

# Space Weather Services in China

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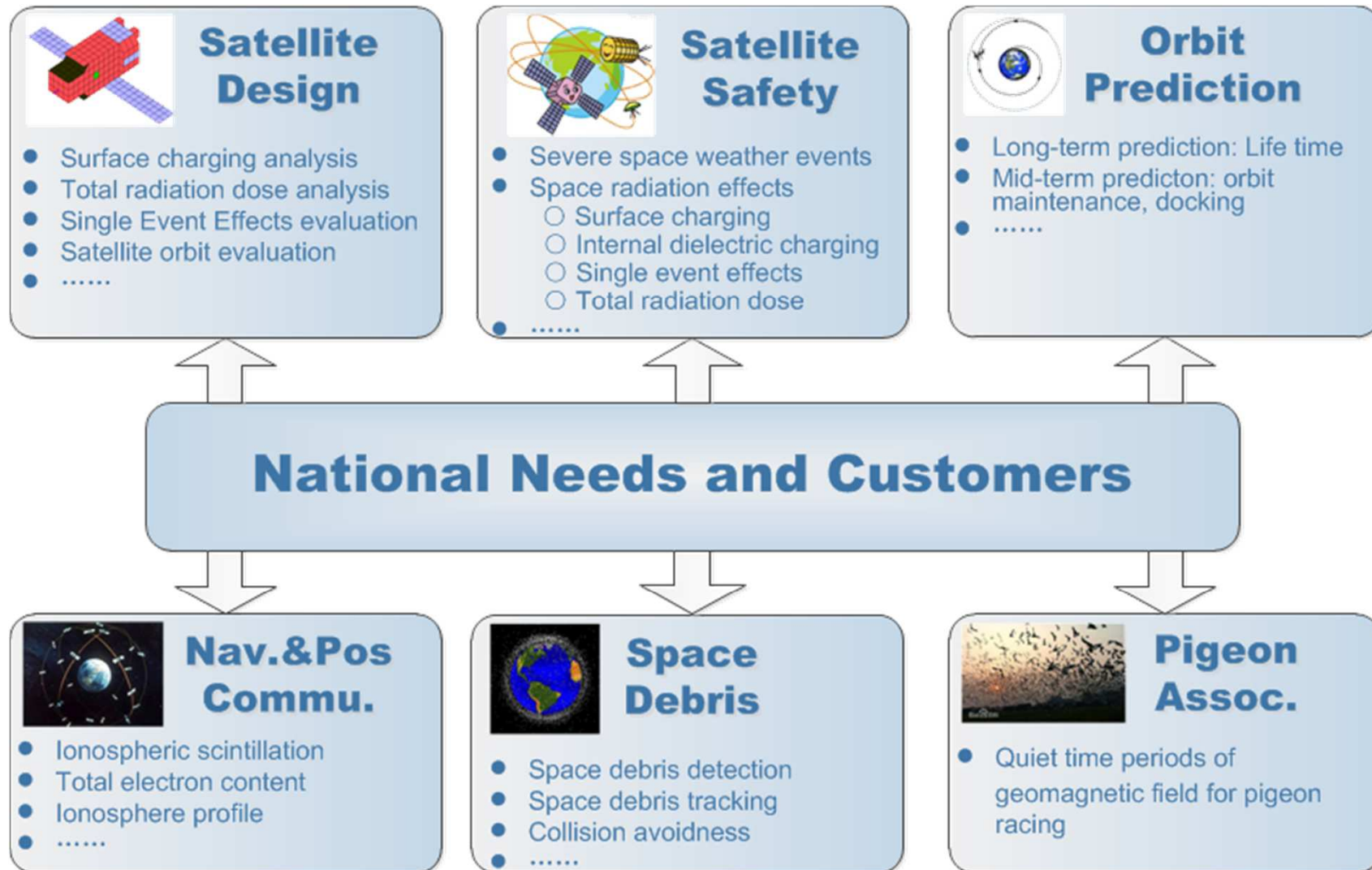
Space Environment Prediction Center  
National Space Science Center  
Chinese Academy of Sciences

# Outline

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- 1. Increasing Need for SpaceWx**
- 2. Successful SpaceWx Services**
- 3. Improvement of Operational SpaceWx Forecasting Framework**

