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Imaging the Earth's Deep Interior using seismic waves

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Forty years ago, the first global seismic tomographic models revealed the presence of two large, antipodal, structures at the base of the Earth's mantle, now known as "large low shear velocity provinces" (LLSVPs), that had no obvious relation to surface geology or mantle dynamics as understood from plate tectonics theory, and as reflected in near surface seismic structure.

With the expansion of digital, very broadband seismic networks and related on-line databases, combined with improvements in theory and computer power, the resolution of mantle elastic structure has progressively improved. In this lecture, I will illustrate how state-of-the-art imaging techniques allow us to: track the fate of tectonic plates that dive back into the mantle beneath the Pacific "ring of fire", improve our understanding of the morphology and role of the LLSVPs, and follow the paths of deeply rooted hot mantle plumes, as they ascend towards the surface and are expressed there in the form of hotspot volcanism (of which Hawaii and Iceland are prominent examples). I will present some of the open science questions, technical challenges for further progress in full waveform tomography, as well as possible paths ahead to address them, combining tools from seismology and other geophysical disciplines.

Promotional text

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