Modified-Fibonacci-Dual-Lucas Method for Earthquake Prediction

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ABSTRACT

The FDL method makes use of Fibonacci, Dual and Lucas numbers and has shown considerable success in predicting earthquake events locally as well as globally. Predicting the location of the epicenter of an earthquake is one difficult challenge the other being the timing and magnitude. One technique for predicting the onset of earthquakes is the use of cycles, and the discovery of periodicity. Part of this category is the reported FDL method.

The basis of the reported FDL method is the creation of FDL future dates based on the onset date of significant earthquakes. The assumption being that each occurred earthquake discontinuity can be thought of as a generating source of FDL time series The connection between past earthquakes and future earthquakes based on FDL numbers has also been reported with sample earthquakes since 1900. Using clustering methods it has been shown that significant earthquakes (>6.5R) can be predicted with very good accuracy window (+-1 day).

In this contribution we present an improvement modification to the FDL method, the MFDL method, which performs better than the FDL. We use the FDL numbers to develop possible earthquakes dates but with the important difference that the starting seed date is a trigger planetary aspect prior to the earthquake. Typical planetary aspects are Moon conjunct Sun, Moon opposite Sun, Moon conjunct or opposite North or South Modes. In order to test improvement of the method we used all +8R earthquakes recorded since 1900, (86 earthquakes from USGS data). We have developed the FDL numbers for each of those seeds, and examined the earthquake hit rates (for a window of 3, i.e. +-1 day of target date) and for >6.5R. The successes are counted for each one of the 86 earthquake seeds and we compare the MFDL method with the FDL method. In every case we find improvement when the starting seed date is on the planetary trigger date prior to the earthquake. We observe no improvement only when a planetary trigger coincided with the earthquake date and in this case the FDL method coincides with the MFDL. Based on the MDFL method we present the prediction method capable of predicting global events or localized

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earthquakes and we will discuss the accuracy of the method in as far as the prediction and location parts of the method. We show example calendar style predictions for global events as well as for the Greek region using planetary alignment seeds.

1. Introduction

There has been major research efforts in discovering the driving mechanisms behind earthquakes, the success of which should lead to answers to important questions, as to when, where and what magnitude the next earthquake will be, [1],[3-8]. Toward this goal there has been many techniques offering a number of leading indicators claiming to be linked to the mechanism of earthquake onset and therefore offering a precursor means of prognosis of such possible catastrophic events. It is referred in [1] that they have counted more than 200 different precursors which have been proposed for this purpose. Techniques based on stress and land deformation induced electric field, which can be measured, [20], (VAN), or anomalous ionospheric electric field variation [6] which could be measured via satellites such as GPS, have been linked to seismic onset. The time of the onset from the measurement of the signal of precursor technique varies from days to minutes, depending on the method used. However there is a lot more to be done in order to optimize the numerous techniques used as far as difficult signal processing as well as isolating the measurement of the precursor and finally the physical explanation of the linkage between precursor and the onset of earthquakes. The coupling of planetary phenomena and earthquakes has long been identified as a possible mechanism of periodicity and the cause of earthquakes. Our solar system for example with the earth's 24 hour daily rotation and 365 day orbit periodicity around the sun, the moon's orbiting the earth, in a sidereal (27.3 day) and synodic (29.5 day) months, offer specific periods which affect our lives and could be linked to the onset of earthquakes. Planets do offer a timing mechanism via their periodic orbiting of the sun, but needs to be complemented with some unknown mechanism which needs to be clarified and understood for the link to earthquakes. For example, the force due to gravity variation due to planets and/or charge emissions has long been studied as a mechanism for earthquakes. The Sun with solar storms in a solar cycle affect the solar wind. The sources of solar wind and coronal holes are charge ejections and coronal mass emissions (CME), [13]. They affect the E/M variations detected on earth prior to earthquakes. In [10], other techniques such as variations of atmospheric angular momentum (AAM) and the correlation to its correlation to the length of Day (LOD),and times of earthquakes has been studied. In [11], fluctuations of LOD were linked to planetary periodicities, the sun, and possible link to tidal forces and earthquakes. In [12], are looking at changes in the probability density function of the earth's vertical velocity when it changes from Gaussian to non Gaussian, linking it to onset of earthquakes within 5-10 hours afterwards suggesting it as a possible precursor. In [13] we have a very interesting modeling of a two fractal overlap time series of catastrophic events, including earthquakes.

