Obserbation of electron number density profiles and VLF plasma waves by using S310 sounding rocketsduring the SEEK-2 campaign

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The SEEK-2 campaign has been carried out in early August 2002 in order to study on the generation mechanism of quasi-periodic radar backscatter echoes due to field-aligned irregularities accompanied with sporadic-E layers of the mid-latitude region, including rocket experiments and ground observations. Two sounding rockets (S310-31,32) were prepared for this purpose and launched toward east from Kagoshima Space Center, at 23:24 JST(S310-31) and 23:39 JST(S310-32) on August 3, 2002. In this campaign, altitude profiles of electron number density were measured by using the Impedance Probe installed on both the rockets. The maximum electron densities of about 9x10^4/cc (for S310-31), and 2x10^5/cc (for S310-32) were measured within an altitude range of 100-105km associated by several sub peaks. On the other hand, TMA experiment on board S310-32 was carried out to observe the neutral wind velocity profile of the ionosphere. The Plasma Wave Monitor, also installed on S310-32, has detected plasma wave signatures associated with the TMA release in the sporadic-E layer.

Electron density profiles showed that sporadic-E layer consists of one or two main peaks(-x10^5/cc) at 104-106km altitude and several small peaks existing above and below the main peaks. We compared these number density profiles with the results of Low Thermosphere Profiler Radar located on Minamitane and FAR on Nishinoomote. In comparison with LTPR data, peaks in the number density profiles well correspond with altitude profiles of intense echoes in the radar data. We purpose a model of 2 dimensional distribution model of sporadic-E structure. In this model, sporadic-E layer patches distribute horizontally being associated with multi-layer structure of relatively weak densities. From each weak ionization region the field-aligned irregularities are possibly generated along the magnetic field lines.

On the other hand, Plasma Wave Monitor data shows generation of plasma waves associated not only with the TMA release but also with the effect of the passage through the sporadic-E layer.

The present results are able to contribute to understand the mechanism of quasi-periodic echoes, and generation mechanism of TMA lightning which was found in the present rocket experiment.