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Statistical study of lightning flash properties and thunderstorm charge structures inferred from the Lightning Mapping Array

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A 3D Lightning Mapping Array has been operational in the Ebro Valley region in eastern Spain since July 2011. This system maps very high frequency (60-66 MHz) pulses in three dimensions within a range of about 150 km. These pulses are emitted mainly by negative leader steps and recoil leader processes during lightning flashes. Typically, flashes initiate between two opposite cloud charge layers and propagate bidirectionally, with the negative leaders propagating mainly through positive cloud charge regions, and the reverse (e.g. van der Velde and Montanyà, JGR-Atm., 2013). Recently, the Ebro LMA has been used to study the leader characteristics during sprite-producing +CG flashes (van der Velde et al., JGR-Atm., 2014).

In this study the statistical properties of lightning flashes and charge regions are investigated based on individual storm cases and four years of data. The parameters include sizes and altitudes of positive and negative charge regions; negative leader speed; flash initiation altitude; rates of flashes of different sizes and polarities, as well as their relation to meteorological background conditions (temperature, humidity, convective available potential energy and vertical wind shear).

In April 2015 a 6-station Lightning Mapping Array will be installed in northern Colombia to allow an equivalent study of tropical thunderstorms. This will offer an improved understanding of differences in thunderstorm and lightning properties between mid-latitude and tropical regions and their corresponding impact on the production of Gigantic Jets and Terrestrial Gamma-Ray Flashes (TGF), which are much more frequently observed in the tropics.