Recent Advances in Space Weather Services at SEPC / NSSC

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Space Environment Prediction Center

National Space Science Center, Chinese Academy Sciences

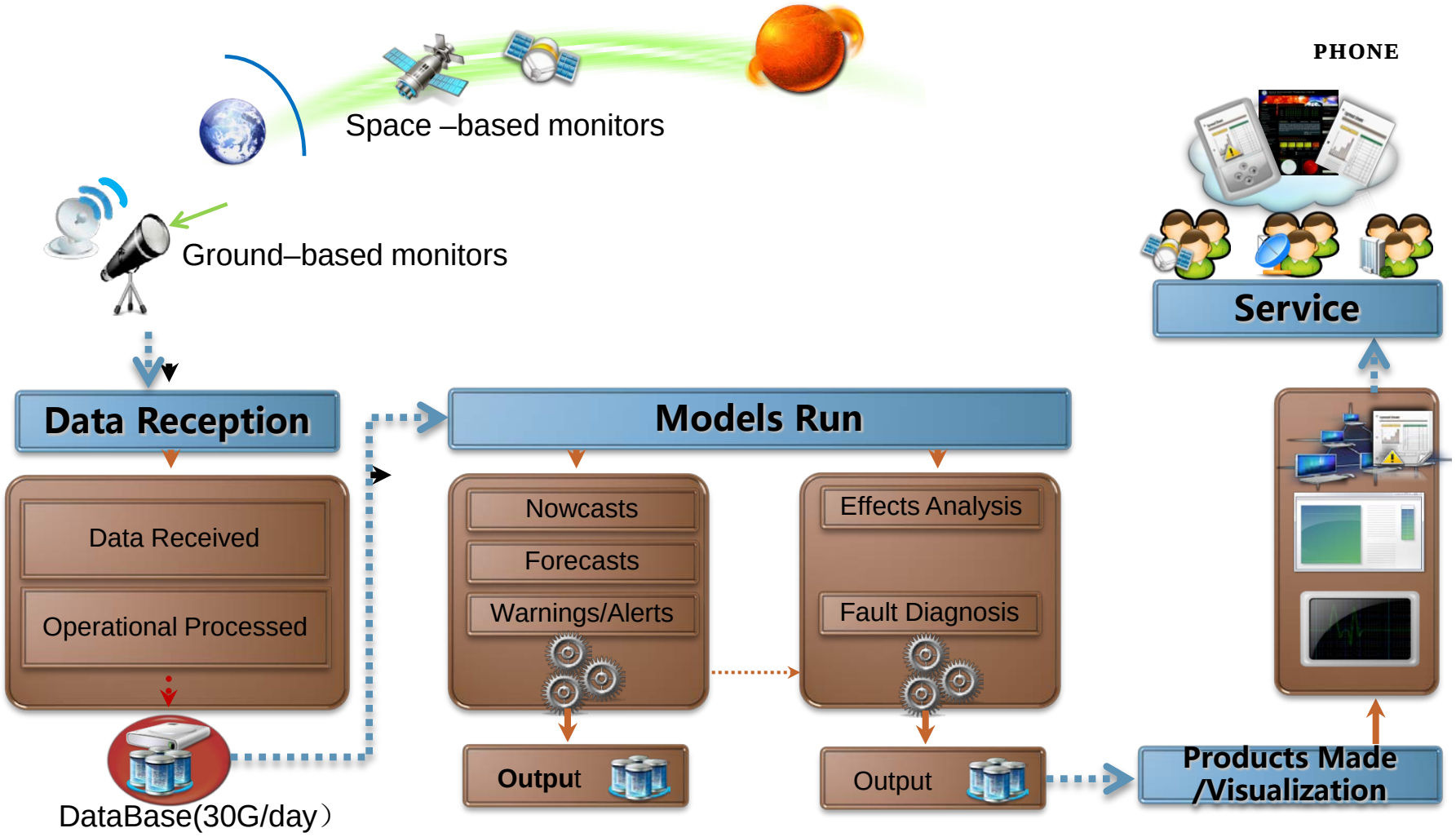
Space Environment Prediction Center

- **Establishment: To meet the space weather requirements for China's space missions, the Space Environment Prediction Center (SEPC) was established in 1992 within NSSC,CAS.**
- **Services: Since 1998, SEPC has been issuing space weather prediction via internet 365days/year.**
- **Customers：Manned Space Mission, Lunar Exploration, Specific space missions…**

