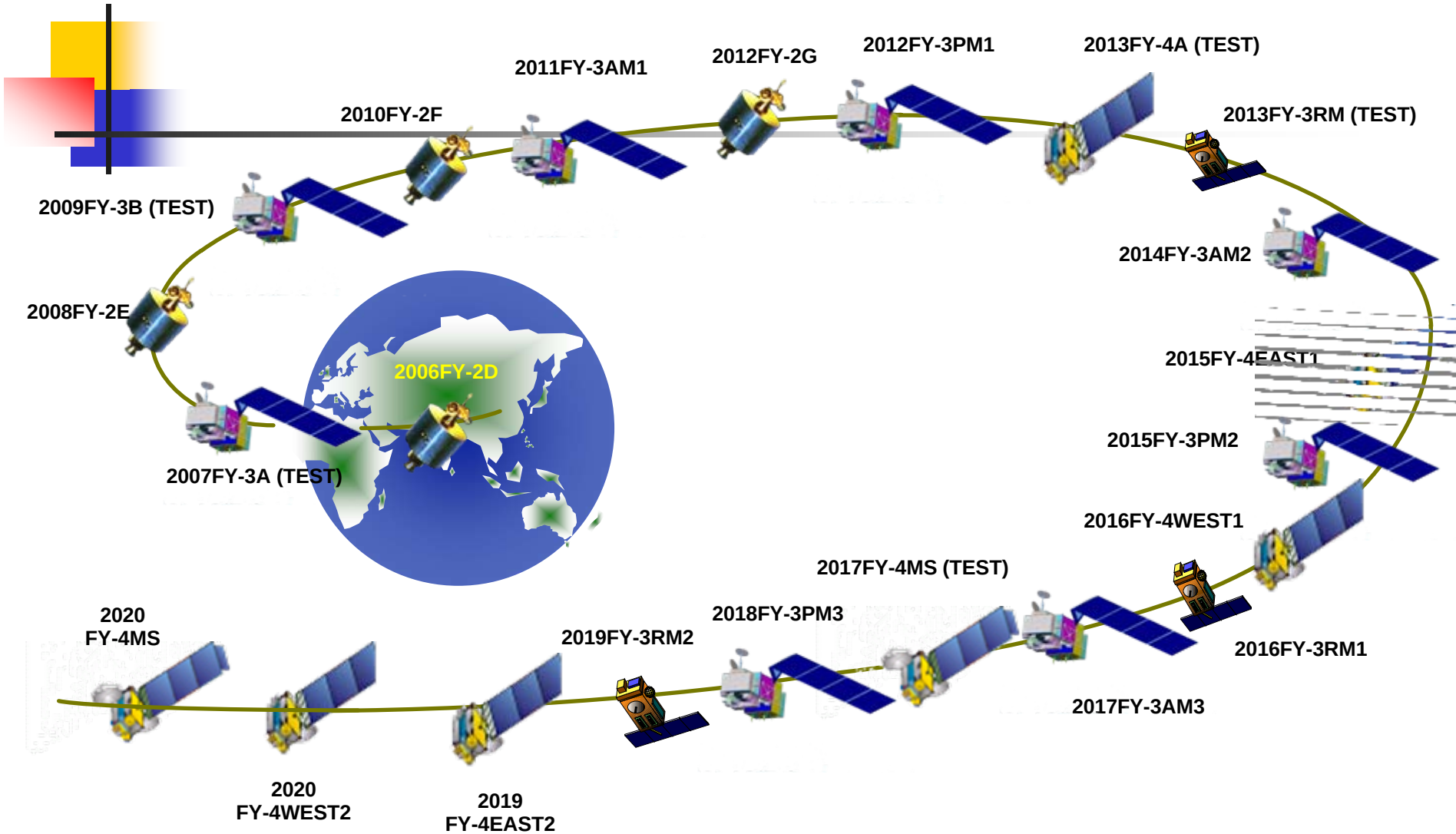
1.Current Satellites are Working Well

FY-1D (Leo), Launched in May. 2002, 10 Chs

FY-2C (Geo), Launched in Oct. 2004, 5 Chs

2. Consideration for Long-term Development of Chinese Meteorological Satellite (Leo & Geo)


2009FY-3B (TEST)
2010FY-2F
2011FY-3AM1
2012FY-2G
2012FY-3PM1
2013FY-4A (TEST)
2013FY-3RM (TEST)
2014FY-3AM2
2015FY-4EAST1
2015FY-3PM2
2016FY-4WEST1
2016FY-3RM1
2017FY-3AM3
2017FY-4MS (TEST)
2018FY-3PM3
2019FY-3RM2
2019
FY-4EAST2
2020
FY-4WEST2
2020
FY-4MS
2008FY-2E
2007FY-3A (TEST)
2006FY-2D

Two phases of FY-3 series

- ✓ **There are two developing phases for FY-3: i.e..**
  - **Exp. Phase (2007-2009 in flight): 2 satellites with limited sounding capabilities**
    - **FY-3A Launch scheduled in Oct., 2007**
    - **FY-3B launched scheduled in Early 2009**
  - **Operational Phase (flight after 2009): Satellites Constellation is planned with expanded sounding and imaging capabilities**

FY-3 Operational Constellation Considerations

- ✓ **Instruments on FY-3A/B will be improved and refined for FY-3 Op satellites**
- ✓ **Two polar satellites in operation (one in the AM and one in the PM orbit, payload will be different for AM/PM satellites, time slots could be coordinated through WMO) FY-3 AM/PM**
- ✓ **One low inclination orbit satellite is planning, mainly for precipitation measurement (mainly Radar, Passive Microwave measurement). Details is still in discussion FY-3 Rm**

Basic Information for FY-3A/B Instrument

Name of Instrument	Number of Channels	Field of Views /line	Spatial Resolution at Sub point
VIRR	10	2048	1.1
IRAS	26	56	17
MWTS	4	15	50/75
MWHS	5	90	15
MERSI	20	2048/8192	1.1/250
SBUS	12	240	70/10
TOU	6	31	50
MWRI	6	240	15-70
ASI	TBD		

FY-3 C/D/F……

- ✓ **Make Some Changes to FY-3A/B**
- ✓ **Cancel VIRR, add IR CHs to MERSI**
- ✓ **High Spectral Infrared Sounder**
- ✓ **GPS Occultation Sensor**

FY-3A Satellite: Progress

- ✓ **Phase a (Design and Structure)**
  - **Sept. 2000- Nov. 2003**
- ✓ **Phase b (Engineering Model)**
  - **Dec. 2003- July 2006**
- ✓ **Phase c (Flight Model)**
  - **Aug. 2006 – Aug. 2007 (Ready for Launch)**

Data types: HRPT format

- ✓ Band frequency: 1698-1710 MHz
- ✓ Band Width: 5.4 MHz
- ✓ Modulation: QPSK
- ✓ Data rate: 4.2 Mbps
- ✓ Encoding: CONV(7, ¾)
- ✓ Broadcasting: Real time

Data types: DPT format

- ✓ DPT=Delayed Picture Transmission
- ✓ Band frequency: 8025-8215/8215-8140 MHz
- ✓ Band Width: 140 MHz
- ✓ Modulation: QPSK
- ✓ Data rate: 110 Mbps
- ✓ Encoding: CONV(7, ¾)
- ✓ Broadcasting: Within China capture area

Data types: MPT format

- ✓MPT=Mission Picture Transmission
- ✓Band frequency: 7750-7850 MHz
- ✓Band Width: 25 MHz
- ✓Modulation: QPSK
- ✓Data rate: 20 Mbps
- ✓Encoding: CONV(7, ¾)
- ✓Broadcasting: program controlled

