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Complexity of the Fennoscandian lithosphere

Lev Vinnik (1), Elena Kozlovskaya (2), Sergey Oreshin (1), Grigoriy Kosarev (1), Hanna Silvennoinen (2), Natalia Vaganova (3), and Sergey Kiselev (1)

(2) University of Oulu, Sodankylä Geophysical Observatory/Oulu unit, Oulu, Finland (elena.kozlovskaya@oulu.fi), (1) Schmidt Institute of Physics of the Earth RAS, Moscow, Russia (vinnik@ifz.ru), (3) Institute of Ecological Problems of the North, Ural Branch of RAS, Archangelsk, Russia (nvag@yandex.ru)

P and S receiver functions are calculated for a few tens of broadband seismograph stations in eastern Fennoscandia and are inverted for P and S-wave velocity models up to a depth of 300 km. The dataset includes the data of the POLNET/LAPNET temporary array and selected permanent stations in southern Finland and northwestern Russia. Most of the stations of the POLENET/LAPNET array are located in the Lapland-Kola collisional belt of Fennoscandia, in which the Archaean litosphere has been significantly reworked in the Palaeoproterozoic. The converted Ps phases from the transition zone at those stations arrive about 1 – 1.5 s earlier than predicted by global models. The latest arrivals with the residuals of -0.5 s are found at the northernmost stations of the POLNET/LAPNET array close to the shield margin. The earliest arrivals with the residuals of around -2.0 s are observed at southern Finland stations located in the Palaeoproterozoic domain of the Fennoscandian Shield. The observed trend in arrival times of phases converted from the transition zone is indication of different upper mantle velocities beneath major tectonic domains of the Shield. The residual of the Ps phase is the difference between the teleseismic S and P travel-time residuals in the upper mantle of Fennoscandia. At most of the stations the S-wave residuals by absolute values are larger than the values of the P-wave residuals by an order of magnitude. The large S-wave residuals and relatively low P-wave residuals present an effect of low Vp/Vs ratio in the upper mantle compared to the global velocity models. In the obtained velocity models there are regional variations of the Vs and Vp as functions of depth. At the Russian stations in a depth range from 100 to 200 km there is a pronounced low- P-velocity layer, without a comparable counterpart in the S- velocity model. The P-wave velocity model for the Russian stations reveals interesting correlations with the data from the QUARTZ nuclear-explosion profile crossing this part of Fennoscandia. At the stations of the POLENET/LAPNET array the P-wave velocities are generally close to the IASPEI91 velocities down to a depth of about 200 km. The S-wave velocities are close to the IASPEI91 velocities in the depth interval from the Moho to 100 km and higher than the IASPEI91 velocities in a depth range from 100 to 200 km. The most complex lithosphere structure is obtained for stations where the anomalously thick (more than 60-km) crust is known from earlier controlled-source seismology experiments. For some stations the S-wave and P-wave crust-mantle boundaries are located at different depths (around 45 km and 75-80 km, respectively). In summary, the structure of the Fennoscandian lithosphere appears to be very complex and deserving further multi-disciplinary studies.