

An Existing Testing Center: CSEP

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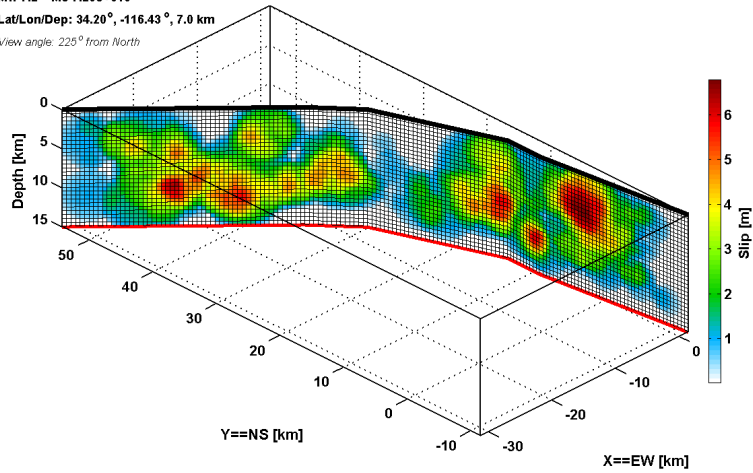
Problems in Assessing Predictions

- Scientific publications provide insufficient information for independent evaluation
- Active researchers are constantly tweaking their procedures, which become moving targets
- Standards are lacking for testing predictions against reference forecasts
- Data to evaluate prediction experiments are often improperly specified
- Infrastructure for conducting and evaluating long-term prediction experiments does not exist

Same Problem

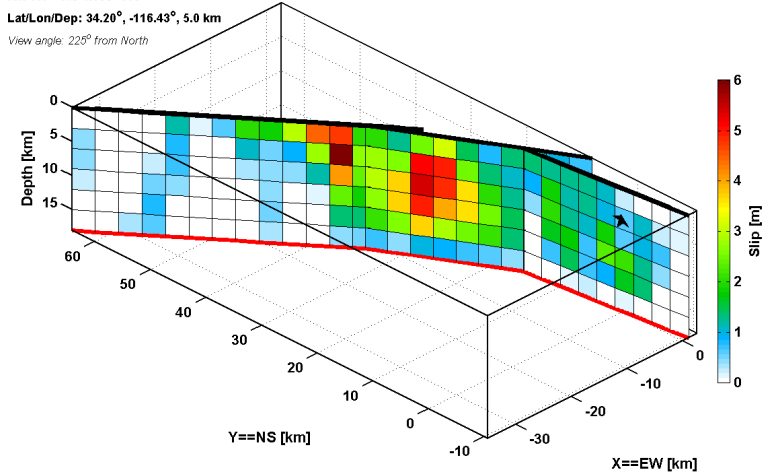
Landers (Calif.)

s1992LANDERzeng
Mw 7.2 Mo 7.20e+019
Lat/Lon/Dep: 34.20°, -116.43°, 7.0 km
View angle: 225° from North



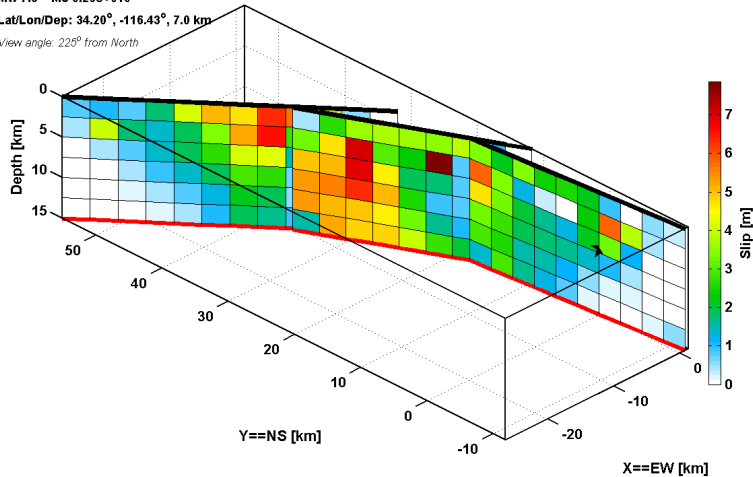
Landers (Calif.)

