Crustal Anisotropy of Hudson Bay from Ambient-Noise Tomography

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Summary

The Hudson Bay basin is more than 1000 km wide and contains up to 2 km of Paleozoic sedimentary rocks that overlie Archean and Proterozoic crust of the Trans-Hudson orogen and adjacent cratonic regions (Eaton and Darbyshire, 2009). Twenty-one months of continuous ambient-noise recordings have been acquired from 37 broadband seismograph stations that encircle Hudson Bay. These stations are part of the Hudson Bay Lithospheric Experiment (HuBLE), an international project that is currently operating more than 40 broadband seismograph stations around the periphery of the Bay with the aim of improving our knowledge of crustal structure of the basin and underlying orogen, as well as to image the thick mantle root beneath the Canadian Shield. Using well-established data processing methods (Bensen et al., 2007) that included trend-removal, one-bit normalization and instrument-response correction, we obtained 591 inter-station group velocity dispersion curves from the amplitude-envelope of average daily cross-correlation functions (Lin et al., 2007). Data from these curves in the period range of 5-40 s provide the input for a tomographic inversion procedure developed for surface-wave analysis. We follow the inversion procedure described by Deschamps et al. (2008), which yields azimuthal anisotropy parameters in addition to an isotropic crustal velocity model. In principle, ambient-noise tomography has an advantage over two-station analysis of surface waves from earthquakes, in that a larger number of paths are typically available to perform tomographic inversion. In practice, however, dispersion curves obtained from ambient-noise analysis are less well resolved than those obtained from surface waves, which add uncertainty to the inversion. In addition to the tectonic interpretation of crustal anisotropic fabrics beneath Hudson Bay, a focus of this preliminary study is to assess the reliability of ambient-noise tomography approach where seismic anisotropy is considered as part of the inversion.

References

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