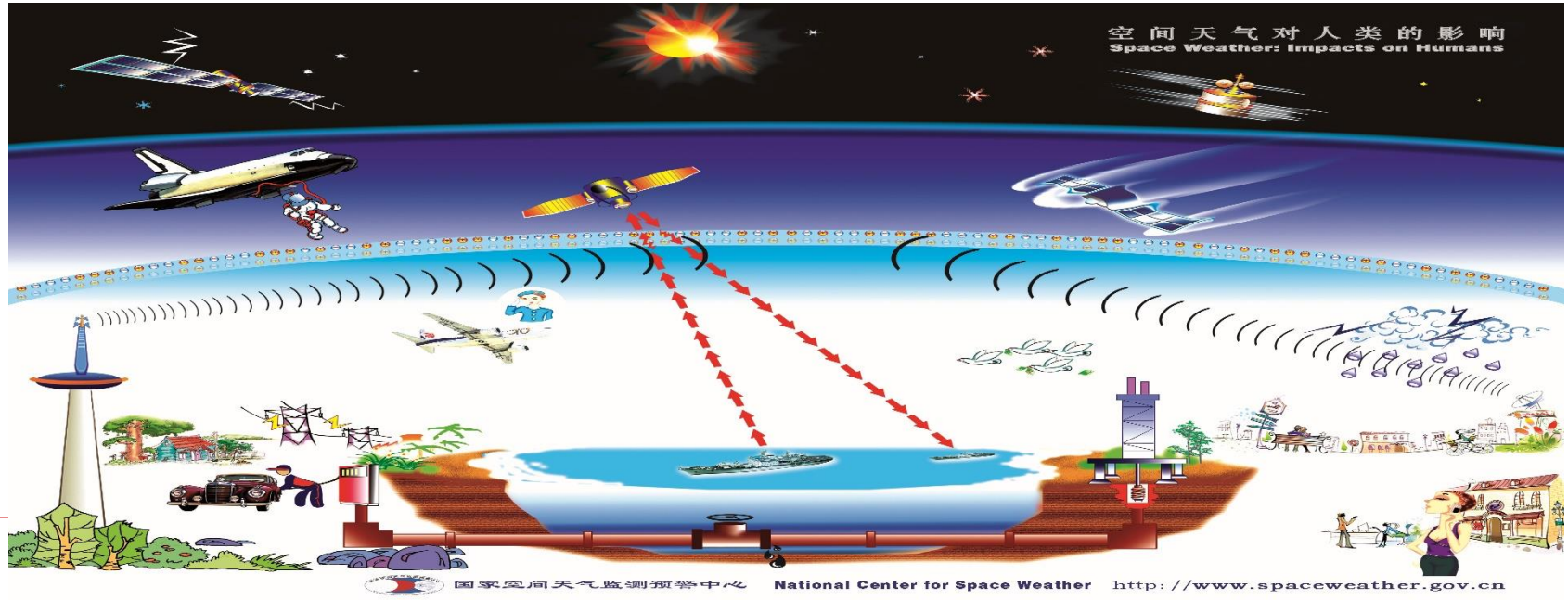
CMA Space Weather Activities

China Meteorological Administration

April, 2021

Outline

- Space Weather Operation in CMA
- International Cooperation Activities
- The proposed activities for the future



