第15卷第4期 西北地震学报 Vol.15, No.4
1993年12月 NORTHWESTERN SEISMOLOGICAL JOURNAL Dec., 1993

THE SEISMIC SCREEN IN THE NORTH CHINA BLOCK AND THE ATMOSPHERIC TEMPERATURE ANOMALIES

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Abstracts

This peper has made a study of the relationship between the seismic screen activities in the North China block area from 1966 to 1976 and the temporal–spatial evolution of temperature anomalies in the Greater North China from February 1960 to January 1977. The principal conclusions are: (1) The atmospheric temperature increment (February 1960, September 1975 and February 1976) and decrement (January 1977) in North China are related with the start and close of the seismic screen activities; (2) The individual earthquakes in the seismic screen and the atmospheric temperature incremen: concurred in certain temporal phases if the 16.5 years from February 1960 to July 28, 1976 when the M7.8 earthquake in Tangshan occurred is divided by 0.618^N into 18 phases in time.

Key Words: North China Block; Seismic Screen; Atmospheric Temperature Anomaly

1.Introduction

Since the 60′s of this century, scientists have been paying more attention to the relationships between the changes of hydrometeorological factors and earthquakes. Valuable works have been published. Meteorological data have been used in the present paper to study the precursory temperature features of the four earthquakes above M7, which occurred between 1966 to 1976 in the North China block and their formation of the seismic screen. And the temporal–spatial laws of changes of the atmospheric temperature before and after earthquakes above M7 have been explored, in order to determine possible seismic areas and predict the time of earthquakes.

2.Data

During our study, the materials of ″[2]The Average Atmospheric Temperature Rate of Change in China from 1951 to1980″has been used. Two principles have been observed in the search for the atmospheric temperature precursors of earthquakes from the monthly departures: first the maximum / minimum in the same months prior to the earthquakes and this value satisfies the maximum / minimum (or temperature increment / decrement) in December, January, February and March of the same years; second the largest possible area in spatial distribution, generally with 25 or more meteorological stations. It is found six regions and time satisfying the condition mentioned above.

(1) The anomalous temperature increment region in February 1960. The boundaries of this region are Mudanjiang City and Suifenhe, in the east; Yinchuan City and Jartai in

the west; the Dong Ujimqin Qi and HorqinYouyi Qianqi in the north; Xinyang and Hefei in the south, with an region area of 188.4 × 10^4km^2 (See Figure 1, positive number) and the average montly departure of 103 meteorological stations is 3.9 ℃.

