The Ordered Network Structure and Prediction Summary for $M \geq 7$ Earthquakes in Xinjiang Region of China

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$M \geq 7$ earthquakes have showed an obvious commensurability and orderliness in Xinjiang of China and its adjacent region since 1800. The main orderly values are 30 a $\times k$ ($k = 1,2,3$), 11 $\sim$ 12 a, 41 $\sim$ 43 a, 18 $\sim$ 19 a, and 5 $\sim$ 6 a. In the guidance of the information forecasting theory of Wen-Bo Weng, based on previous research results, combining ordered network structure analysis with complex network technology, we focus on the prediction summary of $M \geq 7$ earthquakes by using the ordered network structure, and add new information to further optimize network, hence construct the 2D- and 3D-ordered network structure of $M \geq 7$ earthquakes. In this paper, the network structure revealed fully the regularity of seismic activity of $M \geq 7$ earthquakes in the study region during the past 210 years. Based on this, the Karakorum $M7.1$ earthquake in 1996, the $M7.9$ earthquake on the frontier of Russia, Mongol, and China in 2003, and two Yutian $M7.3$ earthquakes in 2008 and 2014 were predicted successfully. At the same time, a new prediction opinion is presented that the future two $M \geq 7$ earthquakes will probably occur around 2019 – 2020 and 2025 – 2026 in this region. The results show that large earthquake occurred in defined region can be predicted. The method of ordered network structure analysis produces satisfactory results for the mid-and-long term prediction of $M \geq 7$ earthquakes.

Key words: Xinjiang of China and its Adjacent Region; Imformational Ordered Network Structure; 2014 Yutian $M7.3$ Earthquake; 2008 Yutian $M7.3$ Earthquake; $M \geq 7$ Earthquake Prediction.

1. Introduction

Measured by China Earthquake Networks Center (CENC), an $M7.3$ earthquake hit Yutian County, Xinjiang Uygur Autonomous Region of China at 17:19 on February 12, 2014 (Beijing time), whose epicenter was at latitude 36.1, longitude 82.5, and focal depth was 12 km. It was the second strong earthquake of $M \geq 7$ in the Xinjinag region after the Yutian $M7.3$ earthquake occurred on March 21, 2008. In twice consecutive $M7.3$ earthquakes in less than six years, this phenomenon is rare. Fortunately the two $M7.3$ earthquakes took place in the unmanned area about 5000 m high mountain, causing no casualties, and other loss was low. So the two Yutian earthquakes have great significance for the study on the earthquake tendency in Xinjiang and its adjacent region and even all over Mainland China.

As everyone knows, the earthquake prediction is a world problem. China is not only a seismically active country, but also a great earthquake-prone country. During the 1980s, academician Wen-Bo Weng, known as a ‘contemporary master of prediction’, had created the information forecasting theory and made outstanding achievements in the forecast of severe natural disasters and forecasting sciences, which created a new way for the natural disaster prediction [1 – 4]. The information forecasting theory, which combines the advantages of Chinese and Western cultures, is a major theoretical innovation in contemporary natural disaster prediction. Xu et al. [5 – 7] and Xu [8 – 11] made a deep study on the orderliness of $M \geq 7$ earthquakes and firstly proposed the network hypothesis of earthquake occurrence and the concept of self-organized network, which further enriched and developed the information forecasting theory. In recent years, based on the information forecasting theory, the ordered network structure analysis method can be used in the mid-and-long term prediction for $M \geq 7$ earthquakes, as well as big floods and droughts and shows an important role [12 – 18].

The successful prediction of two Yutian $M7.3$ earthquakes shows again that it is an effective method for the mid-and-long term leaping prediction of $M \geq 7$ earthquakes combining the information forecasting theory with the ordered network structure analysis. On the basis of above research results, deeply exploring the activity regularity of $M \geq 7$ earthquakes in this study region, this paper focuses on the summary of the ordered network structure of $M \geq 7$ earthquakes, adds new information, further optimizes and constructs the two-dimensional (2D) and three-dimensional (3D) ordered network structure to make new predictions of the future $M \geq 7$ earthquakes in this region, in order to offer a dependable basis for decision-making of disaster reduction in China.

2. Constracting the Orderly Network Structure of $M \geq 7$ Earthquakes in Xinjiang of China and Its Adjacent Region

Natural characteristics of things can be divided into two categories: order and disorder. Oderliness is an order or the laws of nature, which includes periodicity, commensurability, rhythmicity, symmetry, fractal self similarity, informational orderliness etc. Oderliness always comes together with disorder and it runs through human, biology as well as nature. Exploring orderliness has a profound inspiration for us to recognize and study the development of human society and nature [19, 20].

Table 1. Catalogue of $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region during 1800 – 2014.

