Are the Stabilizing and Destabilizing Influences of the Planetary Gravitational Field on the Structural Formation of Complex Systems Real?
- Triggering of Earthquakes –

Lecture on the 2002 Annual Conference of the International Association for Mathematical Geology; Berlin, Germany

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1. Abstract

A whole series of indications would seem to offer evidence that the relatively weak fluctuations in the planetary gravitational field have a non-linear influence on structure-building processes.

Frequencies of the fluctuations, which remain relatively stable over long periods, show a correlation with different structures.

A correlation function displaying the stabilizing and destabilizing states with a certain probability forms a good way of describing these processes. Using this correlation function, correlations in the structural building of biological structures and, indeed, the triggering of earthquakes have already been investigated.

These results seem to indicate that the correlation function might also be suitable for describing influencing factors on other evolutionary processes.

1. Introduction

Let me begin by stating that most researches, which refer to triggering of earthquakes, do not take into account the interactions of the gravitation of the planets.

It is important to begin by saying that this is not always correct. Because of it, the planet system and its fluctuating gravitational field shows some remarkable qualities.

First, the planet system generates very stable frequencies during millions of years. In my opinion is that a new quality of interactions.

Secondly, the interaction of the gravitational field generates higher frequencies in material structures. That leads to a nonlinear theory.

Despite the very weak effects of the interaction, an influence of the gravitation cannot always be neglected, specifically in critical conditions in the earth's crust before an earthquake.

Before I start to deal with some statistical researches, let me begin with some points of the theory.

2. The model of the gravitational interaction

The fundamental Newton's movement-equation of N mass-points has the form:

$$\ddot{r}_i = G\sum_{\substack{j=1 \\ j\neq i}}^{N} M_j \frac{r_j - r_i}{\left|r_j - r_i\right|^3} \qquad (1)$$

r_i, r_j = vectors of the planets i, j with the masses m_i and M_j; G = gravitational-constant.

It is however not in a favourable form for the present problem.

From the helio-centric view, circle-frequencies $\omega_{i,j}$ can be declared. These circle-frequencies are relatively stable in the time.

$$\omega_{i,j} = \frac{2\pi}{T_{i,j}} \qquad (2)$$

$T_{i,j}$ = Time from conjunction to conjunction of the planets i and j.

Only directional-invariant processes are examined. One can write for the alterations of the planets - power (in a first approximation):

$$F_{i,j} \propto f_{i,j}(t) + k_{i,j}(t) \cdot \cos(\omega_{i,j} \cdot t) \qquad t = \text{time} \qquad (3)^*$$

** The relationship (3) follows from the vectorial addition of the powers F_i and F_j.*

$$\mathbf{F}_{i,j} = \mathbf{F}_i + \mathbf{F}_j$$
$$\mathbf{F}_{i,j}^2 = \mathbf{F}_i^2 + \mathbf{F}_j^2 + 2 \cdot |\mathbf{F}_i||\mathbf{F}_j| \cos(\alpha)$$

From a geo-centric view, the cosmic cycles are not quite so stable, therefore it is simpler, instead of $\omega_{i,j}$ to put the angle $\alpha_{i,j}$ (under which the planets i, j from the earth appears), in (3).

$$F_{i,j} \propto f_{i,j}(t) + k_{i,j}(t) \cdot \cos(\alpha_{i,j}) \qquad (4)$$

The weak gravitational-field-fluctuations, especially its cosine-share, can be considered as a type of stimulation-field-strength on matter.
The terms $f_{i,j}(t)$ and $k_{i,j}(t)$ are relatively stable.

$$F_{i,j} = f_0 + k_0 \cdot \cos(\alpha_{i,j}) \qquad (5)$$

The interactions of these "waves" (5) with matter and their different structures, will be not-linearly. In analogy to other not-linear interactions with matter (for example not-linear optics) one can put (with 7) a general correlation-function $H_{i,j}$ for the influence of two planets i, j.

$$H_{i,j}(\alpha) = \gamma_1 F_{i,j} + \gamma_2 F_{i,j}^2 + \gamma_3 F_{i,j}^3 + \ldots \qquad (6)$$

$$\text{with} \quad \gamma_1 = \frac{k_1}{k_0}; \gamma_2 = \left(\frac{k_2}{k_0}\right)^2; \ldots\ldots\ldots \qquad (7)$$

The conversion of (8) into a Fourier-serial is better suitable.

$$H_{i,j}(\alpha_{i,j}) = a_0 + a_1\cos(\alpha_{i,j}) + a_2\cos(2\alpha_{i,j}) + a_3\cos(3\alpha_{i,j}) + \ldots \qquad (8)$$

The form (8) of the correlation-function shows the formation of "higher harmonics" by the interaction with matter.
The problems of the correlation-function are the coefficients a_k and the meaning of H.

The planets represent natural oscillators on a big scale. Such a rhythm is determined by the time period from conjunction to conjunction of two planets. These are relatively stable frequencies over a long period of time.
In my researches I restricted myself to the polar qualities which are associated with the concepts of "stability" and "instability". The change from stable to unstable conditions and vice versa, can be observed in the evolution of many complex systems.
If one translates such criteria for stability and instability into a planetary cycle, one gets a sequence development (after a Fourier-transformation).

