# A numerical study on decrease of electron temperature inside the sporadic E layer

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The sporadic E (Es) layer has been studied for a long time. Wind-shear theory is generally accepted about its generation mechanism. This theory explains an accumulation process of the electron density, but hardly gives information on thermal energy budget inside the layer.Although the electron temperature is the parameter for discussing the thermal energy budget inthe ionosphere, there were few data of reliable electron temperature in the Es layer in the past.Thus, few information on the electron temperature are only available, and there were very few discussions about the thermal energy budget inside the Es layer.The sounding rocket "S-520-29" was launched from Uchinoura Space Center at 19:10 JST on August 17, 2014. The purpose of this experiment is to elucidate spatial structure of the Es layer in the lower ionosphere.Langmuir probe installed on this rocket is capable of making high-speed sampling of probe current, and thereby it is possible to estimate the electron temperature and density more than 10 samples per second. In addition, it becomes possible to obtain the temperature and density in shorter time interval by adopting a new method of interpolation for obtained current -voltage relationship. Data calculated by using such an interpolation based on Langmuir probe measurements suggest that the electron temperature significantly decreased inside the Es layer with respect to the background temperature. Furthermore, the detailed trend of the electron temperature from its boundary toward the center of Es layer was revealed due to the interpolation.In this study, we will discuss a physical implication of the observed high electron temperaturefor energy budget inside the Es layer by conducting numerical calculation in which we consider electrons, ions, and neutrals in the vertical 1-D direction. The electron temperature distribution is estimated for various conditions of electron density using electron energy equation.The photoelectron heating and Joule heating are included in the calculation as a heating process, and the electrons' interaction with the neutrals and the ions is considered as a cooling process. It was found that the electron temperature tends to decrease inside the Es layer when the electron density becomes significantly larger as in the Es layer. Furthermore, we tried to find an important process dominant for the electron temperature increase by examining adependence of various parameters such as ion density and the electric field. We will present a result from this numerical consideration.

Keywords: Sounding rocket, sporadic E layer

 