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Regional modeling of lateral heterogeneity near the CMB from central America to the eastern part of the Pacific LLSVP

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Lateral structure variations at the base of the mantle are not precisely known. There is currently an active debate on the wavelengths of the core-mantle boundary (CMB) topography, the lateral variations on Vp and Vs, anisotropy and the trade-offs between them. Most seismological studies compare 1D or 3D global models to local observations of relatively-weak seismic phases but with strong CMB interaction, such as PcP, ScS, PcS and Sdiff. To reduce upper Mantle contamination these observations are conventionally measured relative to much strong reference phases, such as P and S.

The two major observations are travel-times differences and amplitude ratios. Current major challenges in extracting clean observations are low signal-to-noise ratios (SNR) of CMB phases, and interference with a plethora of mantle phases. Low SNR hinders the extraction of accurate observations in low-magnitude events. While, PcP and ScS is frequently hidden in the coda of P and S, respectively, especially at large distance. Additional, s and p depth phases from P and S overlap precious portions of PcP and ScS phases for intermediate depth events.

We face these problems using high-density seismic networks. We introduce seismic data-processing techniques that use dense arrays to create filters that separate locally signals in slowness, without compromising resolution. We specifically use the local slant-stack transform in the time-scale domain (Ventosa et al., EUSIPCO, 2011) to decompose each seismogram in slowness in a scale-smart way, merging the wavelet and local slant-stack transforms. In the particular case of PcP-P, we are able to extract accurate observations for events with magnitude of mW>5.4 and maximum distances up to 80 degrees. We conduct a regional study of the CMB structure from central America to the edge of the Pacific large-low shear-velocity provinces (LLSVP). Our approach allows us to sample regions of the eastern Pacific LLSVP boundary with unprecedented resolution, and obtain constraints on the sharpness of the boundary and the velocity contrasts across it, which we can compare to results obtained using shear waves.