البحث الخامس

Title

A Statistical Analysis of Plasma Bubbles Observed by Swarm Constellation during Different Types of Geomagnetic Storms

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English Abstract

Based on the observations of Ionospheric Bubble Index (IBI) data from the Swarm mission, the characteristics of plasma bubbles are investigated during different types of geomagnetic storms recorded from 2014 to 2020. The geometrical constellation of the Swarm mission enabled us to investigate the altitudinal profile of the IBIs during different activity levels in a statistical mean. Results show that the majority of IBIs associated with moderate storms are observed at low altitudes and the probability of observing IBIs at high altitudes (Swarm-B) increases with the increase in storm level. This is confirmed by observing the F2 layer peak height (hmF2) during super storm events at larger altitudes using COSMIC data. The maximum number of IBIs is recorded within the South Atlantic Anomaly (SAA) region with a long duration time and tends to increase only during dusk time. Both the large duration time and number of IBIs over the South Atlantic Anomaly (SAA) suggest that the gradient in the electron density and the depression in the magnetic field are the main factors controlling IBI events. Also, the IBIs at high altitudes are larger at sunset and at low altitudes pre-midnight. In addition, the occurrence of IBIs is always larger in the northern hemisphere than in the southern hemisphere irrespective of the type of storm, as well as during the summer months. Moreover, there is no correlation between the

duration time of IBIs and both the altitudinal observation of the IBIs and the storm type. Seasonal occurrence of IBIs is larger during equinoxes and vice versa during solstices irrespective of both the type of storm and the altitude of the satellite. The large number of IBIs during equinoxes agrees with the previous studies, which expect that the large electron density is a developer of steeper ∇n. Large occurrences of super storm IBIs observed within the pre-midnight during summer and at sunset during equinoxes are a novel observation that needs further investigation. Also, the majority of IBIs are observed a few hours after geomagnetic substorms, which reflects the role of the Disturbance Dynamo Electric Field (DDEF) as a main driver of IBIs.