Ground Motion in Urban Los Angeles from the 2019 Ridgecrest Earthquakes: Recorded Versus Model-Predicted Response

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The July 2019 Ridgecrest earthquake sequence, well-recorded by numerous Southern California seismic arrays, offers a unique opportunity for a comprehensive study and comparison of the recorded and model-predicted ground motions. Using recordings from multiple regional seismic networks as well as from the much denser Community Seismic Network (CSN), we study the ground motion response in urban Los Angeles during the two largest events (M7.1 & M6.4) of the sequence. The response spectral (pseudo) acceleration (SA) for a selection of periods of engineering significance is calculated. Significant SA amplification is present and reproducible between the two events. We examine possible correlations of the computed SA with two common geotechnical parameters: basement depth and Vs30, and find no significant correlation for 1 s period, while a correlation appears and gets stronger for longer periods. We also study the performance of 3D finite difference simulations in estimating the ground motions and SA for the largest event of the Ridgecrest earthquake sequence, using the two different Southern California Earthquake Center 3D Community Velocity Models (CVMs): CVM-S and CVM-H. Using the model-predicted ground motions we again calculate the SA at specific periods and compare with the observations. At the shorter periods (<3 s), the predictions using the two velocity models are significantly different, with the CVM-H predicted SA being much more spatially complex corresponding to the model's sharp velocity transitions in the top few kilometers. For longer periods (≥3 s) where the longer wavelengths become more sensitive to the larger-scale structure of the basin, the predictions of the two models become more similar. When comparing with the Ridgecrest event data, the model predictions match the mean amplitude and variance of the observations reasonably well; however neither model is able to reproduce the locations where maximum SA occurred, or match the details of the observed SA patterns.

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