SCEC Utilization of Ground Motion Simulation (UGMS) Committee

Minutes of 4th Meeting (5/4/15) at SCEC Room 265 from 10:00 a.m. – 3:30 p.m.

Member Attendees (in person)	**Member Attendees (Remotely)**	**Members Absent**	**Observers**
C. Crouse – chair	A. Frankel	R. Hamburger	D. Asimaki
T. Jordan	J. Baker	N. Abrahamson	N. Bijelic
N. Luco	J. Bielak	M. Lew	S. Callaghan
J. Anderson		F. Naeim	T. Huynh
P. Somerville		C. Haselton	T. Lin
J. Hooper		R. Bachman	P. Maechling
P. Somerville			K. Milner
M. Hudson			M. Moschetti
S. Razaeian			K. Olsen
R. Graves			R. Taborda
			A. Skarlatoudis

Introductory Remarks: After introductions of attendees, review of meeting agenda and introductory remarks, UGMS chairman Crouse presented an overview of the new seismic code cycle, with emphasis on Project 17, which will address various technical issues dealing with the development of the ground motion maps in the 2021 NEHRP and 2022 ASCE 7 seismic provisions. Maechling then gave an update on CyberShake development progress, and Callaghan followed with a review of the calculation of the risk-targeted Maximum Considered Earthquake (MCER) response spectra.

Preliminary Southern California MCER S_a(T) Maps: After lunch Milner presented three sets of Southern California MCER maps for periods, T = 3, 5, and 10 sec: one from CyberShake, one from the NGA West2 GMPEs, and one with the ratio of the first two maps. The ratio maps generally showed the CyberShake results were greater, but not by large amounts. He also presented the MCER response spectra at 14 Southern California sites using CyberShake and the 2013 NGA West2 ground-motion prediction equations (GMPEs). See attachment with map of site locations and relevant parameter values for the calculation of the MCER response spectra.

Update of MCER Response Spectra at 14 Sites: Callaghan followed with an update of the MCER response spectra at the 14 sites. The update improved the calculation of the spectral accelerations at T = 2 sec, S_a(2 sec). At the November 2014 UGMS meeting, it was noted that the S_a(2 sec) values were underestimated because the frequency band in the simulations did not extend to a high enough frequency. This was corrected and the S_a(2 sec) values increased by a factor of ~2; moderate increases in the S_a(3 sec) values were also observed. However, Kircher noted that the CyberShake calculation of the deterministic MCER spectrum for the San Bernardino site was too high, which generated discussion of the proper application of the CyberShake deterministic procedure, including the selection of the maximum magnitudes for the San Andreas and San Jacinto faults.

Effect of Near-Surface Geology: An action item from the November 2014 UGMS meeting was to investigate the sensitivity of the long period ground motions to more realistic models of the near-surface geology in the upper 200m. Crouse presented results of 1-D SHAKE site response analyses for the site in Carson, where a deep shear-wave velocity (Vs) measurement had been made nearby. The Vs gradually increased from 200 m/sec to 600 m/sec over the upper 200m, given whereas the CyberShake Vs was constant (500 m/sec) over this interval. The linear 1-D model of both Vs profiles produced essentially identical response spectra for $T \geq 2$ sec. However, the nonlinear model of the depth-dependent profile produced unrealistic looking ground motions, which generated considerable discussion. It was concluded that the (1) input outcrop motion at 200-m depth (1978 Tabas record) was probably too severe, (2) modulus reduction versus shear-strain curve used was not realistic (too much degradation and not depth dependent), and (3) 1-D model was not realistic.

Crouse also mentioned the possibility of validating CyberShake with the 1994 Northridge accelerogram data. The study would involve the determination of the spatial distribution of the source slip function using the bedrock accelerograms ("inverse problem"). The source function would be used to do "forward" simulations to compute the motions at accelerograph stations in the San Fernando basin where truly strong motions were recorded and hence would contain the effects of nonlinear site response. These CyberShake motions would be compared to the recorded motions. Similarity in the recorded and simulated motions would serve as another validation of CyberShake and help mitigate the concern about the possible inability of CyberShake to account for nonlinear response of the surficial layer. This approach generated some discussion whether such a study would be fruitful. Possible technical limitations included (1) the period band of the recorded accelerograms was too narrow, and (2) number and spatial distribution of the bedrock stations was not sufficient to accurately compute the source function.

Also, it was not clear who would undertake the study, which organization would fund it, and the time required to complete it. The first technical limitation did not appear to be serious since the Northridge accelerograms, although all analog, provided good S/N ratios out to 4 sec, so at least comparisons could be made with the CyberShake simulations in the 2 to 4 sec period band. The number and spatial distribution of the bedrock stations appeared to be sufficient to determine the source function, particularly if supplemented with very stiff soil records outside the basins.

