

SCEC Award # 17185**Continuation of the Ground Motion Simulation Validation (GMSV) TAG in SCEC5**

Amount Requested: \$25,000 Amount Funded: \$15,000

Category: Collaborative Proposal (Integration and Theory)

Suggested Review Groups: Earthquake Engineering Implementation Interface (EElI), Ground Motions

Science Objectives: 4b, 4c, 4d

Principal Investigators: Sanaz Rezaeian (USGS) and Jonathan Stewart (UCLA)**Technical Report:**Background:

The SCEC Ground Motion Simulation Validation (GMSV) Technical Activity Group (TAG) was initiated in SCEC4 to develop and implement, via collaboration between ground motion modelers and engineering users, testing/rating methodologies for the use of ground motion simulations in engineering applications. In SCEC4, the TAG served as an umbrella under which independently funded GMSV-related projects were coordinated through periodic web-conferences and meetings (for more information on SCEC4 projects and meetings, see the GMSV TAG wiki at <http://collaborate.scec.org/gmsv/>).

In 2017, we proposed the continuation of the GMSV TAG in SCEC5, under the SCEC Award # 17185. The five-year goal of this group is to (1) identify areas of bias in SCEC simulated ground motions with respect to observations, so as to facilitate continued improvements of simulation routines that hopefully remove bias and produce appropriate levels of dispersion; and (2) help engineers to gain confidence in utilizing simulated ground motions by demonstrating the ability of simulations to provide unbiased predictions of ground shaking and unbiased results from response history analyses in various engineering applications. We initiated our periodic conference calls in October of 2017 to plan for these goals and to coordinate between individually funded GMSV-related projects (a list of our SCEC5 projects, conference calls and meetings can be found on our SCEC5 GMSV TAG Google Website, <https://sites.google.com/view/scec5-gmsv-tag/home>, a copy of which is provided at the end of this report).

Workshop with Practicing Structural Engineers:

We held a workshop in February 2018, to start communicating with potential engineering users of SCEC BBP simulations. Our main goal was to educate engineers on the latest developments in ground motion simulation and validation, and to demonstrate to all that the validation gauntlets that have been implemented on the SCEC Broadband Platform effectively identify ground motion simulations that are “valid” for building response analysis. This workshop disseminated the results of the 2016 SCEC project titled “Demonstrations of the Efficacy of the BBP Validation Gauntlets for Building Response Analysis Applications” to practicing engineers and gave them the opportunity to provide feedback. During this workshop we discussed 1) the BBP simulation models, 2) the BBP software, 3) the validation gauntlets, 4) the building response results generated by the 2016 project, and 5) correlations between the gauntlet results and building response comparisons. The workshop information, agenda, and the list of participants are provided below.

Workshop Information:**Website:** <https://www.scec.org/workshops/2018/gmsv>**Title:** Workshop on the Use of SCEC Seismogram Simulations for Building Response Analysis**Conveners:** Sanaz Rezaeian and Nicolas Luco**Date:** February 16, 2018 (10:00 - 16:30)**Location:** SCEC Boardroom, USC, Los Angeles

Workshop Agenda:

| | | |
|---------------|---|--|
| 10:00 - 10:10 | Welcome and Introductions (PDF, 2.7MB) | John Vidale / Attendees |
| 10:10 - 10:15 | Objectives (PDF, 255KB) | Nicolas Luco |
| 10:15 - 10:45 | Overview of ground motion seismogram simulation and validation (PDF, 1.4MB) | Sanaz Rezaeian |
| 10:45 - 11:45 | The science and software of SCEC seismogram simulations (PDF, 1.3MB) | Robert Graves / Christine Goulet |
| 11:45 - 12:30 | Lunch | |
| 12:30 - 13:30 | Validation of SCEC seismogram simulations (PDF, 2.9MB ; PDF, 4.2MB) | Nicolas Luco / Farzin Zareian |
| 13:30 - 15:15 | Demonstrations of the use and validation of SCEC seismogram simulations for building response analysis (PDF, 9.7MB) | Gregory Deierlein / Ting Lin |
| 14:15 - 14:30 | Break | |
| 14:30 - 15:15 | Demonstrations of the use and validation of SCEC seismogram simulations for building response analysis (continued) | |
| 15:15 - 15:45 | Access to SCEC seismogram simulations (PDF, 3MB) | Philip Maechling / Fabio Silva |
| 15:45 - 16:30 | Discussion of next steps | Attendees |
| 16:30 | Adjourn | |

