



中 国 气 象 局
China Meteorological Administration

National Satellite Meteorological Center
National Center for Space Weather



FENGYUN Space

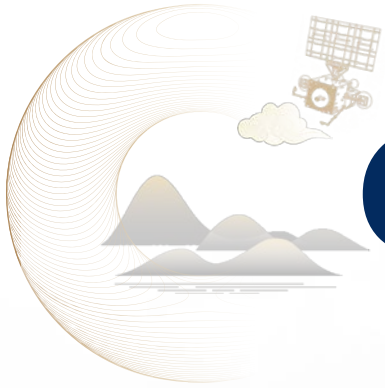
The New-Generation Integrated Space Weather Operational System

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National Center for Space Weather (NCSW), CMA

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02 **FENGYUN Space System Overview**

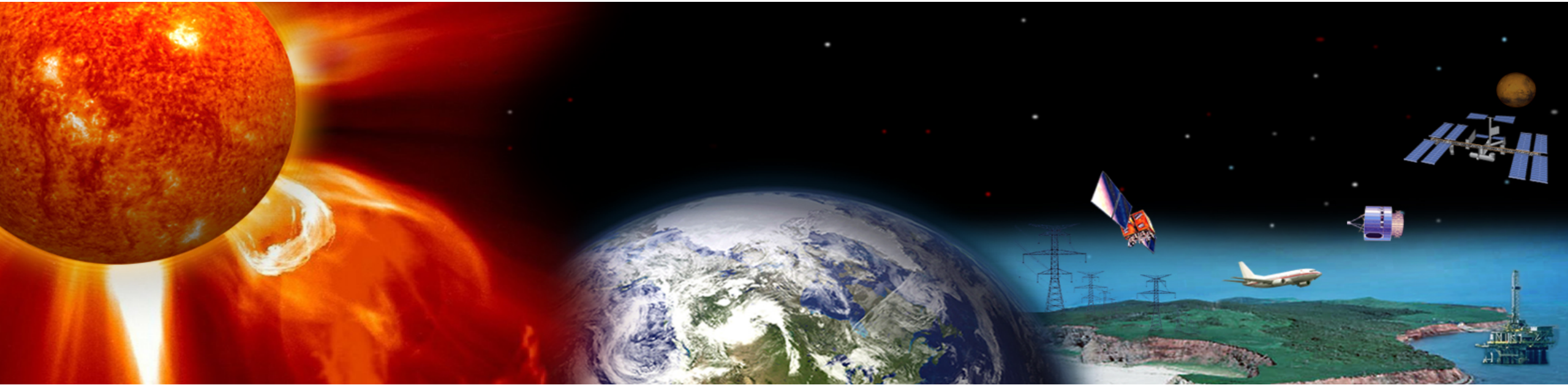
03 **Observational Infrastructure**

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Space Weather: A Growing Global Concern



Why does space weather matter?

- Satellite operations
- Human spaceflight
- Aviation
- Navigation & comms
- Power grids
- Pipelines & railways
-

What Is Space Weather?



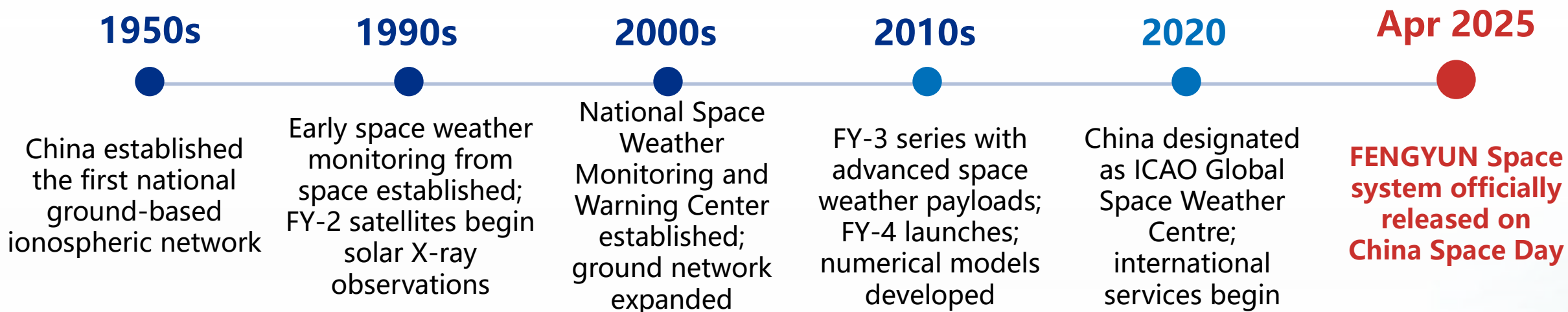
Space weather refers to conditions on the Sun, in the solar wind, magnetosphere, ionosphere, and thermosphere that can influence the performance and reliability of space-borne and ground-based technological systems and can endanger human life or health.

