Seismic Tomography and Interferometry: From Shallow to Deep

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Seismic waves propagating through the earth's interior provide important constraints for studying earth structure. Recently, large-scale seismic array deployments have promoted the development of new data analysis methods. Surface-wave tomography, which uses surface waves to determine crustal and upper mantle structure, and seismic interferometry, which extracts waves traveling between two stations by cross-correlating long duration noise signals, are among the many exciting research areas. In this presentation, two major forefronts of seismic tomography and interferometry research based on USArray data will be discussed. On the shallow end, I will present recent developments in using surface-wave phase velocity and Rayleigh-wave particle motion to determine shallow earth velocity and density structure. By including Rayleigh-wave particle motion, upper crustal structure, which is traditionally not resolvable, can now be constrained and shows clear correlation with known surface geological features. On the deep end, I will show how deep-propagating body waves, particularly core phases, traveling between stations can be extracted using seismic interferometry. These new developments are likely going to provide new opportunities to improve our understanding of earth structure.