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## Abstract


Natural laboratories are a key concept in the Collaboratory for the Study of Earthquake Predictability (CSEP). They define regions in which earthquake generation models are tested and the rules of these tests. Defining natural laboratories require profound knowledge about available data sources, e.g., earthquake catalogs. This includes knowledge about data generation, uncertainties, and derived properties, e.g., completeness of catalogs. CSEP employs working groups for data, test, and model standards to develop guidelines for natural laboratory developments. We present the already implemented natural laboratory of California and the efforts in establishing laboratories in New Zealand, Italy, the Basin & Range region, the Western Pacific region, and for global testing.

**Basin & Range Natural Laboratory**

Data stream  
ANSS catalog?

Area  
Covering many authoritative regions of ANSS

Models  
?

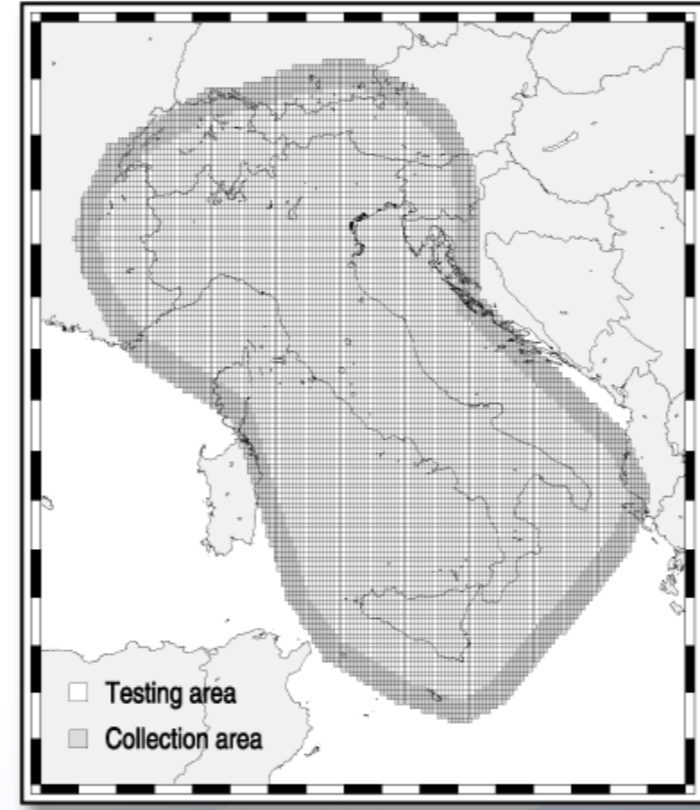
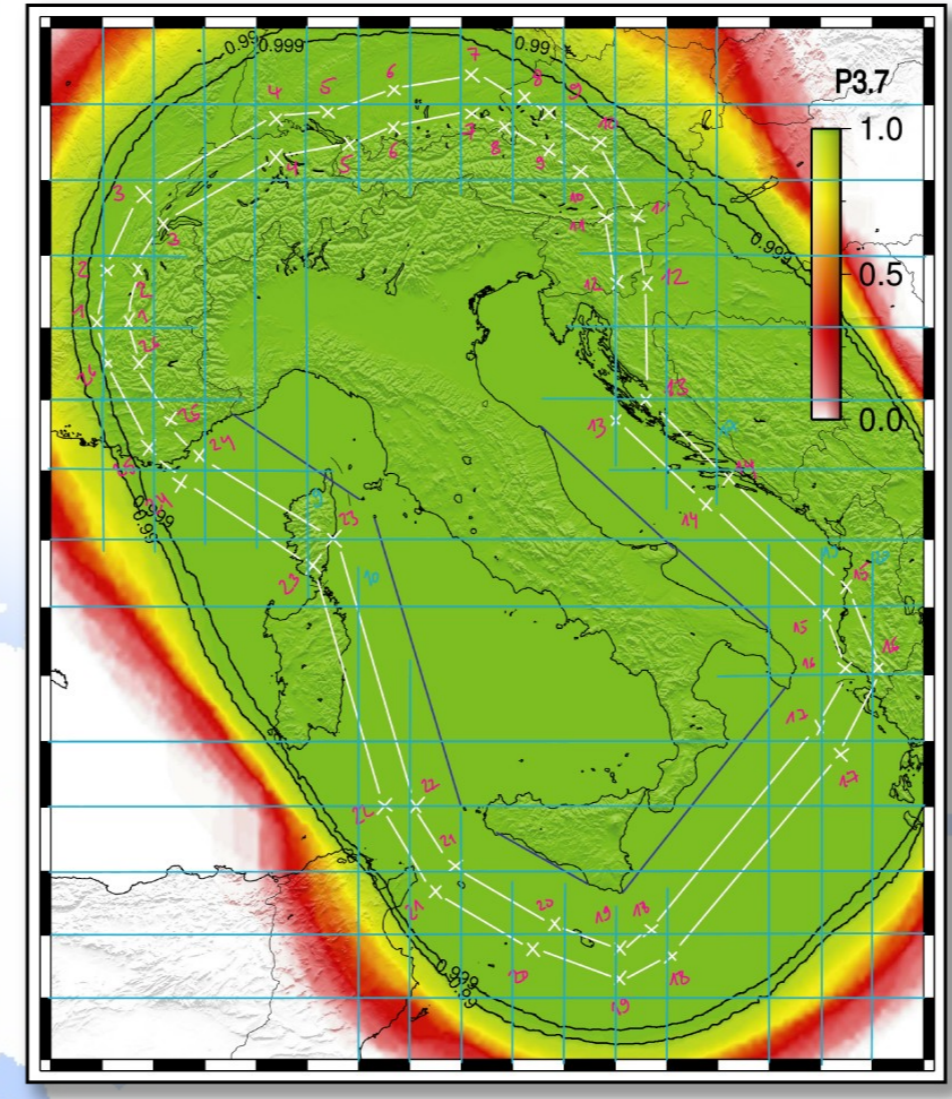


