Forward SCEC Broadband Ground Motion Simulations for the SWUS Project

GMSV TAG Meeting

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Objectives: develop a list of simulation cases to help constrain/establish uncertainty in GMPEs (Identify scenarios to be implemented in the numerical simulations)

Model #	Issue	Magnitude	Distance (km)	Surface/ Buried, ZTOR (km)	Freq Range (Hz)	Addt. Notes
1	HW Scaling	5.5	0-15km	0, 5, 10	up to 10 Hz	Possibly only out to 10 km, and use dynamic ruptures
2	Splay Faulting	Main,7 Splay, 6-6.5	0-15km		up to 10 Hz	Splay faults, key issue is timing between segments
3	Slip partitioning (T. Rockwell)	6.5-7.5	0-15km		up to 10 Hz	Specific for SONGS
4	Large mag scaling	7-8	0-15km		up to 10 Hz	Look at constraints at long periods, Wenchuan (low), ChiChi (high), oversaturation is at high frequencies
5	Low dip angle scaling (10 deg)	5.5-6.5	0-15km	5, 10	up to 10 Hz	Below 30 degrees, not constrained empirically, need buried, need close in
6	Linked, multi-segment faults (short distances)	8.5	0-15km		up to 10 Hz	Are rupture generators valid for M>8?, but expensive (time), oversaturation?
7	Large mag, long distances	7.5-8.5	400 km		1	Specific for APS

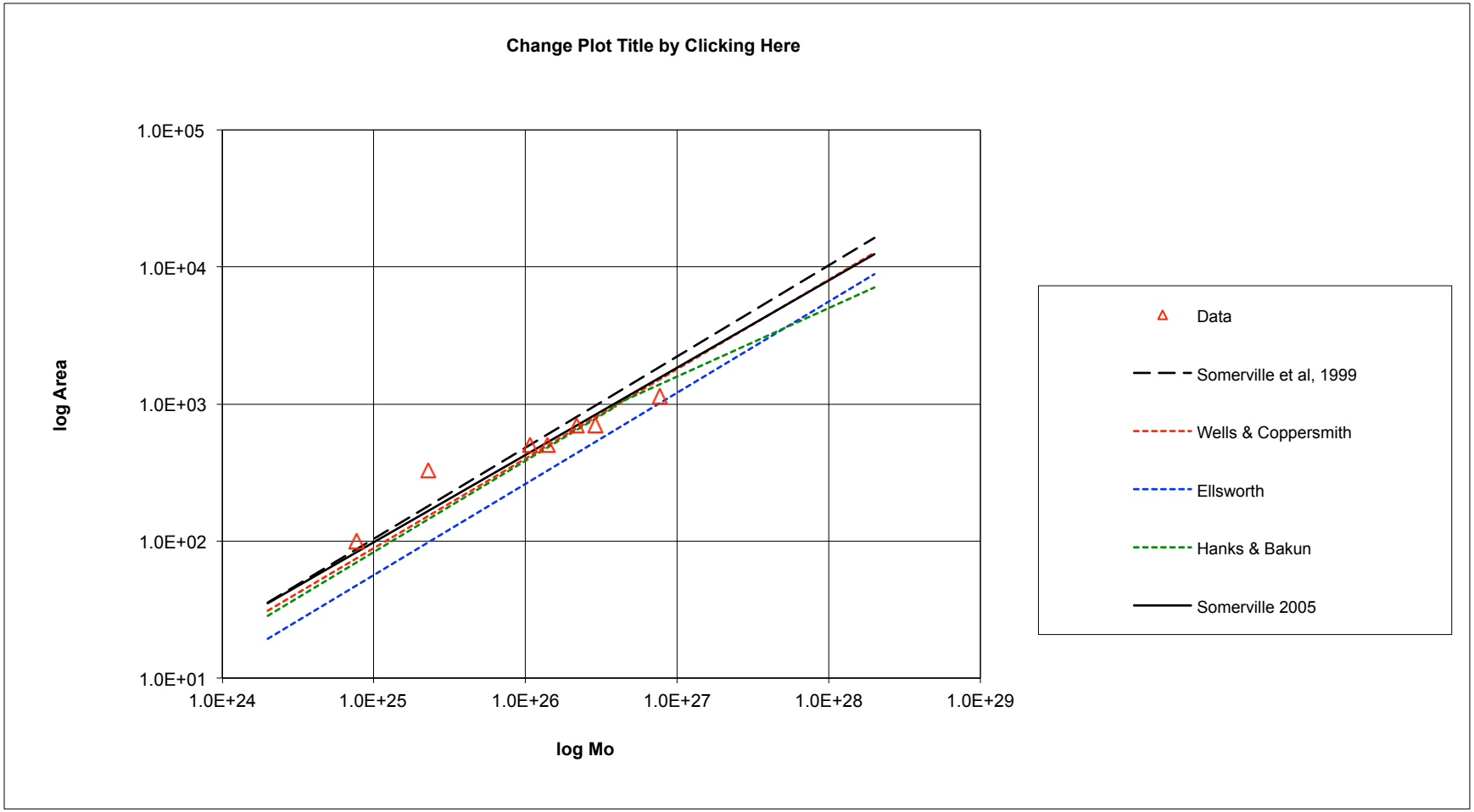
SCEC Modeler Issues: Participation in the Specification of SWUS Scenarios

