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Crust-Correction and Measurement of Finite-Frequency Travel Time Residuals for Body-Wave Tomography in Scandinavia

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The ScanArray experiment is an extensive collaboration between the universities of Aarhus, Bergen, Copenhagen, Karlsruhe, Leicester, Oslo, and Uppsala, Istanbul Technical University, GFZ Potsdam, and NORSAR, that focuses on the structure of the lithosphere and upper mantle processes below Scandinavia. The experiment has acquired broadband seismic data on a dense array of temporary seismometers over a period of four years. This data will be subject to interpretation and inversion by a wide variety of seismological methods.
Here we apply finite-frequency body-wave tomography to determine the velocity structure of the upper mantle in order to provide background for understanding the mechanisms responsible for the topography of the Scandinavian region. Our interpretation will help determining if the crust and lithosphere are in isostatic equilibrium or dynamic forces actively affect the high topography in the region. We will use finite-frequency residuals of P and S waves from teleseismic earthquakes at epicentral distances between 30° to 104° and with magnitudes of at least 5.5, gathered on 200 broadband seismic stations installed in Norway, Sweden and Finland during the period of 2012-2017.
Since the quality of the tomography models directly depends on the precision of the travel time residuals, it is crucial to measure accurate relative travel times. Therefore, in this first part of the study, we pay particular attention to appropriate crustal corrections and procedures for measurement of finite-frequency travel time residuals. Crustal correction will be based on application of the reflectivity method at each station, ensuring that the proper frequency dependence of the corrections is taken into account. Corrections will be applied on low- and high- frequency bands separately. This new crustal correction procedure will be implemented in the data processing routine suggested by Kolstrup et al. (2015), which will be used to estimate finite-frequency travel time residuals using a combination of the Iterative Cross-Correlation and Stack (ICCS) algorithm and the Multi-Channel Cross-Correlation (MCCC) method. At a later stage, finite-frequency body-wave tomography method will be applied and the final results will be discussed in relation to other studies of the Scandinavian upper mantle.