# 1. Increasing Need for SpaceWx



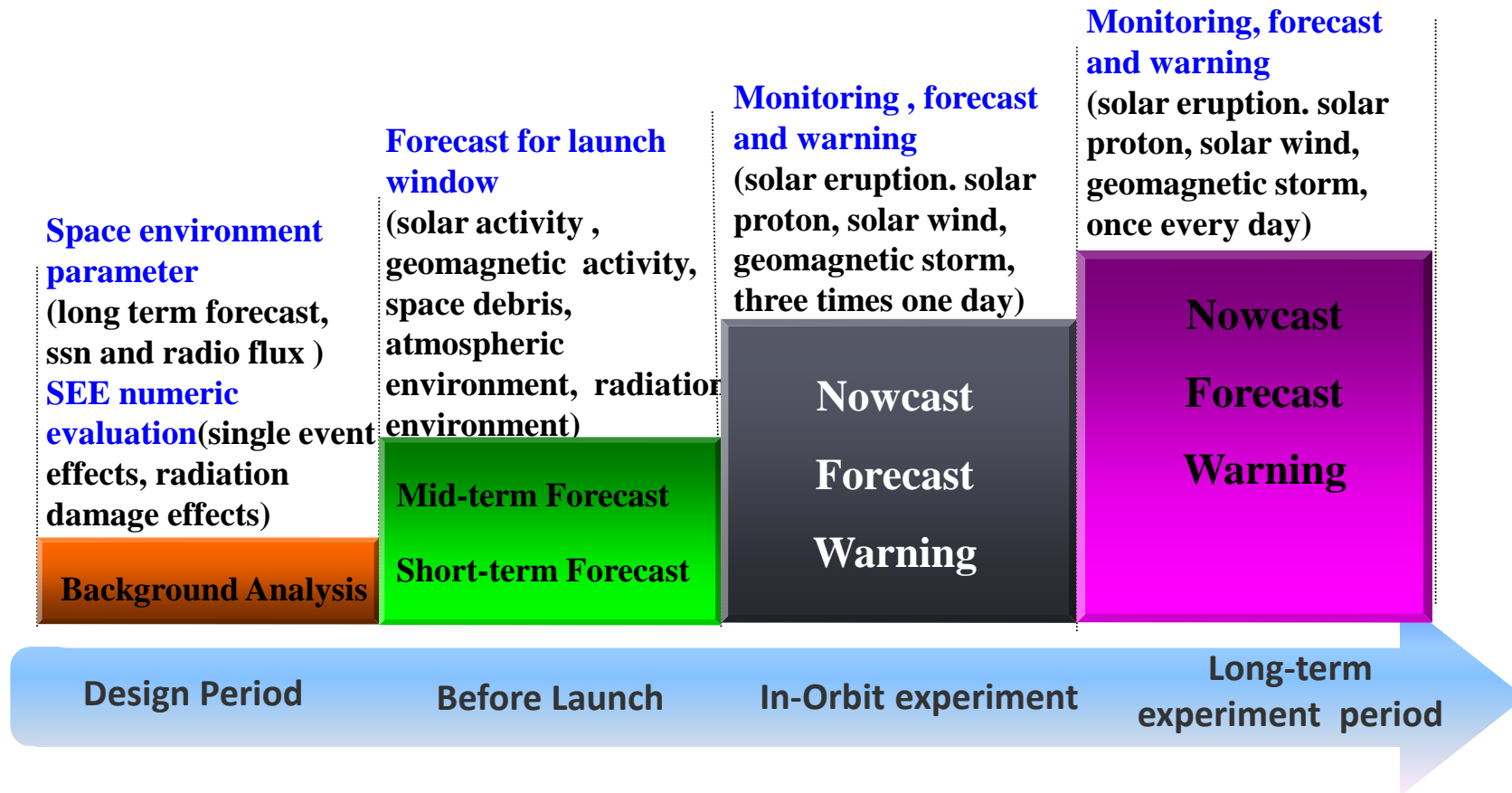
## 2. Successful SpaceWx Services

- To meet the space weather requirements for China's space missions, the Space Environment Prediction Center (SEPC) was established in 1992 in NSSC, CAS.
- In 1998, SEPC set up the first generation of an operational space weather forecast system, and built up a professional forecasting team.
- Since then, SEPC has been issuing space weather prediction via internet 365 days/year and providing space weather services for customers .



