Shear velocity structure of central Antarctica from teleseismic Rayleigh waves

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Part of the multinational IPY effort in Antarctica is the year round operation of over 50 broadband seismometers deployed across East and West Antarctica forming the POLENET and GAMSEIS seismic arrays. Many of these stations have operated successfully since 2007. In conjunction with the earlier TAMSEIS (2000-2003) array and permanent broadband stations on the continent, we have an unprecedented opportunity to explore the seismic structure of Antarctica. We utilize this data to perform teleseismic surface wave tomography and subsequently invert for shear velocity to investigate the seismic structure of central Antarctica from the Gamburtsev Subglacial Mountains in East Antarctica, across the Transantarctic Mountains and West Antarctic Rift System to Marie Byrd Land in West Antarctica. We utilize the two-plane wave method of *Forsyth and Li* [2005] to invert for Rayleigh wave phase velocities across the study region. These phase velocities are then inverted for shear velocity. East Antarctica is defined by a thick crust and fast lithospheric root extending to depths of ~250 km. In contrast, thin crust and slow mantle velocities consistent with regions undergoing extension underlie West Antarctica. A sharp vertical velocity contrast defines the Ross Sea region, whereas the boundary is diffuse beneath central TAMS, and slow velocities extend across the WARS into Marie Byrd Land. We find little evidence for thick crust beneath the central TAMS, rather we suggest that observed topography within the region is due to thermal uplift. The Ellsworth Subglacial Mountains represent an old lithospheric block that has undergone thermal modification of its lithosphere, though there is still evidence for a lithosphere. In the WARS we observe thin, seismically fast crust and slow upper mantle velocities consistent with continental rifting. Marie Byrd Land is underlain by a thicker lithosphere than the WARS, but slow mantle velocities are observed here as well. These slower velocities are observed to depths of >200 km beneath the center of Marie Byrd Land.

References

Forsyth, D. W. and A. Li, Array analysis of two-dimensional variations in surface wave phase velocity and azimuthal anisotropy in the presence of multipathing interference, in *Seismic Earth: Array Analysis of Broadband Seismograms*, edited by A. Levander and G. Nolet, AGU, Washington D.C., 81-97, 2005.