



Evaluation & Testing

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The fundamental principle of science, the definition almost, is this: the sole test of the validity of any idea is experiment.

Richard P. Feynman

Why Evaluation & Testing?

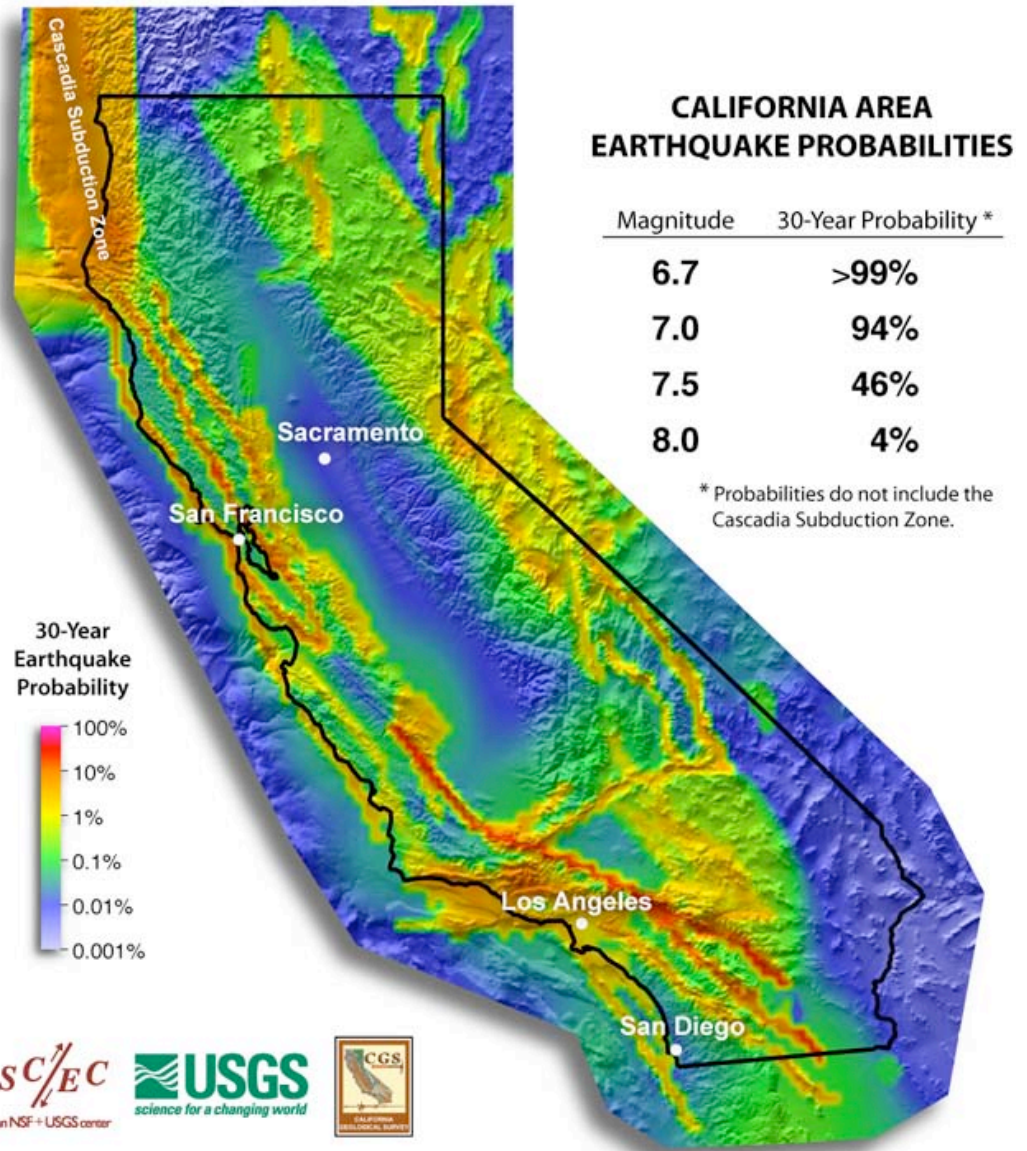
- Scientific best practice
- Increase acceptance of models and concepts
- Surprises (e.g. Seismic Gap Hypothesis)
- Explore validity of common concepts
- Reduce epistemic uncertainty (Disregard models)
- GEM will add testability
- Extension of the peer-review concept



Evaluation & Testing

What can be tested?

