THERMAL ANOMALY BEFORE BALIN M5.9 EARTHQUAKE OF CHINA

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1. INTRODUCTION

Thermal anomaly before earthquake has been widely reported in China, Japan, India, Iran, Algerian etc in recent years [1][2][3][4]. All these researches showed that the anomalies appeared several days or tens of days before the quake, the horizontal scale of the anomaly was hundreds kilometers, and the anomaly is hundreds, even one thousands kilometers away from the epicenter, while the vertical scale was never reported until now, and the distance between the anomaly and the epicenter was too far so that it was difficult to predict earthquake with this anomaly. Another disadvantage was that most thermal anomaly was retrieved with AVHRR or MODIS data, and the thermal information of the land surface could not be retrieved when clouds existed. So here we used air temperature data provided by National Centers for Environmental Prediction (NCEP) and studied the thermal anomaly before Balin M5.9 earthquake which occurred on August 16, 2003 in northeast China.

2. DATA AND METHOD

NCEP used a state-of-the-art analysis method to perform data assimilation with ground weather station data and satellite data. This data had no such problem as clouds cover or interpolation, its spatial resolution was 1 degree, temporal resolution was four times one day, and this provided a reliable data base to analyze thermal anomaly before earthquake.

In this research we used the subtraction method to get the temperature difference at the same time in two consecutive days. If there existed an isolated high temperature area within the low temperature background, and the high temperature area existed more than 6 hours, we considered it as an earthquake thermal anomaly. If the thermal anomaly was caused by meteorological factor, the temperature gradient must change gradually in a large area, not in an isolated area.

3. RESULT AND DISCUSSION

With this method, we studied the temperature difference from August 1 to August 16, 2003, and found a clear anomaly at 18:00 on 12 August, 2003, the temperature difference at 1000hpa reached a maximum value, namely 9°C at 120.5E, N44. It was also the maximum value in the whole north hemisphere. While in other areas it was less than 4°C. The vertical temperature structure showed that the surface temperature is close to the epicenter, the distance was about 50km. From 1000hpa to 700hpa, the thermal anomaly was far away from the epicenter, about 500km at 700hpa. Maybe it was due to wind effect. If the thermal anomaly was caused by warm atmosphere coming from the ocean direction, then the temperature change must be in a gradual pattern, not in an isolated and closed pattern. If it was caused by some inland factors, such as clouds or geomorphology, then why these factors which lead to the temperature increase only existed in the epicenter area, not in other areas. So we considered that it was an obvious thermal anomaly related with this quake. 4 days later, A M5.9 quake occurred at 43.91N, 119.80E, just 50km far away from the thermal anomaly center. The distance is so close that we consider that the thermal anomaly on 12 August is related with the 16 Aug quake.

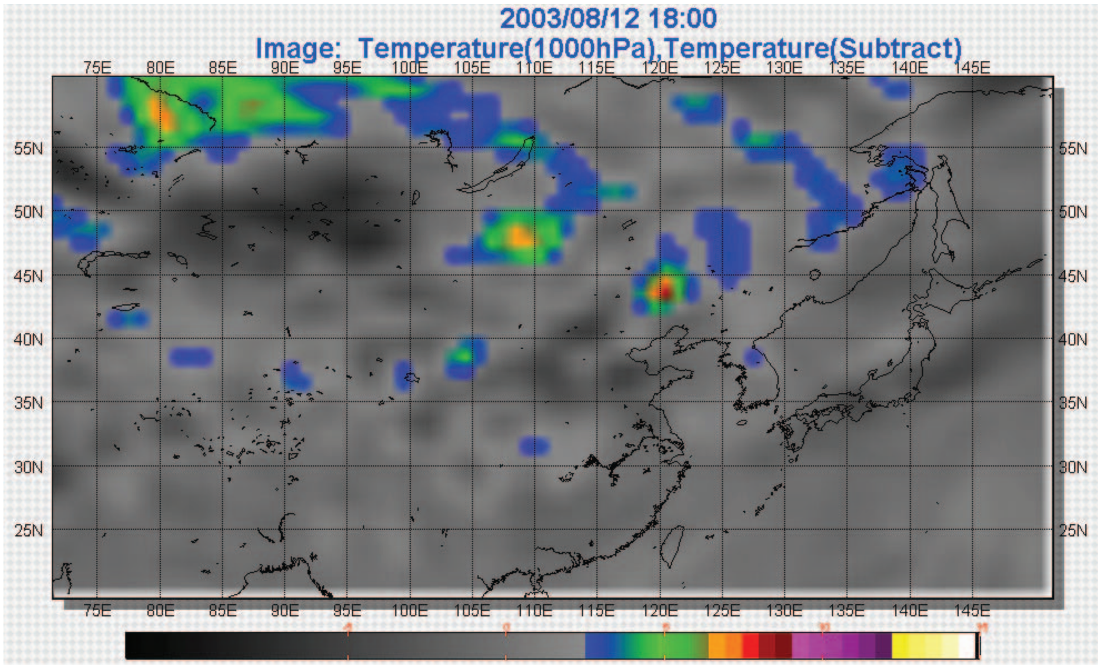

Fig 1. Thermal anomaly at UTC 18:00 on August 12,2003 before M5.9 Quake

From this example, we got three important conclusions:
1. Air temperature can be affected by pre-seismic activity, and this information can be used to predict earthquake;
2.The anomaly related with this quake appeared at 18:00, not 12:00 or 24:00, this meant that thermal anomaly just appeared in a short period, of you used AVHRR or MODIS data, maybe you would lose it and found none pre-seismic signal. So the temporal resolution of NCEP data, 4 times one day, was still not enough to study pre-seismic anomaly, 8-12 times one day is a reasonable resolution.
3. From surface to upper air, the distance between epicenter and thermal anomaly increased from 50km to 500km.This meant when we do earthquake prediction, surface air temperature is a better choice than upper air temperature.

4. REFERENCES

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