

Geodetic consequences of the northern drift of the Earth's core and their confirmations in the space geodesy data

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In the last 10 - 15 years the Russian and Chinese scientists have been fulfilled geodetic studies of contrast changes in the shape of the Earth, in the northern and southern hemispheres. In the works of Chinese scientists were executed empirical studies of secular variations of volumes of the northern and southern hemispheres, secular changes in the lengths of the circles of latitude in the southern and the northern hemispheres, the secular changes in the mean radius of the northern and southern hemispheres on the basis of current data space geodesy and VLBI data. For what was made a careful selection of monitoring stations and analyzed long series of high-precision measurements of the radii of stations and their displacements in the basically Earth's reference frames. In the works of Prof. Y. Barkin and colleagues (starting from 1995 -1996) the modern geodynamics of the forced librations of the core and mantle of the Earth by the gravitational attraction of external celestial bodies has been developed and has been given wide applications in geosciences, in particular in geodesy.

The most important result is the prediction and justification of the existence of the secular trend of the center of mass of the Earth as a consequence of the secular northern drift of the core of the Earth relative to the mantle. The wide geodynamic, geophysical, geodetic studies and their role in climatic change, seismic and volcanic activity, and in many other natural processes have been fulfilled in the last 15 years. Modern DORIS satellite observations (in space geodesy) indicate the existence of the secular polar drift of the center of mass of the Earth (to the North) at 5.29 mm / year. This drift reflects the Earth's core drift (drift of the center of mass of the core relatively to the center of mass of the mantle) at a rate of 27.4 ± 0.8 mm / year (Barkin, 2005). Gravitational effect of the shifting core causes deformations of all layers of the mantle and various offsets of its points (both on the surface and inside the Earth). As a result of these deformations the mean radius of the northern hemisphere increases with secular velocity about 0.17 mm / year, and the mean radius of the southern hemisphere on the contrary, decreases with the same magnitude of velocity - 0.17 mm / year (Barkin, 2005, 2011). As a result of careful processing of satellite data and VLBI observations at 845 stations in a recent paper (Wenbin Shen et al., 2012, private communication) were obtained related values of 0.46 ± 0.01 mm / year and -0.19 ± 0.01 mm / year, respectively. The theoretical value of the greatest secular velocity of lengthening of latitudinal circles in the southern hemisphere at latitude 45° S is 4.17 ± 0.12 mm / year, and in the northern hemisphere the secular velocity of shortening of latitudinal circle (for latitude 45° N) is -4.17 ± 0.12 mm / year. According to the processing data of GPS observations Jin Shuanggen in 2005 has obtained related values of secular velocity in 4.2 ± 0.5 mm / year and 10.0 ± 1.0 mm / year for the corresponding hemispheres (Jin, 2005; Barkin, Jin, 2006, 2007). Thus the main trends of geodetic changes of the northern and southern hemispheres has obtained a nice explanation. Revealed an asymmetry in the shape of the Earth changes are apparently related to the formation of zones of rifting and subduction zones in their asymmetrical arrangement in the northern and southern hemispheres. Also in our joint work we have fulfilled studies of the dependence of the mean radius of the Earth and the mean velocity of secular change in the length of the latitudinal belts from the latitude (Barkin, Jin, 2007; Wenbin Shen, 2012). Theoretical results and data of satellite observations are in good agreement. The report also discusses the expected related phenomena on the Moon and Mars and the possibility of theoretical prediction and detection by high-precision observations in the planned space missions.

Keywords: drift of center of mass, secular geodesy variations, mean radiuses of hemispheres, the Earth, Mars