Strong Ground Motions from 2019 Ridgecrest Earthquake Sequence Mainshocks

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Abstract

The Ridgecrest Earthquake sequence included a **M**6.4 foreshock on 4 July 2019 and a **M**7.1 mainshock event on 5 July 2019. These events occurred in the Eastern California Shear Zone, near Indian Wells Valley, south of China Lake and west of Searles Valley. The **M**6.4 and **M**7.1 events were recorded by approximately 500 and 800 ground motion stations, respectively, belonging to nine different seismographic networks. Preliminary source, path, and site metadata were compiled for all stations and recordings. 1232 ground motions recordings were processed using standard procedures defined by the PEER Center for the NGA projects. Computed intensity measures include peak ground acceleration (PGA) and pseudo-spectral acceleration response spectra (PSA) at 111 oscillator periods. Preliminary analyses and comparisons to existing NGA-West2 models do not show appreciable overall bias (indicating adequate performance of source terms) and consistent attenuation of amplitudes with distance, which indicates that the California-specific path model is effective. Preliminary analysis of data show that ground motions were amplified for softer site conditions at longer periods, consistent with typical patterns in California. Apparent directivity effects observed include fault-normal ground motions controlling the maximum component at stations off the end of the **M**7.1 fault, whereas stations near the epicenter have no such polarization and generally weaker long-period ground motions.

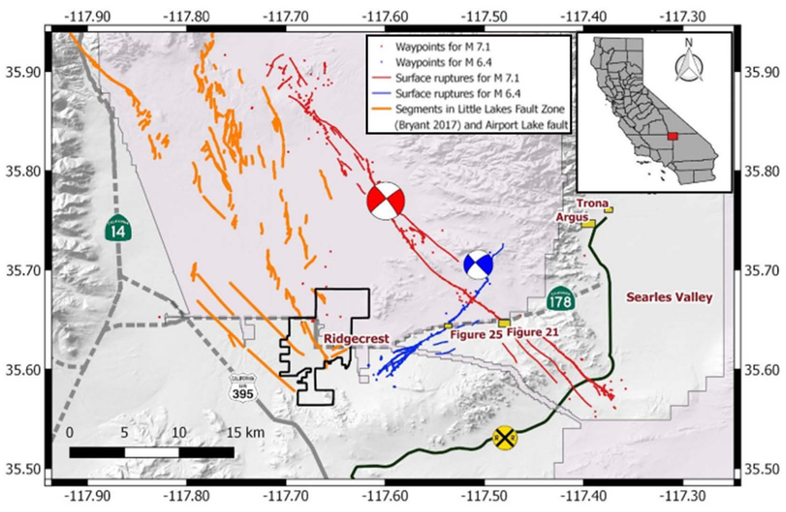


Figure 1. Regional map showing the Ridgecrest - China Lake - Searles Valley region along with mainshock event moment tensors, Little Lake fault zone traces, and other regional faults.

