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Spectral Analysis of Individual Terrestrial Gamma-ray Flashes Detected by ASIM

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Terrestrial Gamma-ray Flashes (TGFs) are sub-millisecond bursts of high-energy photons associated with lightning flashes in thunderstorms. The Atmosphere-Space Interactions Monitor (ASIM), launched in April 2018, is the first space mission specifically designed to detect TGFs. We will mainly focus on data from the High Energy Detector (HED) which is sensitive to photons with energies from 300 keV to > 30 MeV, and include data from the Low Energy Detector (LED) sensitive in 50 keV to 370 keV energy range. Both HED and LED are part of the Modular X- and Gamma-ray Sensor (MXGS) of ASIM.

The energy spectrum of TGFs, together with Monte Carlo simulations, can provide information on the production altitude and beaming geometry of TGFs. Constraints have already been set on the production altitude and beaming geometry using other spacecraft and radio measurements. Some of these studies are based on cumulative spectra of a large number of TGFs (e.g. [1]), which smooth out individual variability. The spectral analysis of individual TGFs has been carried out up to now for Fermi TGFs only, showing spectral diversity [2]. Crucial key factors for individual TGF spectral analysis are a large number of counts, an energy range extended to several tens of MeV, a good energy calibration as well as knowledge and control of any instrumental effects affecting the measurements.

Thanks to ASIM's large effective area and low orbital altitude, single TGFs detected by ASIM have much more count statistics than observations from other spacecraft capable of detecting TGFs. By comparing Monte Carlo simulations to the energy spectrum from single ASIM TGFs we will aim to put stricter constraints on the production altitude and beaming geometry of TGFs. We will present the dataset, method, and some results of the spectral analysis of individual TGFs.

References:

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