Workshop Participants: (*Remote Participants)

| | | |
|----------------------------|------------------------------------|-----------------------------|
| *Brad Aagaard (USGS) | Ken Hudnut (USGS) | *Chukwuebuka Nweke (UCLA) |
| *Ralph Archuleta | Marty Hudson (Wood) | Kim Olsen (SDSU) |
| Bob Bachman (R.E. Bachman) | Jongwon Lee (Arup) | Sanaz Rezaeian (USGS) |
| Nenad Bijelic (Stanford) | Marshall Lew (Amec Foster Wheeler) | Jon Stewart (UCLA) |
| C.B. Crouse (AECOM) | Ting Lin (Marquette) | *Ali Sumer (OSHDP-FDD) |
| *John Egan (SAGE) | Doug Lindquist (Hart Crowser, Inc) | Ricardo Taborda (U Memphis) |
| Geoffrey Ely (Temblor) | Nico Luco (USGS) | John Vidale (USC) |
| Josh Gebelein (SEAOSC) | Philip Maechling (USC) | Wen-Yi Yen (Stanford) |
| Ramin Golesorkhi (Langan) | *Silvia Mazzoni (UC Berkeley) | Kuanshi Zhong (Stanford) |
| Christine Goulet (USC) | Morgan Moschetti (USGS) | |
| Robert Graves (USGS) | *Farzad Naeim (Farzad Naeim, Inc) | |

Summary of Outcomes:

Earthquake ground motion simulations are one of the most important products of SCEC. Convened by a subgroup of the GMSV TAG, this workshop aimed to connect scientists who create simulations with engineers who might use them in the future. The workshop objectives were to 1) engage potential engineering users of the SCEC simulations, 2) inform them of the latest developments in ground motion simulation and validation, and 3) demonstrate the usefulness of simulated ground motions for building response analysis.

- For the demonstration exercises presented at this workshop, we generated a set of Broadband Platform Scenario Simulations (GMSV BBP version 17.3). Our objective was to select a suite of hazard-consistent ground motions for nonlinear building response analysis and to follow the ASCE 7-16 guidelines.
- Two structures were analyzed at three sites and three hazard levels, the details all given in a paper that has been accepted for publication (i.e., Bijelic, Lin, and Deierlein, 2018, *Earthquake Engineering and Structural Dynamics*)
- This workshop was a success at engaging discussions between engineers & earthquake modelers

- Engineers requested access to a selected set of simulations (rather than the thousands of Scenario Simulations in BBP 17.3 version) to start working with simulated motions in their own applications and provide feedback to our group and to modelers.
- In June 2018, we released a subset of about 100 Selected Seismograms (sets of 11 simulations and recording pairs per ASCE 7-16 guidelines), which are posted on the Workshop Website along with a Summary Documentation.
- At the end, this workshop will affect future development of ground motion simulation validation gauntlets in the GMSV TAG, including any validations for the UGMS Committee, as the advances made in this BBP validation exercise are forwarded into CyberShake simulations.

We are currently working on a conference paper (for ICASP 13) that summarizes the results of this workshop.

SCEC5 GMSV TAG Google Website

<https://sites.google.com/view/scec5-gmsv-tag/home>

(Summary of SCEC5 Projects, Meetings, and Outcomes)

Objective:

SCEC has established this TAG focused on GMSV in order to develop and implement, via collaboration between ground motion modelers and engineering users, testing/rating methodologies for simulated ground motions to be used in engineering applications.

Current Projects (SCEC5 Year1, 2017-2018):