Outline

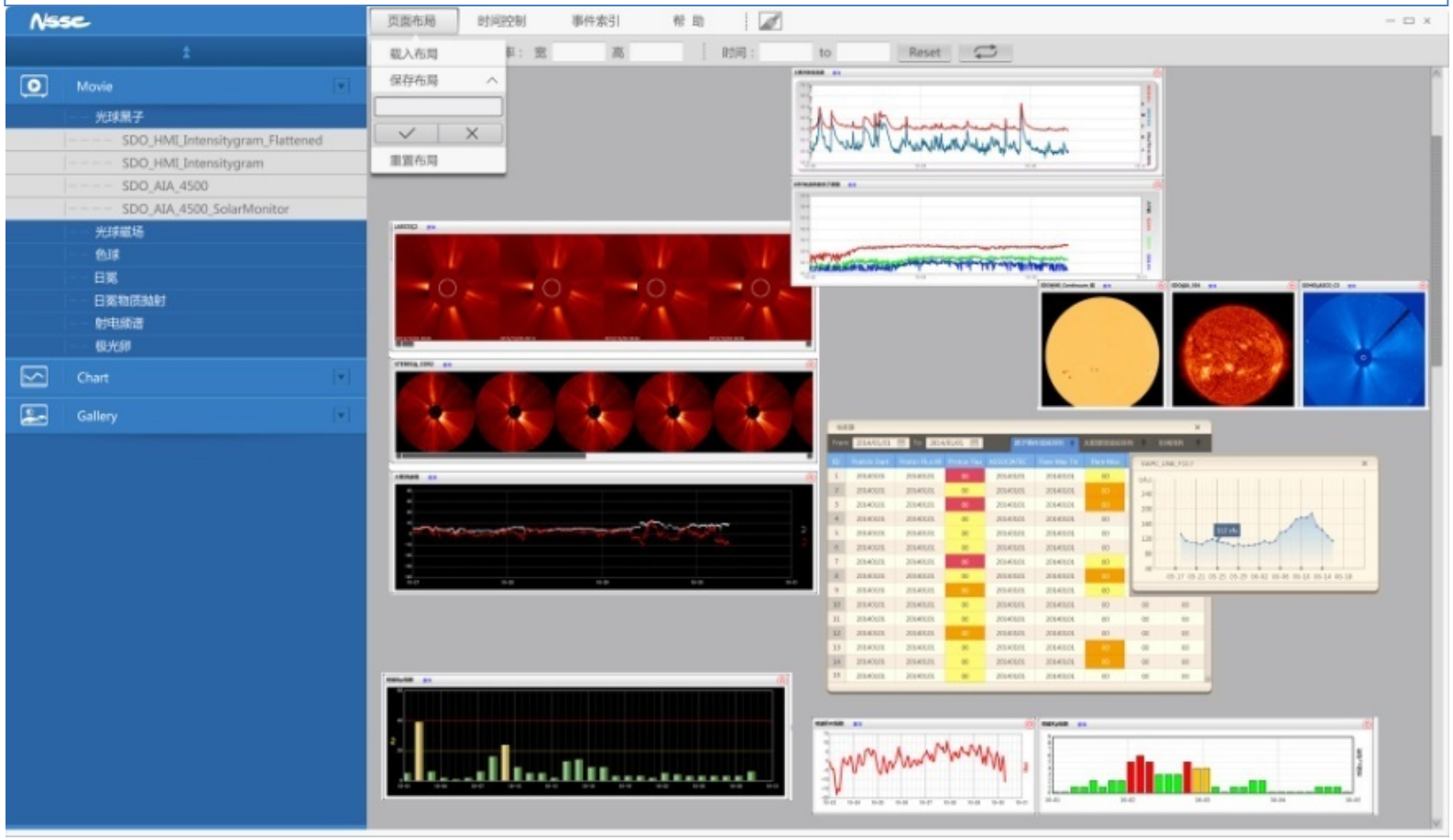
- **Achievements**
  - Operational space weather system
  - Web-based forecasting tools
  - Mobile App "e SpaceWx“
  - Operational models
  - Data available
- Possible international collaboration
  - IT utilities
  - Model research
  - Data mutual-sharing

Operational SpaceWx system



Web-based forecasting tools

- The software is **customer-configurable and adaptable,** used as a powerful decision-making tool and drawing tool.
- It provides **abundant on-line data** resources with charts, movies, reports, statistics form.
- It provides **chartroom services** to promote collaboration between users.



