International Journal of Geosciences, 2010, 38-43
doi:10.4236/ijg.2010.11005 Published Online May 2010 (http://www.SciRP.org/journal/ijg)

The Co-planarity and Symmetry Principle of Earthquake Occurrence

Zhe Yin[1,2]
[1]*Department of Information Management*, *Beijing University*, *Beijing*, *China*
[2]*Mathematics Department*, *Yanbian University*, *Yanji*, *China*
E-mail: *yinzhe@ybu.edu.cn*
Received February 28, 2010; *revised March* 26, 2010; *accepted April* 20, 2010

Abstract

Under the assumption that the earth movement tendency is a sphere, the author does research about the earthquakes occurrence between 2001 and 2010 which over 6 scales of magnitude on occurred time (UTC), magnitude, longitude, latitude and other data, then give out the causal relationship of earthquakes and the co-planarity and symmetry theory of earthquake occurrence. Also, the author does empirical analysis in the paper.

Keywords: Earthquake, Co-planarity, Symmetry

1. Introduction (*Heading* 1)

Research on earthquakes is one of the most important elements about disaster prevention study, because of its devastating and destructive. Especially in recent years, with the rapid development of modern economic activity, destruction to the Earth was continuous. The frequency tends to rise and there are more large earthquakes. Therefore, how to analyze the reason of the earthquake correctly, and predict earthquakes effectively becomes a hot topic in nowadays.

Under the assumption that the earth movement tendency is a sphere and mountains fall to the surface of the earth; estrogens and basin rise to the surface of the Earth. This article gives out the co-planarity and symmetry theory of earthquake occurrence according to research about the earthquakes occurrence between 2001 and 2010 which over 6 scales of magnitude.

2. Questions and Relevant Definitions

The Earth, like a very sensitive being, according to the laws of nature, it has the desire to achieve a balance of features. In this process, it will show a particular trend.

As shown in **Figure 1**, we give some relevant definitions here:

Ecliptic axis: an axis through the center of the Earth which is a vertical line to the ecliptic plane.

Equatorial coordinate system: a celestial coordinate system of the equatorial plane and the axis of rotation.

Ecliptic system of coordinates: a celestial coordinate system of the ecliptic plane and ecliptic axis.

Tangent plane parallel to the equator: the Earth's equatorial plane parallel to the tangent plane (Tangent plane parallel the equator), shown as TPPTE.

Ecliptic line tangent plane: parallel to the ecliptic of the earth tangent plane (Ecliptic line tangent plane), shown as ELTP.

Equatorial vertical plane: after the Earth's surface

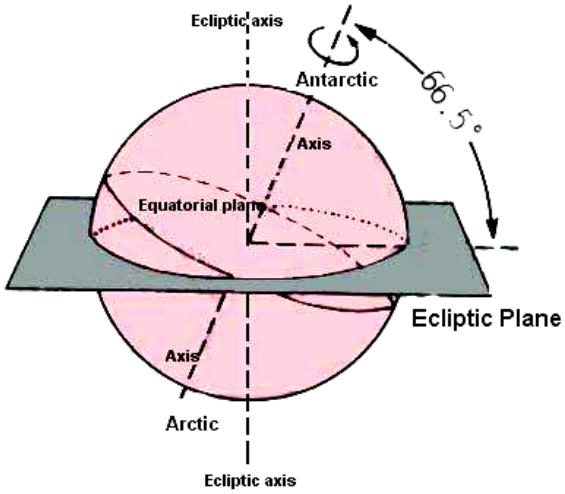

Figure 1. Plane figure.

shock point and the spin axis of the tangent plane (Equatorial vertical plane), shown as EVP.

Longitudinal ecliptic plane: after a shock point and the yellow surface of the Earth axis tangent plane (Ecliptic plane vertical), shown as EPV.

Circular symmetry point: Circular , shown as CSP.

Similar point: Similar Point, shown as SP.

Earthquake effects: measure the Earth's surface; the intensity level of shock is unstable, the stability of the boundary tangent plane level. Plane is the ball away from the more deviation, the more poor results, and the more unstable and more likely point of this earthquake.