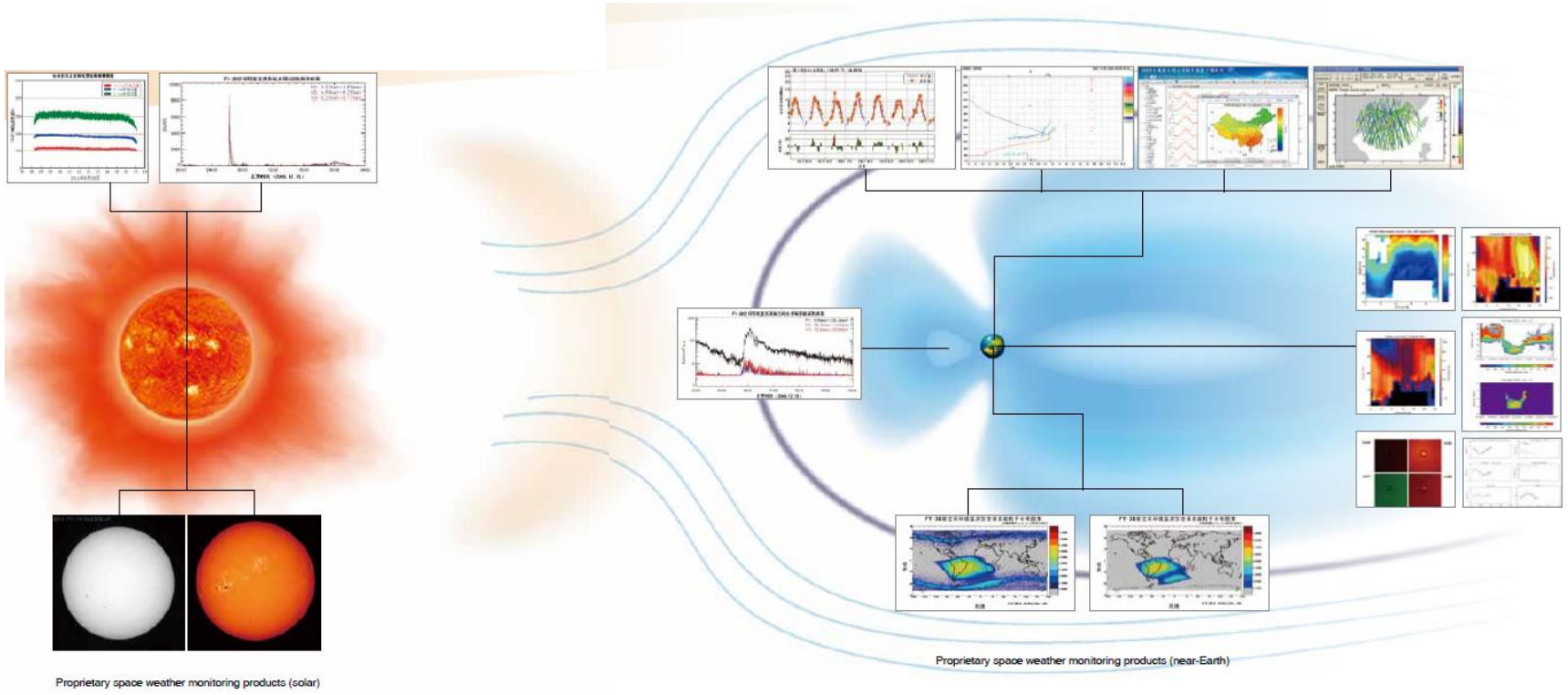
1. Space Weather Operation in CMA

Who Are We？

- In 2002, CMA was authorized by the National Council to establish the National Center for Space Weather (NCSW), assigned to the National Satellite Meteorological Center(NSMC).
- NCSW began to provide space weather operational service on July 1, 2004.
- NCSW has preliminarily developed a complete operational system covering space weather monitor, forecast, and service.

Our Missions:

- **Input**: Reliable space weather observations
- **Output:** Routine and user-tailored products and services