10 technical system for ground segment

- ✓ **DAS** Data Acquisition System
- ✓ **OCS** Operation Control System
- ✓ **DPPS** Data Pre-Processing System (CAL)
- ✓ **PGS** Products Generation System
- ✓ **MAS** Monitoring and Analysis System
- ✓ **QCS** Quality Control System (VAL)
- ✓ **CNS** Computer and Network System
- ✓ **ARSS** ARchive and Service System
- ✓ **UDS** Utilization Demonstration System
- ✓ **STSS** Simulation and Technical Supporting System

- ✓ **7 receiving stations, one of the stations will be in high latitude place (Svabald or Kiruna)**
- ✓ **Products from FY-3 will be broadcasted by DVBS**

FY-3 Operational Products (Atmospheric and Cloud) (1/4)

No.	The name of product	Resolution km	Coverage	Accuracy
1	Cloud Mask	Lw resolution	Granule	5%-20%
2	Cloud Top Temperature	5 km	Granule	0.5-2.0K
3	Cloud Top Height	5 km	Granule	50hpa
4	Cloud Optical Thickness	5 Km	global	5%-20%
5	Cloud Type	5 Km	global	5%-20%
6	Cloud Cover(total amount, high cloud)	5 Km, 10 Km	global	5%-20%
7	Outgoing Long-wave Radiation at TOA	5 Km 50Km 17 Km	global	3-8 W/
8	Aerosol over Ocean	1Km 10 Km	Ocean	15%-30%
9	Fog Detection	1 Km	Granule	RMS < 0.25
10	Total Precipitable Water	1 Km 5 Km 50 Km 27X45	land Ocean	15%-25% 10%-20%

FY-3 Operational Products (Atmospheric and Cloud) (2/4)

No.	The name of product	Resolution km	Coverage	Accuracy
11	Precipitation Rate at the ground	18X30 km	global	30%
12	Atmospheric Temperature Profile 1000-10hPa	50km	global	1.5-2.5K
13	Humidity Profile 1000-300hPa	50km	global	15%-25%
14	Geopotential Height 1000-10hPa	50km	global	TBD
15	Atmospheric Stability Index	50km	global	TBD
16	Total Ozone	50km 17km	global	8-15%
17	Ozone Profile	200 Km	global	8-15%
18	Flux at at TOA from ERM scaner	35Km	Orbit/Regional/ global	LW:10Wm^{-2} SW:30Wm^{-2}
19	Flux at at TOA from ERM non scaner	120°	Orbit	LW:10Wm^{-2} SW:30Wm^{-2}

FY-3 Operational Products
(Land and Sea Surface) (3/4)

No.	The name of product	Resolution	Coverage	Accuracy
1	Vegetation Index Normalized Differential Vegetation Index	250m 1Km	Global	5%-10%
2	Land Cover (Vegetation Type)	250m 1 Km	Global	15%-20%
3	Snow Cover	1Km 5Km	Global	10%-20%
4	Land Surface Reflectivity	250m 1Km	Global	TBD
5	Land Surface Temperature	1 25 50X85km	Global	1.0-2.0K
6	Flooding Index	50X85 25 km	Global	TBD
7	Global Fire Area	1km	Global	5%
8	Sea Surface Temperature	1 5 50 Km	Global Ocean	1.0-1.5K
9	Ocean Color/Chlorophyll	1 Km 10 Km	Global Ocean	15%-20%
10	Sea-Ice cover	250m 1km	Global Ocean	5%-15%

FY-3 Operational Products (Space Weather) (4/4)

No.	The name of product	Resolution	Coverage	Accuracy
1	Solar Proton	20km	Global	15%
2	Solar Ion	50km×50km	Global	20%
3	Solar Electron	50km×50km	Global	20%
4	Potential	50km×50km	Global	20%
5	radiant dose	50km×50km	Global	20%
6	Single event	50km×50km		20%

FY-3 Experiment Products (1/2)

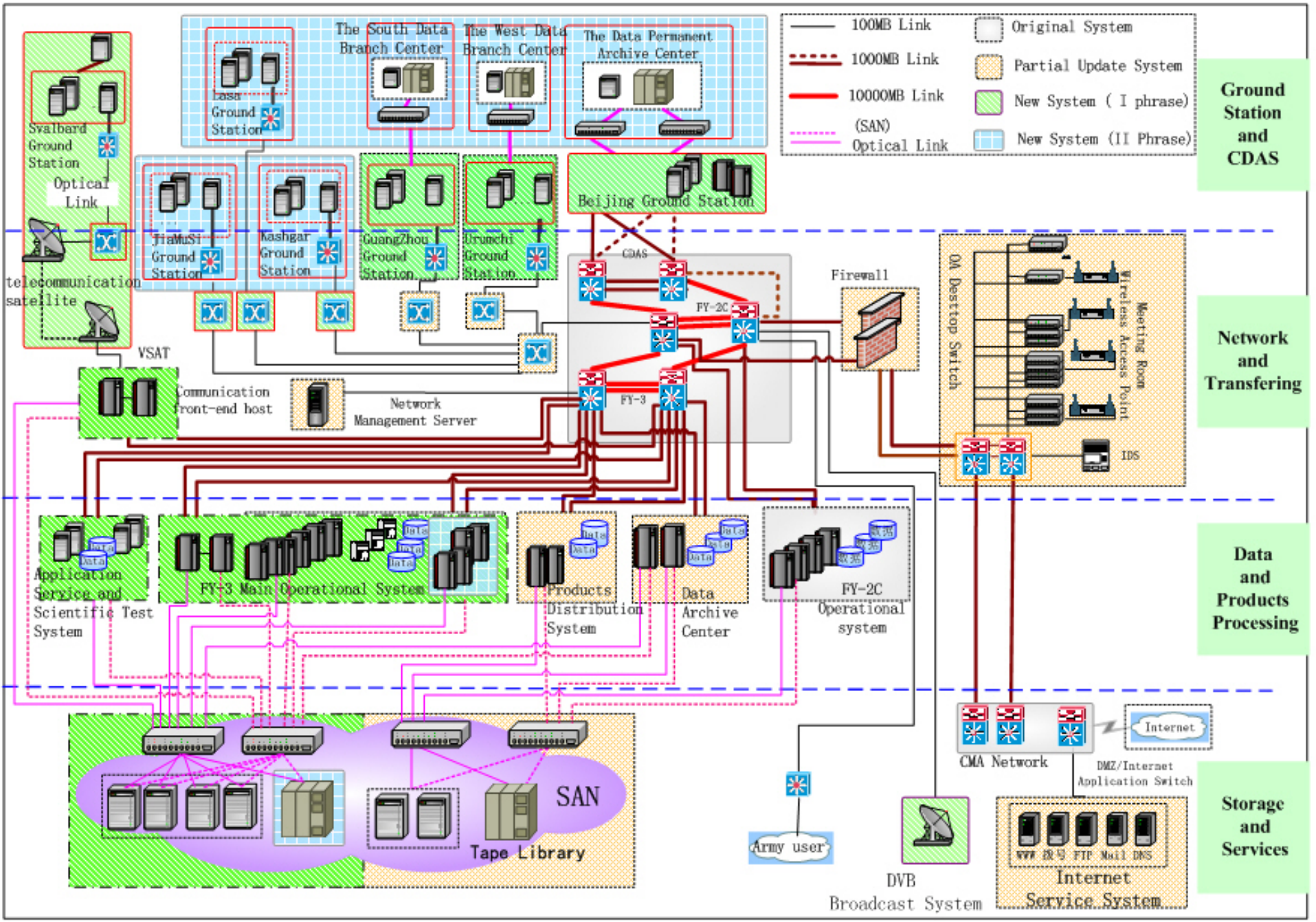
(Atmospheric, Cloud, Land and Sea Surface)

