Numerical Proton Flux Response in South Atlantic Anomaly during Geomagnetic Storm

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In this research, we have developed a test particle simulation code to study the inner proton belt dynamics and the proton flux variations inside the South Atlantic Anomaly (SAA) during the geomagnetic storm event of 15 May 2005. The Tao-Chan-Brizard guiding center model was implemented to evaluate the trajectories of 140-400 MeV protons. The time-varying magnetic field model was evaluated by the Tsyganenko model TS05 with the corresponding inductive electric field. The South Atlantic Anomaly is an important feature of the Low-Earth Orbit (LEO) environment which creates a significant radiation source affecting most of the LEO mission performance. Numerical results showed that during the storm main phase, the SAA proton flux was decreased, while during the initial and recovery phases, the SAA proton flux was increased at most of the altitudes. The latter conclusion was confirmed using satellite measurements.

Keywords: South Atlantic Anomaly, Inner Proton Belt, Test Particle Simulations, Geomagnetic Storm, Inductive Electric Field, Tsyganenko Model