Space weather is a chain of physical processes connecting the Sun to Earth. Disturbances originate at the Sun, propagate through interplanetary space, interact with Earth's magnetosphere, and ultimately affect the ionosphere, thermosphere, and ground-based systems.

Monitoring this entire chain requires observations across multiple regions and at multiple time scales, all of which depend critically on radio frequency spectrum for both active and passive sensing, and for data transmission.

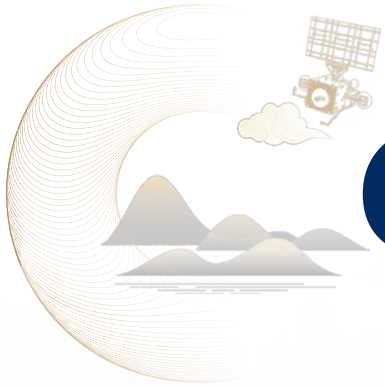


China's Space Weather Development Journey



Key Milestones Summary

- **From single-instrument to integrated system:** Over 70 years, China has built a comprehensive space-ground observation network covering the entire Sun-Earth chain.
- **From domestic service to global responsibility:** China's designation as an ICAO Global Space Weather Centre marks its transition from a national service provider to a global contributor.
- **FENGYUN Space builds on decades of cumulative development,** unifying all observational, modeling, and service capabilities into one operational platform.

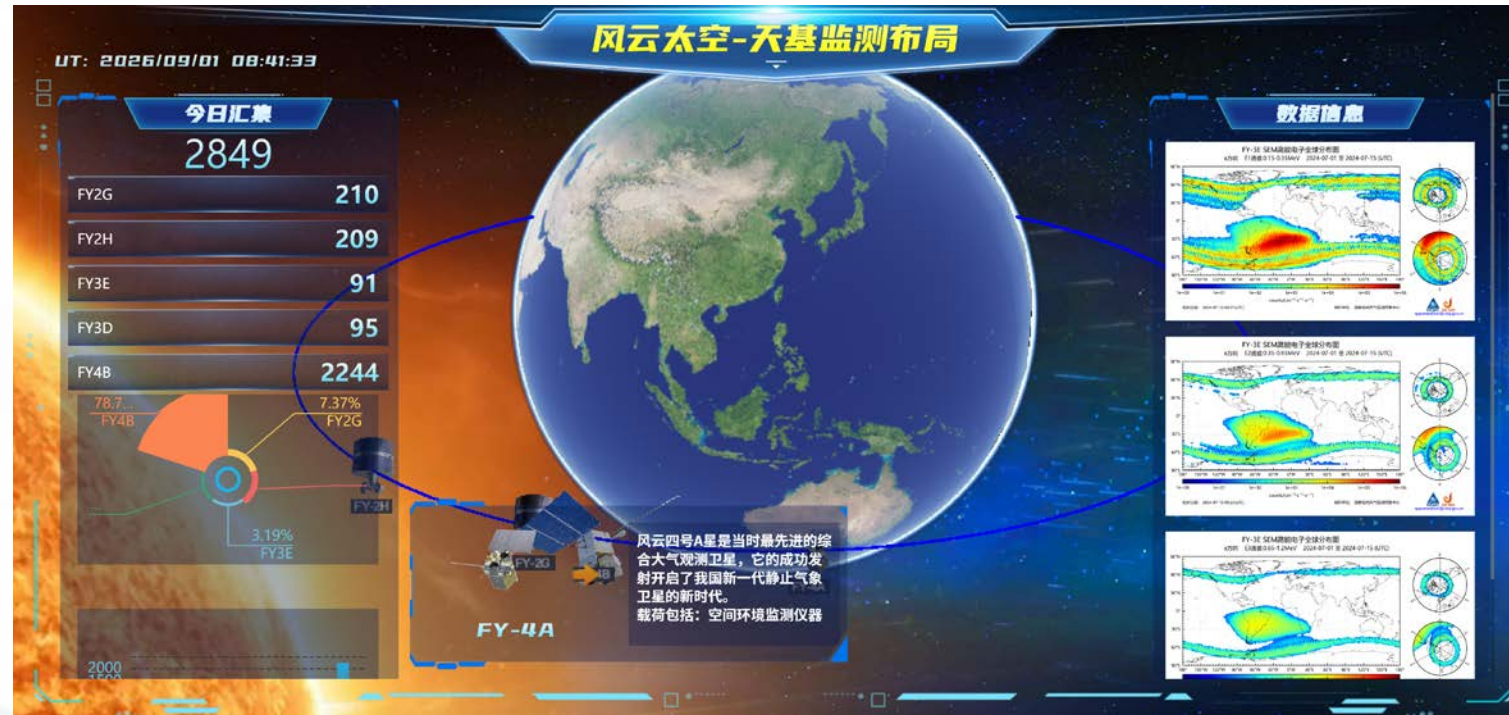


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FENGYUN Space: System Overview



FENGYUN Space (风云太空) is China's **new-generation integrated space weather operational system**, developed by the National Center for Space Weather (NCSW).