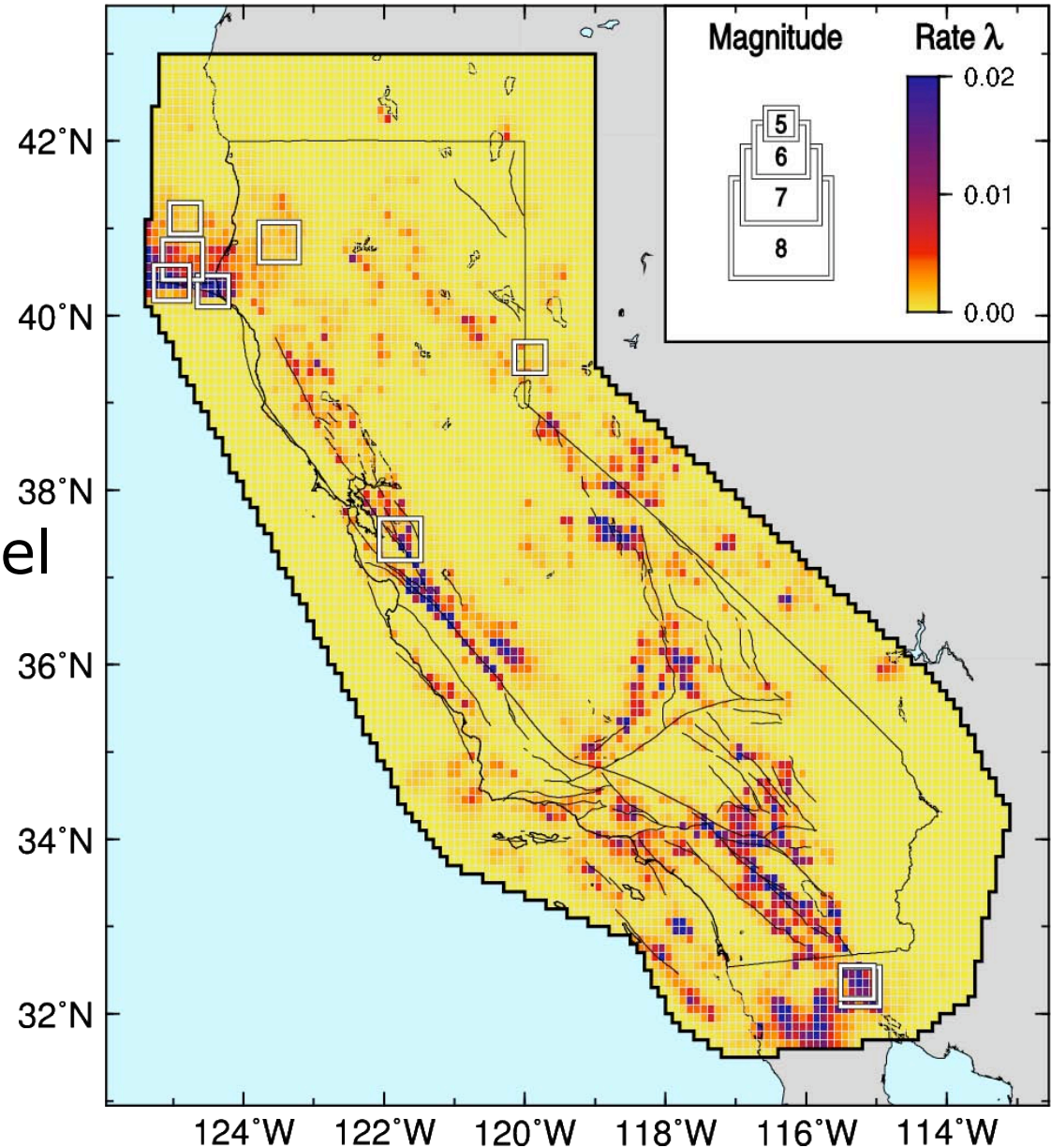
- Model output



Evaluation & Testing

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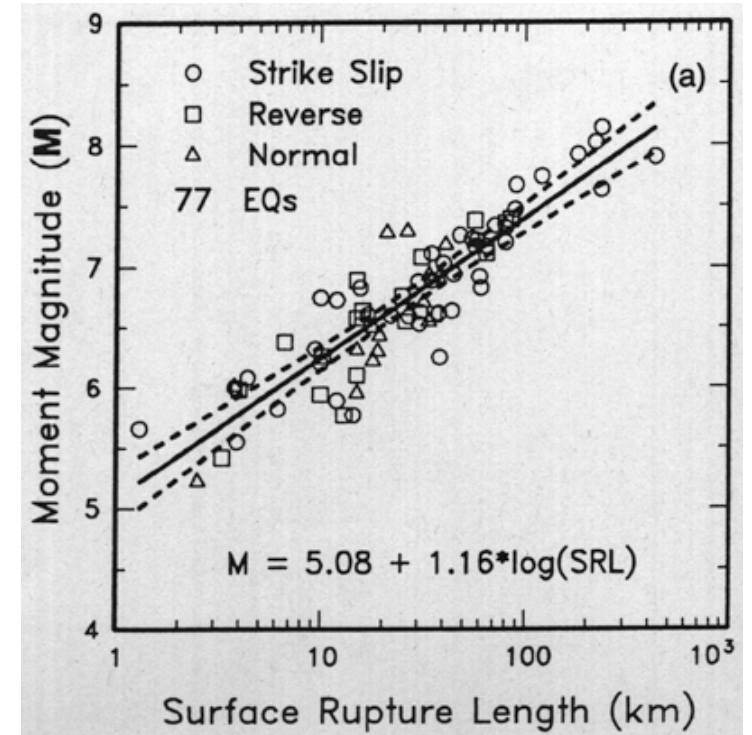
- Model output
- Outputs of components
 - Fault model
 - Deformation model
 - Earthquake-rate model
 - Probability model



Evaluation & Testing

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 - Probability model
- Scientific hypotheses
 - Magnitude-area (-fault length) relationships
 - Frequency-magnitude distribution
 - ...



[Wells & Coppersmith, 1994]

Evaluation & Testing

