

Ground motions for PEER Transportation Systems Research Program

October 16th, 2009 Draft results

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with thanks to Nirmal Jayaram, Ting Lin, Shrey Shahi

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Online data:

http://www.stanford.edu/~bakerjw/PEER_gms.html



The screenshot shows a web browser window with the address bar displaying http://www.stanford.edu/~bakerjw/PEER_gms.html. The page header features the text "Baker Research Group" in white on a blue background, with a white waveform graphic to the right. Below the header is a navigation menu with five items: "Welcome", "Publications", "Research", "People", and "About".

The main content area has a title: **October 16th, 2009 DRAFT: Ground Motions for PEER Transportation Systems Research Program**. Below the title is a paragraph: "The following files document the first draft of ground motions for potential use in the PEER transportation systems research program. Updates and improvements to this documentation are likely to occur following the October 16th Transportation Systems Research coordination meeting. Please contact Jack Baker if you are looking for finalized ground motions."

There is a section titled **Broad-band ground motions** with the text: "This ground motion set consists of 40 unscaled ground motions with a mean and standard deviation of their response spectra equal to the mean and standard deviation equal to".

Below this section is a small icon of a spreadsheet and the text: "Spreadsheet documenting selected ground motions. Worksheets are provided to list a summary of the selected ground motions' metadata, their response spectra, and comparisons of the ground motion set's mean, standard deviation and correlations to comparable values predicted by ground motion models."

On the right side of the page, there is a section titled **Acknowledgements** with two paragraphs of text: "Thanks to PhD students Nirmal Jayaram, Ting Lin and Shrey Shahi for their help in selecting and documenting the ground motions used in this work." and "Thanks to the PEER Transportation Systems Research Program for supporting this work, and to members of the program for their insightful feedback and recommendations regarding criteria for selecting these ground motions."

Background

http://www.stanford.edu/~bakerjw/PEER_gms.html

The goal of this project is to select a standardized set of ground motions for the TSRP that

- Can be used to analyze a variety of bridge and geotechnical systems
- Are appropriate for a variety of locations in California

Because these are not structure-specific and site-specific goals, ground motion selection techniques developed in previous PEER projects are not directly applicable here

Today I will present our “first draft” proposed ground motions, based on feedback from our August 2009 meeting

We intend to make (minor?) modifications and finalize these ground motion sets shortly after this meeting

