Ice Structure Analysis Of The Erlang Mountain

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1 INTRODUCTION

Transmission line ice coating is one of the difficult problems which power and meteorological workers very concerned about and to be solved. The different size of transmission line ice coating is mostly reflected in the difference of thickness, density and ice coating on unit length. There are many factors which inflect ice coating, major in meteorology condition, terrain and geography condition and altitude.

Erlang Mountain is one of the important channels of plateau “west to east power transmission”, and it is one of the serious ice areas, as shown by the actual measurement data, the ice coating of Erlang Mountain is the mixed ice of glaze and rime, its meteorological reason is much more difficult than other place. So, it is necessary to have a deep research about the ice coating problem of Erlang Mountain, provide scientific basis for the construction of transmission line engineer.

2 TERRAIN OVERVIEW

Erlang Mountain is the remaining mountain of cross-sectional Jiajin Mountain, the altitude of the main peak is 3437m, and the altitude of YaKou is 3000m, it is the first transitional ladder of Sichuan basin to Tibet Plateau.

Erlang Mountain is the natural watershed of Dadu river and Qingyi river, it is the first important barrier on the thousand miles line of Sichuan to Tibet, its eastern slope is 50km away from Tianquan county, its total area is 330km2, its eastern mountain foot starts from Xingou to Erlang Mountain YaKou, the distance is 34km, the distance of its western slope is also 34km, ends in Luding county. Its micro-terrain structure is obvious.

3 CLIMATE ANALYSIS

3/4 of Erlang Mountain’s weather is rain and snow; there have ice, torrential rain, and thick fog year round, the local micro-meteorology condition is very bad. The average relative humidity is 66%, its interannual change is small, the winter and summer difference is big, the average relative humidity of winter (Nov-Apr) is 57%, and the average relative humidity of summer (May-Oct) is 74%.

Compared to the meteorology data of Tianquan county and Luding county, the Erlang Mountain’s monthly average temperature, lowest temperature and precipitation is relatively high in Nov and March; while it is lower in Dec, Jan and Feb. In these three stations, the average wind speed of Erlang Mountain is stronger than in Tianquan and Luding. The precipitation of Tianquan is highest, while it is lower in Erlang and Luding. In all these 3 stations, the average temperature and precipitation is higher in Nov and March.

4 THE MAIN ICE COATING TYPE OF ERLANG MOUNTAIN

According to the record of transmission line ice coating process in 2002-2006, the occurrences of different kind of ice coating was counted every month, the results was showed in figure 1:

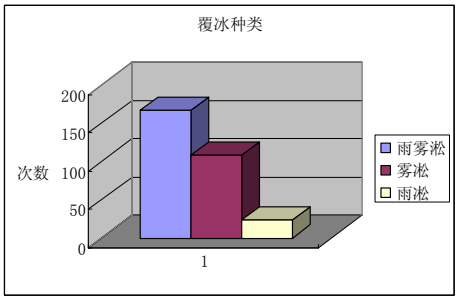

Figure 1 the frequency of different ice coating

According to the above statistical data, during 2002-2006, glaze-rime accounts for 56%, rime accounts for 36%, and glaze accounts for 8%. This shows that glaze-rime and rime are the main ice coating of Erlang Mountain in winter, glaze accounts for only a little. Glaze-rime occur more frequently in all winter, except in Jan relatively small; because the rime is formed by the cooling of frog which freeze on the transmission line, so the rime mostly appear in Sep, Jan and Feb, when the temperature is colder relatively; similarly, the glaze mostly appear in Nov, Feb and March, when the temperature is higher relatively. The above data can be referenced when the transmission line was designed.

5 DENSITY ANALYSIS

5.1 Density analysis of different ice coating

The density distribution range by concluding was shown by figure 2:

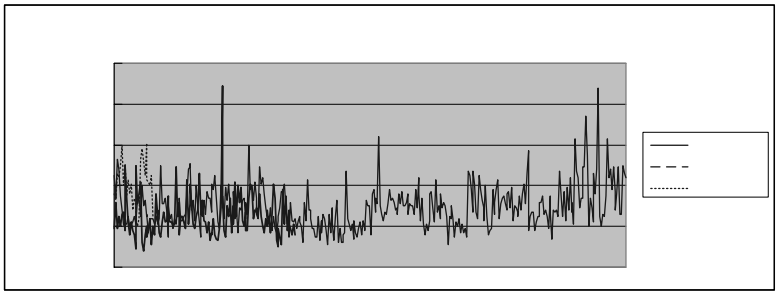

Figure 2 the density distribution of different kinds

Glaze-rime and rime are the main ice coating in Erlang Mountain. The density of glaze-rime is between 0.18-0.41; the density of rime is between 0.-0.4; the density of glaze is between 0.2-0.6.

