



Estimating the electric field at the tip of lightning leaders

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In several studies Terrestrial gamma-ray flashes (TGF) have been associated with radio atmospherics generated by lightning discharges. In particular, a close relationship between TGFs and ⁺IC lightning, which develops in a stepped manner transporting electrons from the main negative toward the upper positive charge layer, have been induced. In light of these observations the production of TGFs has been proposed to occur during the stepping of lightning leaders in the intense field ahead of the leader tip.

We make a semi-dynamical estimate of the electric field at different stages during the stepping of a negative lightning leader. First we approximate the lightning leader simply by a perfectly conducting wire emersed in an external homogeneous electric field. Then we estimate the effects of the positive and negatively charged regions of the initial corona discharge stage. Finally we attempt to take into account the expanding region of the streamer zone by approximating the expansion as a positive and negatively charged cap that expands in steps in the region immediately ahead of the lightning leader. The results are investigated in the context of the production of the TGF.