A Multi-Dimensional Analytic Method of Lightning Locating Big Data

Han Li [1,*], Wenjun Zhou [1], Yurong Deng [2], Shiyang Zhu [2]

1. School of Electrical Engineering of Wuhan University, Wuhan, Hubei, China
2. Guangxi Power Grid Electric Power Research Institute, Nanning, Guangxi, China

ABSTRACT: Based on Lightning Locating System (LLS) data of China Guangxi region (east longitude 104.5 ~ 112.1, north latitude 21 ~ 26.5) from 2009 to 2012, the lightning distribution law is mined. A big data of Cloud-to-Ground (CG) lightning was recorded by Guangxi LLS, which the number of CG fist-stoke is approximately 3×10^6 per year. A multi-dimensional analytic method is defined in this paper, where the data mining model is developed by the SPSS software, and some new rules of lightning activity are found through the extracted data in Guangxi region.

INTRODUCTION

The 2-Dimensional grids are commonly used on lightning-parametric statistics, where latitude for the X-Axis and longitude for the Y-Axis, with only 1 lightning parameter (such as the lightning density) be calculated. If the 3-Dimensional grids are used, additional Z-Axis can be represented a new attribute, and then 2 lightning parameters (such as lightning density and elevation) can be considered. Similarly, if 4-Dimensional grids are adopted, the 3rd lightning parameter can be included, such as the distribution of lightning current amplitude. In this paper, 3-Dimensional grids and 4-Dimensional grids were deployed for LLS data extracting.

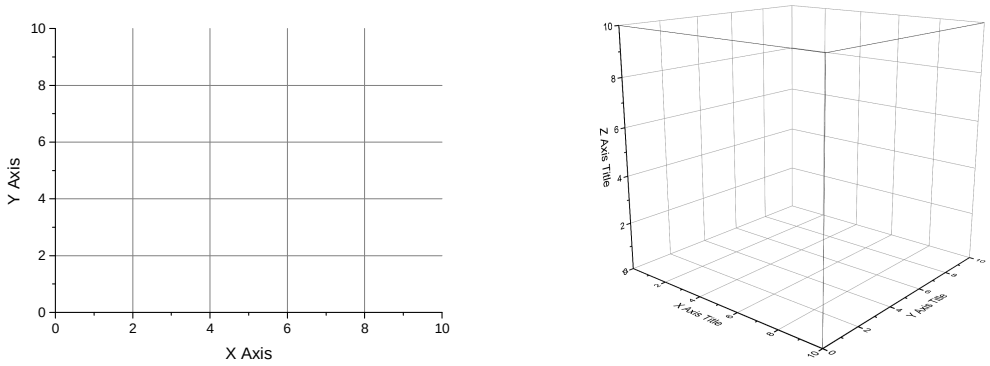

Fig.1 2-Dimensional grids & 3-Dimensional grids

* Contact information: Han Li, School of Electrical Engineering of Wuhan University, Wuhan, Hubei, China, Email: golden.silver@163.com