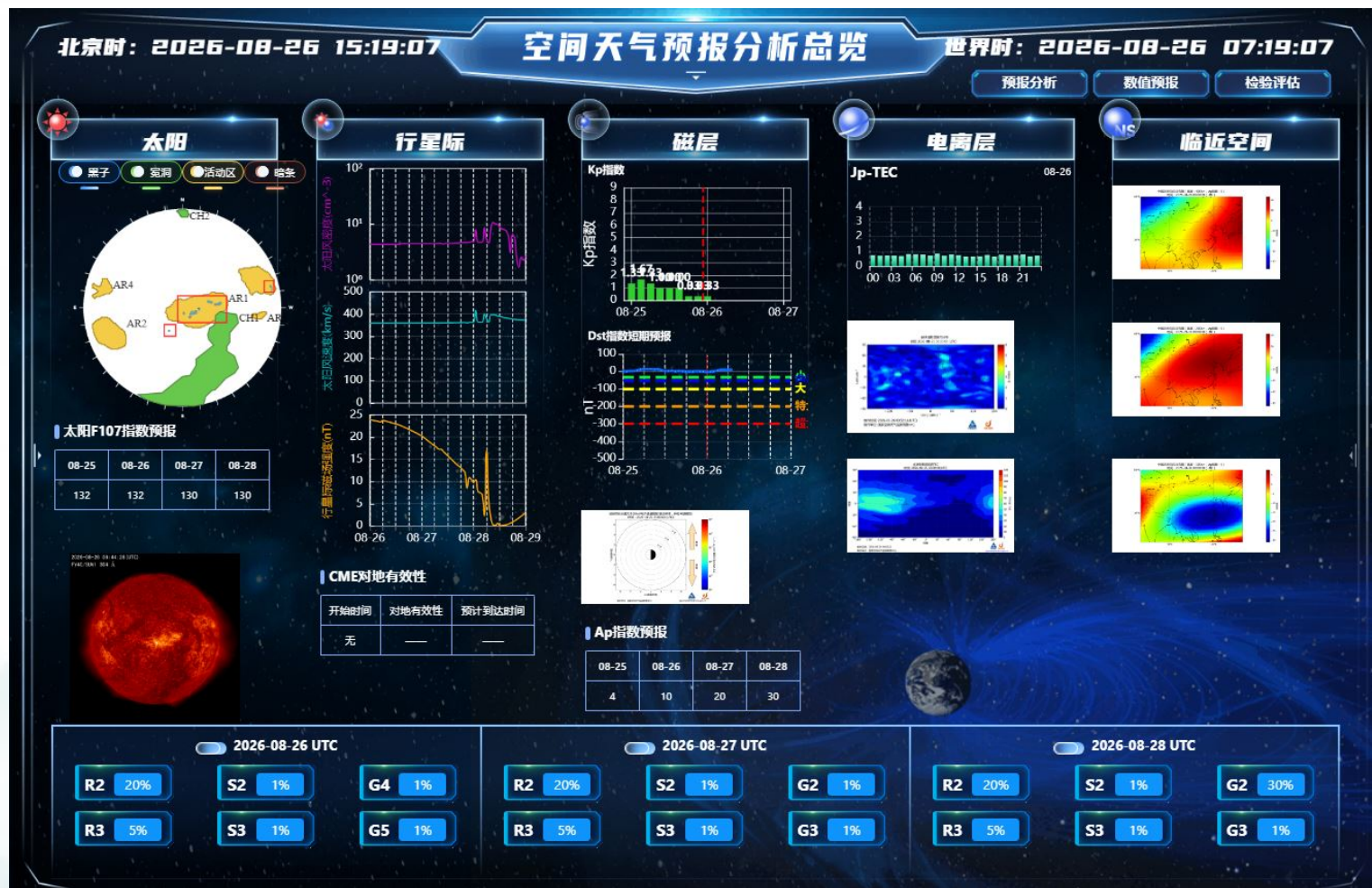
Officially released on **April 24, 2025 (China Space Day)**, it unifies space-based and ground-based observations, numerical modeling, and service delivery into a single platform.



All processing stages run on a unified cloud platform with high-performance computing, distributed storage, and AI/ML capabilities. The client layer provides interactive visualization and serves both domestic users and the international community through WMO and ICAO frameworks.