Technical, Logistical, and Scheduling Issues for Producing Long Period MCER Maps: Crouse led the discussion for this agenda item, and it was concluded that an Ad Hoc, forward planning committee would be formed, tentatively consisting of Crouse, Hooper, Kircher, Lew, Naeim, Luco, Bachman, and possibly another local structural engineer. The objective of the committee would be to develop a strategy for developing the maps and introducing them to the City of Los Angeles for possible adoption as a supplement or replacement of the maps in ASCE 7-16 for the City. Prior to the meeting, Bachman forwarded to Crouse the name and phone number of the person in the City of Los Angeles who would ultimately decide whether to adopt the maps. She is Ifa Kashefi, PhD, SE, Engineering Bureau Chief with the City.

Crouse presented one option for how the maps might be generated; it was to include CyberShake as a branch in the GMPE portion of the PSHA/DSHA logic tree, with the other branch being the NGA West2 GMPEs. Each of the two branches would be assigned weights for each period T. For example, the NGA West2 branch would be given 100% weight for $T \leq 1$ sec, while for increasing T from 2 to 10 sec, the weight of the CyberShake branch would gradually increase while the NGA West2 branch would gradually decrease.

Action Items: The following action items were identified during and shortly after the meeting:

1. Plan CyberShake UCERF3 so that initial runs begin during 2015 (Jordan, Graves, Olsen)
2. Run forward simulation of selected CyberShake ruptures to evaluate assumption of linear ground motion response. (Olsen, Graves)
3. Clarify deterministic MCER calculations with USGS. (Milner, Luco)
4. Modify hypocenter location probabilities to taper few hypocenters near top of fault. (Milner, Graves)
5. Discuss with Jacobo the un-realistic displacement he's seeing in the CyberShake MCER results. (Maechling, Bielak)
6. Define a procedure for "approving" CyberShake result, from just computed to published. This approval process should define a series of checks we perform on a CyberShake computational result. Each stage should indicate increased confidence in the results, up to "publication" state, which indicates the data are ready for publication. (Jordan, Maechling, Callaghan)
7. Send out notification when all CyberShake 15.4 sites are completed. (Callaghan, Maechling)
8. Send out notification when we complete and certify CyberShake 15.4 for all sites and maps. (Callaghan, Maechling, Jordan)
9. Consider adding Alhambra Site City Emergency Response Center 10 Story Steel moment frame building. (Crouse and Ad Hoc team)
10. Form UGMS subcommittee tasked with developing action plan for implementing local amendment to ASCE 7-16 for City of LA. (Crouse and Ad Hoc team)

Next UGMS Meeting: The next UGMS committee meeting was tentatively scheduled for November 2015. A Doodle poll will be sent to members sometime this summer to arrange a date.

Meeting Materials: All meeting materials (including presentations and results) are posted online at the meeting webpage (http://scec.usc.edu/scecpedia/SCEC_UGMS_Committee_Meeting_4).

SCEC Utilization of Ground Motion Simulation (UGMS) Committee

Action Items from 6/15/15 Conference Call following 4th UGMS Meeting on 5/4/15

Participants: C. Crouse, T. Jordan, T. Huynh, and P. Maechling.

cc: Other Persons with Action Items: N. Luco, S. Callaghan, R. Graves

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Action Items: During the call the participants reviewed the ten action items in the minutes of the 4th UGMS meeting on May 4, 2015, and concluded the following five should be accomplished prior to the next UGMS committee meeting scheduled for November (date to be determined). The responsible persons are listed in ( ):

1. Clarify deterministic MCER calculations with USGS, and implement correct MCER calculations to produce updated CyberShake 15.4 maps (Milner, Luco).

2. Modify hypocenter location probabilities to taper few hypocenters near top of fault (Milner, Graves)

3. Prepare CyberShake 15.4 results for publication review (Jordan, Maechling, Graves, Callaghan, Milner)

4. Form UGMS subcommittee tasked with developing action plan for implementing local amendment to ASCE 7-16 for City of LA. (Crouse and Ad Hoc team)

5. Inquire with D. Asimaki about possibility of conducting 1-D site response analyses (SRA) using more realistic constitutive models of soil behavior than those used by Crouse during his presentation of SRA at the 4th UGMS meeting (Crouse)

SCEC personnel listed for the first three items will lead those efforts.

For Item 4 Crouse will email tentative members of the Ad Hoc, forward planning committee (Hooper, Kircher, Lew, Naeim, Luco, Bachman) to find a date for a kick-off phone call (target is July).

Crouse will also email D. Asimaki to see whether she, one of her students, or perhaps another person (e.g., one who participated in the SCEC Site Response workshop she co-organized with J. Anderson) could do SRA sensitivity studies to better determine the effect of nonlinear SRA in the upper 200m.