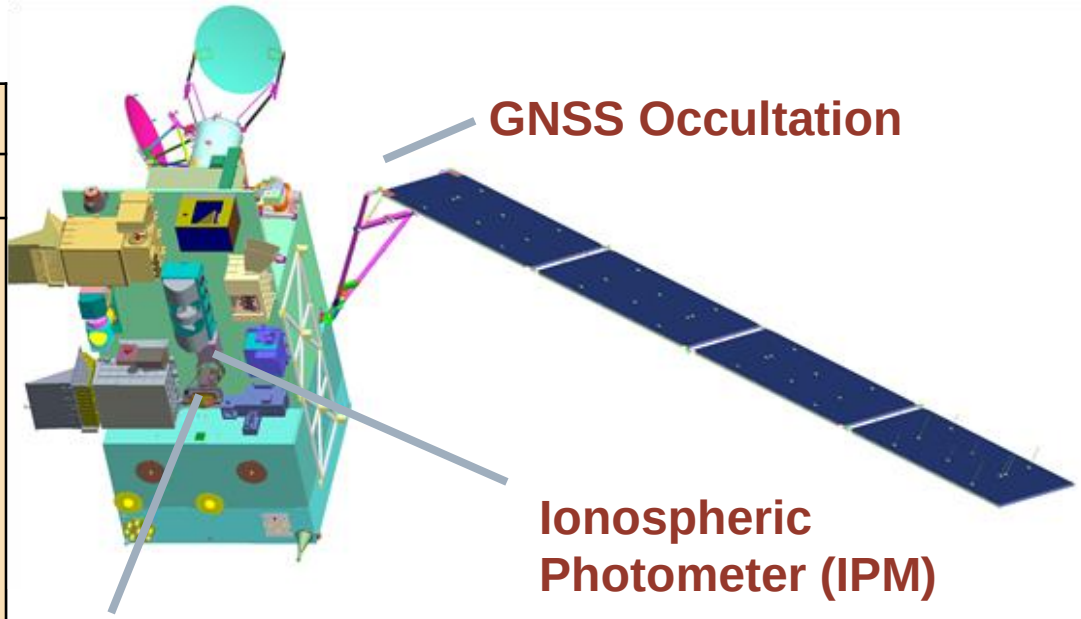


CMA Space-based Observations

The FY satellites have become the ideal platform to monitor space weather. Observations are available for global cooperation.

- The Polar satellites could monitor impacts of energetic particles. The FY-3 could give information of Ionospheric and solar activities.

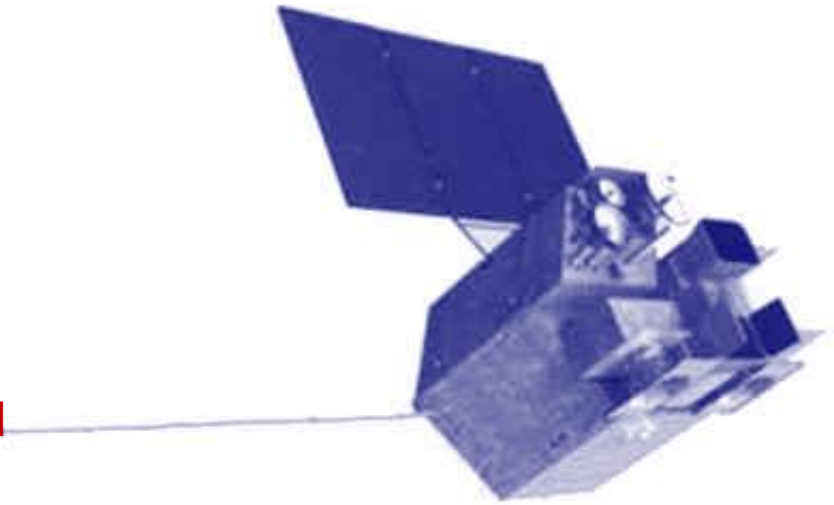
Satellite	Instrument
FY-1D	Energetic particle detectors
FY-3 A/B/C/D/ E/F/G/H (planned in red)	High and medium energy particle sensors , Single-events-upset sensor, Geomagnetic field monitor (FGM), Satellite surface charging potential monitor ,Space radiation environment monitor, Global Navigation Occultation Sounder (GNOS), Ionospheric Photometer (IPM), Wide-angle Aurora Imager (WAI), solar X-EUV imager



CMA Space-based Observations

- The Geo. satellites could measure solar X-ray and energetic particles. FY-4 will provide the solar imaging, Ionospheric image and geomagnetic field observations.