- Continuation of the Ground Motion Simulation Validation (GMSV) TAG in SCEC5 (SCEC Award #17185). **Sanaz Rezaeian, Jonathan Stewart**
- A MultiPI Project on Demonstrations of the Efficacy of the BBP Validation Gauntlets for Building Response Analysis Applications (started in SCEC4). **Nico Luco et al.**
- Nonstationary ground motion spatial correlations in CyberShake simulations, and implications for regional risk analysis (SCEC Award #17058). **Jack Baker**
- Selection of CyberShake Time Series for Engineering Building Code Analyses (SCEC Award #17056). **Jack Baker**
- Physics-based scattering attenuation: Calibrating the correlation structure of a stochastic model for near-surface sediments in the Los Angeles basin (SCEC Award #17113). **Domniki Asimaki**
- SDSU BBP Module Extension: Ground Motion Correlation, Duration, and Multi-Segment Ruptures (SCEC Award #17137). **Kim Olsen**
- Implementing inter-period correlations into SCEC Broadband Platform simulations (SCEC Award #17138). **Jeff Bayless, Paul Somerville, Andreas Skarlatoudis**
- Fourier-spectra based empirical site amplification modeling (SCEC Award #17149). **Jeff Bayless, Paul Somerville, Andreas Skarlatoudis**
- Validation of the UCSB Multi-Segment Kinematic Rupture Simulation Method Against Recorded Ground Motion for Several Events (SCEC Award #17247). **Ralph Archuleta, Jorge Crempien**
(If you have a GMSV-related project that is not listed above please contact Sanaz at srezaeian@usgs.gov)

GMSV News & Events:

Next: November 13, 2018, Web-Conference:

Tuesday 4pm-5pm Pacific Time

Agenda:

- **4:00** Introductions
- **4:15** Jon Stewart (on a multi-PI proposal related to site response modules)
- **4:25** Ting Lin (on a multi-PI proposal related to engineering building response applications of SCEC simulations)
- **4:35** Sanaz Rezaeian (other potential proposals)
- **4:45** Discussion & Other Proposal Plans?
- **4:55** Adjourn

October 9, 2018, Web-Conference:

Tuesday 2pm-3pm Pacific Time

Agenda:

- **2:00** Introductions
- **2:10** [An Overview of the Aug24 "Planning Workshop"](#) (Rezaeian, 15min)
- **2:25** [GMSV Objectives & Path Forward for "Engineering Applications"](#) (Zareian, 10min)
- **2:35** ["Key Take-Aways" from the Workshop](#) (Stewart, 10min)

- **2:45** Questions & Discussion (10min)
- **2:55** Adjourn

Meeting Summary:

During this meeting, we reviewed our Aug24 "Planning Workshop" and discussed what types of GMSV-related proposals should be submitted in response to the SCEC RFP this year. Three research areas were discussed that are of interest to GMSV this year:

1. Proposals related to site response modules for the BBP: Jon Stewart mentioned that he is going to work on a proposal with Jeff Bayless, Andreas Skarlatoudis, and Domniki Assimaki on this topic. Other related proposals are welcome, but PIs are encouraged to collaborate with this group.

2. Proposals that encourage and/or enable engineering applications of SCEC simulations for response history analysis of buildings. Examples include:

a. Forming a committee to review prior GMSV work, vet through engineering practice committees (SEAOC seismology), identify gaps (as applicable), and prepare recommendations: We talked about a potential multi-PI proposal by the conveners of the "Feb 2018 workshop with engineers", this effort will be led by Ting Lin.

b. Proposals that utilize a subset of simulations to analyze a specific structure and calculate responses are also encouraged: Several practicing engineers who attended our Feb and/or August workshops expressed interest in such a proposal.

c. Proposals focused on tall buildings, 2sec or longer fundamental periods.

d. Proposals that focus on preparing tools and protocols to facilitate access to simulated motions (possibly according to geographic bins) and appropriate selection of those motions for specific engineering applications: We have been talking about a multi-PI proposal for "Selection of simulated time-series for the MCER UGMS tool", this effort will be led by Jack Baker. Other related proposals are welcome, but for anything related to UGMS/Cybershake simulations, PIs are encouraged to first coordinate with Jack.

3. Proposals related to validation exercises that are focused on new applications (e.g., bridges, tunnels, dams): Farzin Zareian presented a possible validation framework that could be used for any engineering application, interested PIs are encouraged to take a look at this framework before preparing their proposals

Other ideas that we did not focus on during our last conference call, but have come up in our previous meetings include:

4. Formalizing a collaborative effort with our international colleagues (e.g., Italy, New Zealand, Mexico)

5. Focusing on validations beyond median ground motion, and based on standard deviations and correlations

August 24, 2018, "Planning Workshop" at SCEC :

Website: <https://www.scec.org/workshops/2018/gmsv-aug>

Discussion Questions: https://docs.google.com/document/d/1jMoKdUzGe5SIXo-QVqfGnPLiVD9Tv3g27ATnllbfF_w/edit?usp=sharing

Action Items: <https://drive.google.com/open?id=1ba10eR-ZxXqVxXfXdTxxzhU9zD2wUqXp2Svgu37DWT4>

