



# The Testing Centers of the Collaboratory for the Study of Earthquake Predictability (CSEP)

*Source Inversion Validation Workshop  
SCEC Annual Meeting, September 13, 2009  
M. Liukis, D. Schorlemmer, and the CSEP Working Group*



# Problems in Assessing Predictions

- Scientific publications provide insufficient information for independent evaluation
- Data to evaluate prediction experiments are often improperly specified
- Active researchers are constantly tweaking their procedures, which become moving targets
- Difficult to find resources to conduct and evaluate long-term prediction experiments
- Standards are lacking for testing predictions



# CSEP System Requirements

- CSEP Testing Center Goals (as outlined by Schorlemmer and Gerstenberger (2005)):

## Transparency

- Data Archive
  - Raw and post-processed catalogs
  - Input parameters for forecasts models, forecasts
  - Evaluation tests results
- Version Control
  - Testing center codes
  - Forecast data and codes
- Publishing of results to the web server



# CSEP System Requirements

- CSEP Testing Center Goals (as outlined by Schorlemmer and Gerstenberger (2005)):

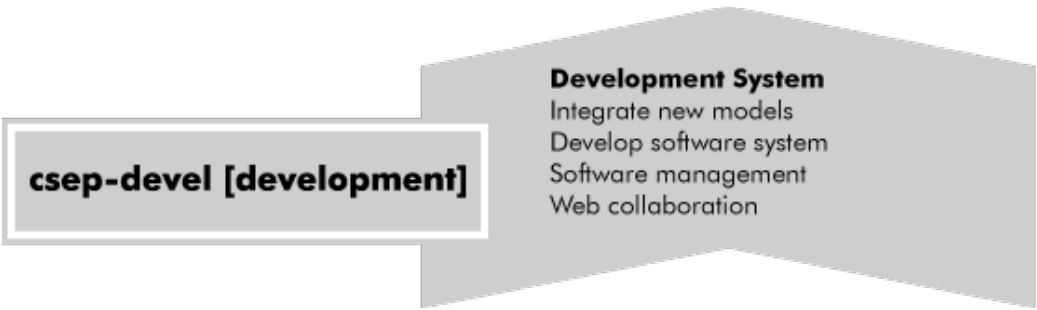
## Transparency

### **Controlled environment**

- Raw catalog from authorized data source
- Forecasts Procedures
  - Installed in the testing center
  - Controlled by the testing center
  - No modeler access



