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Seismic Body-Wave Tomography in Fennoscandia

Nevra Bulut[1], Valerie Maupin[2], and Hans Thybo[1]
[1]Istanbul Technical University, Eurasian Institute of Earth Sciences, Istanbul, Turkey (bulutne@itu.edu.tr)
[2]Centre for Earth Evolution and Dynamics, University of Oslo, Oslo, Norway

We present a seismic tomographic image of Fennoscandia based on data from the ScanArray project in Norway, Sweden, and Finland, which operated during 2012-2017, together with data from earlier projects and stationary stations. We use relative traveltime residuals of P- and S-waves in high- and low-frequency bands and apply the frequency-dependent crustal correction. We use seismic signals from earthquakes at epicentral distances between 30° and 104° and magnitudes larger than 5.5. The general purpose of this study is to understand the possible causes of the high topography in Scandinavia along the passive continental margins in the North Atlantic as well as the interrelation between structure at the surface and in the lithospheric mantle.

We present an upper-mantle velocity structure for most Fennoscandia derived for the depth range 50-800 km with a 3D multiscale parameterization for an inversion mesh-grid with dimensions dx=dy=17.38 km and dz=23.44 km. In all body-wave tomography methods, smearing of anomalies is expected. Therefore resolution tests are critical for assessing the resolution of the parameters determined in the velocity models. The resolution of the models depends on several factors, including the noise level and general quality of data, the density of observations, the distance and back-azimuthal distribution of sources, the damping applied, and the model parameterization. We use checkerboard and model-driven (block and cylindrical) tests for assessing the resolution of our models.

Seismic models derived in this study are compared to existing and past topography to contribute to understanding mechanisms responsible for the topographic changes in the Fennoscandian region. The models also provide a basis for deriving high-resolution models of temperature and compositional anomalies that may contribute to understanding the observed, enigmatic topography.