New Insight into the Physical Characteristics of Compact Intracloud Discharges

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Compact Intracloud Discharges (CIDs) are isolated electrical discharges that occur within intense regions of thunderstorms. We have recently begun to locate the events and characterize their unique physical properties using a number of research systems including the FORTÉ satellite, the Los Alamos National Laboratory Electric Field Change Sensing Array, and the New Mexico Tech Lightning Mapping System (LMS). Additionally we are employing data from meteorological radars to characterize CID source regions.

It has become clear that CIDs represent a distinct class of thunderstorm electrical discharge, and we are working to quantify physical characteristics that support this distinction. Among their remarkable characteristics are their efficiency at producing very powerful radio frequency radiation, their large characteristic current moments, and their spatial/temporal character. Our most recent results indicate that RF emissions from CIDs are 20-30 dB stronger than radiation from other intracloud or cloud-to-ground lightning processes in the VHF. Current moments associated with the discharges are at least an order of magnitude greater than moments that occur in conjunction with other processes. Early results on the spatial/temporal character of CIDs indicated that the discharges most often occurred as singular, temporally isolated discharges. However, recent comparisons with the lightning mapping observations indicate that CIDs, when they occur, are followed within a few milliseconds or less by "normal" intracloud lightning flashes. The lightning mapping observations also indicate that VHF radiation from CIDs is not as well localized in space and/or time as the impulsive radiation events of normal lightning. The latter is consistent with the inference that CIDs develop at high speeds over a limited (500-1000 m) extent in the storm.