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Terrestrial Gamma-ray Flashes and lightning detected from space are not compatible with the same distribution

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Terrestrial Gamma-ray Flashes (TGFs) and global lightning activity are closely related, but it is not clear yet whether all lightning are conducive to TGFs or not. The scenario is further puzzled by recent observations by Fermi-GBM suggesting that many sferics closely associated to TGFs are compatible with the radio signal coming from the runaway avalanche discharge itself rather than any lightning stroke. The AGILE satellite, thanks to its low-inclination orbit, provides a very high TGF detection rate density across the equator, where both lightning activity and TGF observation peak. We explore the correlation between AGILE TGFs distribution and global lightning activity provided by the Lightning Imaging Sensor (LIS) onboard the TRMM satellite, in the spatial and temporal domain. Previous studies have shown a variable degree of correlation between TGFs and lightning flash density in different geographical regions. Here we compare, by means of the Kolmogorov - Smirnov test, simultaneous data of AGILE TGFs and lightning flash density between March 2009 and February 2012. The analysis properly accounts for AGILE exposure and the possible contributions from regions surrounding the satellite footprint. Previous results are confirmed and extended to the temporal domain: AGILE TGFs and lightning flashes detected from space are not compatible with the same distribution. A possible implication of these results is that only a subclass of lightning flashes may be accompanied or conducive to TGFs detectable from space.