Five Regions & Five Timescales Coverage



Five Key Regions

- Solar Activity
- Interplanetary Space
- Magnetosphere
- Ionosphere
- Upper Atmosphere

Five Timescales

- Nowcast (Real-time)
- Short-term Imminent (0-6h)
- Short-term (1-3 days)
- Medium-term (7 days)
- Long-term (Solar Cycle)



Comprehensive Product System

66

Basic Monitoring

234

Forecast Products

156

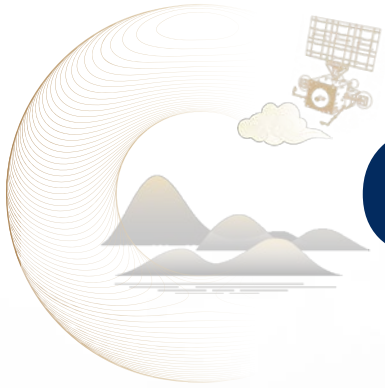
Service Products

600+

Information Products

Product Categories by Region

Region	Key Monitoring Products	Key Forecast Products	Service Applications
Solar	X-ray flux, EUV imaging, sunspots, radio bursts	Flare probability, CME arrival, solar wind speed	Aviation radiation, astronaut safety
Geomagnetic	Kp, Dst, AE indices	Storm timing/intensity, Kp forecast, GIC risk	Power grids, pipelines, railways
Ionosphere	TEC maps, foF2, scintillation	TEC forecast, scintillation warning, HF propagation	GNSS, aviation
Atmosphere	Thermosphere density, temperature, composition	Satellite drag, orbital decay	Satellite operations, space debris

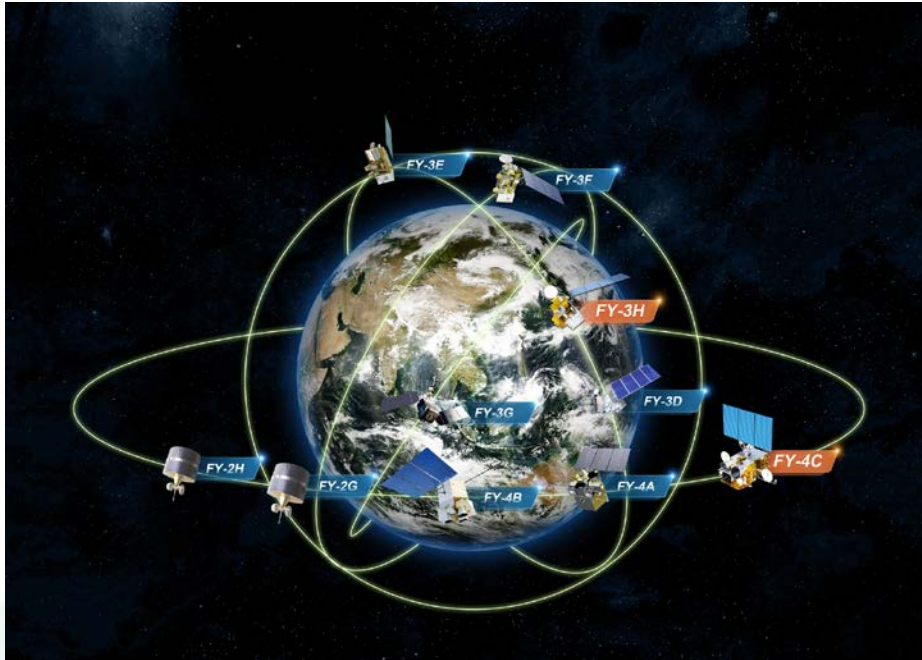


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Space-Based Observational Platform: Fengyun Satellites