Older Docs:

2018 SCEC GMSV TAG Proposal to hold this meeting/workshop: [Proposal](#) (summary [presentation](#) from Oct2017 call)

Acceptance Notice and feedback from SCEC (Received May 2018): [Award#18161](#)

Agenda & the full list of Invitees: https://drive.google.com/open?id=1MbPjM6fQM5FJZtX9aR-hjr_zkGVgXVHb

June 25, 2018, Participation of the GMSV TAG in the SCEC Workshop at 11NCEE:

Website: <https://www.scec.org/workshops/2018/gms-engineering>

June 22, 2018, Data Release:

A selected subset of simulated seismograms that were used in the February 2018 workshop with engineers were released as a product of the SCEC research project "Demonstration of the

Efficacy of the BBP Validation Gauntlets for Building Response Analysis Application". These files and supporting documents are posted on the workshop website:

<https://www.scec.org/workshops/2018/gmsv>

June 6, 2018, Web-Conference

Wednesday 2pm-3pm Pacific Time

Agenda:

- **2:00** Introductions (*Sanaz Rezaeian*)
- **2:10** [Hikurangi Subduction Interface Ground Shaking for Wellington, New Zealand](#) (*Caroline Holden & Yoshi Kaneko*)
- **2:30** Updates on interactions with the engineering community (*Farzin Zareian*)
- **2:45** Update on the "2018 GMSV TAG Planning Workshop" (*Sanaz Rezaeian, Jon Stewart, Nico Luco*)
- **3:00** Adjourn

Participants:

1) Sanaz Rezaeian, 2) Nico Luco, 3) Caroline Holden, 4) Farzin Zareian, 5) John Vidale, 6) Greg Deierlein, 7) Paul Somerville, 8) Brendon Bradley, 9) Marco Stupazzini (participants interested but not able to attend: Jack Baker, Christine Goulet)

Meeting Notes:

- Caroline gave an interesting presentation on the simulations they are performing for large interface subduction earthquakes in Wellington region of New Zealand. John Vidale discussed that the conclusions were somewhat similar to the results of the M9 project in the Pacific Northwest of US. Caroline's group is planning to continue this work and look at the RZZ validation parameters for these simulations.
- Farzin gave a 10min oral update on his recent interactions with the engineers at SEAOSC and LA Tall Buildings meetings. 1) There is interest from SEAOSC community to get access to our "validated set of SCEC simulations". We discussed the timeline for the release of these simulations, we expect them to be posted for access by the engineering community before the 11NCEE conference, June 25 (the next SEAOSC meeting is June 20 and July 11). 2) There seems to be a misunderstanding by many engineers who think that SCEC simulations are equal to Cybershake, there should be better communication/education with engineers. 3) There seem to be an interest by the engineers to use simulations for "buried structures," such as pipelines and basically distributed infrastructures, where they need high frequency motions and need to account for spatial correlations.
- Sanaz briefly discussed a "Working Meeting" to plan future efforts of the GMSV TAG. We have news from SCEC that our proposal to hold this workshop has been accepted. We would like to hold this workshop either in late August at USC, or during the SCEC annual meeting at Palm Springs. more information is listed above under subheading "2018 SCEC GMSV TAG Proposal to hold a "Working Meeting" to plan our future efforts". Since this is a working meeting and likely held at the SCEC boardroom, we will have a small number of invitees, however, **if you would like to be involved in planning this Working Meeting (or to participate, remotely or in person)** please contact srezaeian@usgs.gov

Action Items:

- Start planning a Working Meeting for late August

April 25, 2018, Web-Conference

Wednesday 9am-10am Pacific Time

Agenda:

- **9:00** Introductions (*Sanaz Rezaeian*)
- **9:10** [Selection of CyberShake Time Series for Engineering Building Code Analyses](#) (*Jack Baker*)
- **9:30** Open Discussion: SEAOC Meeting Summary (*Farzin Zareian*), [Update on the Vetted Set of Workshop Simulations](#) (*Greg Deierlein, Ting Lin*)
- **10:00** Adjourn

Participants:

1) Sanaz Rezaeian, 2) Jon Stewart & Students, 3) Nico Luco, 4) Christine Goulet, 5) Farzin Zareian, 6) Greg Deierlein, 7) Kuanshi Zhong, 8) Nenad Bijelic, 9) Wen-Yi Yen, 10) Jack Baker,