s1992LANDERcohe
Mw 7.1 Mo 4.66e+019
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View angle: 225° from North



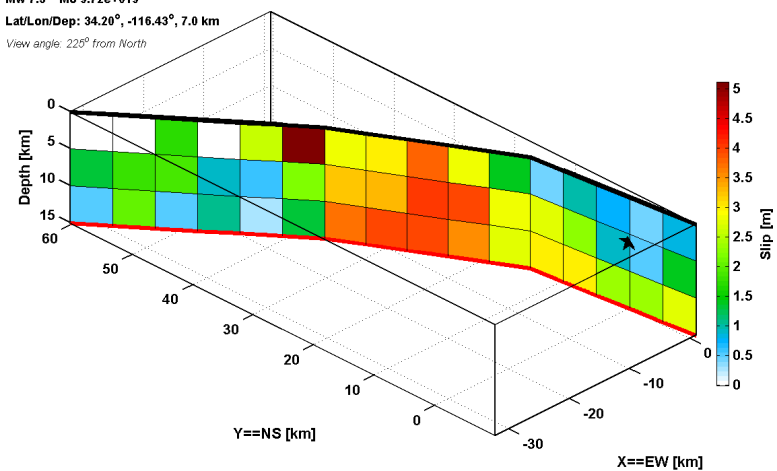
Landers (Calif.)

s1992LANDERwald
Mw 7.3 Mo 9.26e+019
Lat/Lon/Dep: 34.20°, -116.43°, 7.0 km
View angle: 225° from North



Landers (Calif.)

s1992LANDERcott
Mw 7.3 Mo 9.72e+019
Lat/Lon/Dep: 34.20°, -116.43°, 7.0 km
View angle: 225° from North



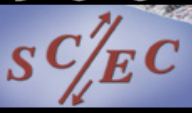
Strategy Change

Possible “problem solvers” (precursors):

- Seismic quiescence
- Foreshocks
- Radon emissions
- EM signals
- ...

None of the considered precursors can be used to predict earthquakes

Let us first solve the 0-order problem!

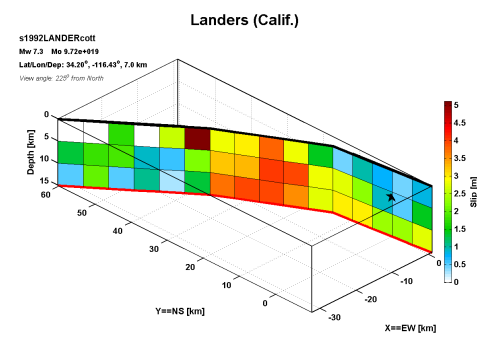
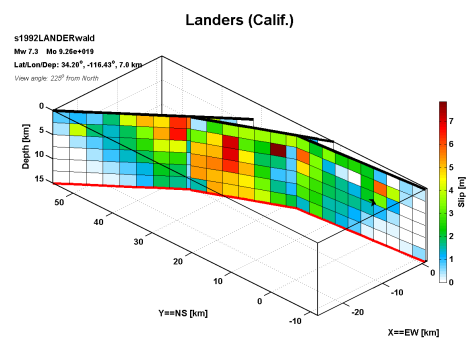
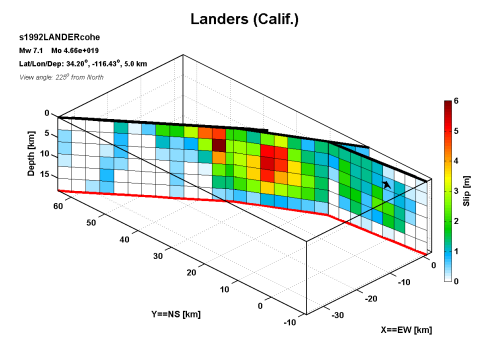
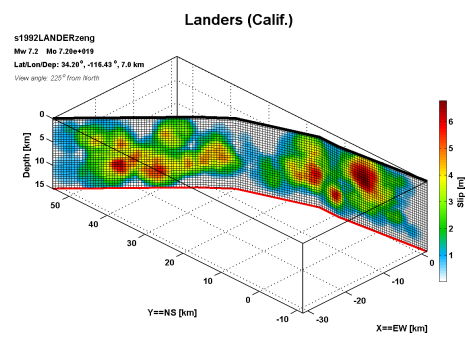


