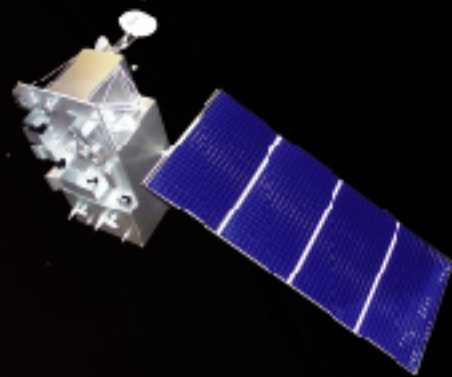




风云

# FENGYUN *Bulletin*

2010 VOL.4

## ■ Highlights

*Launching of FY-3B a Complete Success*

*NSMC participates in the seventh plenary  
session of GEO and its exhibition*

*The 1st Asia/Oceania users' conference*

*NSMC becomes a new member of CEOS*



*National Satellite Meteorological Center  
(National Center for Space Weather), CMA*

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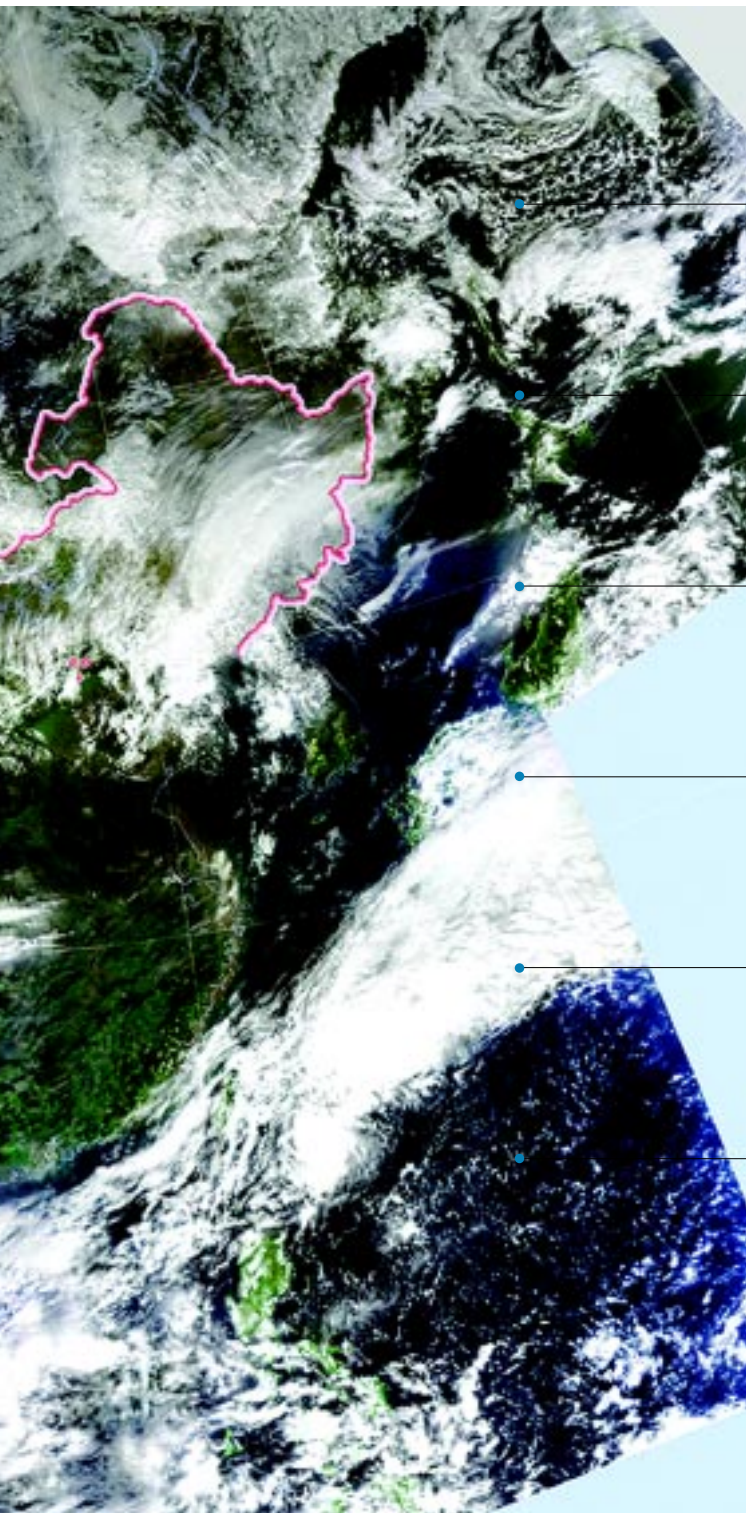
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The First Multitrack Mosaic Image from Visible and Infrared Scanning Radiometer(VIRR) of FY-3B in China(November 7, 2010)



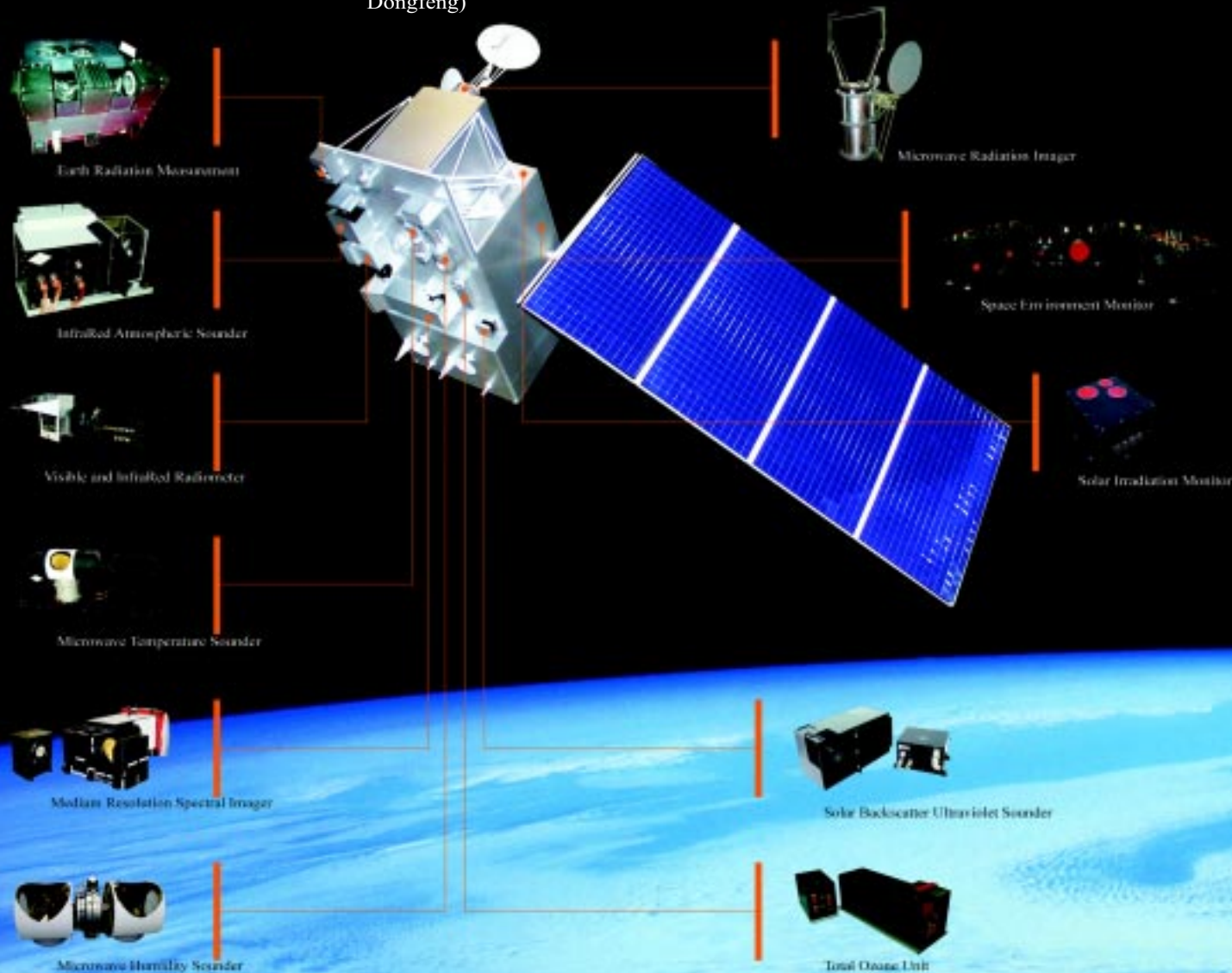
## ➔ Launching of FY-3B a Complete Success