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 - ...
- Make the model as testable as possible

What Evaluation & Testing is NOT

- Testing software codes
- Evaluating input data and their generation (catalogs, various databases, etc.)
- Evaluation & testing targets scientific not technical problems

GEM

First testing targets discussed for GEM:

- Maximum magnitude per fault in the global fault model

GEM

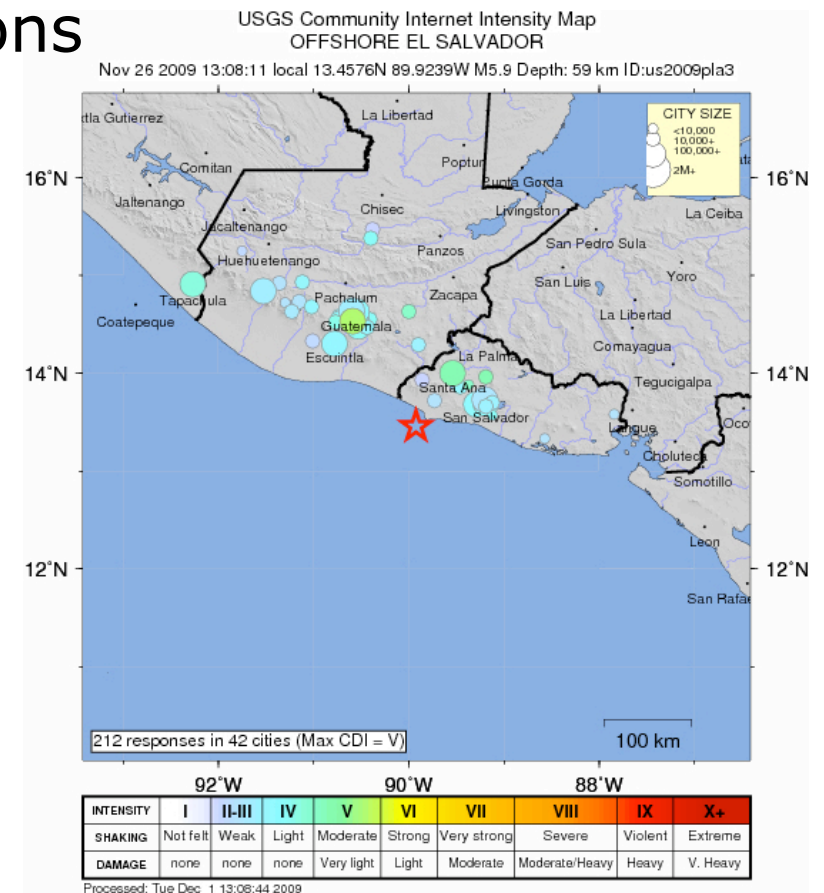
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- Maximum magnitude per fault in the global fault model
- Moment balance

