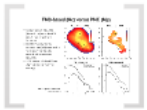
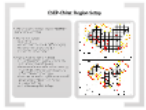
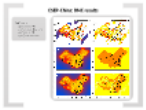
Introduction

Bonus Slides

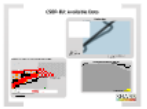


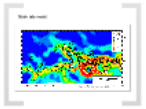
CSEP China

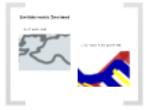


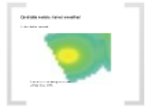


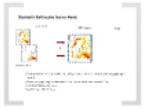
CSEP Mediterran (Europe) & Share

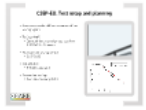




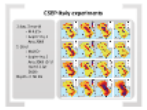








CSEP Italy



Activities at the CSEP-EU testing center at ETH Zurich

Presenter: David Eberhard

Contributions by:

Arnaud Mignan
Stefan Wiemer
Jochen Wössner
Jeremy Zechar

CSEP Europe on the Web

Out-of-date

Current Projects

- EU-Mediterranean
- Italy
- China
- West Pacific
- Iceland

CSEP-EU: Goals of EU-Mediterranean wide testing

- Evaluation of EU-Mediterranean wide long-term earthquake rate models that are part of the SHARE hazard model
    - Test the PSHA combined source model and single branches with CSEP-type rate testing algorithms
    - First time testing on regional scale PSHA program
- Set the test-bed for continued prospective testing
- Enhance testing algorithms to
    - Area Source-type models
- Work performed in coordination with GEM-Testing group at GFZ

SHARE

What CSEP does (so far) - and what PSHA interests...

CSEP targets

- Prospective / Retrospective earthquake rate testing
  - In seismically active regions
- Hypothesis testing in intraplate regions
  - "Recent seismicity is not a good predictor" (S. Stein)

PSHA interests

- T&E procedures for
  - Zonation models
  - Seismicity on faults
- T&E procedures for
  - Fault models
- T&E procedures for Strain Rate Models
- T&E procedures for
  - Ground Motion Prediction Equations
  - Site-Amplification Factors
  - Intensity fields

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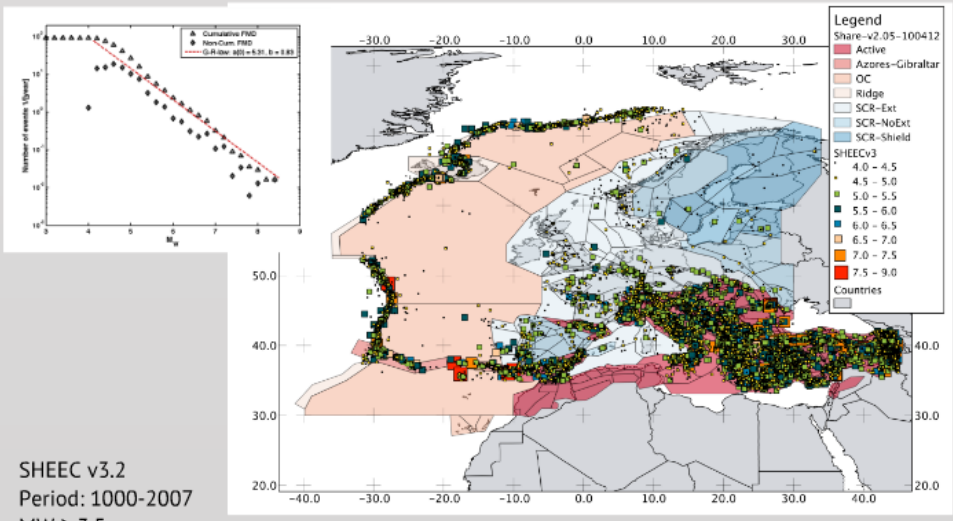
CSEP-EU: Available Data

