

**Utilization of Ground Motion Simulations
Report on the SCEC Committee
Most recent meeting May 4, 2015 (yesterday)**

John G. Anderson,
SCEC, May 5, 2015



Committee on Utilization of Ground Motion Simulations

- The Committee on Utilization of Ground Motion Simulations (UGMS) consists of SCEC/USGS seismologists performing simulations and engineers involved in seismic code development.
- The goal of UGMS is to incorporate simulation results into regional ground-motion maps for inclusion into building standards.
- Focus: Los Angeles
- Chair: C. B. Crouse

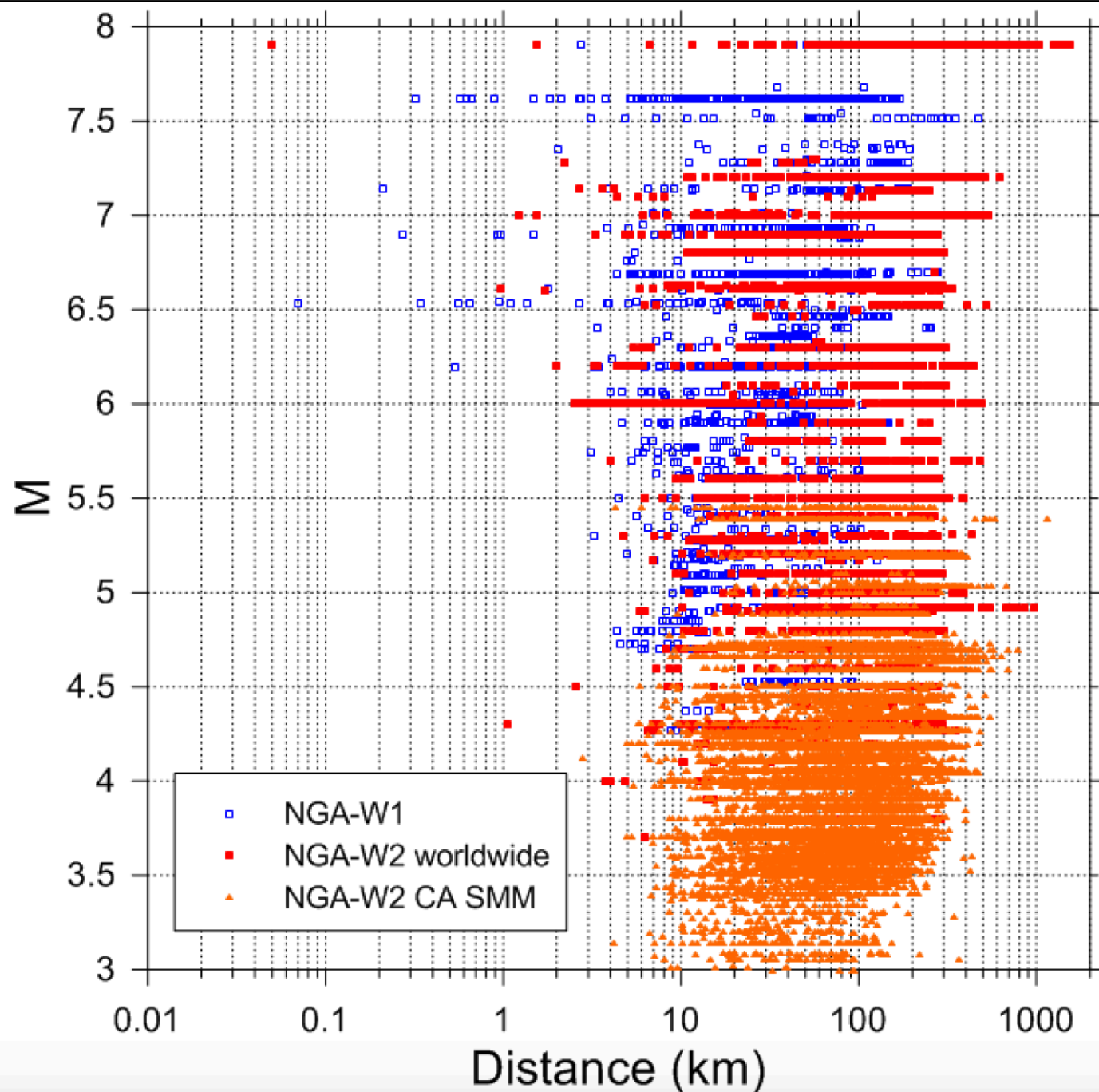
UGMS Meeting Summary

- CB Crouse summary of engineer concerns for the next National Seismic Hazard Map.
 - Several relevant to site conditions
- Motivation for an urban hazard map for the Los Angeles region
 - GMPEs have little data on long periods from large earthquakes
 - Reason to expect that simulations will do as well or better.

