CONTRAST SECULAR VARIATIONS OF THE MEAN ATMOSPHERIC PRESSURE AND MEAN SEA LEVEL IN NORTHERN AND SOUTHERN HEMISPHERES OF THE EARTH

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Abstract. The phenomenon of contrast secular change of sea level in the southern and northern hemispheres, predicted on the basis of geodynamic model about the forced relative oscillations and displacements of the Earth shells, has obtained theoretical explanation and experimental confirmation on a basis of altimetry observations of satellites Topex-Poseidon.

1 Introduction. The slow (secular) drift of the centre of mass of the Earth in the direction of North Pole with velocity about 5-6 mm/yr [1], now has been confirmed with methods of space geodesy. To explain this fundamental planetary phenomenon it is possible only, having admitted, that similar northern drift tests the centre of mass of the liquid core relatively to the centre of mass of elastic mantle with velocity about 2-3 cm/yr [1], [2]. The polar drift of the Earth core with huge superfluous mass results in slow increase of a gravity in northern hemisphere with a mean velocity about 1.5 and to its decrease approximately with the same mean velocity in southern hemisphere [3], [4]. This conclusion-prediction has obtained already a number of confirmations in precision gravimetric observations fulfilled in last decade around the world. Naturally, a drift of the core is accompanied by the global changes (deformations) of all layers of the mantle and the core, by inversion changes of their tension states when in one hemisphere the tension increases and opposite on the contrary - decreases.

2 Atmospheric and oceanic inversion tides. The gravitational attraction of superfluous mass of displaced core (in 22 masses of the Moon) causes a planetary inversion tide of air masses of the Earth and its oceanic masses, from the southern hemisphere – to the northern hemisphere [3], [5]. As consequence the phenomenon of increasing of bottom pressure in the northern ocean must be observed, and in the southern ocean – decreasing. By our estimations the mean atmospheric pressure in the northern hemisphere accrues with velocity about 0.17 mbar/yr and with similar negative velocity in southern hemisphere [5]. The predicted phenomenon of a slow redistribution of air masses from the southern hemisphere in northern has already obtained a confirmation according to the meteorological observations [6]. So changes of mean atmospheric pressure in northern and southern hemispheres have contrast character and are estimated by velocities of 0.17-0.22 mbar/yr and -0.18 mbar/yr. On the basis of modern data of satellite altimetry for 1993-2007 years we for the first time appreciate velocities of secular variations of the mean sea level in northern and southern hemispheres of the Earth which, as well as were supposed, appeared various [7]. The difference of secular velocities for N/S hemispheres consists about 1.5 - 2.0 mm/yr. In the report the mechanisms of the revealed phenomena, their dynamic interrelation are discussed and an possible interpretation to the data of observations is given.

3 Contrast changes of mean sea levels in northern and southern hemispheres. The air masses slowly are transported from a southern hemisphere in northern. They form an original inversion atmospheric tide which existence proves to be true by the modern data of observations [7]. The gravitational attraction of the core displaced along a polar axis causes the similar tide of oceanic masses. The barometric effect of influence of atmospheric tide will result in reduction of expected oceanic tide. Really, an increase of atmospheric pressure in the northern hemisphere results in replacement of oceanic masses in the southern hemisphere. For this reason the mean sea level in the northern hemisphere decreases with secular velocity -1.86 mm/yr. In turn a decrease of atmospheric pressure in the southern hemisphere results in an increase of the mean sea level in this hemisphere with velocity 1.37 mm/yr. Preliminary estimations have shown, that a oceanic inversion tide, caused by a gravitational attraction of the drifting core, gives the basic contribution to the phenomenon of secular variation of the mean sea level in N and S hemispheres (in northern hemisphere the mean level increases with velocity 3.64 mm/yr, and in the southern hemisphere it decreases with velocity -2.69 mm/yr). Taking into account now both described phenomena, we come to a conclusion, that velocity of increase of the mean sea level in northern hemisphere makes 1.78 mm/yr. The velocity of decrease of the sea level in the southern hemisphere (because of influence of the specified two factors) is estimated in -1.23 mm/yr.