# CSEP Computer System

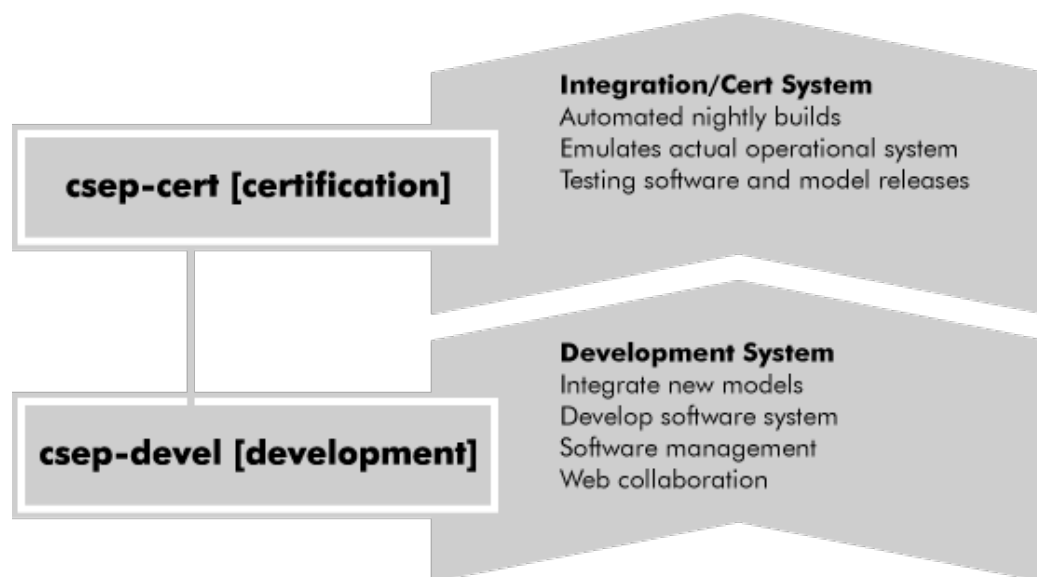


**csep-devel [development]**

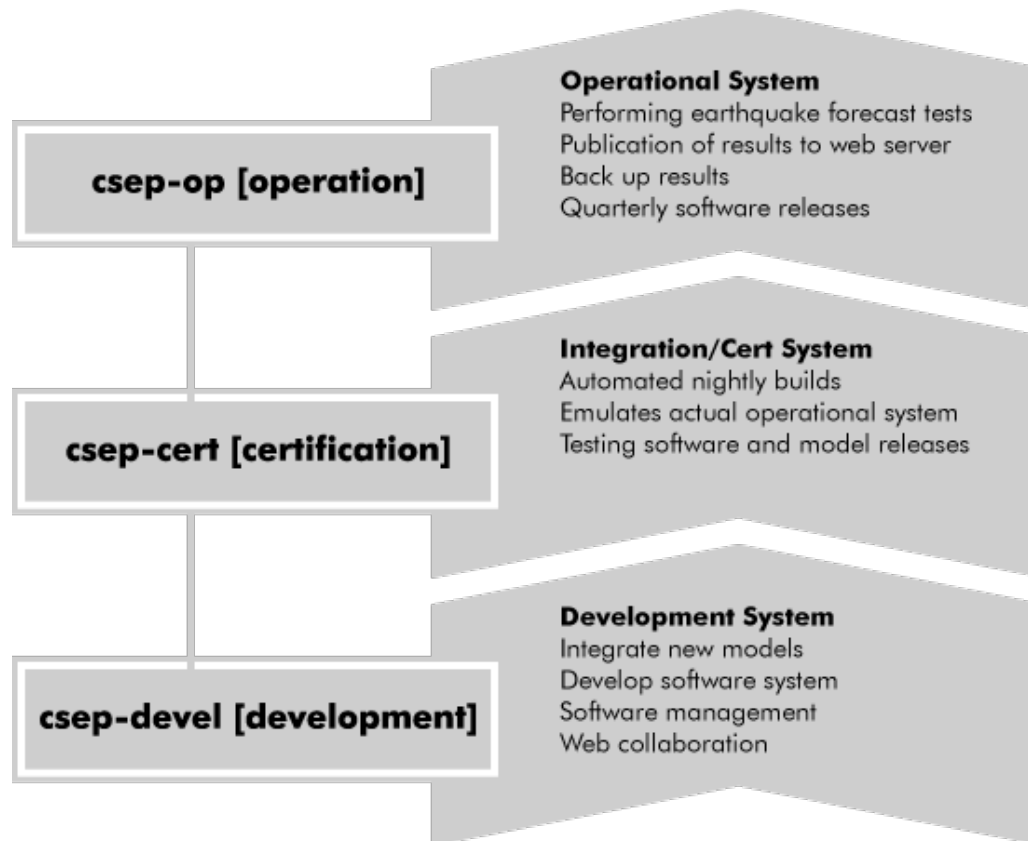
**Development System**  
Integrate new models  
Develop software system  
Software management  
Web collaboration