Project 17 – 2020 NEHRP Maps

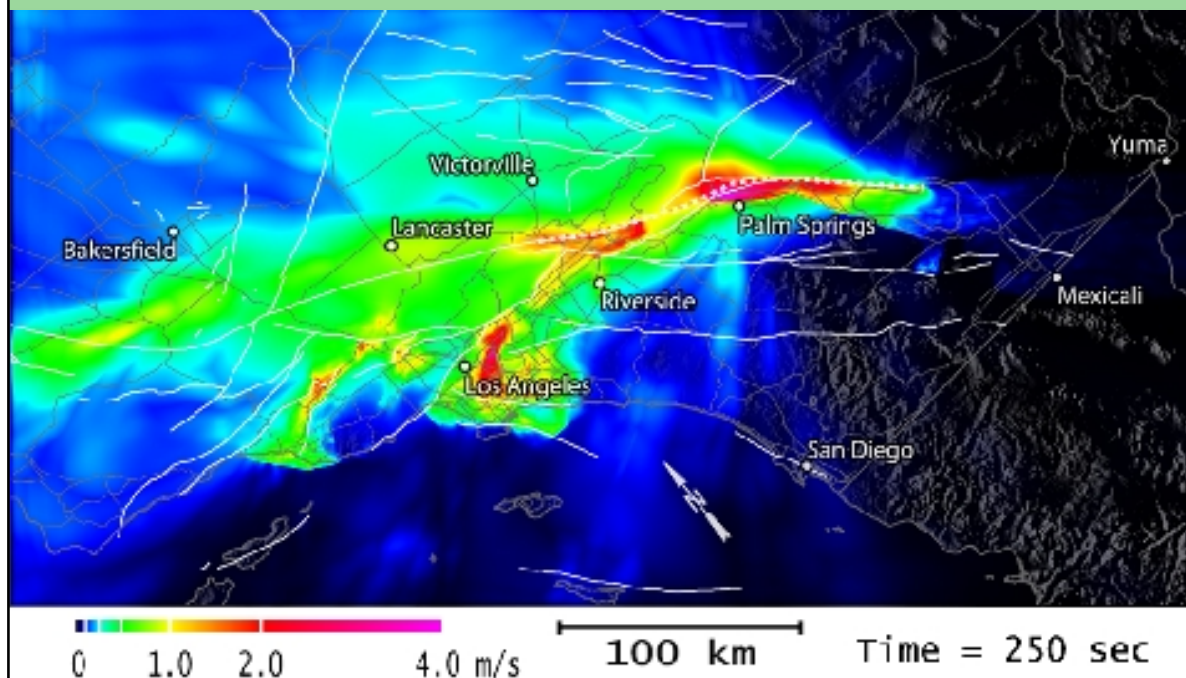
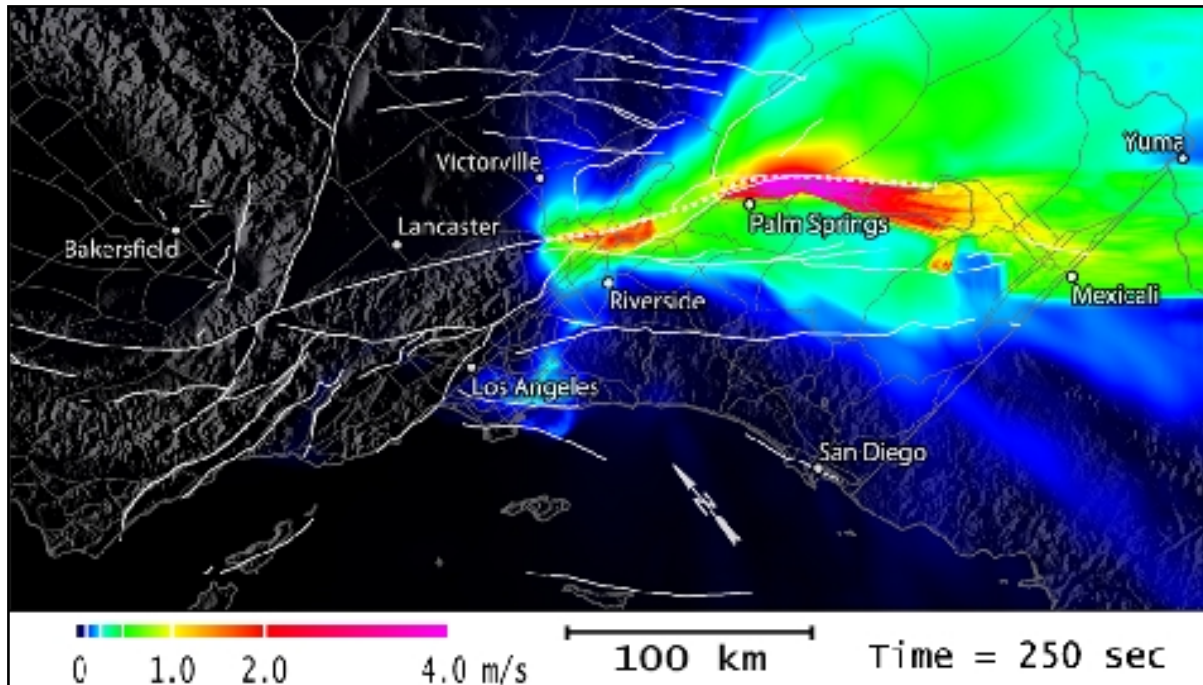
- Every 6 years or longer
- Precision given uncertainty
- Levels (MCE_R + SLE + ?)
- Multiple periods, T
- Damping ratios besides 5%
- Basins (few cities or all US)
- Uniform hazard or risk?
- Deterministic caps (M_{max} ?)
- Fragility (M8-9 vs M7)
- Max direction vs geomean
- Vertical component
- Induced seismicity
- Site factors for CEUS
- Physics-based models
- Other topics ?