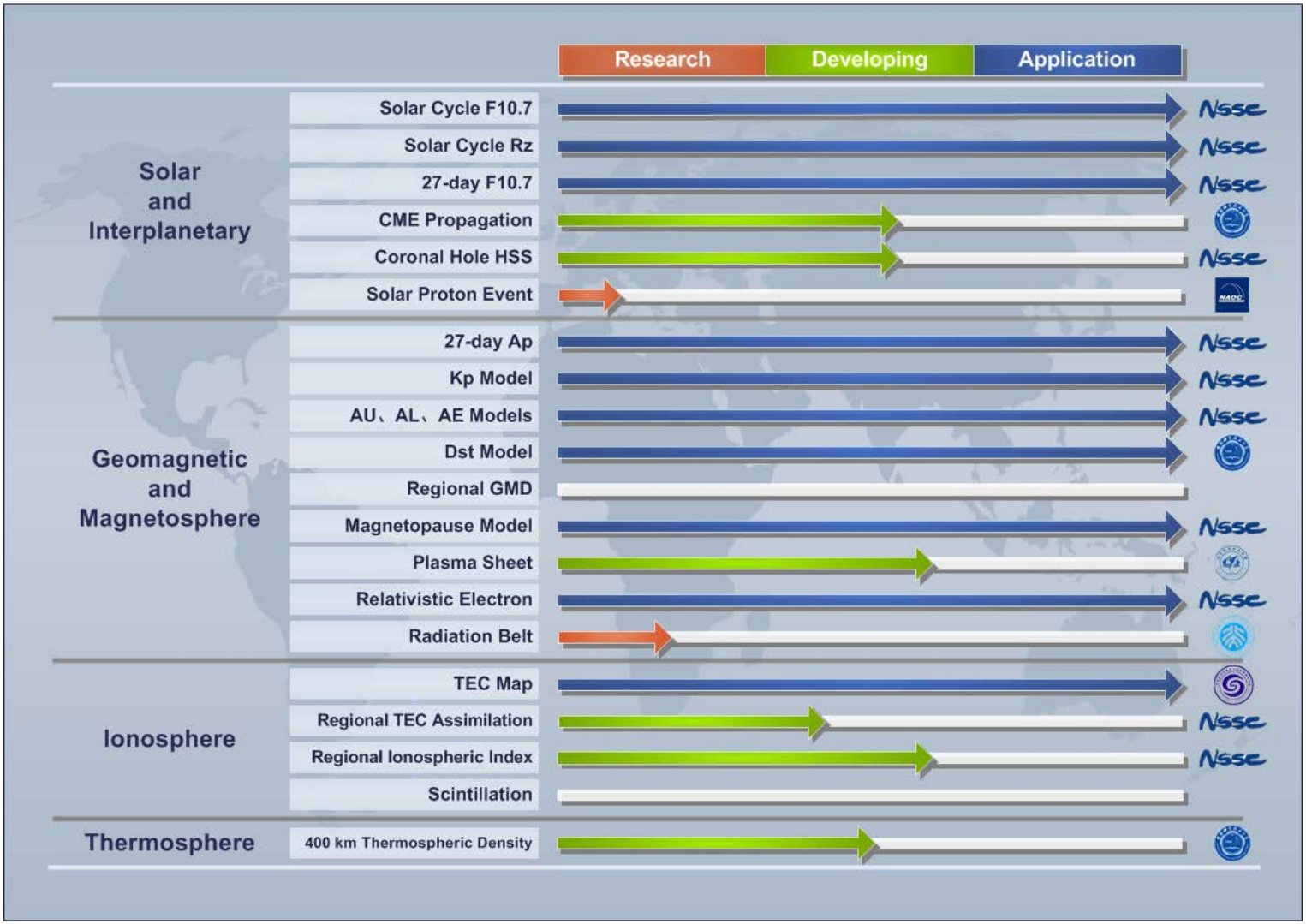
Mobile App “e SpaceWx”

- SEPC developed the **first** space-weather **App** for mobile phone system **in China**, 2013-2014.
- The app has features of showing primary space weather information from both **international** data providers **and local** observations.
- It provides **daily forecast**, **alerts, model results,** minute-by-minute updated observational **data and news** for scientists and engineers.