**Italy Natural Laboratory**

Data Stream  
INGV catalog  
Completeness at M=3.7

Area  
Mainland Italy and Sicily

Tests  
RELM Tests (N-, L-, and R-Test)

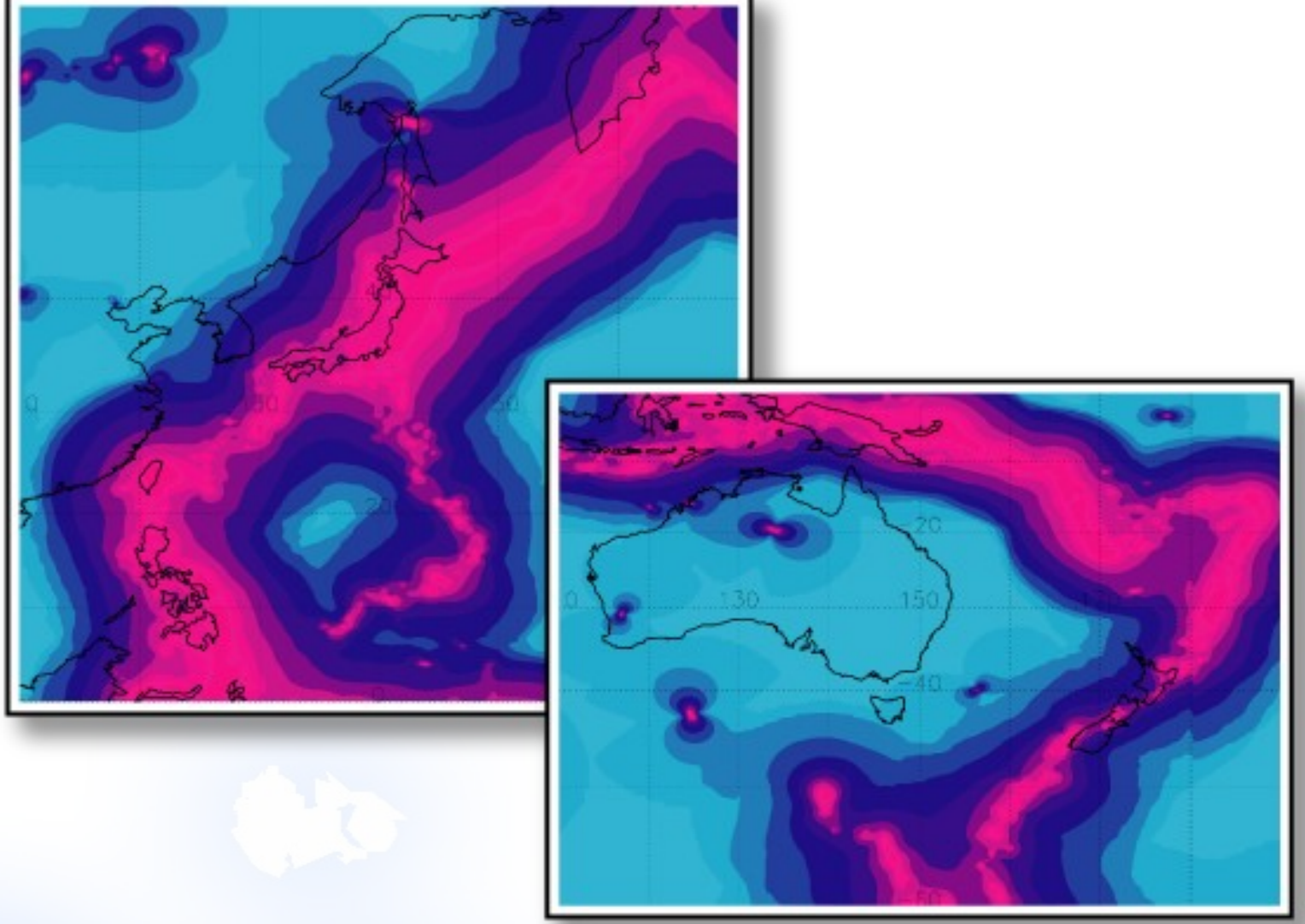
**Western Pacific Natural Laboratory**

Data stream  
