Short-Term Variations of Proton Flux in South Atlantic Anomaly due to Solar Storm Conditions

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We study the short-term variations of the proton flux in the South Atlantic Anomaly (SAA) region due to solar storms, whose intensity is well characterized by the Dst index. We have developed a three-dimensional relativistic test particle simulation code to calculate the proton trajectories in time-varying magnetic field, provided by Tsyganenko model TS05. The South Atlantic Anomaly (SAA) is considered as an additional radiation source for Low-Earth Orbit (LEO) satellites and human operations, since this region involves high-energy charged particles (cosmic rays), emerging from the trapped radiation belts. In this study, we consider the following anomaly variables: the maximum value of the proton flux and the area of the anomaly at given altitudes, and the proton penetration depth. Our results show that when the Dst index was decreased from -7 nT to -210 nT, the penetration depth was increased from 300 km to 150 km (i.e., about 150 km deepened), and the maximal flux and the area of the anomaly region were increased to 14 % at 600 km, and 80 % at 400 km, respectively.