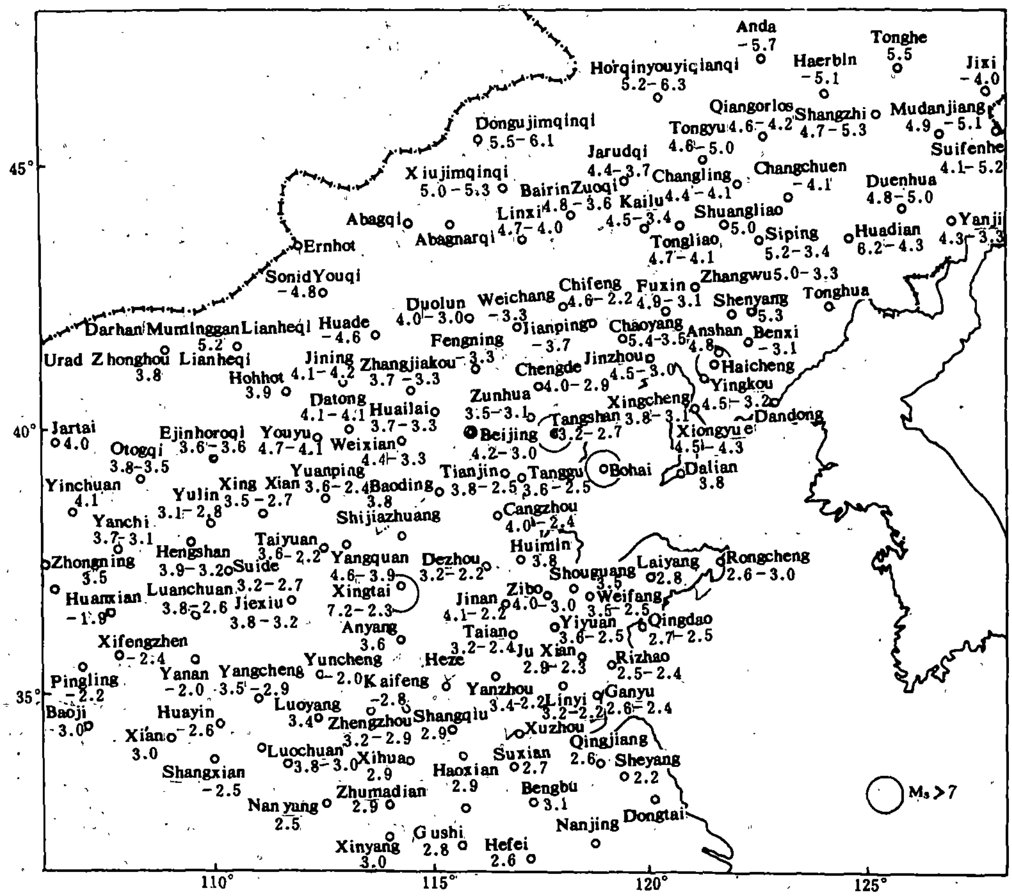

Fig.1 The temperature increment region. (positive number) in February 1960 and decrement (negative number) in January 1977 in Greater North China area

(2) The anomalous temperature increment region in May 1967. This region is in the range of from Linjiang and Jian in east to Erenhot and Youyu in the west; and from Linxi and Shuangliao in the north to Kaifeng and Shangqiu in the south with an area of 84.9 × 10^4km^2 (See Figure 1). The average monthly departure of 57 stations is 2.5 ℃.

(3) The anomalous air temperature increment region in January 1973. This region is from to Duenhua in the east to Weichang in the west and from Changling and Changchuen in the north to Rongcheng in the south with an area of 36.4 × 10^4km^2 (See Figure 1). The averdage monthly departure of 25 stations is 3.7 ℃.

(4) The anomalous temperature increment region in September1975. This region is between Jixi in the east and Jartai in the west; the Dong Ujimqin Qi in the north and Hefei

in the South with an area of $162.9 \times 10^4 km^2$ (See Figure 1) .The average monthly departure of 80 meteorological station is 1.9℃.

(5) The anomalous temperature increment region in February 1976 The timeof this calculation is from 1961 to 1980.The region is approximately located between Jixi in the east and Yinchuan in the west; the Horqin Youyi Qianqi in the north and Xin County in the south with an area of $129.4 \times 10^4 km^2$ (See Figure 1) .The average monthly departure of 42 stations is 4.3 ℃.

(6) The anomalous air temperature decrement region in January 1977 .This region is to Jixi in the east; Yanchi in the west; the Dong Ujimqin Qi in the north; Xuzhou in the south with an area of $160 \times 10^4 km^2$ (See Figure 1, negative number) .The average monthly departure of 72 stations is 3.5 ℃.

3.The temporal–spatial evolutionary features of the seismic screen and the atmospheric temperature anomalies in the North China block

(1) The internal relationship between the anomalous temperature increment region in the Greater North China in February 1960 and the seismic screen in the North China block area.It can be seen from Figure 1 that 17 years elapsed from the temperature increment in February 1960 to the decrement in January 1977.This overlapping areas of this rise and drop in temperature covered the North China block (Ma Zongjin et al., 1982) .In this block between 1966 and 1976 four earthquakes with $M>7$ occurred successively: Xingtai earthquake (M7.2), on March 22, 1966; Bohai Sea earthquake (M7.4) on July 18, 1969; Haicheng earthquake (M7.2), on February 4, 1975 and Tangshan earthquake (M7.8) on July 28, 1976 respectively.In May 1967, January 1973, September 1975 and February 1976 before the latter three events, temperature increment covered the epicentral areas. The rise of temperature in February 1960 is regarded as the precursor of seismic activies in the block and the temperature decrement in January 1977 is the index of the close of the screen.