No.	Dates Year-Month-Day	Epicentral location Latitude (°N)	Longitude (°E)	Magnitude (M)	Locality	Peak and valley year of sun spot period
1	1812-03-08	43.7	83.5	8	East Nileike	$m+2$
2	1842-06-11	43.5	93.1	7	Barkol	$m-1$
3	1883-02-12	43.5	78.0	7.5	Alma-Ata (abroad)	$M-1$
4	1887-06-08	43.1	76.8	7.3	Vilna (abroad)	$m-2$
5	1889-07-11	43.2	78.7	8.3	Qieliekeqi (abroad)	m
6	1895-07-05	37.7	75.1	7	Taxkorgan	$M+2$
7	1902-08-22	39.9	76.2	8 1/4	North Atushi	$m+1$
8	1906-12-23	43.5	85.0	7.7	Southwest of Shawan	$M+1$
9	1911-01-03	43.5	77.5	8.3	Alma-Ata (abroad)	$m-2$
10	1911-02-18	40.0	73.0	7.8	Kyrgyzstan (abroad)	$m-2$
11	1914-08-05	43.5	91.5	7 1/2	East Barkol	$m+1$
12	1924-07-03	36.8	83.8	7 1/4	East Minfeng	$m+1$
13	1924-07-12	37.1	83.6	7.2	Minfeng	$m+1$
14	1931-08-11	47.1	89.8	8	Southeast of Fuyun	$m-2$
15	1931-08-18	47.2	90.0	7 1/4	Northeast of Fuyun	$m-2$
16	1944-03-10	44.0	84.0	7.2	Northeast of Xinyuan	m
17	1944-09-28	39.1	75.0	7	South Wuqia	m
18	1946-11-02	41.5	72.5	7.6	Anjiyan (abroad)	$M-1$
19	1949-02-24	42.0	84.0	7 1/4	Northeast of Kuche	$M+2$
20	1955-04-15	39.9	74.6	7	West Wuqia	$m+1$
21	1955-04-15	39.9	74.7	7	West Wuqia	$m+1$
22	1974-07-05	45.0	94.2	7.1	Northeast of Barkol	$m-2$
23	1974-08-11	39.4	73.8	7.3	Soutwest of Wuqia	$m-2$
24	1978-03-24	42.8	78.6	7.2	Alma-Ata (abroad)	$M-1$
25	1985-08-23	39.53	75.32	7.1	Wuqia	$m-1$
26	1990-06-14	47.90	85.09	7.2	Northwest of Jeminay	$M+1$
27	1992-08-19	42.1	73.9	7.5	Susamer (abroad)	$M+3$
28	1996-11-19	35.2	78.0	7.1	Karakorum	m
29	2003-09-27	49.9	87.9	7.9	Frontier of Russia, Mongol, and China (abroad)	$M+3$
30	2003-10-01	50.1	87.8	7.3	Frontier of Russia, Mongol, and China (abroad)	$M+3$
31	2008-03-21	35.6	81.6	7.3	Yutian	m
32	2014-02-12	36.1	82.5	7.3	Yutian	M?

Note: Revised by [23 – 26] and China Seismic Information (www.csi.ac.cn). In the Table 1, M and m denote the peak year and valley year of sun spot period, respectively, and $m-1$ denotes one year before the valley year of sun spot period, $M+1$ denotes one year after the peak year of that. The rest of analogy and followings are the same.

