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Step-by-step synchronous variations of planetary natural processes in 1997-1998 and their uniform mechanism: phenomenon of "galloping of the core"

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"For an explanation of observably step-by-step variations of geodynamic and geophysical processes the mechanism of sharp sporadic relative displacements of the core and the mantle and deformations of the mantle in the certain periods of time (the phenomenon of "galloping of the core") is offered. Apparently, this mechanism results in spasmodic variations of axial rotation of the Earth, causes gallop in value of a phase of Chandler motion of a pole, to sharp changes of the intense condition in zones of catastrophes" ([1], p. 61).

According to geodynamic model the step changes first of all should to be observed in motion of a geocenter as it reflects relative displacement of the centers of mass of the core and the mantle [1]. A gallop of natural processes in northern and southern hemispheres is characterized by the certain asymmetry. In result the step changes are tested by trend components of secular changes of parameters. In another words and activity (intensity) and trends of its secular changes test synchronous certain steps.

Geocenter. According to observation data of DORIS spasmodic changes of polar rotation of a geocenter in a projection to an equatorial coordinate plane in 1997-1999 are revealed. On data DORIS in values of polar coordinate of a geocenter were observed gallop up to 20-30 cm. Changes of trend components have tested gallop which can be estimated in $-2\ mm$ in coordinate x, $-5\ mm$ in coordinate y and in $-10\ mm$ in coordinate z.

Trajectory of a geocenter. A bend of a trajectory of long - periodic trend "trace" of a geocenter (its epicentre) on a surface of the Earth in 1997-1998 has been discovered (Zotov, Barkin, Lyubushin, 2008). It serves as direct confirmation of the assumption about a fundamental role of interaction and the forced relative displacements of the basic shells of the Earth, first of all the core and the mantle, both their stimulating and directing role in all planetary processes (Barkin, 2002).

Gravitational field. On the data of satellite observations the secular trend of zonal coefficient of geopotential J_2 is characterized by velocity $\dot{J}_2$=-3.70 $\cdot$ 10^{-11} 1/yr (Cheng et al., 1999). In 1997-1998 the positive step in value of coefficient ΔJ_2=2.5 $\cdot$ 10^{-10}had place.

Gravity. Daily gravity values corrected for air pressure, polar motion and tides have been obtained for the period October 1996 June 2000 on superconducting gravimeters (by Zerbini et al., 2002). The phenomenon of galloping of the core generated observed gravity burst (jump, step, glitch) in gravity variations at Medicine station in 1997-1998 with remarkable step about +5.5 mikrogalls.

Global ocean. An action of this mechanism has caused appreciable spasmodic change of a level of ocean in same years. For periods of time: 1993.5-1997.0 and 1999.0 - 2002.0 on the base of Topex-Poseidon observations the following values of increase of mean sea level have been obtained: +2.75 mm/yr, +4.28 mm/yr. A positive step in mean sea level in galloping period 1997-1998 makes about 7.2 mm. Another characteristics have been determined from coastal observations: mean velocities before 1997 and after 1999 make +0.72 mm/yr and +0.60 mm/yr with a jump in 4.8 mm.

Ocean hemispheres. On altimetry data velocities of increasing of mean sea levels in northern hemisphere have made about 0.0 mm/yr during 1993.0 - 1997.0 and 1.5 mm/yr after 1999.0 (Barkin et al., 2008). While in a southern

hemisphere in both periods velocity of trend of mean sea level has made about 3.5 mm/yr. In northern hemisphere it is marked significant "altimetry" jump of a mean sea level in +15 mm in galloping years 1997-1998. In a southern hemisphere the jump of mean sea level is not swept up almost. We shall note, that under northern and southern hemispheres the oceanic areas located between parallels $6^0N - 82^0N$ and $82^0S - 6^0S$ here are meant.

