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Assessing the relationship between the TGF durations and the onset times of the TGFs and the main optical pulses as detected by ASIM

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Using the Modular X- and Gamma-ray Sensor (MXGS) and the Modular Multi-spectral Imaging Array (MMIA) of the Atmosphere-Space Interactions Monitor (ASIM), we investigate the time sequence of the Terrestrial gamma-ray flashes and the optical emissions from the associated lighting. A common observation in the ASIM data is that the TGFs are observed before or during a weak increase in the optical signals in 337 nm and 777.4 nm, and prior to- or at the onset of the main optical pulse. Using data from the MXGS and MMIA instruments for the period from April 2019, we assess the time sequence and the relationship between the observed TGF duration and the time between the onset of the TGF and the onset of the main optical pulse, with a relative timing uncertainty of $\pm 5 \mu\text{s}$. The data prior to April 2019 is presented in Bjørge-Engeland et al.