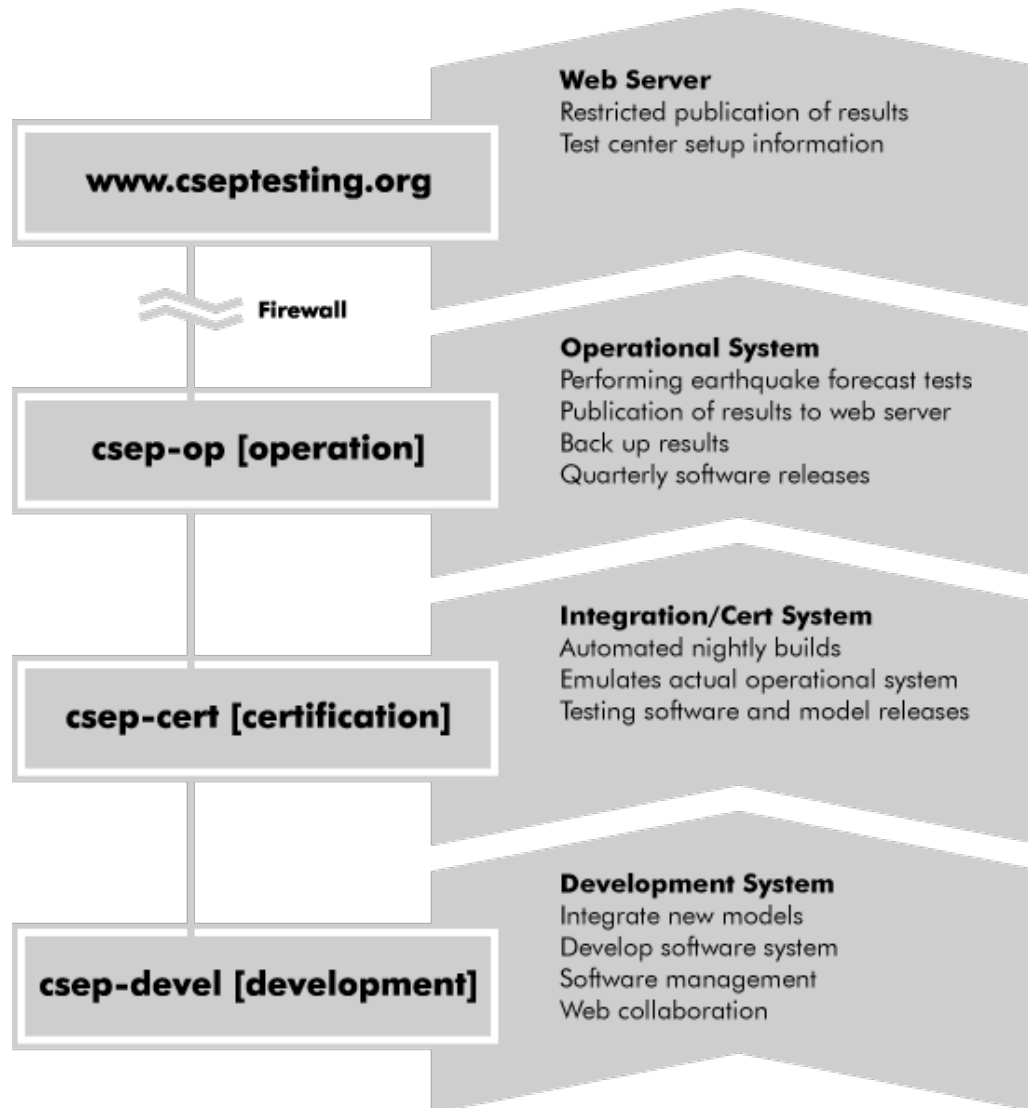
# CSEP Computer System



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- CSEP Testing Center Goals (as outlined by Schorlemmer and Gerstenberger (2005)):

Transparency

Controlled environment

## Reproducibility

- Ability to re-run experiment at later time
  - With alternative options
  - With new tests
  - With fixed version of Testing Center codes

# CSEP System Requirements

- CSEP Testing Center Goals (as outlined by Schorlemmer and Gerstenberger (2005)):

Transparency

Controlled environment

Reproducibility

**Comparability**

- Tested within an experiment
  - Forecast model against observed data
  - Forecasts models against each other
  - Standardization of experiments

# Experiment

## Classes

5-year forecast

## Forecast

0.1x0.1 degree bins

Rates for M5-9 (0.1 step)

