



Mechanism of secular increasing of mean gravity in Northern hemisphere and secular decreasing of mean gravity in Southern hemisphere

Yu.V. Barkin (1) and J.M. Ferrandiz (2)

(1) Sternberg Astronomical Institute, celestial mechanics and gravimetry, Moscow, Russian Federation (barkin@inbox.ru, 07-495-9328841), (2) Alicante University, department of applied mathematics, Spain (jm.ferrandiz@ua.es)

Mechanism. To present time the observant data in various geosciences more and more confidently testify for the benefit of existence of secular drift of the Earth core in the direction of North Pole.

1). So the superfluous mass of a displaced core relatively to elastic mantle, obviously, results in displacement of the centre of mass of the Earth with respect to basic system of coordinates on a surface of the Earth also in northern direction. Methods of a space geodesy let us confidently to determine drift of the centre of mass to the north with velocity about 0.5 - 1.0 cm/yr. The fundamental phenomenon of drift of the centre of mass and the core of the Earth has been predicted in 1995 (Barkin, 1995) at the analysis of secular change of the pear-shaped form of the Earth in present epoch (velocity of drift of the centre of mass of the Earth was appreciated in 1.8 +/-1.0 cm/yr in the direction of North Pole of the Earth). For an explanation of observably drift of the centre of mass at once the model of drift of the core was offered and the geodynamic model of forced relative displacements and wanderings of interacting shells of the Earth under action of a gravitational attraction of external celestial bodies (Barkin, 1996, 2002) has been developed.

2). The core makes slow secular drift and cyclic displacements. Predicted spectrum of oscillations of the centre of mass of the Earth and its core (Barkin, 2001) has received precise confirmation as a result of the Fourier analysis of temporal series for coordinates of a geocenter (Kaftan, Tatevian, 2003; Barkin, Vilke, 2004; Barkin, Lyubushin, Zotov, 2007).

3). The displaced core makes active all bouquet of natural processes in all shells of the Earth (including an atmosphere, ocean and internal shells), varying in the certain rhythms and styles the tension conditions of shells, their thermodynamic conditions etc. The core as though "conducts" by all planetary processes at once.

From here take the origin such fundamental phenomena as cyclicity and synchronism of planetary natural processes, inversion of activity of natural processes in opposite hemispheres. Numerous confirmations give the extensive data of every possible geophysical observations. The phenomenon of synchronism in annual variations of activity of various natural processes is rather brightly expressed - their phases are precisely synchronized, and the periods of extreme activity (or passivity) fall to February - March or August - September. In daily variations of natural processes similar laws are observed. Here we speak about modern processes, but similar laws take place in various time scales, including geological. In the given report we shall concentrate on the analysis of possible secular variations of a gravity at displacement of an external core (of its centre of mass) relatively to the elastic mantle. The analysis has shown, that gravitational influence of displaced superfluous mass of the core are a major factor of secular variations of a gravity.

However the displaced core causes directed redistribution of atmospheric masses from a southern hemisphere in northern, and also complex slow redistribution of oceanic masses. Increase of loading of atmospheric and oceanic masses on an elastic crust of northern hemisphere results in its slow lowering. Return processes should observed in a southern hemisphere. All listed factors, certainly, directly influence variations of a gravity. In a more comprehensive sense redistribution of all fluid masses, including climatic character also result in changes of a gravity.

Hemispheres mean secular trends of gravity. For an estimation of a role of factors of redistribution of air and fluid masses in variations of a gravity the point model of redistribution of masses of the Earth (Barkin, 2001), obtained very effective applications at studying of fundamental problems of geodynamics, has been used.

Let's emphasize, that the Earth is active dynamic object at which activity in the certain regions (for example, in subduction zones, a hilly terrain, a zone of volcanism etc.) at times is more brightly shown. Therefore the steadfast

attention should be paid to local factors of changes of a gravity.

In result the phenomenon of inversion changes of a gravity in northern and southern hemispheres has been predicted: mean value of a gravity in northern hemisphere accrues with velocity 1.36 micro gals in year (mGal), and in southern decreases with the same velocity. Secular variations of a gravity depend from latitude and on equator (within the framework of considered model) change a sign: $dg=2.72t\sin$ micro gals in year (mGal), where is a latitude of a place of observations, t is the time in years (Barkin, 2005).

The data of gravimetric measurements at the European stations: Metsahovi, Potsdam, Moha, Vienna, Wettzell, Strastburg, Medicina etc., in Asia and Australia: Eshashi, Canberra etc., in Northern and South America: Bolder (Colorado), Patagonia (Argentina) etc., and also in Antarctic Region (station Syowa), will well be coordinated to the theoretical values of secular variations of a gravity predicted earlier at the specified stations. Gravity trends are studied and evaluated after removal effects of tides, local pressure and polar motion. The secular gravity variation at Potsdam is evaluated in 2.1 mGal/yr. During 1976-1986 the similar tendency – gravity trend with velocity 2.6 mGal/yr (absolute measurements) here have been observed. The similar tendency has been determined on measurements on superconducting gravimeters during 1993-1997: 2.3-2.5 mGal/yr (Neumeyer and Dittfeled, 1997). For more extensive period of observation (Neumayer, 2002) the similar result for gravity trend has been obtained. Observable annual variations of a gravity are characterized by amplitude about 3 mGal (on our model it is 3.5 mGal). Observations at Syowa station have been confirmed the developed model. Here it was expected negative gravity trend - decreasing of gravity with velocity -2.54 mGal/yr, that have actually confirmed SG observations during 1995-1998: -2.4 mGal/yr (Sato et al., 2001). Amplitudes of an annual and semi-annual variations approximately make 4.8 mGal/yr and 0.8 mGal/yr (theoretical values: 4.2 mGal/yr and 0.95 mGal/yr).

References

- Barkin Yu.V. (2002) Explanation of endogenous activity of planets and satellites and its cyclicity. *Izvestia cekzii nauk o Zemle. Rus. Acad. of Nat. Sciences*, Issue 9, December 2002, M.: VINITI, pp. 45-97. In Russian.
- Barkin Yu.V., Ferrandiz J.M. (2008) Phenomenon of secular increasing of mean gravity in Northern hemisphere and secular decreasing of gravity in Southern hemisphere; predictions and new confirmations. *EGU General Assembly (Vienna, Austria, 13-18 April 2008). Geophysical Research Abstracts, EGU General Assembly 2008. Vol. 10, EGU2008-A-10506.*