11) Jeff Bayless, 12) Jae Park, 13) Kim Olsen & Students, 14) Fabio Silva, 15) Domniki Asimaki, 16) Marco Stupazzini (participants interested but not able to attend: Ting Lin, Caroline Holden)

Meeting Notes:

- There were great discussions on Jack's presentation about the vetted set of Cybershake simulations for engineers (11 ground motions for two sites LADT & PAS)
- Greg gave a short update on the status of vetted set of BBP (GP simulations) presented at the Feb workshop (12 sets of 11 ground motions each, this includes three sites LADT, SF & San Bernardino)
- Farzin's update on the recent SEAOC Meeting was postponed to the next webconference due to the limited time

Action Items:

- Same as Action Items from the March meeting

March 22, 2018, Web-Conference

Wednesday 10:30-11:30am Pacific Time

Agenda:

- **10:30** [Introductions & workshop agenda](#) (Sanaz Rezaeian)
- **10:40** [A summary of "validation of SCEC seismogram simulations"](#) (Nico Luco)
- **11:00** [A summary of "Demonstrations of the use and validation of SCEC seismogram simulations for building response analysis"](#) (Ting Lin)
- **11:20** [Workshop outcomes](#) (Sanaz Rezaeian & All)
- **11:30** Adjourn

Participants:

1) Sanaz Rezaeian, 2) Jon Stewart, 3) Nico Luco, 4) Ting Lin, 5) Farzin Zareian, 6) Kuanshi Zhong, 7) Nenad Bijelic, 8) Wen-Yi Yen, 9) Jack Baker, 10) Jeff Bayless, 11) Caroline Holden, 12) Leo Ramirez Guzman (participants interested but not able to attend: Christine Goulet, Rob Graves, Lunio Iervolino, Greg Deierlein)

Meeting Notes:

- Summarized the Feb 16 workshop and discussed the next steps
- Engineers were interested in validation of simulations but their primary interest was demonstration of how simulations can be used in practice --> our group may want to do more demonstration exercises (especially for different simulation approaches)
- Engineers were interested in a "vetted" set of simulations to be documented by Ting & Kuanshi and posted on the workshop website in the next month or so. The "vetted set" of simulations (11 time-series for 2 sites) that Jack Baker is working on might also be of interest to this group of engineers
- It was suggested to keep in touch with potential engineering users of simulations through other engineering events, one example is the special session at the 11NCEE that SCEC is organizing (SEAOC meetings were mentioned specifically along with the upcoming LA Tall Buildings meeting that Nico and Farzin are attending <http://www.tallbuildings.org/>)

Action Items:

- Keep in touch with the engineers: Once the vetted set of simulations are documented and posted, contact the engineers who attended the workshop and let them know of 1) the presentations and simulations that are available on the workshop website, and 2) the "follow-up" event at the 11NCEE organized by Christine Goulet
- Put Jack Baker in contact with SCEC to distribute his "vetted" set of simulations to the same group of engineers
- Write a SCEC report on the workshop: document the workshop through a conference paper (ICASP2019 conf paper was suggested as a good platform)

February 16, 2018, Workshop With Practicing Engineers

Earthquake ground motion simulations are one of the important products of SCEC. Convened by a subgroup of the GMSV TAG, this workshop aimed to connect scientists who create simulations with engineers who might use them in the future. The workshop objectives were to 1) engage potential engineering users of the SCEC simulations, 2) inform them of the latest developments in

ground motion simulation and validation, and 3) demonstrate the usefulness of simulated ground motions for building response analysis.

See the workshop website for summary, agenda, participants, and presentations:

<https://www.scec.org/workshops/2018/gmsv>

January 10, 2018, Web-Conference

Wednesday 10-11am Pacific Time

Agenda:

- **10:00** [Introductions](#) (*Sanaz Rezaeian*)
- **10:10** [Implementing the inter-period correlation of epsilons in Exsim](#) (*Jeff Bayless*)
- **10:30** [SVM: A stochastic Sediment Velocity Model of the shallow crust based on geotechnical and geophysical data](#) (*Jian Shi* on behalf of *Domniki Asimaki*)
- **10:50** Discuss the timing of future meetings (*All*)

Participants:

1) Sanaz Rezaeian, 2) Nico Luco, 3) Jon Stewart, 4) Ting Lin, 5) Farzin Zareian, 6) Jeff Bayless, 9) Jian Shi, 10) Paul Somerville, 11) Kim Olsen, 12) Jack Baker, 13) Kuanshi Zhong, 14) Philip Maechling, 15) Nenad Bijelic, 16) Fabio Silva

