

Topside density profiles of the polar ionosphere observed by using the plasma sounder experiment on board the Akebono satellite

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The structure of auroral ionosphere is the one of the most important subjects for the understanding of acceleration and precipitation region of auroral particles especially formed in the lower ionosphere altitude. The topside ionograms obtained by the Akebono satellite sometimes show unique traces of sounder echoes in the polar region in an altitude range from 1000 km to 3000km. According to the N-H profile analysis, it has been interpreted as an enhanced ionization region in the altitude range from 1000-2500km, with an enhancement of the scale height parameter with factor of 3. In this paper, we aimed to show the detail of this unique ionosphere structure by comparing with the in-situ electron density profile provided by using the plasma wave spectrum obtained on-board the Akebono satellite.

Observations of the topside ionosphere have long term history since 1960s when the topside sounder satellites Alouette and ISIS started to provide us a global structure of the ionosphere. However, the knowledge of the topside ionosphere structures is not sufficient yet, especially for understanding of polar ionosphere region, because strong disturbances make it difficult to establish a statistical view of the ionosphere due to the auroral ionization and Joule heating of the electrojet currents. However, structure of auroral ionosphere is the one of the most important subjects for the understanding of acceleration region of auroral particles especially formed in the lower ionosphere altitude. The structure and dynamics of polar ionosphere are recognized as a key of escaping ions from the polar ionosphere forming a polar wind as well as escaping heavy ions. These interesting regions are expected to be located in an altitude range from 1000 km to 3000 km where a ground based observation techniques remains difficulty. Then, the topside sounder observation has a significant potential providing us important data for the study of plasma physics in the polar ionosphere.

The Akebono satellite launched in 1989 has been making the topside sounding of ionosphere. Ionograms obtained in the region of polar ionosphere sometimes showed an unique trace of sounder echoes. According to the N-H profile analysis, it has been found to be an enhanced ionization region in the altitude range from 1000 - 2500km, with an enhancement of the scale height parameter. For example, one ionogram observed in the auroral precipitation region on 31st, Jan., 1990 reveals the density and scale height profiles above 800km become larger than those of other ionogram traces separated with 32 seconds, and the scale height of this structure has a peak at 1500 km. The scale height peak showed three times larger than that of other traces. Benson et al. reported a similar structure associated with the auroral cavity in the auroral precipitation region. In this paper, we aimed to show the detail of this unique ionosphere structure by comparing with the high spatial resolution density data provided by using the plasma wave spectrum obtained on-board the Akebono satellite.