2. Fibonacci, Lucas, Dual (FDL) Numbers

We have discovered and reported in [2], that Fibonacci Sequences can be used as a time counting mechanism for earthquake prediction. The use of Fibonacci numbers is well known [16-18] in the relationship between planetary orbits [14], in one scale to the other extreme, the DNA in our cells or particle manipulation, [18]. Fibonacci sequences can be recognized in nature in most things we look and touch. One reason nature is revealing this sequence might be because Fibonacci Sequences are associated with thermodynamic maximum entropy, [15-18], giving life a lot of advantages, such as cost effective use of resources, safety, and many others. Although the mechanism driving behind the Fibonacci sequences is not known, the concept of mimicking nature is often wise and therefore it is increasingly being used.

Fibonacci Numbers, (F), Lucas Numbers, (L), and Dual numbers, (D) have the following properties:

$$F_n=F_{n-1}+F_{n-2} \qquad \text{……………………..…(1)}$$

with seed values $F_1=1$ and $F_2=1$.

Since Lucas and Dual numbers are related to Fibonacci Numbers as:

$$L_n=F_{n-1}+F_{n+1}=F_n+2F_{n-1} \text{ and } D_n=2F_n \qquad \text{……………(2)}$$

$$SF_n=\sqrt{F_n}, \quad SD_n=\sqrt{D_n}, \text{ and } SL_n=\sqrt{L_n}, \qquad \text{……………..(3)}$$

We can see how all of them are reducible to Fibonacci number relationships, and therefore we will focus only on Fibonacci Numbers here as the results are extensible to the other two. Fibonacci numbers are related to the golden ratio and have a closed form solution, the well known "**Binet's Formula**".

$$F_n=\frac{\varphi^n-\psi^n}{\varphi-\psi}=\frac{\varphi^n-\psi^n}{\sqrt{5}} \qquad \text{………………………..(4)}$$

Where

$\varphi=\frac{1+\sqrt{5}}{2}=1.61803$ is the Golden Ratio and

$\psi=\frac{1-\sqrt{5}}{2}=1-\varphi=-0.61803$

Also worth noting are the

$$lim_{n\to\infty}\frac{F_{n+1}}{F_n} = \varphi \qquad \text{..........................(5)}$$

and a very important formula of the continued fraction representation for the golden ratio.

$$\varphi = 1 + \cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+..}}}} \qquad \text{..........................(6)}$$

The importance of (6) has not been often stated as it shows relevance to processes which vary inside a system. It shows a convergence when things change internally such as inside the earth, due to planetary alignments in out example here.

3. FDL Method

In[2], we have shown that there are FDL numbers embedded in the timing of earthquakes. We have demonstrated using two earthquakes well over 100 years old, that we can determine the date of earthquakes of recent years. This linkage between old occurrences of seismic events to a recent earthquake date is remarkable.

In order to test our findings, we have shown that starting with a seed earthquake from 24rh April 1900, magnitude of 6.9R, at northwest of the Ryukyu Islands, Japan. Using this as a seed, we build a Table with the left column has a sorted list of FDL and SF=$\sqrt{F}$ =, SD= $\sqrt{D}$, and SL= $\sqrt{L}$ numbers. This number sequence is added to the original seed date and gives a future date. Those future dates are considered as possible earthquake dates. It is remarkable that a significant number of >6.5R earthquakes have been predicted from a single seed. In the same paper we have also tried another seed from an 8.1R in S. Greece on 11th August 1903. Using this as seed and unfolding the FDL sequence we again predicted with high success rate. We have hinted in this work that a planetary orbit link to the onset of earthquakes maybe present. The main contribution to this paper is to report an improvement modification to the FDL method, (MFDL).

4. Modified FDL Method

If we take the earthquake of 8.1R of 29th April 1919, as an example, we have searched and have found (as we can see from Table 1), 32 hits of earthquake dates of >6.5R, out of 138 predictions, using a window of 3 days, (predicted date, +-1 day). The table also lists the number of dates where more than one (>6.5R) occurred in a day, (Multihits). In the same table we can see the how many hits we have if we unfold the same FDL dates from a few dates before, in this case from 22nd April 1919, to 21st May 1919. We also list the number of missed predictions and also the number of exact hits (0), hits the day before (-1) and the day after (+1). We can clearly see that the 29th April gives the best hit numbers. What is interesting here is that on 30th April 1919, in fact a few hours after the earthquake event, the Sun and Moon were conjunct. Note here the difference in the hits between the two dates is only 3 hits.