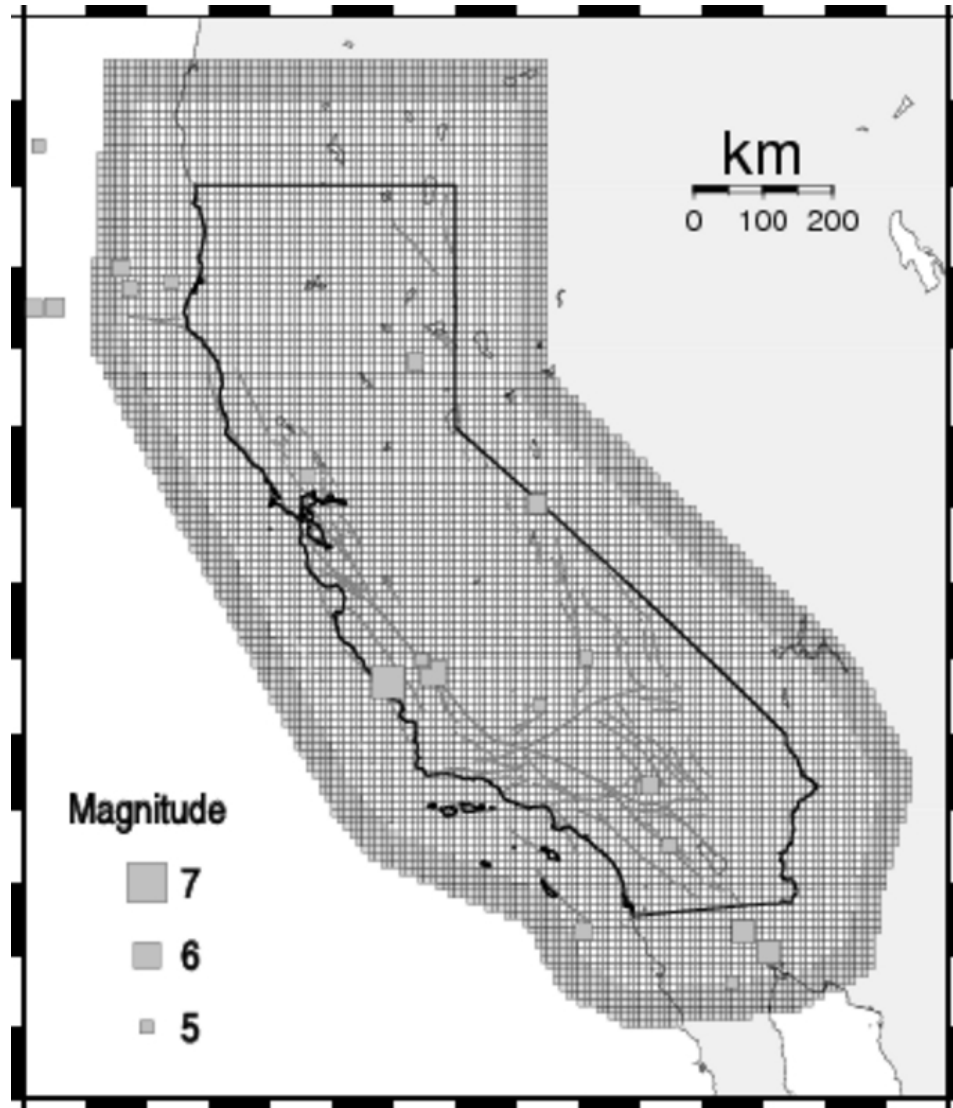
## Data

ANSS Catalog

1 month delay

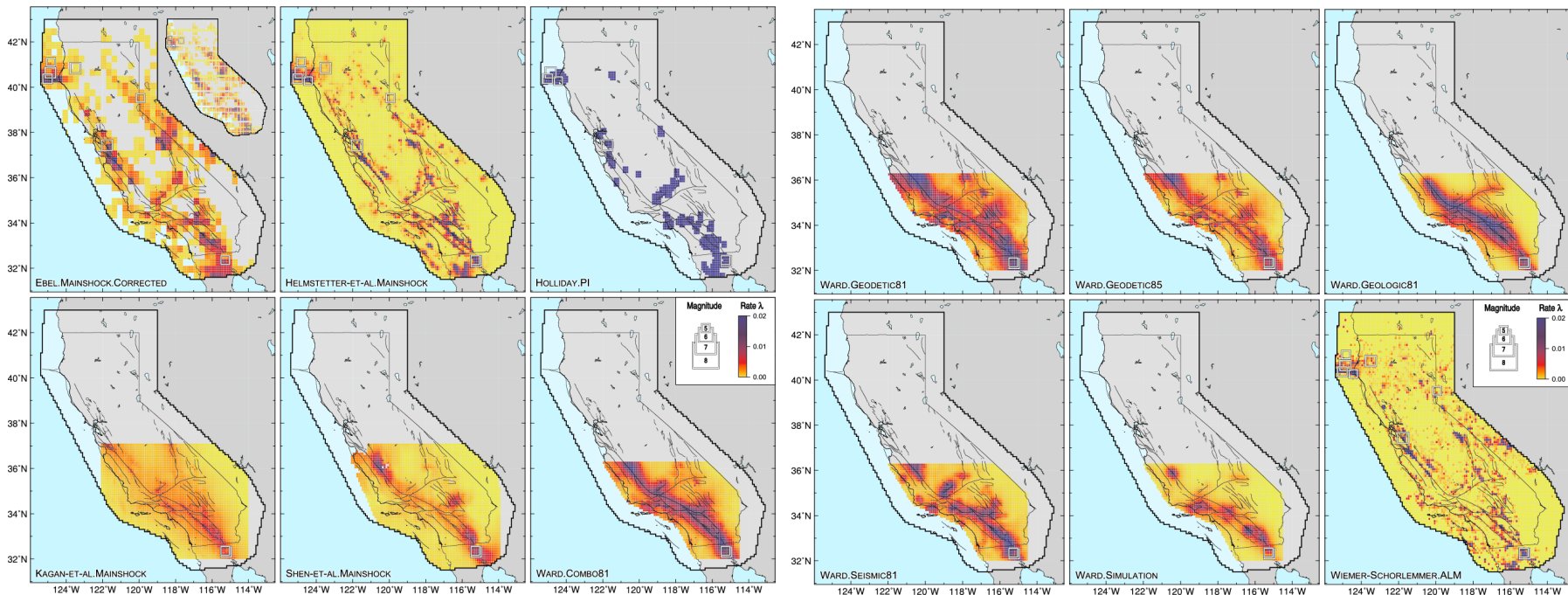
## Test

L-, N-, R-Test



# Experiment

- 12 Models were submitted before January 1, 2006
- Experiment will continue until January 1, 2011





# CSEP Software

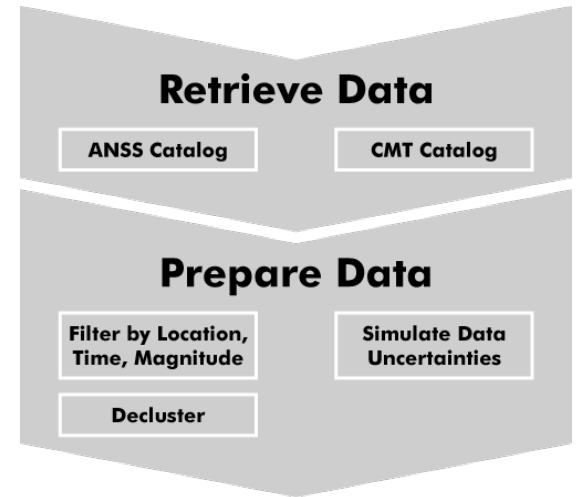
