

Lightning Characteristics Associated with Altitude and Ground Conductivity

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About 160,000 strokes recorded in the state of Minas Gerais in the summer season of 1993 were analysed in terms of the dependence of the peak-current stroke intensity and stroke density on altitude and ground conductivity. Preliminary results will be presented and discussed in the context of measurements made in other countries.

INTRODUCTION

The dependence of lightning parameters on altitude has been studied for several authors (e.g. Reap, 1986). In general, it is well known that the higher is the altitude, the larger is the strike density. Also there are some evidence indicating that the higher is the altitude, the earlier is the peak in the daily strike distribution. However, no information is available on the dependence of the stroke intensity on altitude. The dependence of the lightning characteristics on the ground conductivity, in turn, is a matter of controversy. While some publications report that the lower is the ground conductivity, the larger is the strike density, others report the opposite. Also, some authors seem to suggest that even the stroke intensity may depend on the ground conductivity (see Kindermann, 1997). However, no conclusive evidence is available.

In this paper preliminary results of the analysis of about 160,000 strokes recorded by a lightning positioning and tracking system (LPATS) in the state of Minas Gerais in the summer season of 1993 are presented. The lightning data are analysed in terms of the dependence of the peak-current and density on altitude and ground conductivity. The state of Minas Gerais has terrain elevations from sea level to about 3,000 m. The ground conductivity also shows marked differences. In the center of the state, the conductivity is relatively high, associated with sedimentary rocks, whereas in the mountains the conductivity is very low (average resistivity of about 2,400 Ohm.m, with peak values of 30,000 Ohm.m).

RESULTS AND CONCLUSIONS

The preliminary results presented in this paper were obtained dividing the state of Minas Gerais in a grid of blocks, each block of about 50x50 km. The size was chosen such that the lightning location errors can be neglected. Also, as a first approximation, they were obtained considering the altitude and the ground conductivity as independent. In a near future, a more complete analysis considering both parameters simultaneously will be carried out.

The main conclusions with respect the stroke characteristics in the state of Minas Gerais were:

- the higher is the altitude, the larger is the stroke density and the lower is the stroke intensity;
- the ground conductivity is a minor aspect compared to the altitude in defining the stroke characteristics. In order to evaluate the role of the ground conductivity in the stroke characteristics, only data at same altitude should be considered.

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