

F region irregularities near the southern equatorial anomaly crest in South America during the descending phase of solar cycle 24

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Abstract:

Ionospheric F-region irregularities can acutely affect navigation and communication systems. To develop predictive capabilities on their occurrence, it is key to understand their variabilities in a wide range of time scales. Previous studies at low latitudes in South America have been performed mostly for the eastern region. However, there are still few reports on the spread-F over Argentina owing to a lack of ionosonde data. This work presents the analysis of the spread-F (range spread-F and frequency spread-F) and plasma bubble occurrence characteristics near the southern crest of the Equatorial Ionization Anomaly in Argentina (Tucumán, 26.8°S, 65.2°W; magnetic latitude 15.5°S). We used ionosonde and Global Positioning System (GPS) data from November 2014 to December 2019 for different solar and geomagnetic conditions. The data show that spread-F and plasma bubble occurrence rates peak in local summer and are minimum in equinox and winter, respectively. There is a negative correlation between each type of spread-F and solar activity, whereas the opposite happens for plasma bubbles. Geomagnetic activity suppresses the generation of spread-F in equinox and summer and enhances it in winter. Plasma bubble occurrence is higher during disturbed days than during quiet days, but under medium solar activity, summer months register more plasma bubbles in quiet conditions. Range spread-F observed in winter under low solar activity is not associated with plasma bubbles originated at the magnetic equator. These results contribute to the knowledge necessary to improve the prediction of the spatial and temporal distribution of the night-time ionospheric irregularities.

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