

## **Vertical electric fields and field change parameters due to partly inclined lightning leader channels**

### **Abstract**

Vertical electric fields generated by lightning leader channels, the total leader field change and the total leader field change to the total return stroke field change ratio, at a certain distance, were theoretically analysed by varying the angle of orientation of a segment of upper part. Ground was treated as a perfectly conducting horizontal plane. Results were able to discern significantly large differences in the static field due to leader channels which have the same total length but a certain channel segment is oriented at different angles. The outcome of our calculations consistently explains the scatter of the total leader field observed in previous studies. Without considering such channel segment orientation, one has to assume unrealistic charge source heights or unreasonable charge densities to calculate matching values for many observed total leader fields and leader field to return stroke field ratios, labelled as anomalous observations in the literature. In some cases, irrespective of the charge source height and the charge density, one cannot find a suitable fit for the observed fields with the straight channel model.

**Keyword:** Field change; Horizontal planes; Lightning leader; Return stroke; Static fields; Straight channel; Total length; Vertical electric fields