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# Model explanation of non-tidal acceleration and pole drift of the Earth

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My Professors: E.P. Aksenov, V.G. Demin, E.A. Grebennikov at the beginning of a space age in 60 -70 years very effectively have been used the method of modeling of gravitational field of the Earth by the system of material or complex point masses. The more famous is the modeling of gravitational field of axysimmetric body (the Earth) by the gravitational field of two points with complex-conjacate masses. In result the non-integrable satellite problem was reduced to integrable problem of analytical mechanics. In 1997 -2001 I have used similar approach but with another purpose. I introduced no 2 points but only 1 but with variable mass with the purpose to optimally discribe observed secular variations of geopotential and to explain observed many years fundamental geodynamical phenomena: non-tidal acceleration, pole drift and some others. The result was extremely positive. This simple model (with concrete position and velocity of secular change of the mass) let us to explain about 15 – 20 parameters of mentioned phenomena which yearlier had not any explanations. Here I suggest some development of this approach with geodynamical analysis. The problem of non-tidal acceleration of axial rotation of the Earth is discussed more than 100 years. The most exact determinations of this acceleration were made in work of Stephenson and Morrison (1995) on the basis of the data on observations of antique eclipses of the Sun for 2700 (700 BC-AD 1978). The ratio of positive acceleration of the Earth rotation **dw** to its angular velocity w makes **dw/w = (6.9 +/-1.7) x10 (-11) (1/yr)** (Stephenson, Morrison, 1995). The explanation of secular drift of a pole also represents rather old both not solved and actual problem. On the modern data the pole of an axis of rotation of the Earth is displaced along a meridian **72.9 W** with angular velocity of

**0.331 +/-0.003** seconds of an arch for hundred years (Gross, Vondrak, 1999). Ratios of variations of the equatorial components of angular velocity of the Earth thus make: **dp/w=395 x10 (-11) 1/yr**, **dq/w =-1548 x10 (-11) 1/yr**. A secular variation of coefficients of the second zonal harmonic of a geopotential: **dJ2 =-3.07x10 (-11) 1/yr** it has appreciated on the basis of laser observations of satellites (Cheng, Taplay, 1997). For an explanation of the specified secular variations in our work it is used the point asymmetric inversion model of secular redistribution of masses of the Earth, which is characterized by a general direction along the geocentric axis **OP** directed to the pole **P** with geography coordinates **70 N, 104.3 E** (Barkin, 2001). The model represents the system of two material points with masses **m2** and **m1**, located on surfaces of the Earth at poles of geocentric axes OP. Masses are changed linearly in the time with velocities: **0.179x10 (15) kg/yr** and **0.043x10 (15) kg/yr**. On our geodynamic model the secular drift of a geocenter is a simple reflection of identical drift of the Earth core relatively to elastic mantle in same northern direction (Barkin, 1995, 2001). That results to slow secular redistribution of oceanic and atmospheric masses from a southern hemisphere to northern hemisphere. The space geodesy data confirm the predicted direction of secular displacement of the centre of mass of the Earth to a point with geographical coordinates **72.7 N, 115.4 E** with velocity about **6 mm/yr**. On the basis of the given model we have obtained analytical formulas for secular variations of coefficients of the second harmonic of a geopotential on which the following values of velocities of secular changes of the mentioned parameters have been obtained (**1 unit =10 (-11) 1/yr)**: **dJ2 =-3.06**, **dC21 =-0.294**, **dS21=1.155**, **dC22 =-0.095**, **dS22 =-0.052**. For the acceleration of axial rotation of the Earth we have **dw/w=6.19** and for the components of secular drift of the Earth pole we have obtained values: **dp/w=388**, **dq/w =-1505**.

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