Column	22/04/1919	23/04/1919	24/04/1919	25/04/1919	26/04/1919	27/04/1919	28/04/1919	29/04/1919	30/04/1919	01/05/1919
Total	138	138	138	138	137	138	138	138	138	138
Hits	16	22	24	25	23	23	26	32	29	20
Multi Hits	0	1	3	4	1	2	2	2	2	3
Miss	122	116	114	113	114	115	112	106	109	118
Days										
-1	5	11	11	7	7	12	10	12	9	2
0	7	5	11	11	7	7	12	10	12	9
1	4	7	5	11	11	7	7	12	10	12

Column	02/05/1919	03/05/1919	04/05/1919	05/05/1919	06/05/1919	07/05/1919	08/05/1919	09/05/1919	10/05/1919	11/05/1919
Total	138	138	138	138	138	138	138	138	138	138
Hits	20	21	24	20	17	19	18	16	14	12
Multi Hits	1	0	0	0	3	2	3	3	2	2
Miss	118	117	114	118	121	119	120	122	124	126
Days										
-1	10	9	5	6	9	7	7	5	5	4
0	2	10	9	5	6	9	7	7	5	5
1	9	2	10	9	5	6	9	7	7	5

Column	12/05/1919	13/05/1919	14/05/1919	15/05/1919	16/05/1919	17/05/1919	18/05/1919	19/05/1919	20/05/1919	21/05/1919
Total	138	138	138	138	138	138	138	138	138	138
Hits	15	18	21	20	20	22	27	25	22	17
Multi Hits	2	1	0	1	2	2	2	1	2	2
Miss	123	120	117	118	118	116	111	113	116	121
Days										
-1	8	7	6	8	8	8	13	5	7	7
0	4	8	7	6	8	8	8	13	5	7
1	5	4	8	7	6	8	8	8	13	5

Table 1:

Number of hits and multihits within +-1 day of predicted date, from 21-April-1919 to 21-May-1919. This covers days before and after the earthquake which occurred on 29th April 1919.

In an effort to exhaustively examine the issue of using near planetary alignment prior to the earthquake and using the alignment date as a FDL seed, instead of the exact earthquake date, and comparing the success hit count, we created Table 2, (with a number of columns, c). In [1] we used only two earthquakes as FDL seeds. In contrast here, in Table 2 we have used all >8R earthquakes since 1903, from USGS. For each one of the 86 earthquake seeds we have used the FDL sequence on the left of the table and we have counted how many of our prediction dates are successful in predicting >6.5R, (c4). Multiple hits are shown (c5), and the probability of success (c4/c3), for each of the FDL sequences from the 87 earthquakes, (c6). For comparison, in each row we have determined the nearest date (c7) prior to the earthquake of a planetary alignment between the Sun, Moon and South/North Node, (c8). The corresponding date of the planetary alignment described in c8 deals with the symbols Sun=Sun, Moon=M South/North Node =SN/N, and planetary alignments conjunct=conj, opposition=opp, square=sq, sextile=sex, trine=tr, semisextile=semisex, or ssex, concunx=*concunx*. The number of successful hits of this new seed date is shown in c9, and the new probability of successful prediction is in c11. In c12 we have the relative improvement comparison of the hits between the two methods, defined as (hit2-hit1)/hit1, and finally in c13 we show (hit2-hit1)*100/total where 'total' is c3, the total number of trials in each seed. Note that since the time distance of each seed to 2014 varies, so does the number of trials to 2014, our last year of measurement, varies from 141 to 60. At the bottom of this Table, we have for some columns, the averages max and min values. It is important that in every case we have only positive improvements in the success count. The only planetary alignment seeds which show no improvement over the seeds based on exactly the date of the earthquake are those dates where the earthquake dates and the planetary alignment coincide. Therefore the planetary alignment improves in all cases the success rate. The success rate improvement varies from 0 to 11.7%. We point out that in [19] we have identified planetary alignment as a possible cause of earthquakes, but at this stage we have not yet studied aspects of other major planets than Sun – Moon –S/N Node in conjunction with the FDL sequence.

