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An overview of the core-mantle boundary region from seismological studies

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The core-mantle boundary (CMB) region is both a compositional and thermal boundary layer with the largest density contrast anywhere in the planet. As a result, the structures found within the lowermost mantle are as complex as those found on the Earth's surface. In this presentation we review the major features that have been identified from seismological studies. We review features at (1) the largest (> 1000 km) scales as revealed through seismic tomography of body wave and normal modes (2) intermediate scales (~10's to 1000 km) as revealed through waveform modeling, and (3) at the smallest scales (~10s of km) as revealed through stochastic studies. At the largest scales two Large Low Velocity Provinces (LLVPs) beneath Africa and the Pacific Ocean dominate the tomographic images. These two features are surrounded by high seismic wave velocity regions that are consistent with remains of the past ~200 million years of subduction. At the largest scales, D" discontinuity structure is consistently observed in the high velocity regions, but has also been observed within the LLVP's at an apparently shallower depth. We discuss the nature of the LLVP's, their possible origins, and the ongoing debate surrounding what they physically represent. At the intermediate scales, multiple features have been observed, including core rigidity zones (CRZs), ultra-high velocity zones (UHVZs), and ultra-low velocity zones (ULVZs). Of these features, the ULVZs have received the most attention and appear to occupy a significant portion of the CMB landscape, with as much as 20% of the CMB region containing ULVZs inferred. Here we review current ideas about what these features are, where they are located, and their importance for whole Earth dynamic processes. At the smallest scales, the CMB area contains regions that generate the largest amplitude scattered arrivals. We discuss the locations where this scattered energy originates and the potential origins of the scatterers.

Attendance type

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