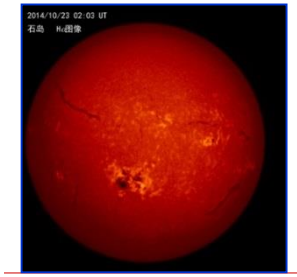
Satellite	Instrument
FY-2 C/D/E/F/ G/H	Space Environment Monitor, Solar X-ray flux Monitor
FY-4 A/B/C (planned)	High, medium and low energy particle sensors , Geomagnetic field monitor (FGM), Satellite charging potential detectors ,Particle radiation dose detector, Ionospheric FUV imager and solar X-EUV imager

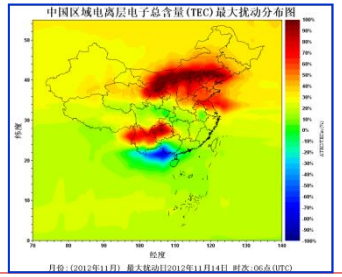


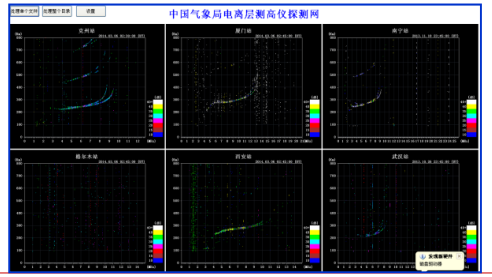
The FY series program is managed by CMA, coordinated by CNSA, and supported by industry contractors.

CMA Ground-based Observations

- **Meteorological disaster monitoring and warning project**
  - ✓ 20+ instruments (Solar, Ionosphere, atmosphere)
  - ✓ 16 observatories
- **Meridian Project**: Civil Forecast Platform
- **GPS/MET**: over 1000 GPS stations to monitor TEC over China
- **Research Project**:
  - ✓ 60+ instruments (Short wave receiver, Ionospheric scintillation receiver)



