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STUDIES A TYPICAL BEHAVIOR OF EARTH DURING TSUNAMI 2011 IN JAPAN

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ABSTRACT

In this article we report bizarre etiquette of earth by studying its motion that makes tsunami in 2011. The report is framed on zenith angle, rotational angle and temperature of the earth; those data have been recorded since 2007. After analysis those data of months February – April at around 11:00 AM inconsistencies among the astronomical parameters have been found. During tsunami the change of zenith angle is about 1.11% per hour. The average rate of change of zenith angles in 2007, 2011 and 2016 respectively are 25'/day, 23'42''/day and 17'24''/day, and average change of rotational angles are found respectively to be $65^o15'$, $71^o11'$ and $63^o46'$.Because of the changes of zenith and rotational angles over the past and present decades, average temperature of the local area increases about 10% in 2016 than that of 2007. Remarkable variations of those astronomical parameters show offbeat motions of the earth and may strive for tsunamis in 2008, 2009, 2011and earthquake in 2015 along with other disasters.

Key Words : Disaster, Motion, Tsunami, Vector, Zenith angle

INTRODUCTION

The heavy earthquake (magnitude 9.0 in Richter scale) stuck off the Indonesian Island Sumatra in December 26, 2004, triggering tsunami that affected neighboring countries too, e.g., Myanmar, Sri-Lanka and India and killed more than 240,000 people, a deadliest tsunami in the history[1-4]. The news shocked soft hearted heavily and I have been touched in finding reasons behind it and how does the motion of earth is affected by this devastation. The subject is studied intensively and been found the prehistoric most popular astronomers: Aryabhtta (476 AD – 550 AD), Nicolaus Copernicus (1473 – 1543), Johannes Kepler (1571 – 1630) and Galileo Galilee (1564 – 1642) who had been playing important roles in this area of investigations. The elementary knowledge what we have been enriched up to now by Kepler's three laws of planetary motions: first law- *all planets move in elliptical paths, with the sun at one focus.* Second law: *a line drawn from the sun to a planet sweeps out equal areas in equal times*. Third law: *the squares of the periods of revolution of the several planets about the sun are proportional to the cubes of the semi major axes of the ellipses*[5]. The precession of equinoxes is caused by the gravitational forces of the Sun and the Moon on the Earth. Axial precession is very similar to the precession of a spinning top. In both cases, the applied force is gravity. The unsteady motion of earth that has no stationary center is verified in our previous studies. It means that Kepler's laws are in complete and have limitations to clarify(i) two dimensional Inkpot motion originated by the change of zenith (θ) and rotational (φ) angles and (ii) seasonal demarcation line between summer and winter solstices[6]. We have studied (i) inconsistency of solar radiation spectrum due to Sunspots, those are originated by the vanishing of fuel in the solar cells, (ii) chromaticity: originated from the fusion reaction of hydrogen atoms, temperature and energy transitions of the respective cells of H, He and Positronium (newly discovered celestial Ps by the author) atoms[7,8], (iii) The effect of variation of colors of solar light on the photosynthesis of green leaves[9] and (iv) change of orbital and rotational motions of the earth during the Tsunami and the Venus transition[10]. We have developed solar spectrum monitor systems for this area of research too. The knowledge of solar system has been improving deeply with the help of advanced technology that makes us confident to explain the versatile nature of the earth and its devastation. In the following sections how θ, φ and temperature have been changing year to year and their impacts on earth and its surroundings as well and novelty will be conferred.

Theory

In order to study tsunami and other relevant issues a general theoretical singularities of planets are taken into account.

Motion of the planet

Earth is the third and only the habitant planet of our solar system. It obliges two motions: (i) rotational (spin) and (ii) orbital. One complete rotation around its own axis is ~ 24 hours and one complete orbit around the sun is ~ 365 days. Most of the solar planets move around the sun in the elliptical path of eccentricity 0.01 – 0.33. In this section theory of orbital motions will be discussed.

