

Imaging the Yellowstone magmatic system using surface waves from ambient noise cross-correlation.

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We present a new velocity model for the Yellowstone magmatic system derived from the inversion of Rayleigh- and Love-wave phase velocity measurements from periods from 6 to 25 s. Continuous data from 2007-2014 for the Yellowstone region was downloaded from the USArray TA network (TA), the Yellowstone Seismic Network (WY), the NOISY array (Z2), the USGS Intermountain West network (IW), the Plate Boundary Observatory Borehole Seismic Network (PB), and the USGS National Seismic Network (US). For each station, we perform daily noise pre-processing (temporal normalization and spectrum whitening) simultaneously for all three components before multi-component noise cross-correlations are calculated (e.g. Figure 1a, c). Results for both Rayleigh- and Love-wave phase velocity inversions clearly show the low velocity anomaly associated with the upper-crustal magma reservoir seen previously using body wave tomography (Figure 1b,d). In addition, low-velocity anomalies associated with sediment-filled basins are visible in Wyoming (Figure 1b,d). Shallow low Love-wave velocities are seen along the Snake River Plain (red outline in Figure 1d), the track of the Yellowstone hotspot. We also plan to use amplitude information of noise cross-correlations to calculate Rayleigh-wave ellipticity, or Rayleigh-wave H/V (horizontal to vertical) amplitude ratios to better constrain the shallow velocity structure.

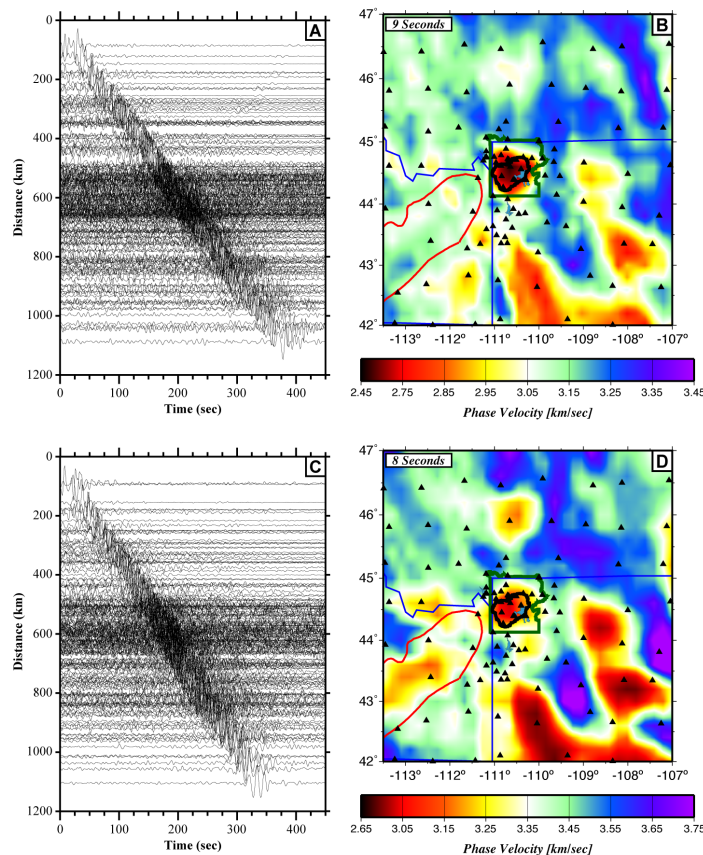


Figure 1: Velocity structure of the Yellowstone hotspot from ambient noise tomography. (A) Record section showing vertical-vertical crosscorrelations between USArray station C11A (extreme NW station in B) to all other stations where clear Raleigh wave move-out can be observed. (B) 9 s Rayleigh wave phase velocity map showing low velocities related to the shallow magma reservoir under Yellowstone. The 0.64 Ma caldera is outlined in black and Yellowstone National Park is outlined in green. Seismic stations used are shown as black triangles. (C) Same as A, but for transverse-transverse cross-correlations where clear Love wave move-out can be observed. (D) Same as (B) but for 8 s Love wave phase velocity map.