AAM. On the data of observations for period 1970.0 -1997.0 the axial angular momentum of atmosphere executes trend with positive velocity $\dot{h}_3 = \dot{R} = +0.0294$ unit/yr AAM had a negative step in -0.91 unit in period of galoping years 1997-1998. Equatorial components of AAM are characterized by trends: $\dot{h}_1 = \dot{P} = -0.0057$ unit/yr, $\dot{h}_2 = \dot{Q} = 0.0007$ unit/yr.

OAM. The trend of the angular momentum of ocean in northern hemisphere makes -0.12 ms/cy for the period of 1981-1989 (Brosche et al., 1997). And for southern hemisphere for the same period trend of axial angular momentum is characterized by velocity -0.24 ms/cy. Accordingly the general trend of OAM is estimated in -0.36 ms/cy(on data of Chen, 2005).

HAM. Negative trends of the hydrological angular momentum for periods of time 1993.0 - 1997.0 and 1999.0-2004.3 consist about: -0.0052 ms/yr and -0.0061 ms/yr. The step of the hydrological angular momentum in 1997.0-1999.0 years consists +0.017 ms.

Climate. In 1997-1998 sharp spasmodic increase of amplitude of change of quantity of low clouds (approximately in three times) has been observed. Sharp reduction of number of days of tropical cyclones in northern hemisphere had place in 1997-1998 (approximately for 130 days at the maximal values in 300-400).

Temperature. On the data of observations for the period 1979 – 2007 the estimations of jumps in trends of temperatures have been obtained. In 1997-1998 years the global temperature has increased approximately on$+0^017$, the average temperature in northern hemisphere has increased on $+0^015$, and in a southern hemisphere is a little bit more essential on $+0^024$.

Cyclones. The number of storm days in the period November - April of each year for area of east Pacific tropical zone for three years 1996-1998 has grown three times in comparison with the similar three-annual periods of last 55 years. The step is in three times.

Stratosphere. Daily values of the global contents of water pair in troposphere (mb) for the period 1979 - 2005 has tested one appreciable jump – step in 1997-1998 on +0.28 mb. The linear trend of decreasing of water pair in troposphere also was changed from velocity -0.021 mb/yr before 1997 to velocity -0.019 mb/yr after 1999.

Sea ice. Hemispheres. Trends in increase of ice cover in a southern hemisphere consist $+28065\ km^2/yr$ during 1979.0 - 1997.0 and $+56452\ km^2/yr$ during period 1999.0 - 2008. A negative step of the area of an ice cover during 1997.0 - 1999.0 has made big value $-325000\ km^2$. Trends of increase of an ice cover in northern hemisphere make $+24194\ km^2/yr$during 1979.0 - 1997.0 and $172200\ km^2/yr$ during 1999.0 - 2008. A negative jump of the area of an ice cover during 1997.0 - 1999.0 has made$-130000\ km^2$.

Rotation of the Earth. LOD. During 1997.0-1999.0 when there was rather fast spasmodic increase of duration of day approximately on 0.038 ms. Similar sudden changes in natural processes in geodynamic model (Barkin, 2002) are explained by spasmodic displacement of the centre of mass of the core relatively to the mantle (phenomenon of galloping of the core, [1]).

FCN. The period of Free Core Nutation has step changed in 1997-1998 years. It has decreased in this short period on about 45 days. The previous years the period decreased with velocity about -1.67 day/yr.

The similar steps in change of activity of natural processes and in their trends before and after steps are observed in all planetary geodynamical and geophysical processes of the Earth. The discussed phenomenon is universal and will be observed on all solar system bodies including the Sun. I've suggested for discussion also a hypothesis that observed on pulsars glitch-phenomena have same nature and are connected with forced relative displacements of pulsar shells.

References

[1] Barkin Yu.V. (2007) Mechanism of tectonic activity of the Earth: deep geodynamics, its modern displays. Fundamental problems of geotectonics. Materials of XL Tectonic meeting. Vol. 1. M.: GEOS. pp. 59-62. In Russian.