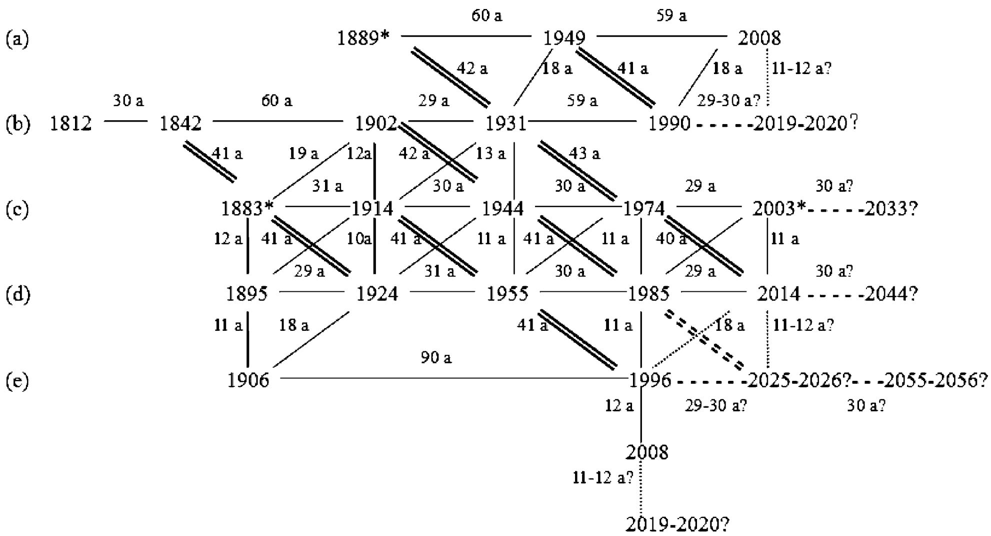

Fig. 1. Ordered network structure of $M \geq 7$ earthquake chains in Xinjiang of China and its adjacent region (revised by Figure 1 in [23, 24]. Dashed lines for prediction, symbol * denotes earthquakes occurred abroad and followings are the same).

Xinjiang is one of the regions with strong earthquake activity in western China. In Table 1, altogether 32 $M \geq 7$ earthquakes occurred in Xinjiang and its adjacent region during 1800 – 2014, in which 22 earthquakes occurred in China including 4 $M \geq 8$ earthquakes and another 10 earthquakes occurred in Kyrgyzstan, Kazakhstan, and Russia etc. The study results showed that, in recent 210 years, the seismic activity of $M \geq 7$ earthquakes in this region assumed good commensurability and orderliness, and there are five kinds of main-order values (or called order parameters) as follow: $\tau_1 = 30\,\text{a} \times k$ $(k = 1,2,3)$, $\tau_2 = 11 \sim 12$ a, $\tau_3 = 41 \sim 43$ a, $\tau_4 = 18 \sim 19$ a, and $\tau_5 = 5 \sim 6$ a. We studied the relationship between the ordered structure and each interval values of $M \geq 7$ earthquakes in detail, and pointed out the special prediction significance in references [21 – 24].

The ordered network structure of $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region from 1800 to 2014 is given in Figure 1. For convenience, each sample of $M \geq 7$ earthquake is denoted by its occurred year in this paper. Among them, the $M \geq 7$ earthquakes occurred twice in 1924, 1931, 1944, 1955, 1974, and 2003, which are represented as one year number for several samples in the same year. 26 earthquakes are used in the network structure in Figure 1 occupying 81.3% of the total sample number. The other six $M \geq 7$ earthquakes occurring abroad are not shown in Figure 1.

In Figure 1, the five horizontal chain lines (a) – (e) constitute the main frame of $M \geq 7$ earthquake activities, and the vertical line and single or double slash plays an auxiliary role. Earthquake samples transfer to occur from left to right in time at intervals of 30 a, 60 a or 90 a: the $M \geq 7$ earthquake samples occurred with the interval of 60 a in chain (a); the interval is 30 a or 60 a in chain (b); the interval is 30 a in chain (c) and (d); the two earthquakes in chain (e) occurred at an interval of 90 a. The vertical lines express the relationship of $M \geq 7$ earthquake samples in same column of chain (b), (c), (d), and (e) with the intervals of $11 \sim 12$ a, the double oblique lines express the interval of $41 \sim 43$ a, and the single oblique line shows the interval of $18 \sim 19$ a. Figure 1 not only shows the regularity of ordered values τ_1 of its own, but also reflects the association between τ_1 and τ_2, τ_3, τ_4. It is fully revealed that the network structure of $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region is in good order, consequently it has stronger prediction function.

As we know, structure is the base of function, and function is the reflection of structure. In Figure 1, the second vertical real line on the right connected in series with four $M \geq 7$ earthquake samples: 1974 – 1985 – 1996 – 2008. At the same time, samples 1931, 1949, 1990, and 2008 constituted a standard parallelogram in the upper part of Figure 1, which shows that it is not accidental for the Yutian $M7.3$ earthquake. The horizontal real line of chain (c) connected with five $M \geq 7$ earthquake samples: 1883* – 1914 – 1944 – 1974 – 2003*, and real line of chain (d) connected with five $M \geq 7$ earthquake samples too: 1895 – 1924 – 1955 – 1985 – 2014, which show that the time nodes 2003, 2014 are also not accidental.