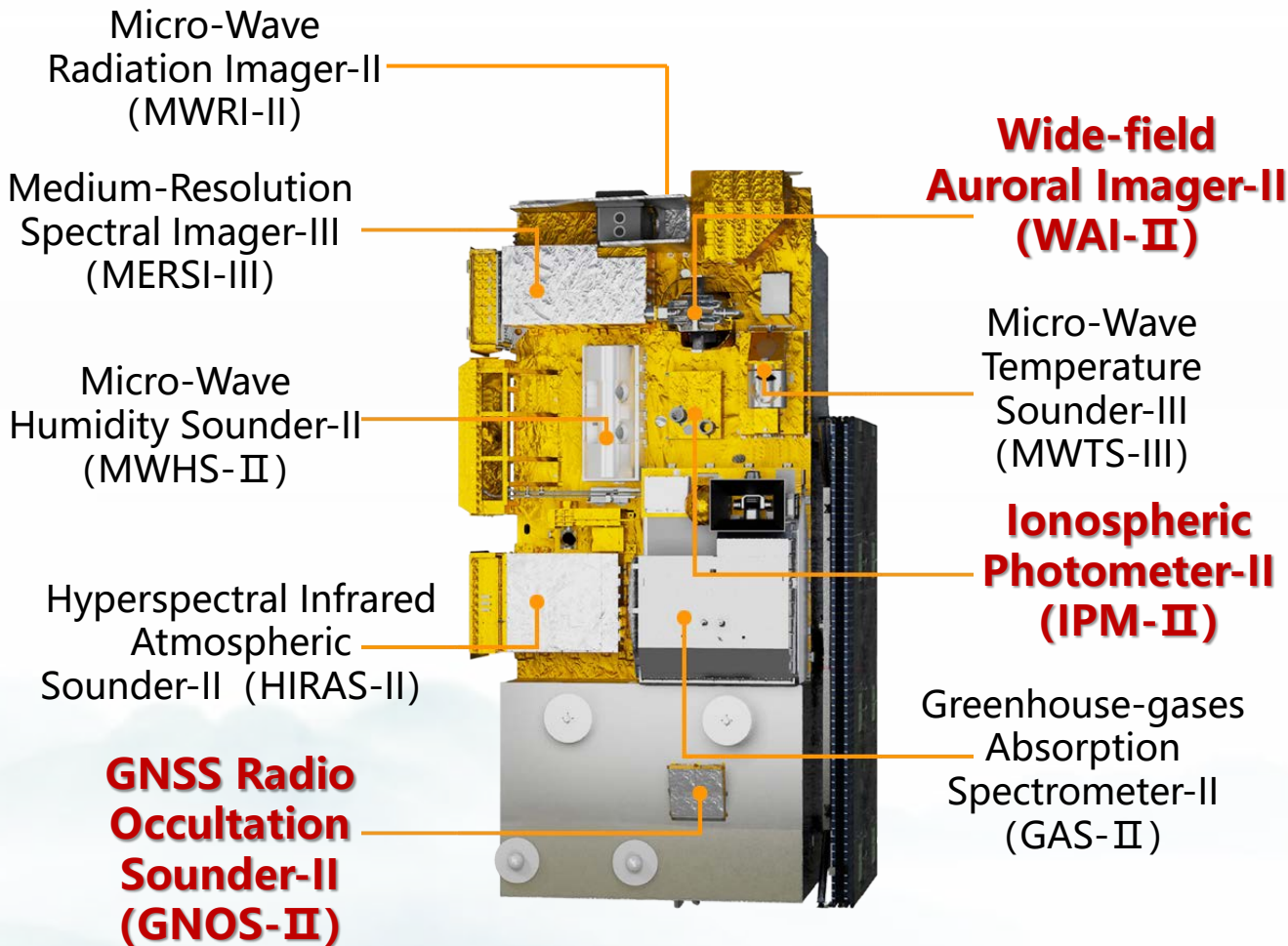
Fengyun Satellite In-Orbit Configuration
(2025)

Dual-Series Constellation

- China operates a complementary constellation of polar-orbiting (FY-1&3) and geostationary (FY-2&4) meteorological satellites, both carrying dedicated space weather payloads.
- As of December 2025, 23 meteorological satellites have been launched, 10 of which are in-orbit to provide continuous global and regional coverage.



FY-3 Polar-Orbiting: Space Weather Payloads



Fengyun-3H (FY-3H) carries nine payloads

GNSS Radio Occultation Sounder-II (GNOS-II)

- Region: Ionosphere
- Key measurements: TEC, electron density profiles via radio occultation

Ionospheric Photometer-II (IPM-II)

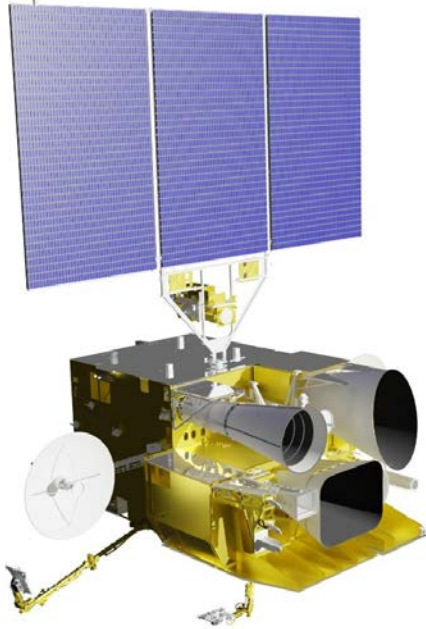
- Region: Ionosphere/Thermosphere
- Key measurements: TEC, O/N₂ ratio via far-ultraviolet airglow intensities

Wide-field Auroral Imager-II (WAI-II)

- Region: Magnetosphere/Ionosphere
- Key measurements: aurora imaging, precipitating electron flux



FY-4 Geostationary: Space Weather Payloads



Advanced
Geostationary
Radiation Imager
(AGRI)

Geostationary
Interferometric
Infrared Sounder
(GIIRS)

Lightning Mapping
Imager (LMI)

Solar X-EUV Irradiance Sensor (SXUS)

- Region: Sun
- Key measurements: solar X-EUV irradiance monitoring

Solar Extreme-Ultraviolet Imager (SUVI)

- Region: Sun
- Key measurements: solar EUV imager

Multiband Ionospheric Ultraviolet Spectrum Imager (MUSI)

- Region: Ionosphere/Thermosphere
- Key measurements: TEC, O/N₂ ratio via far-ultraviolet airglow intensities

Solar
X-EUV
Irradiance
Sensor
(SXUS)

Solar
Extreme-Ultraviolet
Imager (SUVI)

Multiband
Ionospheric
Ultraviolet
Spectrum Imager
(MUSI)

Fengyun-4C (FY-4C) carries six payloads



Ground-Based Observation Network

Complementing the satellite constellation, China operates a comprehensive ground-based space weather observation network across the country and in polar regions.