GEM

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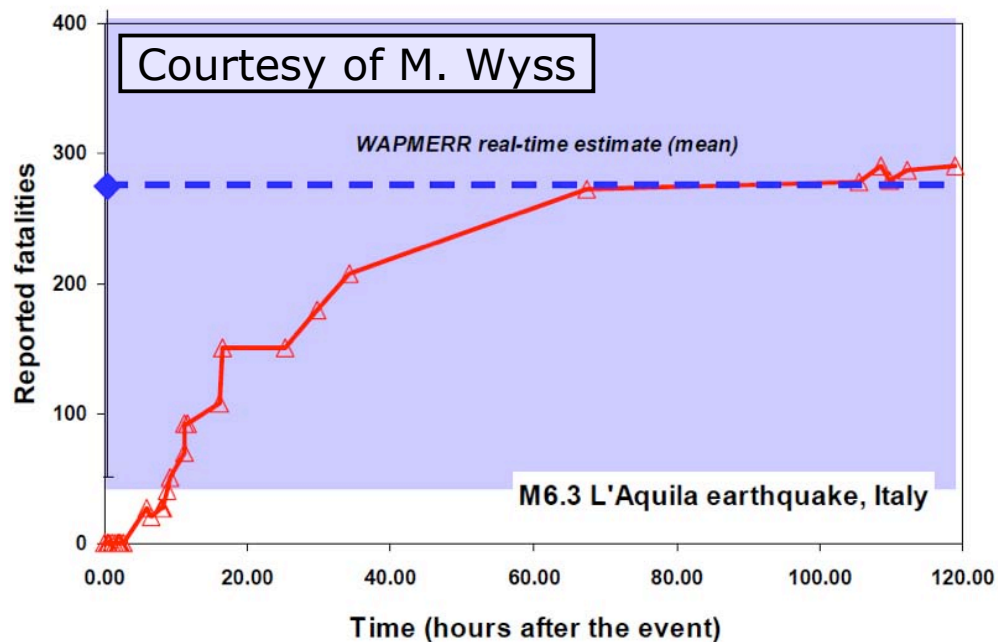
- Maximum magnitude per fault in the global fault model
- Moment balance
- Ground-motion prediction equations



GEM

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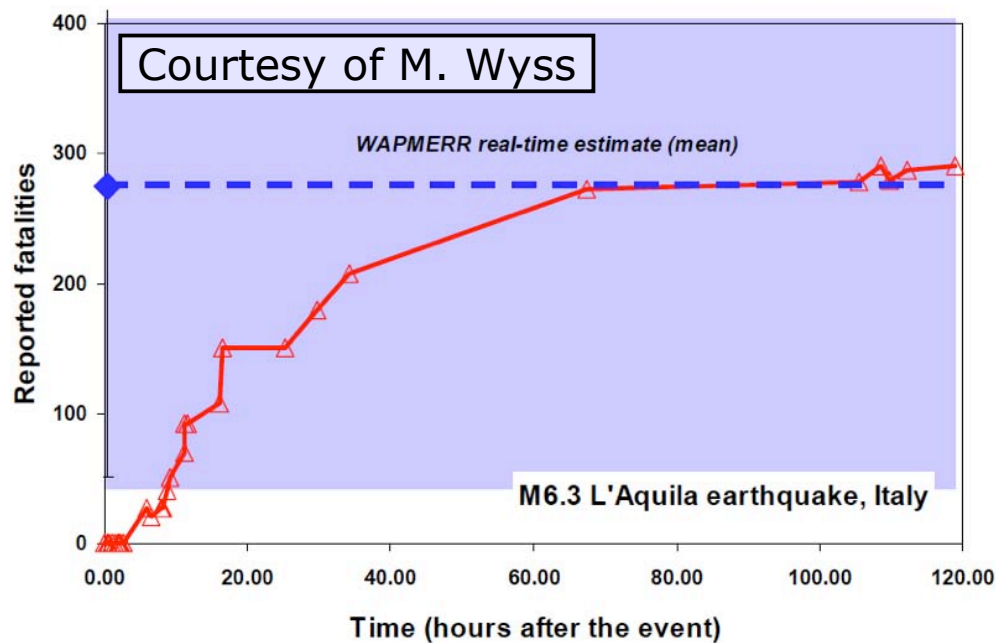
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- Moment balance
- Ground-motion prediction equations
- Number of fatalities/injured