Slide from C. B. Crouse



NGA West 2
Data

Ancheta et al.,
2013



Belief on UGMS

- Simulations are not perfect, but...
- Simulations have a lot of physics behind them
- At long periods, simulations are likely more reliable than GMPEs

Comparisons of Simulations with GMPEs

- UGMS interested in consequences of a switch to simulations.
 - Comparison of hazard curves
 - Maps of differences
 - Comparison of risk-targeted maximum considered earthquake response spectra
 - Cybershake 14.2 and preliminary 15.4 results for selected stations
 - Note that 15.4 appears to give more reasonable results at $T=2$ s as a result of the greater bandwidth.

Calculation of CyberShake MCER Results

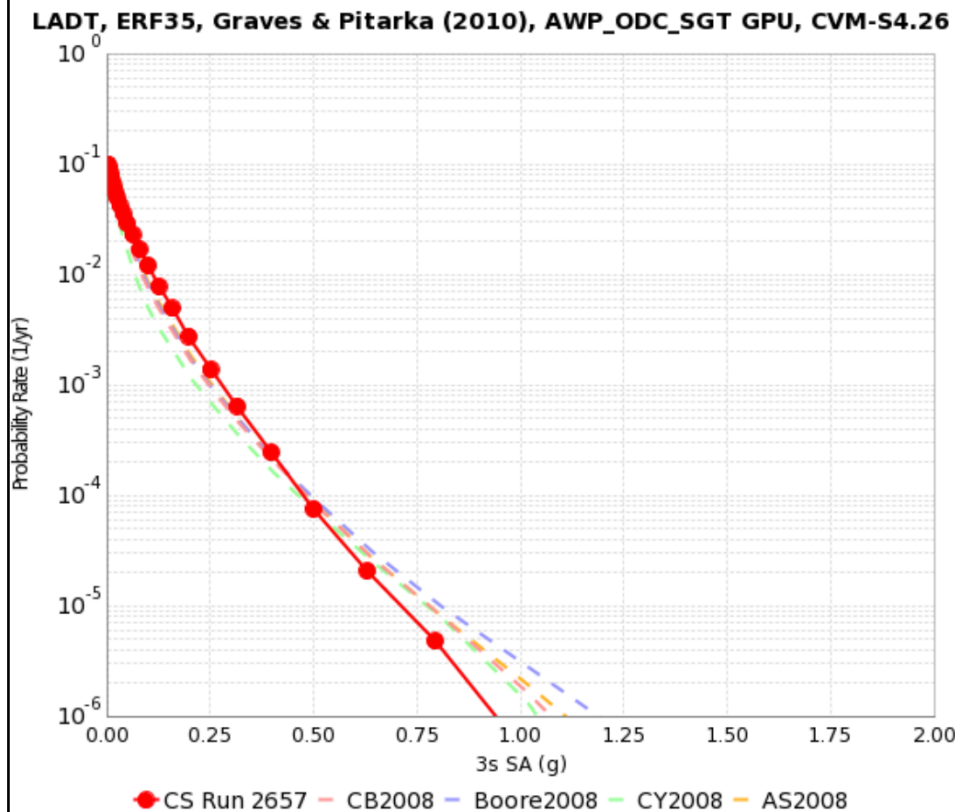
Scott Callaghan
UGMS Meeting
May 4, 2015

CyberShake Data Products

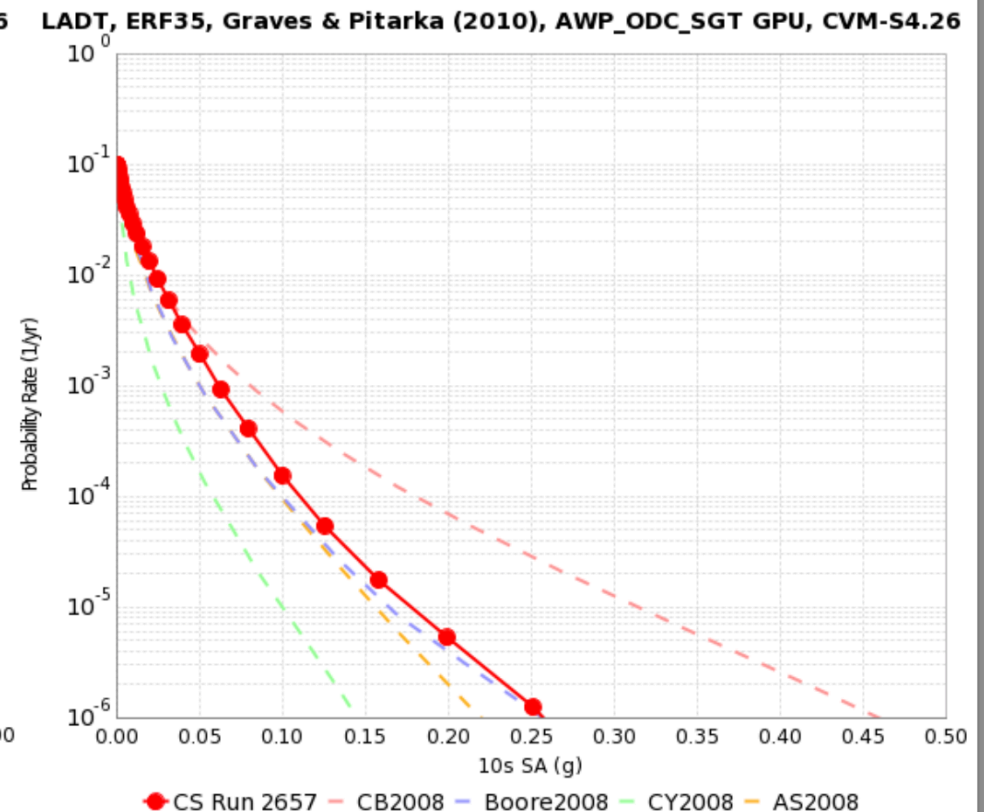
- For each CyberShake site:
 - 2-component seismograms for each of 400,000+ events
 - Intensity measures for each 2-component seismogram
 - Peak Spectral Acceleration at 44 periods
 - RotD100 and RotD50 at 16 periods
 - Intensity measures combined with probabilities from UCERF2 ERF to produce hazard curves