On the sea level the slow deformation changes of a bottom of the ocean render the essential influence. This tectonic phenomenon is connected with global (planetary) changes of forms of hemispheres of the Earth. The last have been predicted and described on the basis of developed geodynamic model [2] and revealed by methods of space geodesy [8]. On the basis of these results the estimation of velocity of increase of the mean sea level because of deformations of ocean bottom in 0.50 mm/yr has been obtained. Due to a heating of ocean layers and their expansion and due to melting of glaciers and other contributions of water masses in ocean its mean sea level rises with velocity about 0.7 mm/yr [9]. Summarizing now all considered factors of increase of the sea level, we come to the important conclusion. In northern hemisphere the mean sea level of ocean increases with velocity about 2.98 mm/yr, and in a southern hemisphere the mean sea level varies slowly with velocity about -0.03 mm/yr.

4 Explanation of altimetry observations. We compare the obtained theoretical values of velocities of change of the sea level to the modern data of altimetry measuremen ts of satellites Topex-Poseidon [7]. As in the specified measurements the drift of the centre of mass of the Earth is not taken into account we should enter additional components in changes of the sea level in hemispheres of the Earth. The drift of the centre of mass (in northern direction with velocity 6.69 mm/yr) results in an additional (fictitious) component in value of velocity of secular variations of sea level in the northern hemisphere -3.03 mm/yr and 3.40 mm/yr - in the southern hemisphere. Thus, for comparison with the data of altimetry observations we obtain the following values of velocities of change of sea level for northern an d southern hemispheres: -0.05 mm/yr and 3.36 mm/yr. The value of secular velocity of the mean sea level variations for a southern hemisphere practically coincides with observably " altimetry" value of velocity 3.35 mm/yr. For the northern hemisphere there is the certain qualitative consent, consisting that the mean "altimetry" velocity of the sea level change for northern hemisphere (about 0.5-1 mm/yr) is much less, than for a southern hemisphere. The offered model and theoretical constructions allow to explain and to understand more deeply the most difficult effects in behavior of ocean in northern and southern hemispheres of the Earth. The Barkin's work was accepted by grants of RFBR: N-06-02-16665, N-07-05-00939 and by Spanish grants.

References

1. Yu.V. Barkin, Motion of the Earth's center of mass induced by global changes in its dynamic structure and by tidal deformations. *Mosc. Univ. Phys. Bull.*, 1995, **50**(5), 92-94. English translation of Vestni. Mosk. Univ. 3, Fiz., Astron. (Russia). 1995, **50**(5), 99-101.

2. Yu.V. Barkin, An explanation of endogenous activity of planets and satellites and its cyclisity, *Isvestia sekcii nauk o Zemle Rossiiskoi akademii ectestvennykh nauk, 2002,* Vyp. 9, M., VINITI, 45-97. In Russian.

3. Yu.V. Barkin, Oscillations of the Earth core, new oceanic tides and dynamical consequences. *Materials of XI International Scientific Conference "Structure, geodynamics and mineral genetic processes in lithosphere" (September, 20-22 2005, Syktyvkar, Russia),* Publisher of Geology Institute of Komi SC of Ural Section of RAS, Syktyvkar, 2005, pp. 26-28. In Russian.

4. Yu.V. Barkin and J.M. Ferrandiz, 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.

5. Yu.V. Barkin, Forced redistribution of air masses between southern and northern hemispheres of the Earth. *Proceedings of IUGG XXIV General Assembly*, Perugia, Italy 2007: Earth: Our Changing Planet (Perugia, Italy, July 2-13, 2007), (A)-IAGA, JAS008, 2007, p. 326. www. iugg2007perugia.it.

6. R.F. Burlutsky, Determination of the global concentration of pair on the ground pressure. *Materials of Sagitov's readings.* M., SAI, MSU, 2007, www.sai.msu.ru.

7. D. Garcia, *Private communication*, 2007.

8. Yu.V. Barkin and S. Jin, On variations of the mean radius of the Northern and Southern Hemispheres of the Earth. *EGU General Assembly (Vienna, Austria, 15-20 April 2007). Geoph. Res. Abstr.*, 2007, Vol. 9, 2007, abstr. # EGU07-A-08183.

9. L. Miller and B.C. Douglas, Mass and volume contributions to twentieth-century global sea level rise. *Nature*, v. 428, 25 March 2004, pp. 406-409.