3. Basic Assumptions and the Co-Planarity and Symmetry Principle of Earthquake

3.1. Basic Assumptions

1) The Earth became positive sphere with earthquakes which rise or low the ground. That is, because of the ecliptic (23.26 degrees), the Ecliptic Plane TPPTE line tangent planes ELTP have tended to be round;

2) The Earth has tended to balance, and because the earthquake, to re-balance;

3) Crustal thickness tends to vary. Earth's core and mantle movement space tends to a ball space;

4) With the earthquake, the earth rotation axis offset. When there is a earthquake which makes the low rise, the earth rotation axis moves to the seismic vertical, those makes the high low is opposite.

3.2. Co-planarity and Symmetry Principle

After the observation of earthquakes on Earth N (154 earthquakes over 6 scales of magnitude in this article) times, it is occur time H_K, H_{K+1} of adjacent earthquakes M_K, M_{K+1} measure with UTC.

A) The previous earthquake is a cause of the after. The tangent plane balances was destroyed, then tend to a new balance, which Ecliptic line tangent plane generate new state plane all the times.

B) Seismic vertical M_K and seismic vertical M_{K+1} are on the same plane at the time H_K or H_{K+1}. That is parallel to the cut-plane in the equatorial plane or Ecliptic line cut the ecliptic plane, or longitudinal vertical plane or equatorial plane.

C) If the tangent of the plane where seismic vertical M_K and seismic vertical M_{K+1} are tends to round, or fall-rise movement in the earthquake tends to stable, M_K and M_{K+1} tends to symmetry in the circle; otherwise, coplanar circle from the difference of the most unstable point will have an earthquake.

D) After earthquake on M_K occurs, if the most unstable point (poor seismic effect) is still M_K, earthquake M_{K+1} will take place near the same point.

4. Research Basis and Calculation Method

Assumptions (1), (2), (3) are prerequisite of conclusion (A), (B), (C) and (D); symmetry points including the spin axis symmetry, yellow axis symmetry and geocentric axial symmetry. With the existence of the ecliptic obliquity (ecliptic plane and the equatorial plane angle 23.26 degrees) and the Ecliptic plane tangent line, parallel to the equatorial plane tangent tends to a circle, the shape of the earth tends to a sphere becomes possible. This can be concluded with (C) and (D). Assumptions (4) decided the longitudinal movement of the M_{K+1} after M_K. Assumptions (1) and (3) show the possibility that the earthquake and the earthquake potential basis for the order. Be noted that symmetrical points at any time change the fact that, in the premise revolution, a startled different points of the Ecliptic OK UTC timing of your cutting surface is subject to change, and cut parallel to the equatorial plane remain unchanged.

Earthquake time: the time the earthquake is very important, when the earthquake occurred; it generates and identifies Ecliptic line tangent plane, tangent plane parallel to the equator, the ecliptic plane and the equatorial vertical longitudinal cut tangent plane, as well as the corresponding point of the plane of symmetry at the same time.

Symmetrical points on the calculation: Earth autobiographical spherical coordinates on the equatorial plane symmetry coordinates of points on the simple calculation, the same latitude, longitude 180 degrees plus or minus 180 degrees. The following calculation Ecliptic coordinate system on the surface of the ball symmetric point computation of positions is shown in **Figure 2**.

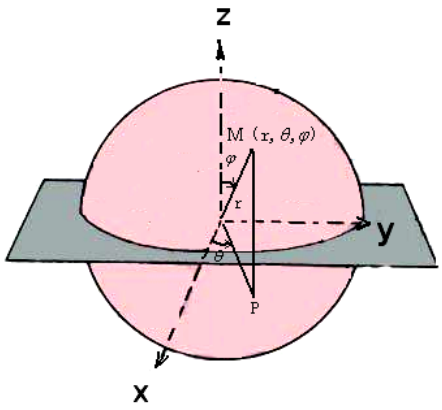

Figure 2. Caculations.