Orbital motion

In **Fig.1,** the sun is at the epicenter and the planet like earth is orbiting at a distance, $r = \frac{a(1-e^2)}{(1-e\,cos\theta)}$, where eccentricity, $e = \frac{\sqrt{(a^2-b^2)}}{a}$, semi-major axis is a, and semi-minor axis is b $(= a\sqrt{1-e^2})$. The position vector r is given by

$r = r\hat{r}$ ……………………………………(1)

The linear velocity along the line of joining and acceleration are given by

$v = \frac{d\vec{r}}{dt} = \dot{r}$ ……………………………………(2)

And

$a = \frac{d\vec{v}}{dt} = \dot{v} = \ddot{r}$……………………………………(3)

Applying Newton's second law of motion we get the centripetal force,

$F = -\frac{GM_S M_P}{r^3} r$……………………………………(4)

Where M_S and M_P are masses of the Sun and the planet respectively and G is the gravitational constant. Hence the equation of motion of the planet can be derived in the following form:

$\ddot{r} + \frac{GM_S}{r^3} r = 0$……………………………………(5)

$\ddot{r} + \omega^2 r = 0$ ……………………………………(6)

natural disasters. It is clarified in our previous studies.The gravitational torque of the earth is given by

$\tau = r \times F = \frac{GM_S M_P}{r^3} r \times r = 0$ ……………(14)

or, $\tau = \frac{d\boldsymbol{L}}{dt} = 0$ ……………………………(15)

Equation (6) represents the second order differential equation of a periodic motion of the planet (earth). Where, $\omega = \sqrt{\frac{GM_S}{r^3}}$ is the angular frequency and is inversely proportional to the time period (T) of a revolution around the sun, i.e.,$\propto \frac{1}{T}$,

or, $T = \mathcal{K}_M \sqrt{\frac{r^3}{GM_S}}$, ……………………………(7)

Here $\mathcal{K}_M$ is a proportionality constant that is equal to 4$\varkappa$, where $\varkappa$ =1.57678,($\varkappa$ = perimeter of ellipse/ 2×semimajor axis).The perimeter of ellipse is given by

$p = 2\varkappa(a+b)\left(1 + \frac{3h}{10+\sqrt{4-3h}}\right)$…………… (8)

Where,$h = \frac{(a-b)^2}{(a+b)^2}$

Putting the value of T, r, G and M_S in Eq. (7) we can obtain the value of $\mathcal{K}_M$. The precise value of $\mathcal{K}_M = 6.29$ is obtained from the slope of the fitted line of graph **(Fig.2)** plotted with time periods vs. orbital distances of the respective solar planets. The values of these parameters can be found elsewhere[11].

Conservation of Angular momentum in 3d

Take the cross product of Eq. (5) with r

$r \times \ddot{r} + \frac{GM_S}{r^3} r \times r = 0$ ……………………(8)

Second term of Eq.(8) is zero. Hence,

$r \times \ddot{r} = 0$ ……………………………………(9)

Or, $\frac{d}{dt}(r \times \dot{r}) = \dot{r} \times \dot{r} + r \times \ddot{r} = 0$ …. ….(10)

Hence, we find that $\frac{d}{dt}(\boldsymbol{r} \times \dot{\boldsymbol{r}}) = 0$, and multiplying both sides by M_P we have

$\frac{d}{dt}(r \times M_P \dot{r}) = 0$

or, $\frac{d}{dt}(r \times P) = 0$……………………………(11)

Integrating both sides of Eq. (11) we obtain angular momentum of the earth,

$L = r \times P = Const$ ……………………………(12)

And magnitude of it is given by

$|L| = |r \times P| = M_P v r = M_P\sqrt{\frac{GM_S}{r}} r = \sqrt{GM_S M_P{}^2 r}$ ………… … … … …(13)

Hence, L is conserved provided r, P and angle between them are simultaneously constant. In any case either two or any one of the parameter change can cause L an atypical that may bring