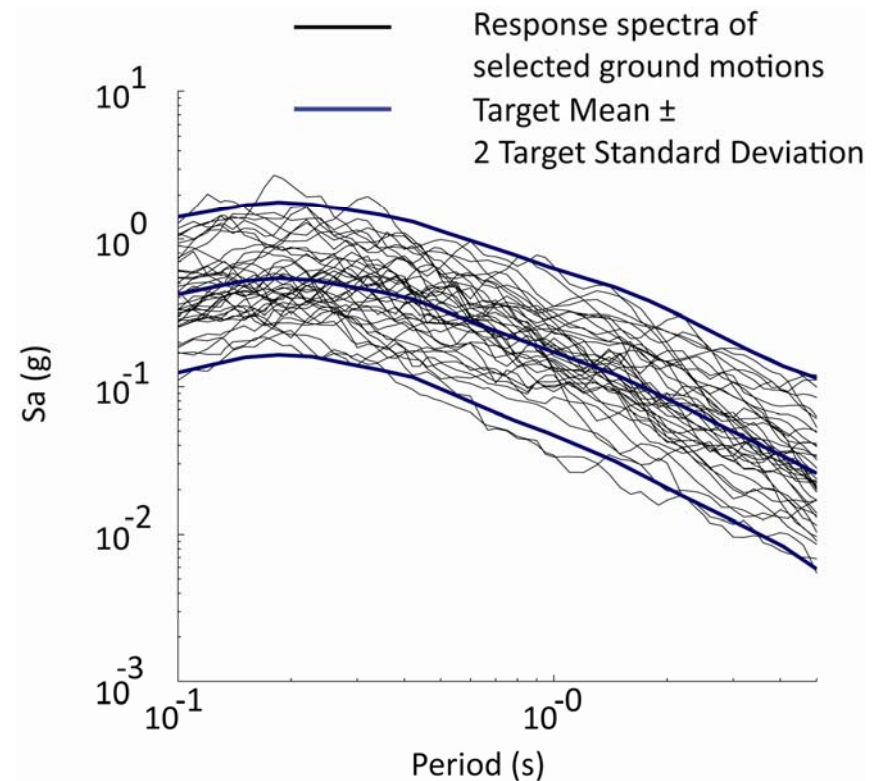
Proposed ground motion sets

http://www.stanford.edu/~bakerjw/PEER_gms.html

- Group 1: “Broad-band ground motions”
- Group 2: “Pulse-like ground motions”
- All ground motions are unscaled, three-component (SN/SP/Vertical), ...

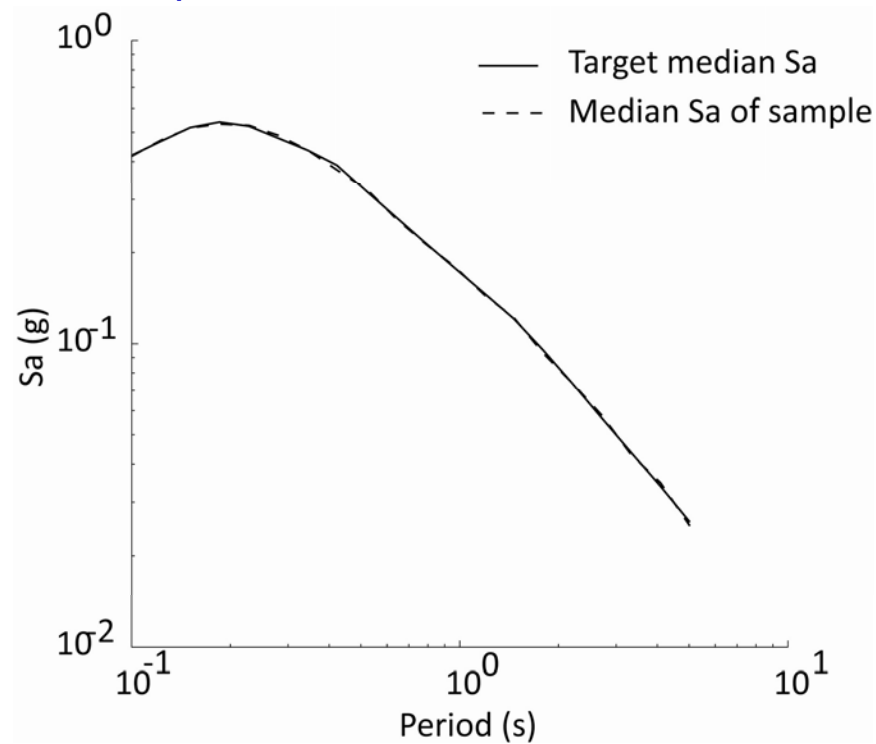
Group I: Broad-band ground motions

- 40 unscaled ground motions
- Varying magnitudes and distances
- Response spectra have means and standard deviations equivalent to that predicted (per Boore and Atkinson, 2008) for a
 - Magnitude = 7
 - Distance = 10 km
 - Strike slip event
 - $V_{s30} = 250$ ms