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EM-DAT
The International Disaster Database
Centre for Research on the Epidemiology of Disasters - CRED

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Dates		Geo		Disaster			Numbers			
Start	End	Country	Location	Type	Sub_Type	Name	Killed	Tot. Affected	Est. Damage (US\$ Billion)	Disks
17/11/2008	17/11/2008	Indonesia	Gerontale, Buol district ...	Earthquake (seismic activity)	Earthquake (ground shaking)		6	10077		2008-0536
09/09/2008	09/09/2008	Indonesia	Lahat (Bengkulu province, ...	Earthquake (seismic activity)	Earthquake (ground shaking)		2	625		2008-0403
20/02/2008	20/02/2008	Indonesia	Simeulue (North Sumatra) ...	Earthquake (seismic activity)	Earthquake (ground shaking)		3	25		2008-0071
26/11/2007	26/11/2007	Indonesia	Sumbawa district (Iluva Te ...	Earthquake (seismic activity)	Earthquake (ground shaking)		3	21800		2007-0565
09/09/2007	09/09/2007	Indonesia	Situbondo (Java Isl.)	Earthquake (seismic activity)	Earthquake (ground shaking)			469		2007-0485
12/09/2007	12/09/2007	Indonesia	Bengkulu, Jambi, West Sum ...	Earthquake (seismic activity)	Earthquake (ground shaking)		25	459567	500	2007-0440
06/03/2007	06/03/2007	Indonesia	Tanah Datar, Solok, Solok ...	Earthquake (seismic activity)	Earthquake (ground shaking)		67	137660	200	2007-0087
01/12/2006	01/12/2006	Indonesia	Bima (Sumbawa region)	Earthquake (seismic activity)	Earthquake (ground shaking)		1	114		2006-0705
18/12/2006	18/12/2006	Indonesia	Mandailing Natal district ...	Earthquake (seismic activity)	Earthquake (ground shaking)		8	1200		2006-0678
17/07/2006	17/07/2006	Indonesia	Tasikmalaya, Ciatis, Suka ...	Earthquake (seismic activity)	Tsunami		802	35543	55	2006-0372

GEM

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Making the model testable:

- Ground-motion intensities should always be expressed in MMI to be tested against “Did You Feel It?” data with each earthquake

GEM budget:

Outflow

Category:	2008	2009	2010	2011	2012	2013	Total (Euro)
Secretariat	123,029	1,059,792	1,152,597	878,625	889,332	896,625	5,000,000
Seismic Hazard		362,355	952,645	730,000	586,000	369,000	3,000,000
Seismic Risk		362,355	1,442,145	1,369,500	1,369,500	456,500	5,000,000
Socio-Economic Impact			400,000	400,000	200,000		1,000,000
Model Building Facilities		579,768	2,007,432	1,891,200	1,891,200	630,400	7,000,000
Integration				400,000	400,000	200,000	1,000,000
Evaluation and Testing		49,980	245,020	235,000	235,000	235,000	1,000,000
Total:	123,029	2,414,250	6,199,839	5,904,325	5,571,032	2,787,525	23,000,000

Long-term Goals

- Make UCERF3 as testable as possible
- Test as many ingredients to the model as possible
- Explore the uncertainties and the validity of ingredients
- Create simple reference models to test UCERF3 and selected ingredients against
- Employ methods of the Collaboratory for the Study of Earthquake Predictability (CSEP)

Proposal for UCERF3

- Establish an independent group that works together with model developers to make the model as testable as possible
- Have this working group as open as possible but maintain a clear distinction between “testers” and “modelers”
- Organize small-scale workshops to discuss testing targets and increase collaboration between “testers” and “modelers”
- Establish close collaboration with Evaluation & Testing within GEM
- Start the working group as soon as possible

Thank You!

If you're doing an experiment, you should report everything that you think might make it invalid — not only what you think is right about it... Details that could throw doubt on your interpretation must be given, if you know them.

Richard P. Feynman