Shock point set M of lat = W, long = J, time (UTC) = a: b, then $\varphi_0 = 90 - W$, $\theta_0 = J + (a + b/60) \times 15$

Step2:

$$\begin{cases} x = \sin\varphi_0 \cos\theta_0 \\ y = \sin\varphi_0 \sin\theta_0 \\ z = \cos\varphi_0 \end{cases}$$

$$0^\circ \le \theta_0 \le 360^\circ, 0^\circ \le \varphi_0 \le 180^\circ$$

Step3: To the counterclockwise rotation 23°26', then

$$\begin{cases} x' = x\cos 23^\circ 26' + z\sin 23^\circ 26' \\ y' = y \\ z' = x\sin 23^\circ 26' - z\cos 23^\circ 26' \end{cases}$$

M point symmetry point assignment
Step4: Clockwise rotation to 23°26', then

$$\begin{cases} x'' = x'\cos 23^\circ 26' - z'\sin 23^\circ 26' \\ y'' = y' \\ z'' = x'\sin 23^\circ 26' + z'\cos 23^\circ 26' \end{cases}$$

Step5

$$\begin{cases} x'' = \sin\varphi_1 \cos\theta_1 \\ y'' = \sin\varphi_1 \sin\theta_1 \\ z'' = \cos\varphi_1 \end{cases}$$

Step6: symmetry point, lat = $W' = 90 - \varphi_1$, long = $\theta_1 - (a + b/60) \times 15$

5. Results

According to the information of 154 earthquakes over 6 scales of magnitude over the world from the USA Earthquake Observation Council, the causal relationship common area, symmetry of them can be concluded as following (**Table 1**) [1]: in the Comments, the next item TPPTE cut parallel to the earthquake in the equatorial plane, ELTP that the next seismic line cutting in the Ecliptic plane, EVP that the next earthquake in the vertical plane perpendicular to the equator, EPV that the next earthquake in the vertical longitudinal ecliptic plane. A total of circular symmetry point, then increasing the CSP, such as TPPTECSP; similar point with the SP said. Two adjacent seismic M_K and M_{K+1}, at present, earthquake moment H_K, when the total surface, then added 1; when the time after the earthquake H_{K+1}, when the total surface, then added 2.

Table 1. Original data.

2001

Date	Time (UTC)	Place	Lat.	Long.	Magnitude	Comments
Jan 13	17:33	Salvador	13.04	-88.66	7.7	ELTPCSP1
Jan 26	03:16	India	23.39	70.23	7.7	TPPTECSP1
Feb 13	14:22	Salvador	13.67	-88.94	6.6	ELTP1
Feb 28	18:54	USA	47.11	-122.6	6.8	EPV2
Jun 23	20:33	Peru	-16.3	-73.55	8.4	ELTPCSP1
Nov 14	09:26	China	36.2	90.9	7.8	ELTP1

2002

Date	Time (UTC)	Place	Lat.	Long.	Magnitude	Comments
Feb 3	07:11	Turkey	38.573	31.271	6.5	TPPTE1
Mar 3	12:08	Afghanistan	36.543	70.424	7.4	SP1
Mar 25	14:56	Afghanistan	36.06	69.32	6.1	TPPTE1
Jun 22	02:58	Iran	35.63	49.05	6.5	TPPTE1
Oct 31	10:32	Italy	41.79	14.87	5.9	ELTPCSP1
Nov 3	22:12	Alaska, USA	63.52	-147.4	7.9	EPV1

2003

Date	Time (UTC)	Place	Lat.	Long.	Magnitude	Comments
Jan 22	02:06	Mexico	18.8	-104.1	7.6	TPPTECSP1
Feb 24	02:03	China	39.61	77.23	6.3	TPPTE1
May 1	00:27	Turkey	39.01	40.46	6.4	TPPTE1

May 21	18:44	Algeria	36.96	3.63	6.8	TPPTE1
Sep 25	19:50	Japan	41.82	143.91	8.3	ELTP2
Nov 17	06:43	USA	51.15	178.65	7.8	
Dec 22	19:15	USA	35.71	-121.1	6.6	ELTP2
Dec 26	01:56	Iran	29.00	58.31	6.6	ELTP1