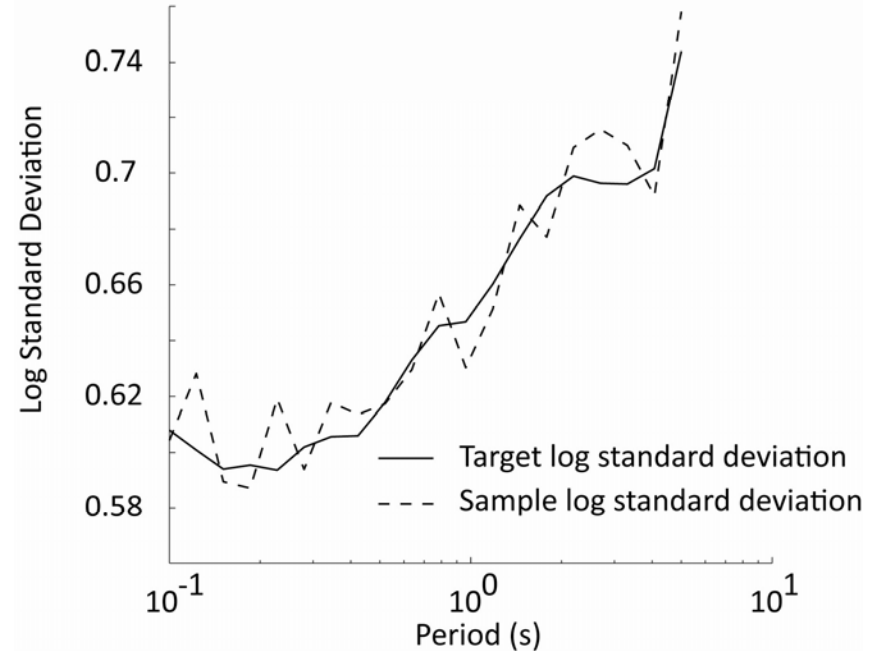


Group I: Broad-band ground motions

Record set mean $\ln S_a$ versus predicted mean for $M=7, R=10\text{km}$

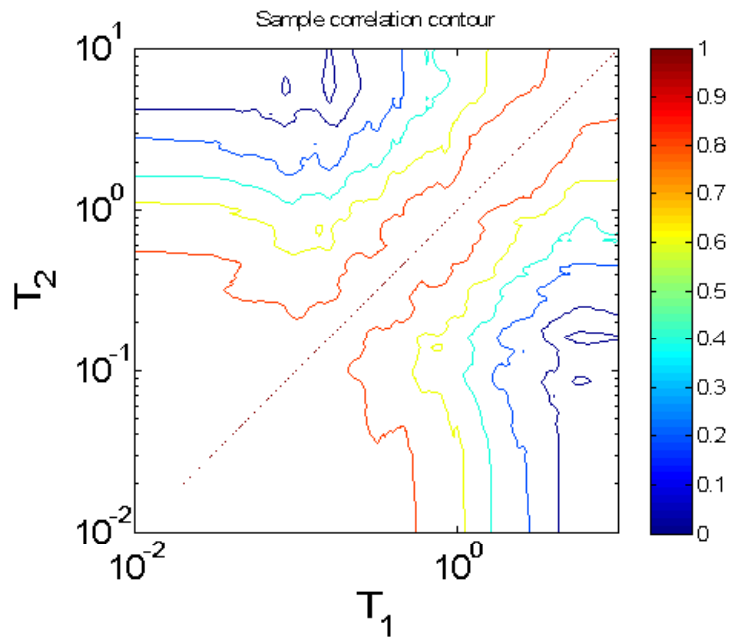


Record set standard deviation of $\ln S_a$ versus predicted standard deviation

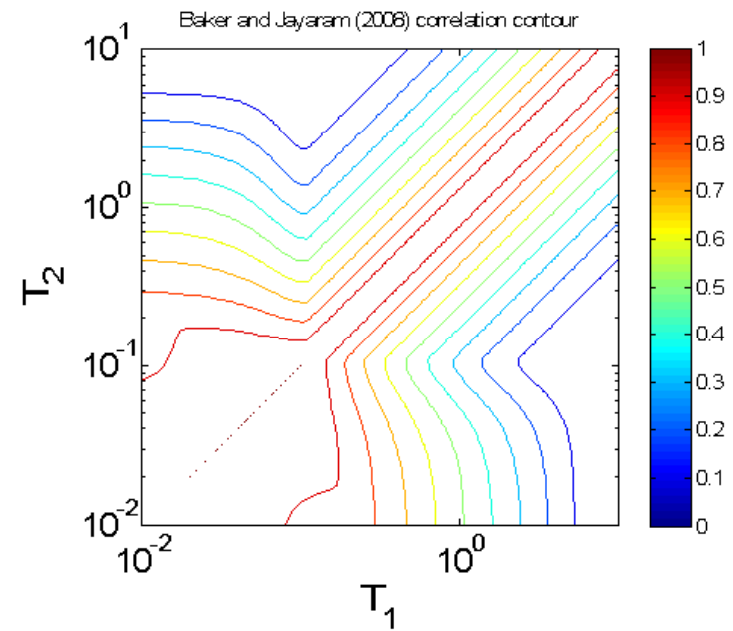


Group I: Broad-band ground motions

Record set correlations at
pairs of spectral values

