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Initial leader extension of lightning flashes

Thomas Marshall (1), Maribeth Stolzenburg (1), Sumedhe Karunarathne (1), Hans-Dieter Betz (2,3)

(1) University of Mississippi, Physics and Astronomy, University, United States (marshall@olemiss.edu), (2) Physics Department, University of Munich, Munich, Germany, (3) Nowcast GmbH, Munich, Germany

Immediately after a lightning flash begins (i.e. just after a small conducting plasma is initiated with a spark), the flash begins to grow into a long, thin conducting 'leader channel' that propagates through the cloud, growing ever longer as it extends. There are two ways in which this extension is thought to occur: (1) a negative leader extends from the initiation point, leaving behind an equivalent amount of positive charge at the initiation point or (2) the leader develops bidirectionally from the initiation point, with equal magnitudes of positive and negative charges at the two ends.

In this presentation we show electric field change data of the initial flash development collected with a network of 5 flat-plate antennas with a bandwidth of 0 – 500 kHz. The initiation location of each flash is determined from a 9-sensor VHF lightning mapping system (the KSC LDAR2 network) and/or with a 7-sensor LINET system operating in the VLF/LF band. These data were obtained at the NASA/Kennedy Space Center (KSC) during the summer of 2010. In order to test which of the above leader extension hypotheses is more correct, we use models of the two hypotheses to fit (or attempt to fit) the flat-plate antenna data at the 5 different locations. Results of these tests will be presented.