

Dynamic Spectral Characteristics of Equatorial Plasma Bubbles

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Equatorial plasma bubble (EPB) is a well-known phenomenon in the equatorial ionospheric F region. As it causes severe scintillation in the amplitude and phase of radio signals, it is important to understand and forecast the occurrence of EPB from a space weather point of view. In order to simulate the instability in the equatorial ionosphere, a 3D high-resolution bubble (HIRB) model with a grid spacing of as small as 200 m has been developed. It provides a unique opportunity to characterize intermediate-scale EPB structure, which was not well resolved until very recently. Estimation of altitude-dependent power law spectral density function parameters provides an altitude versus time history of the intermediate-scale structure development. Local structure onset is associated with successive bifurcation of rising EPBs. Developed structure characterized by a two-component power law spectral density function ultimately subtends several hundred kilometers in altitude. The EPB simulation data fully support the reported EPB diagnostics from previous in situ measurements. In the near future, HIRB model may be able to directly resolve Fresnel scale of GPS frequency band (300-400m), so that the effects of EPBs on radio wave propagation could be evaluated without any assumption.

Keywords: plasma bubble, scintillation, ionosphere