Attenuation with Distance

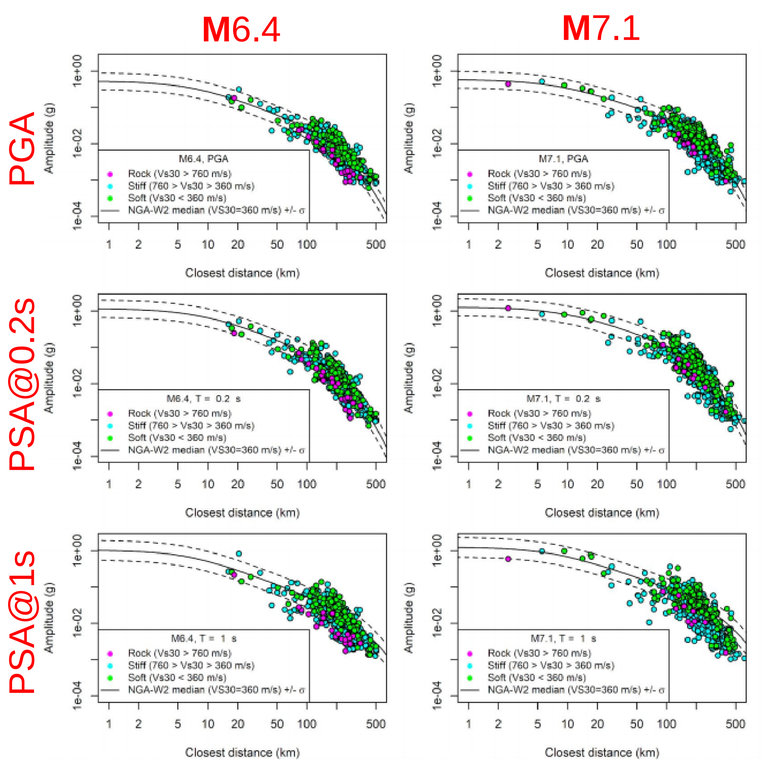
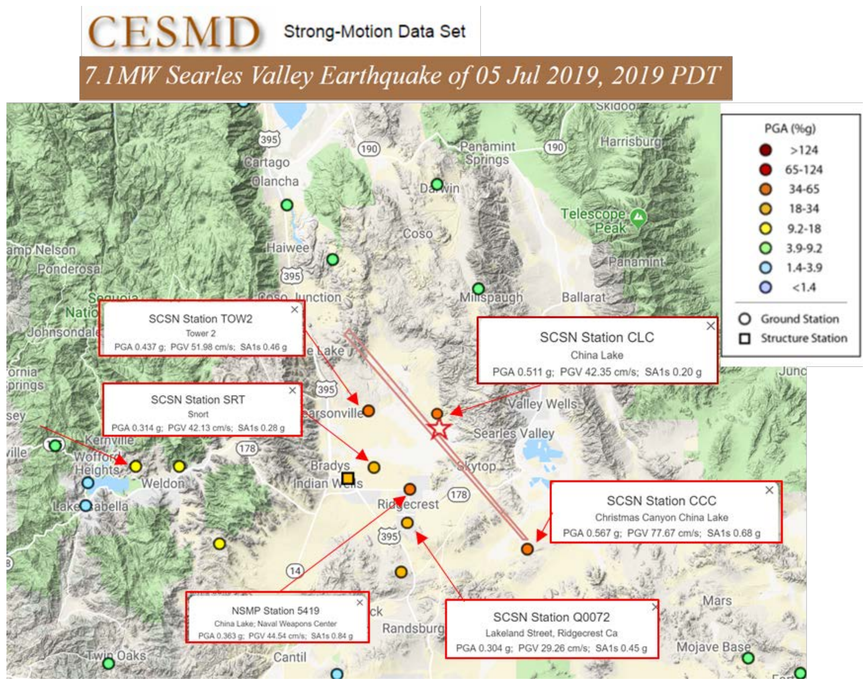
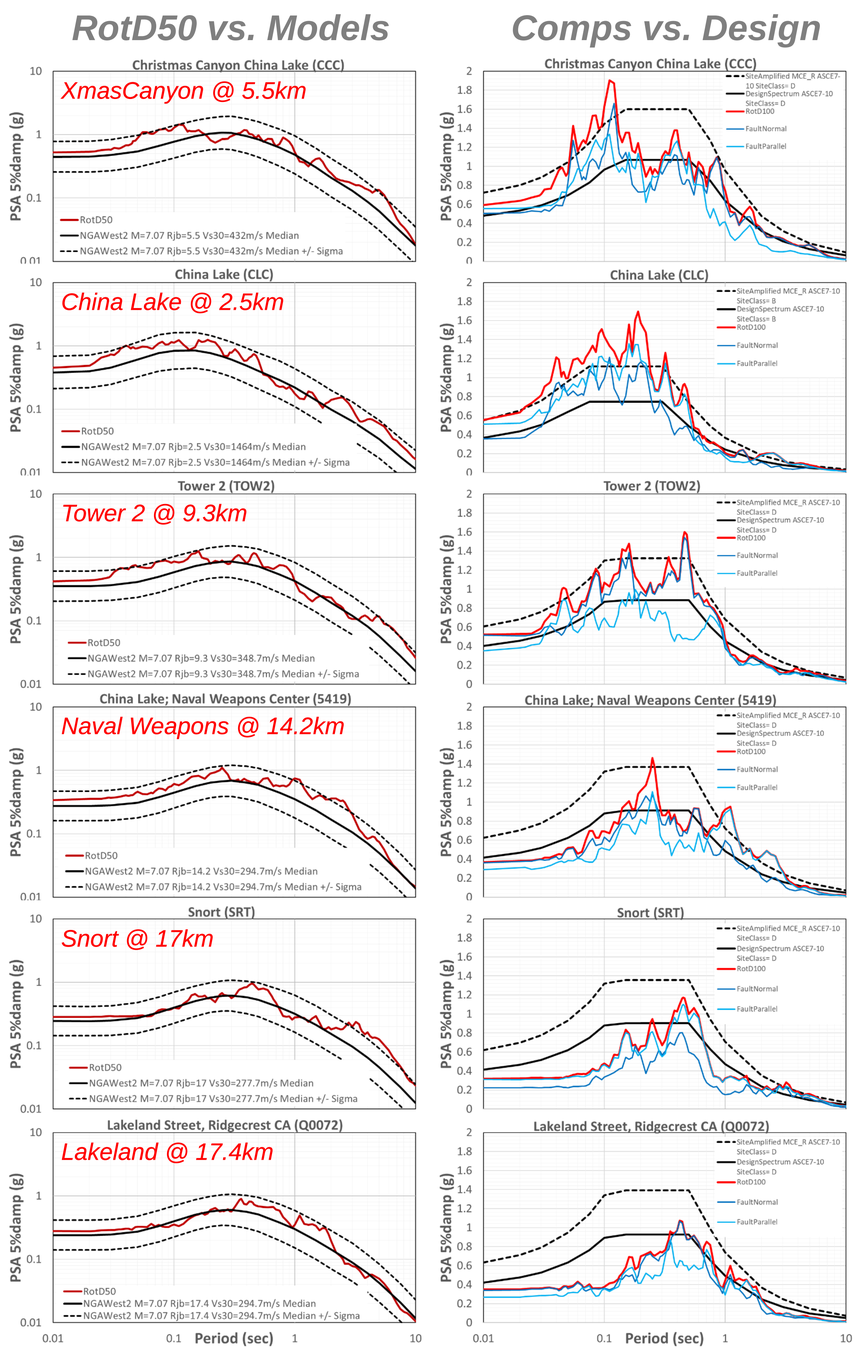


