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Solar system planetary alignment triggers tides and earthquakes

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Abstract

This research hypothesizes that tidal and earthquakes are induced by solar system planet positions, as the planetary attraction act as a trigger force change the speed of the Earth rotation. The occurrence of a sea tide is only a consequence of a relative slowdown of the rotational/revolving speed of the Earth which urges the Earth's plates to move. The research included analyzing earthquake data for the whole Earth over July, 2019 with a case study of the Arabian Plate (AP) seismicity included the Zagros Folded Belt (ZFB) and Zagros Thrust Zone (ZTZ) as a seismic active belt in the northern hemisphere. The rotational velocity of the Earth has been calculated for eight seismic events, and it turns out that the velocity was different for each case. A negative proportional was found between earthquake and the Earth rotational speed. During the configuration of the Jupiter and Saturn in a straight line with the Earth over July 2019, one thousand and thirty-seven of earthquakes occurred around the world were statistically analyzed having 2–6 magnitudes. Rotational/ revolving speed, angular momentum and rotational inertia kinetic energy; gravitational potential energy of the Earth at equator and at 45 degrees were computed to show how rotational speed triggering plates. Planets interact with each other influencing earthquakes via the gravitational stresses arising from the configuration of the solar system planets that cause a slowdown of the rotational/revolving speed of the Earth. This stimulates the Earth's plate to move generating earthquake due to the activation of faults.

Keywords Planetary configuration · Earthquake · Solar system · Tides · Rotational speed

Introduction

The earthquake has been known since ancient times, some of which are simple, and the other is catastrophic. Earthquakes cause a lot of damage, such as shaking the earth and displacing some parts at certain distances, floods, tsunamis, coast destruction, and fires and building collapse, all of which are dangerous to human life (Coburn and Spence 2003; Hall et al. 2019). Large earthquakes resulting in severe environmental effects (Naik et al. 2020). The above risks caused by earthquakes can be avoided if it is possible to make a prediction early, which may reduce natural hazards and reduce physical and moral damage and provide an opportunity to facilitate precautions by the competent authorities. Accordingly, the earthquake was a scientific challenge, and scientists have been puzzled at how to get rid of the disaster (Venkatanathan et al. 2005).

The earthquake prediction had previously investigated by many researchers (for instance, Kossobokov 2004; Li 2006; Venkatanathan et al. 2005) from different point of view. Nobody can predict the earthquake, as there is insufficient knowledge to know the future time of the earthquake. But scientists can only estimate the probability of a major earthquake in a particular region over a long period of time estimated at a few years. Many attempts were made, all of which failed, and did not achieve their goals in setting a clear mechanism foretelling the location and time of earthquakes. Seismic gap theory has been used for the earthquake prediction based on behavior of some animals, changing water color in springs, foreshocks, rock strain, changing in level and chemistry of groundwater, increase radon gas in groundwater and air, thermal gradient anomaly, ground tilting (Yoder et al. 2015). The reasons of earthquakes are known to geologists till now as largely interpreted by the theory of plate tectonic as most of Earth's surface features.

The question here is why did actually those plates move? Some authors have attributed the reason earthquakes to the plate tectonic theory, and others attributed to the solar activity (Tavares and Azevedo 2011). A relationship between the occurrence dates of most of the strong earthquakes that have

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magnitude eight or more and solar activity (solar spots) has been demonstrated by Han et al. (2004) in China and western Mongolia. In any case, all the hypotheses, including the theory of plate tectonics, center around the idea of the inner strength of the Earth's interior that drives the plates. Those hypotheses, along with the theory of plate tectonics, are still unable to explain some phenomena and cannot provide adequate answers to them. From here, some researchers suggest external forces can move the Earths' plates, and are currently a focus of research. There is no doubt that the Earth is affected by the gravitational field of the planets in the solar system. The solar system includes a group of planets, their satellites and the asteroids orbiting the sun in same counter-clockwise direction within almost one plane level. These planets differ in their nature from the aspect of the orbit of rotation and their distance from the sun, and the speed of rotation of the planet, as well as their masses. The closest planets to the sun are Mercury, followed by Venus, Earth, Mars Jupiter, Saturn, Uranus, Neptune and Pluto the farther away. Nowadays, the earthquakes and volcanic activity occur mainly along the plate boundary when they are rubbing against each other (Tavares and Azevedo 2011). The tidal phenomenon arises from the orbital motion of the moon around Earth and the axial rotation of the Earth around itself (Butikov 2002). The gravitational influences of the planets inevitably have an impacted Earth as the gravitational change acts in attraction for both of solid (earthquakes) and liquid parts of Earth (tides).

The importance of this research comes from paying attention to take safety precautions and warning populations in the event that the Earth falls under significant gravity stress due to planetary alignment, which contributes to mitigating coastal damage and reducing the risk of natural disasters such as earthquakes and tsunamis. The general configuration of the planets in the solar system changes constantly over time momently, and hence the Earth is subjected to a changing gravitational force accordingly. The present research goes to shed light on the impact of the planetary configuration of the solar system planets on the Earth based on the seismic data interpretation, earthquake information for the whole Earth and on the seismicity of the Arab Plate (AP), in particular, the subduction zone of continental collision including the Zagros Folded Belt (ZFB) and Zagros Thrust Zone (ZTZ) located along the Iraq-Iran border. The objectives are to investigate the effect of the planetary configuration of the solar system on tides and earthquakes as an attempt for a further contribution to made probable early tsunami and earthquake prediction for avoiding hazard and mitigate the natural risk.

