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Interactive comment on “Causes of earthquakes and lithospheric plates movement” by L. Ostřihanský

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Answer to Anonymous Referee. The title is not misleading; the paper really proves that the seismic activity is the result of external forces acting on the Earth. The Referee fully understood the first target of the paper about the effect of zonal tides. In the second target there is certain misunderstanding the gravitational influence of the Moon is not only on terrestrial tidal bulge bur also on the bulge created by the Earth's flattening. The Referee's comment in column 1): (rows 6-15) the energy of rotational variation exceeding the energy of the greatest seismic event including the formula is very important and I intend to include it to the final arrangement of the paper. As well the remark about the dominance of the azimuthal stress over the meridional one between equator and 48.20 latitude is very important. For this reason for the westward drift I

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consider the area of the tidal bulge (height in range 1 m) but for the N-S movement the flattening caused by the Earth's rotation (height in range 20 km) and the tidal force acting on this flattening (Fig. 2.1). For the study I use the easily available seismological data from USGS NEIC and in some cases from ANSS Catalogue. In this paper the declustering was not performed. It is difficult to distinguish aftershocks from the main shock. Sometimes aftershocks correlate better with LOD than the main shock as can be seen in earthquake Sumatra 28. March 2005 (Fig. 3. (a)). For the Honshu earthquake 11. March 2011, M 9. (Fig. 5. (a)) the earthquake 11. February 2011 in South America is important created exactly 27 days earlier. I have nothing about the claim that the subduction of the Pacific plate has an extensional component however I claim that it is not consistent with the mantle flow but with its subsidence by gravity. Beneath the Eurasian plate there is an eastward mantle flow. A better imagination is that the Eurasian plate together with the Okhotsk plate move westward loosing the Japan islands behind. The westward movement of the Eurasian plate cannot be detected by GPS, which considers the lithosphere stable with GPS satellite system but the abrupt loosing the Honshu Island after releasing the place after the Pacific plate subsidence is remarkably evident from GPS as quick eastward movement (Fig. 5. (b)). In the paper of Defraigne and Smits I did not find any tidal earthquake triggering. The paper of Stavinschi and Souchay presents very convincing correlations of tides and earthquakes in Vrancea zone in Carpathians. Also Cadicaneanu et al., 2007 presented correlations of earthquakes with main lunar and semidiurnal solar tidal components. Our research group very carefully study earthquakes in Carpathians. In Vyhne the strainmeter is installed. The correlation of earthquake with tides I did not study till now, therefore I am not able to make a statement to it. I cannot agree with the Referee at the end of his Comment. There are mentioned several papers of Doglioni et al., 2007, Doglioni et al., 2009, Bostrom 2000, and Bostrom 1971. All these papers present the greatest error: The claim that the Earth's rotation only influences the plate motion and not determines. I argued with Prof. Bostrom in IUGG 1991 in Vienna. I told him several times that he is wrong. The paper should be published because the non-sense about

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mantle convection worked out by geologists the geodesists accept as dogma using it in determination of tidal constituents. The mantle convection is a non-sense which contradicts to observations. Nobody indicated convection cells in mantle and nobody indicated that the convection current would drift the plates. Measurement of the heat flow in oceans argues against such currents. Finally interpretations of seismic tomography ended speculations about convection in mantle. Stress in lithospheric plates in “triple points” where three plates by mid-ocean ridge are connected is in contradiction with an imagination of tension or pressure by convection currents in one direction. Mid-ocean ridges are not stable on mantle but they move with an average speed of adjacent plates. The direction of the plate movements is given by vectorial sum of the westward movement and by the movement in N-S direction. At present time the movement is northward after the decay of Gondwana on the south pole (Fig. 2.5b and Fig. 2.5.c). After the separation of Gondwana from Laurasia the Gondwana moved southward. These two components movement are fully in agreement with the action of tidal forces. Westward drift is given by variations of the Earth’s rotation and the N-S movement is given by action of tidal force on the Earth’s flattening. Absence of tidal forces in higher latitudes results in stable position of Antarctica and Eurasia in higher latitudes. Movement of plates can be exactly reconstructed knowing the age of oceans in every point from mid-ocean ridges as far as continents and subduction zones. Movements depicted schematically on Fig. 2.5a are therefore fully founded. LOD results in variable torques calculated in the paper introducing plates into movement. Forces corresponding to N-S torques exerted by Earth’s flattening vary from maximum to minimum in 12 hours (Fig. 2.1). Forces of westward torques vary from LOD maximum to minimum in 6.83 days. Vectorial sum of these forces directs only on N or to W if one of torques distinctly elevates over other one. For this reason the earthquakes need not always correspond to LOD extremes and the problem can be solved only statistically. However, also statistics need not convey always to correct results. Example: The repetition of earthquakes in the Metonic cycle needd not occurs always in 19 years period but only in coincidence of 19. years with 18.61years tidal wave. Lubor Ostrihansky

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