

Space structure of Es layer observed by Langmuir probe and a new analysis method

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The sporadic E layer has been studied for a long time, and wind-shear theory is generally accepted about its generation mechanism. The theory explains an accumulation process of the electron density, but hardly gives information on thermal energy budget inside the layer. A great number of observations have been reported about the electron density structure in the sporadic E layer, but few information on the electron temperature are available, and therefore the accurate measurement is expected to conduct on the sounding rocket. In general, since a velocity of the sounding rocket is very high, it is difficult to get high special resolution data on the density structure of the sporadic E layer in the vertical direction. Therefore, it is necessary to find a new idea to estimate electron temperature and electron density in high-time resolution to understand the small scale structure of the sporadic E layer.

The sounding rocket "S-520-29" was launched from Uchinoura Space Center at 19:10 on August 17, 2014. The purpose of this experiment is to elucidate spatial structure of sporadic E layer in the lower ionosphere. Langmuir probe was installed as one of the probes for direct measurements. In some current-voltage characteristics obtained by the Langmuir probe during this experiment, it was noted that the current variation with the bias voltage showed unusual behavior which suggests significant gradient in the electron density inside the sporadic E layer. In such a case, it is not possible to estimate electron density and electron temperature by using the conventional method.

In this study, we suggest a new analysis method to enable accurate estimation of the electron temperature and density, even when electron density is rapidly changed. It becomes possible to estimate the temperature and density in a time interval shorter than a period of the voltage sweep, because the probe current are interpolated by using adjacent data.

In this presentation, we report the small scale density structure and vertical thickness of the sporadic E layer estimated by adopting the new method, and validity of the current interpolation.

Keywords: E layer, Langmuir probe, sounding rocket