$$H_{i,j} = \sum_{s=1}^{N\cdot 12-1} a_k \cos(s\cdot\alpha); mit(k = s \bmod 12) \qquad (9)$$

with $a_k = \{0,1,-2,3,-5,0,3,0,-5,3,-2,1\}$

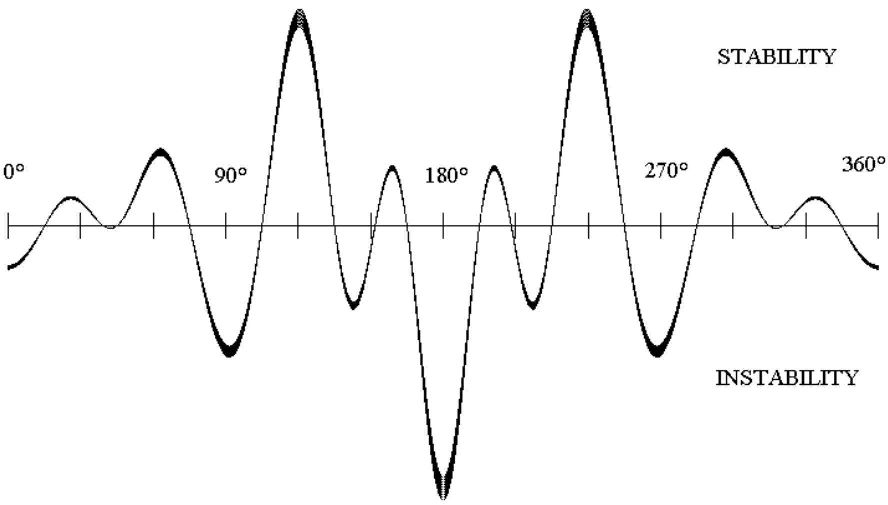

Figure 1. Correlation function 1st order after equation (9) with N=1.

The correlation function H (9) is not developed for earthquakes.
Nevertheless, can this function describe the triggering of earthquakes?
Tensions in the earth's crust are mostly the cause of earthquakes. If these tensions have reached a critical state, there can be vibrations of different strengths.
The first hypothesis that was explored is as follows: If these tensions are in a critical condition, then also the fluctuations of the planetary gravitational field can cause these vibrations. The probability for an earthquake becomes higher if the fluctuations show unstable conditions.

3. The triggering of earthquakes
First, the 41 strongest earthquakes of the last century were explored.
To the calculation of the probability for earthquake-groups: the events of earthquakes become compared with random events in the same time period.

The result (*computer print*) is:

Statistics 4: Probability of events.

Order of the correlation: 1

GROUP-MEMBERS: 41 NUMBER OF THE GROUPS: 5000
Random selection
TEST: Number of random selection >= correlation

CORRELATION-MATRIX

	1	2	3	4	5	6	7	8	9	10
1	*	-48.42	0.91	0.28	16.13	-29.67	23.85	-21.81	-22.98	15.36
2	-48.42	*	-31.40	27.44	17.40	-3.89	11.69	-27.63	-33.01	43.08
3	0.91	-31.40	*	20.23	15.21	-2.46	2.92	12.70	19.79	0.96
4	0.28	27.44	20.23	*	9.35	-3.28	7.85	-22.12	23.00	-13.35
5	16.13	17.40	15.21	9.35	*	20.71	-30.05	-14.36	-30.05	-8.12
6	-29.67	-3.89	-2.46	-3.28	20.71	*	-31.02	-20.24	-39.21	60.88
7	23.85	11.69	2.92	7.85	-30.05	-31.02	*	-10.88	44.17	21.89
8	-21.81	-27.63	12.70	-22.12	-14.36	-20.24	-10.88	*	-42.96	10.97
9	-22.98	-33.01	19.79	23.00	-30.05	-39.21	44.17	-42.96	*	62.09
10	15.36	43.08	0.96	-13.35	-8.12	60.88	21.89	10.97	62.09	*

Sum of the matrix: 3.94

Matrix of the probability of error

	1	2	3	4	5	6	7	8	9	10
1	*	98.64	20.48	65.26	28.50	93.86	14.76	84.10	85.44	25.36
2	98.64	*	92.48	11.34	23.30	57.06	30.98	90.12	93.62	2.88
3	20.48	92.48	*	37.16	26.72	59.00	45.70	29.26	19.54	48.42
4	65.26	11.34	37.16	*	47.00	59.34	35.58	84.54	15.58	74.30
5	28.50	23.30	26.72	47.00	*	13.14	89.94	75.04	91.80	71.70
6	93.86	57.06	59.00	59.34	13.14	*	91.42	82.76	96.58	0.18
7	14.76	30.98	45.70	35.58	89.94	91.42	*	72.04	1.80	22.34
8	84.10	90.12	29.26	84.54	75.04	82.76	72.04	*	81.22	37.80
9	85.44	93.62	19.54	15.58	91.80	96.58	1.80	81.22	*	62.38
10	25.36	2.88	48.42	74.30	71.70	0.18	22.34	37.80	62.38	*

1 = SUN; 2 = MOON; 3 = MERKUR; 4 = VENUS; 5 = MARS;
6 = JUPITER; 7 = SATURN; 8 = URANUS; 9 = NEPTUN; 10 = PLUTO;

Table 1; The matrix of the probability of error is calculated with the **monte-carlo-simulation**. The value (1 ; 2) = 98.64 means that the probability of error for this correlation is 1.36 % for instability. The value (7 ; 9) = 1.80 means that the probability of error for this correlation is 1.8 % for stability. Time period: 1900 to 2000.

The following figure shows the matrix in colour.

