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Spatio-Temporal dimension of lightning flashes based on Three-Dimensional Lightning Mapping Array

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Abstract

3D mapping system like the LMA - Lightning Mapping Array - are a leap forward in lightning observation. LMA measurements has lead to an improvement on the analysis of the fine structure of lightning, allowing to characterize the duration and maximum extension of the cloud fraction of a lightning flash. During several years of operation, the first LMA deployed in Europe has been providing a large amount of data which now allows a statistical approach to compute the full duration and horizontal extension of the in-cloud phase of a lightning flash. The “Ebro Lightning Mapping Array” (ELMA) is used in the present study. Summer and winter lightning were analyzed for seasonal periods (Dec-Feb and Jun-Aug). A simple method based on an ellipse fitting technique (EFT) has been used to characterize the spatio-temporal dimensions from a set of about 29,000 lightning flashes including both summer and winter events. Results show an average lightning flash duration of 440 ms (450 ms in winter) and a horizontal maximum length of 15.0 km (18.4 km in winter). The uncertainties for summer lightning lengths were about +/- 1.2 km and +/- 0.7 km for the mean and median values respectively. In case of winter lightning, the level of uncertainty reaches up to 1 km and 0.7 km of mean and median value. The results of the successful correlation of CG discharges with the EFT method, represent 6.9%

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