■ Solar Observatories

Capture solar activities including sunspots, flares, magnetic-field variations and coronal structures, and record multi-band spectral and radio emissions to characterize solar eruptive events for space-weather early-warning purposes.

■ Ionospheric Network

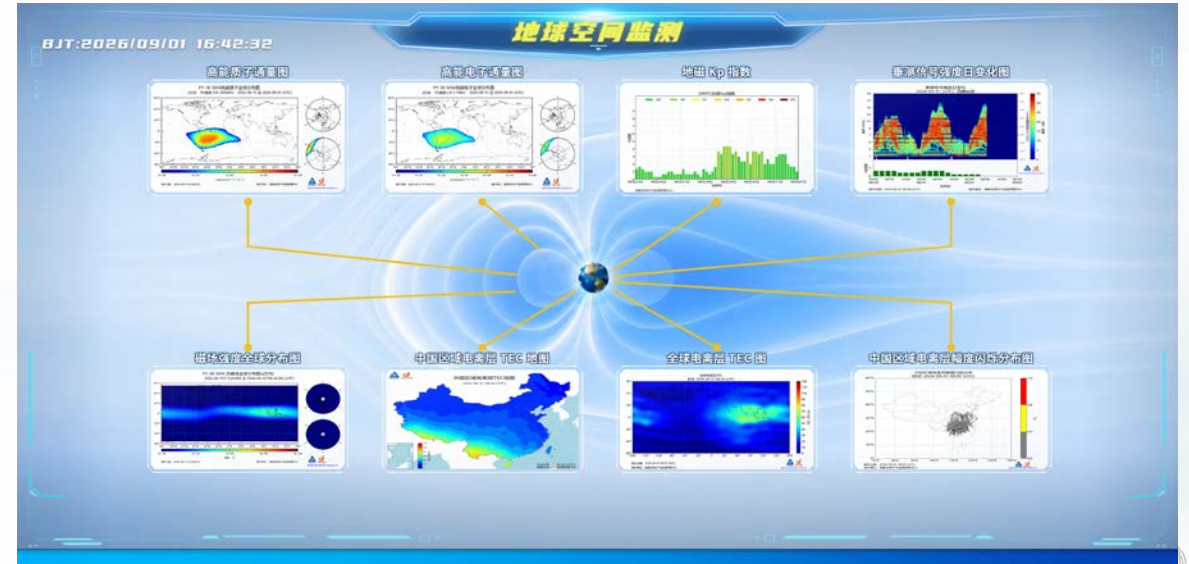
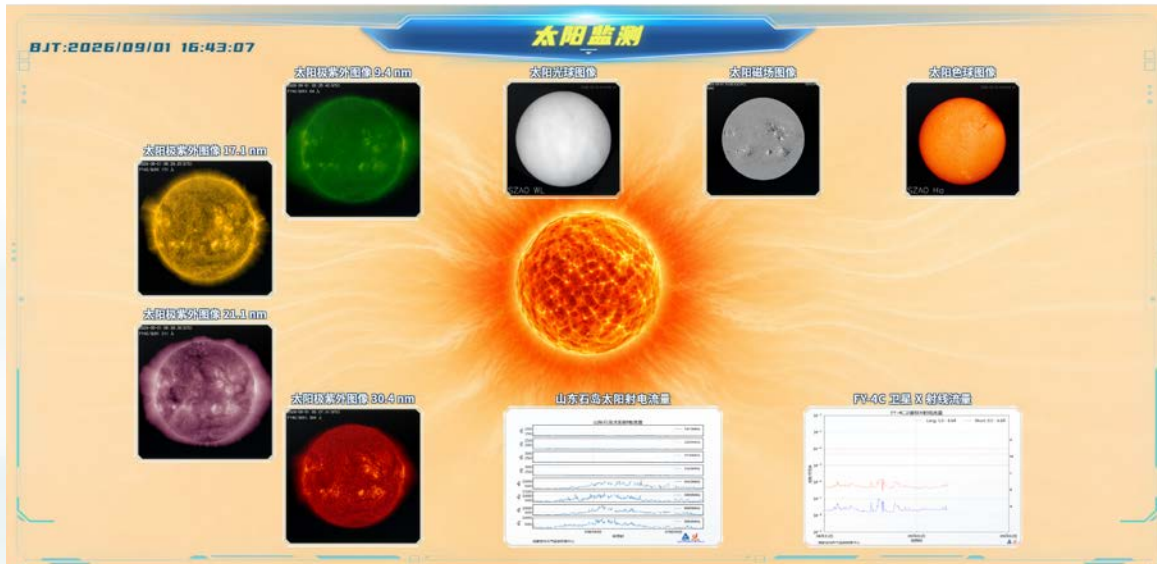
Derive key plasma parameters such as electron-density profiles, total electron content, ionospheric irregularities and D-region absorption, enabling monitoring of ionospheric disturbances and scintillation effects.