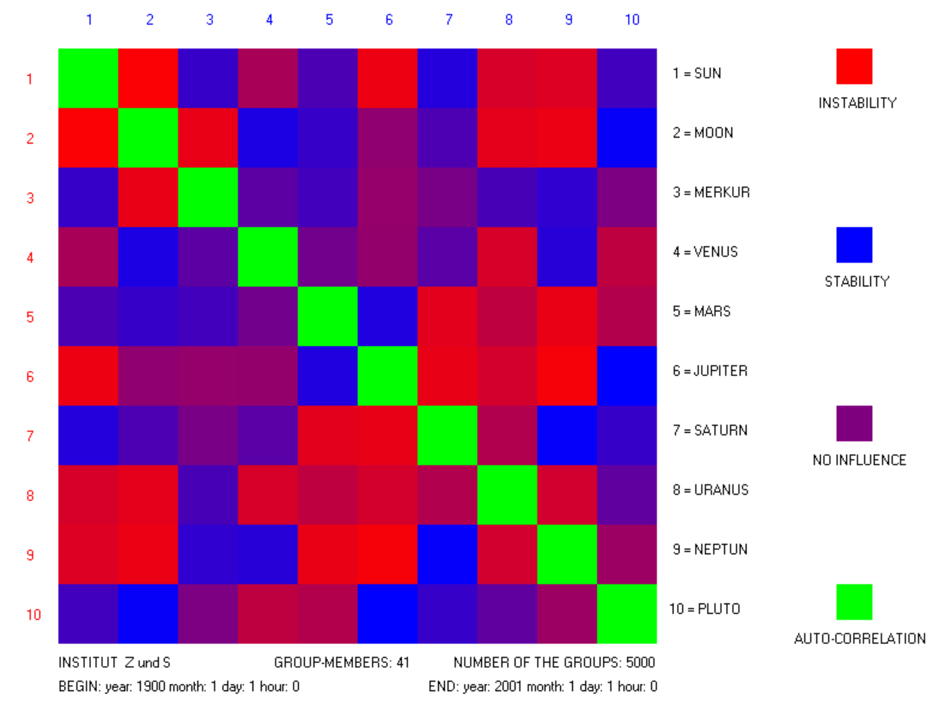

Figure 2. Correlation matrix without auto-correlation. To compare with the computer print

The next figure shows the matrix of the probability of error in distribution.

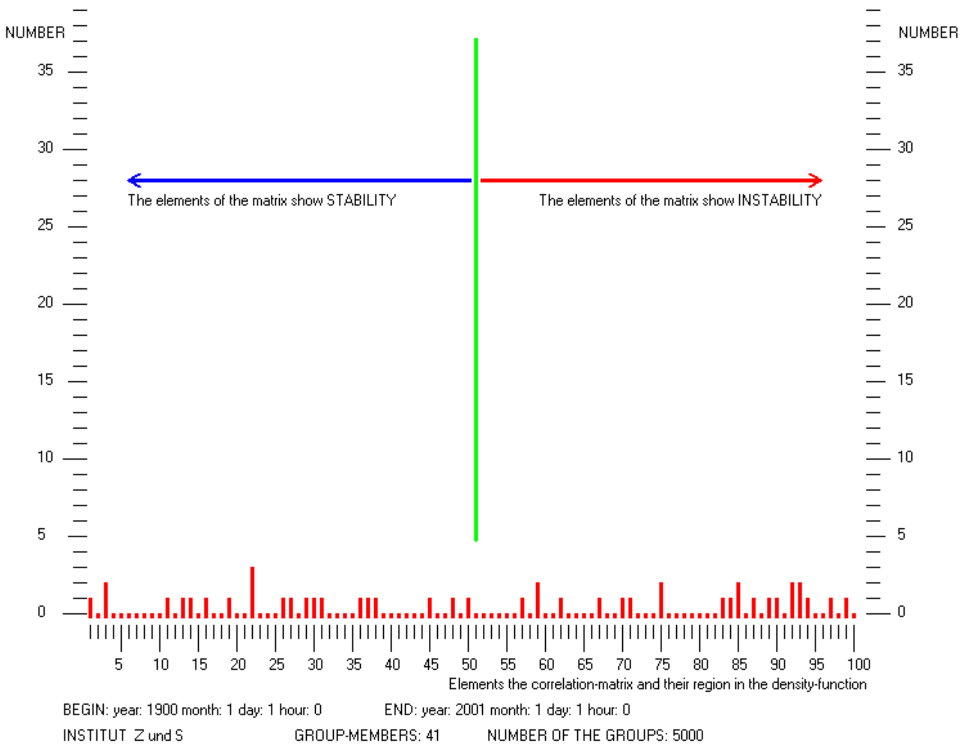

Figure 3. Distribution of the elements of the brobability matrix. The 41 strongest earthquakes are shown. The distribution is relatively normal.

The density function of the sum of the correlation matrix shows figure 4.