PSHA Hazard Curves

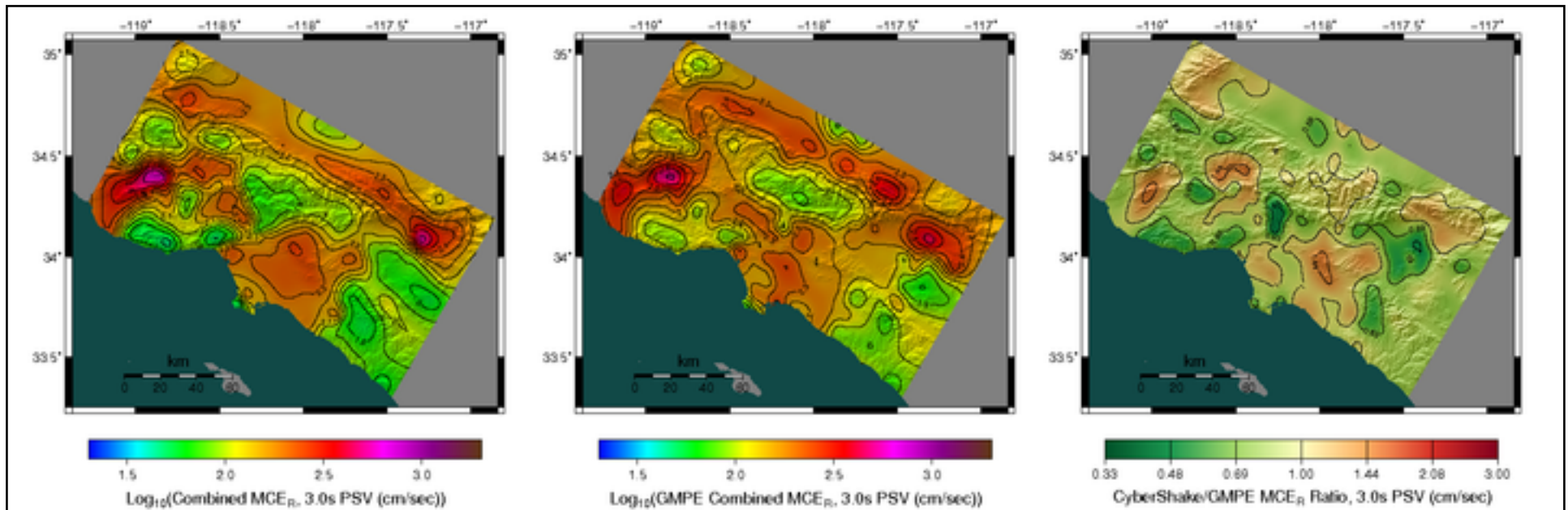
- Produced for each site, at various periods
 - For RotD100, 2, 3, 4, 5, 7.5, 10 sec