At 02:37am from the Taiyuan Satellite Launch Center, November 5, 2010, the carrier rocket CZ-4C lifted off to send FY-3B satellite into predetermined orbit. The launching process is completely successful.

## 01 Highlights

FY-3B is the second testing spacecraft in the new series of China's polar-orbiting meteorological satellite: FY-3s. FY-3B takes up an afternoon orbit and shall join the FY-3A, which is flying in a morning orbit, to form the polar-orbiting satellite constellation of CMA. The deployment of FY-3B is expected to improve the monitoring of the earth's weather and environment, for example, the time needed for the globe-covering observation image is 6 hours by the two satellites now -- a significant reduction from 12 hours using only the FY-3A before.

At present, all 11 instrument payloads have been successfully switched on for the commissioning test of FY-3B being conducted at NSMC/CMA. (Yu Jianrui, edited by Luo Dongfeng)



## ➔ NSMC participated in GEO 7<sup>th</sup> Plenary and its exhibition



The Group on Earth Observations (GEO) held its 20th Executive Committee meeting and the 7th Plenary Session in Beijing from Nov. 2 to 4 in Beijing, China. On Nov. 5, GEO the second Ministerial Summit was held in Beijing.

The Plenary meeting is attended by Dr Zheng Guoguang, Co-Chair of GEO and Administrator of China Meteorological Administration (CMA), Ms Manuela Soares, Director, Environment (DIR-I), Director-General for Research, European Commission, Mr Philemon Mjwara, Director-General, Department of Science and Technology, Republic of South Africa, Sherburne Abbott, Associate Director for Environment, Office of Science and Technology Policy, United State of America, and Mr José Achache, Sec-



retariat Director of GEO. Delegates from members, participating organizations and observers are presented at the meeting.

The meeting is chaired by Dr Zheng Guoguang. The major tasks of the meeting is to recognize new members and participating organizations, accept the Mid-Term Evaluation of GEOSS Implementation Plan and GEOSS Data Sharing Action Plan, listening to the reports of the special Committees, draft the GEO Beijing Declaration and others.

On 3 November 2010, as a side event of the 7th Plenary Session of GEO, an exhibition was hosted by NSMC at the Beijing International Conference Centre. The 3-day exhibition was mainly a showcase for the achievements made by GEO, its member states and participating organizations in establishing the Global Earth Observation System of Systems (GEOSS). Exhibitors included GEO, China, United States, Japan, European Union, some research institutions and relevant sectors. Altogether there were more than 40 exhibition booths. The exhibition attracted many visitors by showing them various advanced technical equipments, vivid video footages, well-designed posters and booklets. (Zhang Xingying, Lu Qingqing)

## ➔ The 1st Asia/Oceania users' conference held

### 01 Highlights

The first Asia/Oceania Meteorological Satellite Users' Conference was held in Beijing, China from 1-2 November, 2010. Over 150 participants included scientists, users, and satellite operators. Topics included current and planned satellite observational capabilities relevant to the Asia/Oceania region, data sharing and utilization, science activities and applications, as well as education and training. Attendees suggested that similar conferences be held on a routine basis. At the end, the offer from the Japan Meteorological Agency was well received to host the second Asia/Oceania Meteorological Satellite Users' Conference in the fall of 2011. This conference was succeeded by (1) promoting the importance of satellite observations and highlighted their utility; (2) advancing satellite remote sensing science by fostering scientist to scientist information exchanges; and (3) providing a forum for education and training by engaging the young people entering in the field. (Wu Xuebao)



The First Asia/Oceania Meteorological Satellite Users' Conference  
(1-2 November 2010 Beijing, China)



## ➔ NSMC - a new member of CEOS

The 24<sup>th</sup> Plenary Session of the international Committee on Earth Observation Satellites (CEOS) was held in 12-15 October 2010 in Rio de Janeiro, Brazil, and 75 representatives from NASA, ESA, NOAA, EUMETSAT, CSA, JAXA member institutions including 28 international organizations such as WMO, GEO, GCOS among others participated in the event. Dr. Wang Jinsong, Deputy Director General of NSMC attended the meeting, at which NSMC, SANSA (South African National Space Agency) and UKSA (UK Space Agency) were all accepted as CEOS new members.

The meeting was chaired by CEOS presidency agency for 2010 - the National Institute for Space Research (INPE), and it was held under 3 agenda items: opening and CEOS work progress, “annual report on CEOS implementation of GEOSS, and organizational development and work plan, with 50 reports being presented. The plenary considered and endorsed the applications from the new members, it discussed the matters regarding the collaborations with UFCCC, GEO and GCOS, and it also invited its member agencies to briefly report their work progress since 2009. The plenary discussed and approved in principle the “CEOS Rio Statement”. Before its conclusion, the Italian Space Agency (ASI) - presidency agency for 2011 chaired a meeting of the new CEOS Secretariat. It was decided that the following two CEOS plenary sessions will be held in Italy in 2011 and India in 2012 respectively.(Zhang Shizhong)

## ➔ International visits

1. Mr. Yang Jun, Director General of NSMC attended the 12th Session of the of the Joint Working Group under the Canada - China Memorandum of Understanding on Cooperation in Science and Technology Related to Meteorology, Hydrology, Environmental Predictions and Climate Change held in Canada in 14-19 September 2010;

2. Mr. Yang Jun, Director General of NSMC participated in the 17<sup>th</sup> Session of the JWG on the PRC-US Cooperation in the Field of Atmospheric Science and Technology held in Silver Spring in 19-25 September 2010;

3. Ms. Wei Caiying, Deputy Director General of NSMC attended the ITU-R SG 7, WP7B and WP7C research and working panel meetings held in Geneva in 4-12 October 2010;

4. Mr. Lu Naimeng, Deputy Director General of NSMC visited Japan in 24-30 October 2010 for learning from and exchanges with Japanese colleagues in the fields of NWP models, research and development of climate system models, operational run of models and management, etc.