- Retrieve data on a daily basis

**Retrieve Data**

[ANSS Catalog](#)      [CMT Catalog](#)

# CSEP Software

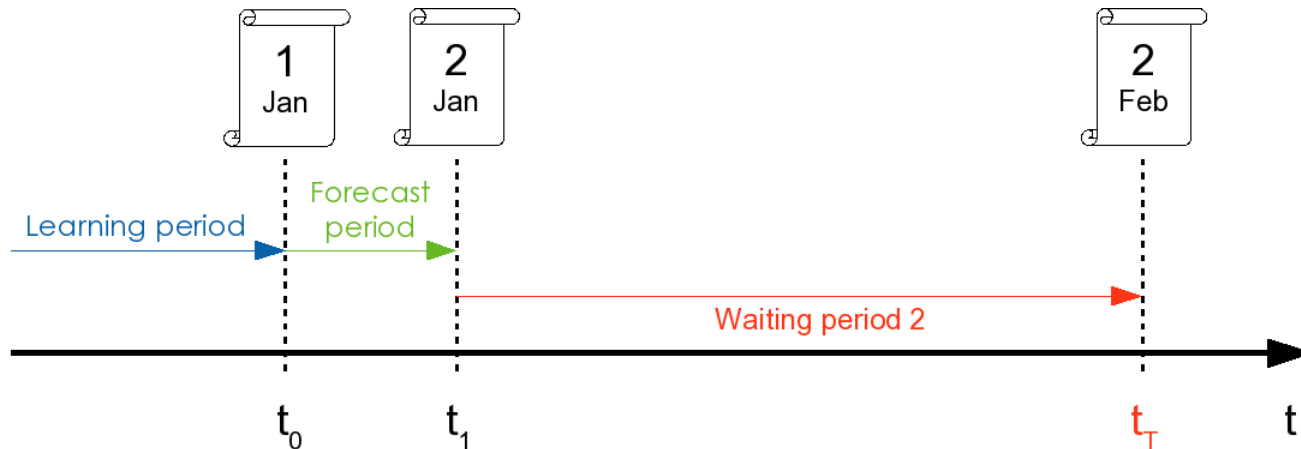
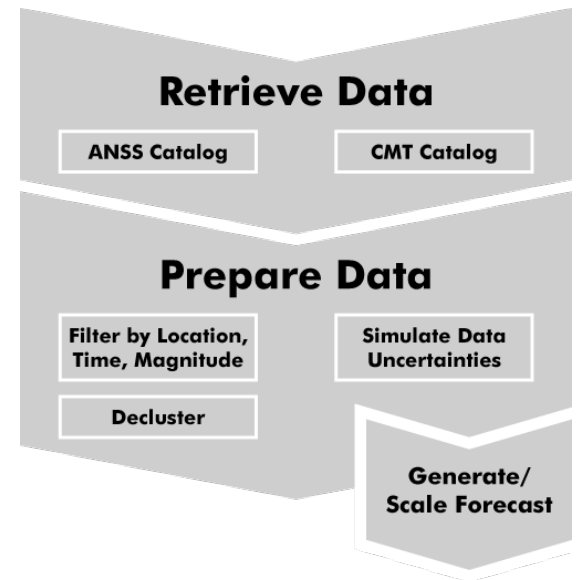
- Retrieve data on a daily basis
- Prepare data sets for  
Forecast model  
Testing