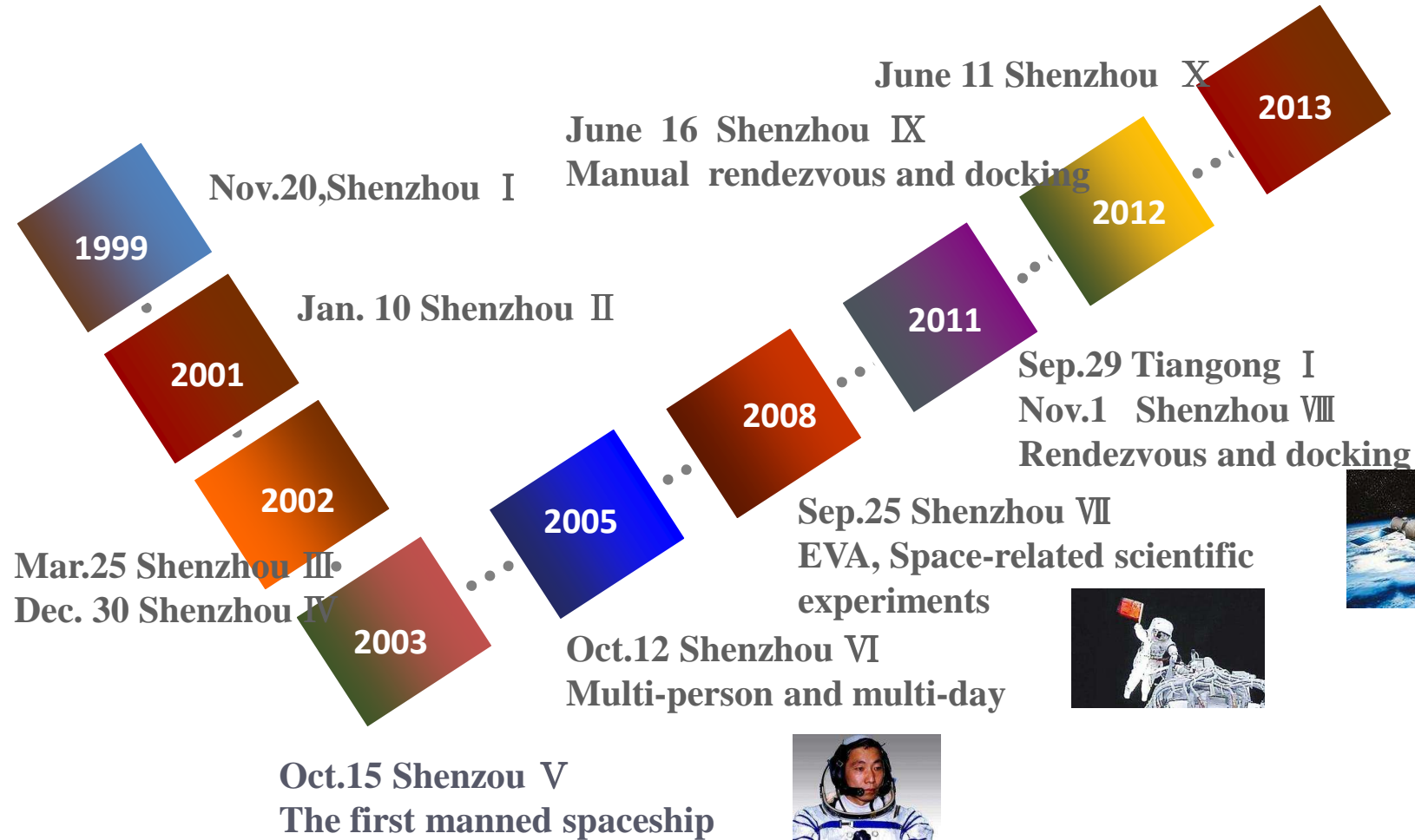
# 2. Successful SpaceWx Services

## SpaceWx Services for the Entire Process of a Space Flight Mission



# 2. Successful SpaceWx Services

## Services for Manned Space Flight Missions

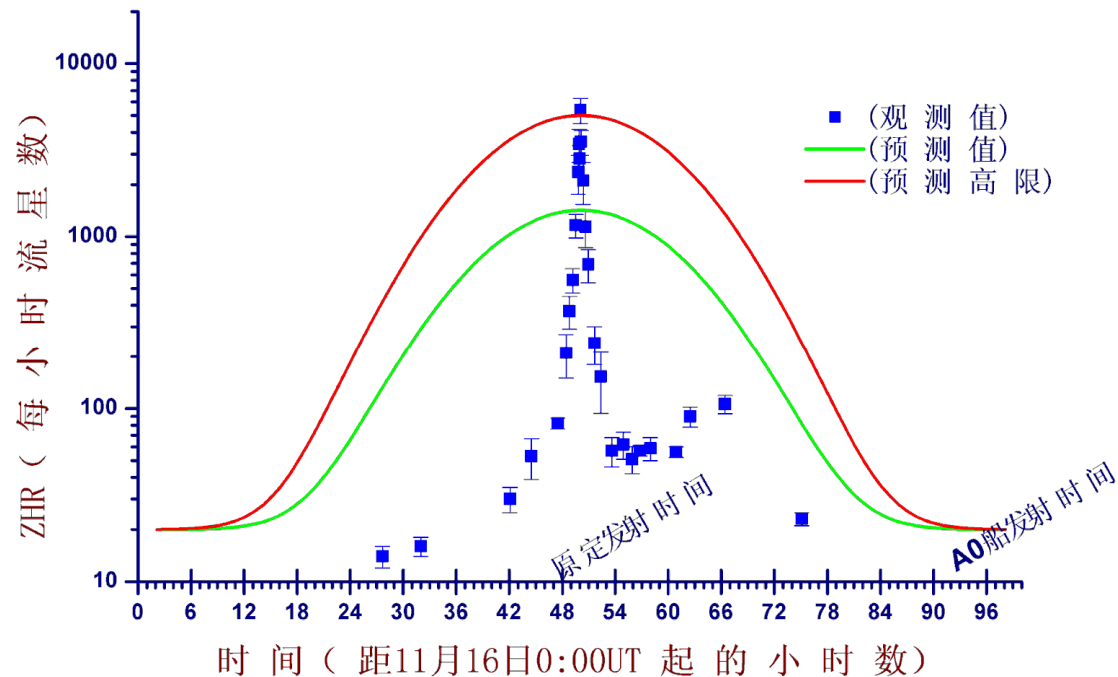


As a subsystem of space application system, SEPC has supplied space weather services in each step of China's Manned Space Program for 10 Shenzhou space ships and Tiangong 1.



# 2. Successful SpaceWx Services

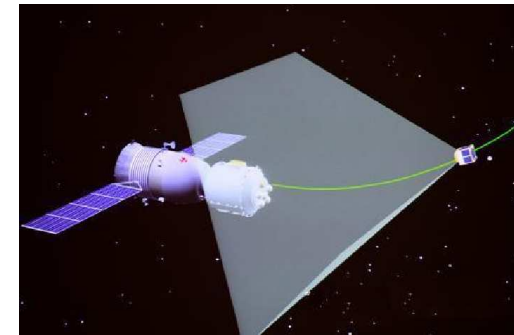
## Leonid Burst Prediction for Shenzhou I



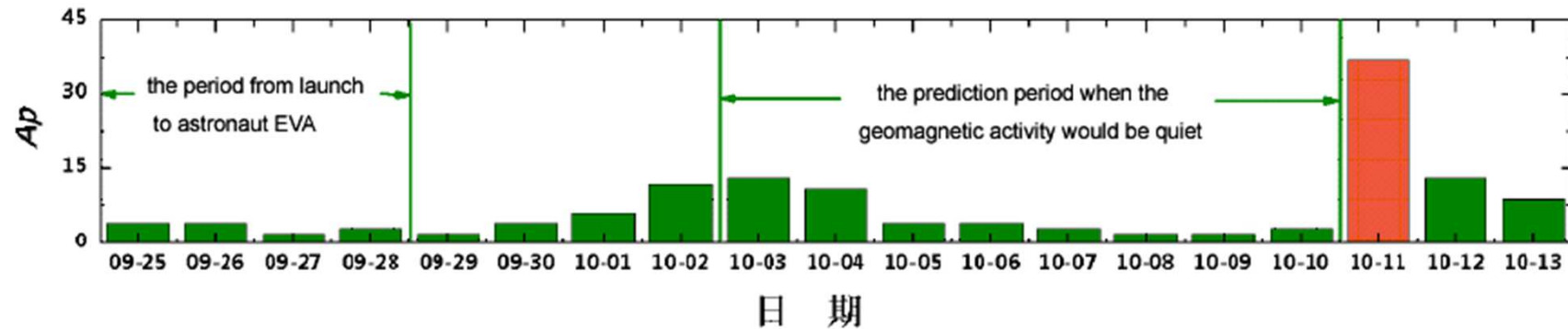
- In 1999, in order to avoid Leonid burst, the launch of Shenzhou-1 was postponed for 48 hours, from Nov.18 to Nov. 20. This is the first time a launch plan was changed due to a space environment event in China.
- According to the observation, meteoroid flux had declined to safe levels at launching time.