iPhone

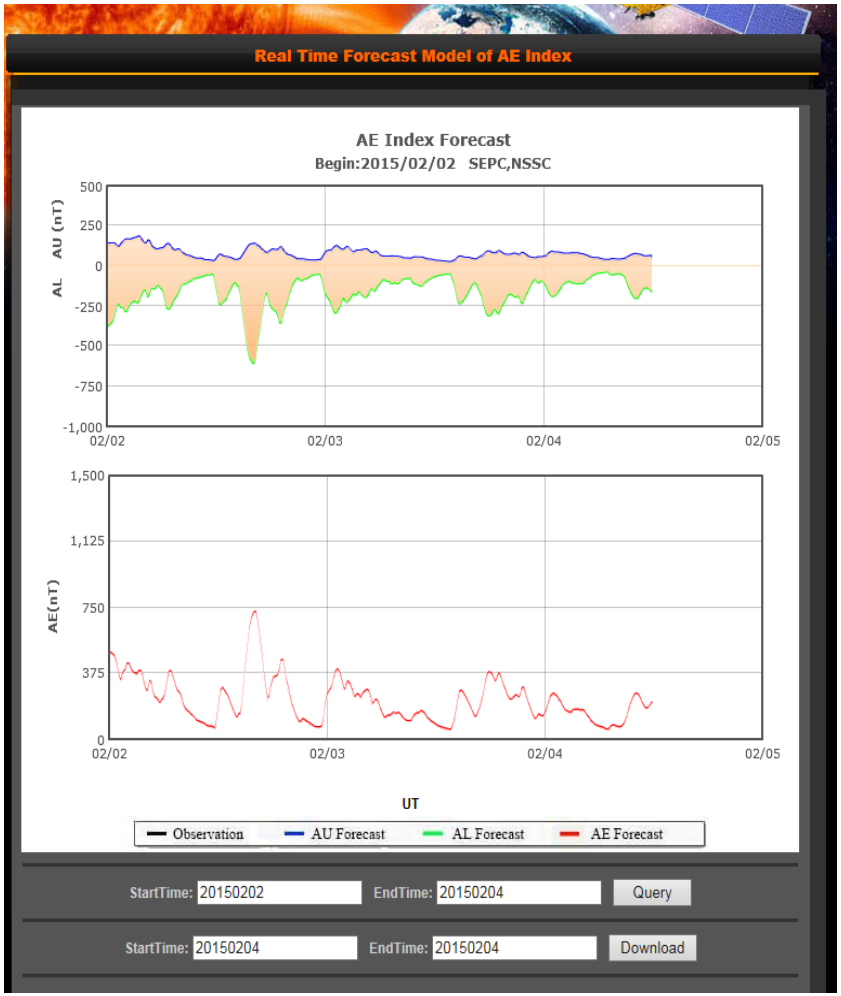
Android

Operational models



New operational model - AU/AL/AE

- Input: Vx, By, Bz, Np (ACE); F10.7
- Output: AU, AL, AE
- Time in advance: ~1 hr (Vx dependent)
- Time resolution: 10 min



http://eng.sepc.ac.cn/AEIndex.php

Model verification (1995-2001):

Index	PE	LC	PE	LC	PE	LC
	10-min		13-point-avrg (2-hr)		25-point-avrg (4-hr)	
AU	0.72	0.85	0.81	0.90	0.85	0.92
AL	0.72	0.85	0.84	0.92	0.88	0.94
AE	0.79	0.89	0.87	0.94	0.91	0.95

For Daily *AE*:

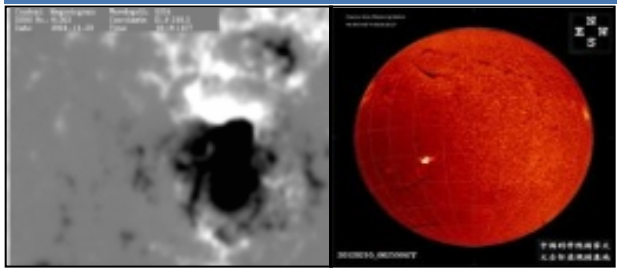
PE = 0.952
LC = 0.976

Luo et al., 2013 JGR

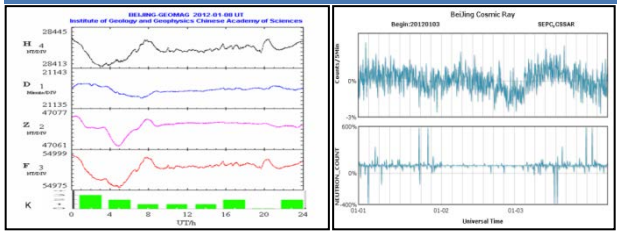
Data Available

- Space Environment Monitoring Network (SEMnet, CAS)

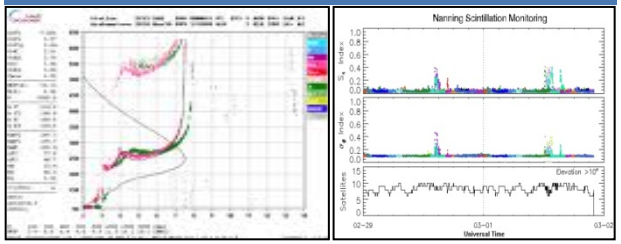
Solar magnetic field and images



Geomagnetic Field, Cosmic rays



Ionosphere profile/scintillation



The Space Environment Monitoring Network (SEMnet) is composed of 17 stations with 39 ground-based instruments, and a processing and prediction center in Beijing.

