Double-Array Stacking of PcP Waveforms: An Application to Ultra-low Velocity Zones in the Southern Hemisphere

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ABSTRACT TEXT

Ultra-low velocity zones (ULVZs) are the most anomalous features in the Earth's mantle. Situated just above the core-mantle boundary (CMB), ULVZs are associated with decreased seismic velocity and increased density. However, the variable ULVZ properties reported between different studies has made ULVZ origins a topic of significant debate. The uncertainties regarding ULVZs are also exacerbated by the limited seismic sampling of the Earth's lowermost mantle, especially beneath the southern hemisphere, which has only been sparsely investigated for these anomalous features. In our study, we employ double-array stacking of core-reflected PcP waveforms recorded by stations in Antarctica to investigate the presence/absence of ULVZ structure. Our study area has been geographically divided into 2° radius bins, and event-station records whose PcP waveforms sample the CMB within each bin have been stacked to assess if precursory PcP energy is present, indicative of ULVZ structure. Preliminary results show widespread evidence for ULVZs throughout the southern hemisphere with variable thickness. Our study not only helps to broaden ULVZ investigations, but it also contributes to our understanding of probable sources for ULVZs and how they may be related to larger-scale mantle processes.

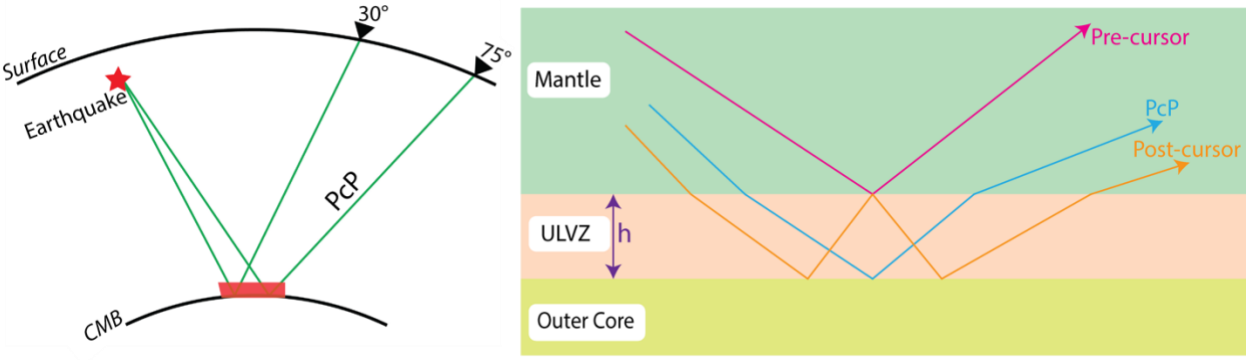

Fig 1: (Left figure) Ray path of a PcP seismic phase (Right figure) Pre-cursor and Post-cursor energy are generated when PcP encounters a ULVZ layer.