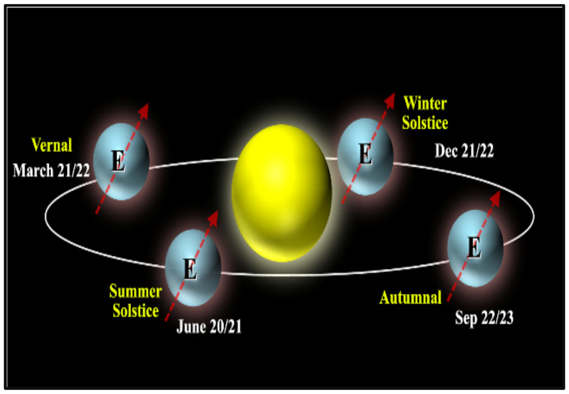

Fig. 1 : Orbital and rotational motions of the earth

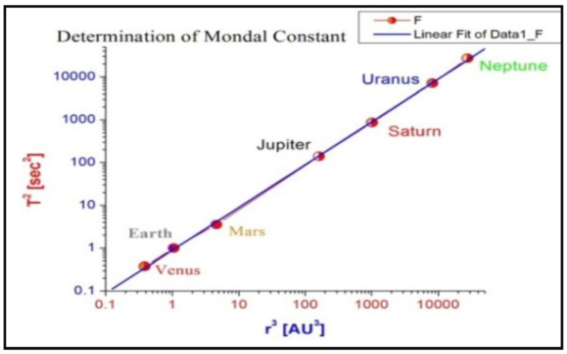

Fig. 2 : Plot of Kepler's 3rd law

Differentiating both sides of Eq. (12) we can conclude the same that the torque of the earth is zero provided the earth does not change its orbital path, distance, plane and speed with time.

Conservation of total energy in 3d

Take the dot product with velocity in Eq. (5) and we obtain,

$$\dot{r}.\ddot{r} + \frac{GM_S}{r^3}\dot{r}.r = 0 \ldots\ldots(16)$$

$$v.\dot{v} + \frac{GM_S}{r^3}\dot{r}.r = 0 \ldots\ldots(17)$$

It is possible to show that $v.\dot{v} = v\dot{v}$ and $\dot{r}.r = r\dot{r}$

Therefore Eq. (17)

reduces to $v\dot{v} + \frac{GM_S}{r^3} r\dot{r} = 0$,

or, $v\dot{v} + \frac{GM_S}{r^2}\dot{r} = 0$

We observe that $\frac{d}{dt}\left(\frac{1}{2}v^2\right) = v\dot{v}$, and $\frac{d}{dt}\left(-\frac{G\,M_S}{r}\right) = \frac{GM_S}{r^2}\dot{r}$

Therefore, $\frac{d}{dt}\left(\frac{1}{2}v^2 - \frac{G\,M_S}{r}\right) = 0 \ldots\ldots(18)$

Multiplying both sides of Eq. (18) by M_P and after integrating we find

$$\frac{1}{2}M_P v^2 - \frac{G\,M_S M_P}{r} = const = \mathcal{L} \ldots\ldots(19)$$

or, $\frac{1}{2}M_P\dot{r}^2 - \frac{K}{r} = \mathcal{L}, \ldots\ldots(20)$

where $k=GM_SM_P$ is a gravitational force constant.

i.e., K.E. − P.E. = Lagrange an ($\mathcal{L}$)

The equation of Hamiltonian ($\mathcal{H}$) is given by,

$$\mathcal{H} = \sum p_r\,\dot{r} - \mathcal{L} \ldots\ldots(21)$$

Hence the total energy of the orbiting planets can be expressed by Eqs. (20) and (21) at an orbital distance ***r***. In this classical phenomena what we have observed is the energy will be conserved only when all the parameters in the L.H.S. of Eq.(20) and R.H.S of Eq. (21) are constant in motion. Applying the Lagrange an and the Hamiltonian equations of motion we will have the same conclusion what we have shown in Eq. (7). The declination of the planet is given by

$$\delta = 23.45 \times sin\left\{\frac{360}{365}(284 + N)\right\} \ldots\ldots(22)$$

Where, N is the number of days in the revolving period. Thus Zenith angle is given by

$$\theta = 90^o - \delta \ldots\ldots(23)$$

Therefore an experimental determination of θwill provide us information about the motion of the earth and issues of devastation.