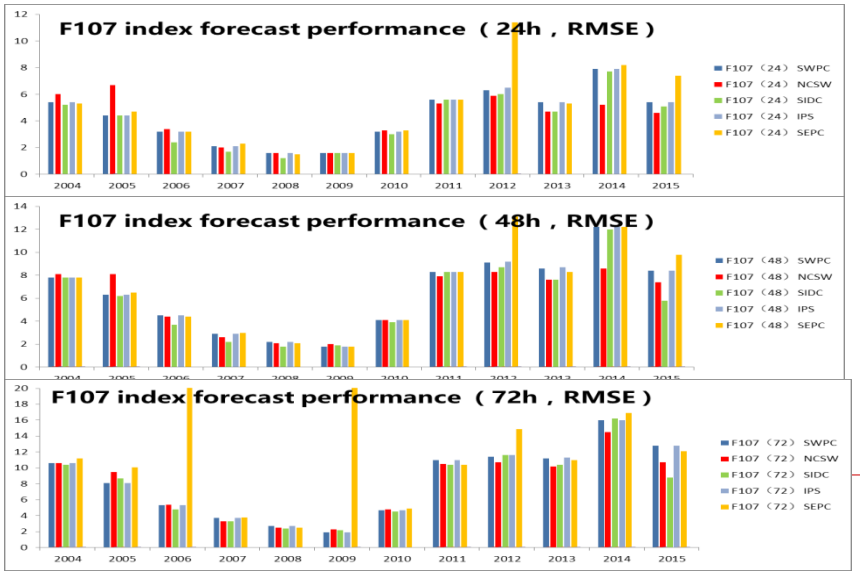


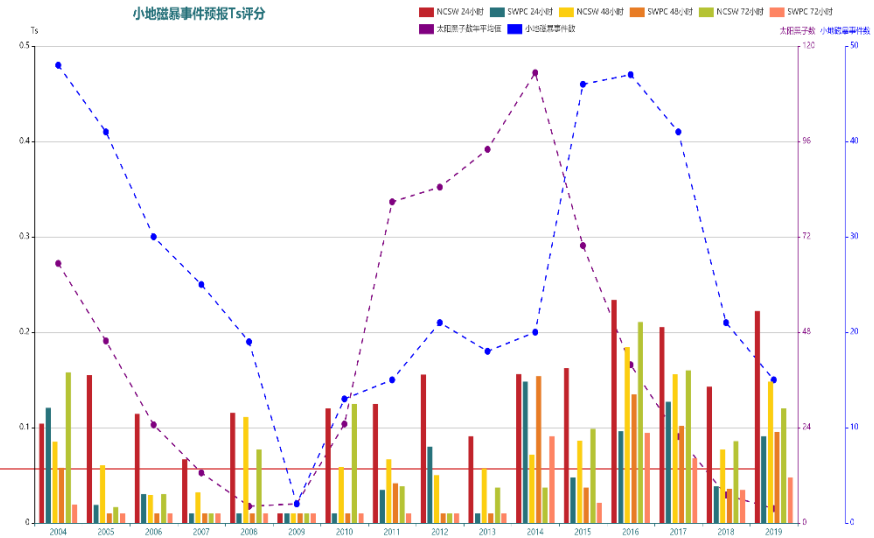


CMA Space Weather Services

☐ Operational products

- **Regions:** Solar, Interplanetary, Magnetosphere, Ionosphere.
- **Timelines:** Long- Mid- and Short-terms, warning and nowcast.
- **Products:** Daily, monthly, annual and user-tailored monitoring and forecasting products.
- **Accuracy:** Comparable to the international level.

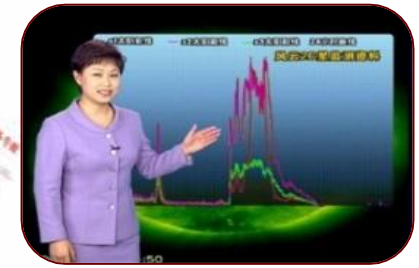




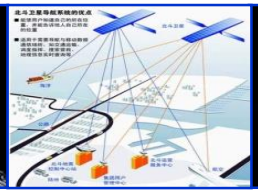
CMA Space Weather Services

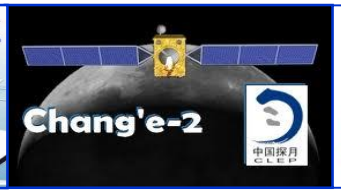
◻ Public Awareness， Education and Applications

NCSW routinely delivers daily, monthly, and annual monitoring and forecasting products and services to users through hard-copy bulletins, internet, phone, SMS, e-mail, public media, Wechat，APP etc.



NCSW also provides special services for customers.





2. International Cooperation Activities

WMO IPT-SWeISS

- 2016, the IPT-SWeISS was established by **CAeM** and **CBS** at the request of **WMO** 68th session of the executive Council (EC-68)
- The team is continuing with the work of the Inter-Programme Coordination Team on Space Weather (ICTSW) initiated in 2010.
- Participation from 22 Countries (2021) as well as 7 organizations
- NCSW/CMA(Xiaoxin Zhang) is co-chairing IPT-SWeISS WMO with SWPC/NOAA(R Rutledge)

2. International Cooperation Activities

- **The main task:**
  - ✓ Integration of Space Weather observations, through review of space- and surface-based observation requirements, harmonization of space-based sensor specifications, monitoring plans for Space Weather observations;
  - ✓ Standardization and enhancement of Space Weather data exchange and delivery through the WMO Information System (WIS);
  - ✓ Coordinating the development of SPW best practices for end-products and services, including, for example, quality assurance guidelines and emergency warning procedures, in collaboration with aviation and other major application sectors;
  - ✓ Encouraging the dialogue between the research and operational space weather communities;
  - ✓ Organization of capacity-building, training and outreach activities towards WMO Members and Space Weather potential users;
  - ✓ Provision of guidance to WMO Members and Programmes on Space Weather matters, and conduct appropriate actions as requested by CBS and CAeM;
  - ✓ Oversee the development and review of OSCAR so that it meets the needs of WIGOS for information concerning user space weather observing system capabilities.

