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Seismic evidences of the Earth rotation role in geodynamics

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In the last decade the problem of differential rotation of the Earth as a semisolid planet attracts particular interest among geologists and geophysics [Bostrom, 2000; Riguzzi, 2010]. A very peculiar bimodal form of latitude distribution of released energy during large earthquakes at the Earth (two strongly pronounced peaks of seismic activity in middle latitudes, a local minimum near equator, and practically zero seismic activity in the high latitudes) presented by [Sun, 1992]. Because up to the present time we have not well founded explanation observed pattern of the global earthquake (EQ) distribution, authors fulfilled data processing of the big seismic data array (about 250000 events with $M \geq 4$, compiled on the base of the ISC catalogue). It was shown [Levin, Sasorova, 2009] that seismic activity of the Earth is almost absent in the high latitudes and in polar caps of the Earth and reveals clearly expressed maximums in middle latitudes of the Northern (40º-50º) and Southern Hemispheres (30º-40º) and the local minimum near the equator. These bimodal distributions by latitudinal belts are observed for a number of seismic events and for released energy. The most earthquakes are concentrated in lithospheric plates boundaries, thus normalizing of earthquake number and released energy by length of the plate boundaries was used. The stability of the obtained distributions in space and time was proved.
The latitudinal distribution of the hotspots of the Earth (calculated on the base of works [Courillot et al, 2003 and Stothers, 1993]) also displays the same bimodal distribution. Analysis of lunar seismicity based on observations fulfilled within the framework of the “Apollo” Project (1971–1974) [Lammlein, 1977] shows, that seismic activity on the Moon also almost absent at high latitudes, reveals clearly expressed maximums at middle latitudes of both hemispheres, and has a local minimum near the lunar equator [Levin, Sasorova, 2010]. Such pattern of distribution is characteristic for both deep and shallow lunar events. Thus a similarity in the latitudinal distribution of seismic activity for different celestial bodies and in latitudinal distributions of the terrestrial hotspots was shown. This similarity may point on the fundamental relationship between some geophysical process and physical mechanisms (regularity), which influences on different geophysics effects in the same way.
The attempt to search the relationship between the rotation process characteristics of the Earth and listed above observation data was carried out. The rotating body is regarded as ellipsoid of revolution consisted from the sum of infinitely thin disks, which are perpendicular to rotation axes. An inertia moment of rotation body and the gradient of the inertia moment as the function of the distance between the equator and infinitely thin disk (polar radius) are calculated. The flex point of the inertia moment plot as function of polar radius is determined as critical geocentric latitude. The gradient of the inertia moment of the infinitely thin disks becomes maximum value in this point. The calculations were fulfilled both for homogeneous and nonhomogeneous in density Earth. The critical latitude for homogeneous in density Earth is equal to 35º15’22". Three Earth models (Bullen and Haddon, 1967; Anderson, 1989; and Montagner, 1995) are used for calculation the critical latitudes for nonhomogeneous Earth, they are equal to 26º18’36", 26º10’16", and 26º17’24" respectively.
Presented seismic and tectonic manifestations of the Earth’s rotation effects illuminate one of the possible causes of occurrence of the critical latitude belts. The decision of this problem will demand many efforts. But the promissory direction of the research may be a study of the special effects of celestial body rotation and hydrodynamic instability zone searching.