3. Prediction Examples and the Prediction for Future $M \geq 7$ Earthquakes

Since 1992, the first author has concentrated on the earthquake prediction research, particularly devoting to studying the orderliness of $M \geq 7$ earthquake chains and its ordered network structure in the research region and achieved a number of results. The mid-and-long term predictions for four $M \geq 7$ earthquakes from No. 28 to No. 32 in Table 1 suggested, respectively, that there would be a large possibility of occurrence around 1996, 2004, 2009, 2015 pre and post [27 – 31]. The occurrence of the Karakorum $M7.1$ earthquakes in 1996, the $M7.9$ earthquake on the frontier of Russia, Mongol, and China in 2003 provides a firm evidence that the predictions above are successful. It stimulated us to further expand our study into a comprehensive approach to obtain new results. Thereafter, he followed up of the Yutian earthquake and presented his prediction opinion to the Nature Disaster Prediction Committee on January 18, 2008 (see the nature disaster prediction statement of 2008). And then he proposed a further prediction opinion containing the submission of his report entitled 'the explanation about the opinion of nature disaster prediction in 2008' on March 11, 2008: it was in 2008 that an $M \geq 7$ earthquake would very likely occur in this region. Just as expected, the Yutian $M7.3$ earthquake happened in 2008. During 2008 – 2013, he continued to focus on tracking prediction research and made clear the prediction opinion: the future $M \geq 7$ earthquake may take place around 2014 – 2015 in this region [21 – 24]. In fact, an $M7.3$ event occurred again in Yutian, Xinjiang, on February 12, 2014.

3.1. 2D-ordered Network Structure and Its Prediction

Now let us illustrate different ordered network diagrams. The $M7.9$ earthquake in 2003 and the two Yutian $M7.3$ earthquakes were predicted not only by using the main structure of Figure 1 which used to show the overall pattern, but also by designing an ordered network with detail and locally refined structure in less samples.

3.1.1. The Orderliness and Prediction Significance of $\tau_1 = 30$ a $\times k$ $(k = 1, 2, 3)$ and $\tau_2 = 11 \sim 12$ a

According to Figure 1, the author used to better predict the $M7.9$ earthquake on the frontier of Russia, Mongol, and China in 2003 and the two Yutian $M7.3$ earthquakes in 2008 and 2014, which were our second,

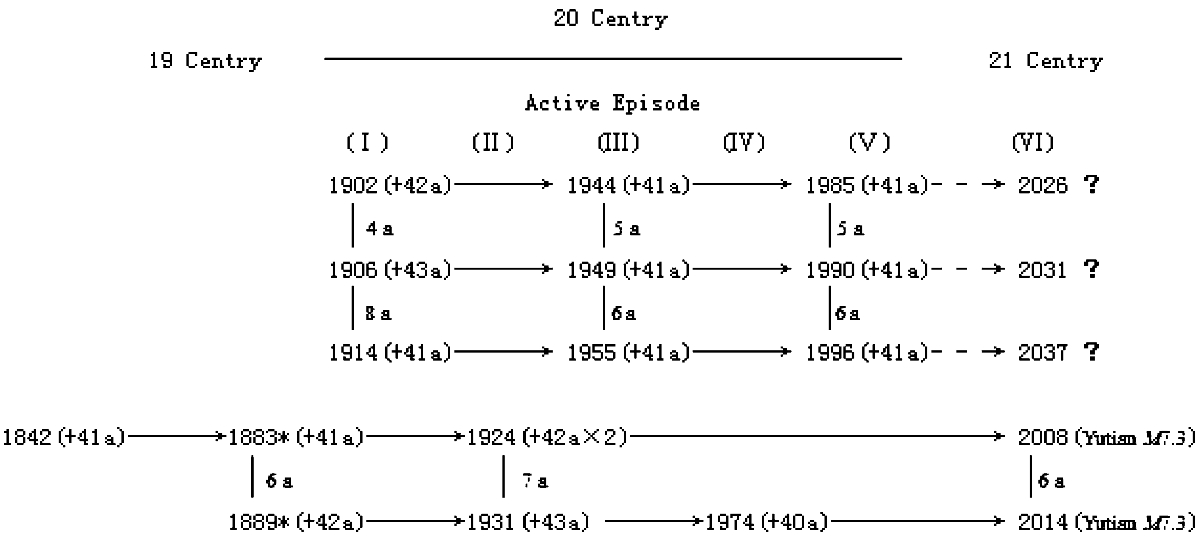

Fig. 2. Transmissible rule of orderly value 41 ~ 43 a and its prediction sketch map (revised by Figure 5 in [23, 24]).

third, and fourth successful prediction cases of $M \geq 7$ earthquakes in the study region [21 – 24, 27 – 31].

According to the above regularities, we can make a new prediction in this region as follows from Figure 1 (in this paper, each $M \geq 7$ earthquake is named by its occurred year, where the prediction error is ± 1 a, and similarly hereinafter):

(i) According to the information carried by the horizontal chains (a) and (b), if the chain (b) is extended for 29 $\sim$ 30 a; in the same way, if the second vertical chain 1974 – 1985 – 1996 – 2008 on the right in Figure 1 is made the corresponding extension for 11 $\sim$ 12 a, we can know that the future first $M \geq 7$ earthquake will probably occur around 2019 – 2020 in this region.

