Generation and movement of equatorial plasma bubbles: Roles of vertical plasma drifts, seeding perturbations, and geomagnetic storms

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We study the characteristics and generation mechanism of equatorial plasma bubbles measured with the Communication/Navigation Outage Forecasting System satellite. It is found that the global distribution of the prereversal enhancement (PRE) of the postsunset equatorial vertical ion drift is very similar to that of the bubble occurrence. Ion density perturbations in different local time sectors are analyzed, and there is no obvious correlation between the afternoon ion density disturbances and the evening bubble occurrence. The results indicate that the PRE is the primary factor that controls the generation of plasma bubbles and that seeding perturbations may always exist in the equatorial region. Effects of geomagnetic storms on the PRE are examined. Penetration electric fields during the storm main phase cause enhancements of the PRE, increasing the occurrence of plasma bubbles, and disturbance dynamo electric fields during the storm recovery phase cause the PRE to decrease, suppressing the occurrence of plasma bubbles. Furthermore, geomagnetic storms cause strong westward plasma drifts in the nighttime equatorial ionosphere, which can reverse the normal eastward drifts of plasma bubbles to westward. The relationship among plasma bubble occurrence, postsunset vertical plasma drift, seeding perturbations, and geomagnetic storms will be addressed.

Keywords: Equatorial plasma bubble, Prereversal enhancement, Seeding perturbation, Vertical plasma drift, Geomagnetic storm

