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Optical discrimination of sprite and lightning by use of green light from ~495-505 nm

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Sprites are transient illuminations of the middle atmosphere above thunderclouds which often occur after intense lightning discharges. Here we report optical recordings of sprites and lightning taken with a video camera and photometers in northern Colombia during October 2019.

Optical observations of sprites are often superimposed on the scattered light produced by the parent lightning discharge. This superposition of two optical sources can result in a misinterpretation of the photometer recordings, for example the determination of the rise time of an optical waveform.

Here we propose to use the green light emissions from ~495-505 nm to discriminate between sprite and lightning. This experimental discrimination has become possible because recent modeling studies suggest that lightning emits green light whilst sprite do not emit green light (Gordillo Vazquez et al., 2011; Xue et al., 2015).

The optical signals are detected by a white light video camera and a photometer which is fitted with a ~495-505 nm band pass filter to detect green light. The observed lightning discharges are characterized by significant green emissions in the ~495-505 nm wavelength band. These green emissions are part of the diffuse glow detected by the video camera which is caused by the scattered light from the lightning discharge. This light is scattered during its propagation through the atmosphere which is most likely caused by aerosols, for example related to the ambient humidity and dust. The majority of sprite observations are contaminated by such a diffuse glow with significant ~495-505 nm emissions. The observation of one particular sprite does not exhibit any significant ~495-505 nm emissions and it is therefore attributed to a ‘pure sprite’. The rise time of these optical emissions and the characteristics of other wavelengths recorded by several photometers will be reported for this particularly pure sprite event.

The knowledge gained from these ground-based observations may assist the interpretation of measurements with photometers onboard the ASIM payload on the International Space Station and the forthcoming TARANIS satellite.

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