Data collection and management

The seismic record, recent events and the largest 20 events throughout the world were obtained from the National Aeronautics and Space Administration (NASA) and the earthquake reports obtained from United States of Geological Survey (USGS). The NASA and USGS are official Administrations for such subject having best available source for the estimation of the earthquake. The earthquakes spreadsheet include date, time, latitude, longitude, depth, magnitude and location throughout the globe for the month of July, 2019 were used for interpreting earthquakes events. Times are reported in milliseconds since the epoch. The depth of earthquake focus is measured via a seismic network based on the average elevation of the seismic stations which provided arrival-time data for the earthquake location. The location uncertainty of is about 100 m horizontally and up to 300 m depth. Data of seismic activity for the period from 1900 to 2019, and seismic map for 2011 to 2020 were collected from the General Authority for Meteorological and Seismic Monitoring.

Results

Moon induced tides

The distance between the Earth and moon is 384,400 km as a diameter in which moon is gradually moving away from the earth (Fidler and Dotger 2009) 4 cm per year (Martel 1997; Taylor et al. 1994). Eventually, the moon is now 18 times more distant from earth (384,400 km) than it was when it formed 4.5 billion years ago. Momently the moon's distance from the sun changes due to its revolving around the Earth, so the closest and most distant between them are 146.7×10^6 km and 152.5×10^6 km respectively. The difference in gravitational attraction of the moon is a reason resulted in tidal phenomenon. The earth is under stress due to its rotation around itself and its revolving around the sun. The night hemisphere of the earth is under the centrifugal force, whereas the day hemisphere suffers from the gravitational attraction.

A certain place on the earth will therefore experience two high and two low tides daily (Le Provost 1991) (Parker 1991). Accordingly, vertical changes up and down in sea level due to the gravitational attraction of the moon and the sun can be seen daily on the offshore (Pitchaikani 2020). In case of the moon and the sun align with the earth in a straight line, the full moon in the second and fourth quarter, the water ascends the water level in ocean both rises higher and falls lower than the average (Fig. 1). Recent research confirms a close relationship between shallow earthquakes and tides (Metivier et al. 2009; Cochran et al. 2004). The alignment of sun and moon in a straight line is acting in existing tides twice a month. At the first and third quarters, exactly the opposite occurs, where the moon is perpendicular in right angle to the earth-sun line, so the tidal forces will resist each other resulting in a tidal range below the average (Paul et al. 2021). Tidal levels in the spring and neap are 20% higher or lower around the average

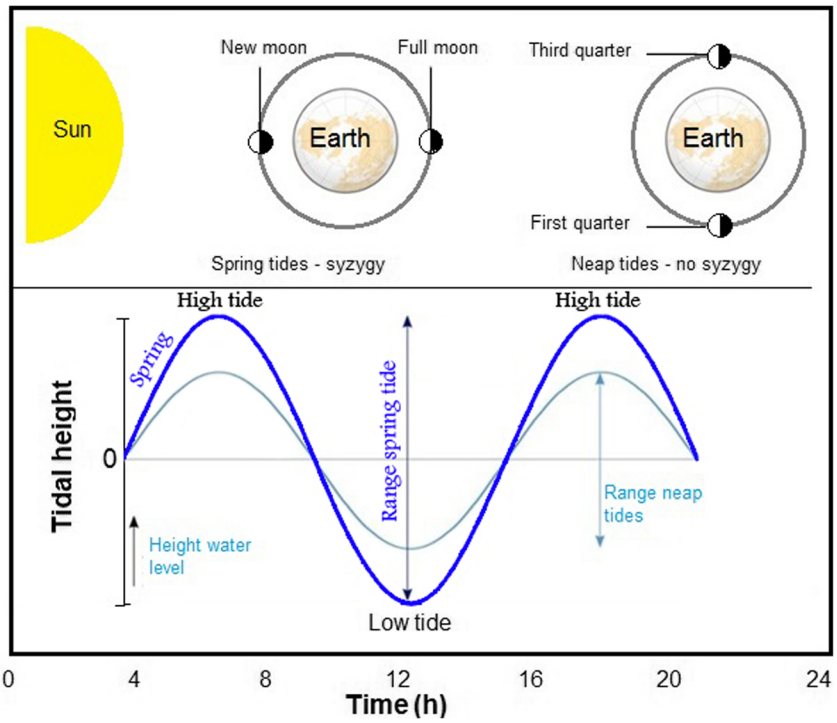

Fig. 1 Semidiurnal tidal cycle showing water height at spring and neap tides versus the time in two high and low tides. The full moon in the second and fourth quarter the water level ascends in ocean; At the first and third quarters, the moon is perpendicular in right angle to the earth-sun line, the tidal range below the average. Tidal levels in the spring and neap are 20% higher or lower around the average

(Sharples 2008) (Fig. 2). The gravitational attraction yielded by the moon is 2.25 times larger than of that yielded from the sun as the moon is much closer to the Earth (Christodoulidis et al. 1988). Aligning the sun and moon with the earth, the combine their attraction. The spring tide delays a day or so behind a full moon or new moon existence due to the friction force resulted from movement the water mass. The moon phase is controlling the time difference between spring tide and neap tide as can be typically estimated almost as 28 days divided by 4 phases (Paul et al. 2021). During lunar one day, two almost equal tides, high and low are happened within 12 h and 25 min. In the same way, the Earth is affected by the position of the moon as well as the positions of other planets, and this is reflected in the rotational and revolving speed of the Earth that may generate a kinetic energy for the Earth's plates resulting in seismic activities. The rise of the water is attributed to the relative slowdown of the Earth's rotation. Such a case will urge the Earth's plates to move as well, which will actually move when the stress increases due to the gradual decrease in the speed of the Earth's rotation, in both case of the rotational speed around its axis or of revolving speed around the sun.