The density of glaze-rime gets lowest in Jan, and gets larger in Nov and March; the density of rime gradually becomes smaller with the month; there is no glaze in Dec and Jan, the density of glaze has little change, it is relatively stable. View from the average density, the density of glaze is the largest, and then is glaze-rime, and the smallest is rime.

5.2 The relationship between ice coating density and meteorology factors

The ice coating density has close relationship with meteorology factors. The temperature, humidity, pressure and precipitation have influence on the ice coating density more or less. In order to study the relationship between ice coating density and meteorology factors, the meteorology data of the longest ice coating process was selected to get the relationship.

5.2.1 The relationship between ice coating density and single meteorology factors

By the related calculations of ice coating density and meteorology factors, the results was concluded. The relationship between ice coating density (Y) and average temperature (x1) is

$$Y=44.1214X1-17.5101 \qquad (2)$$

The correlation coefficient R=0.88

The formula (2) has passed F test of α=0.05.

The related calculations of ice coating density (Y)

0.8

and average relative humidity turn out to be good as well. The relationship between ice coating density (Y) and average temperature (x2) is:

Y＝25.0020X2+86.2496 （3）

The correlation coefficient R=0.78

The formula (2) has passed F test of α=0.05.

The relationship between ice coating density (Y) and average temperature (x3) is:

Y=12.5946X3+0.40378 (4)

The correlation coefficient R=0.88

The formula (2) has passed F test of α=0.05.

The relationship between ice coating density and precipitation is bad. It is because that precipitation means the liquid and solid state falling from the sky to the ground, its deepness in the horizontal plane without evaporation or infiltration. The solid precipitation includes snow, sleet, ice, hail, michelle and ice needles, etc, only a few can melt and cool down and freeze to ice coating on the transmission except wet snow, which has little effect of the transmission line ice coating. So, the influence degree of precipitation to the ice coating almost depends on the form of precipitation. Liquid precipitation is the important condition of ice coating formation.

5.2.2 the relationship between ice coating density and multiple meteorology factors

With multiple correlation analysis of meteorology data and ice coating density, by the ice coating density (y) and meteorology factors which may impact the density, such as: E water vapor pressure (x1), average temperature (x2), average relatively humidity (x3) and precipitation (x4), by doing multiple correlation analysis, the equation was getten as follow:

Y=0.17338X1-0.02816X2-0.010518X3+0.01045X4 (5)

The correlation coefficient R=0.82

The formula (5) has passed F test of α=0.05.

According to the above results, also the ice coating density fitted well with some single meteorology factors, but there still has shortage. The result of multiple correlation analysis of meteorology data and ice coating density is better.

6 DISCUSSION OF ICE COATING STRUCTURE IN ERLANG MOUNTAIN

By the analysis of ice coating in Erlang Mountain, the ice coating in Erlang Mountain has closely relationship with clouds and the flow of clouds. The main ice coating is glaze-rime, single glaze and rime occur sometimes, but can not form large ice coating.

The frequency of ice coating occurrence is high, long duration, ice coating form quickly, the wind speed is 5.0~13.0m/s in general, the highest frequency of wind direction is NNE; the ice coating of east-west trend is larger than south-north trend, the average ratio of this two direction is 1.5; the relative humidity is 95~100% during ice coating, the visibility is lower than 0.1km, the ice coating distribution is not continuous, it is the obvious structure of the ice coating in Erlang Mountain area.

CONCLUSION

The conclusions are as follow:

(1) Ice coating in Erlang Mountain includes: glaze-rime, rime and little glaze. Rime occurs almost in Dec, Jan and Feb; glaze occurs almost in Nov, Feb and March.

(2) The density of glaze-rime is between 0.18-0.41 g/m^3, the density of rime is between 0.-0.4 g/m^3, the density of glaze is between 0.2-0.6 g/m^3.

(3) Liquid precipitation is the important condition of forming ice coating, The result of multiple correlation analysis of meteorology data and ice coating density is better.

(4) On the general condition, the ice coating thickness in the windward is higher than in the leeward, except some special weather condition.