Center for Space Environment Research and Forecast: www.cserf.ac.cn

Data Available

- Space Environment Monitoring Network (SEMnet, CAS)

Center for Space Environment Research and Forecast: www.cserf.ac.cn

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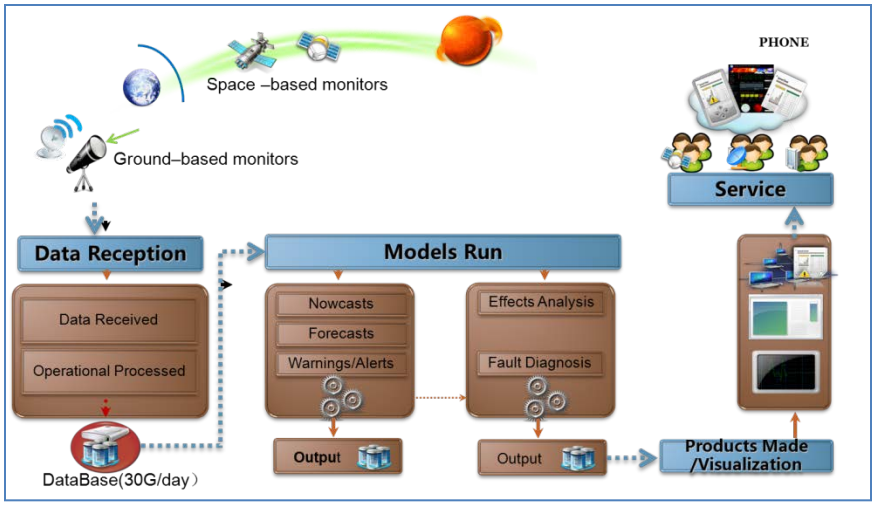
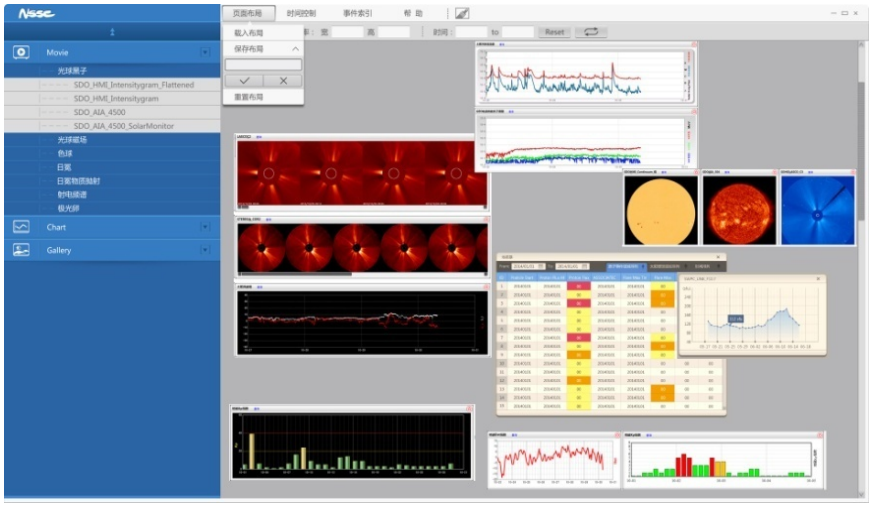
  - IT utilities
  - Model research
  - Data mutual-sharing

IT utilities



Software modules sharing

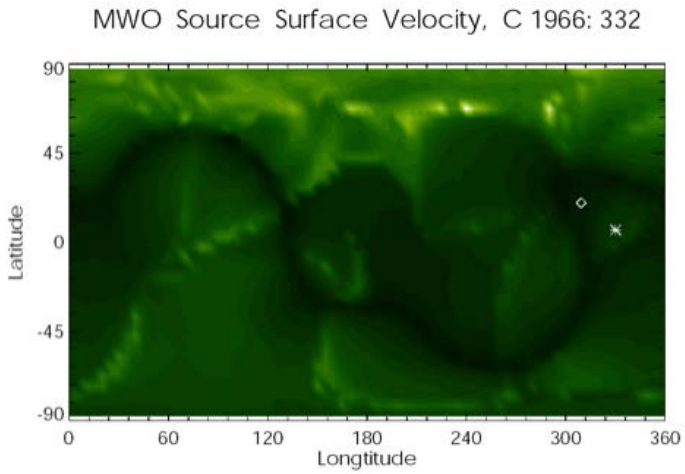
- **Automatic data sending and receiving**
- **Model running management**
- **Product preparation**

