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Some Spatial and Temporal Properties of Secondary Electrons and Positrons Produced By Terrestrial Gamma-Ray Flashes Derived from Monte-Carlo Simulations.

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Terrestrial gamma-ray flashes are natural bursts of X and gamma-rays, correlated to thunderstorms, that are likely to be produced at an altitude of about 10 to 20 km. After the emission, the flux of gamma-rays is filtered and altered by the atmosphere and a small part of it may be detected by a satellite on low earth orbit. Thus, only a residual part of the initial burst can be measured and most of the flux is made of scattered primary photons and of secondary emitted electrons, positrons and photons. Trying to get information on the initial flux from the measurement is a very complex inverse problem, which can only be tackled by the use of a numerical model solving the transport of these high energy particles. For this purpose, we developed a numerical Monte Carlo model which solves the transport in the atmosphere of both relativistic electrons/positrons and X/gamma rays. It makes it possible to track the photons, electrons and positrons in the whole earth environment (considering the atmosphere and the magnetic field) to get information on what affects the transport of the particles from the source region to the altitude of the satellite. In this study, we set-up a simulation close to the FERMI event number 091214 with a particular attention to spatial and temporal properties of electrons and positrons reaching satellite altitude. We focus on the positron/electron ratio and discuss what are the conditions to reach a value of about 19 %, as reported for this event.