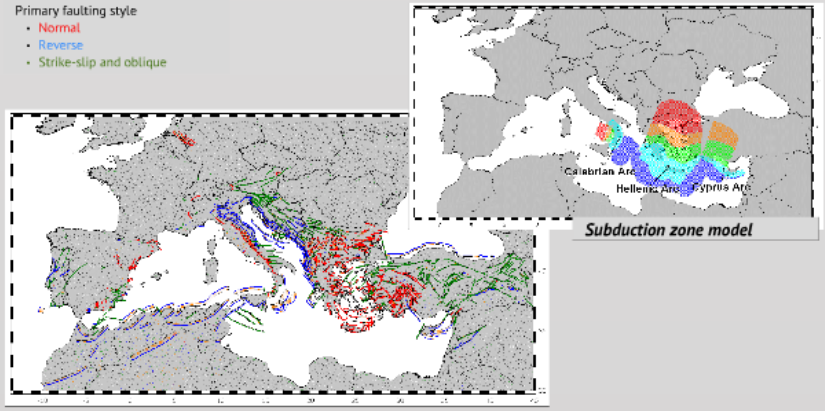
Catalog data



SHEEC v3.2
Period: 1000-2007
MW ≥ 3.5

Headed by M. Stucchi (INGV) and G. Grünthal (GFZ)

Fault Sources: Homogeneously parameterized for PSHA



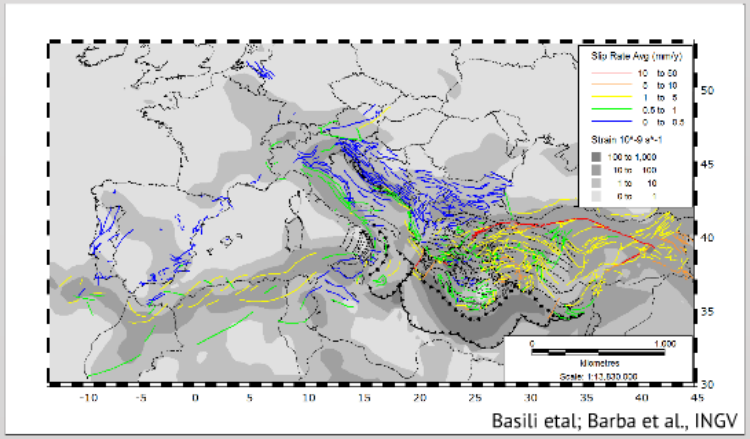
Project start - June 2009:
- 98 data records,
- ~8500 km of faults

(Basili et al., 2008, Tectonophysics)