No.	The name of product	Resolution	Coverage	Accuracy
1	Aerosol over land	5 Km 10 Km	Global	15%-30%
2	Cloud water total column	18X30 km	Global	20%-30%
3	Tropical Cyclone Intensity Estimation	75km	Global	10 hPa
4	Wind Vector over Polar region	5Km	Polar circles	TBD
5	Ice Water Paths Index	20km	Middle and low Latitude	TBD
6	Bidirectional Reflectance Distribution Function	1 Km	Global	20%
7	Leaf Area Index	1 Km	Global	15%-20%
8	Fraction of Photosynthesis Active Radiation (FPAR)	1 Km	Global	15%-20%

FY-3 Experiment Products (2/2)

(Atmospheric, Cloud, Land and Sea Surface)

No.	The name of product	Resolution	Coverage	Accuracy
9	Net primary production	1 Km	Global	15%-20%
10	Drought Index	5 Km 25 km	Global	25%
11	Snow Depth	25 Km	Global	30% or 3cm
12	Snow Water Equivalent	25 Km	Global	30% or 2cm
13	Surface Soil Moisture	50X85 25 km	Global	15%-30%
14	Surface MicroWave Emissivity	75km	Global	TBD
15	Wind Speed over Sea Surface	30X50 km	Global ocean	3m/s
16	Polar Snow cover Extension	25km	North and south pole	10%-20%
17	Radiant belt Proton		Global	30%


100MB Link
1000MB Link
10000MB Link
(SAN)
Optical Link
Original System
Partial Update System
New System (I phrase)
New System (II Phrase)
Ground Station and CDAS
Network and Transfering
Data and Products Processing
Storage and Services
The South Data Branch Center
The West Data Branch Center
The Data Permanent Archive Center
Lasa Ground Station
Svalbard Ground Station
Optical Link
telecommunication satellite
JiaMuSi Ground Station
Kashgar Ground Station
GuangZhou Ground Station
Urumchi Ground Station
Beijing Ground Station
CDAS
FY-2C
FY-3
Firewall
OA Desktop Switch
Meeting Room Wireless Access Point
IDS
VSAT
Communication front-end host
Network Management Server
Application Service and Scientific Test System
FY-3 Main Operational System
Products Distribution System
Data Archive Center
FY-2C Operational system
SAN
Tape Library
Army user
DVB Broadcast System
CMA Network
Internet
DMZ/Internet Application Switch
WWW FTP Mail DNS
Internet Service System

Activities

- FY-2D will be Launched in Dec., 2006
- The Products are same as from FY-2C
- FY-2C is Located at 105 E, FY-2D will be at 87.5 E

FY2C Products

Name of Product	Coverage	Time/Day
Wind	50°N-50°S 55°E-155°E	4
SST	60°N-60°S 45°E-165°E	8
Upper Troposphere Humidity	60°N-60°S 45°E-165°E	8
ISCCP Data set	60°N-60°S 45°E-165°E	8
Precipitation Index	60°N-60°S 45°E-165°E	8
Precipitation Estimation	60°N-60°S 45°E-165°E	4
Cloud Classification	60°N-60°S 45°E-165°E	8
Cloud Amount	60°N-60°S 45°E-165°E	8
Humidity Profile from Cloud	50°N-50°S 55°E-155°E	8
Perceptible Water in Clear Sky Region	60°N-60°S 45°E-165°E	8
Outgoing Long wave Radiation	60°N-60°S 45°E-165°E	8
Solar Irradiance	60°N-60°S 45°E-165°E	1
Snow Cover	60°N-60°S 45°E-165°E	1
Sea Ice	60°N-60°S 45°E-165°E	1
Flood Monitoring	China	1
Soil Moisture	60°N-60°S 45°E-165°E	1
Fire Monitoring	China	24
Tropical Cyclone Position and Intensity	Western Pacific and India Ocean	24
Sand Storm Monitoring	China and Mongolia	8
Fog	China	24
TBB	60°N-60°S 45°E-165°E	8

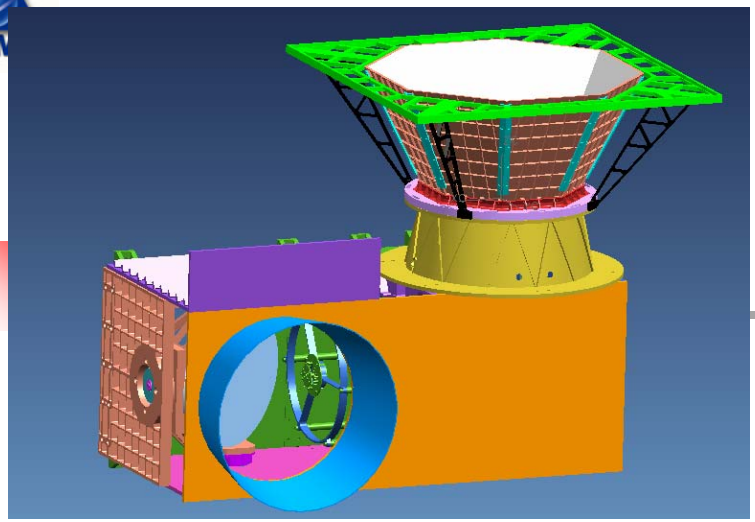
FY-4 is the 2nd generation of GEO Meteorological satellites

Plan to Develop two styles:

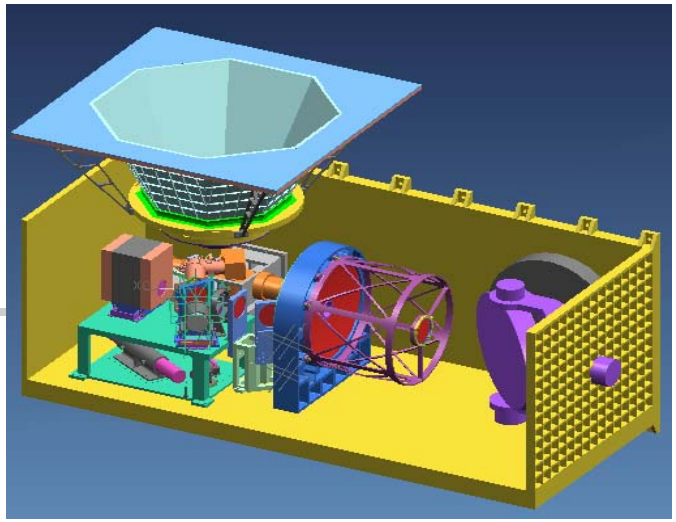
- ✓ **Optic sensor satellites(FY-4 EAST and FY-4 WEST)**
- ✓ **Microwave sensor satellites (FY-4MS)**

Main Instruments of FY-4 Series

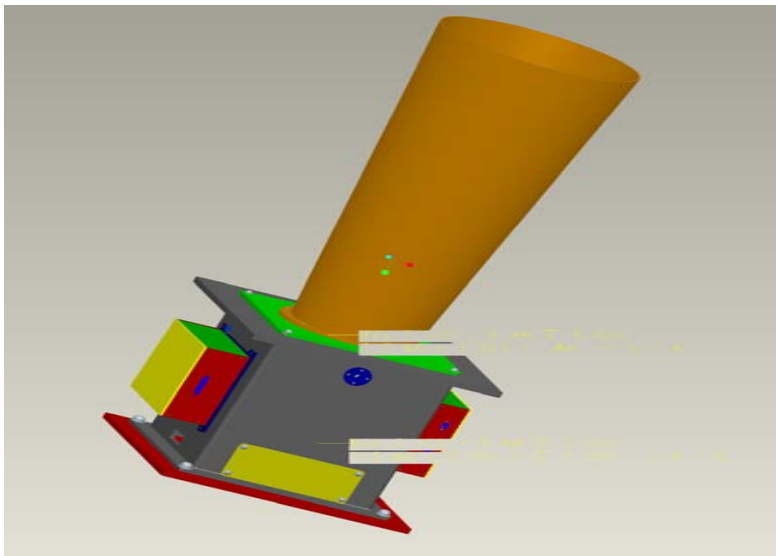
- ✓ Multi-channel scanning Imager/ Radiometer
- ✓ High Spectral Infrared Sounder
- ✓ Lighting Mapping Suit
- ✓ Space Environment Sensor Suite (include X-ray imager etc)
- ✓ Microwave Imager / Sounder
- ✓ Aerosol Polarimtery Sensor/CCD Imager
- ✓ Earth Radiation Budget Sensor



