Electric Field Effect on Proton Flux Response in South Atlantic Anomaly during Geomagnetic Storms

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In this research, we are studying proton flux variations in the inside the South Atlantic Anomaly (SAA) due to the inductive electric field computed by the time-varying background magnetic field provided by Tsyganenko model (TS05) during geomagnetic storm event of May 15, 2005. We have developed a 3D relativistic test particle simulation code using a guiding center theory, where the Tao-Chan-Brizard model was implemented. It is well-known that the South Atlantic Anomaly (SAA) is considered as a source of hazardousness for Low-Earth Orbit (LEO) environment. The objective of this investigation is to compute the proton flux variations in this critical zone to be able to estimate the corresponding radiation doses on spacecraft bodies, due to their passage inside the anomaly, and precisely, during intense geomagnetic storms. So far, it was found that during the main storm phase, the proton flux in the SAA varied greatly with respect to altitude and the protons could penetrate deeper toward the atmosphere by about 100 km. Numerical results were compared with satellite observations.

Keywords: South Atlantic Anomaly, Geomagnetic storm, Tsyganenko model, Inductive electric field, Proton flux, Test particle simulations