# 2. Successful SpaceWx Services

## Geomagnetic field quiet period prediction for Shenzhou VII

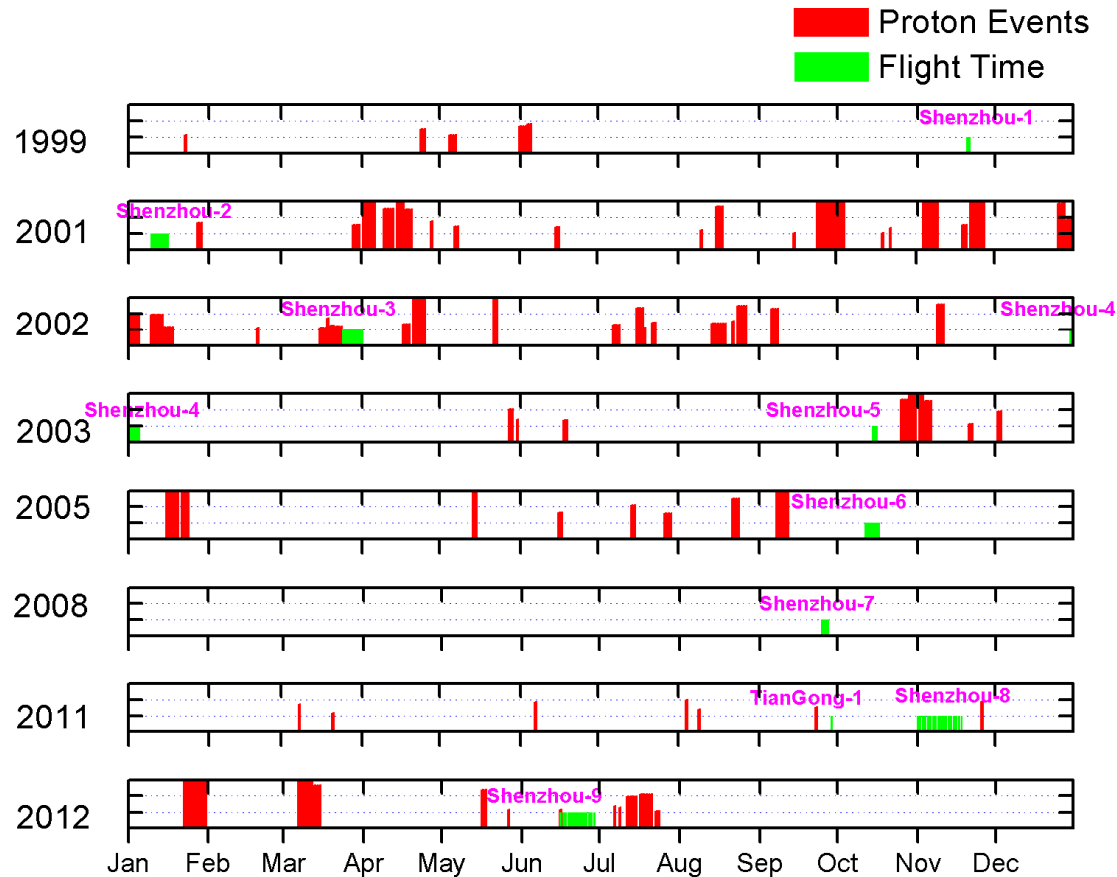


The geomagnetic Ap index during SZ-7 launch, EVA and companion microsatellite experiment





