International Civil Aviation Organization

THE FOURTH MEETING OF ASIA/PACIFIC METEOROLOGICAL HAZARDS TASK FORCE (MET/H TF/4)

ICAO Regional Sub-Office, Beijing, China

19 – 21 March 2014

Agenda Item 7： Any other Business

CHINA'S SPACE WEATHER OPERATIONAL FORECAST AND SERVICE TO AVIATION

(Presented by China)

SUMMARY

This paper presents information on the operational space weather forecast and service provided by the China Meteorological Administration in support of international air navigation.

1. INTRODUCTION

1.1 The National Center for Space Weather (NCSW) was established in 2002 by China Meteorological Administration (CMA) and began to provide space weather operational service in 2004. Since Jun.1 2012, the routine space weather products based on the NOAA scales (Radio blackouts, Solar radiation storm, and Geomagnetic storm) have been provided to aviation industry via the Aviation Meteorological Center of CAAC.

1.2 CMA/NCSW has preliminary developed a complete business system which are designed similar to an architecture commonly seen at a meteorological service, covering monitoring, forecasting, and services, along with some R&D activities and could provide the reliable real-time space weather data from the solar to the earth. An operational space weather monitoring system has been built based on the existing meteorological observing systems, aiming at the enhancement of a seamless atmosphere-space monitoring capability. The FY satellites have become the ideal platform for space weather observations. From FY-1C, every meteorological satellite has carried the space environment detectors. The new sensors for aurora, ionosphere, solar imaging and geomagnetic field observations would on board the next generational satellites. The country-wide network of ground-based observations has been built to conduct systematic investigations on the solar photosphere, chromosphere, and radio, the ionospheric electron density profile, scintillation and D-region absorption, and the wind and temperature of upper atmosphere.

1.3 CMA/NCSW currently delivers daily, monthly, and annual monitoring and forecasting products and services to users through hard-copy bulletins, internet, phone, SMS,e-mail, public media, etc. CMA also provides special services for important customers, including Shenzhou, ChangE, Beidou missions and State Grid, etc. On Jun.1 2013, the space weather channel of the www.weather.com.cn has been online. The website provides space weather information for the public.

1.4 A cooperative agreement has been signed by CMA/ NCSW and CAAC/AMC in May 2012. The terms of reference are to investigate the request of aviation for space weather, develop the relative technology, and promote the service of space weather for aviation. Some products such as alert, key parameters, forecast has been made and delivered for service.

1.5 CMA/NCSW is also the co-chair of the WMO Inter-programme Coordination Team on Space Weather of (ICTSW) which has conducted collaborative actions with the ICAO on the specification of space weather services to global aviation.

2. Aviation Space Weather Index

2.1 The RSG scales from NOAA Space Weather Prediction Centre (NOAA/SWPC) have been widely adopted by aviation to describe space weather information.

2.2 According to NOAA space weather scales, CMA/NCSW could provide aviation space weather indexes (see Figure 1) including geomagnetic storms, solar radiation storms, and radio backouts based on international and domestic data (eg. Fengyun satellites data). CMA/NCSW also issue the space weather forecast based on the scales. As the cooperative agreement between the CMA/NCSW and CAAC/AMC, the aviation space weather product has been routinely delivered.