5. Dr. David Grimes, Assistant Deputy Minister for Meteorological Service of Canada visited NSMC on 1 November 2010.(Qiu YI, Zhang Shizhong)



## Geostationary meteorological satellites

### 1. FY-2D Satellite

| Date        | Event                                                                                                                                                                                                                       |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9 October   | at 00:00 (UTC), the meteorological service in support of the Honor Day of the China Pavilion at the site of the 41st World Expo Shanghai China concluded and intensified satellite observation mode was suspended.          |
| 13 October  | management for the satellite eclipse in autumn was completed.                                                                                                                                                               |
| 19 October  | at 17:45 (UTC), in emergency response to potential landfall of the Super Typhoon Megi, intensified satellite observations were initiated until the end of meteorological support to the 16th Asian Games held in Guangzhou. |
| 26 October  | between 08:00-09:00 (UTC), the satellite underwent an east-west orbital control and a gesture control.                                                                                                                      |
| 29 November | at 00:00 (UTC), meteorological service in support of the 16th Asian Games Guangzhou came to an end, and intensified satellite observations were completed.                                                                  |
| 8 December  | at 00:00 (UTC), meteorological service in support of the 10th Para-Asian Games began and intensified satellite observation was initiated.                                                                                   |

### 2. FY-2E Satellite Events

| Date        | Event(UTC)                                                                                                                                                                                                                                                                                             |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9 October   | At 00:00 (UTC), the meteorological service in support of the Honor Day of the China Pavilion at the site of the 41st World Expo Shanghai China concluded and intensified satellite observation mode was suspended.                                                                                     |
| 14 October  | At 00:30-01:30 (UTC), the satellite underwent an east-west orbital control.                                                                                                                                                                                                                            |
| 19 October  | Management for the satellite eclipse in autumn this year was completed.<br>At 17:45 (UTC), in emergency response to potential landfall of the super typhoon Megi, intensified satellite observations were initiated until the end of meteorological support to the 16th Asian Games held in Guangzhou. |
| 29 November | At 00:00 (UTC), meteorological service in support of the 16th Asian Games Guangzhou came to an end, and intensified satellite observations were completed.                                                                                                                                             |
| 2 December  | At 08:30-09:30 (UTC), the satellite underwent an east-west orbital control and a gesture control.                                                                                                                                                                                                      |
| 8 December  | At 00:00 (UTC), meteorological service in support of the 10th Para-Asian Games began and intensified satellite observation was initiated.                                                                                                                                                              |

Table 2.1 Image acquisition

| SATELLITE<br>VISSR | October |      |              | November |      |              | December |      |              |
|--------------------|---------|------|--------------|----------|------|--------------|----------|------|--------------|
|                    | PLAN    | REAL | Success rate | PLAN     | REAL | Success rate | PLAN     | REAL | Success rate |
| FY-2D              | 1218    | 1218 | 100.00%      | 1400     | 1400 | 100.00%      | 1128     | 1128 | 100.00%      |
| FY-2E              | 1200    | 1200 | 100.00%      | 1400     | 1400 | 100.00%      | 1127     | 1126 | 100.00%      |

Note: "planned cloud imagery reception" refers to the total number of cloud images that are planned to receive monthly subtracts those cloud images that couldn't be received due to satellite operational interruption (e.g. eclipse, orbit control, etc.)

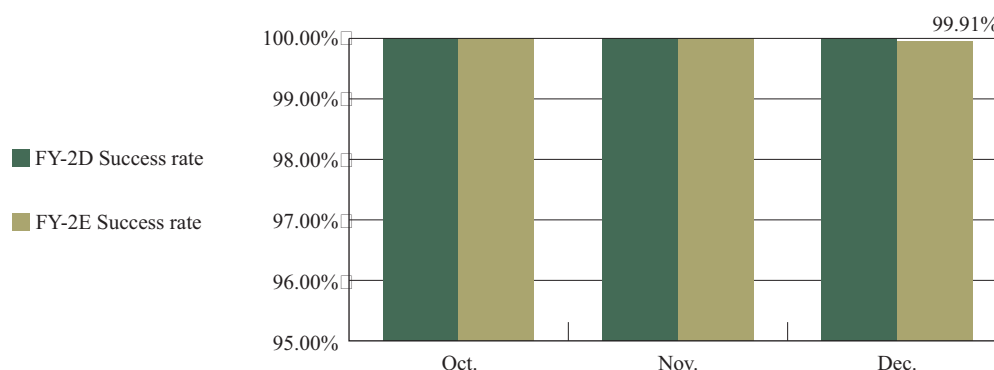


Figure 2.1 The success rate of receiving FY-2 satellite image

## ➔ Polar-orbiting satellites

### 1. FY-3A Satellite

| Date       | Event(UTC)                                                                                                                            |
|------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 3 December | At 06:14 (UTC), data input and output of satellite data transmission system DPT have changed from main storage A into main storage B. |

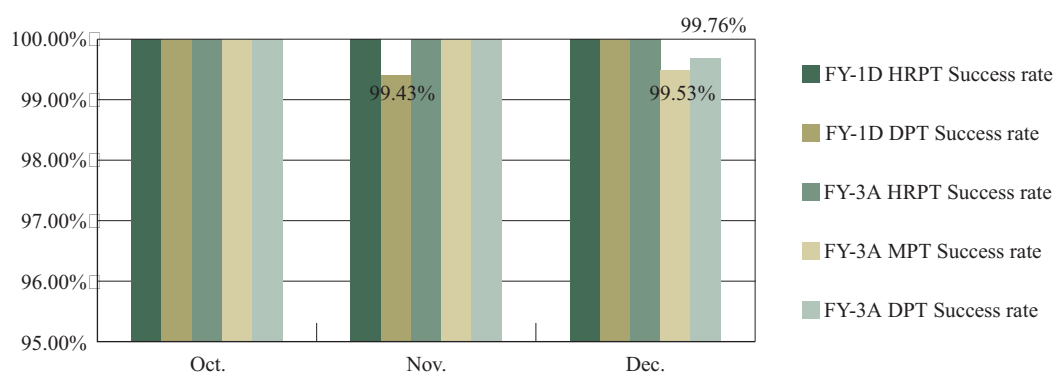


Figure 2.2 The success rate of receiving FY's polar-orbiting satellite image

Table 2.1 Orbit receiving

| SATELLITE<br>VISSR | October |      |              | November |      |              | December |      |              |
|--------------------|---------|------|--------------|----------|------|--------------|----------|------|--------------|
|                    | PLAN    | REAL | Success rate | PLAN     | REAL | Success rate | PLAN     | REAL | Success rate |
| FY-1D HRPT         | 218     | 218  | 100.00%      | 210      | 210  | 100.00%      | 219      | 219  | 100.00%      |
| FY-1D DPT          | 184     | 184  | 100.00%      | 175      | 174  | 99.43%       | 180      | 180  | 100.00%      |
| FY-3A HRPT         | 425     | 425  | 100.00%      | 412      | 412  | 100.00%      | 424      | 424  | 100.00%      |
| FY-3A MPT          | 425     | 425  | 100.00%      | 412      | 412  | 100.00%      | 424      | 422  | 99.51%       |
| FY-3A DPT          | 422     | 422  | 100.00%      | 405      | 405  | 100.00%      | 422      | 421  | 100.00%      |

## ➔ Meteorological services for major social events

In October-December 2010, FY-series satellites provided various special meteorological support services, including emergency response to typhoons, World Expo, Asian Games and the Para-Asian Games. During this period, 62-day intensified observation with dual FY-2-satellites was initiated to obtain more frequent satellite images at an interval of 15 min, and to generate a variety of satellite images and dynamic products, which played an important role in the meteorological services.