- SCEC Modelers have knowledge of earthquake source characteristics and an understanding of the relationships between kinematic earthquake source parameters and strong ground motion characteristics
- SCEC Modelers should contribute this knowledge and understanding to the specification of the earthquake source models of the cases used in the SWUS Project

SCEC Modeler Issues: Mw - Area

- Relation between rupture area and seismic moment – for strong motion simulation, Leonard (2010), Wells & Coppersmith (1994) and Somerville et al. (1997) relations are viable; Hanks & Bakun (2002) is not within the context of kinematic simulations (e.g. Cybershake experience)
- Kinematic methods generate unrealistic ground motions using Hanks & Bakun scaling

Mo – Area for Validation Events



Leonard (2010) Mo - Area

Dip-Slip

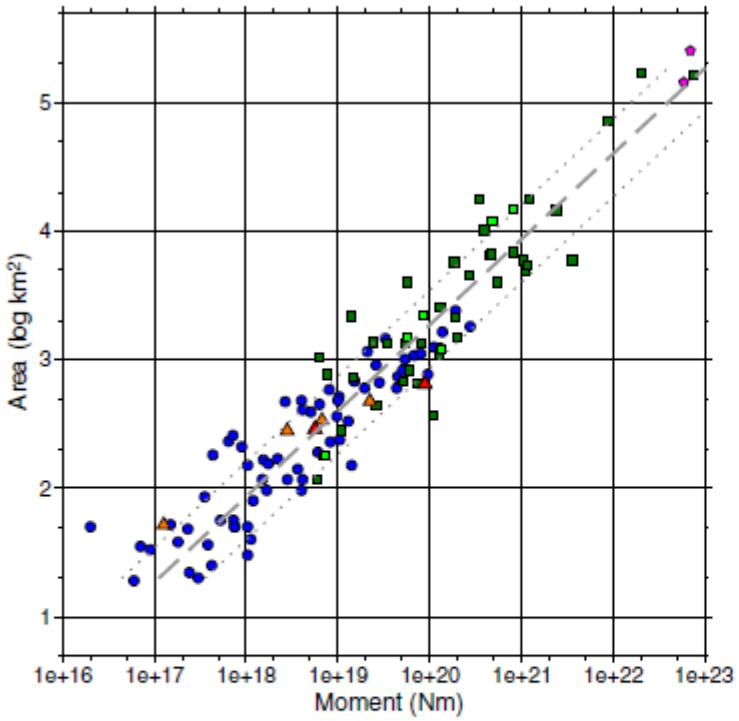


Figure 4. The M_0 versus area data for dip-slip earthquakes The gray dashed line is the constrained least squares (CLS), with a fixed slope of 2/3, best fit to the data and the gray dotted lines are $\pm 1\sigma$ uncertainties. The color version of this figure is available only in the electronic edition.

Strike-Slip

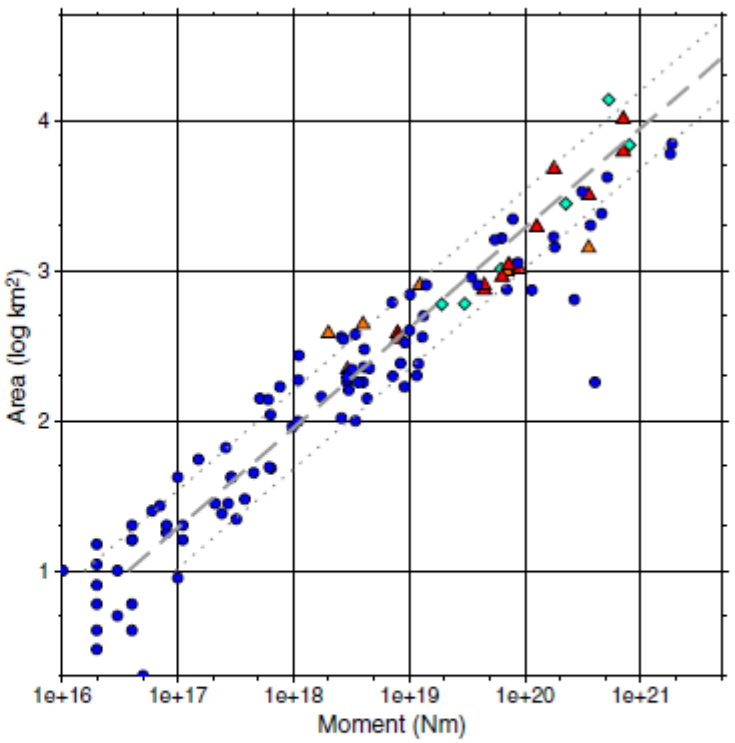


Figure 6. The M_0 versus area data for strike-slip interplate earthquakes. The gray dashed line is the CLS best-fit to the data for areas between 20 km^2 and 800 km^2. Above 800 km^2 the slope is assumed to be 2/3 for a $\sqrt{A}$ displacement model. The color version of this figure is available only in the electronic edition.

SCEC Modeler Issues: Characterization of Mw 8.5 Earthquakes

- Are these to be characterized as “median” events or “extreme” events, e.g. regarding Mw – Area relation
- If average displacements of 60 to 80 meters are required to generate Mw 8.5, is that compatible with what we know about displacements in large earthquakes?
- Kinematic methods will generate unrealistic ground motions for such events