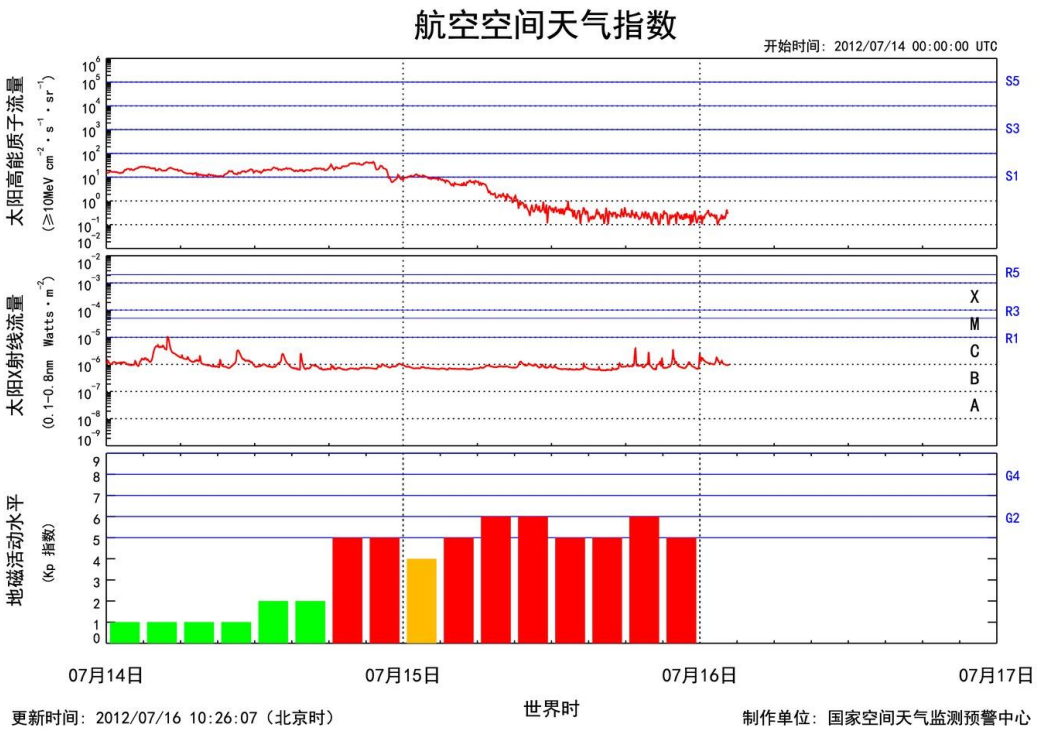

Figure 1 the space weather index for aviation based on the NOAA/SWPC scales

2.3 Space weather products have been integrated into aviation weather products and issued via aviation meteorological service platform of CAAC (see Figure 2).

3. Ionospheric products for aviation

3.1 The ionosonde data could be used for finding the optimum operation frequencies for broadcasts or two-way communications in the high frequency range. Using ionosonde observations from Xiamen, Kezhou, Nanning and Xi'an stations in CMA, the product of variation of Ionospheric critical frequency (foF2) has been developed (see Figure 3). Based on the requirement analysis for aviation, CMA/NCSW would develop specific product for optimum frequency selection.

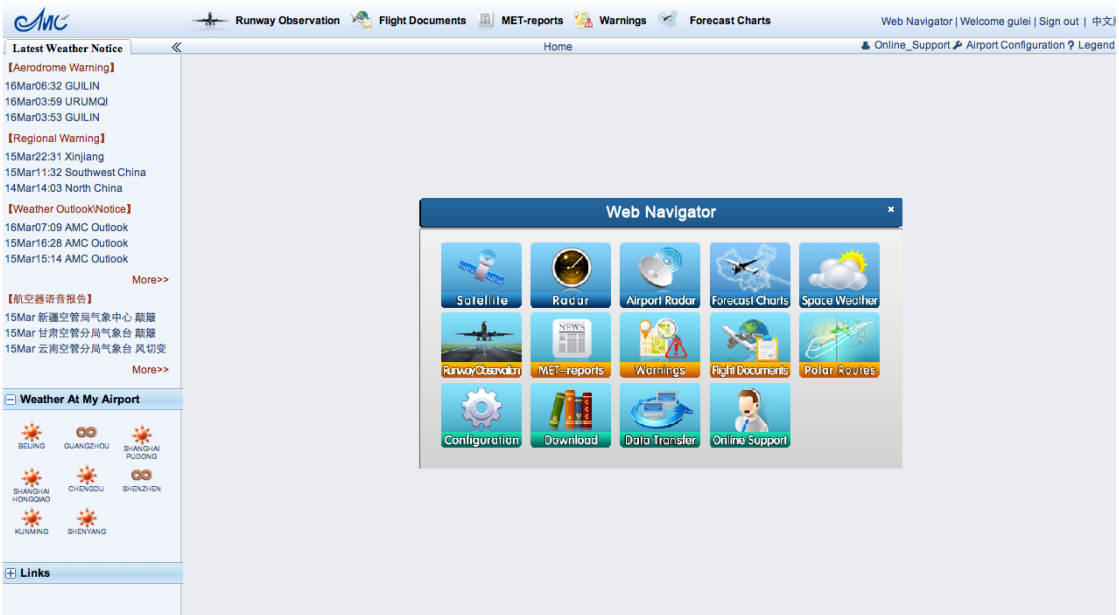

Figure 2 aviation meteorological service platform of CAAC
(http://www.amsc.net.cn/ENG/Flash/Index.aspx#)

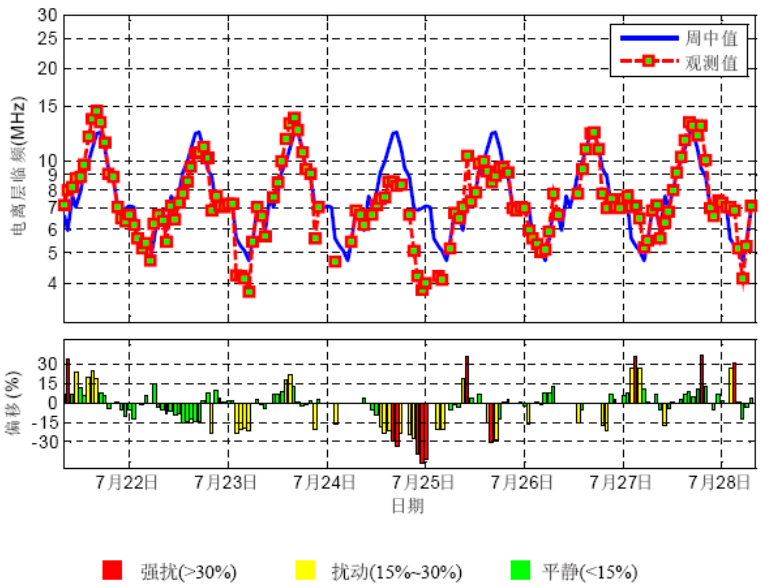

图 5 地区电离层天气（临频）变化
（北京时间 07 月 21 日 8 时—07 月 28 日 8 时）

Figure 3 Variation of Ionospheric weather(foF2)