During the Asian Games and the Para-Asian Games held in Guangzhou, the National Space Weather Monitoring and Warning Center and the Guangdong Provincial Meteorological Bureau provided supports to the telecommunication quality between satellites and the ground stations in Guangzhou areas by using self developed facilities.

# O3 Major Projects



## ➔ Introduction to FY-3B/VIRR

On 5 November 2010, China's new generation polar-orbiting meteorological satellite FY-3B was launched. The FY-3B satellite main payloads include visible and infrared scanning radiometer (VIRR), infrared spectrometer (IRAS), microwave thermometer (MWTS), microwave hygrometer (MWSH), medium-resolution spectral imager (MERSI), Solar Backscatter Ultraviolet Spectrometer (SBUS), total ozone unit (TOU), microwave imager (MWRI), Earth's radiation monitor (ERM), solar irradiation monitor (SIM) and space environment monitor (SEM). As a series of reports, VIRR is firstly introduced this report.

VIRR has 10 detection channels, which is an improved similar FY-1C/D satellite payload. The difference is that VIRR at FY-3 satellites has changed its channel central-wavelength from 0.93  $\mu\text{m}$  to 1.34  $\mu\text{m}$  to enhance the detection of cloud properties. Its performance criteria including sensitivity have been significantly increased to enhance the inversion accuracy of various atmospheric, terrestrial and sea surface calibration products, and to ensure a longer sequence of satellite datasets for climate studies.

Based on the spectral characteristics of surface objects, VIRR chooses the wave band of atmospheric window with a higher transmissivity, ranging from visible to long-wave infrared spectrum for continuous Earth observations and calculations of the parameters that reflect characteristics of various derived objects. Channels 1 and 2 give a sharp contrast of chlorophyll absorption and can be used for land-surface vegetation monitoring. Channel 3 focuses on the radiation peak at 800K objects (close to the temperature of grassland fire), which is suitable to detect high-temperature fire points by showing a clear contrast between fire-point pixels and surrounding ones. Channels 4 and 5 are thermal infrared split window channels within the peak radiation range at normal temperature (about 300K) at surface, and they can be used for inversions of both Earth's surface and cloud top temperatures. Channel 6 can be used for the identification of cloud and snow for their larger absorption rates. Channels 7, 8 and 9 are visible channels with higher sensitivity and narrower dynamic range, and can be used for ocean color monitoring. Channel 10 captures water vapor absorption. By comprehensively using the above detections, various Earth's surface and atmospheric parameters can be quantitatively derived. (Wu Ronghua)

| Parameters                              | Index                                                                                         |
|-----------------------------------------|-----------------------------------------------------------------------------------------------|
| Earth-Scan angle                        | $\pm 55.4^\circ$                                                                              |
| Rotation speed of scan radiometer       | 6 rev/sec                                                                                     |
| Number of sampling points per scan      | 2048                                                                                          |
| Ground resolution (sub-satellite point) | 1.1 km                                                                                        |
| MTF                                     | $\geq 0.3$                                                                                    |
| Channel alignment                       | alignment accuracy of sub-satellite points < 0.3 pixel                                        |
| Scanning jitter                         | 0.72                                                                                          |
| Level of quantification                 | 10 bit                                                                                        |
| Accuracy of calibration                 | For visible and near infrared channels: 5% (reflectivity)<br>For infrared channels: 1K (270K) |

## ➔ Acceptance of the Forecasting Service Platform for the Meridian Project

The forecasting service platform for the Meridian Project is supported by the hardware of three components, the "computer network and storage devices", "large screen consultation system" and "operational application software". Combined with the functional software, it achieves the functions of the Meridian Project, such as data collection and preprocessing, data storage and services, product generation, space weather forecasting, and product services and evaluation, etc, basically completing the construction tasks in forecasting and service of the Meridian Project. The completed platform will effectively improve space weather forecasting services and enhance the capabilities of space weather operations, which is of great significance to persist the scientific development of the national space weather. (Zong Weiguo)

## ➔ Acceptance of the Ionosounder at Kezilesukeerkezi

The ionosounder station at Kezilesukeerkezi in Xinjiang is one of the four ionosounder stations under construction, supported by the meteorological monitoring and forecasting project. Kezilesukeerkezi is the most western canton in Xinjiang in China, and the ionosounder station at Kezilesukeerkezi will be an important station in the international and domestic ionospheric monitoring network after its completion. It's a valuable supplement to the domestic existing ionospheric monitoring network, including the observing system of the Meridian Project. Its monitoring data will be of great significance to the study and investigate of ionospheric characteristics over the west China. (Mao Tian)



Figure 3.1 Ionosounder in Kezilesukeerkezi

## ➔ Acceptance of the Ionospheric Scintillation Stations of Guangzhou, Shaoguan, Maoming and Xiamen

The ionosphere scintillation often leads to the error code and signal distortion of the signal received by the ground receiver, thus affecting the reliability and precision of the navigation and communication systems. Therefore, the observation and research of ionospheric scintillation is not only an important means to study the irregular structure and the changes in ionosphere, but also a great concern of the navigation and communication systems around the world. South China is located near the equatorial anomaly region and it's the best place for monitoring the anomalies in the ionosphere. Centering on Guangzhou station, the four ionospheric scintillation stations, separately at Guangzhou, Shaoguan, Maoming and Xiamen, will initially constitute the monitoring network for the high incidence area of ionospheric scintillation, their data is of great value to investigate the ionosphere in the equatorial anomaly region, and these stations may become strategic sites for the CMA's ionospheric observations. (Mao Tian)

## ➔ Acceptance of the Telescope of Shidao in Shandong



Figure 3.2 The solar photosphere and chromosphere telescope

The photosphere and chromosphere telescope is the first ground-based Sun observation device constructed by the China Meteorological Administration, located in the Meteorological Observatory of Shidao Town near Weihai in Shandong Province. The telescope has 4 observation bands. The caliber of  $H\alpha$  lens is 18cm. It can conduct the overall and local imaging, and uses a single CCD to conduct the data collection. The calibers of the other 3 bands are 15cm, and all of the three bands share one CCD to conduct the data collection. The size of the field-of-view for the overall Sun observation of the 4 bands is  $34' \times 34'$ , and the size of the local field-of-view is  $6' \times 6'$ . (Zong Weiguo)

## ➔ Installation of the Ionosounder at Dulan, Xi'an, and Nanning

The constructions of the three ionosounder stations of Qinghai, Shaanxi and Guangxi are completed. The testing operation of the observation devices is stable, the data reception is normal, and various functions work expectively. This means that the northwest and southwest of China will obtain the firsthand ionospheric data and offer important data support in space weather operations and research in the national aviation, defense, military, and communications etc. (Dun Jinping)