Harvard CMT catalog

Area  
NW: 110E-170E/0N-60N  
SW: 110E-170W/60S-0N

Tests  
L-Test

Model  
2 long-term models



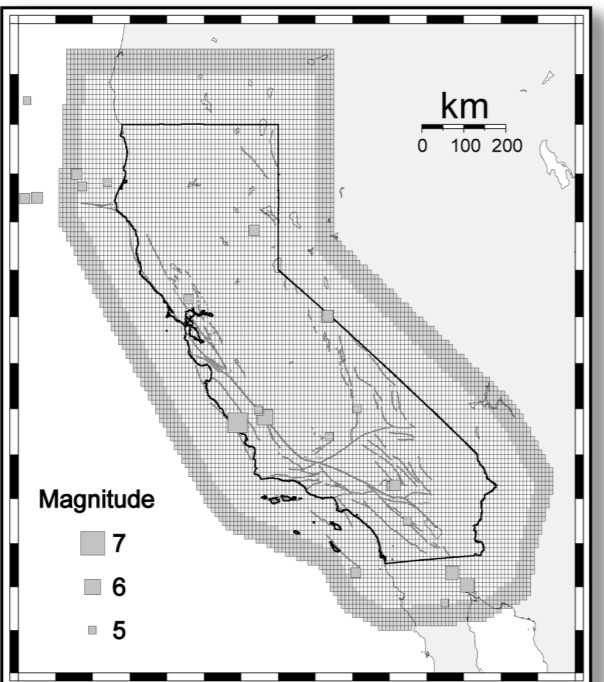
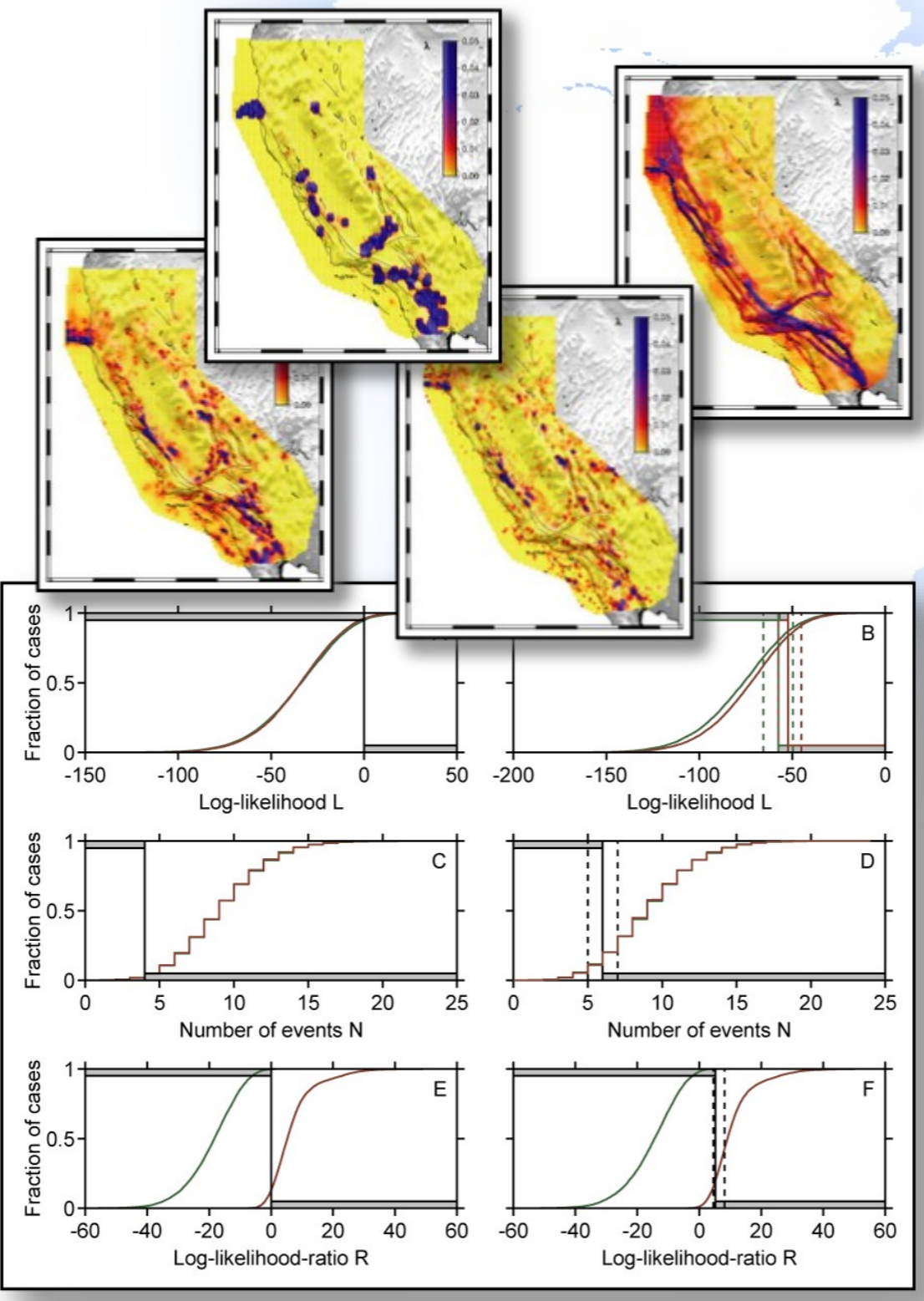
**California Natural Laboratory**