# 2. Successful SpaceWx Services



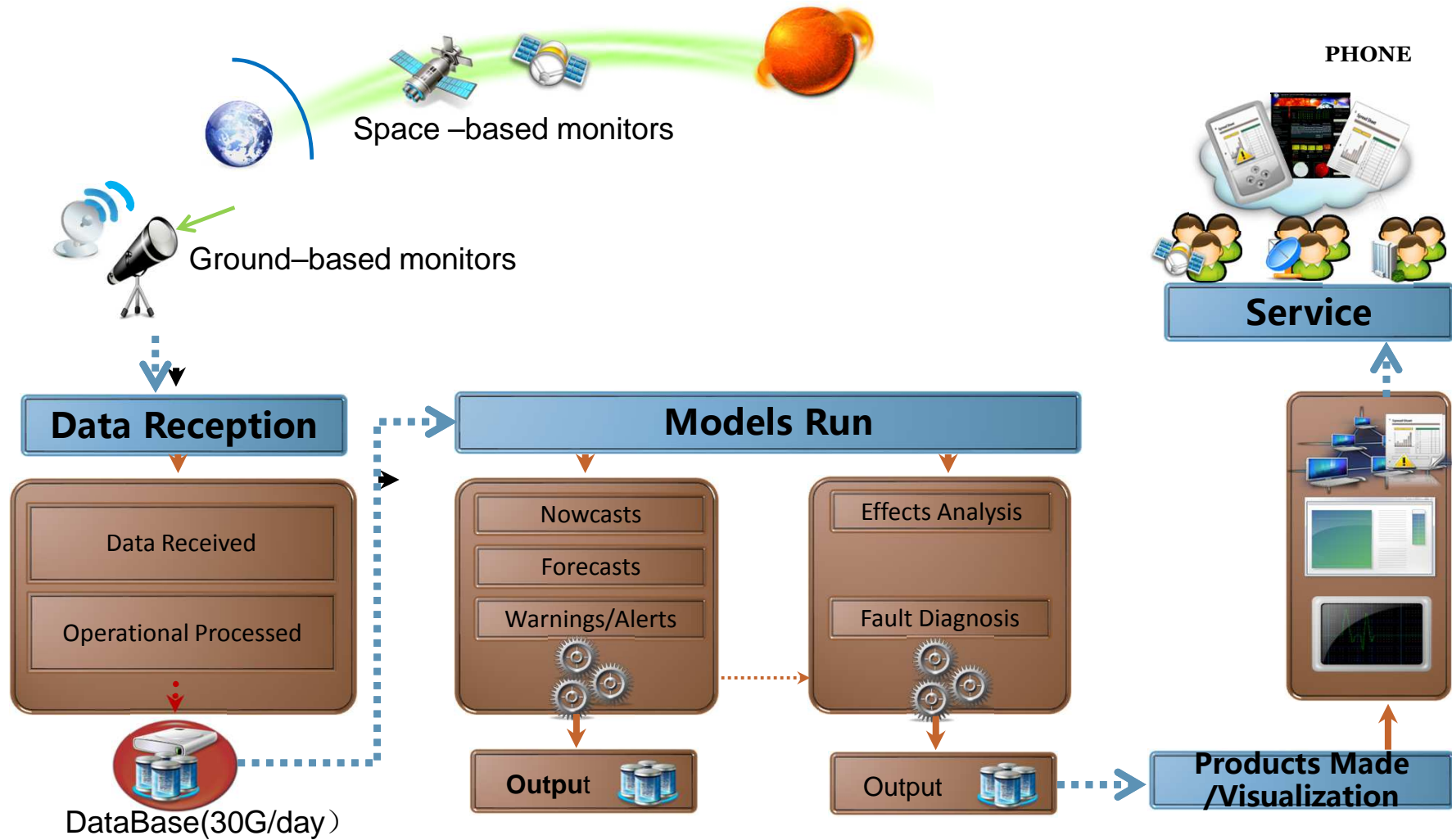
No solar proton event, a kind of severe space environment event, occurred during the missions.

# 3. Improvement of SpaceWx Forecasting Framework

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- (1) SpaceWx forecast system
- (2) Product capability expansion
- (3) Extension of service means
- (4) Development of operational SpaceWx models
- (5) Improvement of SpaceWx data capability

# (1) Space weather forecast system



# (2) Product capability expansion

## Space weather event alerts

- Solar Flare
- Solar Proton Event
- Geomagnetic Storm

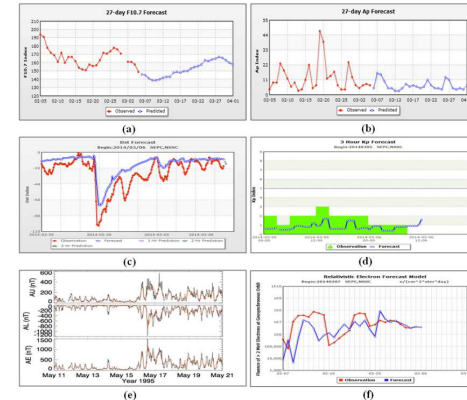
## Fundamental spaceWx parameters observation

- SSN
- F10.7
- Ap



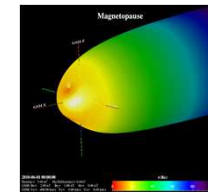
## More SpaceWx Parameters, *prediction*

- SSN
- F10.7
- Ap
- Kp
- AE
- Dst
- Electron Flux



## Space Environment Specification

- Radiation belt
- Middle-upper atmosphere
- Magnetopause
- .....



## Space Environment Effects Evaluation

- Single event effect
- Surface Charging
- Internal dielectric charging
- Total radiation evaluation
- .....

## (2) Product capability expansion

**General Public** : forecasts, models, data

**Contents** : space weather parameters (SSN, F10.7, Ap, Dst, Kp, AE, GEO >2MeV Electron Flux)

space weather events (Solar Flare、SPE、Geomagnetic Storm、Relativistic Electron Flux Enhancement)

**Publish** : Website, Text message, email, App, Wechat, Weibo

**Customers** : Manned Space Mission, Lunar Exploration ...

**Contents** : according to user needs, space environment specification, space environment effect evaluation

...

**Publish** : according to user needs (fax, email, document)



# (3) Extension of service means

□ Website

□ Text message

□ App (IOS + Android)

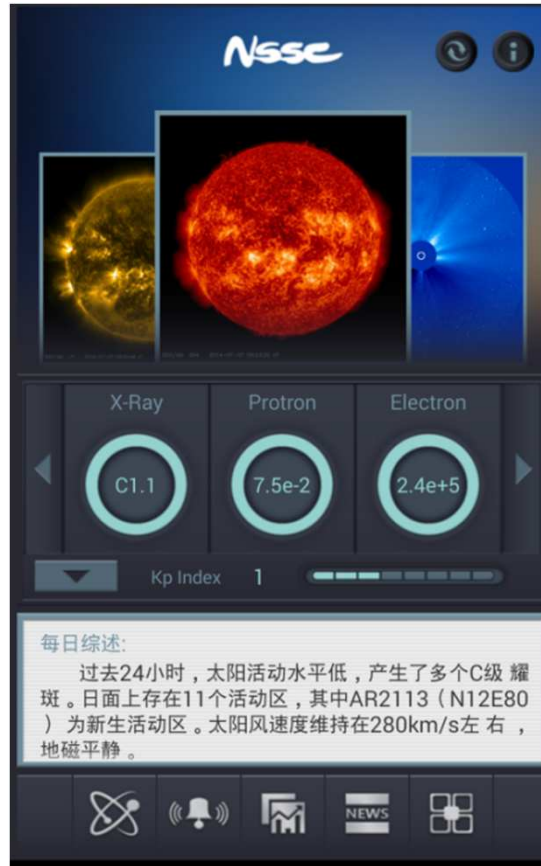
□ Microblog (Twitter)

