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Development of leader conductivity during the initial breakdown stage in two CG flashes

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Recent studies have indicated that lightning initiation starts with an impulsive event. The initiation event is followed by a relatively slow, weak initial electric field change, which is followed by a series of narrow and classic initial breakdown pulses (IPBs). In this presentation we use data from an array E-change sensors and from a high speed video camera to study the first 1.1 ms and 2.5 ms of development of the conducting channel in two cloud-to-ground lightning flashes. For one flash the IBPs created a single initial leader channel; for the other flash the initial leader had a main channel with two branches. The IBPs in each flash are modeled using three methods of determining the IBP peak current: Hilbert transform, Hertzian dipole, and Matrix inversion. Each modeling method yields several IBP properties. We will focus on IBP peak current and current velocity. Among the three methods the values of peak current and velocity are in reasonable agreement. For the first 8 IBPs occurring in the first 1.1 ms of the flash with a single extending initial leader, the IBP peak current generally decreased with successive IBPs from 120 kA to 1 kA, while the IBP current velocity generally increased from 2 x 107 m/s to 12 x 107 m/s. For the first 2.5 ms of the flash with multiple branches, a similar decrease in IBP peak current and increase in IBP current velocity with successive IBPs was found for the IBPs in each branch. Implications of these findings regarding the leader conductivity and its change with time will be discussed.