

Seasonal-longitudinal dependence of the occurrence of equatorial plasma bubbles observed by ISS-IMAP

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Equatorial plasma bubbles (EPBs) are local depletions of the electron density in the ionosphere. Ionospheric irregularities are included in EPBs and cause radio signal scintillation. Recently, research on applying GNSS to Air Navigation System has progressed, therefore, it becomes more necessary to investigate the generation mechanism and the morphology of EPBs.

In this study, we analyzed seasonal-longitudinal dependence of the occurrence of EPBs using airglow-images obtained by ISS-IMAP (Ionosphere, Mesosphere, upper Atmosphere, and Plasmasphere mapping). In 630-nm airglow images, EPBs are visualized as black lines. 181 events are selected during 2012/09 - 2013/08. To calculate the longitudinal dependence of occurrence rate, we divide the ionosphere into 36 longitude bins, each 10 degrees wide. Since EPBs are observed at low and middle latitude, the total observation time is accumulated when $|\text{latitude}| < 30$. We calculate the occurrence rate as the number of EPBs detected over the total observation time.

The occurrence rate is high at the African-Atlantic-American regions in the equinoctial seasons. On the other hand, the occurrence rate is also high at American-Pacific regions in summer, which is not obtained in the previous study, Burke et al. [2004], in which EPBs are detected using plasma density data on DMSP satellite. The altitude of DMSP is 840 km, which is higher than the observation altitude of ISS-IMAP, that is about 250 km. Therefore, it is conceivable that the difference of occurrence rate of EPB is due to the altitude of the observations. This implies that ISS-IMAP observation could detect EPBs not developed to higher altitude.

Based on above, we will present seasonal-longitudinal variability of the Rayleigh-Taylor instability growth rate, contributing the development of EPBs using ionosphere model and other observational data.

Keywords: Equatorial ionosphere, Plasma bubble, airglow, ISS-IMAP