# CSEP Software

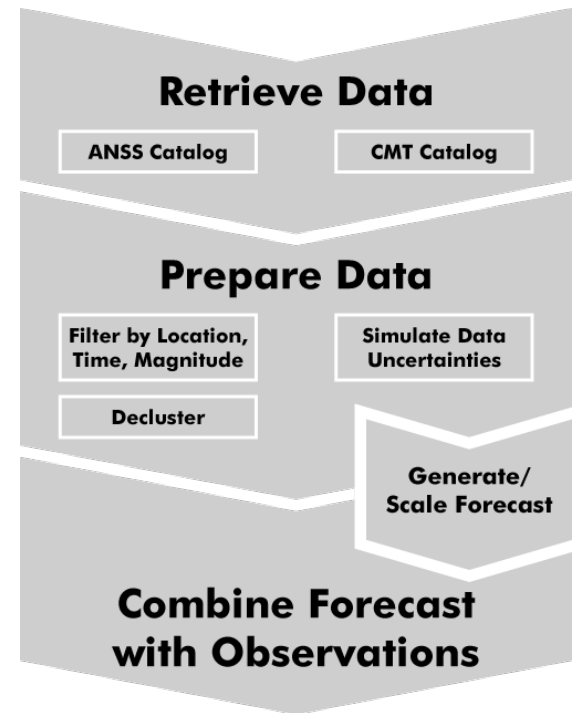
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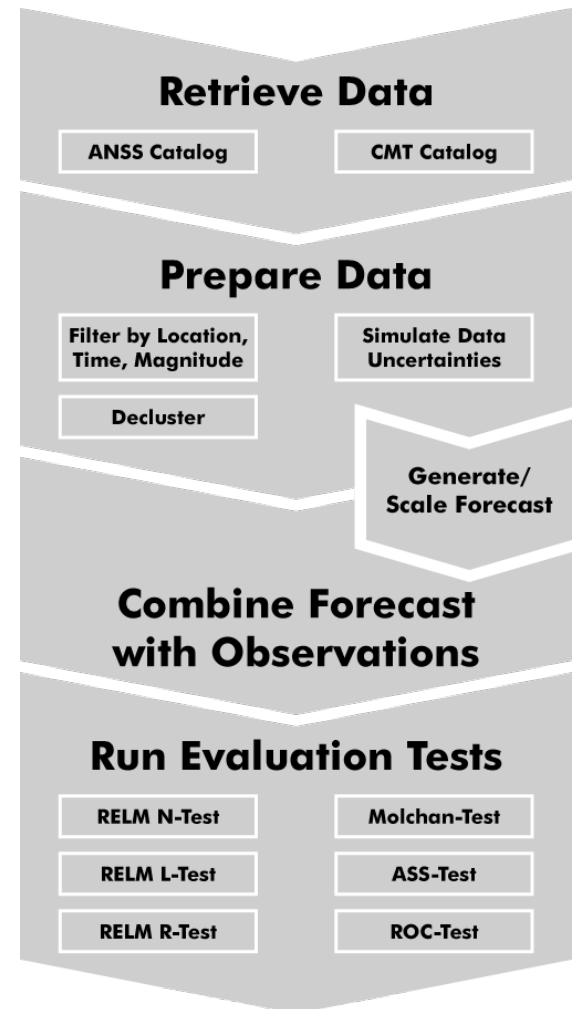
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- Prepare for testing





