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Estimation of rotation regime variation and lunar-solar influence on the stress state of tectonosphere

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Introduction. The stress-deformed state is one the main characteristics of geological environment, determining flowing of many geophysical and geological processes.

Nowadays astronomic and geodesic researches prove variation of rotation speed and position of rotation axis in the Earth body. Paleomagnetic, paleoclimatic and paleontology researches allow to talk about long-period variations of rotation speed and position of rotation axis in geological past. At the change of the rotary regime, the Earth is forced to change the form, adapting to the new rotation regime. Along with rotation regime variations the certain changes of the Earth figure, conditioned lunar-solar influence. These processes will result in the origin of deformations and stresses in tectonosphere.

The aim of the research work is an estimation of the stress state of tectonosphere caused by the above-stated factors, namely: long-period delay of rotation speed, long-period drift of rotation axis in the Earth body, short-period variations of speed, Chandler wobble of the poles and lunar-solar influence.

Method of investigations. Calculations were executed on the basis of estimate algorithms of stresses in the viscid-elastic model of tectonosphere developed an author. The main positions of mechanical theory of plates and membranes are used in the developed algorithms. A transition from elastic decision to viscid-elastic is carried out on the basis of Il'yushin approximation method.

Not unimportant at calculations is a choice of numeral values of physic-mechanical parameters of tectonosphere. It was accepted in our case, that in the reology relation of tectonosphere behaves as a body of Maxwell with viscidity 10^{24} Pa*s, by the elasticity module 10^{11} Pa and by the Puasson's coefficient 0,25.

Results and conclusions. The executed calculations allowed doing next conclusions about the stress values, arising up at variations of the rotation regime and lunar-solar influence.

There are three areas at the long-period delay of rotation speed (lengthening day on $2*10^{-5}$ s/year) in the tectonosphere: two tensions ($+90^0 \div \approx +35^0$, $-90^0 \div \approx -35^0$) and one the compression ($\approx -35^0 \div \approx +35^0$). At the accepted delay of rotation speed the accumulation process of stresses proceeds $\approx$ to 1 million years, where upon due to the processes of relaxation stress not increased, creating the permanent in time field of stresses in a tectonosphere ($\sim 10^5$Pa). In the case of short-period variations of rotation speed, at a change length of day in 0,003 second, there is the axisymmetrical stress field in tectonosphere, in a structure analogical the stress field because of the long-period delay of rotation speed. Thus maximal stresses will arrive to 10^2 Pa.

Because of drift rotation axis of the Earth in two opposite quadrants, which an axis moves in the direction of, there are areas of compression, and in two other are areas of tension. Substantial influence, along with the angular moving of rotation axis in the Earth body, renders speed of moving. At speeds of drift 1°-2°/million year stresses will attain a value $\geq 10^7$Pa at the angular moving of rotation axis of the Earth $\approx$ on 1°. In the case of Chandler wobble of the poles there will be stresses 10^3 Pa.

In the case of lunar-solar influence, nascent stresses have values 10^4 Pa. Thus tension stresses, arising up in areas oriented in the direction of Moon or Sun, is twice as much compression.

Thus, from the transferred factors a most contribution to the stress state of the Earth's crust renders long-period movements of rotation axis in the Earth body (10^7 Pa), after long-period delay of rotation speed of the Earth (10^5 Pa), further lunar-solar influence (10^4 Pa), Chandler wobble of the pole (10^3 Pa) and short-period variations of rotation speed (10^2 Pa).

These results can be used for the solving fundamental questions of geotectonic and physics of the Earth and for investigation of nature and prognosis of geodynamic processes in the earth's crust.