

## Observation and preliminary analysis on the attachment process of lightning flashes striking on high structures

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A field observation experiment of lightning flashes occurring on high structures was conducted in the summer of 2009, at Guangzhou, Guangdong Province, China. Two downward negative lightning flashes, which stroke on high structures and are numbered as L01 and L02, have been analyzed in this paper. L01 stroke on a 610 m TV Tower and L02 on a 432 m structure. The analysis shows that: (1) Both lightning discharges exhibit long upward connecting leader with their 2D lengths of longer than 450 m for L01 and of about 177 m for L02, respectively; (2) The upward-moving leader of L01 only has a single channel, while that of L02 has two branches; (3) For each event the average 2D progression velocity of upward-moving leader is of the order of  $10^5$  m/s; (4) There are no obvious difference between the 2D progression velocities of the upward-moving leader and the downward-moving leader during the last several hundreds of microseconds before the return stroke; (5) There exists a downward propagation optical phenomenon with a velocity of about  $3.4 * 10^7$  m/s at the bottom several tens of meters channel of L01 (below the junction point) after the connection of upward and downward moving leaders. This downward propagation appears to support the presence of the bidirectional extension of the return-stroke channel from the junction point.

Keywords: CG lightning, attachment process, upward connecting leader, high structure, high speed optical observation