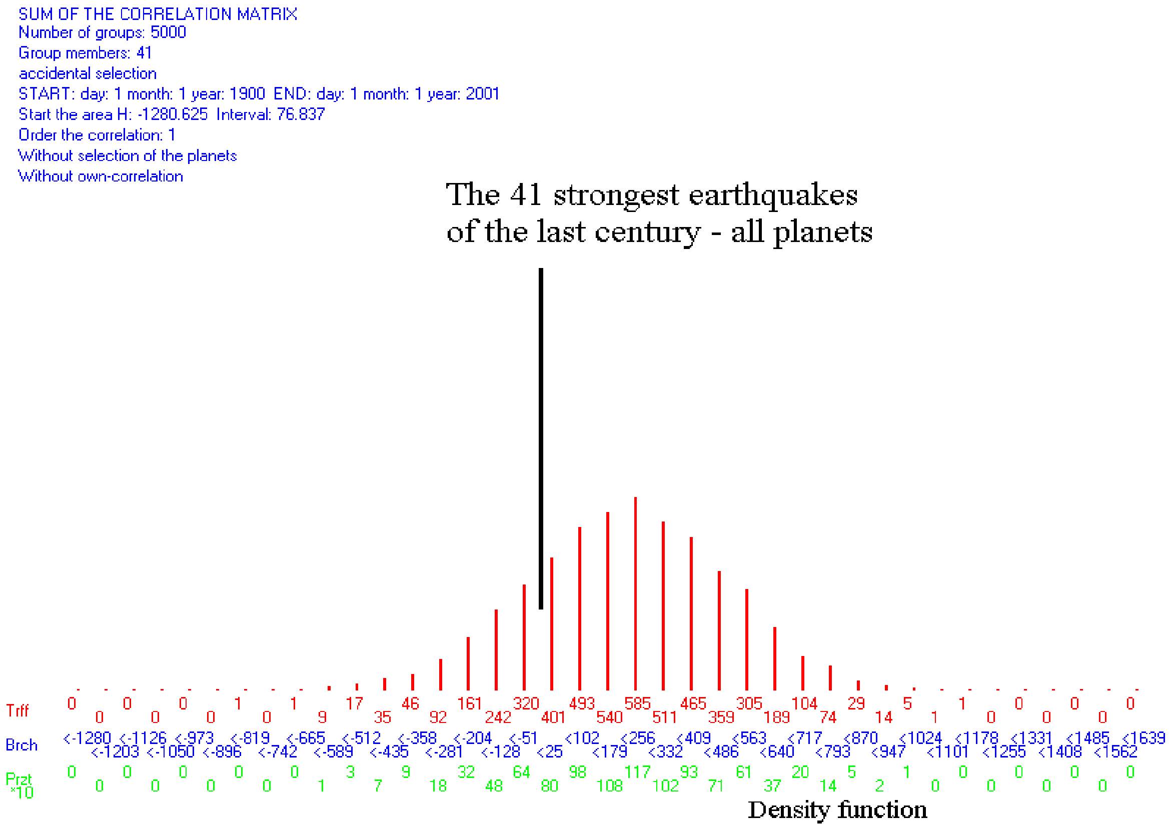

Figure 4. Density function 1st order . The 41 strongest earthquakes are shown. "Brch" represent the range, "Trff" show the score in this range and "Przt*10" show the relative score in per mille.

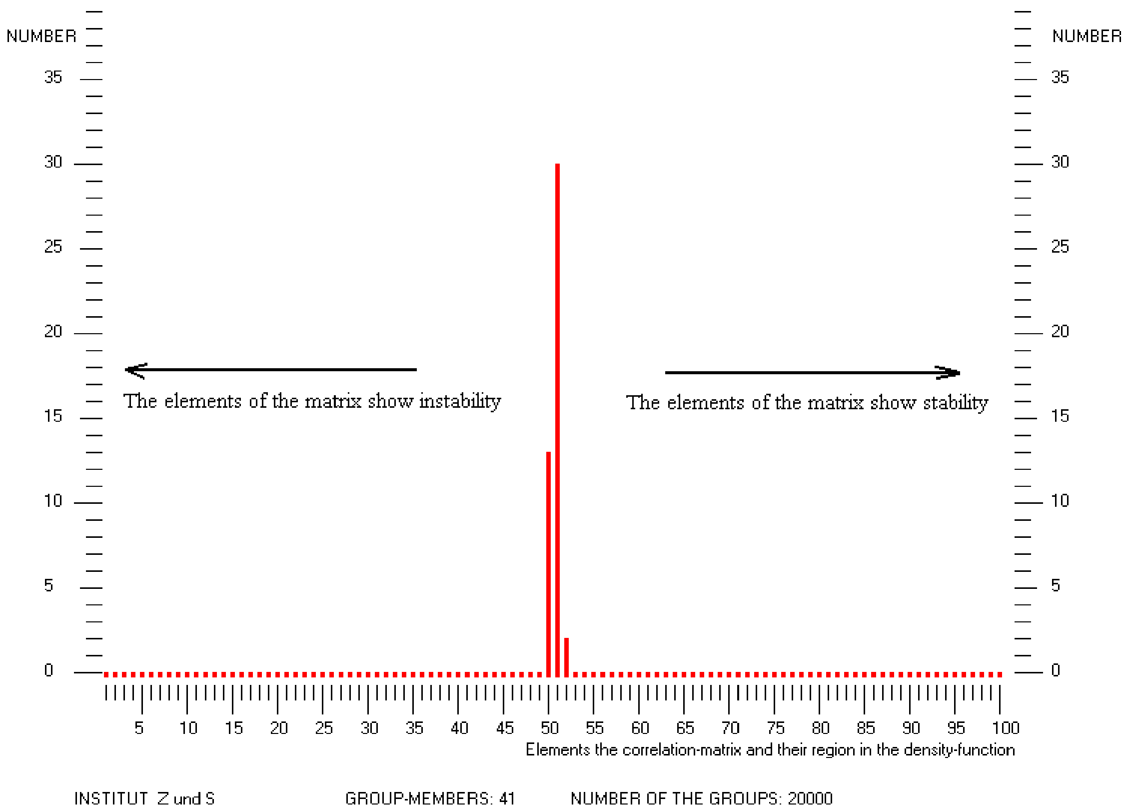

Figure 5. Distribution of the elements of the correlation matrix – for control. Median values from 20000 groups with 41 events per group.

The median values (Figure 5) of 20000 groups (41 events per group) show the expected distribution of the matrix-elements.
The result shows no significant influence of the variable gravity.
Why should the Pluto have an influence then?
Its influence is surely very small - compared with the moon. The matrix of the correlations takes not into account the absolute power of the gravitation. The correlation-matrix shows only oscillations of planets in pairs.
Maybe, the absolute power of the gravity must be taken into account for earthquakes.
The following planets were separated in a first step:
Mercury and Venus - because they are companions of the sun.
Mars - because it is very irregular.
Pluto - its gravity is very weak.
A selection of the planets shows better results (figure 6).

