Patterns of Segmentation in the East Antarctic Lithosphere from Full-waveform Inversion and Long-period Ambient Noise Tomography

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Many seismic tomography investigations have imaged the East Antarctic lithosphere as a thick and continuous cratonic structure that is separated from the thinner lithosphere of the adjacent West Antarctic Rift System by the Transantarctic Mountains. However, recent studies have painted a more complicated picture, suggesting, for instance, a separate cratonic fragment beneath Dronning Maud Land and possible lithospheric delamination beneath the southern Transantarctic Mountains. In addition, patterns of intracratonic seismicity have been identified near the Gamburtsev Subglacial Mountains in East Antarctica, indicating possible rift zones in this region. That said, detailed imaging of the subsurface structure has remained challenging given the sparse distribution of seismic stations and the generally low seismicity rate throughout the interior of East Antarctica. Therefore, new approaches that can leverage existing seismic datasets to elucidate the Antarctic cratonic structure are vital. We are utilizing records of ambient seismic noise recorded by numerous temporary, moderate-term, and long-term seismic networks throughout Antarctica to improve the imaging of the lithospheric structure. Empirical Green's Functions with periods of 40-340 seconds have been extracted using a frequency-time normalization approach, and these data are being used to constrain our full-waveform inversion. A finite-difference approach with a continental-scale, spherical grid is employed to numerically model synthetic seismograms, and a scattering integral method is used to construct the associated sensitivity kernels. Our initial results suggest that some portions of East Antarctica, particularly those beneath the Wilkes Subglacial Basin and the Aurora Basin, may have reduced shear-wave velocities that potentially indicate regions of thinner lithosphere. Further, possible segmentation may be present in the vicinity of the Gamburtsev Subglacial Mountains. Our new tomographic results will allow for further assessment of the East Antarctic tectonic structure and its relation to local seismicity.