## [ 04 ] Applications



### ➔ Record-breaking Heavy Rainfall in Hainan Since 1961

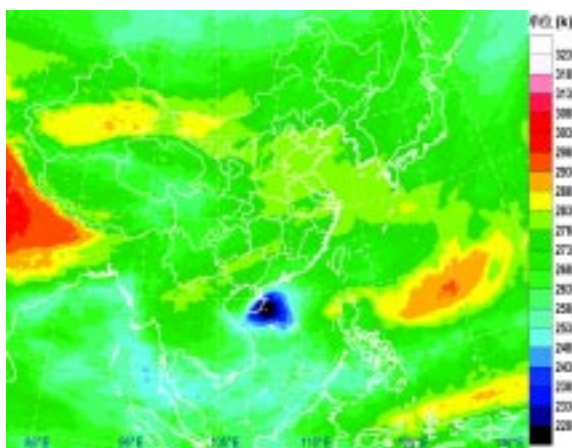


Figure 4.1 The 10-day TBB average from FY-2E

Starting from late September, the intertropical convergence zone over the western Pacific noticeably pushed north, leading to an active phase of the tropical convection over the northern part of the South China Sea. Meanwhile, due to cold air, the subtropical high in West Pacific weakens rapidly, which was dominated by the stable tropical low pressure system in the vicinity of Hainan province, where the very active tropical convective clouds led to a sustained severe precipitation process on the Hainan island. The 10-day TBB chart in early October showed that a lower temperature (228~233K) zone existed over Hainan (Figure 4.1). In 1-19 October, the average rainfall registered 1060.1 mm, with an average number of heavy rain days up to 6.6, which was five times higher than normal in the same periods in recent history, and it was the longest for the same periods since 1961. (Li Yun)

### ➔ Typhoon Megi wild across Southeast Asia



Figure 4.2 Megi watch by FY-3A at 10:25, 18 October 2010  
(Beijing time) as a super typhoon

Megi, the No. 13 tropical cyclone in 2010, was generated over the Northwest Pacific at 20:00, 13 October. At 08:00, 17 October, it became a super typhoon, with the wind speed near its center kept at 72 m/s for a time (Figure 4.2), hence the strongest typhoon over the Northwest Pacific and the South China Sea in recent 20 years, and it was also the strongest typhoon worldwide in 2010. It first landed on the northeastern Luzon, the Philippines, and then on the southeast coast of Fujian on 18 and 23 October. The high winds and heavy rainfalls had severe impacts on transportation, agricultural production, offshore fishing, and human safety in the Philippines and Fujian, Taiwan, Zhejiang and Guangdong, China. (Li Yun)

## ➔ Satellite Remote Sensing Shows more fire in Heilongjiang in autumn 2010

In October 2010, meteorological satellites detected 2556 fire spots, 49 of which were located outside China. They were distributed in Heilongjiang, Inner Mongolia and Jilin, where Heilongjiang witnessed clearly more fire spots over last year.

At 12:47 on 22 October, one satellite discovered several fire spots in Heihe, Wudalianchi, Xunke and Nengjiang in the same province, most of which affect an area of less than 5 pixels respectively (Figure 4.3). (An Siying, Zhang Yeping)

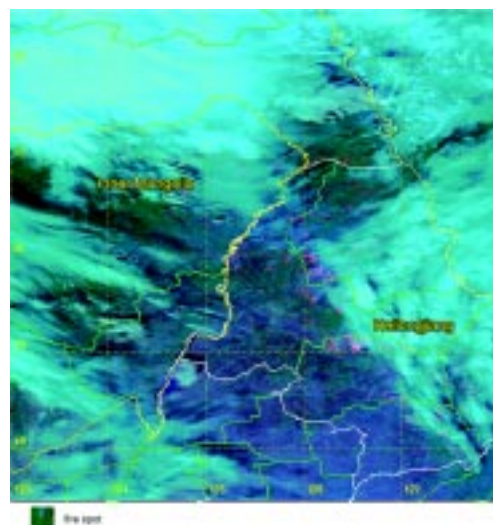


Figure 4.3 A fire image in Heilongjiang from FY satellite at 13:23, 9 October 2010 (Beijing time)

## ➔ Northeast China and Central Northwest China met widespread and persistent snowfall

Affected by the eastward shift of the cyclonic cloud system in early November 2010, mid-northern part of the Xinjiang AR and most Northeast China witnessed moderate to heavy snow, and some areas even met blizzards. In mid November, as a frontal cyclonic cloud system continued strengthening, a snow process swept across central Northwest China and most Northeast China. Among others, mid-eastern part of the Liaoning and western Jilin were even hit by heavy snow or snowstorms. Later in the month, small to moderate snow took place again in the above areas, of which snowstorm occurred in Yili River valley.

This snowfall process mainly concentrated in Northeast China and Inner Mongolia. In late November, some places including Youyinqian Banner, Horqin, Hing'an League of the Inner Mongolia Autonomous Region was hit by snow-related disasters. The FY3B/VIRR data showed that on 28 November, the eastern Inner Mongolia was mostly covered by snow (Figure 4.4). Based on satellite observation (Figure 4.5), the estimated snow depth in the western part of Youyinqian Banner and eastern part of East Uzemchin Banner, Xilin Gol League was significantly higher than the surrounding areas. The snow depth in Midwest Youyinqian Banner and in most of eastern part of the East Uzemchin Banner was 10cm or above, and it was higher than 20cm in some areas. The snow depth in the areas around the road segments in Youyinqian Banner and East Uzemchin Banner exceeded 10cm. (An Siying, Zhang Yeping)

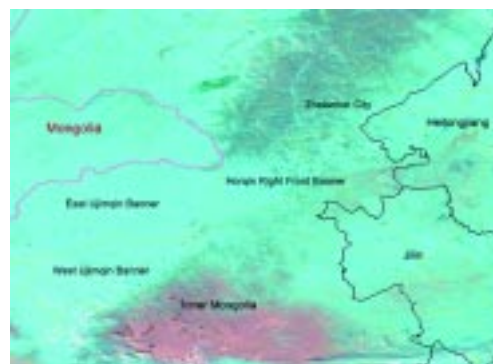


Figure 4.5 FY3B/VIRR snow cover image on 13:00 28 November 2010 (Beijing time)

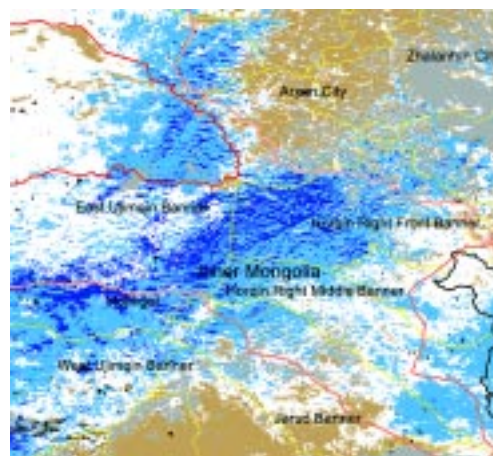


Figure 4.6 Snow depth image from satellite on 10:15 28 November 2010 (Beijing time)



## An Introduction to HDF format and its application in the data storage of FY satellites

# 05

## Data Sharing

As a component of the data sharing system of the National Satellite Meteorological Center, the FY Satellite and Remote Sensing Data Service Network (URL:<http://satellite.cma.gov.cn>) is designed to share data and products from a dozen satellites in multiple file formats, including FY meteorological satellites. This section gives a brief introduction to HDF format and its application in the data storage of FY meteorological satellites.

HDF (Hierarchy Data Format), a self-explanatory hierarchy data format with multiple objects, is a software and function library developed by the USA National Central for Supercomputing Applications (NCSA) in 1987 for storing and disseminating scientific data, mainly for storing various types of scientific data produced from different computer platforms. It is applicable for various computer platforms and easily scalable. With further development, HDF has been widely used in environmental science, Earth science, aviation, marine, biology, and many other areas for storing and processing multiple complex scientific data.

