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Comparison of seismotomographic and thermogravitational models with distribution of the seismotectonic deformation orientations for southern Siberia area

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The recent geodynamics of southern Siberia is under influence of external and internal factors. First, fields of tension arise on borders of a large earth's plates during their interaction caused by lateral movement. Second, processes in the sublithospheric part of the upper mantle of the region. To study influence of these factors we carried out the comparison of various geophysical methods results, with taking into account available geological data on a faults structure of the region.
The joint analysis included results of seismotomographic modeling, determinations of seismotectonic deformation (STD) principal axes orientation, and data of numerical thermogravitational modeling of upper mantle convection with considering influence on its structure of a local overheat under surrounding thick lithosphere blocks. The 3D model of seismic P-waves anomalies distribution in the upper mantle of southern Siberia and adjacent areas is updated by addition to calculations a new data from the ISC catalog. It is calculated by a technique developed during the previous researches (Koulakov, Bushenkova, 2010). Thickness estimates of a «seismic lithosphere» are made in the same way, as in work (Bushenkova, etc., 2008). The received estimates are used for specification of boundary conditions for a numerical thermogravitational modeling (Chervov, Chernykh, Journal of Engineering Thermophysics, in press). A principal axes STD orientations are calculated on Riznichenko&Kostrov's method by data of focal mechanisms solution about 770 earthquakes with magnitude of 3.5 – 7.3 which have occurred in the crust of Altai-Sayan area from 1970 to 2007.
We have executed a comparison of seismotomographic and thermogravitational models with distribution of the principal axes STD orientations for the southern Siberia and adjacent territories. The following features were found. It is possible to observe a tendency to azimuthal change of the principal axes STD orientations along borders of positive and negative seismic velocity anomalies in the obtained seismotomographic model. We observe obvious correlation of the principal exes STD orientations distribution and convection flows distribution in the obtained numerical thermogravitational model of the upper mantle structure. Namely, orientations of an extension are mainly located along descending flow (in the plan), whereas orientations of a shortening – across them respectively. Further with approach to an ascending flow it is possible to observe a tendency to change of the direction of the STD orientations of an extension axes around its center, and on radii - directly over the center of this ascending flow.
We consider that, due to stability of the observed tendencies, in other areas with similar block structure of a lithosphere, it will be possible to predict orientations of a principal axes seismotectonic deformations for the subsequent seismic events in similar regions.
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