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Core structure reexamined using new teleseismic data recorded in Antarctica: Evidence for, at most, weak cylindrical seismic anisotropy in the inner core

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We present a significant addition to the dataset of travel times of seismic PKP waves that sample the Earth's lowermost mantle and core along the Earth's rotation axis. Recorded at permanent Global Seismic Network (GSN) and temporary SSCUA deployment broadband seismographic stations in Antarctica, the new data improve the previously poor and biased coverage that underlies the seismic constraints on recent models of inner core structure and anisotropy. New differential PKP travel time measurements improve the sampling of the eastern inner core hemisphere. PKPab-df and PKPbc-df differential travel time residuals with respect to the spherically symmetric model ak135 are consistently smaller than two seconds along the north-south paths sampled. Therefore, axially symmetric models of inner core seismic anisotropy with fast axis parallel to the Earth's rotation axis require, at most, weak anisotropy to be consistent with our observations. The dataset also increases constraints on D" structure beneath the south pole, and structure at the top of the inner core. We deduce that part of the previously observed large anomaly in travel times along paths from South Atlantic earthquakes to northern high-latitude stations must be due to structure in the mantle along the northern leg of the ray-paths. In contrast to previous inferences based on data from northern stations, we find no evidence of a velocity heterogeneity near the inner core boundary associated with the cylinder tangent to the inner core in the southern hemisphere. New absolute PKP travel time measurements add to the dataset for both hemispheres of the inner core. They confirm the hemispheric trends observed in previous data.