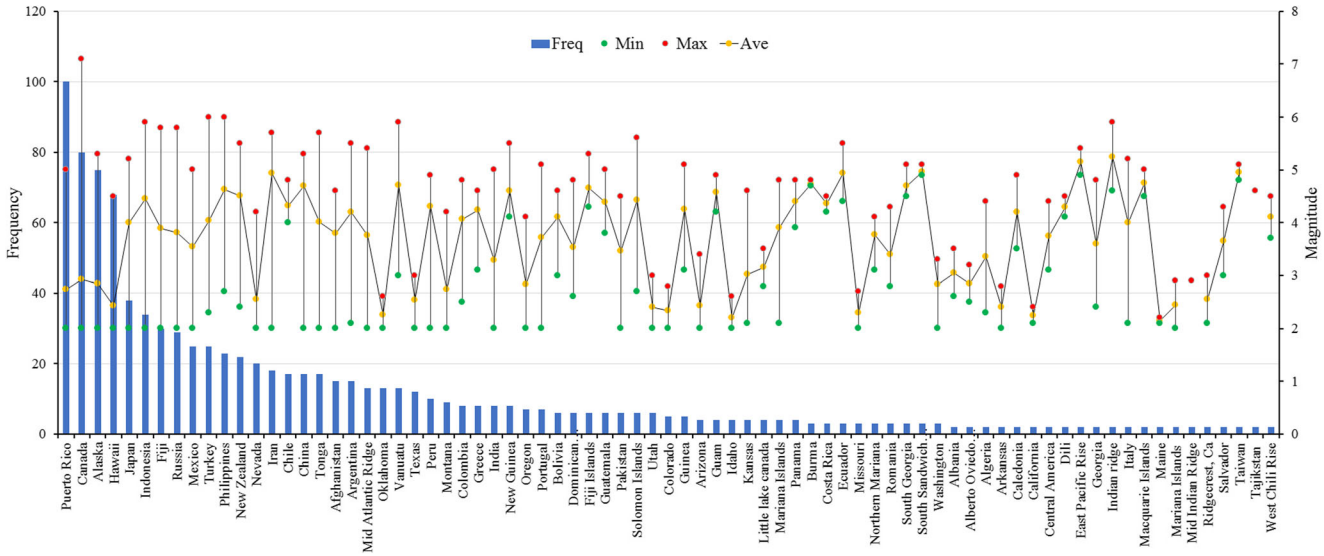

Fig. 2 Statistical frequency of earthquakes for 1073 earthquakes and their magnitudes in whole Earth on July 2019

Planetary alignment moves Earth's plates

The forces of plant's gravity attract the Earth are irregular and constantly changing over time as a response to the orbital configuration of the influencing solar system planets. If the sun aligns with any other planet, assuming that the moon to be in a straight line with the earth, so that it forms or approaches to angle of 180°, then the earth becomes under a different stress. The gravitational stresses would change the speed of the earth in its orbit, and shift the center of the solar system. The seismic data recorded throughout the whole Earth on July 2019 was statistically presented (Fig. 2). On July, 2019, the seismic monitoring stations were recorded 1073 events on the whole earth range between 2 and 6 M. On that date, the Earth was between Jupiter and Saturn on one side and the sun on the other hand, forming a configuration of semi-straight line. The planetary attraction act as a trigger force to change the speed of the earth rotation. The rotational velocity of the Earth has been calculated for eight seismic events, and it turns out that the velocity was different for each case. In response to that, the tectonic plates act to adjust the rotation speed of the earth and accordingly move suddenly to absorb the stress and reduce abnormal stress abruptly. The changing of speed of the earth rotation estimates to slice the earth crust and reactivate the stressed faults along plate boundaries. Earthquakes can happen as ground shaking, displacement, liquefaction and tsunami which are hazardous to human beings (Elnashai and Di Sarno 2008; Hall et al. 2019). Divergent, convergent and transform plate boundaries are the main areas at which the most geological events such as earthquakes, volcanoes and mountain building takes place in a response to the convection current of the mantle materials as a dynamic system represented by moving plates outward due to the upwelling hot mantle at the mid-ocean ridge, and sinking the cold lithosphere into the mantle at a subduction zone.

Arabian plate and Zagros seismicity

The Red Sea floor spreading is separating the African and Arabian plates. The extension of the Red Sea and Gulf of Aden rift is controlled by the convergent processes between the Arabian plate (AP) and the Eurasian plate (EP) and the extensional processes of seafloor spreading in the Indian Ocea (Goslin and Patriat 1984). Accordingly, the AP has divergent (Red Sea and Gulf of Aden), convergent (Zagros-Taurus Thrust and Folded Belt) and conservative tectonic plate boundaries (Dead Sea) surrounded by African, Eurasian and Indian plates (Al-Dabbagh 2014) (Fig. 3). The ZTZ is a considered as an asymmetrical folded belt of 200–300 km wide extending for about 1200 km from eastern Turkey to the Hormuz in south containing a thick sequence of Paleozoic to Late Tertiary age (Alavi 1994). The ZTZ is an array of reverse faults separates the ZFB from Central Iran (CI) (Berberian 1995). Intense seismicity is mainly restricted along the ZTZ and ZFB (Fig. 3), around reverse faulting planes striking parallel NW- SE trend (Ni and Barazangi 1986). The ZTZ and ZFB seismicity occurred in the upper part of the crystalline basement between 8 and 14 km beneath a thick sedimentary layer (Hatzfeld et al. 2003; Manaman and Shomali 2010; Paul et al. 2006). The earthquake at the AP for the time span 1900–2015, a total number of 13,156 events, of which 497 are historical events were they mostly have intensity ranging from <3 to 6 M, followed by those ranging from 6 to 6.9. whereas those of >7 M are few. The seismic activity is presented by earthquake epicenters for the period 1900–2015 (Fig. 3).

