

## Observations of a Terrestrial Gamma Ray Flash at ground level coincident with a current pulse on a triggered lightning channel

Brian Hare (1), Martin Uman (1), Joseph Dwyer (2), Douglas Jordan (1), Jaime Caicedo (1), Felipe Carvalho (1), Robert Wilkes (1), Daniel Kotovsky (1), William Gumerota (1), John Pilkey (1), Terry Ngin (1), Robert Moore (1), Steve Cummer (3), Eric Grove (4), Amitabh Nag (5), Michael Biggerstaff (6), Daniel Betten (6), Alan Bozarth (7), and Hamid Rassoul (7)

(1) University of Florida, Gainesville Florida, United States, (2) University of New Hampshire, Durham New Hampshire, United States, (3) Duke University, Durham North Carolina, United States, (4) Naval Research Laboratory, Washington D.C., United States, (5) Vaisala, Helsinki Finland, (6) Oklahoma University, Norman Oklahoma, United States, (7) Florida Institute of Technology, Melbourne Florida, United States

We report on a second terrestrial gamma ray flash (TGF) detected at ground-level coincident with a rocket-triggered lightning flash. The second TGF was observed in August 2014, while the first was detected in August 2003 and reported by *Dwyer et. al.* [2004]. Both TGFs occurred during the initial stage of the associated triggered lightning flashes and both TGFs were coincident with large pulses of current on the lightning channel. Modeling of the current pulse from the 2014 TGF and direct measurement of the 2003 pulse indicates that the current pulses during both TGFs had very similar shapes and that each current pulses consisted of two superimposed Gaussian shaped currents. Current measured at the base of the lightning channel in 2003 shows that the two Gaussian current waves had full widths at half maximum of  $765 \mu\text{s}$  and  $75 \mu\text{s}$ , and modeling of electric fields measured in 2014 show that the two Gaussian currents in 2014 had full widths at half maximums of  $235 \mu\text{s}$  and  $59 \mu\text{s}$ . Lightning mapping array data collected during the 2014 TGF indicates that the TGF was initiated when the triggered lightning upward positive leader (UPL) reached an altitude of 3.5 km altitude. A comparison between this altitude and the current modeling shows that the TGF was initiated after the beginning of the longer Gaussian current but suggests that peak TGF flux and peak current amplitude occurred at about the same time at the tip of the UPL, suggesting that the faster Gaussian current and the TGF could have been produced by the same physical source.