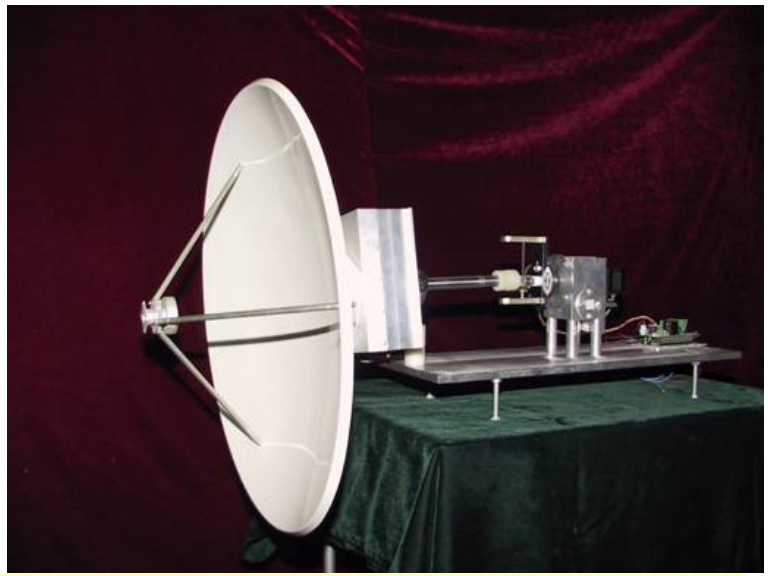
Multi-channel scanning Imager/ Radiometer