HDF has two versions: HDF4 and HDF5. By overcoming the deficiencies of HDF4.X, HDF5 has a powerful and flexible data module that supports management of files larger than 2 GB (the limit for HDF4.X) and concurrent I/O. Thread safe concept was taken into consideration in the process of design, which will be achieved soon. For further details on HDF5, please browse the HDF Group Website (URL: <http://www.hdfgroup.org>).

HDF5 format has become the standard storage format for data and products from FY series meteorological satellites, which is now mainly used in storage of Data L1 and related data products from FY-2 Satellites (FY-2C, FY-2D, FY-2E), FY-3 Satellites (FY-3A and FY-3B) among others.

### 1. HDF5.0 Data Format for FY-2 Satellites

The L1, L2, L3 data storage for FY-2C/D/E are all in HDF5.0 format. The HDF files of FY-2 consist of two major parts: (1) file attributes for describing the additional information of files; (2) scientific datasets for storing various scientific data. For different data and products, the format definition for scientific datasets falls into two categories, i.e. NOM and NOM-based products. NOM products are produced and stored in HDF5 format, with datasets bearing Dataset names in HDF format, by which corresponding data including observation time, image data, angle data, cloud classification data, etc., can be accessed.

### 2. FY-3 satellite data in HDF5.0 format

A HDF file for FY-3 satellite data has 3 sections, i.e. file attribute, scientific dataset and virtual data. In the attribute section of a FY-3A/B data file, scan time, orbital parameters, number of scan lines and instrument status, etc. are described. In a dataset, remote sensing data, positioning and calibration data, etc. are recorded. A dataset also includes some attribute parameters that may be used to scan the data in it. Virtual data refers to tabular of fixed data domains, which are defined by data name, data category and exclusive data domain. Virtual data are used to keep tabular information in a FY-3 data file. (Xian Di, Li Xue)



## ➔ A new generation operational system on duststorm monitoring by Fengyun established

Funded by the key project of the National Science and Technology Support Program in the "11th Five-Year Plan" plan, a new generation operational system on duststorm monitoring by Fengyun Satellites has been established. The new system has the global monitoring capacity mainly with FY-2D/2E geostationary satellite, FY-3A polar orbiting satellite, as well as SEVIRI/MSG-2 of EUMETSAT, MODIS/EOS series of NASA as input data. The new system takes the characteristic of the satellite sensor channels and time sampling into account to designs the quantitative inversion algorithm. It can automatically identify the duststorm and other parameters, serving as the science data source displayed by the system. In addition to validate the monitoring results in the near real time, the system also provides the overlay display of the ground meteorological observation information (weather, visibility, cloud cover, etc.). Figure 5.1 is the user interface of the remote sensing monitoring system for sandstorm, and it displays a sandstorm detected by FY-2D on March 20, 2010 and overlay display figure of the ground station.



Figure 5.1 The remote sand sensing monitoring system interface and the sand monitoring chart



12 groups of criteria are used to determine the outbreak of duststorm, including 0.64um reflectivity, 11um brightness temperature, 3.7um brightness temperature, 11 and 12um brightness temperature difference, 11 and 3.7um brightness temperature difference,

NDSI snow cover index, NDVI vegetation cover index, MNDVI enhanced vegetation cover index, 0.47um and 0.64um reflectance ratio ( $R_{0.47}/R_{0.64}$ ), 11um background brightness temperature and the actual brightness temperature difference, as well as the reflectance standard deviation (only for sea). Among them, 7 criteria are mandatory and the other 5 are optional. In the 7 mandatory criteria, once one criterion fails to be met, the image element can not be determined as sand. The more criteria it passes, and the more close the spectrum is to the standard sand spectrum, the higher scores the sand makes. The final sand detection products are determined according to the scores of the sand. The higher the scores, the greater likelihood of it being sand. Figure 5.2 gives the FY-3A sand detection chart of April 25, 2010.



Figure 5.2 The sand detection map by FY-3A on April 25, 2010

Making use of the horizontal visibility data from the GTS international ground data exchange station, as well as IDDI detection from the FY-2 satellite infrared duststorm index monitoring product, the monitoring results can be displayed. Figure 5.3 (a) (b) separately give the IDDI sand monitoring chart before and after the inosculation. (Zhang Peng)

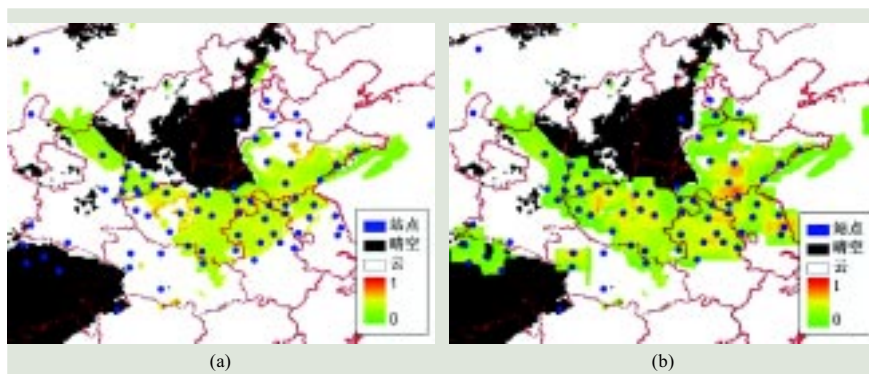


Figure 5.3 The overlap display chart (a) of the cloud, normalized IDDI and visibility before the inosculation; the overlap display chart (b) of the cloud, IDDI inosculation result and the visibility.

## ➔ FY-3A/MERSI VNIR high frequency radiometric calibration tracking based on multiple sites

Five even target sites, including Dunhuang, Libya 1, Libya 4, Arab 2 and Lanai buoy (Figure 5.8) were selected, and the top of atmosphere apparent reflectance was calculated using the vector radiative transfer model V6S. Taking 10 days as a statistical cycle, calibration coefficient (slope) was obtained by conducting a linear fitting to the apparent reflectance of the 5 sites within 10 days and the corresponding MERSI digital counts (dark current subtracted). Based on the calibration coefficient series, the coefficient variation trend with DSL (dates since launch) was tracked with linear model, and the annual decay rate (%) was then obtained.

Figure 5.9 shows the calibration coefficient (slope) variation with DSL in FY-3A/MERSI channel 1 to 4, in which the linear fitting model is shown with black solid line. The annual decay rates of various channels are shown in Figure 5.10. It can be seen that the calibration coefficients present a linear trend with DSL, and annual periodicity exists especially in the short-wave and the water vapor channels. The short-wave channels have large degradation, especially channel 8 with the annual decay rate up to 14%. In the red and near-infrared bands (600 ~ 900nm), e.g. channel 3,4,13,14,15 and 16, the calibration coefficients almost have no change with the annual decay rate below 1%. The RMS%E for the trend analysis is below 2% except for water vapor channels(17, 18 and 19). The error in the input water vapor amount is the main reason for larger deviation in the water vapor channels, especially channel 18. The error in the input surface reflectance may be the main reason for slightly larger deviation in the short-wave channel (400 ~ 550nm), e.g. channel 1,8,9,10 and 11, with RMS%E exceeding 1%. (Sun Ling)