Through more than century from 1900 to 2019, there were 10,737 events, the majority of which (4820 events) are of intensity ranges between 3 and 4 M followed by those (3306 events) characterize by less intensity (2-3 M), whereas strong events were only 24 earthquakes restricted between 6 to 7 M and only 9 earthquakes have 8-9 M (Table 1). At the ZFB and ZTZ along the Iraq-Iran border, earthquakes usually occur and their seismic events on them and near vicinity since 2011 to 2020 presented in Table 1 are shown the common earthquakes ranged between 2 and 3 M, followed by earthquakes of 3-4 M. The seismic activity at the ZFB and ZTZ is presented in Fig. 4, and eighteen events on which were coincided with a planetary alignment (Table 2). Different planets aligned with the Earth act as trigger release energy along strike-slip fault causing earthquakes take place due to the activation of NW-SE trending strike-slip fault. The planetary configuration led to change the rotational speed of the Earth (Table 2). The magnitude of the earthquake is related to the direction of planetary force acting at any particular point (Venkatanathan et al. 2005). In order to calculate some algebraic relationship in the cosmic physics that can be applied to cosmic objects, the general properties of the planets the solar system that have been published by Conte et al. (1997) are used and listed in Table 1.

The formula used for the calculation of the rotational Earth speed (S) at any latitude is:

$$S = V * cos\theta \quad (1)$$

where V is the Earth velocity; and theta (θ) is the latitude at which, the earths speed is calculated. The circumference of the Earth at the equator (0 degree latitude) is 40,070 km with a speed of 1670 km/h decreasing by the cosine of a certain latitude; then, the rotational speed at 45 degrees latitude where cos 45 (0.707) would be 1180 km/h.

For example, the coincided of the alignment of Moon, Mercury, Saturn, Pluto and Earth with an earthquake (4.7 M, 10 km depth) occurred at Kermānshāh, 38 km WNW of Sarpol Zahab on the Iraq-Iran border on 09 Jan 2020 slowdown the Earth rotational speed to 1400.6 km/h, and the Jupiter, Saturn and Earth with a the earthquake occurred in northern Iraq at

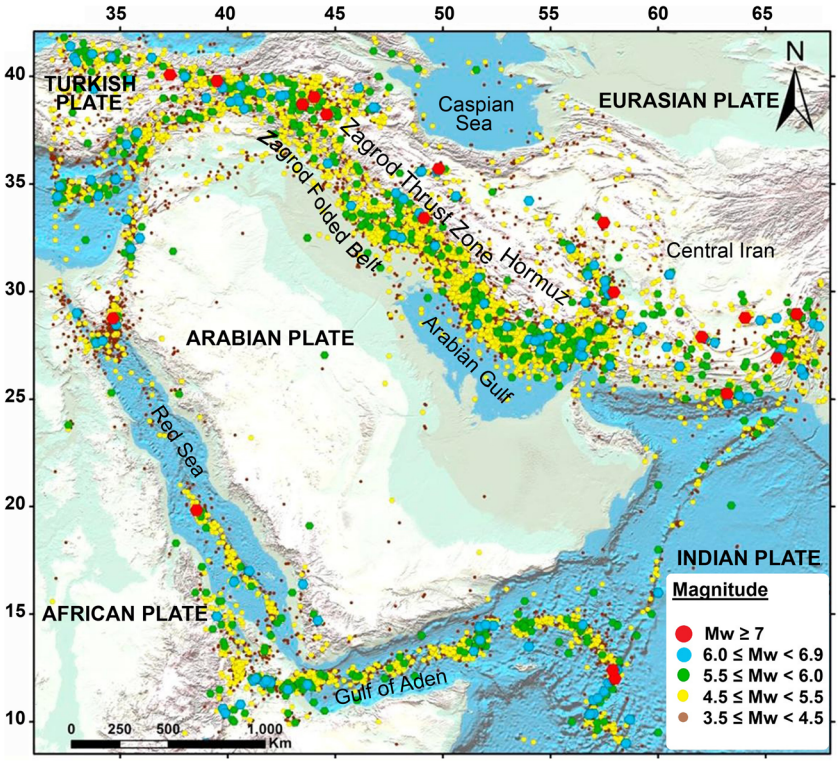

Fig. 3 Tecto-seismicity map of the Arabian Plate (AP) showing the earthquake events in the AP and adjacent areas including the ZFB and ZTZ happened during the period of 1900–2015 (Deif et al. 2017)

Sulaymaniya, 36 km to the west of Derbandkhan, near the Iraqi-Iranian border on 4 July 2020 slowdown the rotational speed of the Earth to1401.6 km/h. The slowdown of the Earth rotational speed confirms that the planet alignment is a trigger that drive the Earth plates that eventually cause the earthquake. Through the event statistics from 2011 until 2019, it was shown that the lowest number of earthquakes was in 2016. They were 483, from which 86 have magnitude between 1 to <2, 267 restricted between 2 and 3, earthquakes range from 3 to 4 was 123, and only 16 have magnitude between less than or equal 4 to less than 5 M. The largest number of earthquakes at the ZFB and ZTZ occurred in 2018, when they reached 1595 earthquakes. The most severe earthquakes occurred in 2017, with intensity 7.3 M.

The properties of the solar system planets coupled with sun and earth's moon are listed in Table 3 so as to serve in calculation the angular momentum and rotational inertia,

The angular momentum (l) is defined by the equation:

$$l = Iv \tag{2}$$

where I is the moment of inertia; v is the angular velocity.