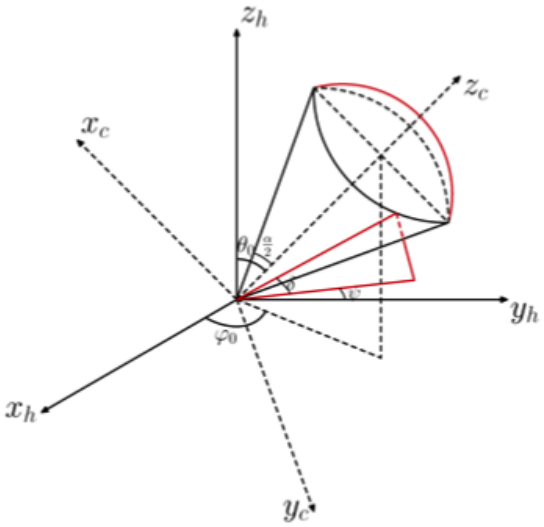


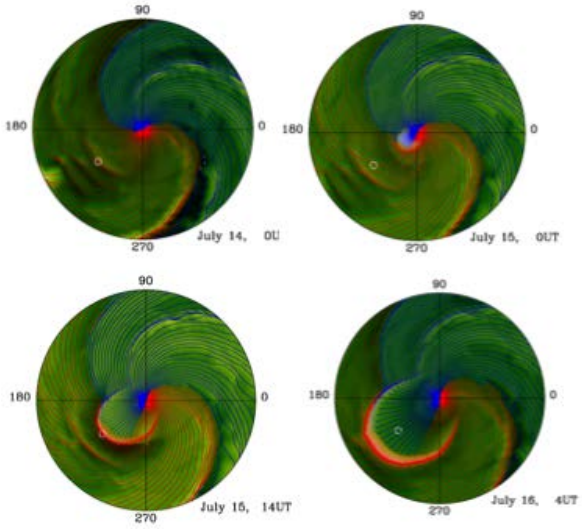
The web-based analysis tools will become available on our website:

http://eng.sepc.ac.cn

Model research - CME propagation model



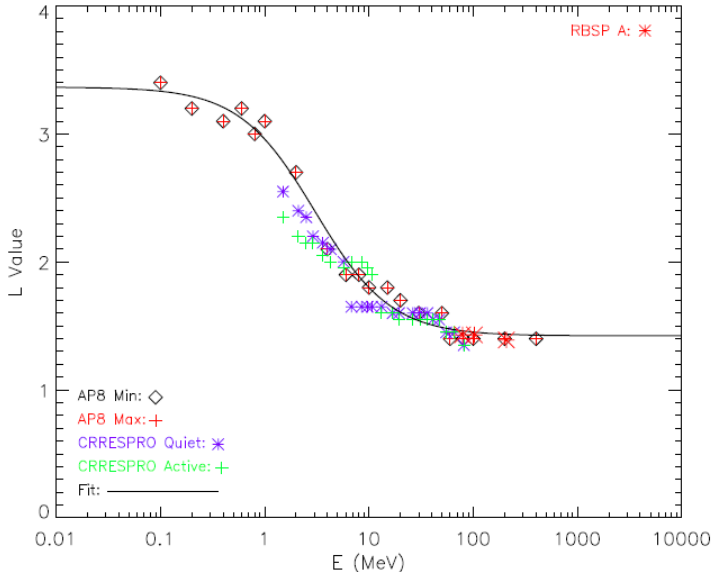




WSA model + CME cone model + HAFv2 model

= CME propagation in the heliosphere

Model research – Proton radiation belt model



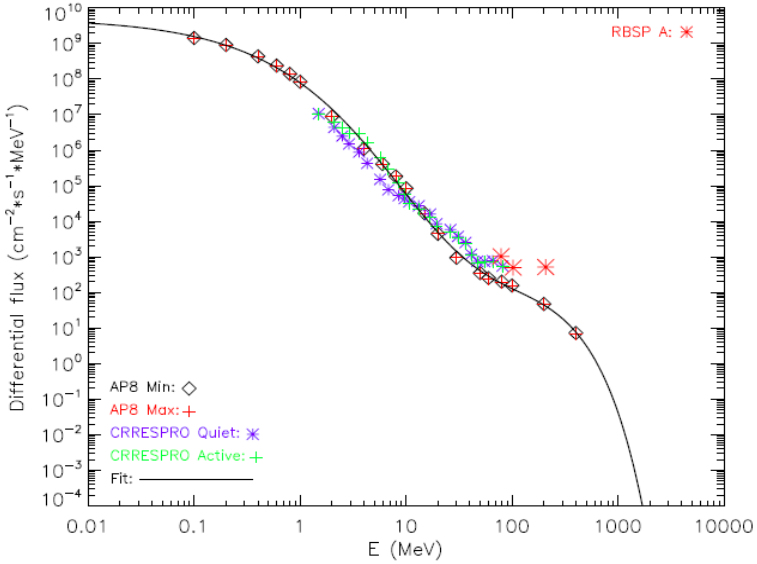
$$L_c(E) = \frac{a_0}{E^{a_1} + a_2} + a_3$$

