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Terrestrial Gamma-Ray Flashes and associated electron emissions at satellite altitude : some properties and modelling using Monte-Carlo simulations.

David Sarria, Pierre-Louis Blelly, and Francois Forme

Institut de Recherche en Astrophysique et Planétologie (IRAP), Université de Toulouse, Toulouse, France (david.sarria@irap.omp.eu)

On-board TARANIS satellite, the CNES mission dedicated to the study of Transient Luminous Events (TLEs) and Terrestrial Gamma-ray Flashes (TGFs), IDEE and XGRE are the two instruments which will measure the relativistic electrons and X and gamma rays. At the altitude of the satellite, the fluxes have been significantly altered by the filtering of the atmosphere and the satellite only measures a subset of the particles. Therefore, the inverse problem, to get an information on the sources and on the mechanisms responsible for these emissions, is rather tough to tackle, especially if we want to take advantage of the other instruments which will provide indirect information on those particles. The only reasonable way to solve this problem is to embed in the data processing, a theoretical approach using a numerical model of the generation and the transport of these burst emissions.
For this purpose, we developed a numerical Monte Carlo (MC) model which solves the transport of both relativistic electrons/positrons and gamma-rays, travelling through the atmosphere and the geomagnetic field. After a brief presentation of the model and the validation by comparison with GEANT4, we discuss the origin of the particles escaping the atmosphere and how they may be spatially dispersed as a function of their energy and radial distance at the altitude of the satellite, depending on the source properties, and the impact that could have on the detection by the satellite.