Although the satellites are of small radius, however, they considered as a point mass, in which the moment of inertia is therefore defined I *as:*

$$I = mr^2 \tag{3}$$

Table 1 Seismic activity at the ZFB and ZTZ along Iraq-Iraq border

Years	1≤M<2	2≤M<3	3≤M<4	4≤M<5	5≤M<6	6≤M<7	7≤M<8	Total
2011	262		376	128	26		–	792
2012	98	264	342	126	–	–	–	830
2013	39	361	157	45	8.0	1.0	–	611
2014	14	509	379	44	11	–	–	984
2015	96	307	134	15	–	–	–	
2016	68	267	123	16	–	–	–	483
2017	84	729	401	83	4.0	–	1 (7.3)	1302
2018	11	908	584	79	13	2.0	–	1597
2019	–	449	257	43	5.0	–	–	754
2020	–	143	64	16	–	–	–	223
Up to 8 July 1900–2019	444	3706	4820	1477	257	24	9.0	10,737

$$l = mr^2 v \tag{4}$$

where m is mass, r is radius and v is an angular velocity.

$$I_1 v_1 = I_2 v_2 \tag{5}$$

$$mr_1 v_1 = mr_2 v_2 \tag{6}$$

Therefore,

$$v_2 = \left(\frac{mr_1 v_1}{mr_2}\right) \tag{7}$$

$$l_E = I v_E \tag{8}$$

$$l_E = mr^2 v_E \tag{9}$$

The value of the angular momentum of the Earth is consequently computed to be:

$$l_E = \left(5.97 \text{ x } 10^{24} \text{ kg}\right)\left(1.5 \text{ x } 10^{11} \text{ m}\right)^2 \left(\frac{2\,\pi r}{3.156 \text{ x x } 10^7}\right)$$

$$l_E = 2.67 \text{ x } 10^{40} \text{ kg.m}^2/\text{s}$$

The Earth's radius is much less than its orbit radius, and it can be modeled as a particle rotate around the Sun:

$$l = 0.4\left(5.97\ x\ 10^{24} kg\right)\left(6.38\ x\ 10^6\ m\right)^2 \left(\frac{2\pi\ rad}{86400 s}\right) \tag{10}$$

$$l = 7.07\ x\ 10^{33}\ kg.m^2/s$$

The rotational inertia is calculated by the equation:

$$I = \frac{2mr^2}{5} \tag{11}$$

The kinetic energy (E_k) of a planet can be computed by using the eq. 12, and for the Earth is computed and presented in Table 4.

$$E_k = \frac{1}{2} mv^2 \tag{12}$$

The gravitational potential energy (E_g) between the Earth and the moon is

$$E_g = -G\frac{M_{moon} M_{earth}}{r} \tag{13}$$

where v is the planet's tangential velocity, G is Newton's constant and r is the earth-moon distance.

$$E_{tot} = E_k + E_g \tag{14}$$

E_{tot} is the total energy.

The oval shape of the lunar orbit results in a change in the distance between the Earth and the Moon. Consequently, the gravitational energy changes a bit, while the orbital kinetic energy is changing just enough to balance the total energy**.** The rotational/revolving speed, angular momentum and rotational inertia of the Earth is calculated and listed in Table 4.

Discussion

As is currently recognized, a gravity acts with the convection current in the mantle as main driving forces of plate tectonics. The dense oceanic lithosphere dives beneath the less dense

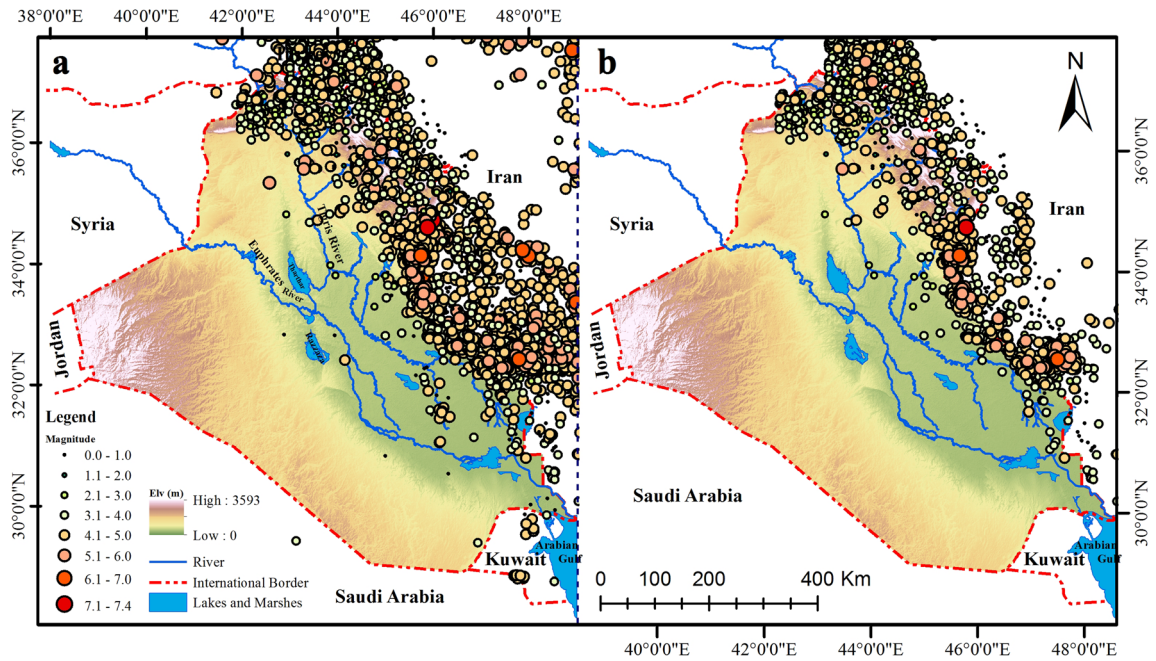

Fig. 4 The seismic activity at the ZFB and ZTZ; **a** from 1900 to 2019; **b** for 2011–2020

