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Africa's Lithospheric Architecture with Multi-mode Body Wave Imaging

Jean-Joel Legre[1] and Tolulope Olugboji[1,2,3]
[1]Earth and Environmental Science, University of Rochester, Rochester, New York, United States of America (j.joel.legre@gmail.com)
[2]Department of Electrical and Computer Engineering, University of Rochester, Rochester, New York, United States of America (tolugboj@ur.rochester.edu)
[3]Georgen Institute of Data Sciences, University of Rochester, Rochester, New York, United States of America

Africa’s lithosphere hosts the longest-lived cratons on our planet and records a rich and diverse tectonic history: plate subduction to the North, a long rift system in the East, the super swell in the South, and a record of continental breakup to the West. However, gaps remain in our current efforts to study its lithospheric layering due to sparse coverage and noisy short-term seismic deployments. Here, we present a body-wave dataset and model assessment products for investigating Africa’s lithosphere (ADAMA). We address the challenge of lithospheric imaging on the continent using sparse and noisy teleseismic body wavefields, i.e., receiver functions and SS precursors. The latter extends lithospheric illumination in regions without station coverage. In both cases, we explore novel denoising approaches: (1) CRISP-RF (Clean Receiver Function Imaging with Sparse Radon Filters), which uses sparse Radon transforms to interpolate the sparse receiver function data and eliminate incoherent noise, and (2) FADER (Fast Automated Detection and Elimination of Echoes and Reverberations), which deconvolves thin-layer reflections buried in long-period SS precursors. We improve constraints on bulk crustal structure and lithospheric layering, e.g., from H-k stacking, following CRISP-RF denoising. We extend spatial sampling and detections of lithospheric layering by jointly interpreting receiver functions and SS precursors following cepstral deconvolution of long-period SS precursor waveforms. Our final model, ACE-ADAMA-BW (Africa’s Continental Layering Evaluated with ADAMA’s Body Waves), will improve 3-D resolution of lithospheric layering spanning the cratons (West Africa, Tanzania, Congo, Kaapvaal, Zimbabwe), rifts (Gourma, East African Rift System) and basins (Taoudeni, Goo, Congo) of Africa.