

修士論文要旨

A study on electron density distributions at high latitude (高緯度域における電子密度分布の研究)

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Many investigations have been carried out since 1960's for the polar ionosphere and magnetosphere, where the coupling between the terrestrial ionosphere, the magnetosphere and also the solar wind is taking place. These investigations disclosed fundamental and characteristic features of the plasma phenomena in the high latitude, and suggested various physical processes of plasma in this region. However, a unified understanding of plasma processes in the polar ionosphere/magnetosphere is not sufficient up to the present. One of the reasons is that the basic plasma structures and variability of the polar ionosphere/magnetosphere have not been well known.

Although the global structure of plasma distribution has been eagerly desired, it has been really difficult to obtain enough data for the investigations because long lived satellite observations which provide the accurate and constant quality of plasma data have not existed up to date in the polar region.

Purposes of this thesis are to make clear the structure and variabilities of the electron density profiles under the various conditions at high latitude, and also to understand the forming process of the density distributions. We made a statistical investigation of the plasma density profiles for geomagnetic activities, seasons and

magnetic local time. An electron density data set was made by using the plasma wave data obtained with the Plasma Wave and Sounder experiment (PWS) on board the EXOS-D (AKEBONO) satellite, and the average density profiles were then, fitted to the function of altitudes to make an empirical model of electron density in the polar and auroral regions.

We made some case studies to confirm the existence of plasma depletion and increase phenomena in the polar ionosphere/magnetosphere. Electron densities from the PWS system were compared with the charged particles fluxes obtained by Low Energy Particle Instrument (LEP) and plasma flow velocities derived by DC Electric Field Experiment (EFD) on board the EXOS-D satellite.

The results of this study are summarized as follows:

1. An empirical model of electron density profiles was made in the case of Summer and $K_p < 2+$, and it showed good agreement with in-situ data. Namely, the electron density can be described by simple function of altitude.
2. From the statistical study, the structure of the density depletion region was clarified with respect to the altitude and latitude. It was also confirmed that the depletion region overlaps with the region where electron of a few keV energy are precipitating above the auroral oval.
3. It is statistically confirmed that the plasma density increases in the cusp/cleft region. The origin of downward electron flux with hundreds eV corresponds to this density enhance region.
4. It was suggested that the electron density enhancement in the cusp/cleft region is caused by heating from electron precipitation.
5. In the case of disturbed magnetic activity, the electron densities increase in the polar cap especially in the day side.
6. Seasonal variation appears in the region of high latitude ($> 55^\circ$) and in the altitude range lower than 6000 km.