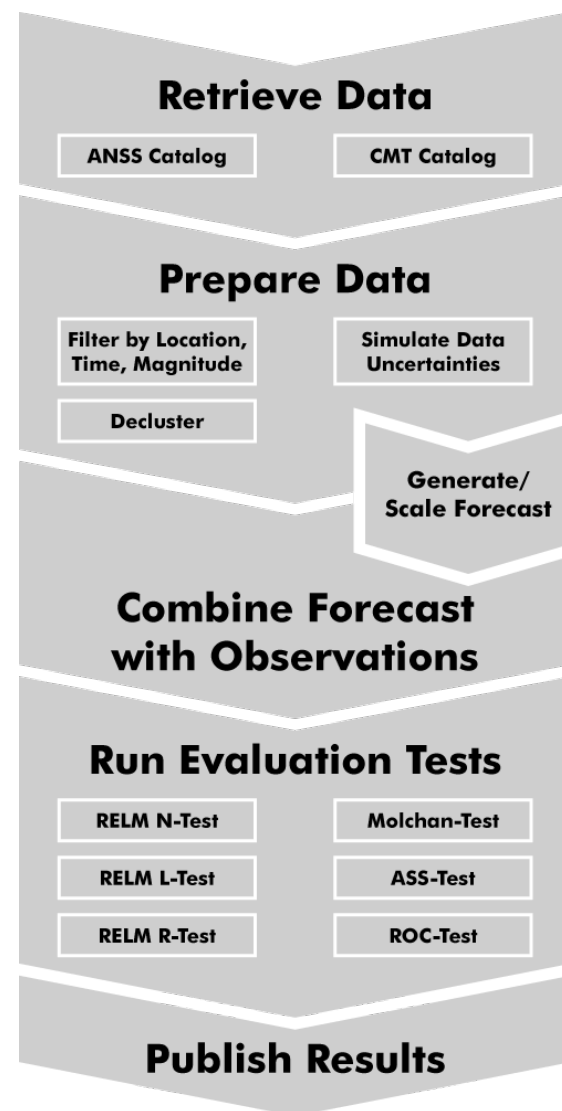
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- Test