(2) The cooling process corresponded the close of the seismic screen in the North China block In January 1977 in North China, a weather process with the lowest temperature appeared in a large ares, roughly covering the temperature increment region in February 1960, shown in Fig. 1, the dashed–line encircled section.The temperature ranges from−1.9 to−6.3 ℃.By the end of 1992, there was no earthquake $M>7$ within studied region.It may be thought that the large area cooling process in the North China is the mark of the close of the seismic screen in the North China block.

4.Discussions on the credibility of the relationship between the seismic activities in the North China block and the temperature anomalies.

(1) The correlativity between the duration of abnormal weather and the energy of earthquakes.The relationship between the two factors is expressed as:

$$E = 9.945 \times 10^{23} T - 4.551 \times 10^{23} \quad (1)$$

in which the correlation coefficient is 1.00.

(2) The correlativity between the scope of temperature anomalies and the seismic energy in the block.The relationship between the two items is:

$$E = 23.799 + 7.470 \times 10^{-3} \times S \tag{2}$$

in which S is $10^4 km^2$ in unit .The correlation coefficient of equation (2) is above 0.99.

(3) The correlativity of the time and area of abnormal temperature and the energy of earthquakes.The relationship between the three factors is:

$$T \times S = 2.591 \times 10^{-22} \times E - 312.404 \tag{3}$$

in which the correlation coefficient of the two items is 1.00.

(4) The orderliness of temperature anomalies and earthquakes.During the period of seismic screen there is a correspondence pattern between the time of the occurrence in five large areas of abnormal temperature and four earthquakes M > 7 and the variation of T_0 at the golden section 0.618^N.The interval Ta.e between the time of temperature anomalies or earthquakes and the time of main shocks is expressed as:

$$Ta.e \approx 0.618^N T_0 \tag{4}$$

Where N is a natural number.Their corresponding cases are shown in Table.This might have revealed certain regular patterns of the alternative occurrences of temperature anomalies and earthquakes in the seismic screen.

Table The corresponding relations between 0.618^N T_0 and the intervals between the time of temperature anomalies and earthquakes and the time of main shocks

N	0	1	2	3	5	6	7	18
Ta.e(Year)	16.5	10.20	6.30	3.89	1.49	0.92	0.57	0.03
Temperature anomaly time	1960.2	1967.5		1973.1		1975.9	1976.2	
Time interval Ta	16.5	9.25		3.58		0.92	0.6	
Error(%)	0	−9.3		−8.0		0	5.3	
Earthquake date		1966.3.22	1969.7.18		1975.2.4			
Time interval Te		10.33	7.04		1.5			1976.7.28
Error(%)		1.3	11.7		0.7			

But why are these events arranged by 0.618^N in time? Its physical meaning is not completely clear yet.However, the following facts may help realize the generality of 0.618^N.In a regular five−pointed star, each two adjacent vertexes of the pentagon are located 0.618 and 0.382 positions of the corresponding five lines (length equal to 1) .It is also discovered in studying the component of matter that: 1.the inorganic chemical compounds of two or three elements (like NaCl, MgO, and $CaCO_3$) have 0.618 in component proportion and here Cl, Mg, and CO_3 are of their molecular weight. 2.complex matter of four or more elements possesses the characteristic of 0.618, its related sectional component has the 0.618^N nature. Taking hsianghualite (n = 1, 5) as an example, $BeSiO_4$ is 0.618 of the molecular weight of hsianghualite and $0.618^5$of the molecular weight is the content of F_2, similar phenomena exist in the biological system. Therefore, the golden section 0.618 is an objective law in the natural world, precisely because of this, the optimization of 0.618 is able to be widely used in proluction and scientific experiments, so that similar regularities could be inferred from the events in temporal sequences. In the block between 1960 and 1977, the four M7 earthquakes and the five temperature anomalies accord the law of 0.618^N in temporal distribution and in the 0.618^Ntime phase of this very period earthquakes and temperature anomalies are most likely to occur.

