EPSC Abstracts
Vol. 5, EPSC2010-431, 2010
European Planetary Science Congress 2010

The seismic activity in 2001-2005 and movement of the Earth pole

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Abstract

The relationship between the parameters which characterize the movement of the Earth pole and seismic activity are considered. The correlation of the considered parameters is studied.

1. Introduction

The discussions about the relationship of poles movement and irregularity in speed of Earth rotation with seismic activity were actively performed in 60-70th years of last century [1]. Mainly, the influence of seismicity on pole movement was considered in this works. In particular, the question about excitation of a pole by earthquakes chandler's fluctuations [2, 3] was studied. An interest in the similar researches continues till now. The chandler's movements investigations and their relation with rotation of the Earth and seismicity [4, 5 and 6] were proceeded. The correlation between appearance of earthquakes and abnormal evasion of time and latitude for the observatories located near an epicenter was also discussed [7, 8 and 9].
Scientists of Institute of Astronomy of the Russian Academy of Sciences and the Crimean astrophysical observatory from the analysis of 130 thousand earthquakes had been established a high correlation between the global seismic activity and the changes of angular speed of the Earth rotation [10].
O.V.Ponomareva from Far East center of science has received quite interesting results. She found, that high correlation communication between the parameters, which characterize the Earth rotation and seismic activity, exists in a long periodical range. The data analysis of seismic events of 2004-2007 near island Sumatra has led to indignation of a speed movement vector of a pole along axis X [11].
What changes in position of the Earth pole do occur as a result of the strongest earthquakes? To answer on this question it is necessary to study variations of "an average pole", where the basic periodic components in movement of a pole having amplitude 0.1"-0.3" are accepted.

2. Analysis of the question

To perform the analysis of the pole co-ordinates (X and Y) the International service of the Earth rotation for 1995-2007 have been considered [15].
Linear Orlov-Saharov transformation has been applied to an exception of the periodic movement [14]. On the basis of this positions changes of an average pole (aperiodicity displacement and long periodical variations of an axis of rotation in a Earth body) have been calculated with an interval of 0.1 years.
For a special presentation, the scale on a vertical axis of the data presented in Fig.1 is increased in 10 times. It is seen that the sharp changes in such parameters as direction, speed and size of an average pole displacement have occurred in 2000- 2002. For the rage from 2000.2 to 2001.2 y a pole displacement is 0.017" (0.52 meter) on axis X (along a meridian), whereas for the range from 2001.8 to 2003.0 y., the pole was moved on 0.019" (0.59 meter) to the West on axis Y. Since 2003 the movement of an average pole was practically stopped. In the range 2003-2006 the movement does not exceed 0.001" (0.03 meter). Usually, periodic of movement of a pole and displacement of an average pole on schedules are presented in a vector form.

Thus, the changes of position of an average pole of the Earth was preceded the most considerable seismic events of the beginning of 21 century. As a whole, the increase of seismic activity has begun after 2002 only. For example, there were 2 strong earthquakes with magnitude 7 and more (Salvador, India) in 2001 , 2 earthquakes (Tajikistan, Taiwan) occurred in 2002, and 5 (including earthquake in Mountain Altai) were in 2003, 5 earthquakes (including near to an island Sumatra)were in 2004, 4 earthquakes (again Sumatra, Iran, Japan, Pakistan) occurred in 2005.

There is a correlation between of the strongest earthquakes and fluctuations in the movement of an average pole. Results of work [11] say that such a dependence must exist. A detailed study of such a correlation would be useful for the forecast of the strongest earthquakes. Obviously, for an exact study of this question it is necessary to increase a time interval.

Another interesting aspect of interrelation of a pole movement and earth activity is revealed. It is appeared that the moments of earthquakes are closely related with a phase of a pole periodic movement on the given meridian, and occur more often near maxima or minima of this movement.

The schedules of change of astronomical latitude (a projection of movement of a pole for the given meridian) calculated in the basis of the known formula of Kostinsky:

$$\Delta\varphi = X\cos\lambda + Y\sin\lambda, \qquad (1)$$

where X and Y are co-ordinates of the Pole, A is the longitude of the earthquakes point.

The change of the earthquakes latitude point on the sinusoid are shown. The appearance of earthquakes are represented by lines. Not all earthquakes take place near extreme. For a quantitative estimation, 21 greatest earthquakes were studied.

The value of the interval changes during each six-year period. Each period includes fluctuation of the main component (year) and additional component (14 months), which form the pole movement. It should be noted that the quantity of half period sometimes is characterized by higher values in 2001-2005, but not less than 0.55 of year (near 200 day). Let us divide this quantity into three parts: 1) the middle; 2) 0.28 of year; 3) two intervals which is equal 0.14 of year (for the range from extremum to medium). The sum of these intervals is a half of the interval between closest extremes. It turned out that 16 earthquakes (76 % of the total number) are in the interval 0.14 of year (i.e. 50 days) from the closest extremes. Five earthquakes only are in the middle part of the interval between the next extremes (0.15-0.24 of year), including the strongest earthquake in the Gorno-Altai autonomous region (the magnitude is 9).

The change of velocities of the moving pole can be taken as an external factor to characterize the appearance of earthquake. This change of velocities can be a trigger, when earthquake has already "ripened". On the other hand, it is possible that the anomalous deflections in astronomical observations of the latitude before the strong earthquakes [7,8,9] and concentration of the earthquake appearance near extreme of the moving pole on the given meridian are closely related. The anomalies are also correlated with the deforming of the terrestrial cortex, which exist before earthquakes.

3. Summary and Conclusions

In conclusion, this results can be useful in the prediction for the appearance of the forthcoming earthquakes.

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