$$a_0 = -0.515$$

$$a_1 = -1.195$$

$$a_2 = 0.245$$

$$a_3 = 3.366$$



$$\ln(J_{\max}) = b_0 + b_1 \cdot e^{b_2 \cdot E^{b_3}} + b_4 \cdot E$$

$$b_0 = 5.496$$

$$b_1 = 16.858$$

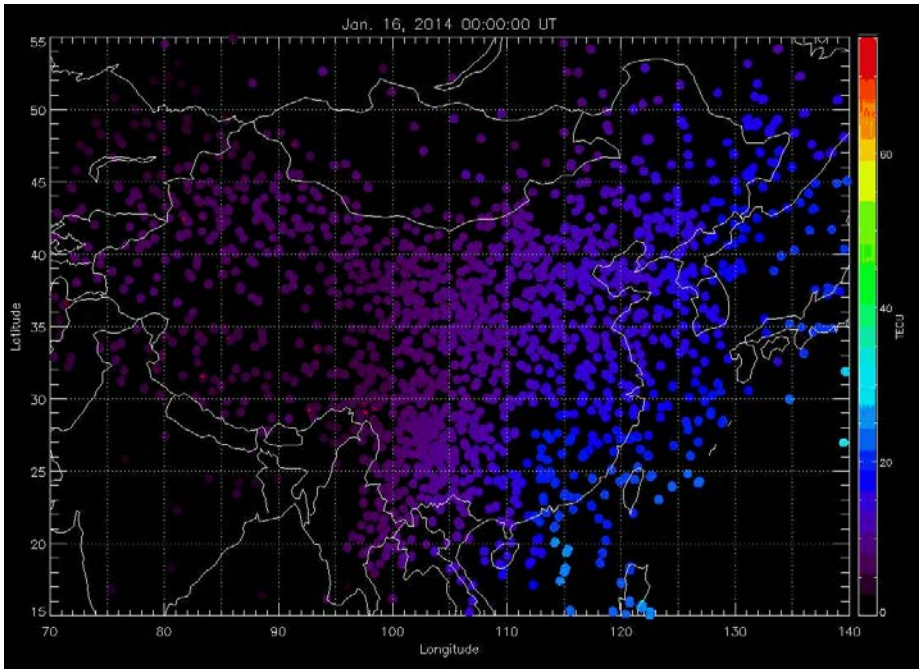
$$b_2 = -0.284$$

$$b_3 = 0.592$$

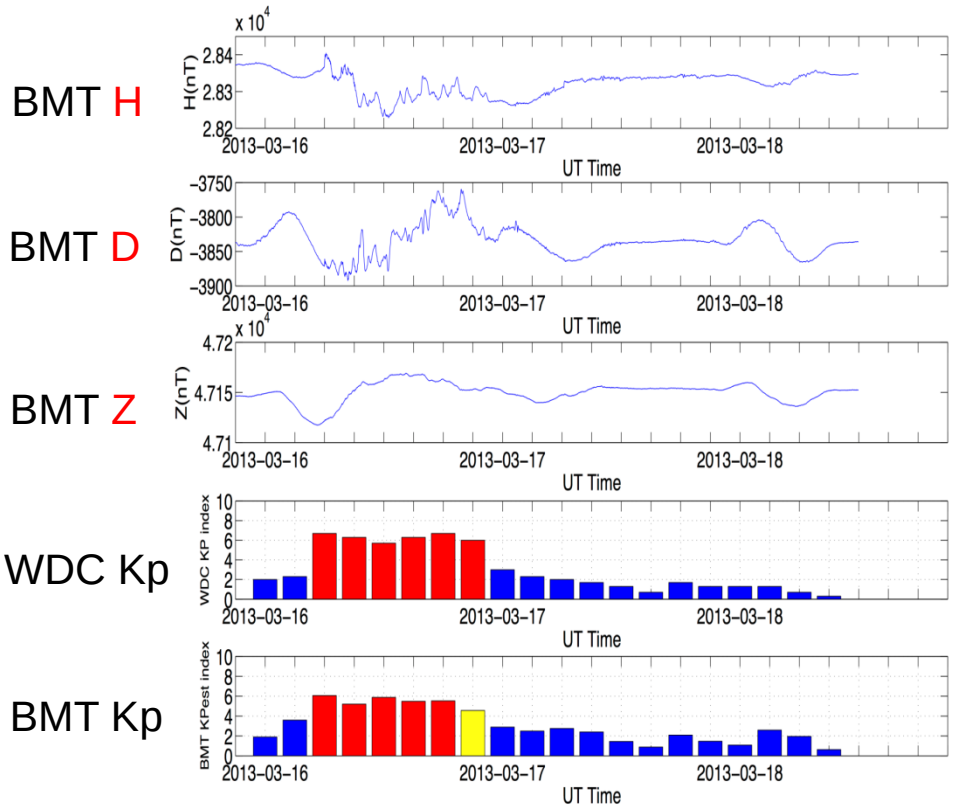
$$b_4 = -0.00865$$

Mutual data sharing on ionosphere

- Extend the applicable area of data assimilation model of ionosphere
