

Relationship between low-latitude irregularities and background ionosphere with the Equatorial Atmosphere Radar

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Depletion of plasma density, or plasma bubbles, frequently grows in the nighttime equatorial F region. Plasma bubbles contain various scales of field-aligned irregularities (FAI). In this paper, we studied the background ionospheric condition for generation of plasma bubbles based on the data from the Equator Atmospheric Radar (EAR) [1] and ionosondes. Observations were conducted in March-April 2004 as a part of the first international observation campaign (CPEA-I), and in October-November 2004. National Institute of Information and Communications Technology operated three ionosondes located along the same geomagnetic meridian during these periods.

Comparing between the EAR and ionosonde observations, we confirmed that plasma bubbles were generated when the F layer was raised by the prereversal enhancement, and reached 400 km at Chumphon. We also found disappearance of E region FAI in the post sunset hours related to the rise of the F layer. Bottom height of FAI echoes agreed well with that of the F layer observed by the co-located Ionosonde (see Figure 1). Different height variation of the F layer observed with three ionosondes suggests that the vertical motion of the F layer should be controlled by the other factor, i.e. neutral wind, than the zonal electric field.

In order to determine spatial distribution of plasma bubbles, we investigated zonal drift velocity of plasma bubble from the EAR multi-beam observations. Zonal drift speed was about 140 m/s just after the sunset, and it gradually decreased by 10 m/s every one hour. On the assumption that plasma bubbles are generated just after the sunset and the drift speed decrease linearly, we estimated the generation region of plasma bubbles. We found that plasma bubbles which contain 3-m scale FAI echoes can appear as far as 2000 km west from the EAR. Large-scale distribution of plasma bubbles were estimated to show intermittently occurrences with spacings of 600-800 km. This scale may be related with the day-to-day variation of plasma bubbles.

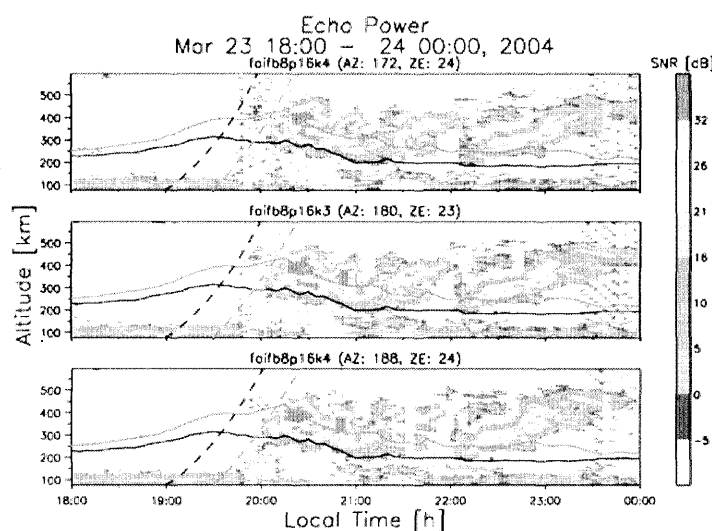


Figure 1: Time-height cross-section of FAI echoes observed with the EAR during 18-24 LT on March 23, 2004 and time variation of the bottom of F -layer.

REFERENCES

- [1] Fukao, S., H. Hashiguchi, M. Yamamoto, T. Tsuda, T. Nakamura, M.K. Yamamoto, T. Sato, M. Hagio, and Y. Yabugaki (2003) The Equatorial Atmosphere Radar (EAR): System description and first results, *Radio Sci.*, 1053, doi:10.1029/2002RS002767.