Today:
- 1128 data records
- ~64000 km of faults

Access at http://diss.rm.ingv.it/diss/
Courtesy of R. Basili / G. Valensise

Fault parameterization: Slip rate



Basili etal; Barba et al., INGV

SHARE

Available Data

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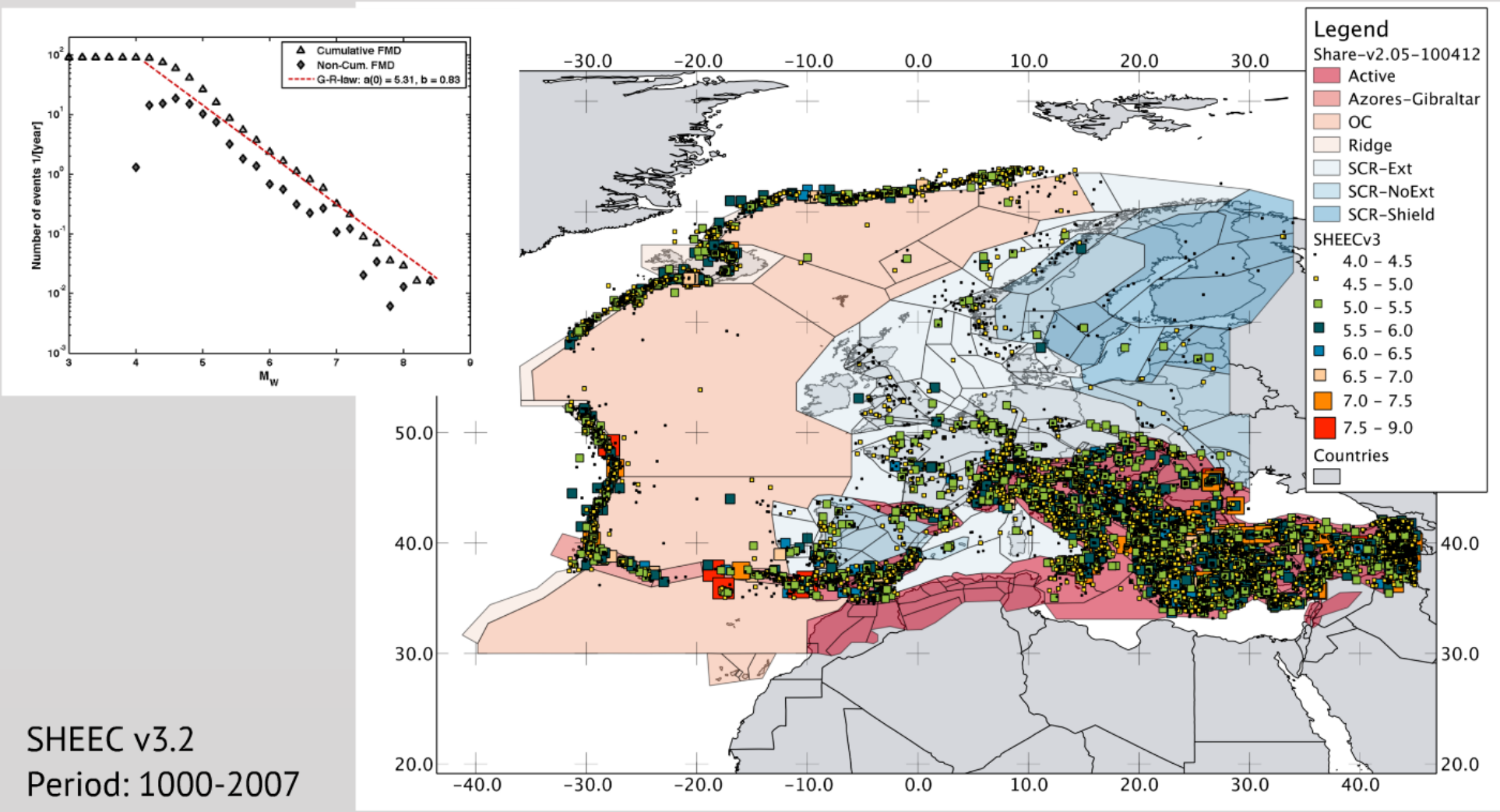


