Geophysical Research Abstracts
Vol. 13, EGU2011-6126, 2011
EGU General Assembly 2011

Surface wave tomography for southern Norway from ambient seismic noise and earthquake analysis

Andreas Köhler, Christian Weidle, and Valerie Maupin
University of Oslo, Department of Geosciences, Oslo, Norway (andreas.kohler@geo.uio.no)

The objective of the TopoScandiaDeep project is to study the possible relation of the anomalously high topography of the Scandes mountains with lithospheric structure and processes. One major component of the project is the analysis of seismological data recorded at a temporary passive seismic array in Southern Norway. As part of this analysis, we integrate measurements of surface wave phase velocities to invert for crust and shallow upper mantle structures.

Surface waves generated from earthquakes at regional and teleseismic distances are analyzed at periods from 20 to 200s using a novel multiscale wavefield interpolation method and f-k analysis. Such waves are mostly sensitive to upper mantle seismic velocities but also crustal structure, primarily crustal thickness. Surface waves at shorter periods are more difficult to observe in earthquake generated wavefields due to higher attenuation and scattering, but can be obtained from analysis of ambient seismic noise. We are able to measure reliable Rayleigh and Love wave phase velocities for periods between 3 and 25s from noise cross-correlation functions.

By combining observations from noise and teleseismic events, we obtain phase velocity maps of southern Norway continuously in the period range 3 and 200 s, thus covering frequency ranges that are commonly interpreted independently. While such independent interpretations often rely severely on external constraints for a stable inversion of the data (e.g. Moho depth), the bandwidth of our observations allows us to invert for shear wave velocities entirely independently of external data input. A first average model of the S-wave velocity variation with depth under southern Norway shows that the lithosphere in the area has the characteristics usually found under continental platforms and not, as we would have expected, those found under cratonic areas.

Our result show no lateral changes of phase velocities at longer periods, whereas clear anomalies are found at shorter periods in the order of 3%. These anomalies can be explained by variation of the crustal structure (Caledonian nappes, Oslo Graben) and Moho depth.