Table 2 Detailed earthquake data of the ZFB and ZTZ

Place, date and time	Epicenter coordinates	*M	Depth (km)	Planet aligned	Earth rotational speed (S) at epicenter (km/h)
Baynjiwayn, Sulaymaniya, Iraq 17 Sep, 2019 19:29 PM	35.348, 46.209 28.2 km from Banjiwayn	4.6	18	Mars Moon	1367.9
Mehran, Iran 28 Dec 2019 10:20 AM	33.001, 46.57 42.2 km from Mehran	4.5	10	Moon Venus	1474.5
Kermānshāh, Iran 09 Jan 2020 10:51 AM	34.613, 45.487 38 km WNW of Sarpol Zahab	4.7	7	Moon Mercury Saturn Pluto	1400.6
Mandali, Diyala, Iraq 28 Jan 2020 06:52 AM	33.731, 45.727 16 km E of Mandali, Iraq	4.9	10	Moon Saturn Pluto	1460.6
Mandali, Diyala, Iraq 28 Jan 2020	33.731, 45.727 16.2 km Mandalī	4.8	10	Moon Saturn Pluto	1446.3
Mandali, Diyala, Iraq 29 Jan 2020	33.647, 45.739 16.2 km Mandalī	4.4	10	Moon Saturn Pluto	1455.6
Kirkuk, Iraq 16 March 2020 07:13	35.637, 44.243 23 km NW of Kirkuk	4.4	10	Mars Jupiter Saturn	1416.2
Sulaymaniya 4 July 2020 12:06	33.47°N, 46.02°E 36 km W Derbandkhan	3.5	10	Jupiter Saturn Moon	1445.6
Ghare Shirin, Kermanshah, 8 July 2020, 16:05:10	34.42 N, 45.52E	3.0	9.0	Jupiter Saturn	1450.1
Ghare Shirin, Kermanshah, 8 July 2020, 14:29:09	34.40 N, 45.53E	2.7	19.94	Jupiter Saturn	1450.5
Alamarodasht, Fars 7 July 2020, 23:57:29	27.69 N, 53.01E	3.0	9.97	Jupiter Saturn	1449.2
Arad, Fars 7 July 2020, 20:40:41	27.73 N, 53.45E	3.3	5.95	Jupiter Saturn	1448.4
Arad, Fars 7 July 2020, 23:20:29	27.63 N, 53.49E	3.3	9.97	Jupiter Saturn	1448.1
Lirdaf, hormozgan 7 July 2020, 03:57:10	25.89 N. 58.53E	2.9	19.95	Jupiter Saturn	1450.2
Qatruyeh, Fars 8 July 2020, 07:45:59	28,90 N, 55.07E	2.6	4.99	Jupiter Saturn	147.8
Bandar Chark, Hormozgan 8 July 2020, 12:45:53	26:84 N, 54.10E	3.9	9.98	Jupiter Saturn	1459.9
NE Iran 8 July 2020, 10:10:57	37.67 N, 46.15E	4.05	9.98	Jupiter Saturn	1357.6
Iran-Iraq border 8 July 2020, 10:10:38	34.12 N, 45.59E	4.2	9.98	Jupiter Saturn	1417.4

*M: magnitude

Table 3 Properties of the solar system planets together with sun and earth's moon (after Conte et al. 1997)

Property	Sun	Mercury	Venus	Earth	Moon	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Distance from Sun (10^8 km)	0.0	57.9	108.2	149.6 (av) 1.521 (min) 1.471 (max)	150	227.9	778.3	1427	2873	4498	5914
Equatorial diameter (km)	14×10^5	488	12,104	12,756	3476.2	6787	142,800	120,600	51,300	49,100	2300
Mass (g)	1.989×10^{33}	3.3×10^{26}	4.9×10^{27}	6×10^{27}	7.35×10^{25}	6.4×10^{26}	1.9×10^{30}	5.7×10^{29}	8.7×10^{28}	1×10^{29}	$1.5X10^{25}$
Mass to Earth	333,000	0.055	0.815	1.0	0.123	0.1	317.9	95.2	14.4	17.2	0.1?
Volume (km/cm^3)	1.409×10^{18}	6.083×10^{10}	9.284×10^{11}	1.083×10^{12}	2.196×10^{10}	1.632×10^{11}	1.4313×10^{15}	8.271×10^{14}	6.833×10^{13}	6.25×10^{13}	7.15×10^9
Volume to Earth	$1.3X10^6$	0.06	0.88	1.0	0.0203	0.15	1316	755	67	57	0.1?
Radius (km)	69,634	2440	6052	6371	1737	3390	69,911	58,232	25,362	24,622	1188
Density (g/cm^3)	1.14	5.4	5.2	5.5	3.34	3.9	1.3	0.7	1.3	1.6	2.0
Revolution period	250×10^6 years	88 days	224.7 days	365.26 days	27 days	687 days	11.86 years	29.46 years	84.01 years	164.8 years	247.7 years
Rotation period	24 days	59 days	243 days	23 h, 56 min	27 day	24 h, 37 min	9 h, 50 min	10 h, 14 min	17 h, 12 min	22 h	6 days, 9 h
Axis inclination	7.5	0	178°	23° 27'	6.68°	23° 59'	3° 5'	26° 44'	82° 5'	28° 48′	?
Orbit inclination to earth's orbital plane	66.5°	7°	3° 24'	0	1.45°	1° 51′	1° 18'	2° 29'	0° 46'	1° 45'	17° 12'
Orbital speed (km/s)	200	47.9	35	29.8	1.022	24.1	13.1	9.6	6.8	5.4	4.7
Gravity (m/s^2)	274	3.7	8.87	9.807	1.62	3.711	24.79	10.44	8.69	11.15	0.62
Gravity relative to Earth	22.84	0.38	0.9	1.0	0.164	0.38	2.54	1.07	1.17	1.2	0.063
Escape velocity (km/s)	618	4.3	10.4	11.2	2.38	5	60.2	37	22.5	23.9	low
Atmosphere (%)	–	He (98) H_2	CO_2 (96), N_2	N_2(77), O_2(21)	–	CO_2 (95), N_2	H_2(89), He	H_2(87), He	H_2,He,CH_4, NH_3	H2,He,CH_4	CH_4
Magnetic field	Very strong	weak	Yes	Strong	Very weak	Weak	strong	strong	strong	?	?
Internal composition	–	Fe core silicate	Fe-Ni core silicate	Fe-Ni core Silicate mantle and crust	Fe-Ni core, Ultrabasic mantle, Mg-Ca silicate crust	Solid Fe-FeS core. Silicates	Ice-silicate core, liquid H_2 mantle	Ice-silicate core, liquid H_2 mantle	Rocky core, liquid H_2O mantle	Rocky core, ice mantle, H_2+He crust	CH_4

