Geophysical Research Abstracts
Vol. 14, EGU2012-3044-1, 2012
EGU General Assembly 2012
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Imaging small velocity variations trough improved noise correlation approach: application to northern Fennoscandia

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Ambient noise tomography is now widely used method to imaging of the Earth crust and uppermost mantle, and it can in many cases yield higher resolution than tomographies that use seismic sources. Many of these applications are carried out in settings with strong velocity contrasts, for example between sediment and bedrock. Small velocity variations (around 1%) are potentially within the limit of resolution of the method, because non-isotropic noise sources, or small time averaging can provide an estimated Green's function affected by errors larger than the velocity variations. Here we present the result of a noise correlation tomography using one year of data (2008) continuously recorded by the LAPNET seismological array in the northern part of the Baltic shield. This zone is characterized by the absence of undeformed sediments and the lateral velocity variations are the order of 1-2 %. To extract such small velocity variations we use a novel correlation approach, able to provide high quality estimated Green's function. The noise correlation functions calculated between each station pair were then used to produce a high-resolution 3D Vs model of the area from to a depth of 20 km. The model is in good agreement with previous 2-D active seismic profiles and tectonic models of the area. With our tomography, we obtain 3-D constraints on the crustal structure, and more particularly on the Archean-Proterozoic transition.