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Surface wave studies of the Greenland crust using ambient seismic noise

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As the largest island on earth, Greenland exhibits a wide variety of geological features, ranging from an early Archean shield to a large igneous province. A systematic and comprehensive investigation of its seismic structure, particularly the crust and uppermost mantle structure, provides important information to decipher the features' tectonic implications. However, the lack of open seismic data prevented such investigation in the past. Since 2009, the seismic stations of the Greenland Ice Sheet Monitoring Network (GLISN) have become available for broadband seismology on Greenland. Using this network, seismic surface waves can be exploited to study the structure of Greenland's crust. Here we present preliminary results of surface wave investigations utilizing the GLISN network as our first attempt to pursue a comprehensive seismic model for Greenland. First, we measured the Rayleigh wave dispersion curves from a 3 years' stack of ambient noise cross-correlations using a FTAN program. We obtained about 160 reliable curves of Rayleigh wave phase and group velocities between different pairs of stations, predominantly in the range of periods between 5 and 40 s. We then applied two-dimensional tomography for the discreet set of periods to these data. Maps obtained are characterized by a spatial resolution of 300-450 km for latitudes between 64o and 77o N, going down to 650 km for northern latitudes and the southern tip of the island. Eventually two types of Bayesian Monte Carlo inversion were used to infer the shear velocity structure of the crust and uppermost mantle of Greenland. One type used sets of dispersion maps on a 1ox1o grid obtained by bilinear interpolation of tomographic maps for a regular set of periods. The other used the surface wave dispersion information and Rayleigh wave H/V ratios obtained for individual stations using teleseismic events.