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On the development of equatorial plasma bubbles around midnight hours of June solstice

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The equatorial plasma bubbles (EPBs)/equatorial spread F (ESF) irregularities are an important topic of space weather interest because of their impact on trans-ionospheric radio communications, satellite-based navigation and augmentation systems. This local plasma-depleted structures develop at the bottom side F layer through Rayleigh-Taylor instability and rapidly grow to topside ionosphere via polarization electric fields within them. Using the 47 MHz Equatorial Atmosphere Radar (EAR) at Kototabang, Indonesia, the nocturnal occurrence of EPBs were examined during the moderate solar activity years 2011-2012. While the evolution of EPBs were mostly (86%) confined to post-sunset hours (1900 – 2100 LT) during equinoxes, in contrast, the majority of EPBs (∼71%) in June solstice found evolve around the midnight hours (2200 – 0300 LT). The mechanisms behind the fresh evolution of summertime midnight EPBs were investigated through SAMI2 model simulations with a realistic input of background ExB drift variation derived from CINDI IVM on board C/NOFS satellite. The term-by-term analysis of linear growth rate of RT instability indicates that the formation of high flux tube electron content height gradient (KF) (steep vertical gradient) region at higher altitudes is the key factor for the enhanced growth rate of RT instability. The responsible factors are discussed in light of relatively weak westward zonal electric field in the presence of equatorward neutral wind and bottom side recombination around the midnight hours of June solstice.