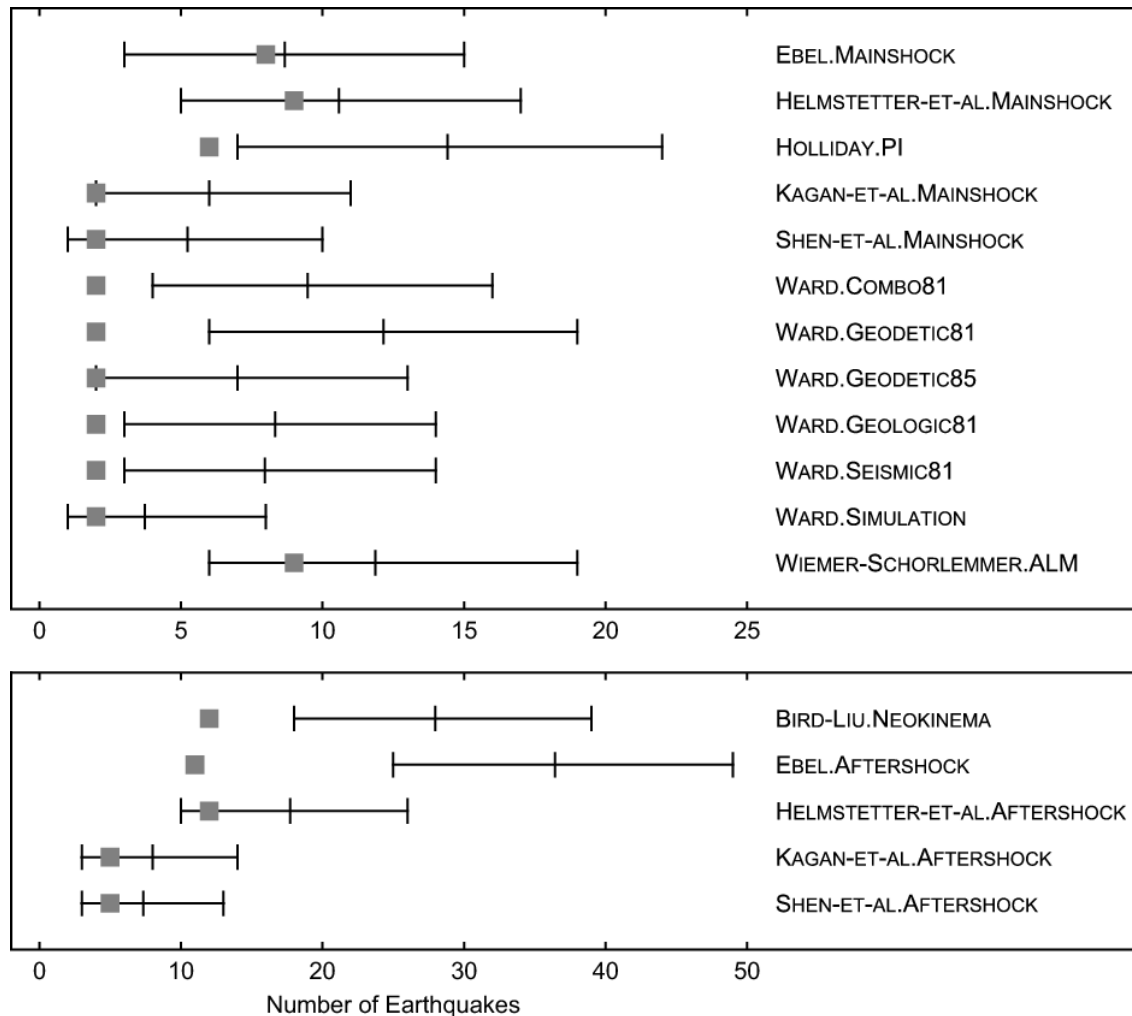
# CSEP Software

- Retrieve data on a daily basis
- Prepare data sets for
  - Forecast model
  - Testing
- Prepare for testing
- Test
- Publish results



# Experiment

## N-Tests for consistency of forecasts with observation



# Experiment

- Web representation

**CSEP**  
Collaboratory for the Study of Earthquake Predictability

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Home » Results » SCEC Testing Center Results

**SCEC Testing Center Results**

california  
RELM-mainshock-models  
wiemer\_schorlemmer.alm  
go

wiemer\_schorlemmer.alm results as of 2009-08-03  
---Test Results--- ---R-Test Comparisons---

**Testing Centers**

- ERI, Japan
- ETH, Switzerland
- GNS, New Zealand
- SCEC, United States

**Testing Regions**

- California
- Japan
- Northwest Pacific
- Southwest Pacific
- New Zealand
- Global

**CSEP Tests**

- The N(umber)-test
- The L(ikelihood)-test
- The likelihood R(atio)-test
- The Molchan-test
- The ASS-test
- The ROC-test

**User login**

Username: \*  
Password: \*  
Log in  
Request new password

Magnitude Rate  $\lambda$   
4 5 6 7 8  
0.03  
0.02  
0.01  
0.00

42°N  
40°N  
38°N  
36°N  
34°N  
32°N  
124°W 122°W 120°W 118°W 116°W 114°W

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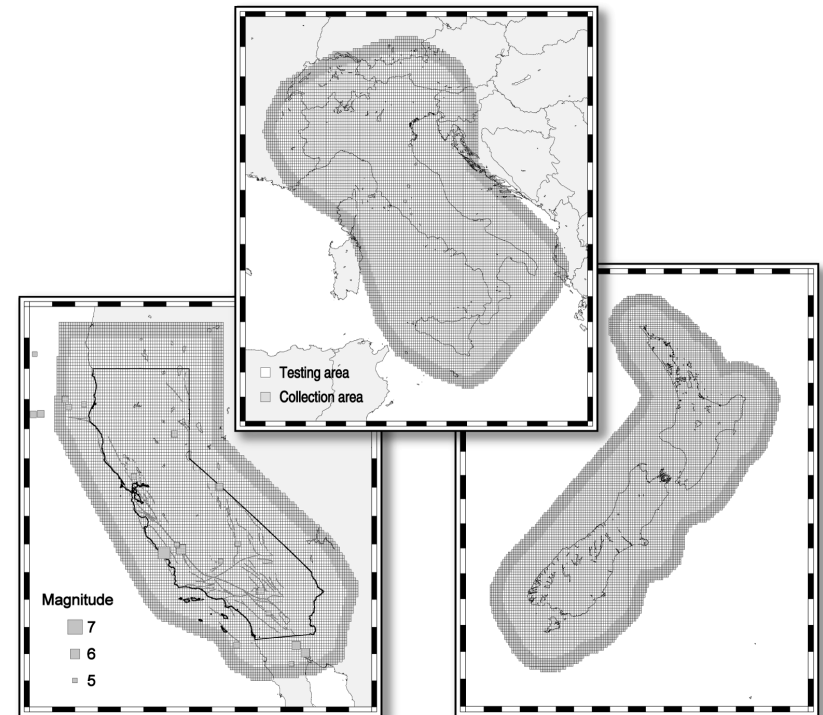
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# Testing Center Challenges

- Multiple Testing Regions
- Modelers not conforming to the experiment rules
- Keeping all testing centers codes up-to-date



# Summary

- CSEP is globally established with 4 testing centers
- CSEP became the “Gold Standard” for earthquake prediction research
  - Full characterization of regions and experiments
  - Standardization of procedures, formats, software, and experiments