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Evaluation of M-Components in Natural Cloud-to-Ground Lightning Using High-Speed Cameras and Multiple Lightning Location Networks

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Abstract

High-speed cameras are used to characterize processes involving lightning, since most of its processes occur on a microsecond scale. Some important features of this phenomenon were only discovered by using this tool. In 2012, the RAMMER (Automated Multi-Camera Network for Lightning Monitoring and Study) campaign featured a small network of high-speed cameras taking place in São José dos Campos. In the same period, a project called CHUVA-GLM Vale do Paraíba was carried out and, due to this, several lightning location networks were installed near the study area, with unusual sensor densification. This made it possible to identify the location and peak current estimation of M-components, which are processes of lightning channel intensification during its connection to the ground. Given the importance of this phenomenon, in this work, the M-components were characterized through the integrated study between cameras and lightning detection network data. A total of 179 filmed lightning flases were analyzed, of which 138 had visible return strokes for evaluation. Of these, 80 had some kind of M-component. For the first time, the M-components were categorized into three types according to the moment they occurred, brightness intensification, and peak current from the lightning location network. Most of the M-components (about 60%) were identified as the classical type, and about 10% were classified as strong M-components. The other 30% were M-components that occurred less than 4ms after the return stroke, i.e., they were not related to the continuing current. Some of those M-components (38 cases) were located by the LLS and reported a mean peak current of 6 kA. The interval between M-components and the interval between M-component and the discharge that produced it, among others, were also evaluated.

Topic Areas

Lightning Physics, Characteristics and Measurements

Submission Format

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