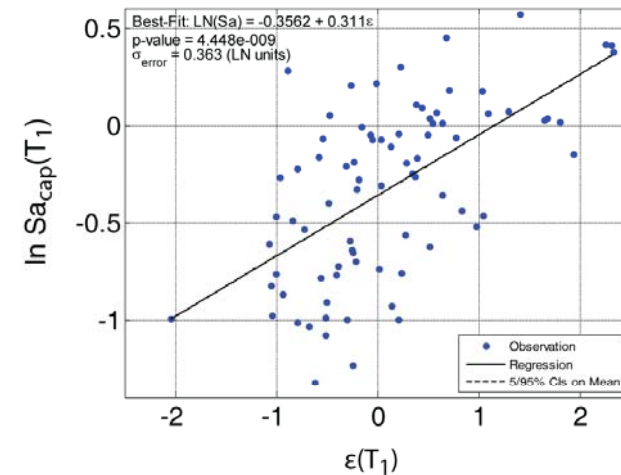
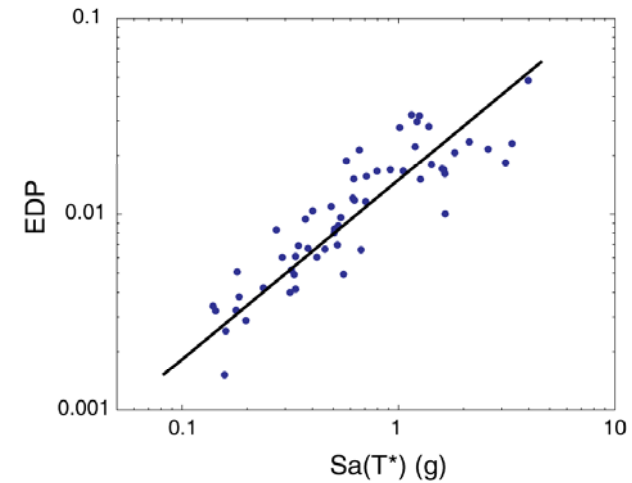
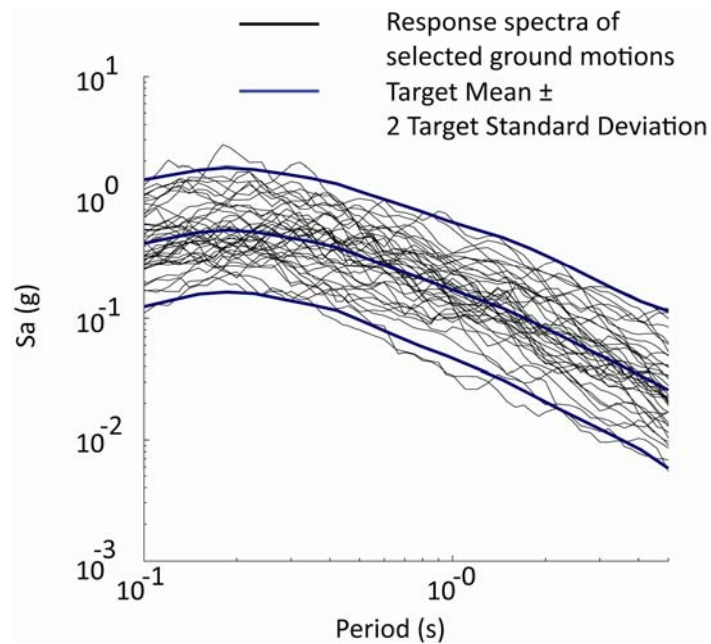


Predicted correlations at
pairs of spectral values



Coming soon: suggested analysis techniques

We will prepare a (short?) report describing how EDP results can be post-processed to choose effective intensity measures for a given system, integrate with hazard curves, etc.