High Spectral Infrared Sounder

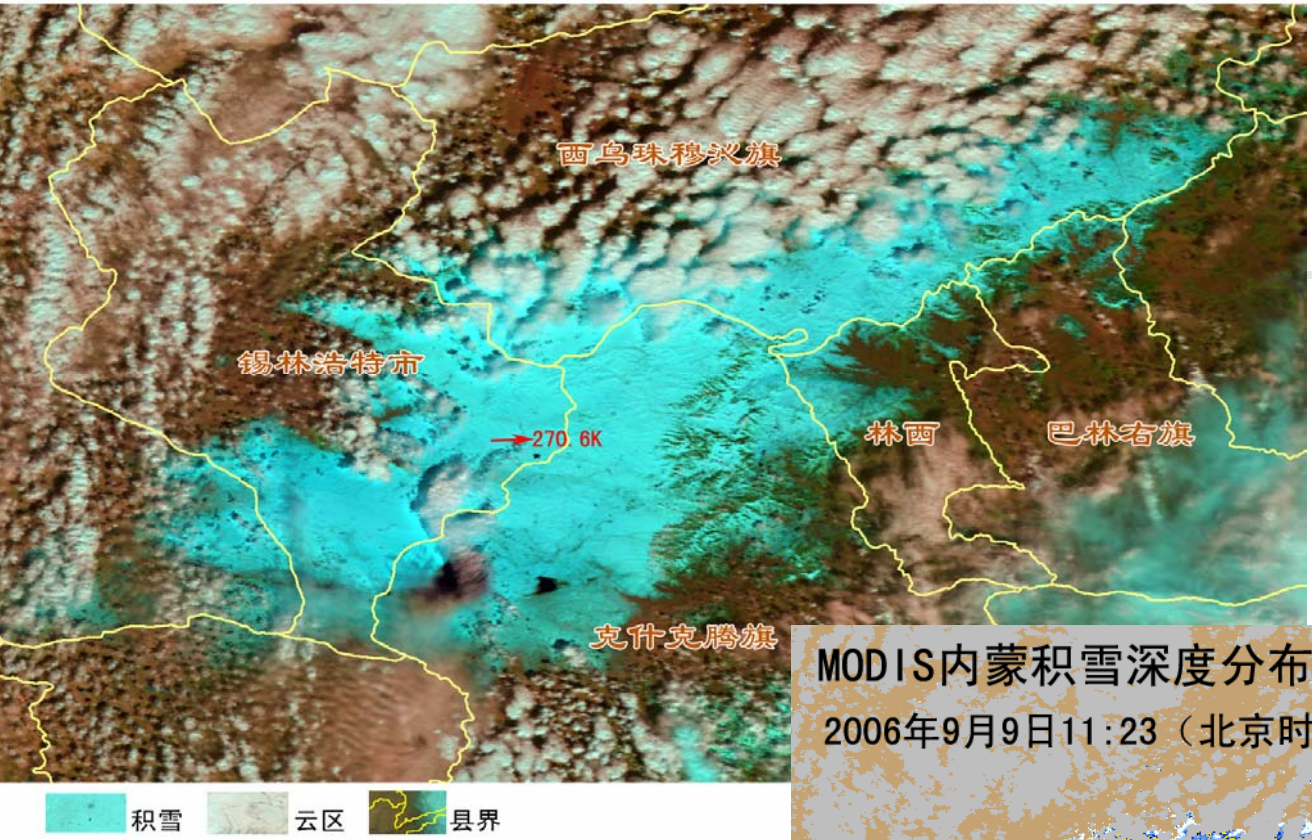


Lighting Mapping Suit



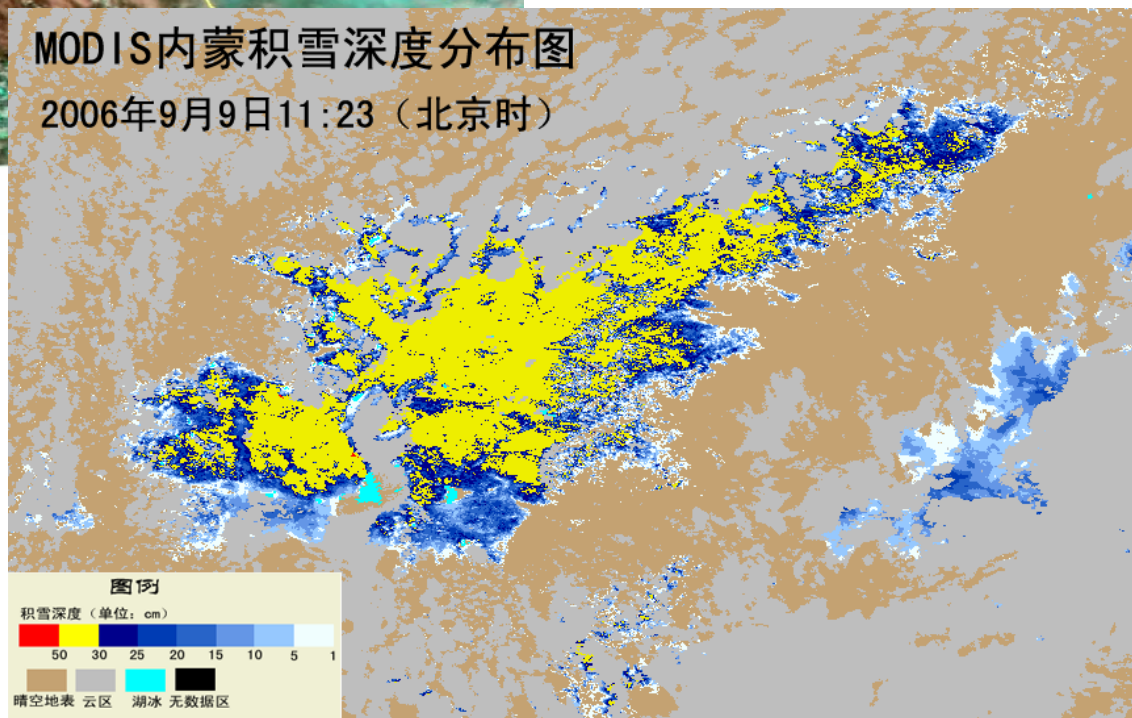
Microwave Imager / Sounder

Snow Cover From MODIS

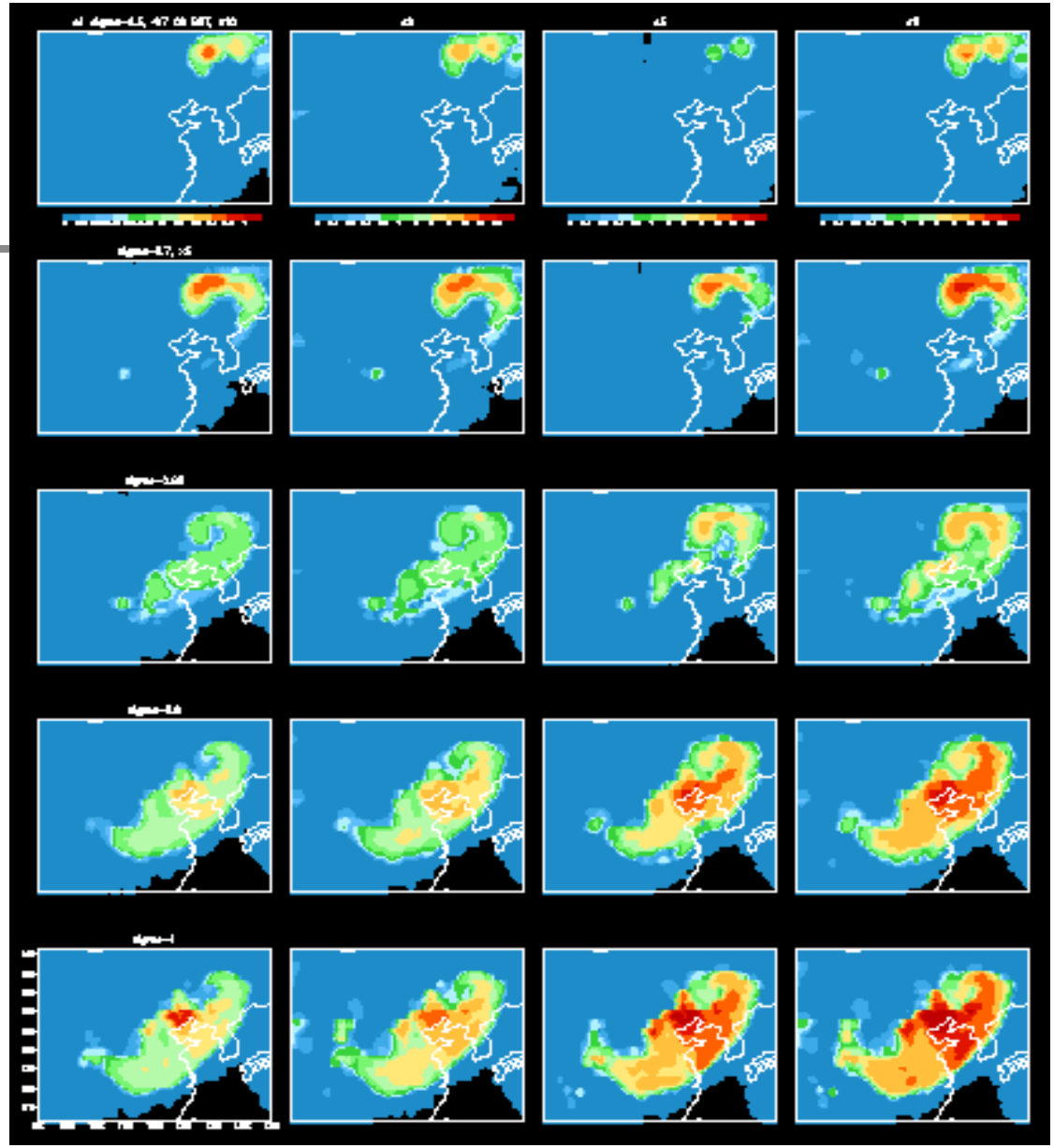


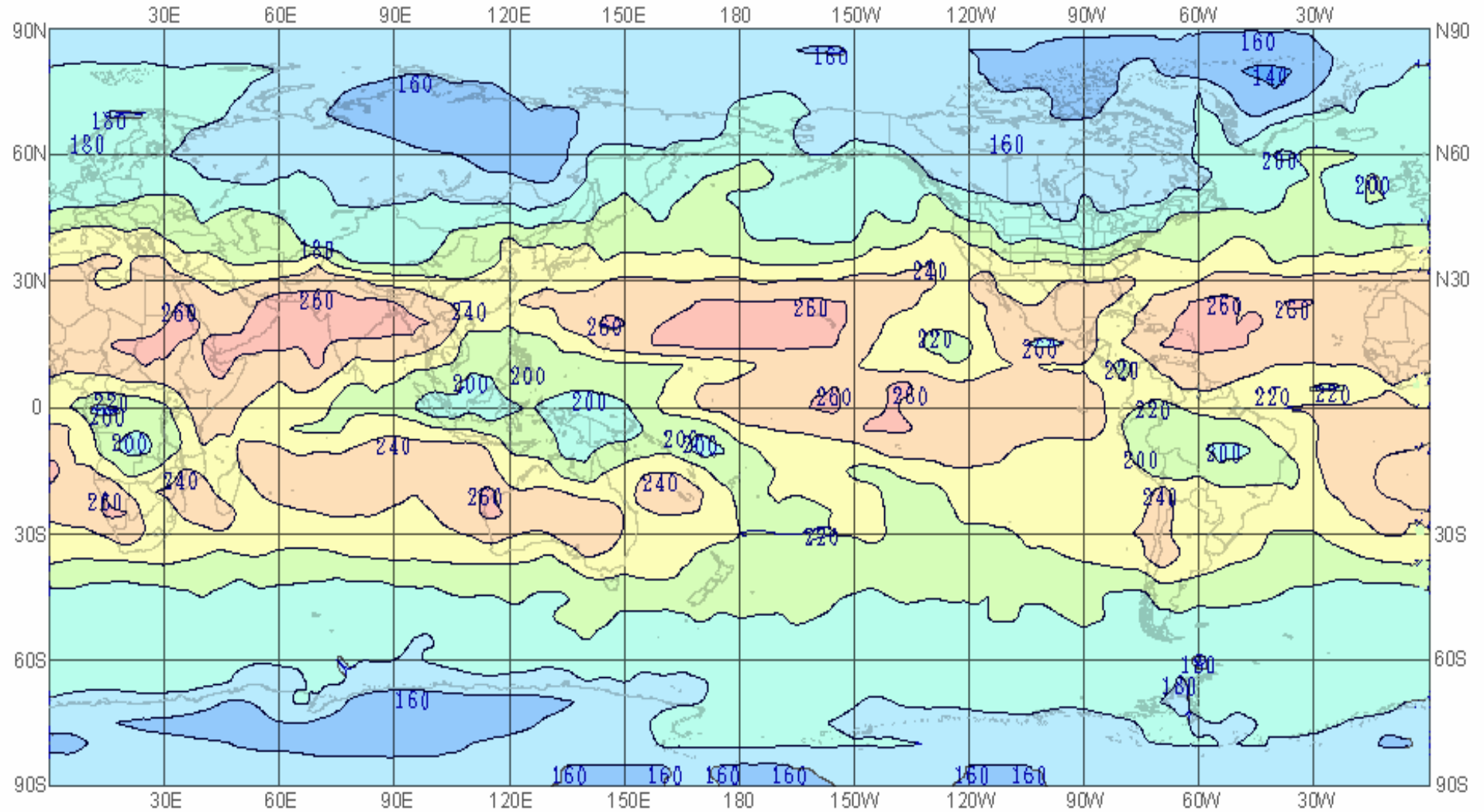
Inner Mongolia
Sep.9.2006

Size: 2700Km²
Depth:30 50cm
Ts: 3