Strategy Change

Develop generic forecast models, e.g., smoothed seismicity

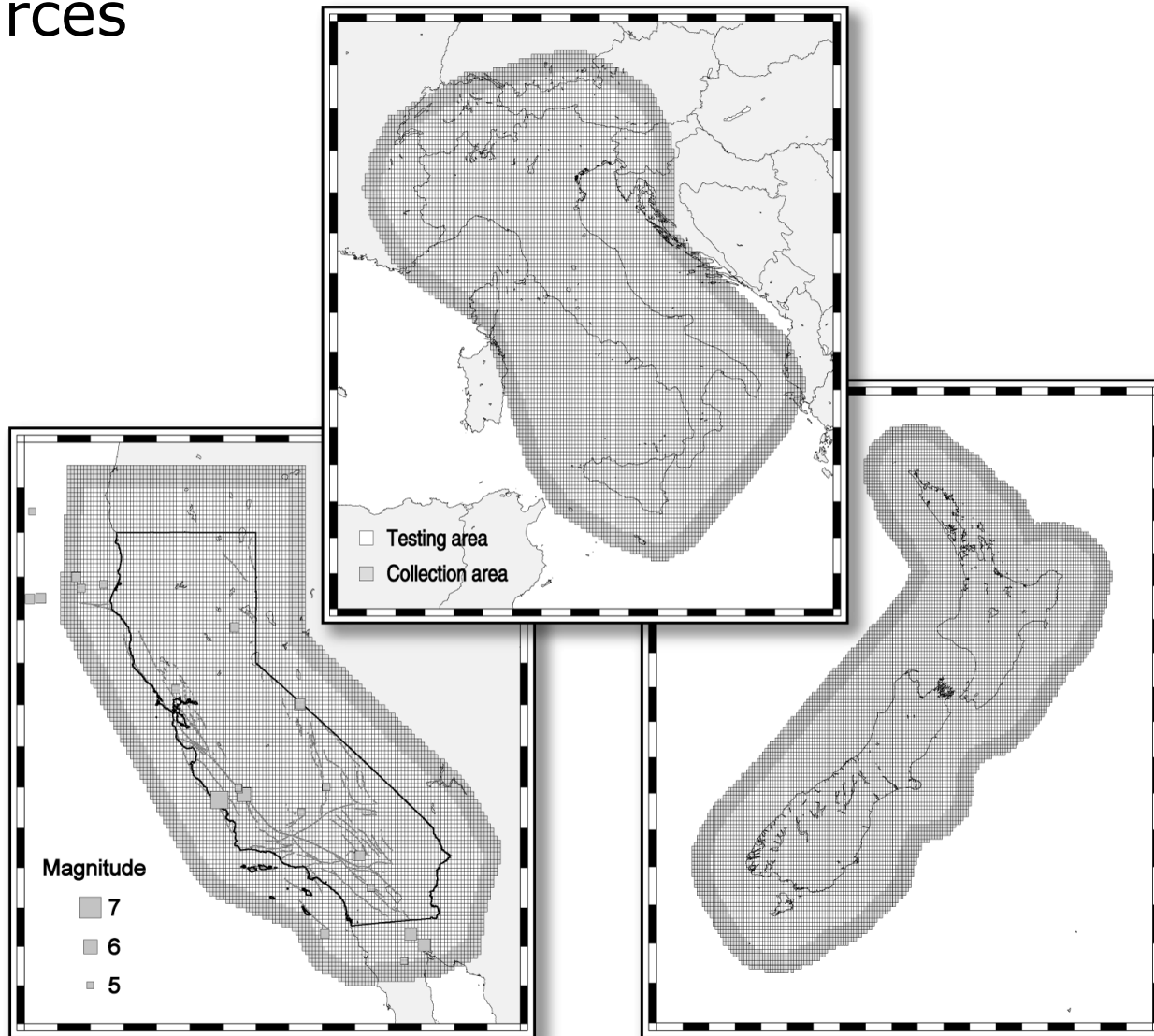
Test such models against future observations