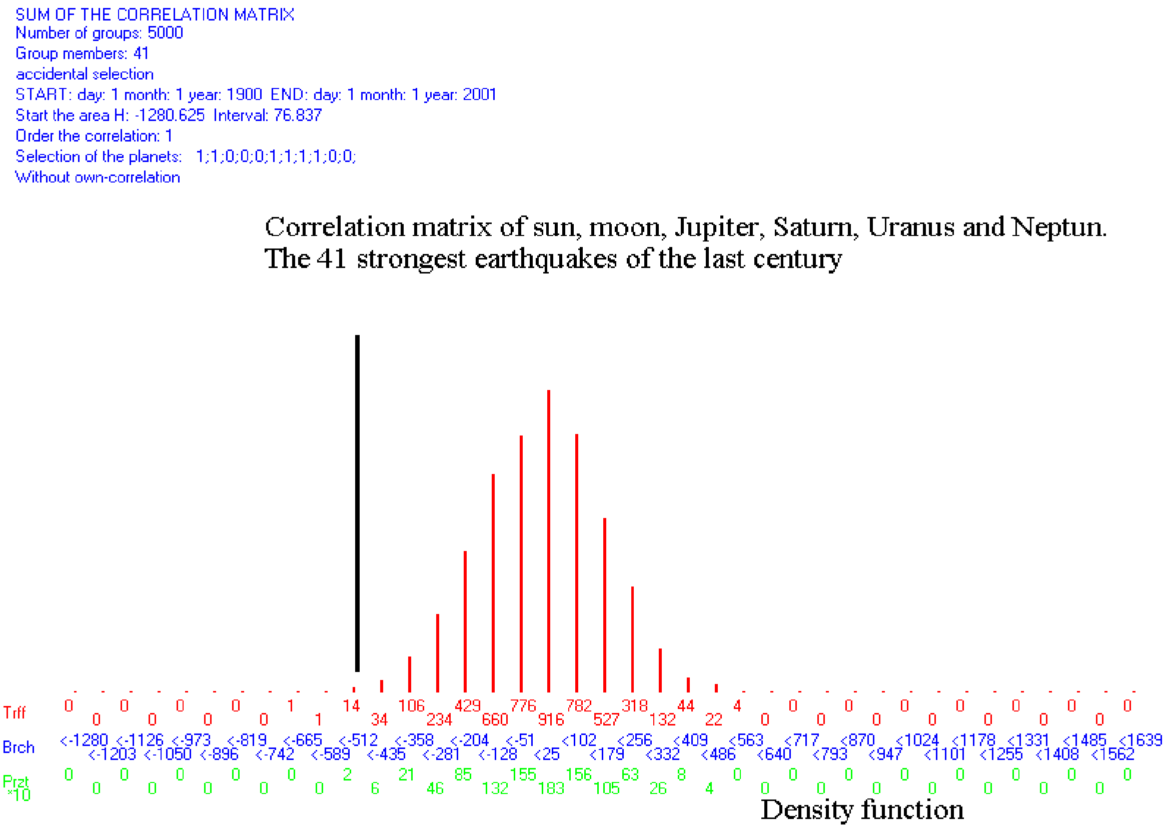

Figure 6. Density function 1st order . The 41 strongest earthquakes are shown. "Brch" represent the range, "Trff" show the score in this range and "Przt*10" show the relative score in per mille. The probability of error is 0.6%. All calculations with the monte-carlo-simulation.

I obtained the following results for the 41 strongest earthquakes:

1. Only the big planets show an effect. Pluto doesn't play a role.
2. The planets, which out of the perspective of the earth are always close to the sun (Mercury and Venus), don't shows any important effect either.
   They are dominated by the sun. Their planetary fluctuations are more or less disorders of the correlation frequencies with the sun.
3. During the earthquake, the correlation function shows certain instability.
   The first derivation is positive. This means that the correlation function before the actual earthquake shows an even stronger instability - in the average value.
   This coincides with the fact that there are also pre-earthquakes and other signs of the coming event, before the earthquake actually begins.

That was the second hypothesis.

41 strongest earthquakes; 1900 until 2000	Superimposition	Median value of the continuum;	Probability of being wrong
$\Sigma H_{i,j}$	-503.98	-34.72	< -503.98 are 0.6 %
$\Sigma H'_{i,j}$ (first derivation)	107.60	8.59	> 107.60 are 17.8 %

Table 2. Results of the 41 strongest earthquakes.

As a result of these researches, we can state the following: earthquakes can also be stimulated by the planetary fluctuations of the gravitational field. This has been proved with a probability of being wrong of 0.6%.

What will happen if I examine other groups of earthquakes? Maybe, that result is only an artefact? Or it is truly valid for strong earthquakes only?

Brian Johnson [3], I found him in the Internet, examined earthquakes on its context to planets constellations.

Johnson selected and analyzed a random sample of 438 earthquakes from the overall database of 1458 earthquakes. From this study 260 earthquakes were selected at random and he has sent it to me.

The result of my researches is:

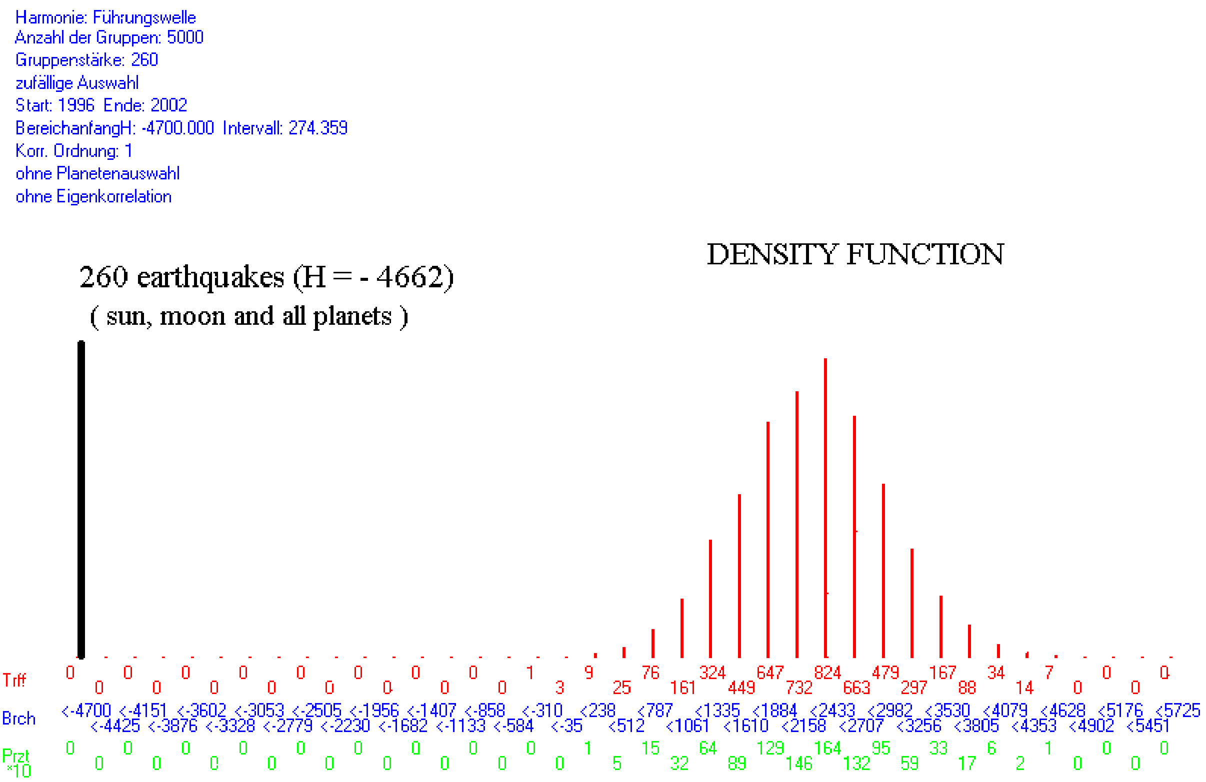

Figure 7. Density function 1st order . 260 earthquakes are shown. "Brch" represent the range, "Trff" show the score in this range and "Przt*10" show the relative score in per mille. The probability of error is 0.0% !

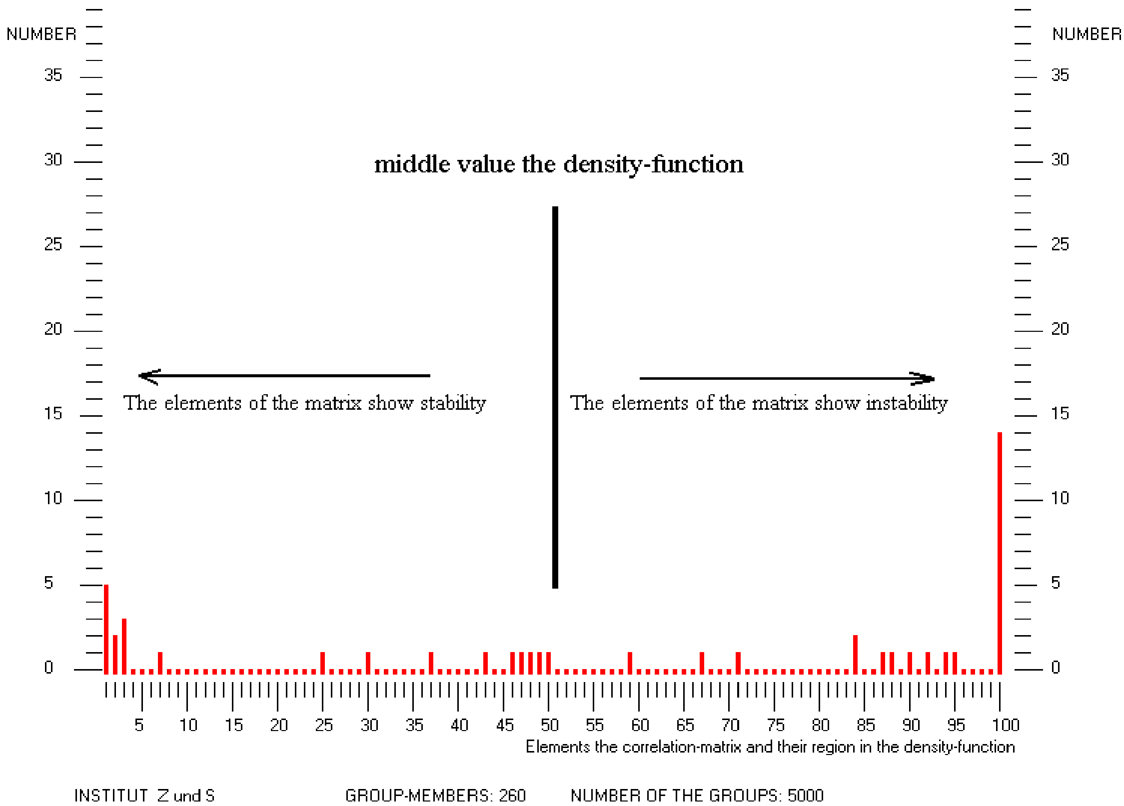

Figure 8; Distribution of the elements of the correlation matrix. 260 earthquakes are shown. Left side: 10 elements of the matrix lie in the area from 0 to 3%. Right side: 14 elements of the matrix lie in the area from 99 to 100%.

The results in figure 7 and 8 are wonderful indeed. But it is real? Where is the artefact? Should earthquakes really be triggered through the planet system?
There are many other causes for earthquakes.
One gets a similar distribution, as in figure 8, if one compares earthquake-groups with random groups in other time periods. That is normal, because each time period has another description of the planets constellations. Nevertheless, earthquakes take place in each time period. Maybe, an artefact originates through a random selection of earthquakes in a certain time period. Two groups of earthquakes were examined in order to explore that. These two groups are complete in two time periods (2000 and 2001).

