1.1 Introduction

- Well established that the attenuation (1/Q), or the inefficiency of energy propagation, of Lg-phase waves is greater west of the Rocky Mountains than east of the Rocky Mountains (Benz et al., 1997).
- Less clarity in delineating the boundary or defining the transition in attenuation between the Western U.S. (WUS) and the Central and Eastern US (CEUS).
- Local geology and surface topography can amplify or dampen seismic waves, and consequently the observed local shaking associated with an earthquake.

1.2 Motivation

- Attenuation is a crucial component for modeling the spatial variation of ground motion prediction equations (GMPEs).
- Lg waveform inversion can provide insight into local-scale attenuation mechanisms and site response.
- This can improve ground motion characterization and help to mitigate seismic hazards.

2.2 Waveform Inversion and Determination of Regional Q

- Inversion of Lg-phase wave amplitudes at 1.5 Hz for source term (size of seismic event), receiver term (characterizing local geology), and path averaged Q (attenuation).
- Path averaged apparent Q regionally averaged for the Basin and Range, Rocky Mountains, Interior Plains, Colorado Plateau, and Atlantic Plain regions.
- Lg waveform data (BHE, BHN, BHZ) acquired from the USGS Global Seismograph Network (GSN), Advanced National Seismic System (ANSS), and the USArray Transportable Array (TA) programs and accessed through the IRIS Data Management Center (DMC).
- Approximately 95 events, recorded at 382 stations within study area from June 2006 to June 2016.
- Events limited to magnitude 4.0+, limited to 40 km depth.

3.1 Results

- Highest Q (lowest attenuation) found in Interior Plains region, followed by the Colorado Plateau and Rocky Mountains regions.
- Lowest Q (highest attenuation) found in Atlantic Plain followed by the Basin and Range region.
- Lg waves are amplified in sites with soft sediment (Interior Plains and Atlantic Plain regions), and dampened in sites with surficial hard rock (Colorado Plateau and Basin and Range regions).
- Areas with high relief correspond broadly to the dampening of seismic waves, whereas areas with low relief correspond broadly to amplification.

4.1 Discussion

- Attenuation and consequently Q, show a strong qualitative correlation with local geology and topography.
- Attenuation is highest in areas with recent volcanism, geothermal and tectonic activity, corresponding to the findings of previous studies of attenuation (Phillips and Stead, 2008).
- Topographic relief can serve as an effective proxy to infer ground shaking due to site amplification and dampening.
- Sparsity of events and ray paths in the Atlantic Plain and Rocky Mountains regions creates a low resolution upper limit characterization of Q in these areas.

5.1 Future Work

- Incorporation of additional frequency bands (e.g., 0.5 Hz, 1 Hz, 3 Hz, 6 Hz, 12 Hz).
- High-resolution Q(1) tomographic inversion to provide an enhanced understanding of the changes in attenuation across geologic boundaries (similar to that of Pasyanos et al. (2009)) and as a function of frequency.
- Incorporation of measured Vs30 values in the CEUS to better characterize local ground shaking.
- Improved event distribution, particularly within the Central US region.

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Works Cited


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