

Development of the electric field sensor for a sounding rocket

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Measurements of electric fields are one of key elements for the investigation of ionospheric plasma. The detection of electric field is useful to identify global plasma dynamics and energetic processes in magnetosphere and ionosphere. The concrete examples are as follows.

- Electric field structure associated with the charged particle precipitation and the global motion of the ionosphere
- The role of the electric field in the acceleration and heating mechanisms of ions
- Propagation mechanism of the electric field in the auroral ionosphere to the low latitude ionosphere
- Electric field structure in the equatorial ionosphere

Many electric field measurements have been carried out in Japan. And the electric field detector onboard sounding rockets have been successfully used in the D, E and F regions of the ionosphere. The double probe technique have been extensively used on sounding rockets in order to measure electric field in the ionosphere. And the passive double probe technique has been proven to be a reliable technique in the high electron density plasmas of the ionosphere. The technique has been extended to the lower density plasmas of the D region of the ionosphere. For electric field measurement, a wire antenna has been used as a sensitive sensor onboard Japanese sounding rocket. And this antenna will be used for several spacecraft in the future mission. However, its extension mechanism is complicated and it is difficult for the sounding rocket to extend a wire antenna in the ionosphere. Accordingly new type sensors are developed in order to measure the electric field by the sounding rocket. Their sensors fulfill the severe requirements to the sensor system, i.e., light mass, enough stiffness, compact storage, safe extension, and reasonable test efforts. Four sensors were newly developed for the electric field measurement. These sensors were loaded on four sounding rockets in Japan (S-310-37, S-520-23, S-520-26 and S-310-44). And these new style sensors deployed normally during the flight of a sounding rocket, and succeeded in the electric field observation in the ionosphere.

This paper describes about the basic measurement techniques of the electric field in the ionosphere. In particular it explains about four new type sensors in detail. Then we show the electric field data in the ionosphere measured by the new type sensor onboard the Japanese sounding rocket.

Keywords: electric field sensor, sounding rocket, ionosphere, electric field measurement