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Source Altitudes of Optical Emissions Associated with TGFs

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Terrestrial Gamma-Ray Flashes (TGFs) observed from space appear to be generated after a few milliseconds of optical activity and before the onset of a main optical pulse. The pre-activity is thought to be from a propagating leader and the main optical pulse the emissions from the ensuing stroke. Scattering of photons in the cloud increases the rise time and durations of the pulses and thus allows for estimates of their optical path from their sources.

In this presentation we estimate the depth inside thunderclouds of pulses associated with more than 100 TGFs observed by the Atmosphere-Space Interactions Monitor (ASIM) on the International Space Station (ISS). The observations are in narrow bands at 337 nm, to include the strongest line of $N_2$2P and 777.4 nm of OI, considered a strong lightning emission line. With the assumption that the sources are instantaneous and at single points within a cloud, we find optical paths for the events by using typical cloud properties. Combined with cloud top heights from a recent study on TGF producing thunderstorms, this gives an estimate at which altitude the optical detections are produced.

Data from VAISALA's lightning location network GLD360 and NASA's Lightning Imaging Sensor on the ISS (ISS-LIS) will be used to assess the results from the optical analysis. This includes investigations of the correlations between TGF durations, detected peak lightning current and optical path in the cloud.