ANALYSIS RESULTS

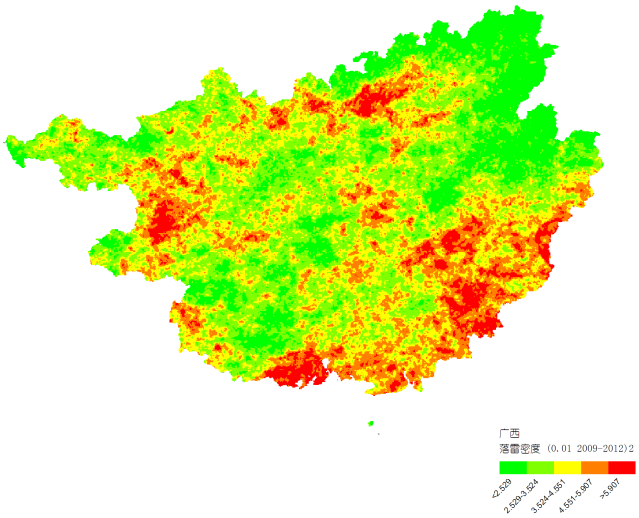

Fig.2 CG Lightning density of Guangxi from 2009 to 2012

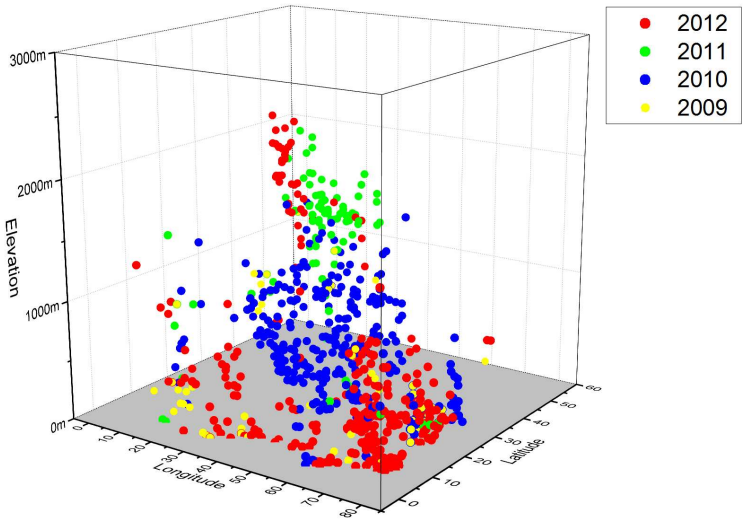

Fig.3 High lightning density points with elevation of Guangxi

Figure 2 is average CG lightning density of Guangxi, whose Lightning mainly concentrated in the south-eastern coastal areas and north-western mountains. Figure 3 is the points of high lightning density each year, which classified by colours, at the same time, with the elevation attribute. In 2009, 2011 and 2012, lightning mainly distributed in the south-eastern area with low-altitude and north-western area with high-altitude, in accord with the distribution of lightning average density. In 2010, lightning activity concentrated in mid-elevation areas of central Guangxi, which is likely to affect by the 2009-2010 ENSO phenomenon.

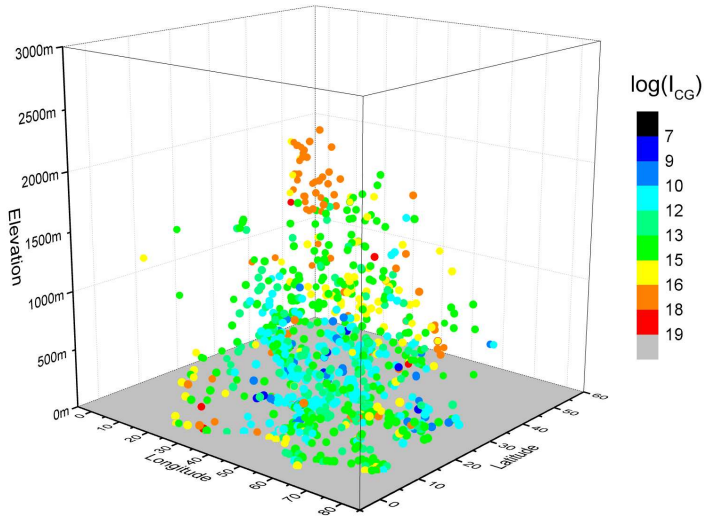

Fig.4 Guangxi high lightning density with elevation and log-value of lightning current amplitude

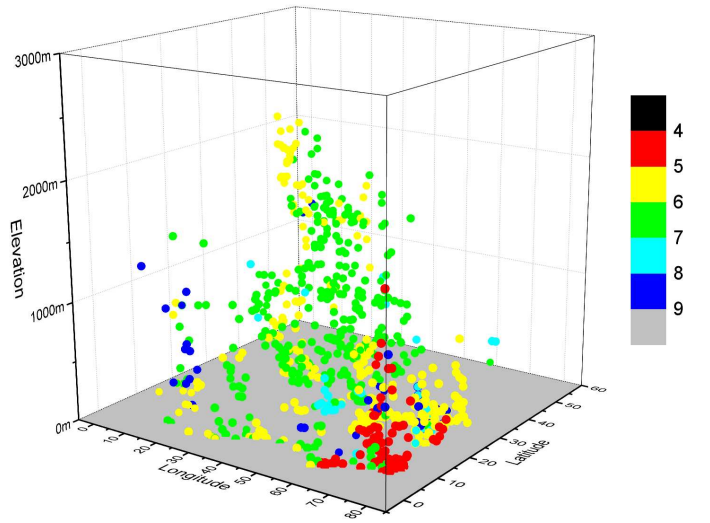

Fig.5 Guangxi high lightning density with elevation and month attribute

In addition, multi-dimensional analysis found that lightning current amplitude mainly increases with altitude(figure 4). Guangxi lightning activity is strongest in April, May and June, in April mainly concentrated in the south-east coastal areas, in May and June extending to the inland and mountains (figure 5).

CONCLUSIONS

Based on proposed multi-dimensional analytic method of lightning parameters, the related law

between the lightning multi-parameters is mining. Under the conditions of the sufficient data amount, the various temporal and spatial scales of the lightning data analysis can be applied.

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