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Probing Lightning Effects at the Edge of Space¹

CAITANO DA SILVA, New Mexico Tech

The lower ionosphere marks the separation between neutral and ionized regions of the Earth's atmosphere, and has been colloquially referred to as the edge of space. The Earth and the ionosphere create a cavity that traps low-frequency electromagnetic waves, making long-range radio communications possible. Leveraging this phenomenology, the high variability of the lower ionosphere, the so-called ionospheric D region, has been extensively probed with ELF/VLF remote sensing. A byproduct of thunderstorms, transient luminous events (TLEs), have appeared as an opportunity for optical remote-sensing of the lower ionosphere-mesosphere system, by being not only a consequence of the electrical coupling of atmospheric regions, but also its thermometer. In this presentation, we review our group's recent efforts to probe the impacts of lightning in the lower ionosphere by remote sensing of sprites and their electromagnetic signatures [Contreras-Vidal et al., *J. Geophys. Res. Atmos.*, 2021], and by looking at direct electron density changes measured by the Arecibo Observatory Incoherent Scatter Radar in coincidence with underlying thunderstorm activity [da Silva et al., *Sci. Rep.*, 2021].

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