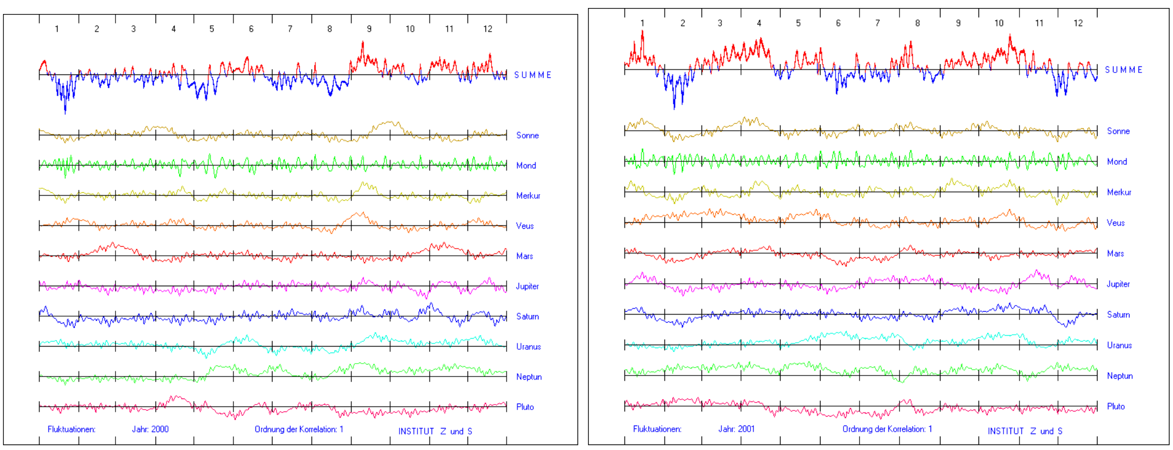

Figure 9. The time periods 2000 and 2001. The upper curve shows the alteration of the sum of the correlation-matrix. The low curves show the alterations of the line-sums of the matrix.

That are 84 earthquakes for 2000 and 73 earthquakes for 2001 [4]: “Earthquakes of magnitude 6.5 or greater or ones that caused fatalities, injuries or substantial damage.”

The summary of the results consolidates the hypothesis: Earthquakes are also caused by the gravity of the planets of the solar system.

The following table 3 contains the groups:

41 - The 41 strongest earthquakes - 1. January 1900 to 1. January 2001
73 - “Earthquakes of magnitude 6.5 or greater…” - 1. January 2001 to 1. January 2002
84 - “Earthquakes of magnitude 6.5 or greater…” - 1. January 2000 to 1. January 2001
157 - “Earthquakes of magnitude 6.5 or greater…” - 1. January 2000 to 1. January 2002
260 - “260 earthquakes were selected at random…” - 1. January 1996 to 1. January 2002
*(The group **157** is the group **73** plus group **84**)*

The elements of the matrix were counted, which falls into significant areas of the probability.

Correlation function H
h-left: Elements the correlation matrix in significant areas <= 5% for stability.
h-right: Elements the correlation matrix in significant areas <= 5% for instability.

Correlation function abs(H) *(*Square-root of the energy)
i-left: Elements the correlation matrix in significant areas <= 5% for high energy
i-right: Elements the correlation matrix in significant areas <= 5% for low energy

Correlation function, first derivation of H
z-left: Elements the correlation matrix in significant areas <= 5% for high dynamics.
z-right: Elements the correlation matrix in significant areas <= 5% for low dynamics.

Correlation function, first derivation of H – absolute
za-left: Elements the correlation matrix in significant areas <= 5% for high dynamic absolute.
za-right: Elements the correlation matrix in significant areas <= 5% for low dynamics absolute.

Earthquake groups - the edge-areas of the correlation-matrix

Group	H	H	/H/	/H/	H’	H’	/H’/	/H’/			
	h-left	h-right	i-left	i-right	z-left	z-right	za-left	za-right	average-left	average-right	average
41 1900-2001	3	2	1	5	2	2	2	0	2	2,25	4,25
73 2001-2002	2	4	5	3	4	2	7	5	4,5	3,5	8
84 2000-2001	8	9	6	4	8	8	9	3	7,75	6	13,75
157 2000-2002	5	6	6	3	3	5	9	5	5,75	4,75	10,5
260 1996-2002	10	14	10	22	14	16	12	26	11,5	19,5	31

Table 3. Earthquakes groups – all planets. To the comparison with figure 8 for the group 260: h-left = 10 and h-right = 14. See appendix 1.

Earthquake groups - the edge-areas of the correlation-matrix and its probability

Group	average	theoretical	30 control-groups	Probability of error – 30 control-groups	Probability of error – theoretical
41 1900-2001	4,25	4,5	4,9	>= 4 is 70%	>= 4 is 67,1%
73 2001-2002	8	4,5	4,9	>=8 is 13,3%	>= 8 is 7,6%
84 2000-2001	13,75	4,5	4,9	>=13 is 0%	>= 13 is 0,0%
157 2000-2002	10,5	4,5	4,9	>=10 is 0%	>= 10 is 1,2%
260 1996-2002	31	4,5	4,9	>= 31 is 0%	>= 31 is 0,0%

Table 4. Earthquakes groups - all planets. The table is to the comparison with figure 8 for the group 260. 3690000 events were calculated. See appendix 1.

Although only 30 by random selected control-groups were calculated, the agreement with the theoretical values is good.
Result: The earthquakes behave abnormally, also in such, relatively small time periods. The event of an earthquake is not always absolutely random to the correlation-function H.
The correlation-function H was developed for complex systems of the evolution. The function seems also to be suitable for earthquakes. That doesn't exclude that there is a particular function for earthquakes.

4. Conclusion and outlook

Here are a couple of final remarks about further researches: The researches about the earthquakes have already shown that not all correlations are of equal importance. So Pluto, for example, had no influence on the triggering of strong earthquakes. But the other examples [5] also suggest, to introduce a certain factor called γ, which helps to find an adaptation to the problem we explored.

Future optimization the correlation with $\boldsymbol{\gamma}$:	$\boldsymbol{\gamma}_{i,j}\ \mathbf{H}_{i,j}$

This factor $\boldsymbol{\gamma}$ has the function of a frequency-filter. It will possibly be dependent on the gravitational strength, on the frequency and on the resonance frequencies.
Such an optimisation is necessary, if this correlation theory is being used to make prognoses which have a higher probability. It could be an element of a probability based forecasting of earthquakes: maybe in supplement to a model constituted by point processes generated by transitions of a Markov chain. It is generally accepted that the seismic process develops by phases that can be characterized by variations of some indicator of the seismic activity in the region under exam; for instance, one can recognize aftershock sequences, quiescence periods or intervals with background activity.

