2D/3D Modeling of the Pacific Lower Mantle Using S, SKS and SKKS Traveltimes and Amplitudes

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We analyze a new collection of traveltimes and amplitudes of the shear wave phases S (Sdiff), SKS, and SKKS which propagate from Tonga-Fiji earthquakes to stations in North America at distances between epicentral distances 85 degrees to 120 degrees. The traveltimes and amplitudes of S, SKS, and SKKS vary smoothly as a function of both epicentral distance and azimuth. Positive correlation of the traveltime differences is detected between SKKS and SKS and between S and SKS. Combined, these observations suggest that S, SKS, and SKKS interact with the southwestern margin of the large low-velocity anomaly in the lower mantle beneath the Pacific (the Pacific Anomaly). Forward modeling of the velocity profiles and 3D tomography are used to model the traveltimes and amplitudes of S, SKS, and SKKS in order to determine (1) the location of the "edge" of the Pacific Anomaly, (2) the radial extent of the Pacific Anomaly into the mantle, and (3) the significance of ultra-low velocity zones at the base of the mantle.