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Imaging of lightning and sprites in the shortwave IR (SWIR) with the BGUSAT satellite

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Space-based observations of lightning and transient luminous events (TLEs) offer an unobstructed line-of-sight as well as global coverage, and therefore are far superior to ground-based observations. These advantages led to several campaigns from the space shuttle (Yair et al., 2004; 2005), the International Space Station (Blanc et al., 2004; Sato et al., 2017; Chanrion et al., 2017) and from several satellites, the most prolific one being ISUAL on FORMOSAT (Chern et al., 2003). Most of these observations were conducted with cameras and spectrometers operating in specific wavelength ranges in the visible or Far Ultra Violet (FUV) parts of the spectrum, where sprites are known to emit from excited states of nitrogen molecules. There are very few, if any, reports on sprite emissions in the Infra-Red (IR) range even though there are 8 vibrational-vibrational transitions of the N2 1PG state in the 1.55-1.7 micrometer spectral range, 4 of which could be quite bright.
We conducted space-based observations in the shortwave IR (SWIR) on-board the BGUSAT satellite that was launched on February 15th 2017. The satellite is a 3U Cubesat with geocentric orbit at 97 degrees inclination and an altitude of 505 km. The optical payload is an InGaAs SWIR camera with a spectral range of 1.55-1.7 microns, and it can change the image integration time from 10 milliseconds to 3 seconds. The camera has a 25 mm lens (f1.4) with 17x21 degrees FOV. The satellite looks to the nadir but can also rotate the camera along the velocity vector to oblique view. Thunderstorm targets were selected based on the methodology developed for the MEIDEX and Cosmic Shore sprite campaigns (Ziv et al., 2004; Yair et al., 2013), and commanding was uploaded 48 hours prior to the observation. Initial results from several storm targets will be presented and discussed.