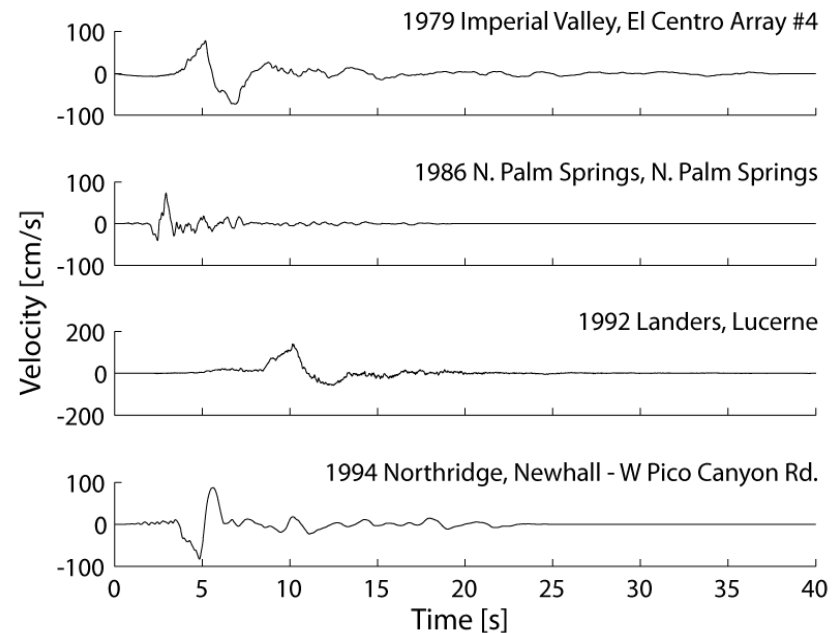


(figure adopted from Curt Haselton)

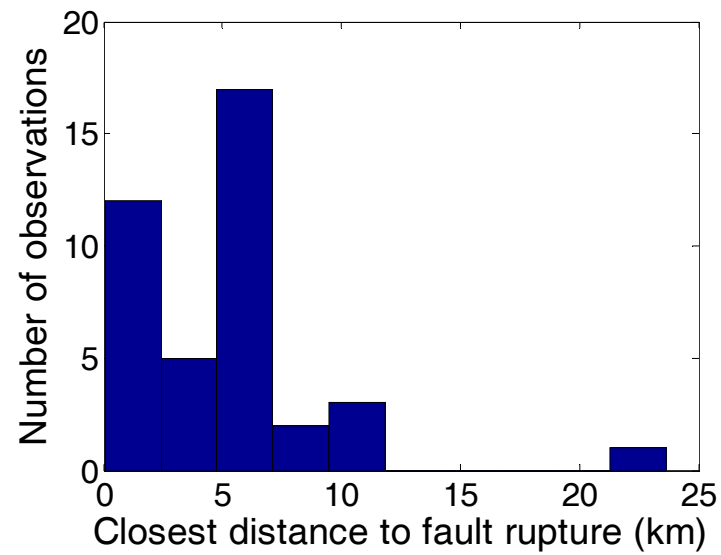
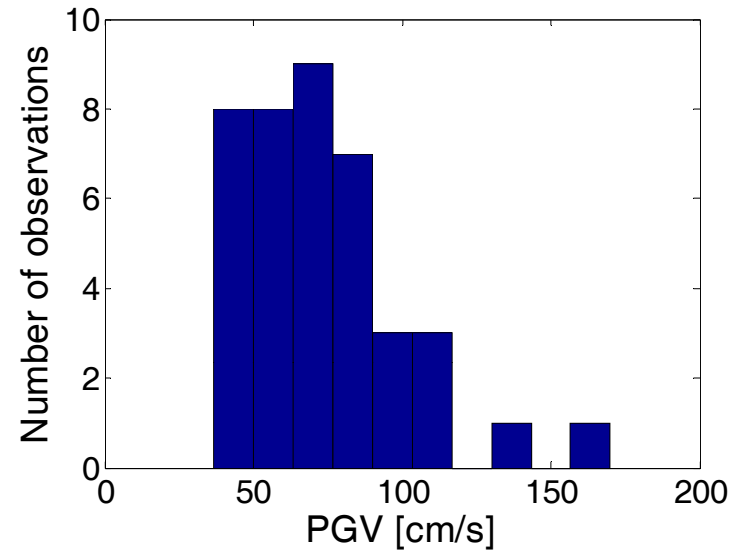
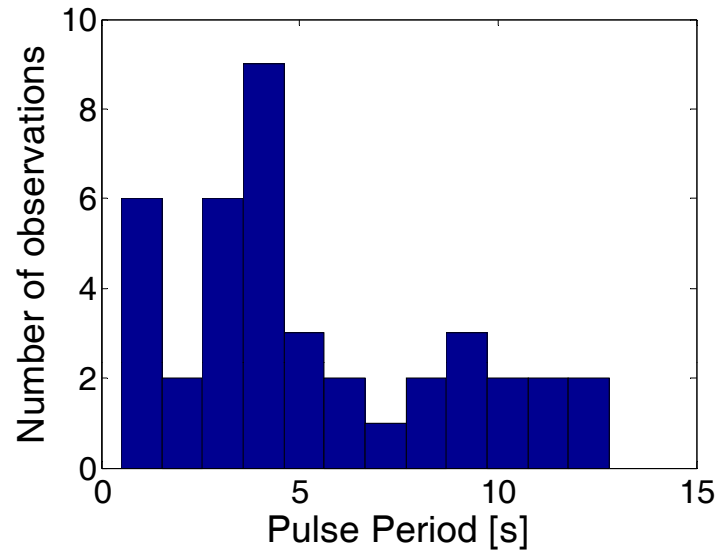
Group 2: Pulse-like ground motions

