This work presents a study of the ionospheric variability over a location under the southern crest of the Equatorial Ionization Anomaly (Cachoeira Paulista, Brazil) during the last extended solar minimum period. Recent results have showed the frequent occurrence of spread-F principally during June Solstice around midnight post midnight hours. The most important feature of this spread-F occurrence is the inverse correlation between the spread-F occurrence rate and the solar activity, very similar to the extensively reported midlatitude spread-F. We analyzed ionospheric data obtained by a digital ionosonde (spread-F features, h`F, hmF2 and foF2), an optical imager (OI 630 nm emission images) and a GPS receiver (total electron content - TEC). Also we studied the local time variation of thermospheric nighttime meridional wind with the HWM07 model in order to investigate its influence in the F-layer movement. The dynamics of F-layer heights and plasma densities suggest that these spread-F events are likely associated with Traveling Ionospheric Disturbances (TIDs) occurring during geomagnetically quiet times, under very low solar flux, and extremely low plasma densities that characterized the background ionosphere. 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.