Counting from exact earthquake date						Counting from the Planetary aspect date						
EARTHQ. DATE	Mag. (R)	Total	Hits1	Multiple Hits1	prob1	FDL start Date	Planetary aspect	Hits2	Multiple Hits2	prob2	Improvement1	Improvement2
24/05/2013	8.3	60	10	3	0.17	24/05/2013	M-conj-NN	10	3	0.17	0.00	0.00
06/02/2013	8	66	12	2	0.18	06/02/2013	M-tr-iSun	12	2	0.18	0.00	0.00
11/04/2012	8.2	75	15	5	0.20	10/04/2012	M-conj-NN	16	6	0.21	6.67	1.33
11/04/2012	8.6	75	15	5	0.20	10/04/2012	M-conj-NN	16	6	0.21	6.67	1.33
11/03/2011	9	82	18	2	0.22	11/03/2011	M-semisex-NN	18	2	0.22	0.00	0.00
27/02/2010	8.8	87	31	8	0.36	27/02/2010	M-concux-NN	31	8	0.36	0.00	0.00
29/09/2009	8.1	89	22	6	0.25	28/09/2009	M-conj-NN	22	4	0.25	0.00	0.00
12/09/2007	8.5	95	29	7	0.31	11/09/2007	M-conj-Sun	32	11	0.34	10.34	3.16
15/08/2007	8	95	30	5	0.32	15/08/2007	M-ssex-Sun	30	5	0.32	0.00	0.00
01/04/2007	8.1	95	17	3	0.18	02/04/2007	M-opp-Sun	18	4	0.19	5.88	1.05
13/01/2007	8.1	96	18	1	0.19	11/01/2007	M-Sq-Sun	19	3	0.20	5.56	1.04
15/11/2006	8.3	97	15	4	0.15	15/11/2006	M-conj-SN	15	4	0.15	0.00	0.00
03/05/2006	8	98	13	6	0.13	02/05/2006	M-Sex-Sun	15	4	0.15	15.38	2.04
28/03/2005	8.6	100	18	2	0.18	26/03/2005	M-sex-Sun	18	4	0.18	0.00	0.00
26/12/2004	9.1	101	25	4	0.25	21/12/2004	M-conj-NN	28	6	0.28	12.00	2.97
23/12/2004	8.1	101	22	4	0.22	21/12/2004	M-conj-NN	28	6	0.28	27.27	5.94
25/09/2003	8.3	102	23	4	0.23	25/09/2003	M-Tri-NN	23	4	0.23	0.00	0.00
23/06/2001	8.4	106	18	1	0.17	22/06/2001	M-conj-NN	20	1	0.19	11.11	1.89
16/11/2000	8	106	24	5	0.23	11/11/2000	M-opp-Sun	25	8	0.24	4.17	0.94
25/03/1998	8.1	106	23	4	0.22	21/03/1998	M-Sq-Sun	26	5	0.25	13.04	2.83
17/02/1996	8.2	111	35	8	0.32	18/02/1996	M-conj-Sun	38	5	0.34	8.57	2.70
09/10/1995	8	111	19	4	0.17	08/10/1995	M-opp-Sun	23	6	0.21	21.05	3.60
30/07/1995	8	112	19	5	0.17	27/07/1995	M-conj-Sun	23	5	0.21	21.05	3.57
04/10/1994	8.3	113	25	6	0.22	30/09/1994	M-Sex-Sun	31	5	0.27	24.00	5.31
09/06/1994	8.2	113	21	5	0.19	03/06/1994	M-Sex-Sun	31	5	0.27	47.62	8.85
23/05/1989	8.1	117	15	2	0.13	22/05/1989	S-Sq-NN	17	1	0.15	13.33	1.71
07/05/1986	8	119	26	5	0.22	03/05/1986	M-conj-NN	28	5	0.24	7.69	1.68
19/09/1985	8	119	20	1	0.17	15/09/1985	M-conj-Sun	26	3	0.22	30.00	5.04
