

EGU21-14757

<https://doi.org/10.5194/egusphere-egu21-14757>

EGU General Assembly 2021

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## Investigating the relationship between TGF durations and the onset times of the optical pulses and the TGFs

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*We investigate and determine the sequence of the Terrestrial Gamma-ray Flashes (TGFs) and the observed optical emissions associated with lightning flashes, as well as the connection between the duration of TGFs and the time between the onset of the TGFs and the observed main optical pulses. Over 200 observations from the instruments of the Atmosphere-Space Interactions Monitor (ASIM) on board the International Space Station (ISS) are used, together with data from the lightning detection networks GLD360 and WWLLN. The ASIM data consist of two separate recordings: High energy measurements from the Modular X- and Gamma-ray Sensor (MXGS), and optical measurements from the Modular Multi-Spectral Imaging Array (MMIA). The optical measurements are from photometers operating in the 337 and 777.4 nm bands, and the temporal uncertainty between the two instruments of ASIM is  $\pm 5 \mu\text{s}$ .*