Ground Motion Response Study of Urban Los Angeles following the 2019 Ridgecrest Earthquake Sequence

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The Ridgecrest 2019 Earthquakes

Using ground acceleration measurements recorded during the M7.1 and M6.4 events of the 2019 Ridgecrest earthquake sequence we calculate the response spectral accelerations over the urban LA region. We are using data collected from three different networks: CSN (circle markers), SCSN and CSMIP (diamond markers), which all together result in a total of about 550 stations.

Conclusions:
- The long period motion was amplified in the deeper parts of the LA basin by a factor of 5 relative to the bedrock site values.
- For the longer periods, coherent patterns are present throughout the basin.
- For the shorter periods the motions are less spatially coherent, indicating a high level of scattering in the kilometer scale.
- Regional networks lack the necessary station density to show the smaller length scale patterns revealed by the dense CSN instrumentation.

Simulation-Predicted Spectral Accelerations

- We find that for the shorter periods both Community Velocity Models (CVMs) overpredict the observations.
- At the longer periods, the range of predicted spectral accelerations is correct, but both CVMs have trouble matching the specific locations of the maximum spectral accelerations.
- The different formulations of the two CVMs manifest themselves in the results. In the top few kms the CVM-S model is overall smoother, while the CVM-H model contains sharp transitions and patches with large jumps in velocity. This is readily apparent in the results for T=3 s where the RotD50 pattern for CVM-H is much more spatially complex than the pattern seen for CVM-S.
- Comparing with the observations, CVM-S performs better for the longer periods (T=6 and 8 s), while CVM-H performs better for T=3 s.

Correlation with Depth-to-Basement & Vs30

(A) Contoured depth-to-basement map. (B) Contoured Vs30 map.

- We find no significant correlation with depth-to-basement or Vs30 for 1 s period.
- A correlation appears for longer periods and gets stronger for the longer periods.
- Other factors are influencing the response beyond what is captured considering depth-to-basement and Vs30 alone. The depth-to-basement grid values used are from Shaw et al. (2015) & the Vs30 grid values are from Thompson (2018).

The Community Seismic Network (CSN)

The Community Seismic Network (CSN) is a permanent, cloud-based, strong-motion network, located in LA.

Key features:
- Over 700 deployed active stations
- Recording continuous acceleration time series 24/7
- Real-time access to the data & event detection
- Inexpensive three-component MEMS accelerometers, ability to detect low-magnitude events in southern California. Up to par with state-of-the-art accelerometers.
- Distributed on-board computing
- Next-generation Cloud computing
- Highly scalable, due to the use of commercial parts and cloud computing. Fast and easy deployment.

For more information visit: http://csn.caltech.edu

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