RotD100, 3 sec



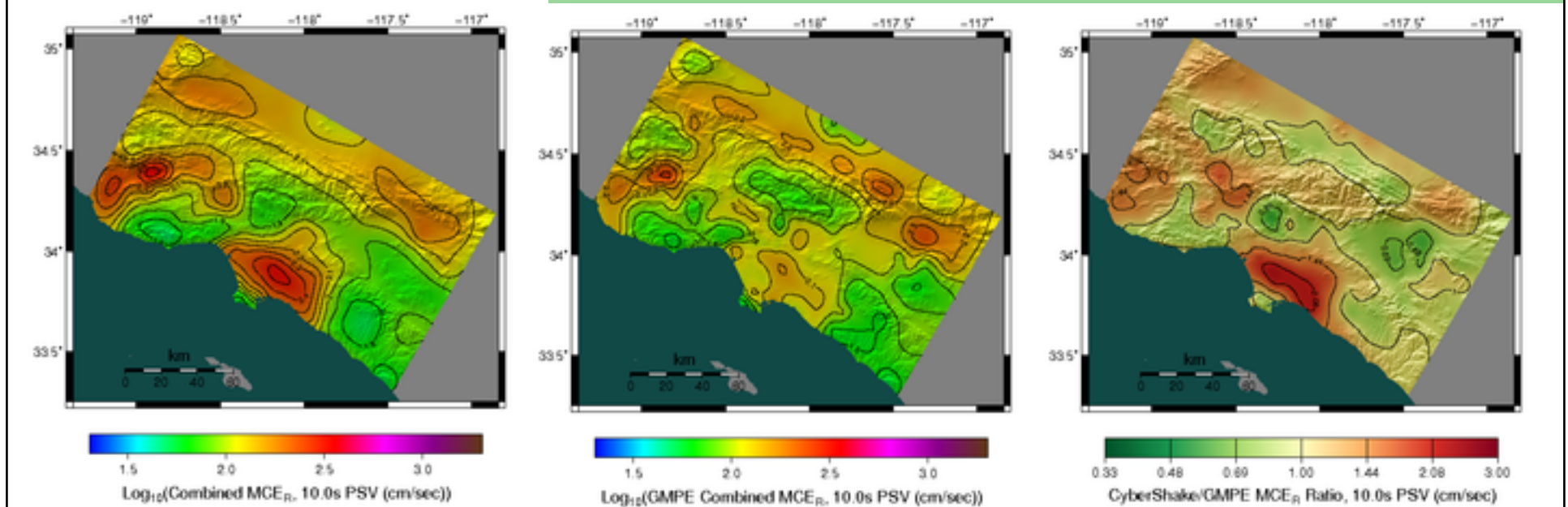
RotD100, 10 sec



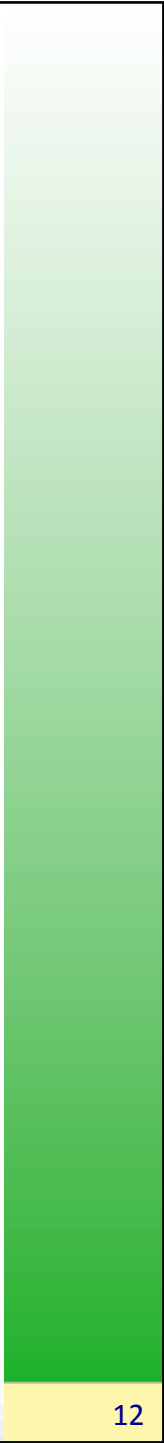
