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3-D inversion of Moho discontinuity using wide-angle reflections in the Baltic Shield

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A three-dimensional Moho discontinuity was inverted using wide-angle PmP reflections from the deep seismic surveys BALTIC, SVEKA'81, SVEKA'91 and FENNIA, the BABEL profiles and the SVEKALAPKO data. Using the PmP data from the SVEKALAPKO array made it possible to invert the Moho surface in three-dimensions in between the DSS profiles. The Moho inversion was calculated using a 3-D tomographic seismic velocity model of the crust beneath central Baltic Shield. The Moho was inverted using 2418 PmP wave arrivals measured from 173 sources. The crust velocity model was derived using 12116 first P wave arrivals of 326 sources including additional data recorded at permanent station network. All non-controlled source events were relocated with grid search technique from the tomography model by minimizing the travel time differences between the synthetic and observed rays. Lateral velocity resolution was tested and proved to be at least 60 km in the most parts of the crust. The inverted Moho model differs from interpolated models in introducing smaller structural details based on data. The variation of the crustal thickness is notable. In general the crust is thicker than 40 km reaching more than 60 km thickness in two depressions, in central, eastern and south-western Finland. Thinner crust is observed in the Bothnian Bay, in the southern Bothnian Sea and around the Vyborg rapakivi region in south-eastern Baltic Shield. The seismic velocities are laterally and vertically varying in the whole crust. At the surface the velocity is between 5.7 and 6.2 km/s. At the depth of 20 km it is between 6.4 and 6.9 km/s and at the depth of 40 km between 7.0 and 7.4 km/s. On the average the Archean part is characterized by higher velocities than the Paleoproterozoic part. The Laitila and Vyborg rapakivi areas are distinguished by higher velocities than the surrounding schist belts. The Central Finland Granitoid Complex is associated with slightly higher velocities than schist belts.