2. International Cooperation Activities

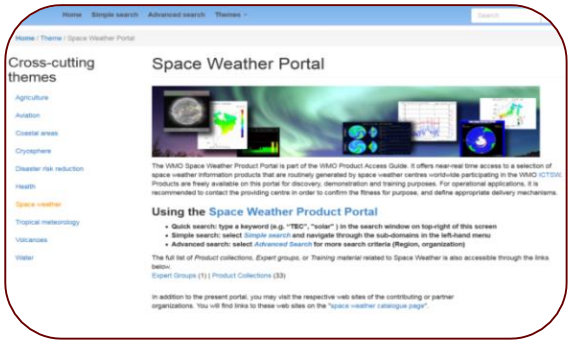
- **Progress to date**

✓ updating a WMO baseline document "Statement of Guidance for Space Weather Observation"

✓ radio frequency coordination for space weather observation

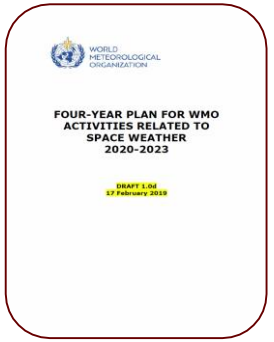
✓ Cooperation with ICAO on the space weather service

✓ WMO Four-year plan for space weather(2020-2023)



SWx Product Portal

ICAO: CONOPS



2. International Cooperation Activities

The China and Russian Federation Consortium for ICAO global space weather centers

- In its 219th Session (17th meeting, 27 Apr, 2020) the Council of ICAO has designated the China and Russian Federation Consortium (CRC)as the 4th global space weather service centers.

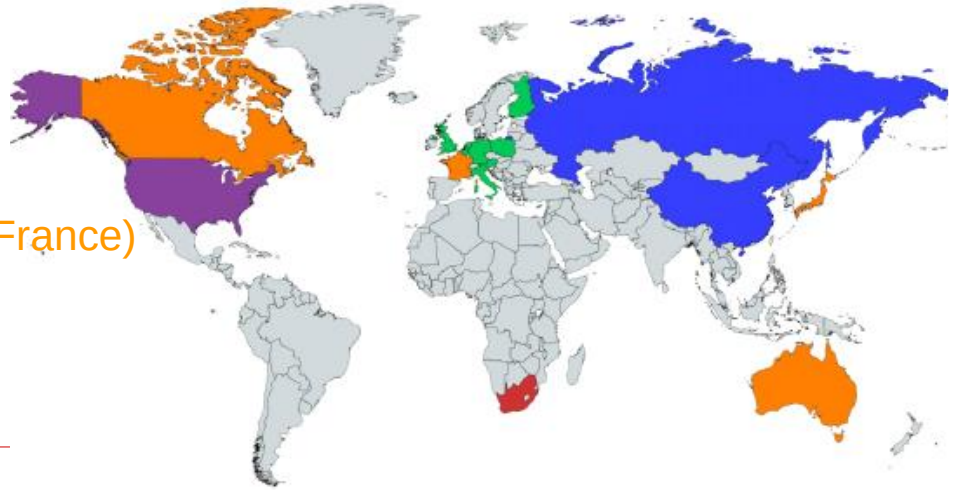
✓ PECASUS (European consortium lead by Finland)

Finland, United Kingdom, Germany, Austria, Poland, Italy, Netherlands, Belgium, Cyprus

✓ NOAA SWPC (United States)

✓ ACJF (Australia, Canada, Japan, France)