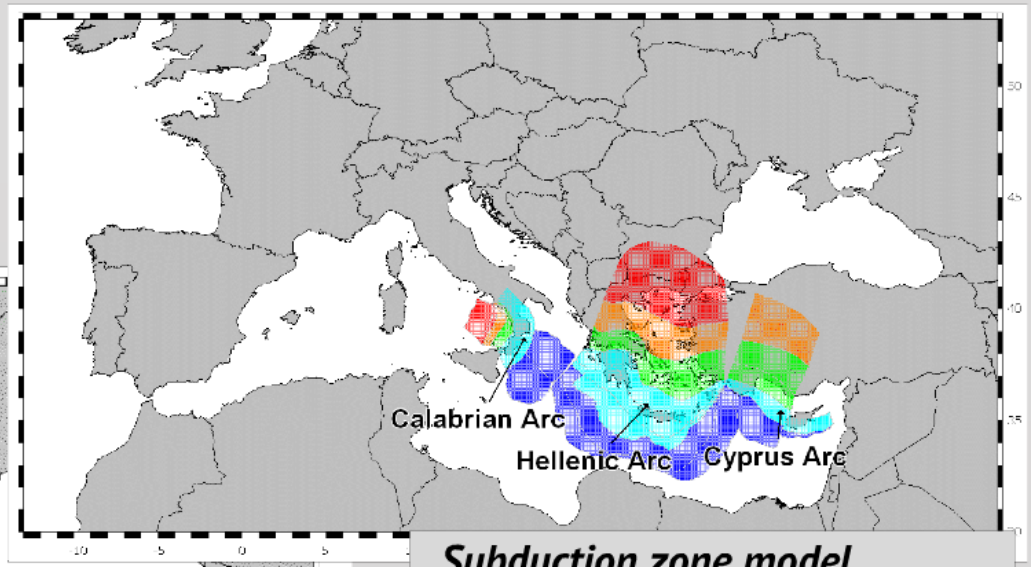
SHEEC v3.2
Period: 1000-2007
MW ⩾ 3.5

Headed by M. Stucchi (INGV) and G. Grünthal (GFZ)