□ Wechat



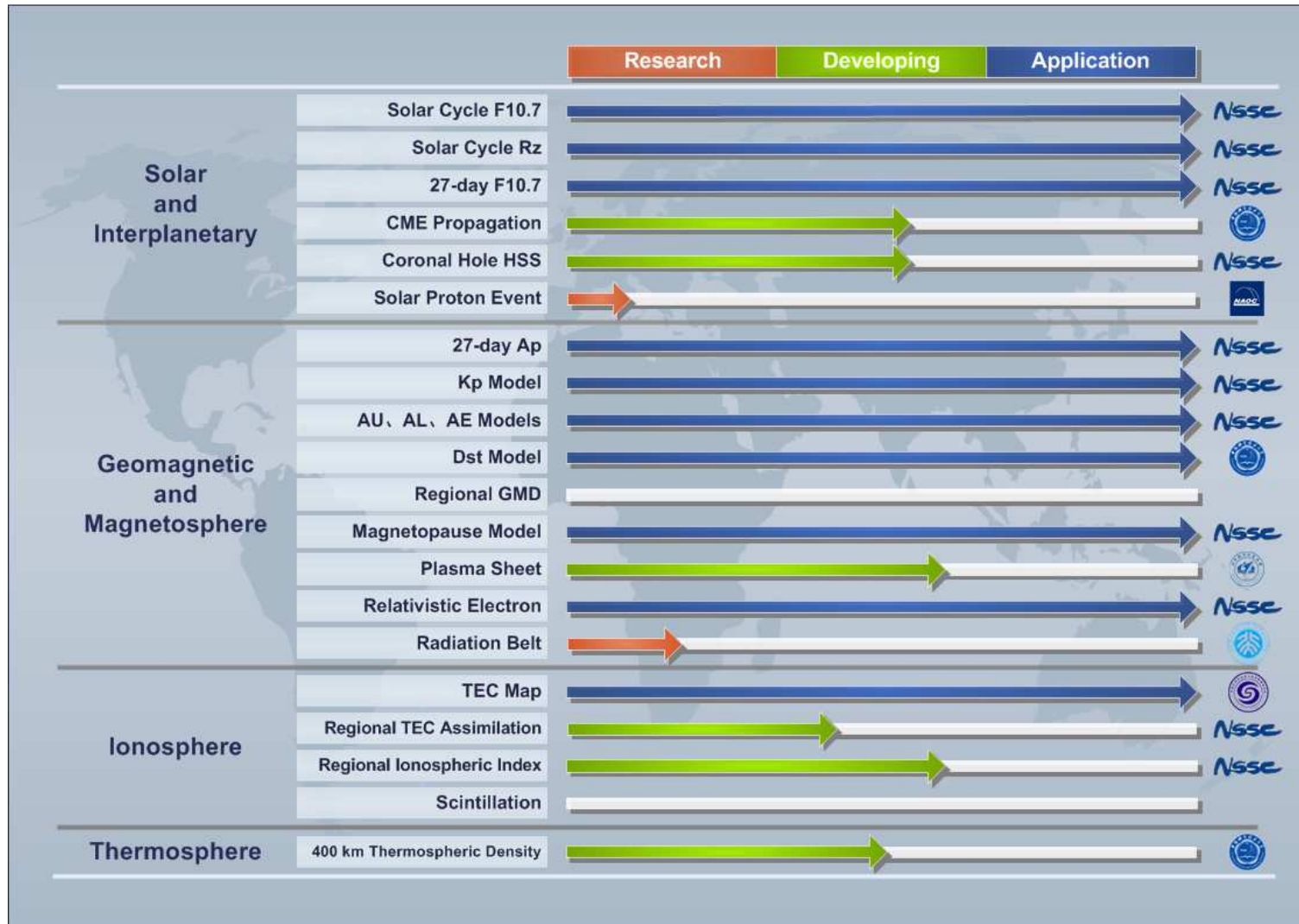


# (3) Extension of service means

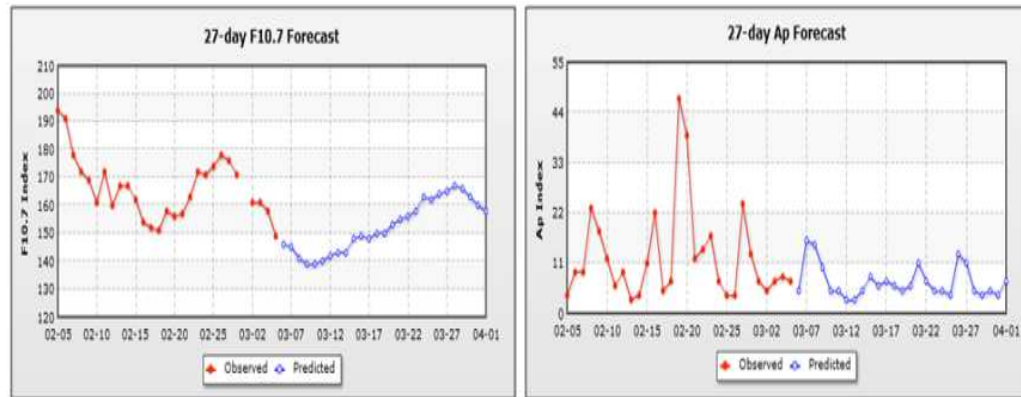


Space weather information are pushed to customers by:  
(Left) text message; (Middle) mobile App; (Right) Wechat

