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Power System Short-Term Load Forecasting Based on Multiple Proportions Smoothing Method

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***Abstract*—Aiming at the problem of short-term load forecasting in power system, this paper propose a load prediction method based on multiple proportions smoothing method. We perform multiple linear regression analysis and partial correlation analysis on the load with respect to the weather, and found the meteorological factors that are highly correlated with the power load. Then, we establish a primary power system short-term load forecasting model by using the ratio multiplication smoothing method.**

***Keywords*—daily load curve; short-term load forecasting; multiple proportions smoothing method**

I INTRODUCTION

In order to solve the problem of short-term load forecasting in power systems of region 1 and region 2, this paper first processed the abnormal data in load and meteorological data, and then conducted multiple linear regression analysis and partial correlation analysis on load with respect to weather, and found the correlation with load high meteorological factors [1]. At the same time, the primary power system short-term load forecasting model was established by using the ratio multiplication smoothing method, and the model was meteorologically corrected by gray relational analysis [2, 3].

We first make a statistical analysis of the annex data and get the distribution statistics of the four indicators. Then we plot the annual load continuation curve in units of days in 2014 and the two regions. After comparing the differences between the data and the images in the two regions, we found the periodicity of region two. If the data are supported by many years, region 2 can obtain more accurate prediction results.

In this paper, we use SPSS software to carry on the regression analysis of the prediction target, and analyze the model error. We find that the model can well fit the load of region two. At the same time, the partial correlation analysis between the forecast target and the meteorological factor is carried out, the correlation between each index is obtained. Finally the average temperature is selected to be most suitable for improving the load forecasting accuracy.

By using the method of multiples and smoothing, the paper divides the prediction model into the prediction of base value and the prediction of the value of per unit. We calculate the January 11 prediction curve and the prediction result has good accuracy.

II SYMBOL DESCRIPTION

TABLE I. SYMBOL DESCRIPTION

Symbol	Meaning	Unit
y	Load	MW
B	Base value (average load)	MW
γ	Daily load rate	
t	Temperature	°C
φ	Relative humidity	%
p	Rainfall	mm

III STATISTICAL ANALYSIS

Before the image is drawn, it is necessary to screen and correct the bad data (similar data and impractical data). Throughout the annex, we find that there are two main bad data. In the face of these two kinds of invalid data, this paper adopts different processing methods.

After dealing with the bad data, using Matlab, we obtained the curve of the daily maximum load, daily minimum load, daily peak valley difference and daily load rate of the two places as shown in Figure I.

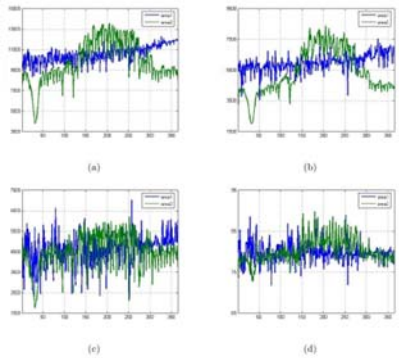

FIGURE I. THE INDEX OF 2014 IN TWO AREAS (A): DAILY MAXIMUM LOAD; (B): DAILY MINIMUM LOAD; (C): DAILY PEAK VALLEY DIFFERENCE; (D): DAILY LOAD RATE

The load curve used in power system mainly includes time series curve and continuous curve. Load duration curve is an important tool for power system planning and planning.

The load duration curve takes the time as the transverse axis and the load as the longitudinal axis. If the horizontal axis

time is 15min per unit, the load can be drawn directly from the large to the small. For hours, days or months, it needs to get the root mean square of the data, as the average load per hour, daily or monthly, the average load ranking after drawing.

The horizontal axis is based on the day, and the load curve of the two region in 2014 is plotted as shown in Figure II.

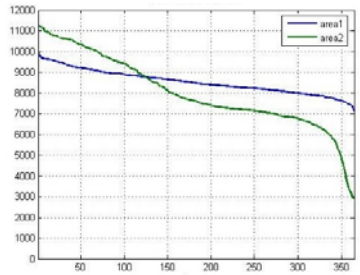

FIGURE II. LOAD DURATION CURVE IN 2014

IV PARAMETERS TO IMPROVE PREDICTION ACCURACY

Partial correlation analysis, also called net correlation analysis, analyzes linear correlation between two variables under the linear influence of other variables. Due to the coexistence of multiple meteorological factors, we can make partial correlation analysis on these factors, and select the main factors which have significant impact on the load.

After calculation, the correlation coefficient between daily average load and average air temperature is the largest, which shows that the average temperature has the highest impact on daily average load in various meteorological factors. Therefore, if meteorological factors are used to improve the accuracy of load forecasting, the average temperature should be recommended preferentially.

V FORECASTING BASED ON MULTIPLE PROPORTIONS SMOOTHING METHOD

The normal day ratio smoothing method based on time series analysis divides the prediction process into the per unit curve prediction and the base value prediction. Combining the above model building method, the process of forecasting short-term load is shown in Figure III.

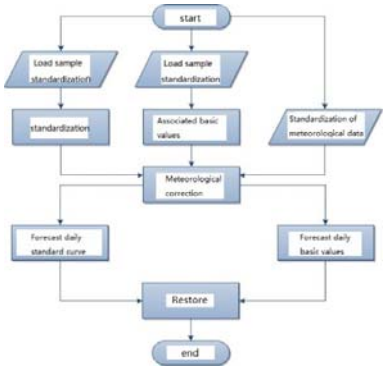

FIGURE III. FLOW CHART OF FORECASTING

Through the above process, we obtained the prediction curves of two regions, which were in good agreement with the actual data.

REFERENCES

[1] Kang Chongqing, Xia Qing, Liu Mei. Power system load forecasting [M]. Beijing: China power out Edition society, 2007: 121-130.(in chinese).

[2] Kwang H, Hyoung S, Yong C. Short-term load forecasting for special days in anomalous load conditions using neural netw orks and fuzzy inference method, IEEE Transactions on Power System,2000,15(2) : 559-565.

[3] Kspinoza M, Joye C, Belmans R, et al. Short-term load forecasting, profile identification, and customer segmentation: a methodology based on periodic time series[J]. IEEE Transaction on Power Systems,2005,20(3) : 1622-1630.

[4] SHI Wenbo, WANG Jian, SHENG Tianfu, BIAN Ruien. Prediction method of short-term load in holidays based on improved multiple proportions smoothing method, Power Construction ,2014,35(10):21-25.(in chinese).