2004

Date	Time (UTC)	Place	Lat.	Long.	Mag-nitude	Comments
Feb 5	21:05	Indonesia	-3.61	135.53	7.0	ELTP1
Feb 24	02:27	Gibraltar	35.14	-3.99	6.4	TPPTE1
May 28	12:38	Iran	36.29	51.61	6.3	TPPTE1
Sep 5	10:07	Japan	33.07	136.62	7.2	SP1
Sep 5	14:57	Japan	33.14	137.07	7.4	ELTP1
Oct 9	21:26	Nicaragua	12	-86	7.0	ELTPCSP1
Oct 23	08:56	Japan	37.3	138.8	6.6	EVP1
Nov 11	21:26	East Timor	-8.15	124.87	7.5	ELTPCSP1
Nov 15	09:06	Colombia	4.7	-77.51	7.2	ELTP1
Nov 20	08:07	Costa Rica	9.6	-84.17	6.4	TPPTE1
Nov 21	11:31	Islands	15.68	-61.71	6.3	TPPTECSP1
Nov 26	02:25	Indonesia	-3.60	135.40	7.1	EPV1
Nov 28	18:32	Japan	42.94	145.28	7.0	EVP1
Dec 23	14:59	New Zealand	-50.24	160.13	8.1	ELTP1
Dec 26	00:58	Indonesia	3.30	95.87	9.1	ELTP1

2005

Date	Time (UTC)	Place	Lat.	Long.	Magni-tude	Comments
Feb 22	02:25	Iran	30.726	56.817	6.4	TPPTE1
Mar 20	01:53	Japan	33.54	130.12	6.6	EPV1
Mar 28	16:09	Indonesia	2.08	97.11	8.6	ELTPCSP1
Jun 13	22:44	Chile	-19.89	-69.12	7.8	EPV1
Jun 15	02:50	California	41.284	-125.9	7.2	TPPTE1
Aug 16	02:46	Japan	38.259	148.98	7.2	EPV1
Sep 9	07:26	New Guinea	-4.539	153.47	7.6	TPPTE1
Sep 26	01:56	Peru	-5.68	-76.4	7.5	EPVD2
Oct 8	03:50	Pakistan	34.43	73.54	7.6	TPPTE1
Nov 26	00:49	China	29.7	115.7	5.2	TPPTE1
Nov 27	10:22	Iran	26.77	55.86	5.9	EPV1
Dec 5	12:19	Tanzania	-6.212	29.599	6.8	EPV1

2006

Date	Time (UTC)	Place	Lat.	Long.	Mag-nitude	Comments
Jan 8	11:34	Greece	36.250	23.498	6.7	EPV1
Feb 22	22:19	Mozam-bique	-21.32	33.58	7.0	EPV1
Apr 20	23:25	Russia	61.075	167.08	7.6	EPV1
May 3	15:26	Tonga	-20.13	-174.1	8.0	EVP1
May 16	10:39	New Zea-land	-31.55	-179.2	7.4	ELTP2
May 27	22:54	Indonesia	7.977	110.31	6.3	EPV1
Jul 17	08:19	Indonesia	-9.334	107.26	7.7	EPV1
Aug 20	03:41	Scotia Sea	-61.02	-34.37	7.0	EPV1
Sep 10	14:56	Mexico	26.339	-86.56	5.9	TPPTE1
Oct 15	17:07	USA	19.801	-156.0	6.7	EPV1
Nov 15	11:14	Russia	46.616	153.22	8.3	ELTP1
Dec 26	12:26	Taiwan	21.818	120.53	7.1	ELTP2