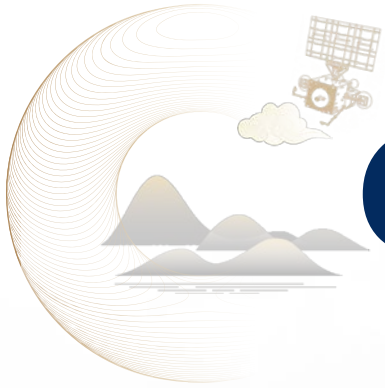
■ Thermospheric observations

Retrieve thermospheric temperature, wind fields, constituent distributions and airglow features, and track atmospheric wave activities and upper-atmosphere dynamic variations.

Space weather monitoring along the Sun–Earth chain

- It integrates multi-wavelength solar observations, global ionospheric sounding and in-situ particle detection, delivering a seamless view of space weather conditions.
- This chain-wide observational framework serves as the core foundation of the FENGYUN Space Weather operational system, supporting quantitative forecasting and impact assessment.





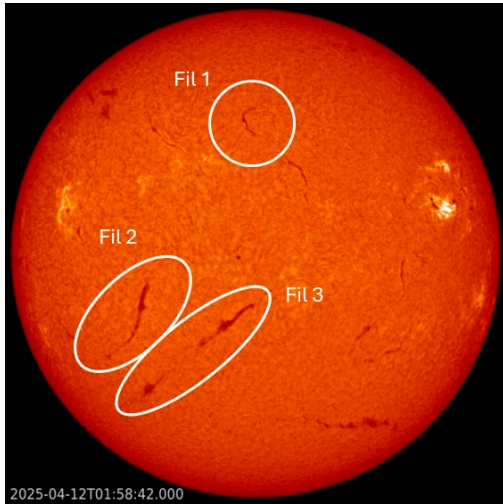
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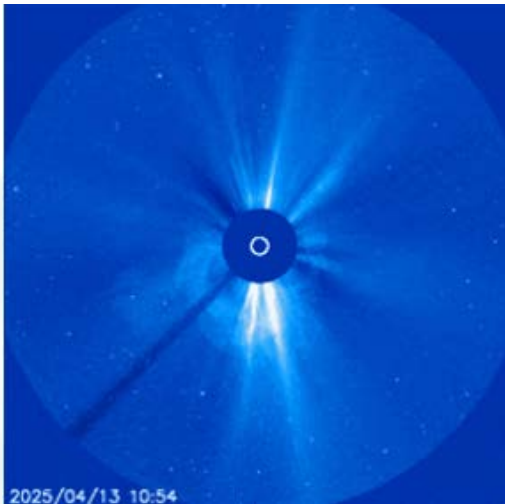


Application Case 1: Severe Geomagnetic Storm Response



April 2025 Severe Geomagnetic Storm

- Driven by unstable solar magnetic fields, three filaments erupted on April 12-13, 2025, producing a southeast-oriented partial-halo CME and an Earth-targeted full-halo CME.
- The ensuing solar storm reached Earth on April 16 (Beijing time) and triggered intense geomagnetic disturbances. The Kp index reached 7 or 8 for six hours.