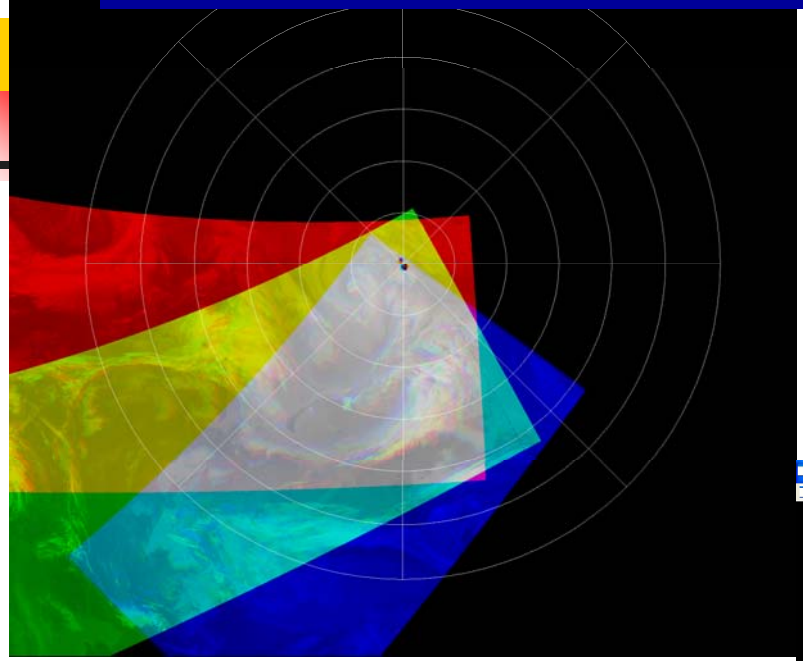
Dust clouds: Temporal variation



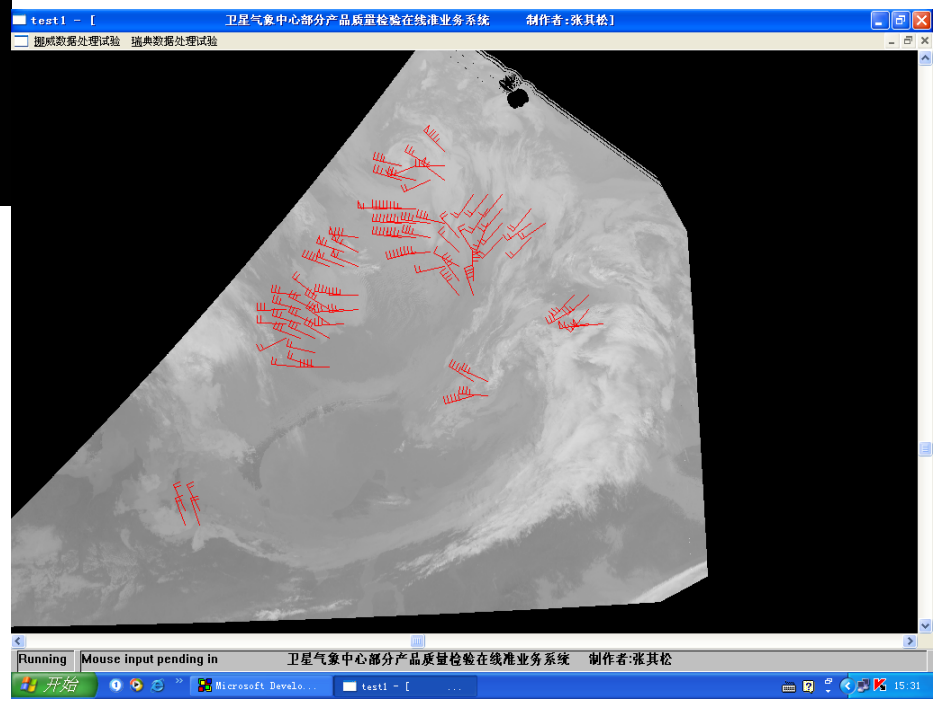

30E
60E
90E
120E
150E
180
150W
120W
90W
60W
30W
90N
60N
30N
0
30S
60S
90S
N90
N60
N30
30S
60S
90S

OLR

Wind Vector over Polar region



The Data From FY-1D



$\Delta T_i = T_i - \bar{T}_i$ (MV+IR)

From NOAA Sat

CHANCHIU

2006-05-16-1752(UTC)

