

Assessing hypothesis of charge distribution during the formation of lightning channels based on simultaneous records of influent quantities

Intended for the Lightning Physics Topic

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We have been measuring several quantities related to lightning events at Morro do Cachimbo Station (MCS) in a tropical region in Brazil, since the station's instrumentation was updated at the end of 2008.

Records of electric field change, 1-s-long records of currents of strikes to the instrumented tower (comprising both the returns strokes of the flash and the pre-return stroke phase of the first return stroke), relative luminosity and fast camera videos have been acquired at the station, in addition to information provided by the local lightning location system.

Based on such time-correlated data, it has been possible to achieve new findings and to identify specific features of certain events. For instance, considering 15 cloud-to-ground flashes measured recently in MCS, we have found out that M-events are a very common feature of first return strokes, different from the usual assumption. They occur in about 50% of cases, typically superimposed on the current wave tail and not on the continuing currents after the return stroke pulse. Also, we have identified in recently measured upward lightning events that the charge transferred by almost all events is very close to 6 C, a value much lower than those measured in temperate regions, where typically this charge is higher than 20 C. Furthermore, we have been developing interpretations of the records to clarify some processes involved in lightning processes.

In the proposed work, based on simultaneous records obtained for some real events associated to strikes to MCS's instrumented tower, we evaluate certain hypothesis related to the evolution of the lightning channel, notably the amount and the distribution of charge along such channel during this process. In this work, we intend to show the simultaneous records for some specific events to discuss the consistency of each considered hypothesis.