(ii) If the first vertical chain on the right and chain (e) in Figure 1 is made the corresponding extension, respectively, the point of intersection will be around 2025 – 2026, when the second $M \geq 7$ earthquake will probably occur in this region.

(iii) If the horizontal chains (c), (d), and (e) are extended for 30 a, respectively, we can make the predic-

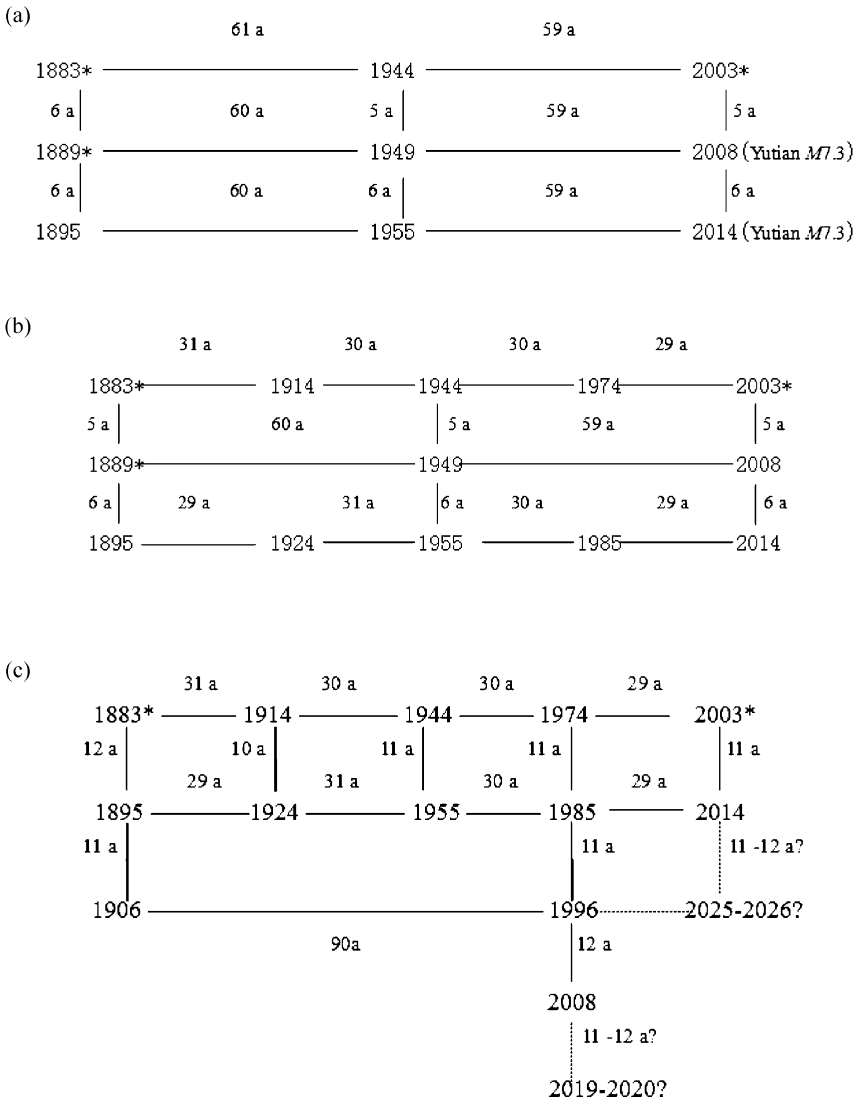

Fig. 3. Details of ordered network of Figure 1 for prediction of the 2008 and 2014 Yutian. $M7.3$ earthquakes in Xinjiang of China (revised by Figures 2 – 4 in [23, 24]).

tion that the following $M \geq 7$ earthquakes will occur around 2033, 2044, and 2055 – 2056 in this region.

3.1.2. *The Orderliness and Prediction Significance of $\tau_3 = 41 \sim 43$ a*

The west of Mainland China has undergone five stages of $M \geq 7$ earthquakes since the 20th century. Figure 2 reflects that the transfer regularity of the ordered value τ_3 only on the first, third, and fifth active episodes in series, and three level lines and nine points are connected to form a very regular and symmetrical '3-order matrix' (see the real lines of the first three rows in Fig. 2). In 1994 we predicted that the ninth point would be emplaced in 1996 according to the informational orderliness of network in Figure 2 [27]. Thus, the $M7.1$ Karakorum earthquake occurred on November 19 in 1996, which was our first successful prediction case of $M \geq 7$ earthquakes in Xinjiang region of China.

By the application of Figure 2, we can also successfully predict the 2008 and 2014 Yutian $M7.3$ earthquakes:

(i) The fourth level line in Figure 2 elaborates that the second active episode transfers to the sixth active episode with two 42 a intervals from 1924 earthquake (the two Minfeng earthquakes with $M \geq 7$) to 2008 earthquake, and indeed the $M7.3$ earthquake occurred in Yutian on March 31, 2008.