2007

Date	Time (UTC)	Place	Lat.	Long.	Mag-nitude	Comments
Jan 13	04:23	Russia	46.288	154.44	8.1	ELTP1
Jan 21	11:27	Molucca Sea	1.207	126.29	7.5	EPV1
Feb 12	11:27	Portugal	36.09	10.26	6.0	ELTP2
Mar 6	05:49	Indonesia	-0.490	100.52	6.4	ELTP2
Mar 25	00:40	Vanuatu	-20.59	169.41	7.1	EPV1
Mar 25	00:42	Japan	37.537	136.43	6.7	EPV1
Apr 1	20:39	Islands	-8.474	156.95	8.1	ELTP1
May 16	08:56	Laos	20.470	100.70	6.3	ELTP1
Jun 2	21:34	China	23.013	101.05	6.1	ELTPCSP1
Jun 13	19:29	Guatemala	13.628	-90.73	6.7	ELTPCSP1
Jul 16	01:13	Japan	37.574	138.44	6.6	ELTP2
Jul 18	17:30	Tanzania	-2.586	36.281	5.9	ELTP1
Aug 1	17:08	Vanuatu	-15.67	167.60	7.2	EPV2
Aug 2	02:37	Russia	47.259	141.75	6.2	EPV1
Aug 8	17:04	Indonesia	-5.968	107.65	7.5	ELTPCSP2
Aug 15	23:40	Peru	-13.32	-76.50	8.0	ELTPCSP1
Sep 12	11:10	Indonesia	-4.517	101.38	8.5	ELTP1
Sep 28	13:38	USA	21.980	142.68	7.5	EPV1
Sep 30	05:23	New Zealand	-49.39	163.84	7.4	SP1
Oct 15	12:29	New Zealand	-44.68	167.21	6.8	EPV1
Oct 24	21:02	Indonesia	-3.909	101.06	6.8	ELTP2
Oct 31	03:04	USA	37.432	-121.7	5.6	ELTP1
Oct 31	03:30	USA	18.854	145.31	7.2	ELTP2
Nov 14	15:40	Chile	-22.18	-69.84	7.7	ELTPCSP1
Nov 25	16:02	Indonesia	-8.294	118.36	6.5	EPVD1
Nov 29	19:00	France	14.951	-61.24	7.4	EPV1
Dec 9	07:28	Fiji	-26.15	-177.4	7.8	EVP1
Dec 19	09:30	Alaska, USA	51.495	-179.4	7.1	ELTP1

2008

Date	Time (UTC)	Place	Lat.	Long.	Mag-nitude	Comments
Jan 5	11:01	Canada	51.299	-130.7	6.6	ELTPCSP1
Feb 3	07:34	Congo	-2.314	28.896	5.9	EVP1
Feb 14	10:09	Greece	36.646	21.833	6.9	ELTP2
Feb 20	08:08	Indonesia	2.751	95.966	7.4	EPV1
Feb 21	15:26	(Norway)	77.41	14.48	6.1	ELTP1
Feb 21	14:16	USA	41.076	114.77	6.0	TPPTE1
Apr 18	09:37	USA	38.450	87.890	5.2	ELTP1
May 7	16:45	Japan	36.141	141.54	6.9	ELTP2
May 12	06:28	China	31.099	103.27	7.9	ELTP2
May 24	19:20	Colombia	4.447	-73.67	5.9	EPV2
May 29	15:46	Iceland	63.992	-21.01	6.3	ELTP2
Jun 8	12:25	Greece	38.029	21.464	6.4	TPPTE1
Jun 13	23:43	Japan	39.122	140.67	6.9	ELTP2
Jul 15	03:26	Greece	35.983	27.785	6.4	ELTP1
Jul 19	02:39	Japan	37.627	142.11	7.0	SP1
Jul 23	15:26	Japan	39.807	141.46	6.8	ELTP2
Jul 29	18:42	California	33.955	-117.7	5.5	ELTP2
Aug 21	12:24	China	25.066	97.737	6.0	EPV2
Aug 25	13:21	China	30.893	83.614	6.7	ELTP2
Aug 30	08:30	China	26.277	101.91	6.0	EPVD2
Sep 8	18:52	Vanuatu	-13.51	166.96	6.9	ELTP1
Sep 10	11:00	Iran	26.823	55.825	6.1	ELTP1
Sep 11	00:20	Japan	41.979	143.62	6.8	EPV1
Sep 29	15:19	New Zealand	-29.87	-177.6	7.0	
Oct 5	15:52	Kyrgyzstan	39.515	73.768	6.6	ELTP2
Oct 6	08:30	China	29.759	90.302	6.3	ELTP1
Oct 11	09:06	Russia	43.271	46.262	5.8	ELTP2
Oct 16	19:41	Mexico	14.443	-92.42	6.7	ELTP2
Oct 19	05:10	Tonga	-21.85	-173.8	6.9	ELTP2
Oct 28	23:09	Pakistan	30.653	67.323	6.4	ELTP1
Nov 16	17:02	Indonesia	1.290	122.10	7.3	EPV1
Nov 24	09:02	Okhotsk	54.194	154.31	7.3	EPV2