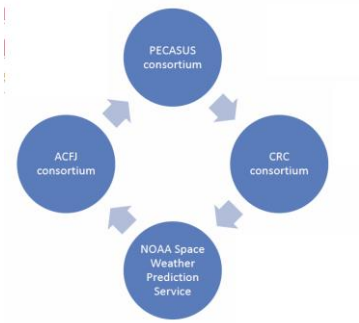
✓ China/Russia Consortium



2. International Cooperation Activities

The China and Russian Federation Consortium for ICAO global space weather centers

- The space weather information service to support international air navigation have commenced operations on 7 November 2019.
- Since march of 2021, the CRC has entered on the phase of test scenario. In the last quarter of 2021, the ICAO space weather service will be implemented by joint operation of four global SWX centers (PECASUS, SWPC, ACFJ and CRC), with each center providing the service for 2 weeks in turn.



2. International Cooperation Activities

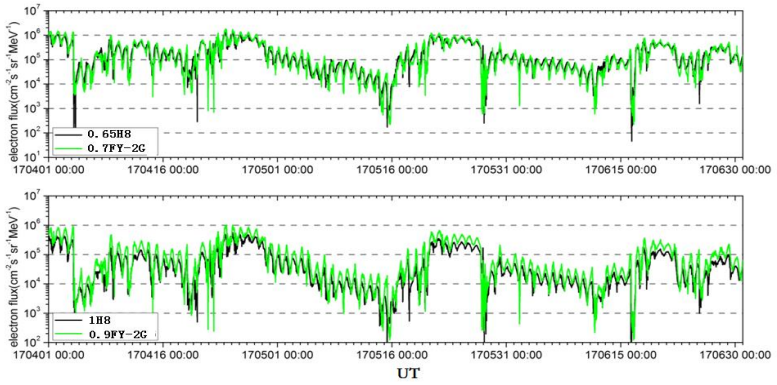
CGMS Space Weather Coordination Group

- The CGMS Space Weather Coordination Group (SWCG) was established by the 46th CGMS plenary on 8 June 2018, building upon the work performed by the former Space Weather Task Team, created in 2015 during CGMS-43.
- The SWCG supports the continuity and integration of space-based observing capabilities for operational space weather products and services throughout CGMS and the user community and the CGMS satellite operators with regard to space weather phenomena.

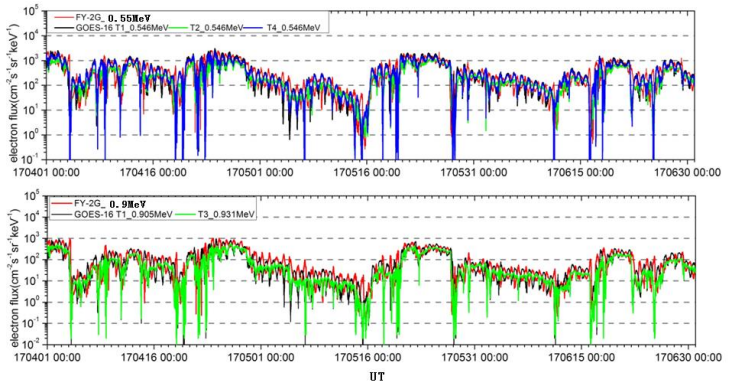
2. International Cooperation Activities

CGMS Space Weather Coordination Group

- The SWCG formed a Task Group on Inter-calibration of High Energy Particle Sensor and performed an inter calibration campaign period from Apr. 2017- Jul. 2017. The initial result shows that the FY-2G energetic particle measurement is consistent with that of Himawari-8 and GOES-16.



FY-2G vs. H8



FY-2G vs. GOES-16

3.The proposed activities for the future

- The new solar cycle, Solar Cycle 25, officially began in December 2019. In order to protect people and systems that might be at risk from extreme space weather events, international community need to maintain long-term continuity of the cooperation of space weather.
- Exchanging information on the space weather observation, payloads and inter-calibration for existing ground-based and space-based instruments.
- Joint action in the frame of WMO and ICAO to improve the global coordination of space weather activities. Provide shared, regular and sustained support to the WMO space weather activities.

Thank You!

谢谢！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