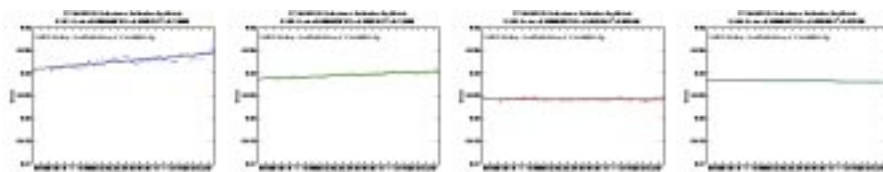


Figure 5.8 FY3A/MERSI calibration coefficient variation trend in channels 1 to 4

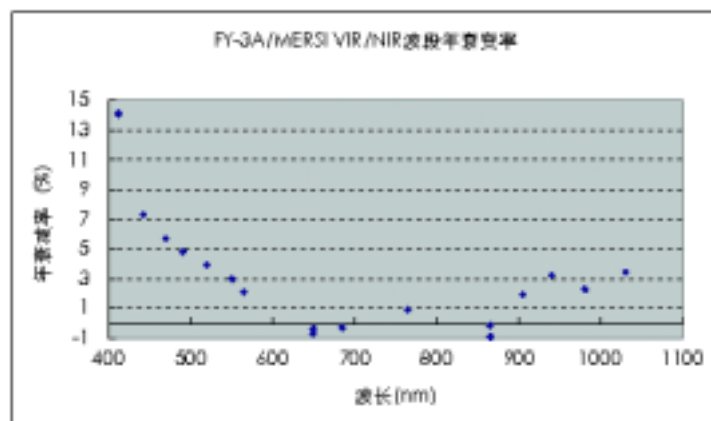
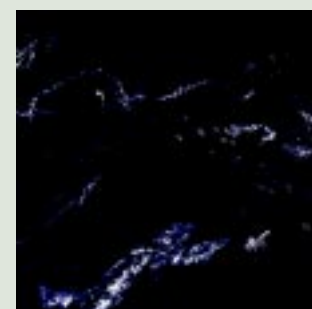
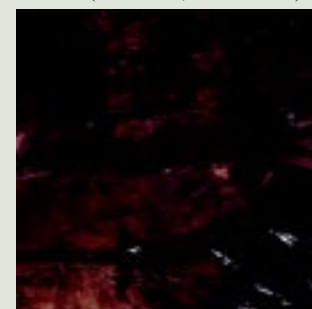


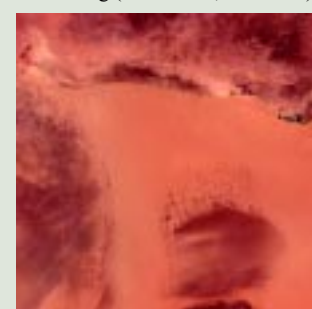
Figure 5.9 FY3A/MERSI annual decay rate(%) for VNIR channels



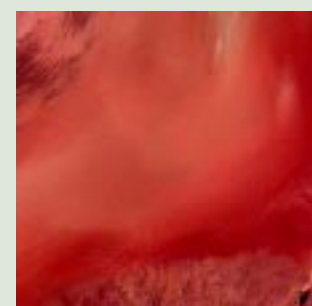
Lanai (20.49° N, -157.11° E)



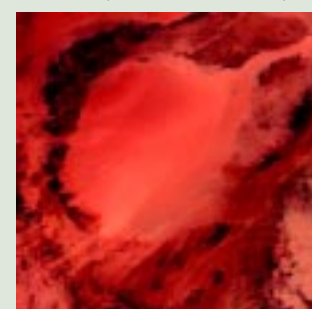
Dunhuang (40.138° N, 94.32° E)



Libya4 (28.55° N, 23.39° E)



Arab2 (20.13° N, 50.96° E)



Libya1 (24.42° N, 13.35° E)

Figure 5.7 FY3A/MERSI true color images for target sites

### ➔ Estimation on the long-wave radiation budget of clear sky surface by FY-3A/B IRAS

After one year's efforts, through the radiative transfer simulation and statistical regression for the 5,056 global atmospheric profiles, the inversion models of the multi-channel radiant emittance of the IRAS instrument of the FY-3A and the to-be-launched FY-3B satellite and the downwelling and upwelling long-wave radiation flux were established. SD, the standard deviation of the models is less than  $14.91 \text{ W / m}^2$ . Making use of the inversion models and the FY-3A IRAS L1 data files, the lattice field products of the surface long-wave radiation budget in September 2008 were processed. The products went through the comparison of the measured data with the United States SURFRAD observation station, and they turned out to have the accuracy of the same level of similar products of the current MODIS. Figure 5.10, 5.11 and 5.12 show the FY-3A IRAS surface radiation budget products during the daytime of September 28, 2008. (Wu Xiao)

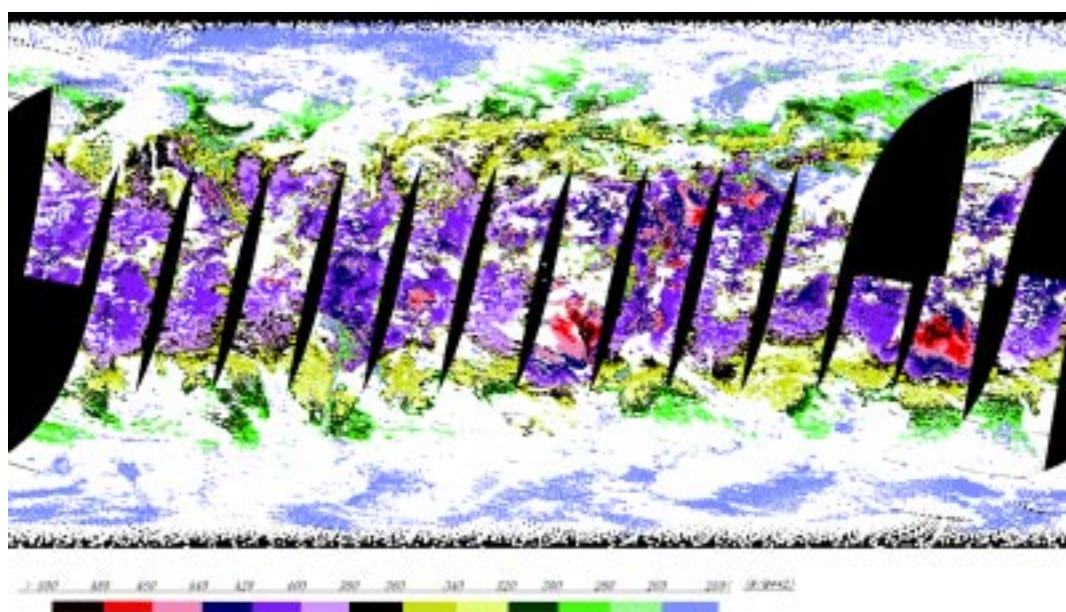


Figure 5.10 FY-3A IRAS downwelling long-wave radiation flux of the global clear sky surface (September 28, 2008)

