

Occurrence and disruption of low-latitude ionospheric irregularities near sunset time

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The relationship between sunset terminators and the onset of radar backscatter plumes associated with equatorial spread F, or plasma bubble observed with the 47-MHz Equatorial Atmosphere Radar (EAR; 0.20S, 100.32E; dip lat. 10.36S) from October 2002 to April 2004 is discussed. Almost all irregularity echoes began to appear between sunset time at the observed area (local sunset) and that at the altitude of the apex of the geomagnetic field line connected with the observed area (apex sunset), and the onset time of more than half of the events corresponded exactly to apex sunset time. When the entire flux tube is out of the sunlit region (after apex sunset), flux tube integrated F-region conductivity decreases. The dynamo electric field in the F region then weakens, resulting in that plasma bubble onset is rare after apex sunset. Before apex sunset, on the other hand, 3-m scale irregularities rarely grow along the flux tube which penetrates the observed region because they are damped by the solar radiation at the geomagnetic equator.

Disruption of irregularity echos from the E region is frequently detected with the EAR associated with the development phase of plasma bubble. This disruption corresponds to the plasma bubble occurrence rather than local or apex sunset time. Since the E region over the EAR is coupled with the F region over the geomagnetic equator, polarization electric field associated with the plasma bubble depletion, which maps down to the low-latitude E region, may be responsible for the inhibition of growth of irregularities in the E region.