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Statistical analysis of spread-F occurrence and ionospheric variability over Brazil during solar minimum activity

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In this work we present a study of spread-F occurrence over a location under the Southern crest of the Equatorial Ionization Anomaly (Cachoeira Paulista: 22.7o S, 45.0 o W, mag lat: 16 o S, dip angle: -32.3o, Brazil) during the last solar cycle, which presented an extended solar minimum activity. After analyzing hundreds of ionograms obtained with a digital ionosonde DGS 256, between 1996 and 2010, we verified a high occurrence of spread-F during June Solstice (Southern hemisphere Winter) with a peak occurrence during solar minimum period. The spread-F events present the follow remarkable features: they occur around midnight-post midnight hours, during June Solstice and under quiet geomagnetic conditions. Several events presented high intensities and long durations. The most important result is our finding of an inverse correlation between the spread-F occurrence rate and the solar activity, similar to the extensively reported midlatitude spread-F events. The dynamics of F-layer heights and plasma densities suggest that these spread-F events are likely associated with Traveling Ionospheric Disturbances (TIDs) and/or the extremely low plasma densities that characterized the background ionosphere preceding these events, whose causes are not yet established. These new results show that the low latitude ionosphere is very active under solar minimum conditions and a variety of distinct disturbances associated with upper-atmosphere/ionosphere coupling can be separately studied without the direct influence of solar flux, geomagnetic activity and equatorial processes.