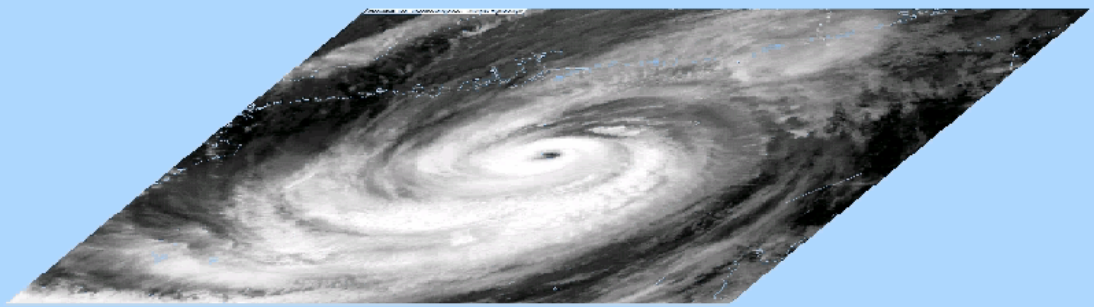
100hPa

150hPa

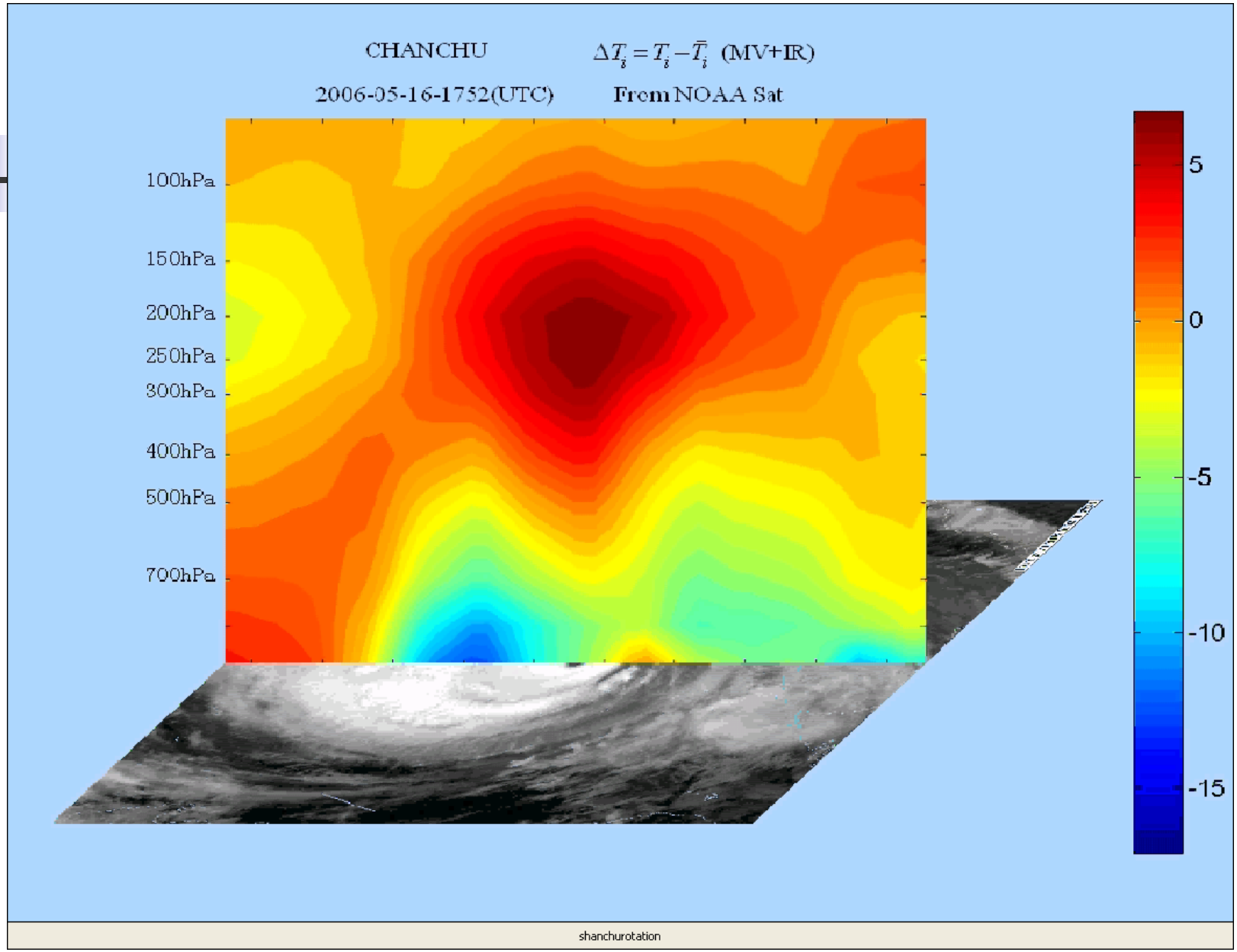
250hPa

500hPa

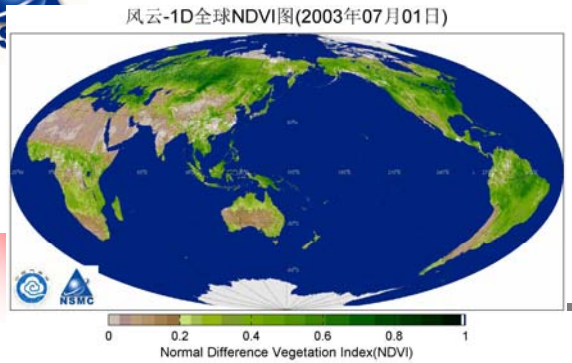
850hPa



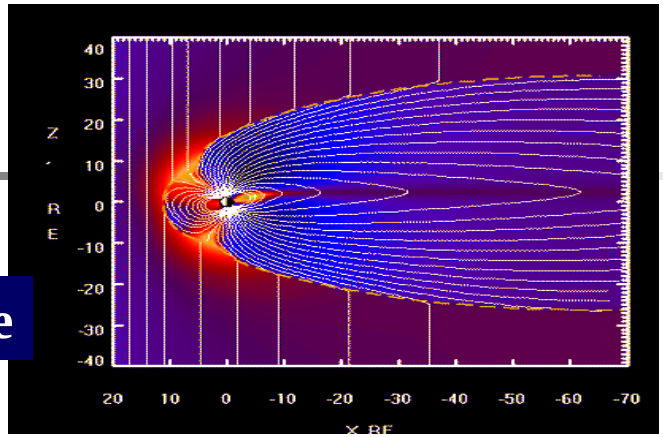
shanchuprf


CHANCHU
$\Delta T_i = T_i - \bar{T}_i$ (MV+IR)
2006-05-16-1752(UTC)
From NOAA Sat
100hPa
150hPa
200hPa
250hPa
300hPa
400hPa
500hPa
700hPa
5
0
-5
-10
-15
shanchurotation

