Influence of ground motion duration on structural collapse risk

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Background and Motivation

- Current structural design and assessment practice requires explicit consideration of only the response spectra of the ground motions anticipated at a site, not their durations
- In a previous study by the authors
- Their study anticipated at a site, not their durations
- Results help quantify the influence of ground motion duration on structural collapse risk

Objectives

- Characterize seismic hazard in terms of the durations and response spectra of the anticipated ground motions
- Quantify the influence of ground motion duration on structural collapse risk at different sites
- Incorporate the effect of duration into structural design and performance assessment guidelines (ongoing research)

Hazard-consistent source-specific targets

- Target distributions of duration are computed using the GCPM, which is similar to a conditional spectrum, and requires
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- A production equation for Ds(5−75)
- A model for the median between values of Ds(5−75)
- Median duration and response spectrum targets at Seattle, conditional on the 2% 50-year exceedance probability of Ss(1.1)

Selected ground motions

- Eighty-eight records were used as the study input event for the Cascadia subduction zone
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Collapse risk estimates

- Defined a procedure to select hazard-consistent ground motions that match source-specific target distributions of duration and response spectra
- Highlighted the importance of considering ground motion duration in addition to response spectra, in structural design and assessment
- Provided data that could help incorporate the effect of duration into seismic design codes, to ensure a uniform risk of structural collapse over different geographical regions

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