Upper Mantle Structure of the Eastern Africa from Body Wave Tomography

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Abstract

This study presents preliminary results of the upper mantle structure beneath the east Africa from body wave tomography. This work is part of an on-going study aimed at investigating the origin and structure of the African Superplume. The available global tomographic studies suggest that the African Superplume is a low velocity-anomaly extending from the core-mantle boundary upward into the mid mantle beneath southern Africa and may reach the upper mantle beneath eastern Africa. However, the limited vertical resolution of global tomographic models makes it difficult to confirm a connection from the lower to the upper mantle. Previous regional studies of upper mantle structure in east Africa have found evidence of a low velocity anomaly beneath the region that has been suggested as the upper mantle expression of the Superplume. Models from previous tomographic studies in east Africa have limited resolution below ~400 km beneath the eastern rift and are less well resolved beneath the western part of the rift due to less data coverage. This study uses teleseismic data from a wider region in east Africa than previously used. Data for this study are from a 3-year (2007-2010) deployment of 40 broadband seismic stations in Uganda and Tanzania. The dataset is supplemented by data from the 1994-1995 Tanzania broadband seismic experiment, the 2001-2002 Kenya broadband seismic experiment, the permanent AfricaArray seismic stations and IRIS/GSN stations. The data have been used for body wave tomography by computing relative travel time delays using a multi-channel cross-correlation technique and then inverting them for a 3D wave speed model. Preliminary results from the inversion of the relative delay times show that there is a low wave speed anomaly beneath east Africa extending from shallow upper mantle depths to at least 500 km.