03/03/1985	8	119	19	2	0.16	03/03/1985	M-Tri-SN	19	2	0.16	0.00	0.00
12/12/1979	8.1	122	20	4	0.16	11/12/1979	M-sq-Sun	25	6	0.20	25.00	4.10
19/08/1977	8.3	123	27	9	0.22	19/08/1977	M-conj-NN	27	9	0.22	0.00	0.00
22/06/1977	8.1	123	24	8	0.20	22/06/1977	M-Sex-Sun	24	8	0.20	0.00	0.00
16/08/1976	8	124	20	3	0.16	17/08/1976	S-Sq-M	20	1	0.16	0.00	0.00
03/10/1974	8.1	125	30	3	0.24	01/10/1974	M-opp-Sun	33	5	0.26	10.00	2.40
26/07/1971	8.1	126	28	3	0.22	25/07/1974	M-Semisex-Sun	29	3	0.23	3.57	0.79
14/07/1971	8	126	26	3	0.21	10/07/1971	M-conj-NN	34	7	0.27	30.77	6.35
11/08/1969	8.2	126	20	6	0.16	10/08/1969	S-semse-M	23	4	0.18	15.00	2.38
16/05/1968	8.2	127	36	3	0.28	12/05/1968	M-opp-Sun	42	7	0.33	16.67	4.72
17/10/1966	8.2	127	21	5	0.17	16/10/1966	M-conj-SN	22	3	0.17	4.76	0.79
04/02/1965	8.7	128	20	6	0.16	06/02/1965	M-Sex-Sun	24	5	0.19	20.00	3.13
24/01/1965	8.2	129	15	4	0.12	17/01/1965	M-opp-Sun	30	4	0.23	100.00	11.63
28/03/1964	9.2	129	38	6	0.29	21/03/1964	M-Sq-Sun	45	9	0.35	18.42	5.43
13/10/1963	8.6	129	23	4	0.18	10/10/1963	M-conj-SN	28	3	0.22	21.74	3.88
22/05/1960	9.6	130	32	6	0.25	22/05/1960	M-Quincux-NN	32	6	0.25	0.00	0.00
21/05/1960	8.2	130	26	5	0.20	20/05/1960	M-Sex-Sun	26	3	0.20	0.00	0.00
04/05/1959	8	130	20	6	0.15	04/05/1959	M-Conj-SN	20	6	0.15	0.00	0.00
06/11/1958	8.4	130	21	1	0.16	07/11/1958	M-Sex-Sun	24	2	0.18	14.29	2.31
04/12/1957	8.1	131	27	4	0.21	04/12/1957	M-opp-NN	27	4	0.21	0.00	0.00
09/03/1957	8.6	131	36	11	0.27	09/03/1957	M-Sq-Sun	36	11	0.27	0.00	0.00
04/11/1952	9	132	20	2	0.15	28/10/1952	M-conj-NN	22	4	0.17	10.00	1.52
04/03/1952	8.1	132	22	4	0.17	29/02/1952	M-Sex-Sun	23	3	0.17	4.55	0.76
15/08/1950	8.6	132	27	5	0.20	13/08/1950	M-conj-Sun	27	7	0.20	0.00	0.00
22/08/1949	8	132	24	3	0.18	19/08/1949	M-Sex-Sun	27	1	0.20	12.50	2.27
24/01/1948	8.1	132	29	6	0.22	23/01/1948	M-conj-Ura	30	7	0.23	3.45	0.76
20/12/1946	8.1	133	21	3	0.16	17/12/1946	M-Sex-Sun	34	3	0.26	61.90	9.77
01/04/1946	8.6	133	26	3	0.20	02/04/1946	M-conj-Sun	27	5	0.20	3.85	0.75
27/11/1945	8	133	28	4	0.21	21/11/1945	M-conj-Ura	31	7	0.23	10.71	2.26
07/12/1944	8.1	133	35	6	0.26	07/12/1944	M-Sq-Sun	35	6	0.26	0.00	0.00
