Crustal Structure of the Khartoum Basin, Sudan

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The Khartoum basin is one of several Mesozoic rift basins in Sudan associated with the Central Africa Rift System. Little is known about the deep crustal structure of this basin, and this limited knowledge hampers the development of a more detailed understanding of its origin and evolution. Constraints on crustal structure in Sudan are only available through regional gravity studies and continental-scale tomography models, but these studies have poor resolution in the Khartoum basin. Here, we investigate the crustal structure of the northern part of the Khartoum basin beneath 3 permanent seismic stations in Khartoum, Sudan through the H-k stacking of receiver functions and the joint inversion of receiver functions and Rayleigh-wave group velocities. Our H-k-stacking results indicate that crustal thickness beneath the Khartoum basin ranges between 33 and 37 km, with an average of 35 km and that crustal Vp/Vs ratio ranges from 1.74 to 1.81, with an average of 1.78. These results are consistent with 1D velocity models developed from the joint inversion of receiver functions and Rayleigh-wave group velocities, which display similar estimates for crustal thickness and an average shear-wave velocity of 3.7 km/s for the basin's crust. Our results provide the first seismic estimate of Moho depth for a basin in Sudan and, when compared to average crustal thickness for the unrifted Proterozoic crust in eastern Africa, reveal that at most a few kilometers of crustal thinning has occurred beneath the Khartoum basin.