

Study of the ionospheric variability in the South American Magnetic Anomaly (SAMA) during solar minimum (2017-2018)

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Abstract

We investigate for the first time the variability of the F₂ layer critical frequency (f_oF_2), its peak height (h_mF_2), the thickness parameter BO , and the E-region critical frequency (f_oE) over Santa Maria (29.7°S, 53.7°W, dip= -38°), a station located in the central region of the South American Magnetic Anomaly (SAMA). The selected ionospheric parameters were obtained from ionograms recorded by a recent Digisonde Portable Sounder (DPS-4D). The time period covers 309 days from 1st September 2017 to 30th August 2018. The diurnal analyses revealed a large day-to-day ionospheric variability, with some peculiarities as a strong semi-annual pattern superimposed to expected ionospheric behavior. Furthermore, the results show significant differences between the averaged foF_2 in December and June solstices, revealing a possible presence of the annual asymmetry. The coefficient of variation (CV) is used as a quantitative description of the variability of each parameter versus time and season. Considering low solar flux and geomagnetically quiet days only, we note that CV is smaller during the daytime, and larger during nighttime for all parameters. The least variable ionospheric parameter in our study is f_oE , while the most variable one is BO . Regarding the F₂-layer parameters, we observe that foF_2 is much more variable than h_mF_2 . We attribute the observed CV to the neutral atmosphere source over Santa Maria. The ionospheric variability is in general enhanced during geomagnetically disturbed periods. The estimated CV is higher over Santa Maria than Wuhan (30.5°N, 114.4°E, dip= 46°), China, a station with no influence of the SAMA.