06/04/1943	8.2	133	29	7	0.22	04/04/1943	M-conj-Sun	30	6	0.23	3.45	0.75
10/11/1942	8	133	32	7	0.24	08/11/1942	M-conj-Sun	33	10	0.25	3.13	0.75
25/11/1941	8.1	134	29	5	0.22	26/11/1941	M-Sq-Sun	31	3	0.23	6.90	1.49
10/11/1938	8.3	134	36	5	0.27	10/11/1938	Sun-conj-NN	36	5	0.27	0.00	0.00
01/02/1938	8.6	134	28	5	0.21	01/02/1938	M-conj-Sun	28	5	0.21	0.00	0.00
20/09/1935	8.1	135	26	6	0.19	18/09/1935	M-Sesquisq-NN	32	7	0.24	23.08	4.44
30/05/1935	8.1	135	27	3	0.20	26/05/1935	M-Sex-Sun	33	3	0.24	22.22	4.44
15/01/1934	8	136	23	2	0.17	11/01/1934	M-Sex-Sun	28	6	0.21	21.74	3.68
02/03/1933	8.4	136	21	1	0.15	01/03/1933	M-Sex-Sun	21	1	0.15	0.00	0.00
14/05/1932	8.1	136	31	3	0.23	14/05/1932	M-Tri-Sun	31	3	0.23	0.00	0.00
27/06/1929	8	136	12	1	0.09	21/06/1929	M-opp-Sun	28	2	0.21	133.33	11.76
14/04/1924	8.2	137	28	2	0.20	12/04/1924	M-Sq-Sun	29	3	0.21	3.57	0.73
01/09/1923	8.1	137	16	4	0.12	26/08/1923	M-opp-Sun	32	7	0.23	100.00	11.68
03/02/1923	8.5	137	23	4	0.17	31/01/1923	M-opp-Sun	28	3	0.20	21.74	3.65
11/11/1922	8.7	138	25	4	0.18	05/11/1922	M-opp-Sun	30	3	0.22	20.00	3.62
16/12/1920	8	137	22	2	0.16	16/12/1920	M-Sex-Sun	22	2	0.16	0.00	0.00
30/04/1919	8.2	138	28	2	0.20	30/04/1919	M-conj-Sun	28	2	0.20	0.00	0.00
15/08/1918	8.2	138	20	3	0.14	15/08/1918	M-Sq-Sun	20	3	0.14	0.00	0.00
26/06/1917	8	139	20	7	0.14	20/06/1917	M-conj-SN	31	7	0.22	55.00	7.91
01/05/1917	8.1	139	25	6	0.18	01/05/1917	M-Tri-Sun	25	6	0.18	0.00	0.00
15/06/1911	8.1	140	23	3	0.16	11/06/1911	M-opp-Sun	27	4	0.19	17.39	2.86
12/12/1908	8	140	32	9	0.23	11/12/1908	M-quincux-NN	35	7	0.25	9.38	2.14
14/09/1906	8	140	34	5	0.24	14/09/1906	M-quincux-SN	42	7	0.30	23.53	5.71
17/08/1906	8.2	140	39	8	0.28	13/08/1906	M-sex-NN	40	8	0.29	2.56	0.71
17/08/1906	8.4	140	40	9	0.29	18/08/1906	M-conj-NN	41	9	0.29	2.50	0.71
31/01/1906	8.6	141	32	8	0.23	30/01/1906	M-Tri-NN	32	8	0.23	0.00	0.00
23/07/1905	8.5	141	27	0	0.19	16/07/1905	M-opp-Sun	31	6	0.22	14.81	2.84
09/07/1905	8	141	26	4	0.18	06/07/1905	M-conj-NN	33	5	0.23	26.92	4.96
11/08/1903	8.1	141	14	2	0.10	07/08/1903	M-opp-Sun	29	2	0.21	107.14	10.64
				AVERAGE	0.20				AVERAGE	0.22	14.91	2.40
				MAX	0.36				MAX	0.36	133.33	11.76
				MIN	0.09				MIN	0.14	0.00	0.00

