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Electric Field Change Measurements of a Terrestrial Gamma Ray Flash

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Cummer et al. [GRL, 2014] reported on two terrestrial gamma ray flashes (TGFs) detected by the Gamma ray Burst Monitor (GBM) on the Fermi satellite. At a range of 632 km we detected an electric field change pulse associated with the first of these TGFs. The sensor bandwidth was 0.16 Hz – 2.6 MHz and was sampled at 5 MS/s. The measured zero-to-peak amplitude was 3.1 V/m. Assuming a 1/R range dependence, the amplitude range normalized to 100 km would be about 20 V/m. However, a little more than half of the path from the TGF to the sensor was over land rather than ocean, which should cause the attenuation to be greater than 1/R. Based on recent measurements of Kolmasova et al. (2015 AGU Fall Meeting), we estimate that the real peak amplitude was 40 - 50 V/m. The detected pulse was bipolar with a leading positive peak and had an overall duration of about 50 μs; these characteristics are typical of initial breakdown pulses (IBPs) that occur at the beginning of intracloud (IC) flashes. However, the pulse amplitude is an order of magnitude larger than typical IBPs. These data support the notion that IBPs of IC flashes cause TGFs [e.g., Shao et al., JGR 2010; Lu et al., GRL 2010; Cummer et al., GRL 2014].