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Lithospheric Structure of Caucasus Using Joint Inversion Method

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In this study we invert crustal and Pn velocities as well as Moho depth simultaneously applying the joint inversion method developed by Zhen et al. (2009). This method is interesting, because all those three parameters are iteratively jointly inverted. It's using a spherical pseudo-bending ray tracing method for the heterogeneous crust and include secondary Pg waves at large distances. We applied the method to the Caucasus and adjusted territories for reconstruction of the lithospheric structure of the area. Our data set includes information about more than five thousand earthquakes from Georgian seismological catalogue. New digital seismic network was developed in Georgia since 2003 and because of that we selected data from 2004 up to 2010. Also we add data of past earthquakes from the time interval 1960-1990, with local magnitude more than 3.5. Before 1960 and during 1990-2004 seismic station coverage and hypocentre determination were very poor, so it was better not to use data from this time windows to avoid big errors in hypocentre locations. Our data set includes Pg and Pn wave arrivals from the data recorded by seismic stations of the regional seismic network of Georgia, Central Caucasus Local Network (installed in 2007), regional seismic networks of Azerbaijan and Armenia. We applied the checkerboard resolution test to estimate the spatial resolution of the tomographic images. The results of the checkerboard test indicate that the initial model with passive and negative values is well reconstructed for all depths. The results of tomography show some significant features, rapid variations of Moho discontinuity, heterogeneities in upper crust, high and low Pn velocity zones. The depth of Moho discontinuity is relatively big in northern and southern part of Georgia, beneath the Greater and Smaller Caucasus, it has relatively large variations in this region. We can see the similar results in previous studies. Our tomography results in upper crust also show correlation among the velocity variations, seismicity, active faults and quaternary volcanic centres. At shallow depth are visible low velocity zones, which may be related to the thick sedimentary layer.