CS

GMPE

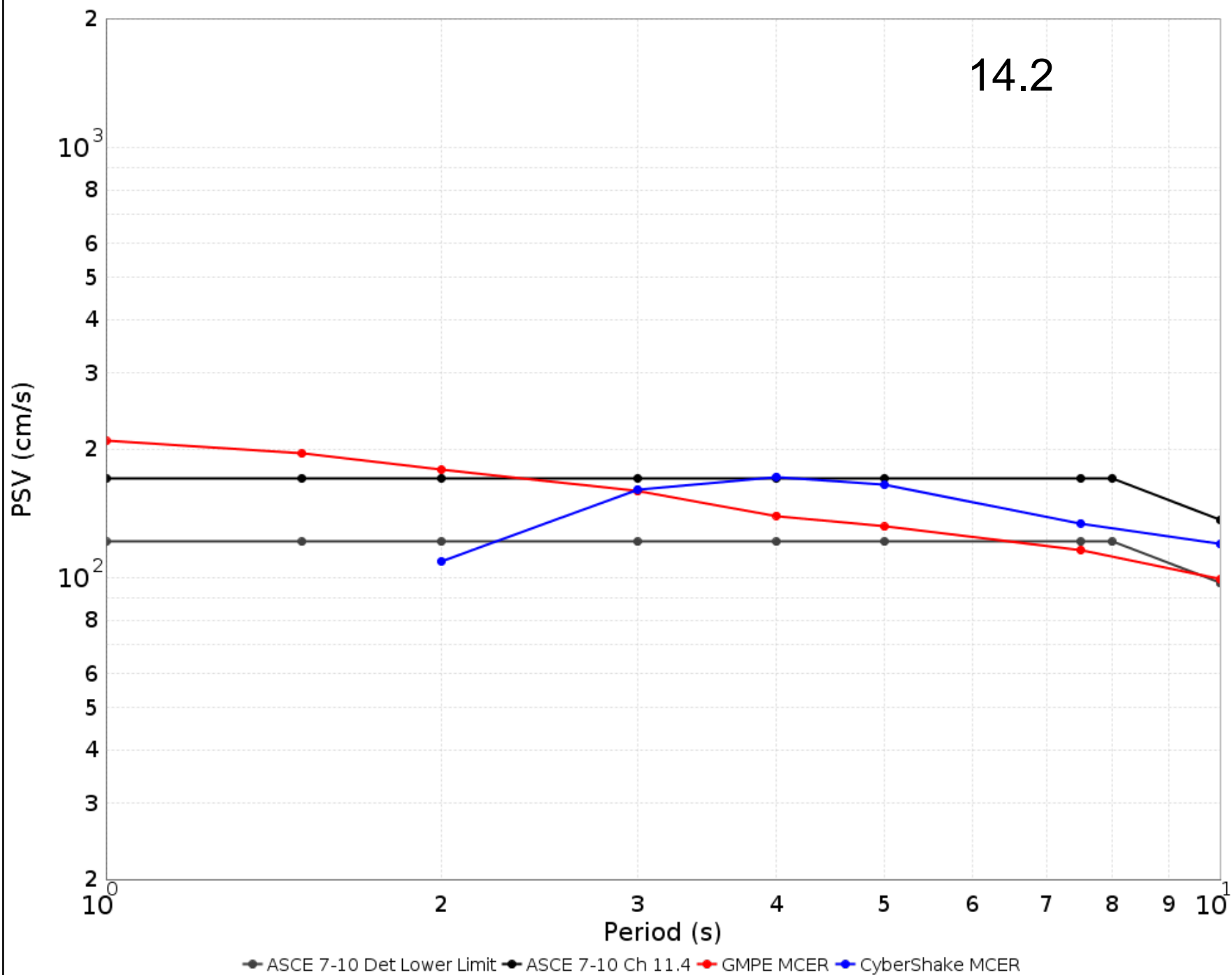
Ratio



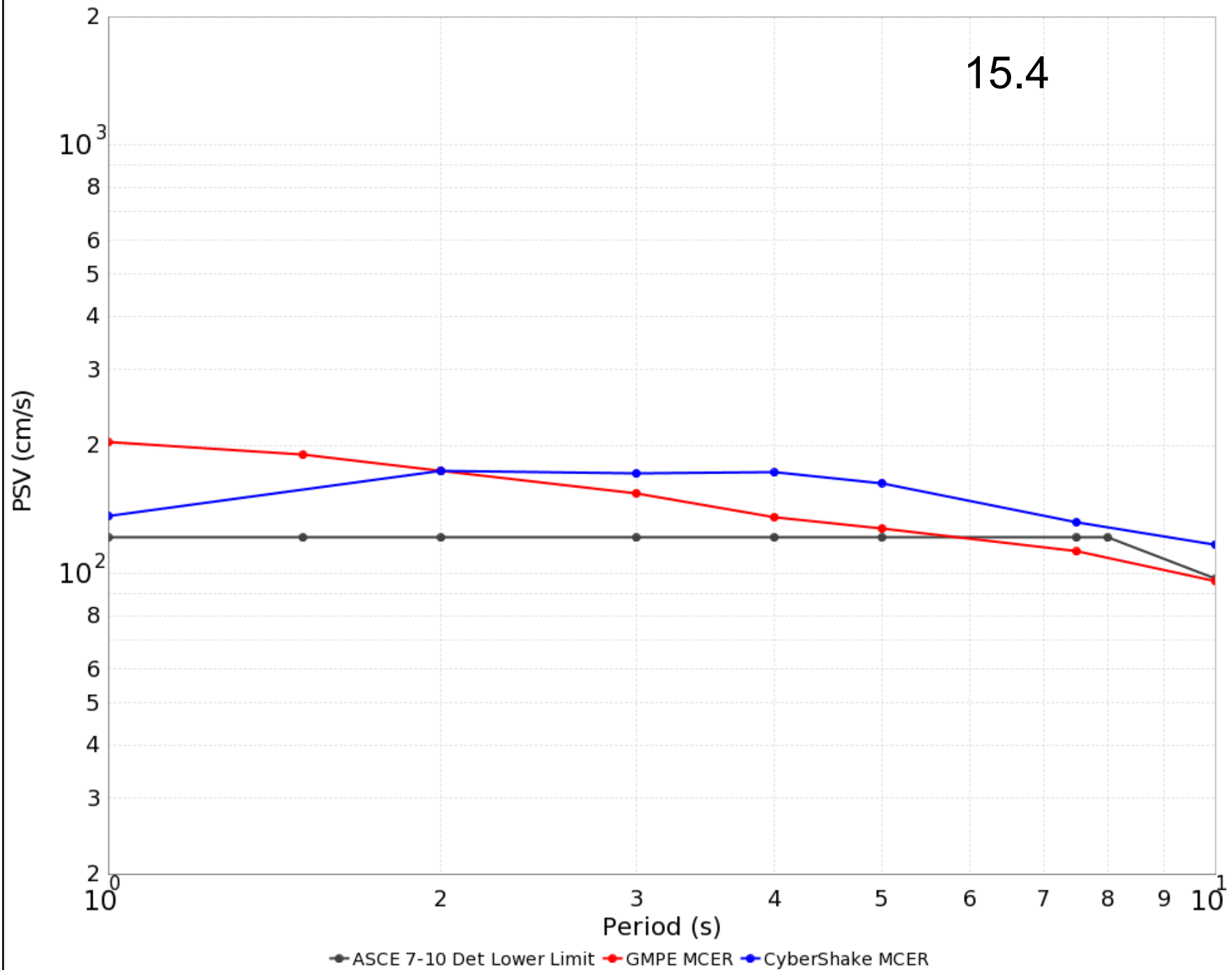
