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The African upper mantle: the view from surface waves

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Given the sparse distribution of seismic stations across significant regions of the African continent surface wave tomography is the ideal seismological technique to give a clear picture of the large scale structure for the upper mantle. An updated tomographic model is presented, and reviewed in comparison with other tomography for the region. Cratonic regions are clearly outlined with fast velocities extending to depths of >175km. Areas of slow shear velocity, at depths of 100-150km, show good correlation with long wavelength gravity highs and areas of uplifted topography. The numerous temporary deployments of seismometers along the East African rift system provide strong constraints on the structure in this region. Importantly, many of the seismological features are now converging in a range of tomographic models, adding to the confidence in interpretations.

However, significant challenges remain, both for seismology and for the interpretations of the results. Pushing towards smaller features and higher resolution to understand geological problems is still difficult. For example, the mantle structure imaged beneath the Bushveld Complex remains very variable depending on the technique used. Lithospheric thickness can be estimated using a variety of proxies – comparisons of this are shown for southern Africa. But, are the seismic models actually compatible with a mineral physics view of the lithosphere? From a geodynamic perspective, how do localised regions of low velocity in the upper mantle relate to the larger patterns of whole mantle circulation? While seismic imaging is providing an increasingly clear picture of the present velocity structure more integration is still needed to answer many of the questions related to the African continent.