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Scandinavian Lithosphere Structure derived from Ambient Noise and Surface Waves

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The western rim of Scandinavia is characterized by the Caledonian mountain range with topography up to 2500 m. Since this region lacks recent compressional tectonic forces, it provides a great opportunity to study the geodynamic evolution of crustal and upper mantle structures at today's passive continental margins. Together with the ScanArray network we use data from previous and permanent projects, in total more than 200 stations, for a surface wave tomography of the area using both earthquake and ambient noise data.
In previous studies, an unusually thin crust and shallow lithosphere-asthenosphere boundary (LAB) have been found beneath the high-topography of western Norway, where a clear crustal mountain root seems to be absent. The lower topography regions of eastern Norway and Sweden, however, reveal a thicker crust, in contrast to the principles of Airy isostasy. Lower seismic velocities than expected have been found with a sharp transition to higher velocities beneath Sweden.
Beamforming of Rayleigh surface waves yields average phase velocities for all Scandinavia and several of its subregions. A remarkable cos(1Θ) phase velocity variation with azimuth is estimated for periods >35 s. Since this effect can be seen in northern and southern Scandinavia but not in the central area this might indicate a dipping LAB related to varying topography from North to South. From previous studies it is known that the cos(1Θ) feature and the dipping LAB are also seen at the eastern rim of the Appalachians - however mirrored. Both mountain ranges exhibit the same orogeny.
Phase velocity maps were derived with the two plane wave method. Ambient noise were analyzed using a transdimensional MCMC Bayesian inversion. We use a transdimensional Bayesian method to invert for the VSV structure. The Moho below Northern/Lofoten region is highly undulated but a crustal root of the high topography is not present. The Lofoten peninsula shows very low crustal and lithospheric VSV with a shallow Moho around 20 km at the continental margin. The LAB is deepening from west to east with a sharp kink both in the South (120 km depth) and the North (150 km depth). The LAB in the North is even more undulated and related to a gravity anomaly imaged as high-velocity spot. However, the central area shows rather smooth varying structures from west to east. Additionally, we find evidence for a MLD around 150 km depth beneath the Paleoproterozoic Baltic Shield.