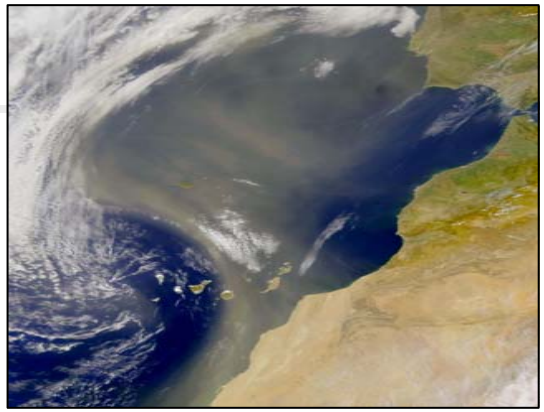
Potential Applications



Applications on Agriculture

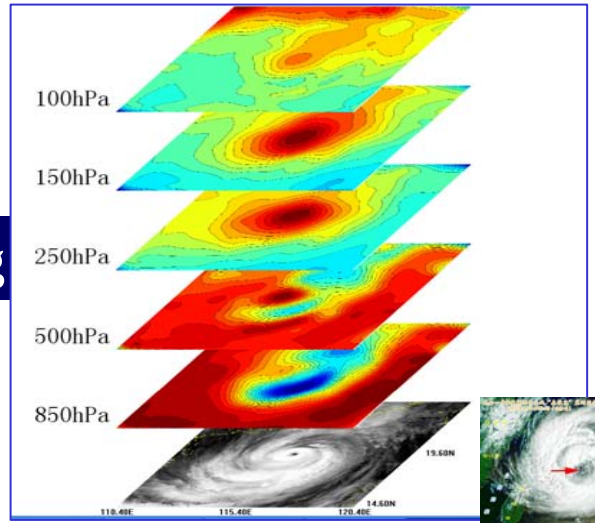


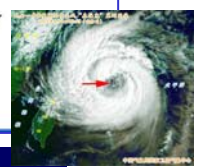
Space weather Monitoring



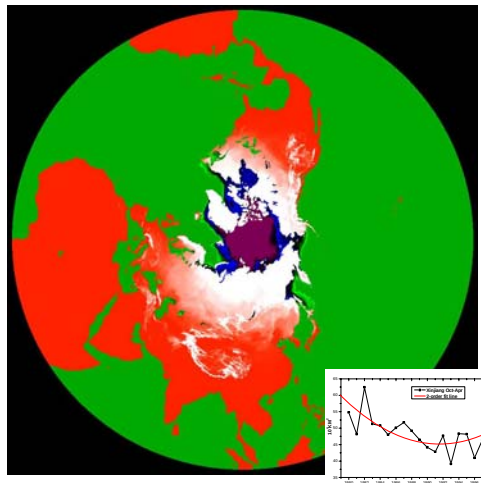
Environment Monitoring

Natural calamities Monitoring



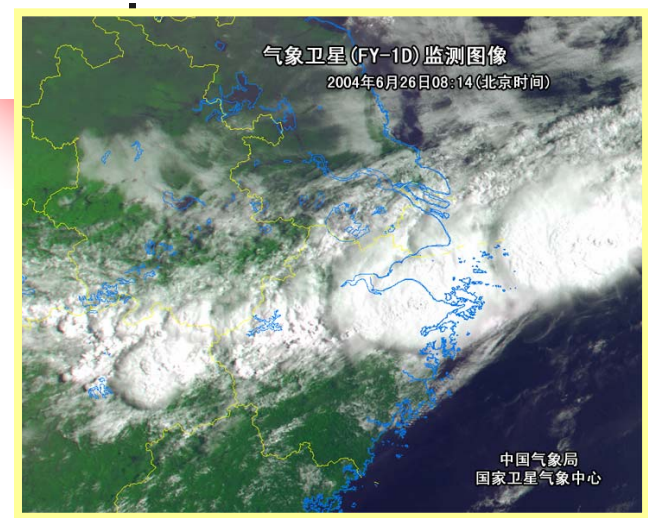


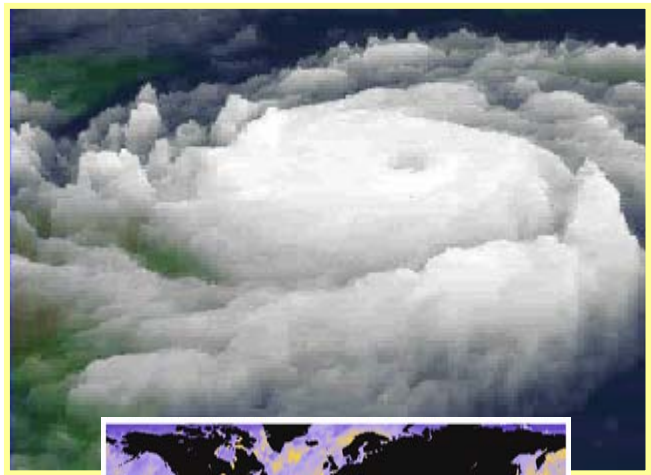
Weather Analysis

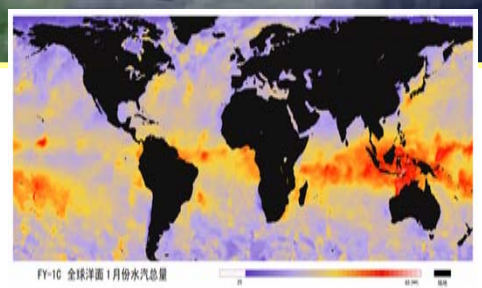


Climate research

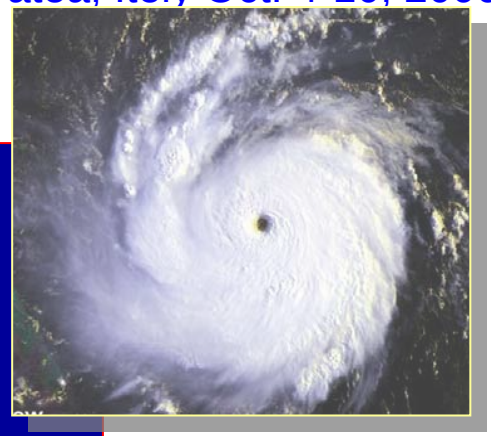
Weather Analysis

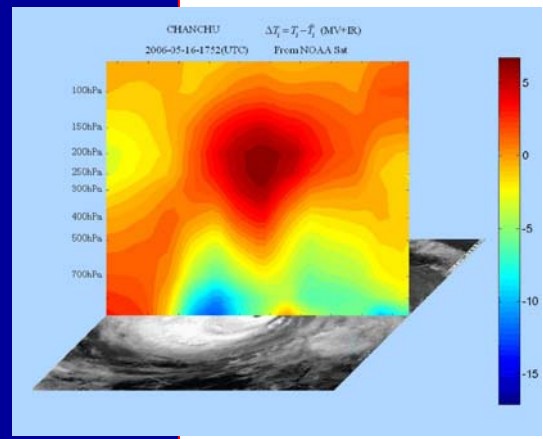




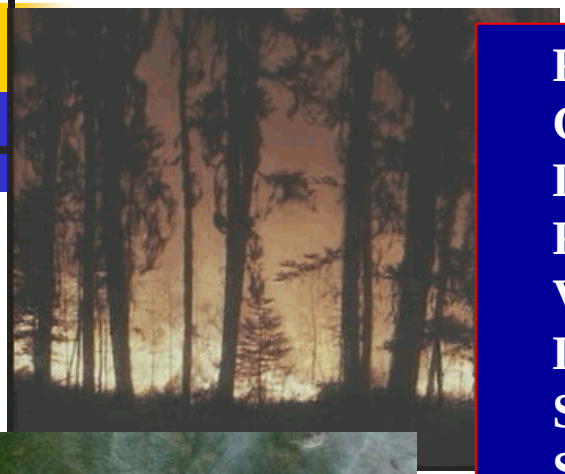


- Atmospheric Temperature Profile
- Humidity Profile
- Geopotential Height
- Atmospheric Stability Index
- Outgoing Long-wave Radiation
- Total Precipitable Water
- Precipitation Rate at the ground
- Cloud Top Temperature
- Cloud Top Height
- Cloud Optical Thickness
- Cloud Type
- Cloud Cover
- Fog Detection
- Cloud water total column
- Tropical Cyclone Intensity Estimation
- Wind Vector over Polar region
- Ice Water Paths Index

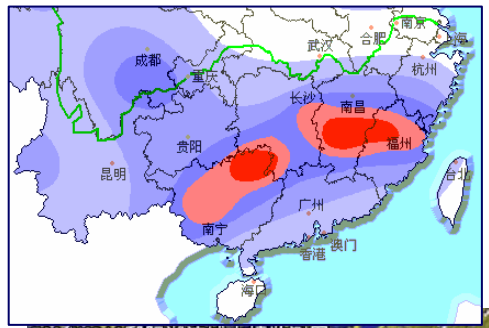


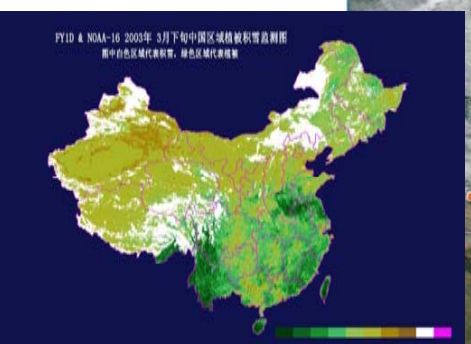


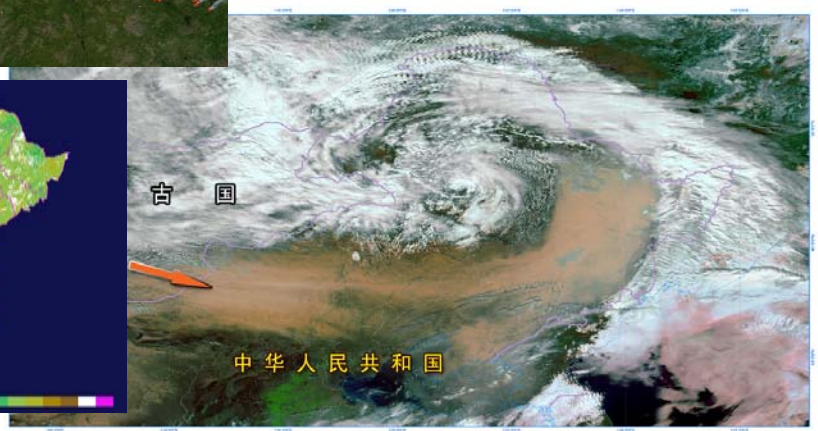
Natural Calamities Monitoring

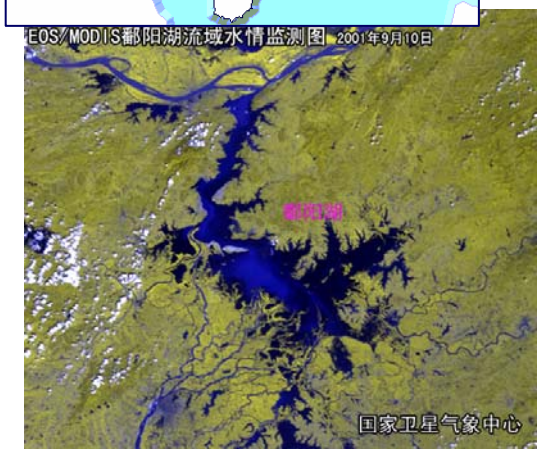


- Flooding Index
- Global Fire Area
- Land Surface Temperature
- Fog Detection
- Vegetation Index
- Land Cover
- Snow Cover
- Snow Depth
- Snow Water Equivalent
- Surface Soil Moisture
- Surface Albedo









Thank you!