Development of geomechanical model of the segment of Central Sakhalin fault zone

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Most of the population of the Sakhalin region lives in close proximity to the Central Sakhalin fault (CSF), or rather in its southern part. Thus, observation of seismic activity in this zone, control of stresses and deformations of the crust are relevant and open the prospect for seismic predictions. The prerequisites for the development of this model were the studies conducted by IMGG team together with other structural units of the RAS and universities. The organization of integrated geophysical monitoring points was of great importance. In structural terms, the southern part of the CSF zone is a system of thrusts. The selected area of simulation is presented of the Central Sakhalin and nearness Aprelovsky fault. The planes of the fault displacers of both branches are inclined to the West at angles of 60° – 80° at the exit to the day surface with a gradual flattening with a depth of 20° – 30° at depth of 10-15 km.

The geomechanical model describing the distribution of stresses and strains in space and their evolution in time was developed for the southern part of the CSF. The boundaries of the model are the faces of the parallelepiped with sides of 150 km in the meridional direction, 60 km in the sublatitudinal direction and depth of 30 km. Geographically, the model is confined to the coordinates within 46.4° – 47.4° N and 142.2° – 142.8° E. The Graphical model was created in COMSOL Multiphysics.

The results of seismic exploration of DSS, well logging, measurements at GPS observation points, seismological data were used as initial field data of the model. There are 9 different blocks on the surface. In depth, the model is divided into 8 layers with different densities from 1.9 to 2.78 g/cm^3, Young modules from 1.2 to 44.9 GPa, Poisson's ratio from 0.27 to 0.28. Strain rates of different blocks varied from 1/2 to 2/3 mm per year.

The comprehensive use of the geomechanical model, geophysical methods of monitoring the active fault area and the medium-term predictions by various methods allowed identification of "problem"fault zones, to optimally use geophysical equipment for observations, and significantly improve the accuracy of the medium-term predictions.