EGU2020-4645
https://doi.org/10.5194/egusphere-egu2020-4645
EGU General Assembly 2020

Modelling the production of terrestrial gamma-ray flashes during the final leader step

Christoph Köhn, Olivier Chanrion, Heumesser Matthias, Krystallia Dimitriadou, and Torsten Neubert
Technical University of Denmark, DTU Space, Astrophysics & Atmospheric Science, Lyngby, Denmark (koehn@space.dtu.dk)

Recent measurements by the Atmosphere-Space Interactions Monitor (ASIM) indicate that the production of energetic electrons and of subsequent terrestrial gamma-ray flashes (TGFs) occurs immediately prior to intracloud lightning breakdown. Inspired by this finding, we relate the production of high-energy particles to the occurrence of streamer coronas initiated during the final leader step when the leader is in the vicinity of the upper cloud charge layer. Therefore, we model the acceleration of electrons and the subsequent production of energetic photons in the electric fields of the two encountering streamer coronas which are initiated in the vicinity of the leader tip and of the charge layer. Applying a particle Monte Carlo code, we first initiate thermal electrons in the electric field of the leader tip and subsequently turn on the streamer coronas and simulate the acceleration of electrons from thermal energies to energies of several tens of MeV. We present the temporal evolution of the electron and photon energies and spectra, and discuss the role of the electric fields of the encountering streamer coronas. Finally, we relate our results to ASIM measurements and discuss the duration and the relative timing of TGF bursts.