(ii) The fifth level line in Figure 2 connects three $M \geq 7$ earthquake samples according to the time sequence: 1889 – 1931 – 1974. After 40 years it can be passed to the position of 2014, and thus the Yutian $M7.3$ earthquake occurred on February 12, 2014.

The successful prediction cases showed that the ordered network structure analysis was a research method of 'less defeat much', and it displayed significant effects on some conditions. According to the above regularities, we can get the following prediction by extending the first three real lines of Figure 2 for 41 a: the future $M \geq 7$ earthquakes may still occur around 2026, 2031, 2037 in Xinjiang of China and its adjacent region.

3.1.3. *Ordered Network Structure in Detail and Prediction for the two Yutian M7.3 Earthquakes*

The Heavenly Stems and Earthly Branches conveys the wisdom of ancient Chinese People, and the 60 a orderliness has universally adaptable significance in the Chinese traditional culture. The time intervals of $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region is closely related to it, 30 a is one half of 60 a, and 90 a can be split into 60 a and 30 a, so we took the interval values 30, 60, and 90 a all in consideration.

Figure 3 is the local refinement structure of Figure 1. Using any graph of (a), (b), (c) in Figure 3, we can successfully predict the two Yutian $M7.3$ earthquakes in 2008 and 2014.

In particular, the $M \geq 7$ earthquakes occurring in 1996, 2003, 2008, and 2014 all can be predicted successfully in turn by using only one ordered network of graph (c) in Figure 3 just as Figure 1.

3.2. *3D-ordered Network Structure and Its Prediction*

In the construction of large earthquake ordered network, we usually only focus on the ordered connection of line length (time interval) between the nodes, but do not care about the location of the node, the form of line (straight or curved, whether they intersect). Therefore, the ordered network of large earthquakes is a complex network with topological structure.

According to the topological properties of ordered network, the $M \geq 7$ earthquake network can be designed into 2D- or 3D-forms to display. Sometimes a network chart is not comprehensive, it can be divided into several figures, described from multiple angles. In order to ensure the upper and lower left temporal association between samples, when necessary, an individual sample can be repeated. The 2D-network with horizontal and vertical lines is used to depict the overall pattern, its sequential rules are very simple and intuitive (see Fig. 1), and the 3D-network is often used in the image to display local structure feature.

3.2.1. *Ordered Network Structure of Six Prism and Its Prediction*

Processing Figure 1 into 3D forms, we can build the ordered network of $M \geq 7$ earthquakes in six prism shaped (see Fig. 4). According to the bottom of Figure 4, we can get predictions not only for the $M7.9$ earthquake on the frontier of Russia, Mongol, and China in 2003 and the two Yutian $M7.3$ earthquakes in 2008 and 2014, but also for the future large earthquake prediction in this region, that is, the future $M \geq 7$ earthquakes will probably occur around 2033, 2044, and 2050.

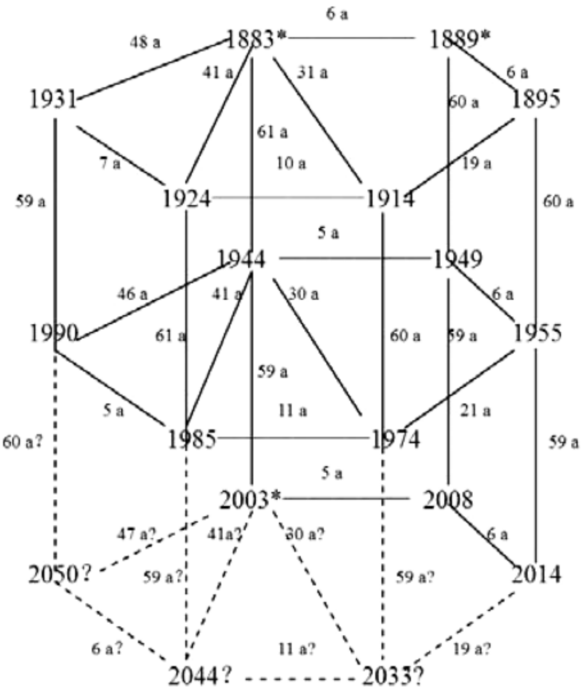

Fig. 4. Sketch of prediction for $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region by using a six prism ordered network structure.

3.2.2. *Ordered Network Structure of Quadrangular, Five Prism and Their Prediction*

With the same method, processing Figure 2 into 3D forms, we can build the ordered network of $M \geq 7$ earthquakes in quadrangular and five prism shaped (see Figs. 5 and 6). In Figures 5 and 6, the ordered value $\tau_3 = 41 \sim 43$ a is the main body. It shows the coherent law of interval value τ_3 and the relationship between τ_3 and other ordered values.