Table 2 : All >8R earthquakes since 1903, and the number of correct hits (c4) from a finite number of trials (c3). The next date in the rows is the nearest date of a stated planetary alignment followed by the corresponding success hits.

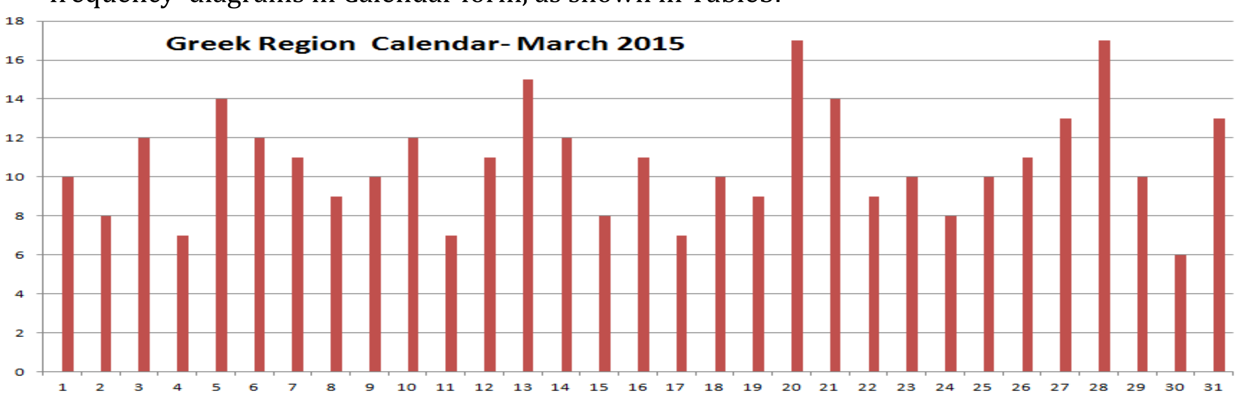
5. Discussion

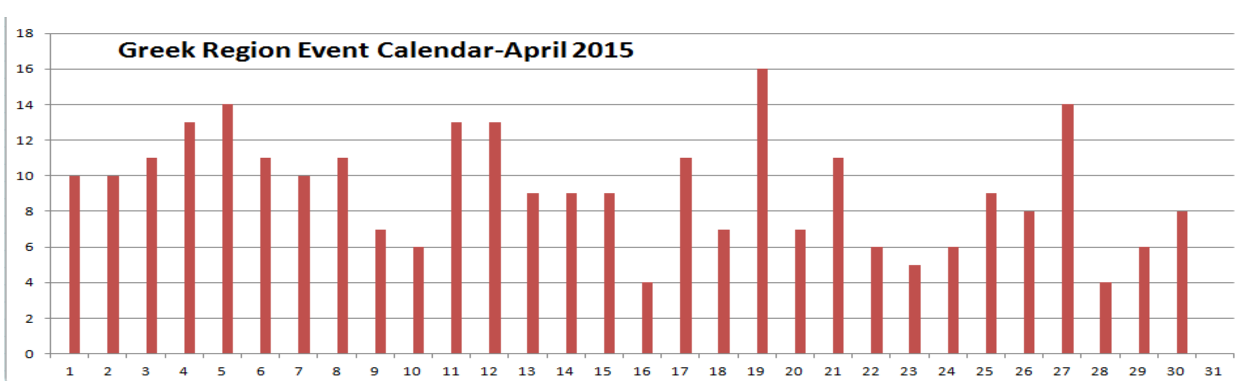
We have shown in Table 2 that starting from a seed based on alignments of the sun and the moon and the nodes prior to the date of the earthquake gives better seeds. Using those dates which vary form 0-5 days prior to the earthquake event. We can see that for the selected 141 – 60 samples of the MFDL method covering dates from 1903 to 2014 the average success (hits within 3 day window) is 22%. The maximum counted was 36%. It is worth noting we have not optimized the FDL sequence length. We cannot therefore state that this number of samples is optimum. However it is worth comparing the MFDL method with random dates so as we can give an indication of the value of MFDL. We start by brute counting force. One difficulty in being precise is the fact that we cannot use the same number of samples over the time period considered. Therefore we use consider comparing the average number of our samples approx 85 samples. Using therefore 85 random samples from 86 random dates (since there are 86 seeds) using a random number generator, we have done exhaustive searches for every element random dates of the 86x85 matrix and counted the hits (>6.5R) for the same +-1 day window and same period and we have found that the average hit is 15.3%. The maximum was never higher than 22%. This demonstrates that the MFDL method gives 44% better results to random therefore it has value. Another way of estimating the expected probability of success of the MFDL method is to use the Hypergeometric Distribution. It should be of better accuracy than binomial distribution because of the removal of the samples occurred. Using 3 day window and for >6.5R earthquake date only considered as hit if predicted, then this distribution gives for 22 hits 1.2% as normal and considered as 'expected'. The MFDL seems to perform better.

