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Shear-wave Velocity Structure of the Crust and Upper Mantle beneath East Antarctica from Full-Waveform Ambient Noise Tomography

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The origin and tectonic evolution of various features in East Antarctica, such as the Wilkes Subglacial Basin (WSB), Aurora Subglacial Basin (ASB), Transantarctic Mountains (TAMs), and Gamburtsev Subglacial Mountains (GSM), are unconstrained due to thick ice coverage and a lack of direct geologic samples. We are modeling the crustal and upper mantle structure beneath these areas using a full-waveform tomography method to further our understanding the tectonic evolution of the continent as well as the behavior of the overlying ice sheet. A frequency-time normalization approach is employed to extract empirical Green's functions (EGFs) from ambient seismic noise, between periods of 15-340 seconds. EGF ray path coverage is dense throughout East Antarctica, indicating that our study will provide new, high resolution imaging of this area. Synthetic waveforms are simulated through a three-dimensional heterogeneous Earth model using a finite-difference wave propagation method with a grid spacing of 0.025º, which accurately reproduces Rayleigh waves at 15+ seconds. Following this, phase delays are measured between the synthetics and the data, sensitivity kernels are constructed using the scattering integral approach, and we invert using a sparse, least-squares method. Preliminary results show that slow velocities are present beneath both the WSB and ASB, possibly indicating old rift systems or other inherited tectonic structures. The transition from slow to fast velocities beneath the Northern Victoria Land section of the TAMs is consistent with thermal loading beneath the mountain range. The presence of slow velocities near the GSM may be associated with rifting along the Lambert Rift System.