Radio interferometer study of high-power lightning narrow bipolar events in Florida

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Narrow Bipolar Events (NBEs) are distinguished by their fast-rising, bipolar electric-field waveforms, and there is growing evidence that they play a significant role in the initiation of lightning [Rison et al., 7, 10721, doi: 10.1038/ncomms10721, 2016]. The source discharge typically lasts on the order of ten microseconds, and emits brightly in VHF. In this paper we present observations of NBEs obtained with the New Mexico Tech broadband VHF interferometer (INTF) at Kennedy Space Center, Florida. The observations show that high-power (>10-100 kW) NBEs occur commonly in Florida storms. We present observations of different classes of NBEs, including those that initiate full-fledged flashes, those that appear in isolation as precursor events and upper-level screening discharges, and those that are embedded within flashes.

The INTF utilizes 100-m long baselines and is able to resolve the development of high-power NBEs out to 50 km distance or more. The system automatically triggers either on strong VHF radiation from distant or close lightning events, recording 100 ms of high-speed (180 MHz) data around the time of the trigger, or alternatively from the electrostatic field change of relatively close discharges, recording entire flashes. The INTF observations are complemented by the data provided by the KSC Lightning Mapping Array, and by fast and slow electric field change measurements from sensors deployed at KSC together with the INTF.