Data Analysis of upward lightning in Jaragua Peak

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Observations of upward lightning from tall objects have been reported since 1939. Interest in this subject has grown recently, some of it because of the rapid expansion of wind power generation. Also, with the increasing number of tall buildings and towers, there will be a corresponding increase in the number of upward lightning flashes from these structures. Reports from recent field observations are beginning to address the nature of upward lightning initiation, but much still needs to be learned. Examples are studies of upward lightning from towers in winter thunderstorms in Japan (Wang and Takagi, 2010; and Lu et al., 2009) and summer thunderstorms in Europe (Miki et al., 2005; Flache et al., 2008; and Diendorfer et al., 2009; Zhou et al., 2011) and in North America (Mazur and Ruhnke, 2011; Hussein et al., 2011; Warner, 2011, and Warner et al., 2011). During CHUVA Campaign, a combination of high-speed video and standard definition video were used to record upward lightning flashes from multiple towers in Sao Paulo, a city located in southeastern Brazil with a population over 10 million people, an average elevation of around 800 meters above sea level, and a flash density of 15 flashes/km^2.year. The upward flashes initiated from two towers located on top of a 300 m tall hill. The heights of the towers were 130 m and 90 m. In this work, observations of 15 upward flashes made with these assets were analyzed along video observations, different Lightning Location Systems, electric field sensors and a lightning mapping array (LMA).