3.2 The solar-induced drifting ionospheric electron-density irregularities may lead to the scintillation of trans-ionospheric GNSS signals. Scintillations not only degrade signal quality but also cause loss-of-lock, posing a major threat to GNSS-based applications demanding high levels of accuracy, availability and integrity. Using ionospheric scintillation data of both GPS and FY-2D satellites, the services of ionospheric scintillation monitoring product in South China has been provided to Guangzhou 2010 Asian Games and Shenzhen 2011 Universal Games (see Figure 4).

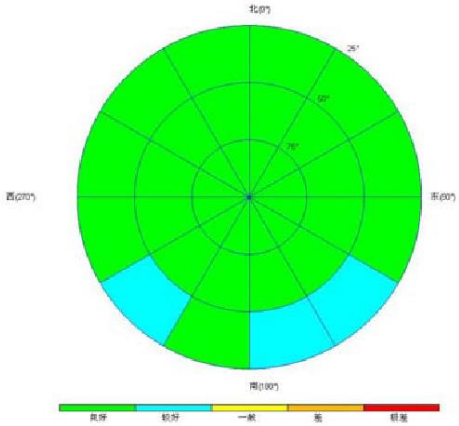

图 1、2010 年 10 月 10 日
广州上空不同天区星地通信质量统计图

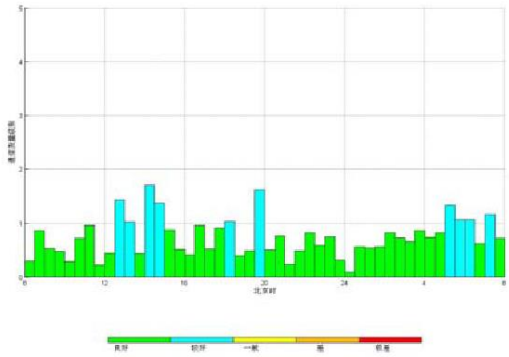

图 2、2010 年 10 月 10 日
广州每日随北京时变化的星地通信质量统计图

Figure 4 Satellite communication quality for Guangzhou 2010 Asian Games

4. Radiation dose for aviation

4.1 It is well known that radiation increases with altitude and latitude. Especially in the polar and high-latitude regions, solar radiation storms can further increase the radiation exposure to passengers and crew in aircraft. A radiation dose calculation system is developing which can give the dose rate and accumulated dose expected along a flight path (see Figure 5).

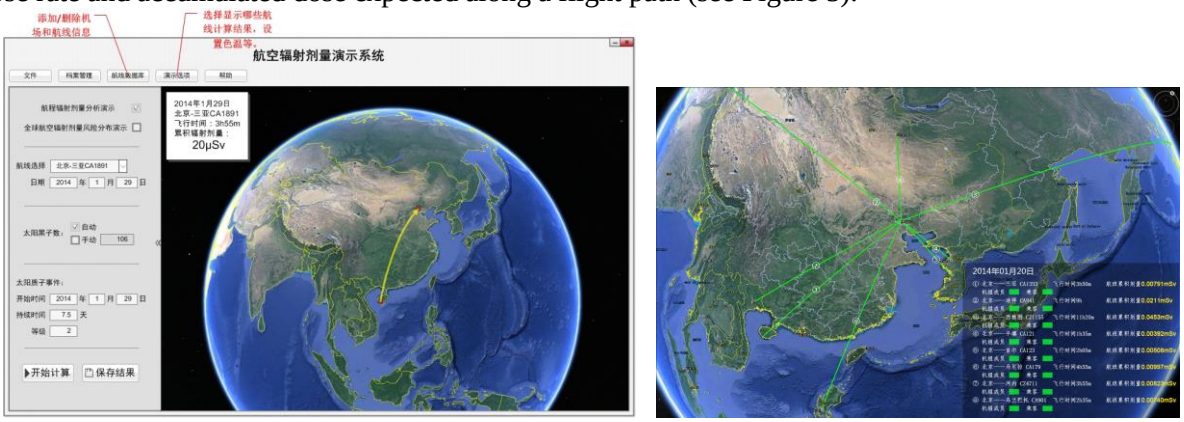

Figure 5 The demo system for aviation radiation dose

5. ACTION BY THE MEETING

5.1 The meeting is invited to note the information in this paper.

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