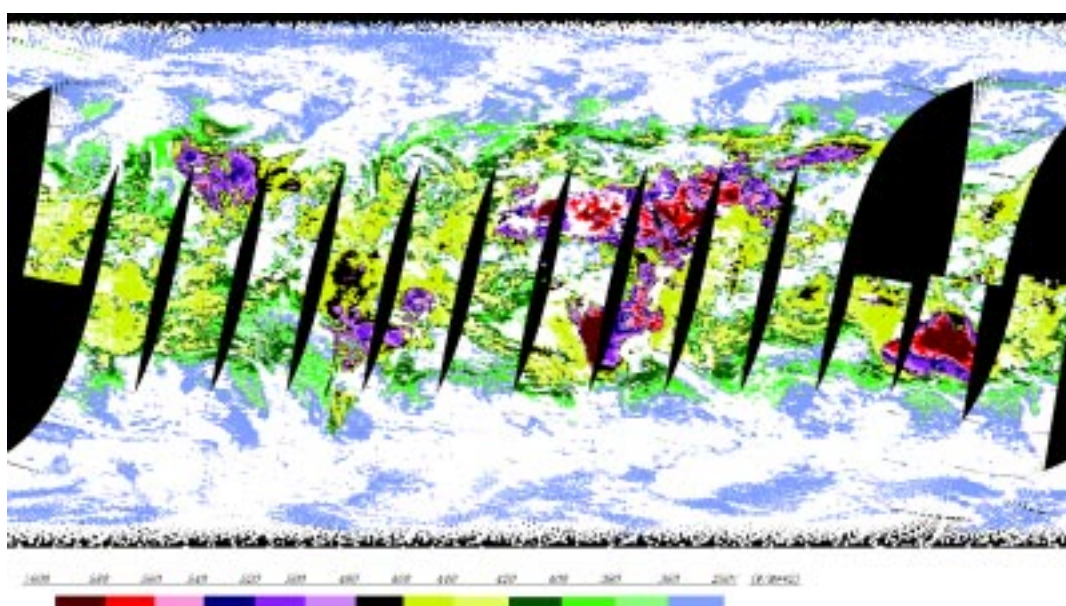


Figure 5.11 FY-3A IRAS upwelling long-wave radiation flux of the global clear sky surface (September 28, 2008)

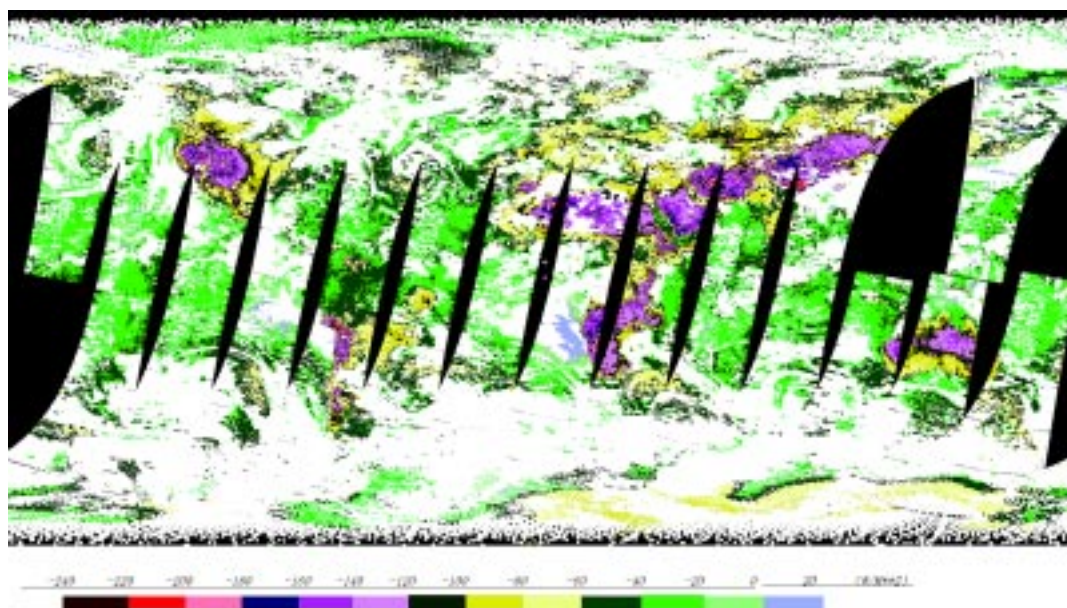


Figure 5.12 FY-3A IRAS net long-wave radiation flux of the global clear sky surface  
(September 28, 2008)

## Publications

- ◆ Xingying Zhang, Jos van Geffen, Peng Zhang, Jing Wang, 2010, TREND SPATIAL & TEMPORAL DISTRIBUTION, AND SOURCES OF THE TROPOSPHERIC SO<sub>2</sub> OVER CHINA BASED ON SATELLITE MEASUREMENT DURING 2004~2009, Proceedings of the Symposium Dragon 2 Programme Mid-Term Results 2008-2010, Guilin, China, 17-21 May 2010, ESA publications division SP-684, ISBN 978-92-9221-248-3.
- ◆ Weihe Wang, Xingying Zhang\*, Xingqin An et al., 2010, Analysis for retrieval and validation results of FY-3 Total Ozone Unit (TOU), Chinese Science Bulletin, 2010 Vol. 55 (26): 3037-3043.
- ◆ Weihe Wang, Xingying Zhang\*, Yongmei Wang et al., 2010, Introduction to the FY-3A Total Ozone Unit (FY-3A TOU): Instrument, Performance, and Results, International Journal of remote sensing, 10.1080/01431161.2010.489073
- ◆ Wenguang Bai, Xingying Zhang\*, Peng Zhang, 2010, Characterization of carbon dioxide over China based on Satellite measurement, Chinese Science Bulletin, Vol.55 No.31: 3612 3618.
- ◆ Yu Tao, Wang Yungang, Mao Tian, Wang Jingsong, Wang Siyu, Shuai Fanghong, Su Weidong, Lijiantong, A case study of the variation of ionospheric parameter during typhoons at Xiamen, Acta Meteorologica Sinica, 2010, 68(4): 569-576.
- ◆ Rae I. J., K. Kabin, J. Y. Lu, R. Rankin, S. E. Milan, et al., Comparison of the Open-Closed Separatrix in a Global Magnetospheric Simulation with Observations: the role of the ring current, J. Geophys. Res., 115, doi: 10.1029/2009JA015068, 2010.
- ◆ Zhao J. S., D. J. Wu, J. Y. Lu, On nonlinear decay of kinetic Alfvén waves and application to some processes in space plasmas, J. Geophys. Res, doi: 10.1029/2010JA015630, 2010.
- ◆ Zhao J. S., D. J. Wu, J. Y. Lu, On nonlinear decay of kinetic Alfvén waves and application to some processes in space plasmas, J. Geophys. Res, doi: 10.1029/2010JA015630, 2010.
- ◆ Du D., P. B. Zuo, X. X. Zhang, Interplanetary Coronal Mass Ejections Observed by Ulysses through Its Three Solar Orbits, Solar Physics, Vol. 262, 2010.
- ◆ Du Dan, A Magnetic Cloud Observed by both ACE and Ulysses, The Proceedings of 2010 International Conference On Application of Mathematics and Physics, Vol.1, 2010.

A satellite image of Earth from space, showing the curvature of the planet. The top half shows Europe and North Africa, while the bottom half shows the Middle East and parts of Asia. The image is taken from a high angle, showing the horizon and the dark space of the universe.

## Contact Point

Fang Meng

National Satellite Meteorological Center

No.46, Zhongguancun Nandajie, Haidian District, Beijing 100081, China

Tel: 86-010-58995409

Fax: 86-010-62173230

E-mail: [fangmeng@cma.gov.cn](mailto:fangmeng@cma.gov.cn)