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Optimization of Selection Criteria for Weak Signal TGFs

Nini Lykke Berge, Nikolai Østgaard, and Kjetil Haakonseth Albrechtsen
Department of Physics and Technology, Birkeland Centre for Space Science, University of Bergen, Norway (nini.berge@student.uib.no)

Terrestrial Gamma-ray Flashes (TGFs) consist of high-energy photons produced in thunderstorms in connection with the lightning flash, and are the most energetic photon phenomena naturally occurring on Earth. The satellite Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI), originally designed for observing solar flares, is also able to detect gamma rays from Earth.

Østgaard et al (2015) presented a new method of identifying TGFs that were not part of previous RHESSI TGF catalogs. By superposing RHESSI data intervals for each lightning detection by the World Wide Lightning Location Network (WWLLN) within a distance of 800 km of the sub-satellite point, they showed that there exists a group of weak signal TGFs.

Expanding on this work we here provide a statistical analysis, comparing the signal strength both to background levels and to a Poisson distribution. We seek to optimize the range of the search parameters in order to minimize the chance of including background events. The parameters covered are the distance of the lightning from RHESSI's sub-satellite point, the signal strength, and the duration of the events.