Increase number of parameters and test for probability gain



Four Essential CSEP Components

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- Testing facilities with validated procedures for conducting and evaluating prospective prediction experiments

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- Communication protocols for conveying scientific results
 - the scientific community, including professional societies
 - government agencies responsible for risk management
 - the general public and other end-users

Transparency

- All data cataloged
- All codes version-controlled
- Open-source codes (fully downloadable)
- Every change is documented

Controlled Environment

- Model codes cannot be changed (no moving targets)
- All data streams are authorized and fully specified
- All data streams come from independent providers and are not “interpreted” by the Testing Center (e.g., which fault ruptured during an earthquake)
- All models get identical input data
- All models are evaluated using the same testing codes

Comparability

- Models are tested against observation (consistency tests)
- Models are tested against each other (comparative testing)
- Avoids testing against overly simple null hypotheses

Reproducibility

- Any previous result can be recomputed:
 - All data used is cataloged
 - All codes are version-controlled
 - All system configurations are stored
 - All library packages (e.g., Python) are in a dedicated repository
- Tests can be rerun with alternative tests



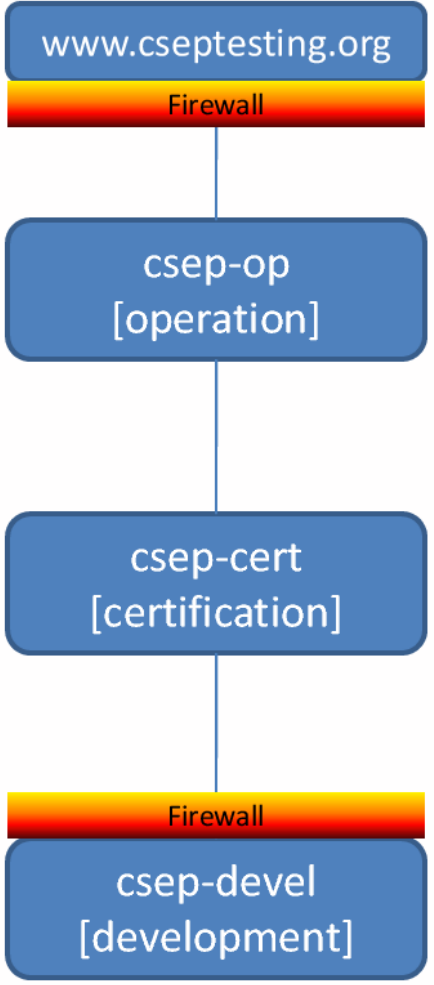
Testing Center

Hardware
 2 Dual-Core AMD Opteron
 2220
 8 GB RAM
 3.4 TB RAID 5 disks

OS/Kernel
 Fedora Core 7 – 64 bit
 2.6.22.1-41.fc7
 gcc 4..1.2

Related Software
 apache ant-1.7
 R-2.5.0
 elementtree-1.2.6-20050316
 matplotlib-0.90.1
 mpich2-1.0.3
 CruiseControl

Identical hardware & software



Webserver
 Restricted publication of results
 Restricted dispatcher download
 Test center setup information

Operational Machine
 Automated Nightly builds from dispatcher
 Publication of results to web server
 Back up results
 Quarterly Implementation of new models

Integration/Cert Machine
 Automated Nightly builds from dispatcher
 Emulates actual operation machine
 Fulfill software dependencies
 Implementation of new models

Development Machine
 Import new models
 Develop dispatcher
 Fulfill software dependencies

Summary

- Source inversion validation efforts may learn from CSEP
- CSEP partly has similar needs (e.g., input data)
- CSEP provides an excellent infrastructure for experiments
- Maybe this can be a starting point for an interdisciplinary effort?