These are strong ground motions, with distinct velocity pulses of varying periods

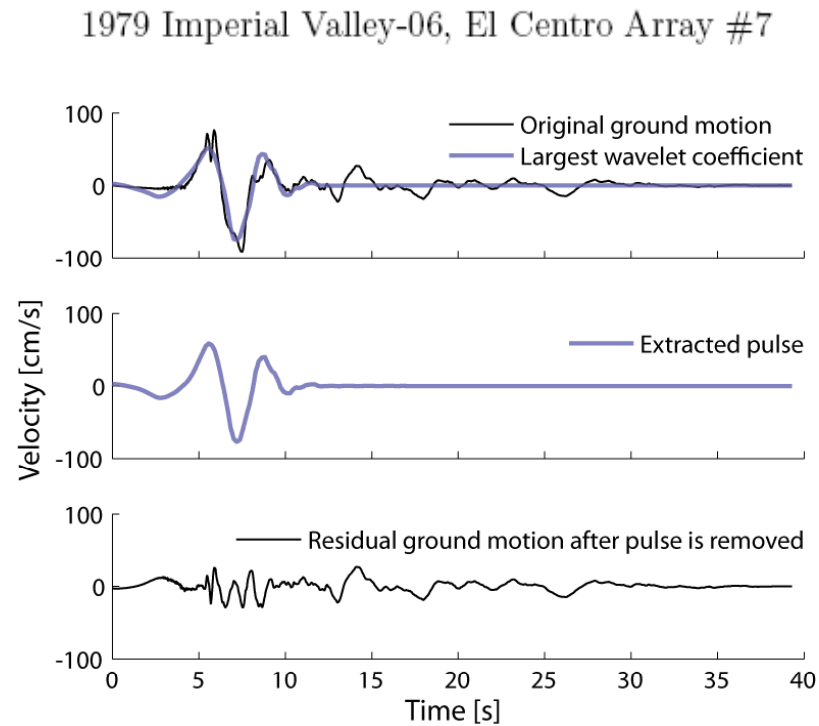
Original orientation will be strike-normal and strike-parallel, and I will provide information about the range of angles over which a strong pulse is present



Group 2: Pulse-like ground motions



Additional documentation for Pulse-Like Ground Motions



All three “parts” of the ground motions will be available as plots and raw data files

Our next steps

- Review the candidate records individually
- Get all documentation in order, file formats standardized, etc.

Our requests for you:

- Let me know if you have analysis needs that won't be met by these ground motions
- Let me know if you have concerns regarding data formats, documentation, etc.
- Let me know if you have any concerns about specific ground motions in these draft sets (of lesser importance at the moment)