- Increase the reliability of the model output

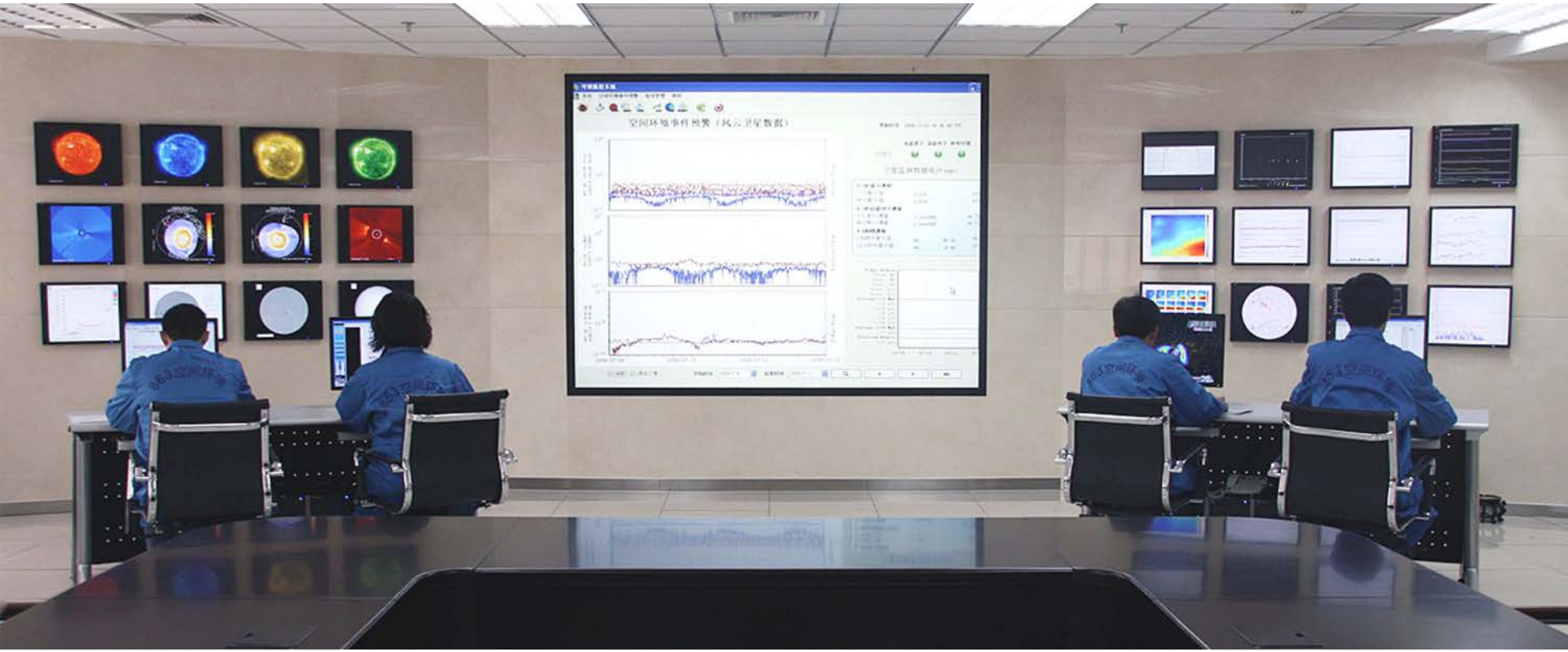


Mutual data sharing on geomagnetic field



	Takahashi	SEPC
Elimination of Sq	10-day average	Modified FMI
Method of estimating K	Converting function	Converting function
Method of estimating Kp	Linear fit	Poly fit
LC of single station Kp	0.87	0.92
LC of Multi-station Kp	0.94	0.96

Thank you for your attention!



Space Environment Prediction Center, NSSC/CAS