

Multi-scale analysis of the cosmic noise absorption by the geomagnetic activity and galactic cosmic ray precipitation

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In this work we present and discuss the ionospheric D region response to the geomagnetic activity and the galactic cosmic ray (GCR) precipitation under sub-auroral region (Brazilian Antarctic Station (BAS) - geographic coordinates: 62,56°S; 58,39°W). For this propose, it was analyzed the galactic cosmic noise absorption (CNA) registered by riometers operating at 30 MHz over BAS (connected to an antenna pointed to the zenith direction) during almost one complete solar cycle (1989-1996). In order to study the variability of the CNA, we employ a filtering procedure using the continuous wavelet transform analysis that it is consisted by the decomposition of the signals using *Morlet* “mother” function. From the correlation of the wavelet details among these signals it was detected that the GRC is the main source of the ionization of the lower ionosphere in this region with a correlation coefficient (CR) closest to 1.0 for the detail D11 (with the 3 to 6 years of periodicity). Also, from this same analysis, it was verified an expressive CR of the detail D9 (≈ 0.8) for periodicity of the 1 to 2 years denoting a seasonality dependency of the CNA by the GCR precipitation. The seasonality dependence also was verified by the CR in the detail D9 between the CNA and kp index decomposition ($CR \approx 0.9$). From these results we follow that the GCR is the major source of the ionization of the sub-auroral lower ionosphere and its precipitation is modulated by the local geomagnetic cut-off variation with a bi-annual/annual periodicity.