The aim of these researches was, to produce the prove that the planetary fluctuations have an influence, which cannot always be neglected.
If one defines coincidence in the evolution as a lack of complete piece of information, this lack can be reduced to a certain extent, if one takes into consideration the fluctuations of the planetary gravitational field.
I hope that with this overview I was able to arouse your interest for the fascinating fluctuations of the planetary gravitational field. Our planetary system is a huge complex system and it sounds unbelievable that the constellations of the big celestial bodies shall even have an influence on the triggering of earthquakes.
Can we get used to such an idea at all? I think we should do!

6. References

[1] Nitsche, M. E., 2001: Planetare Fluktuationen der Gravitation und ihr Einfluss auf komplexe Systeme, Institut Z & S, www.zunds-institut.de/forschung

[2] Kurths, J., Seehafer, N., und Spahn, F. Nichtlineare Dynamik in der Physik: Forschungsbeispiele und Forschungstrend. In: Mainzer, K. (1999) Komplexe Systeme und Nichtlineare Dynamik in Natur und Gesellschaft. Springer, Heidelberg New York Barcelona Budapest Hong Kong London Milan Paris Santa Clara Singapore Tokyo.

[3] Johnson, B., 2001: private message.

[4] "Earthquakes of magnitude 6.5 or greater or ones that caused fatalities, injuries or substantial damage."
Compiled by Waverly J. Person
USGS National Earthquake Information Center
http://www.usgs.gov/
http://neic.usgs.gov/neis/eqlists/significant.html

[5] Nitsche, M. E., 2002: Are the stabilizing and destabilizing influences of the planetary gravitational field on the structural formation of biological patterns real? Lecture on the 10th conference on synergetics and complexity research: "Self Organization in Psychology, Psychiatry and Social Sciences" 6th - 8th June 2002 conference centre Bildungszentrum Kloster Seeon (Bavaria, Germany) www.zunds-institut.de/vortrag

Appendix 1:

Earthquake probability - evaluation of the edge-areas of the correlation-matrix -1000 Control-groups

Group	Earthquake h-left	h-right	i-left	i-right	z-left	z-right	za-left	za-right	average-left	average-right	average
41	3	2	1	5	2	2	2	0	2	2,25	4,25
1900-2001											
73	2	4	5	3	4	2	7	5	4,5	3,5	8
2001-2002											
84	8	9	6	4	8	8	9	3	7,75	6	13,75
2000-2001											
157	5	6	6	3	3	5	9	5	5,75	4,75	10,5
2000-2002											
260	10	14	10	22	14	16	12	26	11,5	19,5	31
1996-2002											
AVERAGE	5,6	7	5,6	7,4	6,2	6,6	7,8	7,8	6,3	7,2	13,5
RANDOM											
41	0	3	0	1	1	5	0	2	0,25	2,75	3
	2	3	0	3	1	3	0	2	0,75	2,75	3,5
	0	3	4	4	1	1	1	0	1,5	2	3,5
	0	2	1	3	1	0	2	4	1	2,25	3,25
	4	1	1	1	2	3	3	2	2,5	1,75	4,25
	3	3	1	4	1	3	2	1	1,75	2,75	4,5
average	1,5	2,5	1,1667	2,667	1,1667	2,5	1,333	1,8333	1,2916667	2,375	3,6667
equally-distributed	1	2	1	4	6	2	3	0	2,75	2	4,75
73	3	3	2	3	2	3	0	5	1,75	3,5	5,25
	1	0	3	0	1	4	0	4	1,25	2	3,25
	2	1	2	2	0	4	1	5	1,25	3	4,25
	0	2	1	5	1	3	0	4	0,5	3,5	4
	4	4	2	6	2	5	4	5	3	5	8
	3	3	2	6	3	2	2	7	2,5	4,5	7
average	2,166667	2,1667	2	3,667	1,5	3,5	1,167	5	1,7083333	3,5833333	5,2917
equally-distributed	0	1	0	0	0	2	0	4	0	1,75	1,75
84	4	1	0	2	4	3	3	3	2,75	2,25	5
	1	1	1	1	1	3	1	6	1	2,75	3,75
	1	0	1	1	2	4	1	2	1,25	1,75	3
	3	5	6	5	1	4	10	5	5	4,75	9,75
	3	1	0	5	1	2	1	6	1,25	3,5	4,75
	0	3	0	1	0	4	0	3	0	2,75	2,75
average	2	1,8333	1,3333	2,5	1,5	3,333	2,667	4,1667	1,875	2,9583333	4,8333
equally-distributed	1	0	0	0	0	2	0	2	0,25	1	1,25
157	1	3	0	2	3	3	1	5	1,25	3,25	4,5
	2	2	0	2	6	3	0	2	2	2,25	4,25
	4	2	2	1	1	2	1	5	2	2,5	4,5
	0	1	2	4	1	7	1	5	1	4,25	5,25
	4	4	3	4	5	4	3	6	3,75	4,5	8,25

	2	3	2	3	1	4	2	7	1,75	4,25	6
average	2,166667	2,5	1,5	2,667	2,8333	3,833	1,333	5	1,9583333	3,5	5,4583
equally-distributed	0	0	0	1	0	2	0	2	0	1,25	1,25
260	2	2	2	1	2	3	3	1	2,25	1,75	4
	2	3	3	4	4	8	1	1	2,5	4	6,5
	2	4	2	3	3	2	3	2	2,5	2,75	5,25
	2	2	7	2	1	4	1	3	2,75	2,75	5,5
	5	5	2	6	3	3	3	6	3,25	5	8,25
	0	0	0	2	1	2	1	3	0,5	1,75	2,25
average	2,166667	2,6667	2,6667	3	2,3333	3,667	2	2,6667	2,2916667	3	5,2917
equally-distributed	0	0	0	1	0	1	0	1	0	0,75	0,75
average all	**2**	**2,3333**	**1,7333**	**2,9**	**1,8667**	**3,367**	**1,7**	**3,7333**	**1,825**	**3,0833333**	**4,9083**

The equally-distributed group approaches the median value - if the number of the group-members grows. That is normal.