# (4) Operational models

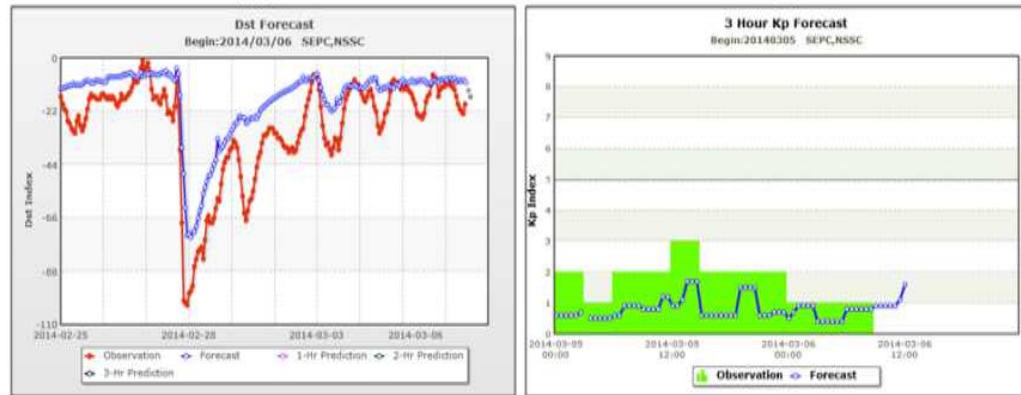


# (4) Operational models



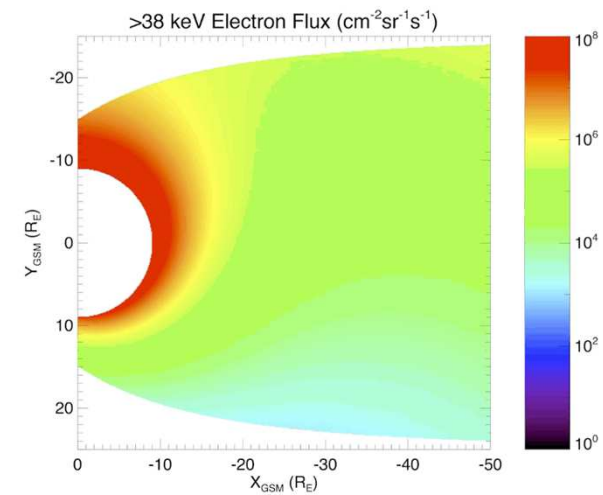
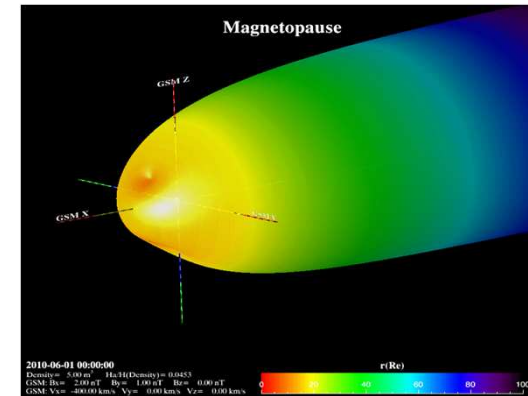
(a)

(b)



(c)

(d)