The equation of planet's orbit

It is mentioned that the Laplace-Runge-Lenz vector $\boldsymbol{A}$ is[12-15]

$$A = P \times L - GM_S M_P^2 \hat{r}. \ldots \qquad (24)$$

Taking dot product with $\boldsymbol{r}$both sides of Eq. (24) we obtain

$$A.r = (P \times L).r - GM_S M_P^2 \hat{r}.r. \ldots \qquad (25)$$

or, $Ar\cos\Lambda = (r \times P).L - GM_S M_P^2 r = L^2 - GM_S M_P^2 r$

or, $Ar\cos\Lambda = L^2 - M_E kr$ ……………………(26)

Where,$\Lambda$is used to denote the angle between $\boldsymbol{r}$ and the fixed direction of $\boldsymbol{A}$. Rearranging we have,

$$\frac{1}{r} = \frac{M_P K}{L^2}\left(1 + \frac{A\cos\Lambda}{M_P K}\right) \ldots \qquad (27)$$

or,$\frac{1}{r} = \frac{M_P Ke}{eL^2}\left(1 + \frac{M_P Ke\cos\Lambda}{M_P K}\right)$,

it can be shown that $\boldsymbol{A}$ is in the direction of the radius vector to the perihelion point on the elliptical orbit, and has a magnitude $A = M_P Ke$.

or, $\frac{1}{r} = \frac{A}{eL^2}(1 + e\cos\Lambda)$

$$\text{Hence, } A = \frac{e L^2}{r(1+e\cos\Lambda)} \ldots \qquad (28)$$

The value of Λvaries from $-\pi$ to $+\pi$ and we can determine the Laplace-Runge-Lenz vector both theoretically and experimentally using Eq. (28).If we observe A throughout the year and find its discrepancies, it may assure the planetary devastation.

Geophysical issues

The shape of the earth is not completely spherical, mostly oblate. Inside the planet there are many plates, cells and chambers those consist of cores, gas, minerals, water etc. When earth is moving with a velocity,

$$v = \frac{2\pi r}{T} = r\omega = \sqrt{\frac{GM_S}{r}} = 36.5\ km/s$$

every components should have this velocity otherwise it may occurs disruption and cause a huge damage in the form of natural disasters. The strange velocities form unlike momentum among the plates that may cause of collision and over lapping and bring huge tsunami when it occurs under the huge water bodies. A few deadliest tsunamis and earthquakes in the recent past are tabulated here :

Experiment

In order to measure the rotational and orbital motions of the earth an inexpensive solar spectrum monitor system is developed. Using this system θ , φ, temperature and intensities of spec-tral colors are determined. Detail of this system can be found elsewhere. All the data has been recorded manually in every hour during the daytime in weekends and almost in every holiday throughout the years (2005–2011, 2014–2016). During this time many natural calamities hit the earth especially the deadliest tsunami in 2011. Experimental and theoretical data are analyzed and presented in the following section.

