Geophysical Research Abstracts, Vol. 7, 06118, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06118


# Combined receiver function and surface wave phase velocity inversion of SVEKALAPKO teleseismic records

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During SVEKALAPKO (1998-1999) deep seismic experiment 44 broad band stations operated on the territory of central and southern Finland. First results on receiver function study in SVEKALAPKO area were obtained by Alinaghi et.al., 2004 by Zu and Kanamori method. They reported about complex Moho topography and higher shear velocities in the upper mantle of the Baltic Shield. The present study is based on the use of receiver function tomography technique (Vinnik et.al., 2004) and joint inversion of body wave receiver functions and surface waves phase velocities (Herrmann, 1978). The 3-D seismic model of the lithosphere under the SVEKALAPKO array area is constructed by interpolation of local layered models. Twenty three events recorded at 24 stations of the array were used for inversion. Three characteristic phases at delay times about 1, 3-7 and 15 s are present in most receiver functions. The first phase (if it is observed) points out the presence of a thin (1-3 km) “destroyed” layer in the upper crust. The second phase is caused by a wave converted on Moho boundary. It is clearly seen on all records. The last phase may be caused by conversion within the mantle (depth about 120-150 km), or by the Moho or intra-crustal multiples. For inversion of the data Adaptive Simulated Annealing Algorithm, developed by L. Ingber, (www.ingber.com) was used. The existing 3D P velocity crustal model allows us to significantly restrict the space of search. Despite the insufficient space resolution of the surface wave data, they allow to fix average absolute Vs value of the top part of model. We use here Rayleigh wave phase velocity dispersion curves (Bruneton et al., 2004) and travel times of P-SV conversions from 410 km and 660 km discontinuities.

For this purpose we calculated a stack of 383 P receiver functions for events with epicentral distances greater than 27 degrees. Ps410 and Ps660 travel times are equal to 42.3 and 66.2 respectively and approximately 1.8 s earlier than IASP91 times. The difference of Ps660 and Ps410 travel times is equal to 23.9 and it perfectly corresponds to the standard IASP91 model. Our conclusion is that the SVEKALAPKO upper mantle is not anomalous at depths 410-660 km and has higher velocities above the 410 km only. We suppose that minor differences in Ps660 and Ps410 travel times are possible at different SVEKALAPKO stations. To take into account this fact in the inversion procedure, data on these times for 15 stations were obtained. There are no strong regular discontinuities in the SVEKALAPKO mantle at depths between Moho and 410km discontinuity, but local inhomogeneities were found in this depth range by analyzing the data on separate stations in the northern part of the region. Records at some northern stations demonstrate strong conversions in the uppermost part of the crust. Usually such conversions indicate the presence of a sedimentary layer. Earlier Grad and Luosto, 1992 reported about the fracturing of the crystalline uppermost crust beneath the northern part of the SVEKA profile approximately in the same area. Area with fractured uppermost crust may be related to the deep manifestation of the Ar-Pt boundary. Results of the receiver function inversion in the crust are supported by large amount of DSS data and local traveltime tomography inversion. The study is supported by RFBR grants 03-05-64654, 04-07-90362.