A Preliminary Study on the Effects of Solar Proton Events on the South Atlantic Anomaly

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The cause of the continual weakening of the weakest part of the geomagnetic field- the South Atlantic Anomaly (SAA)- is currently unknown. The research problem discusses if Solar Proton Events (SPEs) affect the magnetic field strength of the SAA. The purpose of researching SPEs' effect on the SAA is to know if and how solar activity should be considered when observing the SAA. Using the CHAOSmagpy python program, SAA data was extracted and algorithmically processed from SWARM satellite files 5 days before, after, and during each SPE event from 2013-2017. SPE data was gathered from NASA's SPEs Affecting the Earth Environment dataset. The overall, positive, and negative correlations were 0.0104, 0.1187, and -0.2602, respectively. The average slopes before and after the SPE were 5.3133 nT/day and 13.3426 nT/day. During the SPE, 21% had weak flux strength and no extrema, 43% had weak flux strength and extrema, 21% had strong flux strength and no extrema, and 14% had strong flux strength and extrema. There was no correlation between changes in the magnetic field of the SAA and SPEs. The slope changes indicate that the SPE significantly increased the rate at which the magnetic field was increasing. The sinusoidal pattern analysis of the magnetic field strength graphs of the SAA showed that the strength of the SPEs do not have a significant effect on the extrema of the graphs. Further calculations with larger data samples may determine if the impact of the SPEs on the SAA magnetic field is consistent.

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