

Micro and macro structure of the geomagnetic equatorial plasma bubble observed by the PALSAR

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Abstract

We investigated the stripes over the large area of Amazon when the region was scanned by the radar (PALSAR) onboard ALOS satellite. The stripes appeared on the local midnight along the geomagnetic field line with a typical characteristic width of 600 to 4000m in the range direction and several hundred kilometers in azimuth direction. The radar has sensitivity not only on the scattering characteristics of the ground surface but also on the irregularity of the ionosphere between the ground and the satellite. The phenomenon was investigated by three different kinds of data taken by the SAR image amplitude, interferometry and the polarization measurement. All measurements gave the same profiles of the space irregularity. Furthermore when the ALOS PALSAR observed the stripes, the GPS receivers located at the same area observed the scintillation. The frequency spectrum of the striped image has a good agreement with that of the GPS data. Therefore, it would be natural to set a hypothesis that the stripes are induced by the irregularity of the ionosphere and more specifically induced by the interaction between the refractive signal properties through the local inequality of the plasma bubble. This investigation has been made being based on the data set obtained in the observation days between April 2006 and September 2008. During that time the satellite scanned the Earth surface almost twice and collected more than several tens data sets. The number of the scintillation image is increased in the year 2008. This is related to the increase of the solar activity, which is minimized in the year 2006. The stripes were observed not only over Amazon but also over West Africa, South-East Asia, east New Guinea and Hawaii in their local night. The majority is in the Amazon and the second majority is in the Africa.

In this paper, we will conduct the relationship between the stripes and the geomagnetic line and the seasonal and longitudinal occurrence probability in reference to the DMSP measurement, which has been conducted over the world scale plasma bubble occurrence.

Taking account of these facts, we may conclude that the stripes are induced by the Rayleigh-Taylor instability enforced by the planetary wave raising from the lower altitude passing through the mesosphere.