<http://eng.sepc.ac.cn>

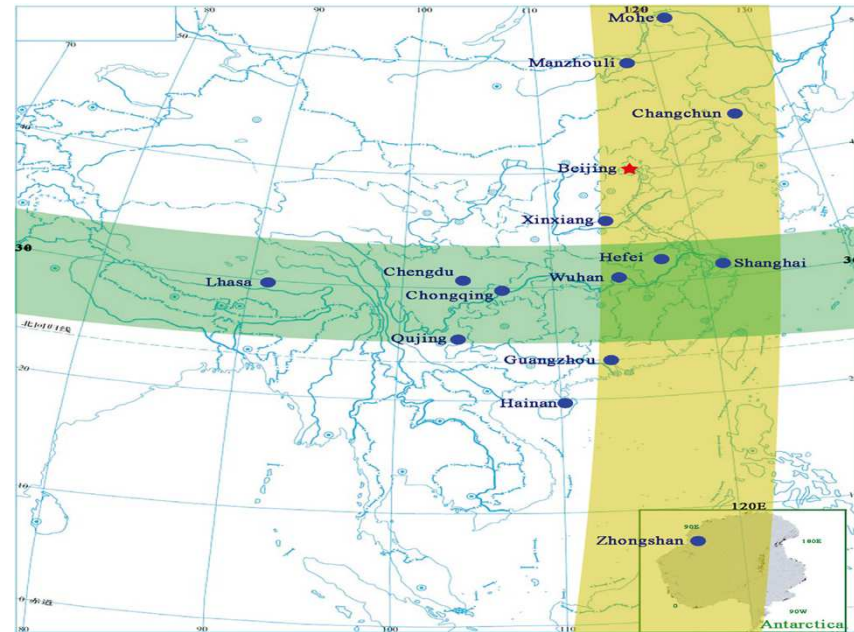
# (5) Space weather data

## Ground Based

### Space Environment Monitoring Network



### Meridian Space Weather Monitoring Project

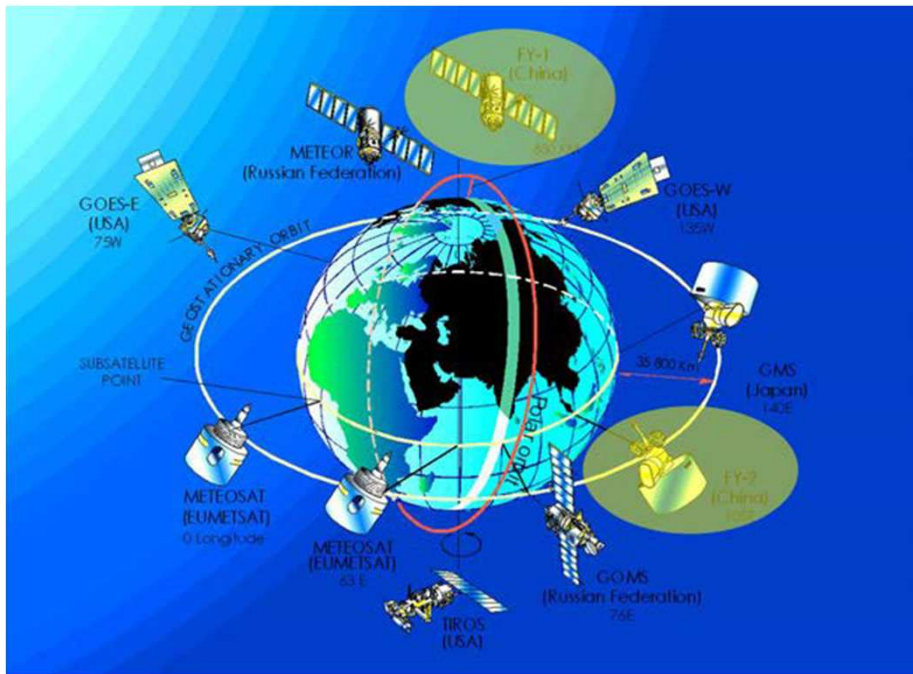


**Two ground based space weather monitoring networks have been constructed. The first one, Space Environment Monitoring Network (SEMnet), is to support operational forecasting works in Space Environment Prediction Center (SEPC). The other one, Meridian Space Weather Monitoring Project , is to supply data for space weather integrated modeling that will be translated into operational frameworks through SEPC-China.**



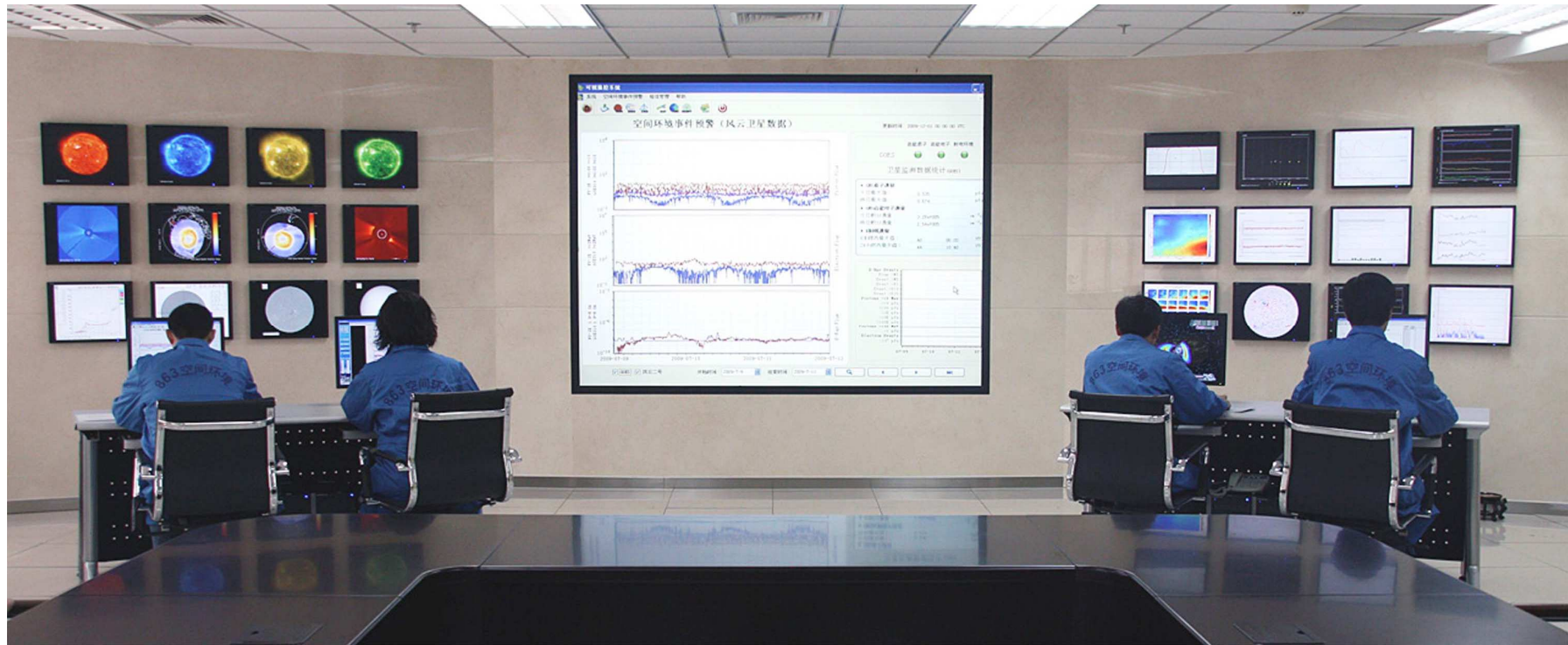
# (5) Space weather data

## Space Based



**Space environment data from satellites, either from meteorological satellites such as Fengyun series, or from applied satellites such as China Beidou's navigation satellite system, are used to support space weather services and modeling.**

# Thank you for your attention!



**Space Environment Prediction Center, NSSC/CAS**