However, as we also mentioned in [2] we go further and in order to make a prediction we enhance the FDL or MFDL methods using 'frequency' diagrams. It is the combination of the use of FDL numbers as well as the 'resonance' phenomena [21-22] from such numbers that give us predictive powers. When we create a frequency diagram with single day as 'bin width', when different past earthquake seeds give the same future date as a possible event the bin count increases and this multiple convergence on a specific date acts as an attractor and we have further increased probability of occurrence. However a more complete analysis of this will be the topic of another publication.

The analysis both in this paper and in [2] has focused on very large >8R earthquakes, since 1903. We made use as seeds the earthquake dates or in this work dates of prior Sun-Moon-S/N alignments. The location of those earthquakes was not explicitly considered. Therefore what we described here can be used as a prediction method for global earthquakes, of no specific location. We have shown already [2], that this is not restrictive and that we can apply it locally. This is possible using the FDL sequence with either earthquake seed dates or with planetary alignment seed dates as described here for a specific area on earth. Then use 'frequency' plots with bin width=1 and create monthly or yearly calendars showing the strong probability of an event in date and magnitude. A large bin count, compared to its preceding or next date, indicates not only a high probability of an event on that date but also a high magnitude event.

As an example, we have taken in [2] the Greek Geographic Region and collect all >4.5R events. In this work for the first time we show preliminary results of our new method where we apply the MFDL method for the same region but with seeds only the planetary (Sun-Moon-S/N Nodes) alignment dates. We carry out this process for the 2014-2015 period only with data ALL the above period alignments irrespective of earthquake occurrence. Using the FDL sequence on the alignment dates we derive the predictive 'frequency' diagrams in Calendar form, as shown in Table3.





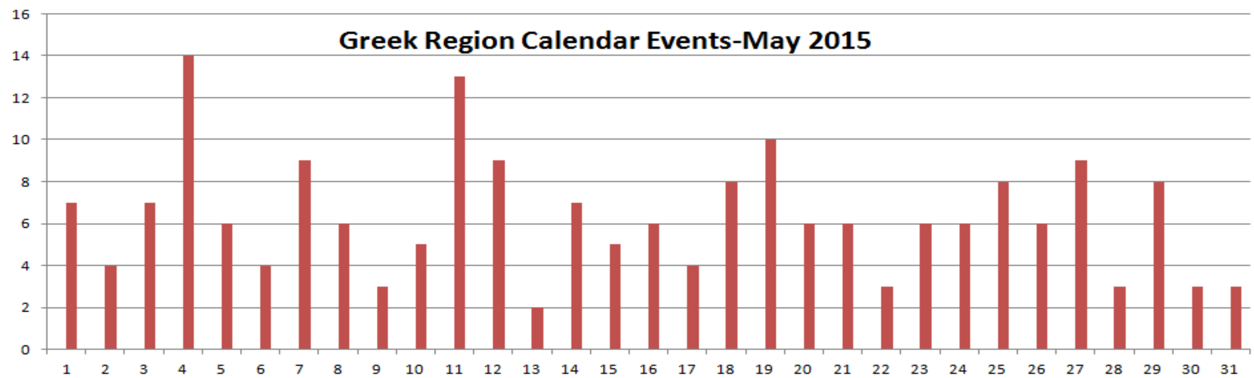


Table 3: Predicted earthquake monthly cluster histogram for the first four months of March, April and May 2015 for the Greek Geographic Region. The x-axis is calendar dates of the month.

This is particularly advantageous as it can be regional and we always have enough data due to the abundance of relevant aspects. Further work needs to be done to study the validity of this method in particular to a number of issues such as the choice of aspects and the choice of planets, in trying to maximize the predictive rate and to examine the limitations. However preliminary results show that this method is very promising.

6. Conclusion

We have reported on a modification of the FDL forward time prediction method using Fibonacci Lucas and Dual numbers and their roots. The method is based on the observation that using planetary (Sun Moon Node) aspect on a date prior to a strong earthquake >8R and using it as a seed for the unfolding of FDL time spiral, we can predict strong (>6.5R) future earthquakes at a rate of ~22% of our trials with accuracy of +- 1 days. When multiple earthquake seeds are used, we apply a frequency method for building a likely future date for months to years ahead. The MFDL method is a way for building up a probability distribution function of future events, with considerable success when using FDL sequences and combined with resonance like enhancement effect of the frequency diagram. The method can be applied to localized regional predictions as well as global events.

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