# Space Weather Research in China and Introduction of CSSAR

J. Cao (E-mail: jbcao@center.cssar.ac.cn)

## 1. Space Weather Research in China

The most important programs in china, which are space weather related, are Meridian project and SMMS mission:

(1) Meridian Project

Meridian Project is a mission to establish an observatory chain with ground-based multi-instruments for the Solar-Terrestrial environment observations. The station chain, which starts from Mohe, the northwest station via Beijing, Wuhan, to Hainan and towards Zhongshan Station in the Antarctic along the 120 E meridian, is named the meridian chain.

(2) SMMS mission

The orbit of the SMMS satellite is a polar sun-synchronous orbit (H=800 km). Focused on the severe near-earth environmental problems, such as the geospace storms and ozone depletion, the main scientific goal of the SMMS is to study the response of the near-earth environment to the solar activity and interplanetary disturbance.

The principal scientific objectives of SMMS mission are listed below:

* To investigate the magnetospheic disturbances triggered by the solar activity and interplanetary disturbance by measuring the precipitating particles and aurora.
* To investigate the response of the global structure of ionic and neutral atmosphere and the ozone to the solar activity and magnetospheric disturbances. SMMS mission will help us elucidate some fundamental physics process in the sun-earth connection, advance the understanding of the physical and chemical coupling mechanism between magnetosphere, ionosphere and atmosphere.

## 2. Introduction of Center for Space Science and Applied Research/ Chinese Academy of Science

(1) CSSAR began the exploration and research of space environment in 1960s. After thirty years' research, important achievements have been made in the areas of space environment, effect analysis, and the development of space environment detectors. Some important parameters of space environment are obtained, such as high energy charged particles (electrons, protons and heavy ions), single event upset, radiation dose, space plasma, surface charging, deep dielectric charging, upper atmosphere density and components, solar electromagnetic radiation and etc.

(2) In 1971, CSSAR launched Practice-1 (Shijian-1), the first satellite for the exploration and research of space environment

(3) In 1990, Chinese sun-synchronous meteorological satellite FengYun-1B was launched successfully. The cosmic rays detectors (made in CSSAR) on board detected the heavy ion components of C, N, O, and Fe of the radiation belt, and anomalous components of cosmic rays C, N, O, and Fe. A lot of data of high energy charged particle in the south Atlantic magnetic anomaly region and solar proton event were obtained.

(4) In 1994, Chinese Practice-4 (Shijian-4) was launched, which aimed at the investigation of the space environment and effect analysis. Almost all payloads are made in CSSAR. There were high energy proton and heavy ion spectrometer, high energy electron spectrometer,

electrostatic analyzer, surface potential monitor, SEE monitors and other payloads on board Practice-4. A large number of data about inner and outer radiation belts were obtained. Practice-4 observed magnetospheric storms and substorms, solar proton events. The satellite surface potential reached -2400 V. Single event upset rates were observed to be 3.4 errors/Mbit-day and Single event latchup rates 1/month.

(5) In 1997, China launched the meteorological satellite FengYun-2.The X-rays detector and particle detector (made in CSSAR) on board comprised the warning and monitoring system of solar proton event. On November $4^{th}$ and 6th of 1997, Solar X-ray detector successfully gave the warning of the solar proton event several hours ahead of time. The particle detectors soon detected the solar high energy particle fluxes.

(6) In 1999, Practice-5 was succesfully launched. By means of the payloads on the Practice-5, Scientists in CSSAR monitored the distribution of single event effect on the low earth orbit and studied possible protection method.

August 1999