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Amplitudes of Long-Period PcP, SKS and SKKS and the Structure at the Base of the Mantle and in the Outer Core

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We have studied the amplitude ratios PcP/P and SKS/SKKS in long-period WWNS and CSN records of 2 South American and 5 Tonga-Fiji deep-focus earthquakes. These data are compared with theoretical ratios PcP/P and SKS/SKKS, derived from theoretical seismograms for a variety of models of the lowermost mantle, the core-mantle boundary (CMB) and the outer core. The PcP/P data discriminate against models with discrete layers above the CMB and against nonzero S velocities below the CMB. They are reasonably well explained by simple first-order discontinuity models of the CMB. The data may indicate a negative P-velocity gradient above the CMB, but it was not possible to find a satisfactory fit for both PcP/P and the travel times of PcP. The SKS/SKKS ratio is most sensitive with respect to the P-velocity distribution in the outer core down to depths of about 4200 km. Traditional distributions produce ratios which are significantly larger than the observed ratios between 100° and 110°. Agreement of observation and theory is found for a model with increased velocities around 3750 km depth. This model also satisfies the differential travel times of SKS and SKKS, and its SKKKS phase is weak enough to be compatible with the observations. Other models explaining the SKS/SKKS data have not been found. Our model implies pronounced chemical zoning in the outer core.

References

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