5.Possible causes for anomalous temperature increment in North China

Not many writers have studied the possible causes for meteorological anomalies. We believe that the possible reason for the temperature increment is the crustal movement, the temperature increment and earthquake are allophenomena of coorigin and two forms of energy release of crustal movement. The seismic activities in North China might be controlled by westward thrust movement of the Japanese Sea block. In thermodynamically speaking, withthe function of external force internal energy of the North China block increases, strain energy accumulates in certain parts of the crust and earthquakes are prepared meanwhile, in certain other parts the internal energy is reduced by way of deformation, friction and creep forming abnormal region of temperature increment. Experiment shown that deformation may release thermal (Сальман, А.Г.идр 1989) . Before the activities of the seismic screen in North China, from 1955 to 1960, the crustal deformation accelerated. Sixteen years before Tangshan M7.8 earhquake, there had already been seismic deformation precursory. Though the whole view of deformation in the North China block was not outstand ing , deformation precursory did exist in large areas, especially around the region of four M7 earthquakes. Before the Xingtai M7.2 earthquake, the graben level at Shulu sank by 210 mm, while at Xingjiawan it was raised by 140 mm; the four stages of deformation before the M7.8 earthquake amounted to 50.8 mm, and the horizontal and vertical deformations were especially condpicuous, determined the creep section corresponding to Tangshan M7.8 earthquake was in the deepth of 2–8 km underground, and the averagerates of strike and dip slips were 186mm / year and 14mm / year respectively. Similar phenomena happened before Haicheng the M7.3 earthquake. These crustal deformation rises and sinks, expansions and contractions occurred repeatedly and violently. Friction generates heat, this is one of the laws in thermodynamics. The border of the North China block is dissected by clefts. The block is divided into several parts by secondary or north–northeast fault systems. These small blicks are further cut into a net by east–west or north–west structures. The structural stress brings relative motions to the netlike blick or the clefts and generates deformation, friction and creeps. The mechanical energy, by way of deformation and friction, is turned into heat energy, and large quantity of heat is sent out from the rifts, moreover, the abruption belts become thc channels of heat generation and overflow. During the activities of the seismic screen in North China, in fact, the crustal deformarion, friction and creeps are a process not easy to differentiate either in time or in space. The anomalies reveal themselves when the overall thermal effect exceeds the temperature variations of the same month of a period. Sometimes the temperature appears normal in spite of the thermal effect because it might be concealed by such variations.

6. Conclusion

The relationship between the seismic screen and the temperature anomalies in the North Chinablock area is rather complicated. We have carried out the research to a certain breadth and depth and discovered some features of the temporal–spatial evolution of seismic screen activities and temperature anomalies. These features are of very important practical meaning in the prediction of seismic screens and individual earthquakes.

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华北断块区地震幕与气温异常

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摘　要

本文利用 1951–1980 年期间中国气温资料研究了 1966–1976 年间华北断块区地震幕活动与 1960 年 2 月–1977 年 1 月气温异常之间的关系。主要结论如下：1.华北断块及其邻近地区 1960 年 2 月天气异常增温到 1977 年 1 月天气异常降温过程与地震幕活动开始和结束的时间相关联；1967 年 5 月、1973 年 1 月、1975 年 9 月和 1976 年 2 月的气温异常与该地震幕中 1969 年 7 月 18 日渤海 7.4、1975 年 2 月 4 日海城 7.3 和 1976 年 7 月 28 日唐山 7.8 级三次地震密切相关。2.气温异常时间和异常范围之间以及它们与地震能量之间都有较高的可信度，表明气温异常与地震幕之间有成因上的联系。3.从 1960 年 2 月气温异常开始到 1976 年 7 月 28 日唐山 7.8 级地震发生时的 16.5 年可按 0.618^N 划分为 18 个时段，4 次 7.0 级以上地震和 5 次气温异常发生的时间恰好位于某几个时间段上。