Response of the nighttime equatorial D-region ionosphere to the magnetic storm of October 29 - November 3, 2003

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We have proposed that tweek atmospherics can be effectively used as a tool for the nighttime D-region ionosphere observations. Only nighttime tweeks can be analyzed, because the attenuation of daytime tweeks is larger than that of nighttime. By analyzing nighttime tweeks, electron densities at the reflection heights, the reflection heights, and propagation distances can be estimated. From characteristics of the cut-off frequency, the reflection heights correspond to the bottom of the ionosphere.

From previous studies, it has confirmed that tweek reflection heights were lower than the monthly mean quiet value in two main phases in three severe magnetic storms. The peak Dst indicies of three magnetic storms was around -200 nT. We assume that a lowering of tweek reflection height means the increase of electron densities at the bottom of the ionosphere. At the same time with the lowering of tweek reflection height, phase disturbances of LF radio waves (40 kHz) were confirmed. Furthermore, it was revealed that the electron densities more than 84 km increased by MF radar measurements.

In F-region ionosphere observations, h'F parameters were lower (24 - 43 km) than the quiet value. This lowering is meaningful, because the deviation of h'F parameter in quiet time is 8 -16 km. On the other hand, TEC data also increased at the same time with the lowering of tweek reflection heights. That is, the whole ionosphere was lower than the quiet time in the main phase of magnetic storms. It is considered that the whole ionosphere was lowered by the westward electric field cross B drift.

Geomagnetic H component variations in 210 degrees MM magnetic field data coincided with the lowering of tweek reflection heights. It seems that the lowering of tweek reflection height was related with magnetic field variations around maximum depressions. That is, it shows that disturbances of the bottom of the ionosphere might be closely associated with the electric field penetration from the magnetosphere.

In this presentation, we report the case study of the response of the nighttime equatorial ionosphere to a huge magnetic storm from October 29 to November 3, 2003. At 23:00 UT on October 30, 2003, the peak of Dst index was -401 nT, and the AE index was about 4000 nT. In the nighttime on October 29, 2003, a positive storm was observed by f0F2 parameters of ionograms. In this session, we discuss that there might be possible for electron density increase even in the ionosphere at the low-latitudes and low-altitudes at the beginning of the magnetic storm.