



A new population of TGFs in RHESSI data

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Terrestrial Gamma-ray Flashes (TGFs) are short bursts ($\sim 300\mu\text{s}$) of highly energetic gamma-rays associated with positive upwards lightning discharges in thunderstorms. Originally they were thought to be rare events due to the BATSE instrument only detecting 87 TGFs during its 9 years of operation (9 TGFs/yr). However with the RHESSI satellite's launch in 2002 the detection rate increased to 160 TGFs/yr, and with improved search algorithms this reached 350 TGFs/yr. Other notable satellites are the Fermi GBO detecting TGFs at a rate of 850 TGFs/yr and AGILE at ~ 1000 TGFs/yr. An unanswered question is; how common are TGFs?

We have used the World Wide Lightning Location Network (WWLLN) in addition to RHESSI to extract 100ms interval of RHESSI data centred at the time of each lightning flash. By superposing the RHESSI intervals of data (excluding already identified TGFs) between August 2004 and December 2014, we find a 9.03σ increase in gamma-rays at the time of lightning, indicating that there exists a new population of TGFs that cannot be detected by current search algorithms.

We have looked at the distribution of counts detected by RHESSI for each lightning flash, and we have identified up to 765 new TGFs (with WWLLN matches). This is almost twice as many as the previously detected TGFs with WWLLN matches (~ 367) for the same time period. This shows a large new population of weak TGFs, and indicates that TGFs are more common than previously thought.