Table 4 Rotational/ revolving speed, angular momentum and rotational inertia of the Earth

Rotation type	Position	Speed (km/h)	l (kg.m^2/s)	I (kg.m^2)	E_k (kg m^2 / s^2)	$E_{g\ earth\text{-}moon}$ (kg.ms^2
Rotation	At equator	I,670	7.07×10^{33}	79.192×10^{76}	38667×10^{29}	432.18×10^{52}
Revolution	At equator	108,805.7	2.67×10^{40}	5.3712384×10^{43}	$355{,}495{,}393.5\times10^{27}$	–
Rotation	At 45°	1180	–	–	–	–

$*l$ is the angular momentum; $**I$ is the rotational inertia; E_k is kinetic energy; E_g is gravitational potential energy

other plate and sinks into the mantle whenever they have collided post convergent (Gill 2012). The sinking oceanic lithosphere drags the rest plate downwards causing plate motion. On the other side, new mid-ocean ridges create by submarine volcanism. The mantle convection currents work together with gravity to move plates by flowing the hot rock materials upward to the crust, while less hot materials move downward. The tide of Earth's surface may move up and down by a couple of centimeters, but the tide of ocean surface of the ocean moving up and down by a meter or more (Affholder and Valiron 2001) (Pickard and Emery 2016). The high tide increases the probability of slipping the dipping faults near the boundary of plates. The observed of focal mechanisms of earthquakes at the ZTZ and ZFB are reverse and strike-slip faulting (Tatar et al. 2004). The linking of reverse and strike slip faulting resulted in oblique convergence between the AP and CI is accommodated by the deformation distribution of both shortening and strike slip motion in the Zagros (Talebian and Jackson 2004).

Previous studies did not show any significant correlation between the incidence of earthquakes and the semi-diurnal tides according to the large earthquake records (Tavares and Azevedo 2011). The Earth's gravitational field is somewhat disturbed according to planetary positions relative to Earth. It was found that there is a significant increase in earthquakes associated with the maxima solar cycle and often occurs in the Pacific Ocean, South America (Tavares and Azevedo 2011), and eventually, the entire environment is affected by the solar wind energy that strikes the earth's magnetosphere causing shrinks earth's radii due to pressure increase, consequently, earthquakes in specific plates happen due to the sudden compression (Tavares and Azevedo 2011). Bonnet et al. (2019) had documented seamount buildup and with subduction down to ~30 km; they also clarified that this type of seamount building did not cause a large earthquake, but acting as barriers. Banerjee et al. (2018) found that strong earthquakes generate a gravity variation. The results of this research bring attention to the extent to which the Earth is affected by its momentarily changing location over time, as it confirms the occurrence of the tidal frequency due to the continuous variation of the Moon position around the Earth, and indicates the solid relationship between the spatial position of the Earth within the planets of the solar system. Sun-Earth, Moon-Earth or Sun-Moon-Earth is considered as influencing external variables stimulate earthquakes depending on the location where the event happened (Hagen and Azevedo 2019).

Earthquakes are a reaction to the action of the dynamic changing of the Earth. The most important factors affecting the occurrence of these changes are the volume of the planets and their distances. The distance between the Earth and the Moon is semi-constant (384,400 km) increases 4 cm each year, whereas, the distance between the moon and the sun is not constant because the moon revolves around the Earth, and the Earth revolves around the sun. The closest distance between the sun and the moon is therefore 146.7 million km, and the most distant distance between the sun and the moon is 152.5 million km. The cause of the tidal phenomenon is the result of the moon's gravity and rotation around the earth. The orbital rotation of Jupiter around the sun is eleven years long, thus, periodic changes may be repeated as per eleven years. Many earthquakes are related to Jupiter's position, because it attracts earth, consequently, the Earth's events can be predicted. The review of the seismic history of the Earth indicates that the planetary alignment coincided with the fiercest seismic events; for example, an earthquake of 9.5 M occurred in Chile on 22 May 1960 coincided when Jupiter and Saturn became on one line with the Earth. When an earthquake of 9.2 M struck Alaska Island on 28 March 1964, the Earth has in semi line with Saturn and Uranus. An earthquake of 8.08 M occurred in Chile on 2nd Feb 2010, the Earth was under gravitational stress between Mars and Saturn. Finally, the 20 largest earthquakes in the world are listed in Table 5. There is a seasonal difference in the seismic activity, as water of heavy rainfall penetrating downward acting as a lubricant to slide the plates and activating faults. On the other hand, Severe evaporation means less the Earth weight which is estimated at billions of tons leading to relative change of the earth's gravity and consequently difference in rotational speed, which contributes to stimulating earthquakes.