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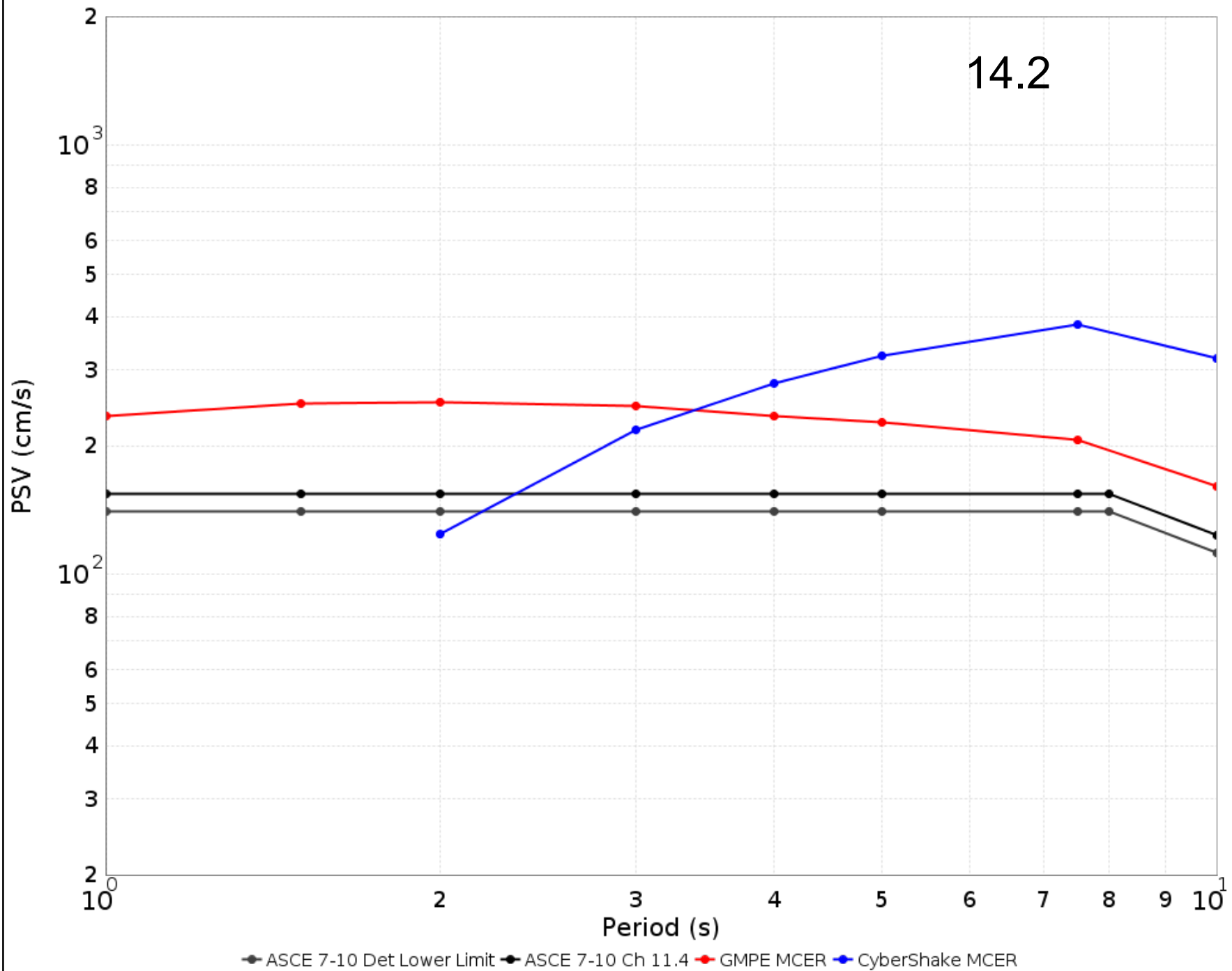
LADT MCER