Figure 35. Attenuation with distance of ground motions from M6.4 event (left column) and M7.1 event (right column). RotD50 component PGA and PSA at 0.2 and 1.0 sec.

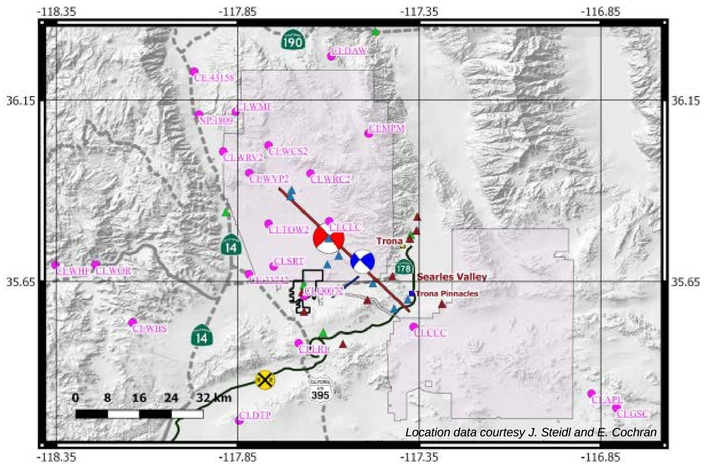
Recording Stations



Response Spectra



Temporary Array Deployment



Ground-Motion Database

- Recorded Accelerometer Data
  - Raw data obtained from CESMD
  - Processed 3-component acceleration traces
- Event Metadata
  - Hypocenter Location
  - Magnitude
  - Mechanism
  - Finite-Fault Model ...
- Site Data
  - Station Location
  - V_{S30}
  - Site Geology
  - Instrument type …
- Path Data
  - R_{rup}
  - R_{JB} …
- Computed Data
  - PGA – attenuation with distance
  - PSA
    - RotD50 5% elastic
    - As-Recorded Components
    - Fault-Normal & Fault-Parallel
    - Compare to Ground-Motion Models
  - Duration …

→ NGA Ground-Motion Database & Flatfile

Preliminary Findings

1. The ground motion models do not appear to have appreciable bias relative to the data for the intensity measures considered (formal residuals analyses are pending).
2. The California-specific path model used in the models captures relatively well the attenuation of ground motions with distance.
3. Ground motions are amplified as site condition softens, with the largest amplification at the longest periods. This is consistent with typical patterns of behavior in California.
4. Further studies of rupture directivity effects on RotD50 spectra, ground motion polarization, and pulse-like characteristics are warranted.

GEER Report

http://www.geerassociation.org/%20component/geer_reports/?view=geerreports&id=91&layout=build

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