Observed and predicted North American teleseismic delay times

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1 About

- AIMBAT used to measure absolute delay times of teleseismic P and S waves
- Recorded by seismic station from EarthScope's USArray, previous PASSCAL arrays, other networks in North America
- Estimate contributions to delays from
  1. Delays from crustal structure
     Using crustal models
  2. Event side heterogeniety
     Using delay time distribution
- Subtract contributions to delays, from actual measurements $\Rightarrow$ map average delay at each station
- Analyze average delay times to investigate structure of North American mantle, formation of North American continent.
  1. Mantle S delay times from stations west of the Rocky Mountains are 4.2 s larger than delay times from stations within the US portion of stable North America.
  2. S delays at Yellowstone are another 4 s larger than those west of Rocky Mountains.
  3. Delay time gradients of various steepness coincide with surface geological boundaries.
- Predictions
  - Predictions of teleseismic S delays from 12 3D tomographic mantle S velocity models agree with observed delay time patterns.
    Underestimate delays and advances to varying degrees.

  - Similar predictions from tomographic models derived from data other than teleseismic arrival times

    These overestimate the smoothness of delay time patterns.

- Using tomographic models to predict and study the size and distribution of delay contributions from modeled heterogeneity in different depth ranges.

  - 80 - 240 km depth range is dominant contributor to delay time contrasts and variance

    Corresponds to asthenosphere in western US and lithosphere in central and eastern US.

  - Average depth to which observed delays require central US lithosphere to extend is likely shallower than 240 km.

    Consistent with seismic bottom of lithosphere imaged in seismic-velocity models not derived from teleseismic delay times.