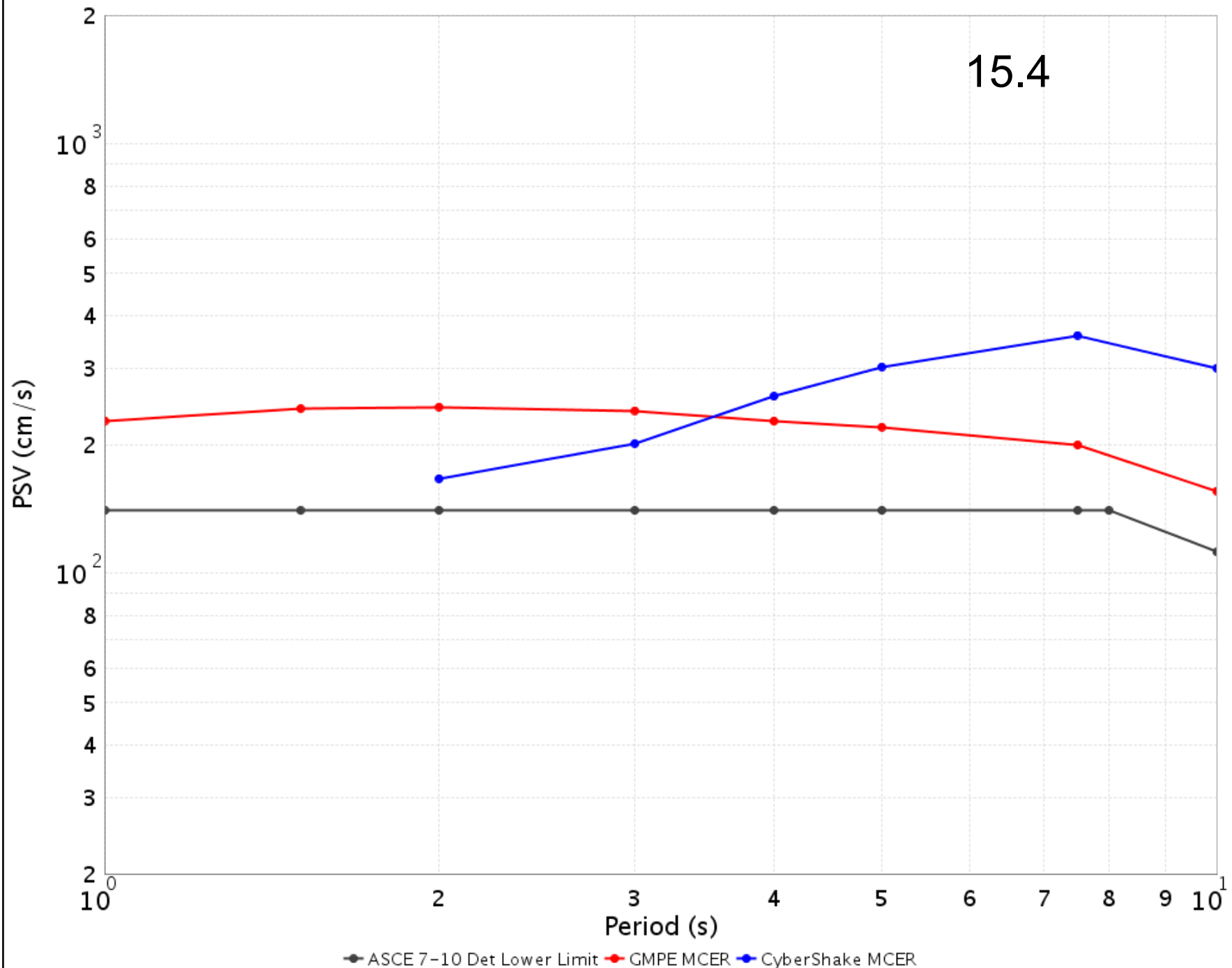
LADT MCER



STNI MCER



STNI MCER



Possible Implementation Strategy

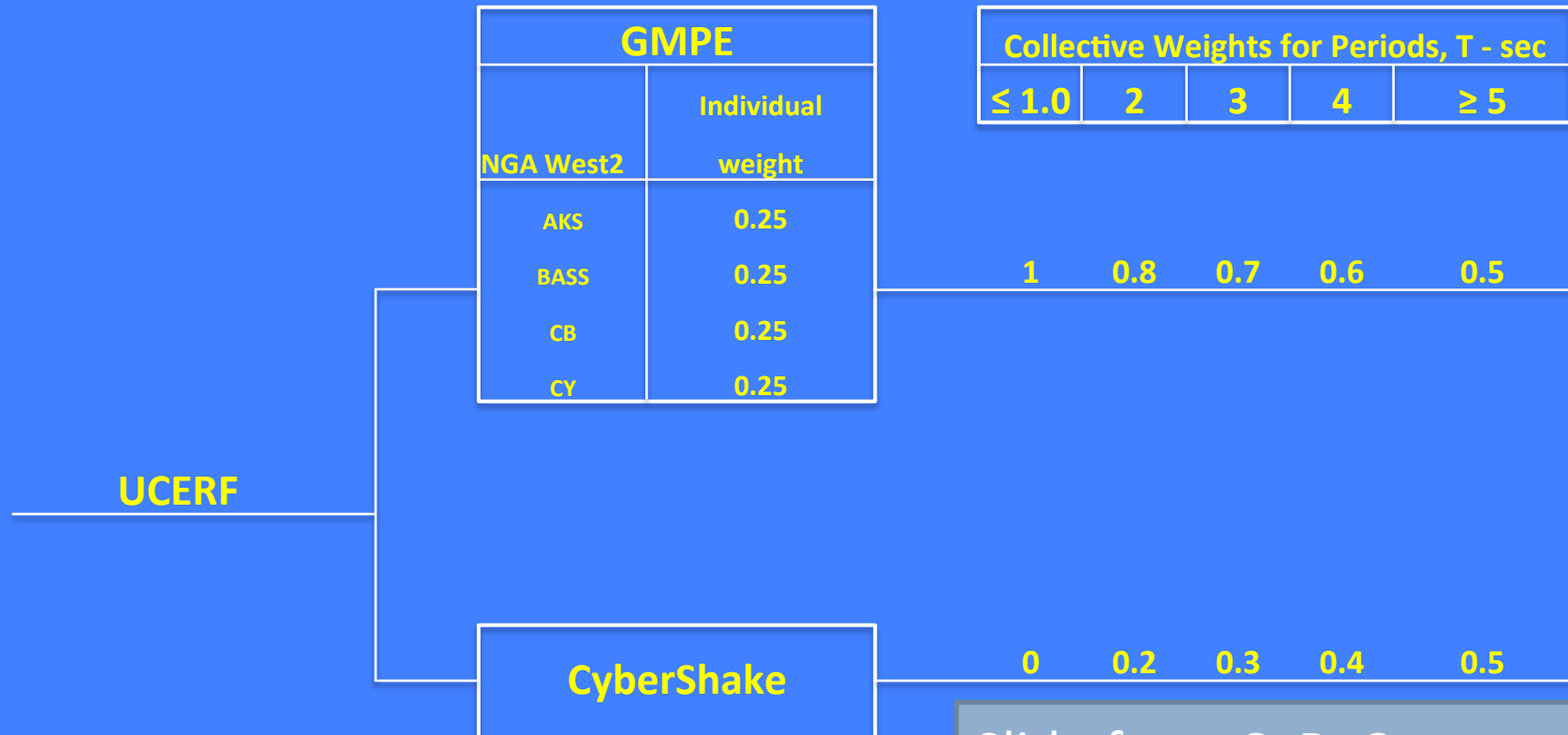
- CB Crouse proposed the use of a logic tree to implement the use of simulations
 - Increasing weight to simulations at longer periods.

Logic Tree for PSHA/DSHA for MCER

Source Model

G-M Models

Weights



Slide from C. B. Crouse

Important Issues

- Linear site effects – scale for Cybershake generally not as fine as measured layered structures
- Non-linear site effects – How important are they at long periods?

Key Point

- Committee on UGMS represents an element of the engineering community that is a current user of Cybershake simulations.
- This committee is convinced that simulations will lead to improved seismic design.
- Aim is to see simulations incorporated into design standards in ~2017