Table 5 Planetary configuration of the largest earthquake events in the world

Mag	Location	Alternative name	Date (UTC)	Time (UTC)	Latitude	Longitude	References	Planetary alignment
9.5	Bio-Bio, Chile	Valdivia Earthquake	22-05-1960	19:11	38.14°S	73.41°W	(Kanamori and Anderson 1975)	Jupiter Saturn
9.2	Southern Al-Aska	1964 Great Alaska earthquake, prince William sound earthquake, good Friday earthquake	28-03-1964	3:36	60.91° N	147.34°W	(Kanamori and Anderson 1975)	No
9.1	Off the west coast of Northern Sumatra	Sumatra, Andaman Islands, Earthquake, 2004 Sumatra Earthquake and Tsunami, Indian ocean Earthquake.	26-12-2004	00:58	3:30°N	95:98°E	(Duputel et al. 2012)	Saturn Moon
9.1	Near the East Coast of Honshu, Japan	Tohoku Earthquake	11-03-2011	5:46	38:30°N	142:37°E	(Duputel et al. 2012)	Saturn Moon
9	Off the East Coast of the Kamchatka, Peninsula, Russia	Kamchatka, Russia	04-11-1952	16:58	52.62°N	159.78°E	Kanamori, 1976	Jupiter Moon
8.8	Offshore Bio-Bio Chile	Maule Earthquake	27-02-2010	6:34	36:12°S	72.90°W	(Duputel et al. 2012)	Saturn Mars Moon
8.8	Near the Coast of Ecuador	1906 Ecuador-Colombia Earthquake	31-01-1906	15:36	0.96°N	79:37°W	(Kanamori 1977)	No
8.7	Rat islands, Aleutian Islands, Alaska	Rat islands earthquake	4-2-1965	5:01	51.25°N	178.72°E	(Kanamori and Anderson 1975)	Mars Moon Uranus Pluto
8.6	Eastern Xizang- India border region	Assam, Tibet	15-08-1950	14:09	28.36°N	96.45°E	(Kanamori 1977)	No
8.6	Off the west coast of Northern Sumatra		11–04–2012	8:39	2.33°N	93.06°E	(Duputel et al. 2012)	Jupiter Moon Mercury
8.6	Northern Sumatra, Indonesia	Nias Earthquake	28-03-2005	16.10	2.09°N	97.11°E	(Earle et al. 2012)	Jupiter Moon Mercury
8.6	Andrean of islands, Aleutian Islands, Alaska		09-03-1957	14:23	51.50°N	175.63°W	(Johnson et al. 1994)	Jupiter Moon
8.6	South of Alaska	Unimac islands earthquake, Alaska	01-04-1946	12:29	53.49°N	162.83°W	(López and Okal 2006)	Jupiter Moon Mercury
8.5	Banda Sea		01-02-1938	19:04	5:05°S	131.61°E	(Okal and Reymond 2003)	No
8.5	Atacama, Chile	Chile-Argentina border	11-11-1922	4:33	28.29°S	69.85°W	(Kanamori 1977)	Moon Venus
8.5	Kurl islands		13-10-1963	5:18	44:87°N	149.48°E	(Kanamori and Anderson 1975)	Jupiter Moon
8.4	Near the East Coast of the Kamchatka, Peninsula, Russia	Kamchatka, Russia	03-02-1923	16:02	54.49°N	160.47°E	(Okal 1992)	Mercury Moon Nepton
8.4	Southern, Sumatra, Indonesia		12-09-2007	11:10	4.44°S	101.37°E	(Earle et al. 2012)	Venus Moon Uranus
8.4	Near the coast of southern Peru	Arequipa, Peru earthquake	23-06-2001	20:33	16.27°S	73.64°W	(Duputel et al. 2012)	Mars Moon Mercury
8.4	Off the East Coast of Honshu, Japan	Sanriku, Japan	02-03-1933	17:31	39.21°N	144.59°E	(Kanamori 1971)	Jupiter Mars

Earthquakes pose great danger to human life and property, and tsunamis rapidly produces harmful effects on coastal surroundings as seawater extends farther inland bringing destructive erosion, flooding, contamination of agricultural lands. It also can harm plants, birds and fish. This research proposes a new conceptual hypothesis that can be developed as a guide for warning and community response to risks and disasters, to enhance pre-disaster activities that certainly have the potential

to reduce disaster losses, and mitigate risks. Hence, understanding this concept, although it protects people's lives, it also enhances coastal engineering design.

Conclusions

This research dealt with the phenomenon of tides and earthquakes from a geoastronomical point of view affected by planets and the Moon configuration relative to the Earth, and draw several findings. Different positions of the planets control the rotational/revolving speed of the Earth. The alignment of the Earth with two planets in a straight line causes the rotational speed of the Earth to slow down, the planetary attraction act as trigger generating earthquakes, as the earthquakes is negatively proportioned with the rotational speed of the Earth. Any shifting speed of earth rotation or revolution stimulates plate tectonics to move and activates faults as well as urging the water to rush forward that leads to sudden high wave seas and oceans resulting in what is known as the tsunami. As for the sea tide, it occurs as a direct result of lunar attraction. The earthquake events follow the alignment of planets relative to the Earth; and if the Earth's position approaches an alignment with another planet along a straight line at an angle of 180 with the sun it warns of an earthquake and can be predicted approximately. The frequency of earthquakes less than 6 degrees on the Richter scale, which was detected was related to planetary alignment. The speed of the Earth's rotation is affected according to its location within the solar system, and the Earth's rotational/revolving speed slowdown when it becomes under the stress of the alignment of the planets, which contributes to moving the Earth's plates. This research has built a prediction of an earthquake of around 5 M will be occurred on the ZFB and ZTZ at the Iraq-Iran border on 11 Feb, 2021. However, further efforts are required to evaluate the viability of the predictions, and the study recommends to correlate the world seismic record with the planetary configuration, focusing particularly on aligning of the influencing planets (Mars and Jupiter). On the other hand, the seismicity appears to be shallow as mainly located in the upper part of the crystalline basement with depth not exceed 10 km.

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Declarations

Conflict of interest The authors declare no conflict of interest.

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