According to Figure 5 on the middle level surface, we can predict that the Yutian $M \geq 7$ earthquake may occurred in 2014. At the same time, according to the intersection of the second vertical line on the right and the bottom in Figure 5, we can also predict the events of 1996. In addition, from the bottom of Figure 5, we can also predict that the future $M \geq 7$ earthquake will probably occur around 2055 – 2056.

Similarly, according to the first vertical line on the left of Figure 6, we can also get the successful prediction of the 2014 Yutian $M7.3$ earthquake, and according to the intersection of the second vertical line on the right and the third level surface from the top to bot-

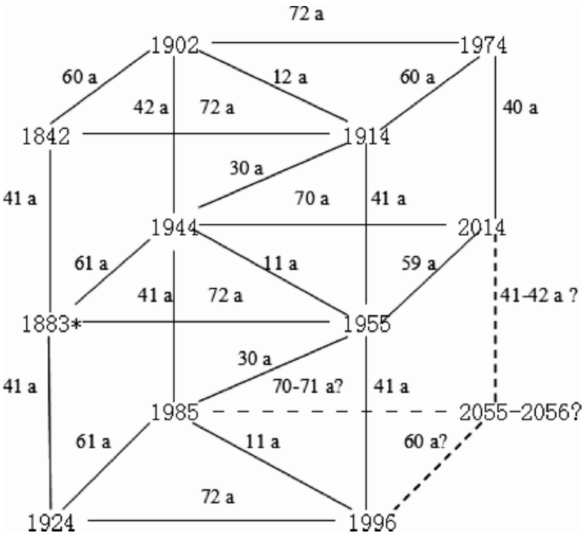

Fig. 5. Sketch of prediction for $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region by using a quadrangular network structure.

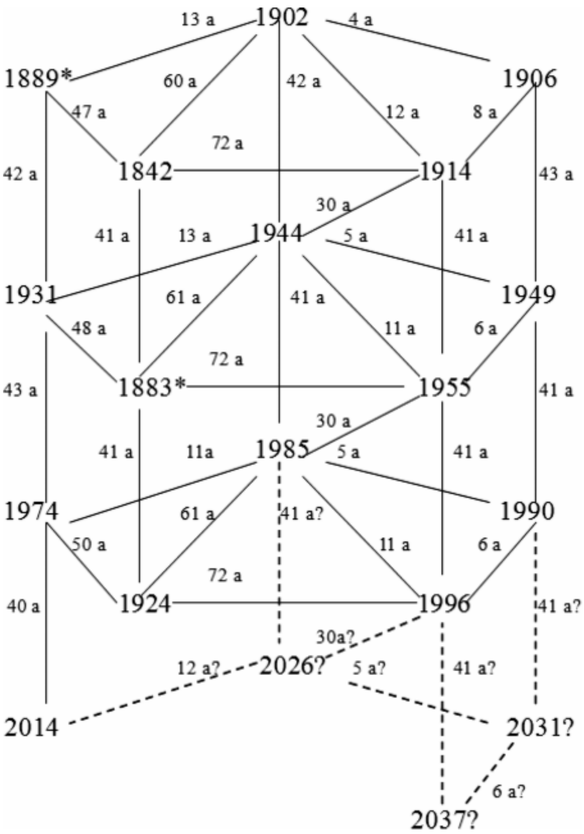

Fig. 6. Sketch of prediction for $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region by using a five prism network structure.

tom in Figure 6, we can also predict the earthquake event occurred in 1996. In addition, from the bottom of Figure 6, we can also predict that the future $M \geq 7$ earthquakes will probably occur around 2026, 2031, and 2037.

As stated above, the future $M \geq 7$ earthquakes will probably occur around 2019 – 2020, 2025 – 2026, 2031 – 2033, 2037, 2044, 2050, and 2055 – 2056 in Xinjiang of China and its adjacent region.

3.2.3. To Pay Attention to the Influence of Solar Activity

As everyone knows, the average sun spot period is 11 a, one of magnetic period of solar activity is 22 a, and the long period is 80 $\sim$ 90 a. So we could consider all the ordered values 11 a, 22 a and 44 a. This paper studied the relationship between solar activity and $M \geq 7$ earthquakes. The first column on the right in Table 1 shows that most large earthquakes in Xinjiang of China and its adjacent region occurred near the peak or the valley years of sun spot period, and there were 19 $M \geq 7$ earthquakes occurred one year ago or later than sun spot peak or valley year, accounting for 61.3%, among them, 13 earthquakes one year ago or later than sun spot valley year, accounting for 41.9%. Dating from 1755, 1996 was the valley year of the sun spot period 23. It was in the year of 1996 that the M6.9 Atushi earthquake and the M7.1 Karakorum earthquake occurred separately, followed by the Jiashi M6 strong earthquake swarm in early 1997. These cases provide new evidence for the above conclusion.

