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Anisotropies of cosmic ray flux: observations made from the space weather laboratory installed at the Argentine Marambio Antarctic base

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A new water-Cherenkov radiation detector, located at the Argentine Marambio Antarctic Base (64.24S-56.62 W), has been monitoring the variability of galactic cosmic ray (GCR) flux since 2019. One of the main aims is to provide experimental data necessary to study interplanetary transport of GCRs during transient events at different space/time scales.

We present the empirical corrections for atmospheric pressure and temperature on the observations made during one full year. From in situ pressure measurements we got the mean barometric coefficient. After that, the temperature effect is modeled using the isobaric layer associated with 100 hPa from ERA5 reanalysis. This model explains seasonal variations and changes on shorter time scales.

After the analysis and correction of the GCR flux variability due to the atmospheric conditions, a study of the periodicities is performed in order to analyze modulations due to heliospheric phenomena. We can observe two periods: (a) 1 day, associated with the Earth's rotation combined with the spatial anisotropy of the GCR flux; and (b)

~30 days due to solar impact of stable solar structures combined with the rotation of the Sun. From a superposed epoch analysis and considering the geomagnetic effects on the asymptotic arrival directions, we find that the mean diurnal amplitude is 0.08% and that the maximum flux is observed in 15 LT (local time) direction in the interplanetary space. We interpret our result in the theoretical frame of the force-free GCRs equilibrium. In such a way, we determine the capability of Neurus to observe GCR flux variabilities at ground level, associated with the interplanetary modulation.