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Analysis of convective thunderstorms correlated with Terrestrial Gamma Ray Flashes (TGF)

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ABSTRACT
Terrestrial Gamma Ray Flashes (TGFs) are extraordinarily bright events of gamma radiation originating from thunderclouds [Fishman et al., 1994]. These events have been further investigated by several satellites devoted to high-energy astrophysics, such as the Reuven Ramaty High-Energy Spectroscopic Imager (RHESSI) [Grefenstette et al., 2009], the Astrorivelatore gamma ad Immagini Leggero (AGILE) [Marisaldi et al., 2010a; Tavani et al., 2010; Marisaldi et al., 2014] and the Fermi Space Telescope [Briggs et al., 2010].
Despite the recognition from their discovery that TGFs originate from thunderstorms (Fishman et al. 1994), relatively little is known about the TGF-producing storms. In order to understand if they can exhibit any distinct characteristics and to start a long term of research with the aim to create a link between TGF and meteorological events, we examined a population of 78 TGF and corresponding WWLLN lightning data in the spatial and temporal proximity of TGFs detected by AGILE from 2015 April to 2015 June.
The analysis of satellites (both LEO and GEO) observations' coincidence makes us able to study convective characteristics and precipitation structures related to TGF occurrence. In particular, we use the frequent GEO satellites data to follow the cloud system dynamics, and passive microwave sensors on polar orbiting satellites to study the inner cloud structure. When possible, this is further improved using the Dual-frequency Precipitation Radar (DPR) observations provided by the Global Precipitation Measurement (GPM).
Finally, we carried on a statistical analysis for the whole population of TGF in order to study the temporal evolution of the cloud electrical activity in relation with TGF occurrence. The analysis of the spatial and temporal distribution of flashes shows that most of TGFs occur during the peak of flash production.