According to the observations of the Beijing Astronomical Observatories, Chinese Academy of Sciences, 2007 – 2009 were very low solar activity years, and the solar relative number were 7.5, 2.9, 3.1, respectively, less than 10 for three years in a row. From 1996, the beginning of the sun spot period 23 has experienced nearly 14 years, the longest for 200 years of sun spot period since 1798. The length of sun spot period (SCL > 11), the abnormal phenomena of solar activity years long valley, often goes with global disasters together. 2008 was in the valley of the sun spot period 24. With the astronomical background, at the beginning of 2008, South China was suddenly attacked by low temperature and snow disaster, then the Yutian M7.3 earthquake on March 21, 2008 in Xinjiang, the Wenchuan M8.0 earthquake on May 12, 2008 in Sichuan, the Yushu M7.1 earthquake on April 14, 2010 in Qinghai, occurred in succession [23, 24]. It is not an accidental phenomenon, but the objective law. Here is an excellent example for us.

Besides, solar activity has been on the rising phase of the sun spot period 24 since 2010. In prediction, the peak may be around 2013 – 2014, while the next one may be around 2025 – 2026. The astronomical background changes deserve high attention.

The universe is a unified whole, and the running of the sun, the earth, and the moon has interrelationship and interdependence with the nature disasters such as earthquakes. The earthquake can be considered as the result of a nonlinear interaction between the internal factors and external factors of the earth. The external factors are more closely correlated with earthquakes, and the stronger the earthquake is, the better the correlations are [32, 33]. In a word, serious disasters such as a large or great earthquake or a big flood could be studied in the systems of astronomy, earth science, and biology because of its uniqueness.

4. Conclusion and Discussion

(i) A predictor of the Era of Big Data, Viktor Mayer-Schönberger [34], says that big data will bring great era transformation. The change of thinking from causality to correlation is the key of big data, while the forecast based on correlation is the core. To find useful information from mass data, dig out the closet pattern, trend, and correlation, and reveal the natural and social phenomena, stronger data insight is required. The information forecasting theory is devoted to dig out symmetrical, simple, and inevitable ordered information from disorderliness, complexity, and haphazard, is more devoted to mining the regularity of severe disaster events (such as large or great earthquakes, big floods etc.) from a small number of effective data. At the same time, we also can draw much better study results by using the information orderliness and small data than the causality. The 2D- and 3D-ordered network structure of $M \geq 7$ earthquakes built in this paper highly contains and reveals complexity and orderliness of $M \geq 7$ earthquakes in Xinjiang of China and its adjacent region for over 210 years. This is better for us to deeply understand the occurrence regularity of $M \geq 7$ earthquakes so as to promote the prediction research of $M \geq 7$ earthquakes.

(ii) During the past 20 years, from the Karakorum M7.1 earthquakes in 1996 to the M7.9 earthquake on the frontier of Russia, Mongol, and China in 2003, and to the two Yutian $M7.3$ earthquakes in 2008 and 2014, four large earthquakes had been predicated successfully in Xinjiang of China and its adjacent region by using the analysis of orderliness and ordered network based on the information forecasting theory. They provide a wonderful example to illustrate that $M \geq 7$ earthquakes can be predicted. The summary in this paper shows that the ordered network analysis method is very fruitful to analyze and solve the leaping (especially long time and long distance) prediction of $M \geq 7$ earthquakes. It can be served as useful tool for understanding the correlations among $M \geq 7$ earthquakes in defined area, and it is intuitive, vivid, easy, and different from the complex and unrecognized traditional mathematical method. According to the 2D- and 3D-ordered network structure represented in this paper, we can make new prediction (predictions of long time neglected): in future two $M \geq 7$ earthquakes in this region will occur around 2019 – 2020 and 2025 – 2026.

(iii) Although the earthquake prediction is a hard problem in the whole world, earthquakes can be predicted. It is generally known that earthquake prediction should be a gradual process, a system engineering. There may be false and missing in above prediction. The subsequent short-term and imminent prediction should be based on the medium and long term prediction, combining multi-disciplinary, multichannel with collaborative research to strengthen comprehensive study on a variety of impending seismic phenomena, to track and focus on the large or great earthquake information. By various means to discard the false and retain the true, narrowing forecast range, we can lock and capture the future $M \geq 7$ earthquakes in order to contribute to disaster prevention and reduction of mankind.

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