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Deep structure beneath the Altai region (Southern Siberia) revealed by joint inversion of gravity and seismology

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Seismological part of inversion is based on the data about the differential travel times of PP-P and SS-S rays which allows obtaining the information about deep heterogeneities beneath regions where there are neither many seismic stations nor strong seismicity. In the preliminary step, the inversion for P and S seismic velocities is performed in five depth layers from 80 to 480 km depth. Lateral resolution of the resulting tomographic model is estimated from synthetic testing as 100-150 km. Gravity effect is computed separately from 3D density anomalies in five depth layers and from the Moho depth variations. Initial density model is computed on the basis of the tomography derived seismic anomalies using a-priori values of velocity/density coefficients which are taken from laboratory and theoretical studies. The values of these coefficients, as well as the value of the density contrast in Moho, are then corrected using the Tikhonov's regularization which provides the best fit with the observed gravity field and minimal variances of unknown parameters. As an alternative way, we used also stochastic algorithm SAEM which provides the similar results. Joint consideration of P and S velocity anomalies and velocity/density ratios allows estimating the temperature in the upper mantle. This algorithm has been performed for the real data in the Altai region, in southern mountain framing of Siberia. The results of inversion show that rather strong low velocity seismic anomalies beneath Altai region have apparently non-thermal nature. This is consistent with normal level of the heat flow (q$\sim$40-45 mW/m^2) and absence of Cenozoic volcanism in Altai.