2009

Date	Time (UTC)	Place	Lat.	Long.	Mag-nitude	Comments
Jan 3	19:43	Indonesia	-0.510	132.78	7.6	ELTPCSP1
Jan 8	19:21	Costa Rica	10.197	-84.15	6.1	ELTPCSP2
Jan 15	17:49	Russia	46.862	155.15	7.4	EPV1
Feb 11	17:34	Indonesia	3.902	126.40	7.2	ELTP1
Mar 19	18:17	Tonga	-23.05	-174.6	7.6	ELTPCSP2
Apr 6	01:32	Italy	42.334	13.334	6.3	ELTPCSP2
Apr 7	04:23	Islands	46.088	151.49	6.9	ELTPCSP1
Apr 16	21:27	Afghanistan	34.197	70.065	5.4	ELTPCSP1
May 28	08:24	Honduras	16.730	-86.20	7.3	TPPTECSP1
Jul 9	11:49	China	25.619	101.08	5.7	EPV2
Jul 15	09:22	New Zealand	-45.75	166.58	7.8	EPV1
Aug 9	10:55	Japan	33.144	138.04	7.1	ELTP1
Aug 10	19:55	Andaman	14.013	92.923	7.5	EPV2
Sep 2	07:55	Indonesia	-78.09	107.25	7.0	TPPTE1
Sep 12	20:06	Venezuela	10.70	-67.92	6.3	ELTP1
Sep 29	17:48	Samoa	15.509	-172.0	8.1	ELTP1
Sep 30	10:16	Indonesia	-0.725	99.856	7.6	ELTP2
	22:03		-13.05	166.18	7.6	SP1
Oct 7	22:18	Vanuatu	-12.55	166.32	7.8	SP1
	23:13		-13.14	166.29	7.3	ELTP1
Dec 19	13:02	Taiwan	23.763	121.68	6.4	ELTP2

2010

Date	Time (UTC)	Place	Lat.	Long.	Mag-nitude	Comments
Jan 3	22:36	Solomon	-8.912	157.30	7.2	ELTP2
Jan 10	00:27	California	40.645	-124.7	6.5	EPV1
Jan 12	21:53	Haiti	18.451	-72.44	7.0	ELTPCSP1
Feb 26	20:31	Japan	23.472	123.71	7.0	ELTPCSP1
Feb 27	03:34	Chile	-35.84	-72.71	8.8	SP1
Feb 27	15:45	Argentina			6.1	ELTPCSP1
Mar 4	0:18	Taiwan			6.4	EPV1
Mar 5	23:29	Sumatra			6.5	ELTP1
Mar 8	4:32	Turkey			6.0	ELTP1
Mar 11	11:39	Chile	-34.25	-71.88	6.9	ELTPCSP1
Mar 14	9:57	Indonesia			6.4	EPV1
Mar 14	8:08	Japan			6.6	ELTPCSP1
Mar 16	2:21	Chile			6.7	EPV1
Apr 4	22:40	Mexico	2.128	115.3	7.2	ELTP1

6. Analysis

According to the information of 154 earthquakes over 6 scales of magnitude over the world from the USA Earthquake Observation Council, the causal relationship common area, symmetry of them we can get the following results, as shown in **Table 2**:

Table 2. Results.

Type	Equatorial level Line plane	Which Symmetry	Ecliptic Line plane	Among Symmetry	Vertical Flat	Similar point	Other Not coplanar	Total
Quantity	22	(Four)	77	(23)	45	7	3	154
Percentage of total	14%	(3%)	50%	(15%)	29%	5%	2%	100%

7. Conclusions

This study allowed existence of the errors, but those errors do not interfere the co-planarity and the symmetry principle. Errors may come from the inaccuracy of observation time, perhaps the errors accelerate the process of the Earth becoming to sphere. In the next step of our research, we plan to study on earthquake prediction and the relationship between earthquake and economic development.

8. References

[1] Http://earthquake.usgs.gov/recenteqsww/quakes/quakes_all.html

