The new application research related to CSES

*Xuemin Zhang[1], Shufan Zhao[1], Chen Zhou[2], Zhipeng Ren[3]

1. Institute of Earthquake Science, China Earthquake Administration, 2. Wuhan University, 3. Institute of Geology and Geophysics, China Academy of Science

China CSES satellite will be launched in 2017. There are eight scientific payloads onboard, to detect the electric field with frequency band of DC-10MHz, magnetic field to 20kHz, in-situ plasma parameters including electron density, electron temperature, ion composition, ion density and ion temperature, high energy particle of electrons and protons, electron density profiles and tomography. In order to bring them into full play, new research has been carried out in data processing and application. The main progress has been concluded as following.
By receiving the TBB signals, about 30 stations will be set up to construct two profiles in south-north direction in China mainland. The ionospheric tomography technology has been developed by employing the methods of Truncated Singular Value Decomposition, Spherical Function and Empirical Orthogonal Function (EOF). On the basis of beacon receiver data in China, the Ne profiles along the observing links have been built up, and their temporal features have been studied.
Based on the constellation observation, and taken COSMIC data as an example, the assimilation model of ionosphere on electron density has been developed by using EOF method. Considering the inversion accuracy at different layers, E and F layer have been calculated separately under different coordinate systems. Furthermore, the Hall and Pederson conductivity have been obtained at the altitude of 90-500km, which can be an input for computing the current system in ionosphere.
The full wave propagation model of VLF radio waves has been improved, and the two-dimensional calculating results are displayed to reveal the spatial distribution features of these radio waves. The actual observation on DEMETER satellite of ground transmitters is compared with the 2D theoretical results, and their consistence verifies the reliability of the model.
By emitting the high power HF signals into the space, one can disturb and cause the heating phenomena in lower and topside ionosphere. Three heating events have been chosen out in SURA-DEMETER experiments. Based on the Ohmic heating theory, a 3D model has been constructed to simulate the heating process, in which the disturbed amplitudes in Ne are close to the actual observing under different ionospheric state.
In the LAIC model related to earthquake research, the DC electric field coupling model has been paid more attention in recent years. Some simultaneous variation phenomena have been obtained around earthquakes. To explain these disturbances, the electric field model is suggested and improved, in which the additional current at the ground surface is considered. It is found that, vertical electric field is more obvious at low latitude and the horizontal electric field does not change with the height at high latitudes. The penetration height of LAI electric field in ionosphere is lower at low latitude than that at high latitude.

Keywords: CSES, LAI coupling mechanism, ionospheric tomography