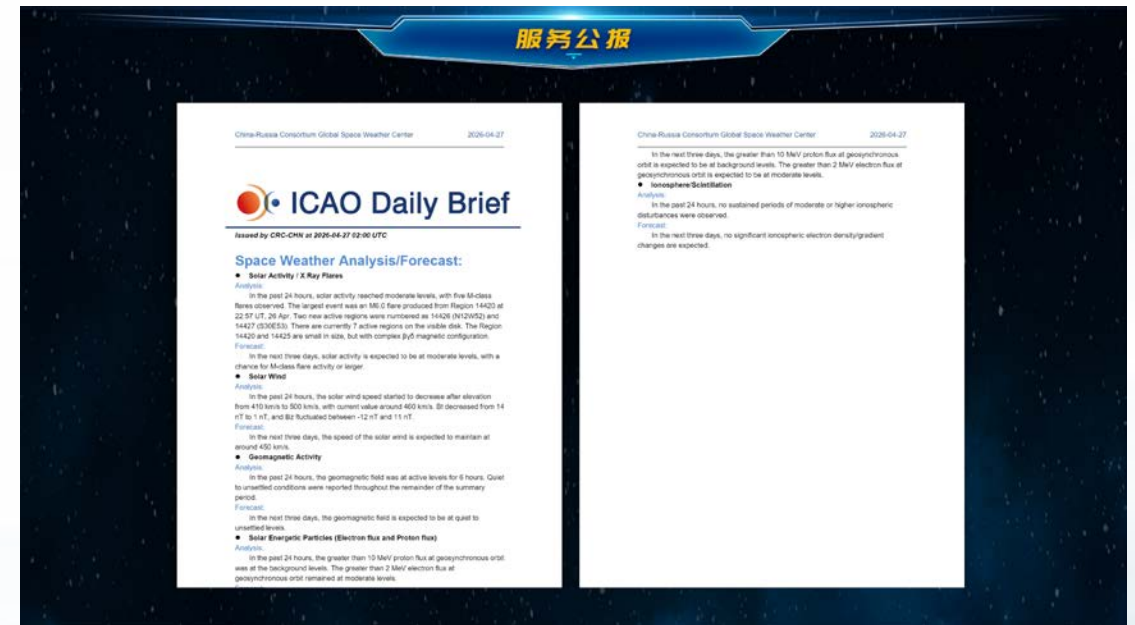
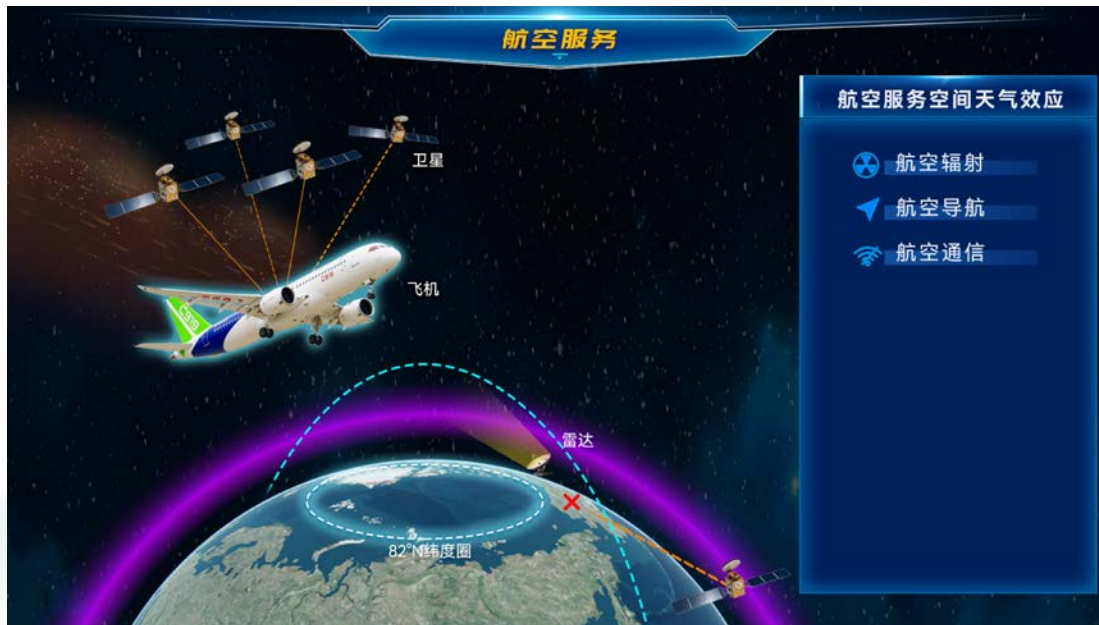


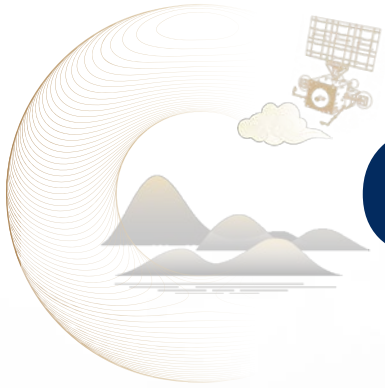
FENGYUN Space Response

- **Zero-time-lag response:** Automatic event detection, product generation, and user notification
- **72-hour advance warning:** CME arrival time and storm intensity forecast issued 3 days before impact
- **Continuous nowcasting:** Kp, Dst, AE indices updated in real time

Application Case 2: Aviation & Navigation Services

As one of the four ICAO Global Space Weather Centres, China (CMA/NCSW) provides operational space weather services to international aviation through FENGYUN Space.





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Spectrum Applications & Challenges

1. Observation



2. Space-to-Earth



3. Earth-to-Space



4. Service

Solar radio (15 MHz-40 GHz)

Ionosonde (1-30 MHz)

GNSS-RO (L-band)

.....

(WRC-27 AI 1.17)

1670-1710 MHz

7450-7550 MHz

7750-7900 MHz

25.5-27 GHz

.....

2025-2110 MHz

8175-8210 MHz

.....

Internet

WMO

ICAO

.....

Radio spectrum resources and their protection underpin all space weather observations and operational services.



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Thank You

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