RESULTS AND DISCUSSION

In the following spectra experimental results of significant variations of θ , φ and temperature (during 2007 – 2011, 2016) at around 11:00 AM are shown. In **Fig. 3(a)** the change of θ with time (February – April) are plotted. The abrupt change of θ raises the temperature in 2016 which is reflected in **Fig. (c)**. It is clearly shown in **Fig. 3(d)** the effect of orbital motion on environmental temperature. The vertical lines of each average data points indicate the standard deviation of all measured data over a month. The change of ϕ in **Fig. 3(b)** infers the average change of ϕ in 2007, 2011 and 2016 respectively are $65^{o}15'$, $71^{o}11'$ and $63^{o}46'$. This abrupt change of ϕ is one of the reasons of tsunami in 2011. Because of the change of $\theta$and ϕ, average temperature of the local area increases about 10% in 2016 than that of 2007. This is sharply displayed in **Fig. 3(d)** when temperature is plotted with θ . The increase of individual local area temperature aggregately affects the Global warming. It can be seen from the tabulated values (see **Table 1**), the devastation depends on the center of earthquake, depth of the center from the soil of earth, and power of Richter scale (sl. no. 2, 9, 12). Now we find that the power of the Richter scale depends not only on the vibrational amplitude but also on the change of momentum of the planet, zenith angle and rotational angle. In **Fig. 4** we have plotted the distribution of declination (see Eq. 22) with time in a year and the corresponding experimental values in 2007, 2011 and 2016. A sharp deviation of declination is observed in March (blue line of tsunami) 2011. During tsunami the change of θ is about 1.11% per hour.

Table 1 : Devastating Tsunamis and Earthquakes in the recent past

S/N	Date	Place	Magnitude (Richter scale)	Claimed deaths
Tsunami				
1.	June, 2001	Southern Peru	8.4	78
2.	December 24, 2004	Sumatra, Indonesia	9.0	240,000
3.	July 17, 2006	Java, Indonesia	6.8	668
4.	April 2, 2007	Solomon Island	8.0	50
5.	September 29, 2009	Samoa, Pacific Island	8.0	184
6.	January 4, 2010	Solomon Island	6.5+7.2	1000
7.	February 27, 2010	Chile	8.8	600
8.	October 25, 2010	Sumatra	7.2	509
9.	March 11, 2011	Tokyo, Japan	8.9	30,000
Earthquakes				
10.	July 16, 2007	Chuetsu, Japan	6.6	11
11.	June 14, 2008	Iwata, Japan	6.9	12
12.	April 25, 2015	Kathmandu, Nepal	8.0	5,000
13.	April 16, 2016	Kumanmoto, Japan	7.0	35