Data stream  
ANSS catalog including location parameter uncertainties  
Assumed overall completeness at M=3.7  
Declustering (Reasenberg including parameter uncertainties)

Area  
Testing area = California + 1deg (0-30km)  
Collection area = Testing area + 0.5deg

Tests  
RELM Tests (N-, L-, and R-Test)

Models  
19 long-term (5-year) models  
2 short-term (1-day) models

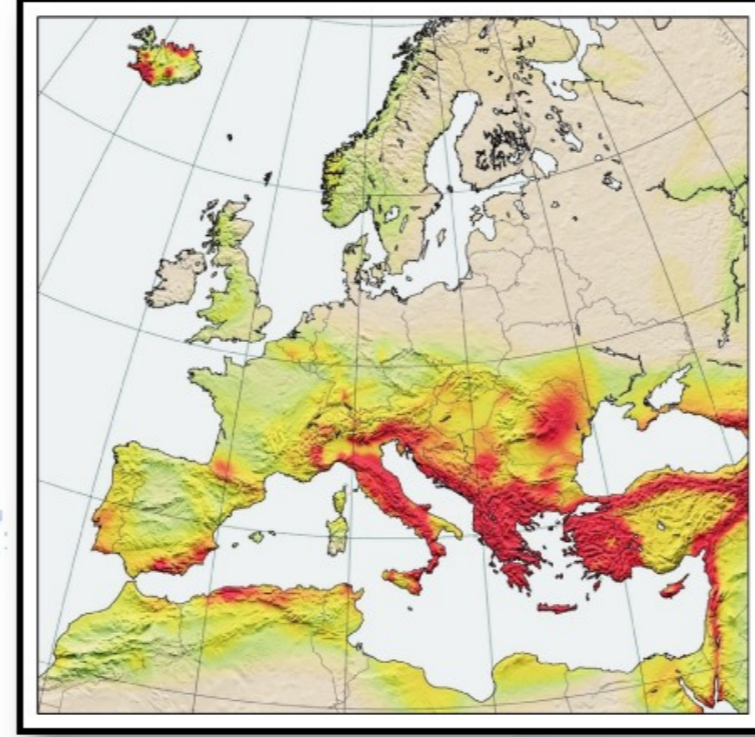



**Euro-Med Natural Laboratory**

Data stream  
EMSC catalog?

Area  
All of Europe/Mediterranean region

Models  
1 long-term (SESAME)




**New Zealand Natural Laboratory**

Data stream  
Catalog including location parameter uncertainties  
Assumed overall completeness at M=4  
Declustering (same method as used in national hazard assessment)

Area  
Testing area = New Zealand + 100km  
Depth = 0-40km

Tests  
RELM Tests (N-, L-, and R-Test)  
New tests under development

Models  
4 5-year models, 4 3-month models, and 4 1-day models



Zürich  
Roma

## Summary

These examples indicate a few of the interesting challenges of defining a natural laboratory:

- Identifying the appropriate earthquake catalog(s)
- Working with regions containing multiple "authoritative sources" (e.g., California)
- Working with regions where no authoritative source has been identified (e.g., Basin and Range)
- Testing forecasts that transcend geographical boundaries (e.g., Italy)
- Working in regions with subduction zones (e.g., New Zealand)

All of these issues arise from the simplest form of observation: seismicity catalogs. As CSEP extends the experiment space to include other data such as GPS or fault models, careful consideration should be given to the process of defining the natural laboratories.

Los Angeles

Wellington