電離圏最下部の電子密度構造について

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On the electron density structure in the lowest region of the nightside ionosphere

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Electron density structure in the ionosphere has been observed by in-situ and the ground-based instruments for many decades. We have used Langmuir probe and fixed-bias probe on the sounding rocket to measure the local electron density in the ionospheric D, E, and F regions. As a result of analyzing several altitude profiles derived from the sounding rocket data, we notice that a ledge structure of the electron density is observed to exist at the altitude of 80-85 km on the nightside. In this talk, characteristic feature of the ledge structure will be presented.

It is well known that the ionospheric D region disappears at night because there is no direct irradiation by the sun light. Therefore, the electron density below 90 km altitude is remarkably lower at night than at daytime. In fact, the sounding rocket observation shows that electron density in the nightside ionosphere is lower than $3x10^3$ cm^{-3} below 90 km altitude. In addition, it is significant that the electron density profile has a very steep positive gradient at a certain altitude, *i.e.*, it abruptly increases by more than 10 times in a narrow altitude range. For example, altitude profile of the electron density observed at 23:48 LT on December 19, 2011 by S-310-40 rocket abruptly increases by about 70 times at the altitude of 92 km. Similar increase was also observed during S-520-26 experiment, which was conducted at 05:51 LT on Jan 12, 2012. In these data set, the electron density was estimated from Langmuir probe measurement. Thus, it is noticeable that the altitude profile has a ledge structure where the density abruptly increases by more than a factor of 10 at a certain altitude. Such a ledge structure is found only at night but not at daytime.

Such an electron density structure was also observed by other sounding rocket experiments in US (Dickinson et al., 1980). They suggested that the ledge structure of the electron density at night is related to the abrupt fall to undetectable levels in the atomic oxygen density with decreasing height around 83 km altitude because the atomic oxygen density profile had a similar spatial structure as seen in the electron density. The common feature is attributed to chemical reaction in the lower D region in which atomic oxygen, metal, metallic ion, and other primary species play an important role.

In this talk, we present the detail structure of the electron density in the lowest region of the ionosphere and discuss a possible implication of the ionospheric chemistry.

Reference

Dickinson, P.H.G. et al., The determination of the atomic oxygen concentration and associated parameters in the lower ionosphere, Proc. R. Soc. London, 369, 379-408, 1980