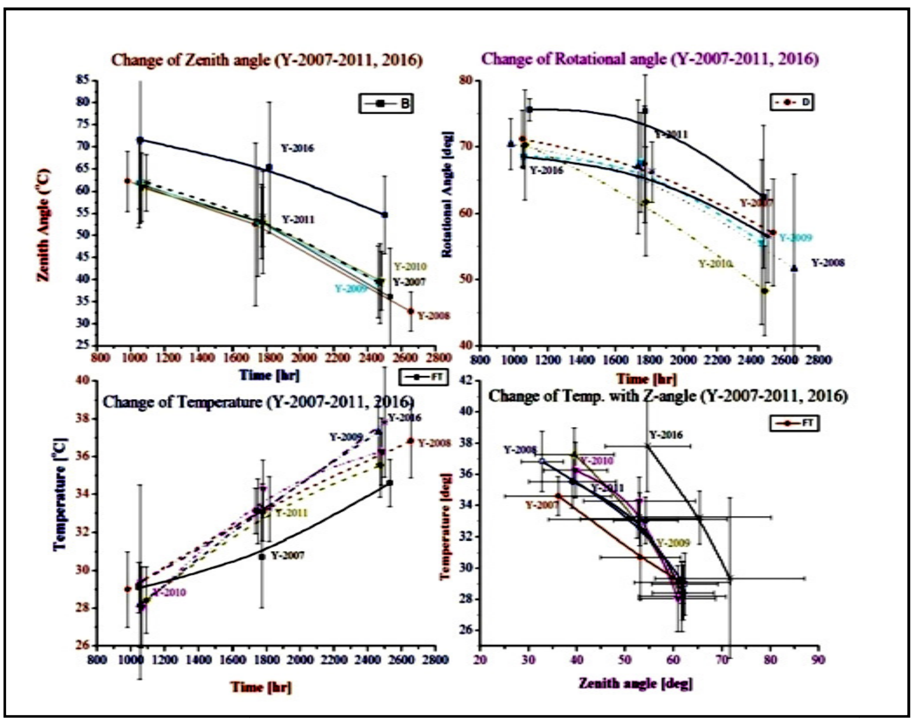

Fig. 3 : Experimental evidence of Tsunami 2011

In **Fig. 5** a rate of zenith angle between February–March and March–April from year 2007 – 2011, 2016 are plotted with time. The average rate of change of θs in 2007, 2011 and 2016 respectively are 25˙0′ /day, 23˙42′ /day and 17˙24′/day. Lines of tsunami during 2008, 2009 and 2011 show moment a of earth were different due to variation of rate of change of θs. After tsunami 2011 zenith angle sharply falls and it may occurs another devastating earthquake in September 2015 in Kathmandu, Nepal. The strength of Richter scale stipulates atypical behavior of the earth's orbital and rotational motions that results atmospheric temperature change and consistently increase the global warming.

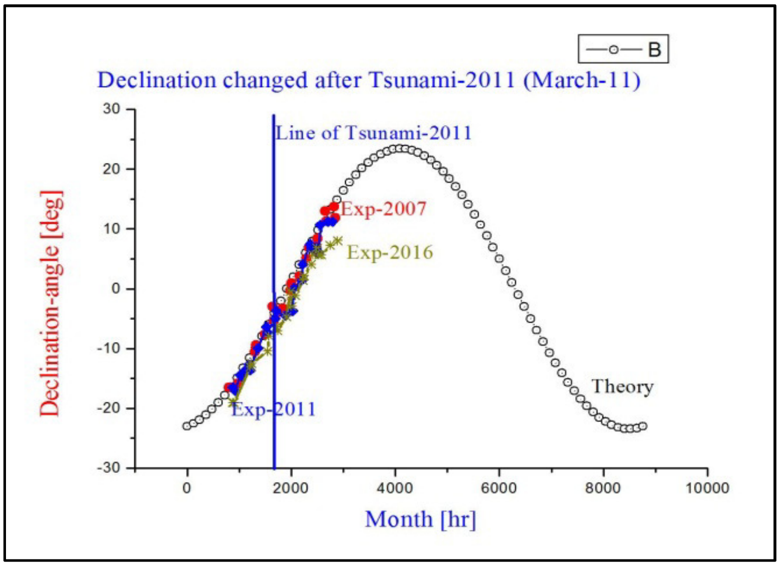

Fig. 4 : Declination change in a years

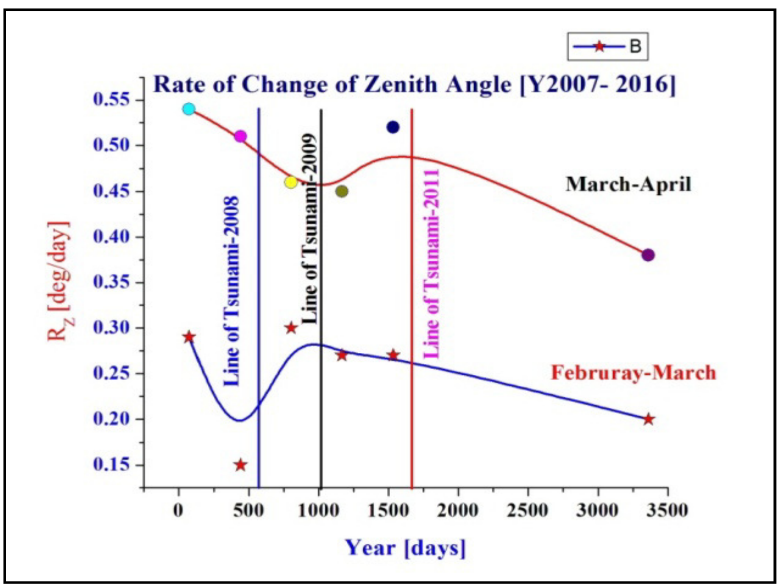

Fig. 5 : Rate of Zenith angle per day in years

CONCLUSION

An atypical motion of earth plays a crucial role behind any natural calamities which is experimentally verified. During tsunami/ earthquake periodic nature of earth's movement is disturbed.

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