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Crustal structures of southern Mongolia from seismic anisotropy and gravity analysis

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This study integrates gravity modelling and analysis with seismic constraints through the prism of seismic anisotropy to characterize the structures of southern Mongolia, in particular at the lower crustal but also the upper mantle levels. Recently, gravity signal analysis and forward modelling combined with magmatic geochemistry and thermodynamic modelling demonstrate that relamination of allochthonous felsic to intermediate lower crust played a major role in southern Mongolia structure. Relamination of material induces a homogeneous layer in the lower crust, which contrasts with the highly heterogeneous upper crustal part composed of different lithotectonic domains. The seismic signals of the seven southernmost stations of the MOBAL2003 experiment were analyzed to get the receiver functions. The data treatment was performed following a new protocol, which reduces the noise on the different components. This treatment reveals the variation of the crustal thickness of cca. 10 km along the first 450 km of the profile. In addition, some seismic stations display significant signals related to the occurrence of a low velocity zone (LVZ) at lower crustal and upper mantle levels. The depth of the Moho discontinuity and the dips of the seismic interfaces obtained from the seismic inversions as well as the boundaries of the different tectonic zones constitute the starting points from the 2D forward gravity modelling along the southern part of the MOBAL 2003 profile. Moreover, the density values applied to the different blocks were determined according to the global lithological composition of the different units and the vergences of the tectonic contacts were constrained by the geodynamic studies. The gravity modelling reveals the occurrence of a low density zone in the lower crust beneath the four southernmost seismic stations, which corresponds to the LVZ observed with the receiver function analysis. The combination of the independent methods enhances the occurrence of a low velocity and a low density zone (LVLDZ) at lower crustal level beneath the southernmost part of the MOBAL 2003 seismic profile. These LVLDZ may demonstrate the existence of the relamination of a hydrous material in southern Mongolia.