Meeting Notes:

- Discussed the importance of inter-period correlations in simulations (they are related to how noisy the response spectrum is and how wide the peaks and troughs are, which could effect variability in structural response) and Jeff's plans for their implementation in the BBP EXSIM (SMSIM) and GP high frequency simulations (already implemented for GP low frequency simulations). We discussed that these correlations are related to Fourier Spectrum, unlike Jack Baker's study that considers Response Spectrum, the assumption being that if FS correlations are good then RS correlations will also be good. How to validate/evaluate the results is to be addressed in future.
- Jian Shi talked about their Sediment Velocity Model (SVM), which is completed for 1D for shallow crust sediments (<Z1). Four datasets are merged in this model and the model is validated using existing models (CVM, GTL, etc). Questions were asked about the model being conditioned on Vs30, which comes from the Wills maps etc. Further discussed their plans to use 1D SVM to populate 2D and 3D spaces.
- Decided to hold future meetings on the 2nd or 3rd Wednesday of each month, take another poll to see if we should start at 10am or 11am.

November 14, 2017, Web-Conference

To talk about potential SCEC proposals for next year, Tuesday 4-5pm Pacific Time

Agenda:

- **4:00:** [Introductions](#) (*Sanaz Rezaeian*)
- **4:10:** *Potential Proposals (10min presentations & discussions)*
Jon Stewart: on Validation of Cybershake simulations using observations of site effects from small-to-moderate magnitude earthquakes
Jack Baker: on Spatial Correlation of ground motions in CyberShake simulations
Ting Lin / Greg Deierlein: on Using Cybershake motions for estimating large structural deformations and collapse / relating intensity measures to fault features and basin effects
Jeff Bayless: on Sensitivity of structural response to the variability of ground motion simulations
Kim Olsen: on Incorporating spatial correlation and coherency in the SDSU BBP module.
Sanaz Rezaeian: GMSV workshop at the SCEC Annual Meeting - focus on Cybershake
- **5:10:** Adjourn

Participants:

1) Sanaz Rezaeian, 2) Nico Luco, 3) Jon Stewart, 4) Ting Lin, 5) Farzin Zareian, 6) Christine Goulet, 7) Hoby Razafindrakoto, 8) Jeff Bayless, 9) Ruth Harris, 10) Kim Olsen, 11) Jack Baker

October 30, 2017, Web-Conference

The first SCEC5 GMSV TAG web-conference, Monday 2-3pm Pacific Time

Agenda:

- **2-2:10:** Introductions (*Sanaz Rezaeian*)

- **2:10-2:30:** [Continuation of the Ground Motion Simulation Validation \(GMSV\) Technical Activity Group \(TAG\) in SCEC5](#) (*Jon Stewart*)
- **2:35-2:55:** [A MultiPI Project on Demonstrations of the Efficacy of the BBP Validation Gauntlets for Building Response Analysis Applications](#) (*Nico Luco*)

Participants:

1) Sanaz Rezaeian, 2) Nico Luco, 3) Jon Stewart, 4) Luis Dalguer, 5) Nenad Bijelic, 6) Peng Deng, 7) Andreas Skarlatoudis, 8) Phil Maechling, 9) Marco Stupazzini, 10) Greg Deierlein, 11) Ricardo Taborda. Ting Lin joined towards the end after her class. Jack Baker, Christine Goulet, Ralph Archuleta, Caroline Holden were not able to make it, although interested.

Meeting Notes:

- The next SCEC RFP is due in about a month, we need a coordinated set of proposals to address the two objectives of our TAG in the upcoming years: 1) validation for GMPEs (focusing on dispersion and correlation as well as the median predictions), 2) validation for specific engineering applications.
- It was suggested to explore external sources of funding to be able to conduct a more focused and impactful project, similar to what Dreger-Goulet project did with PG&E for median GMPEs.
- Luis brought up the possibility of joint international efforts.
- For our next web conferences, Jon suggested to hear from speakers who have explored validation for 3D simulations such as CyberShake simulations. Phil mentioned a reference to Graves & Goulet study/report. Greg, Ting and Nenad also have done some related work.

Link to previous (SCEC4) GMSV TAG wiki site:

http://collaborate.scec.org/gmsv/Main_Page