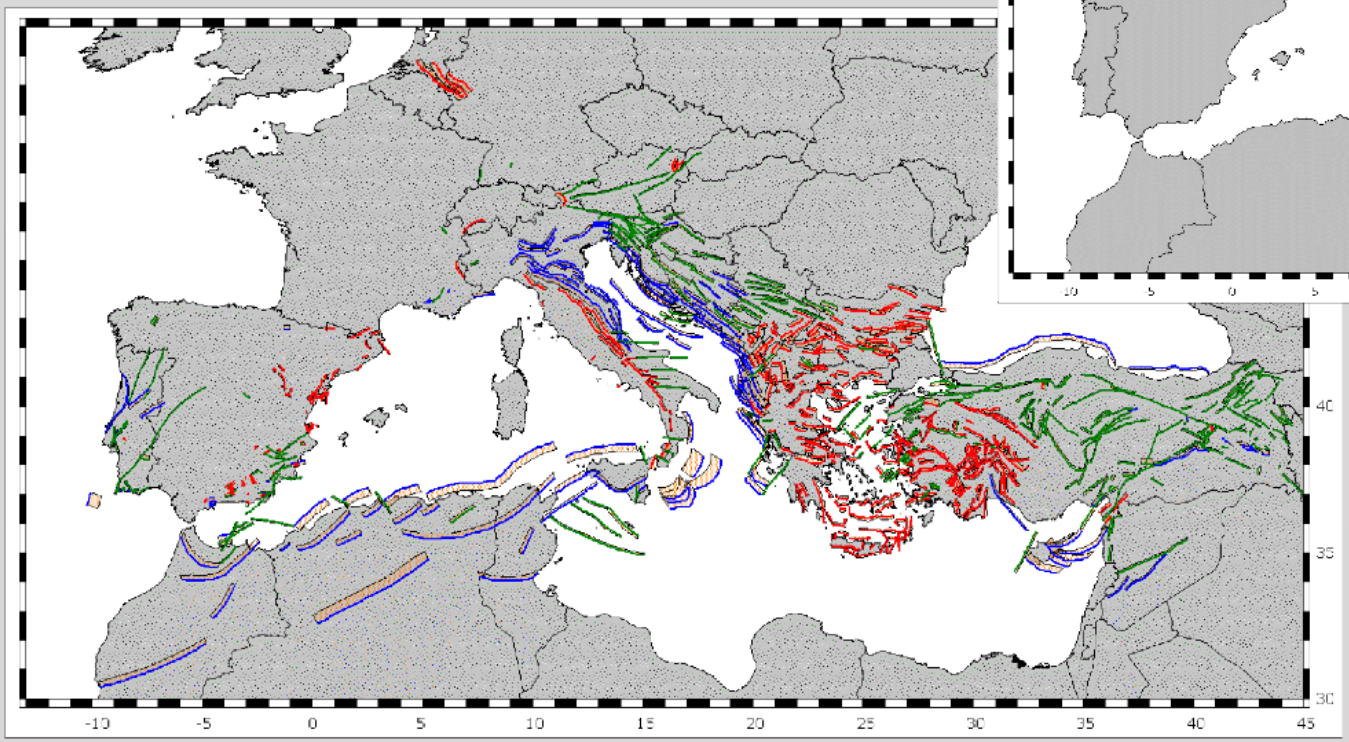
Fault parameterization: Slip rate

Fault Sources: Homogeneously parameterized for PSHA

Primary faulting style
- Normal
- Reverse
- Strike-slip and oblique



Subduction zone model



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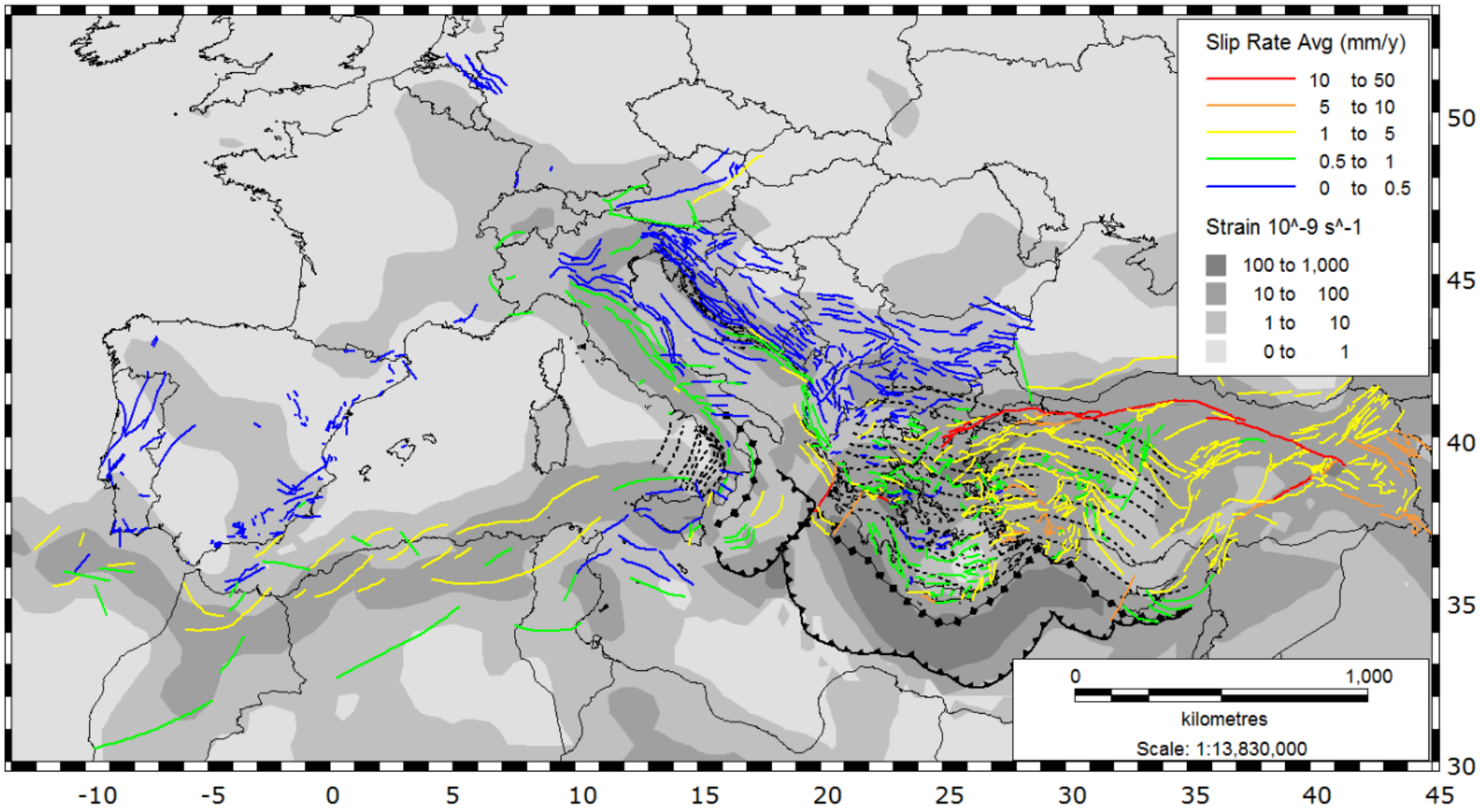
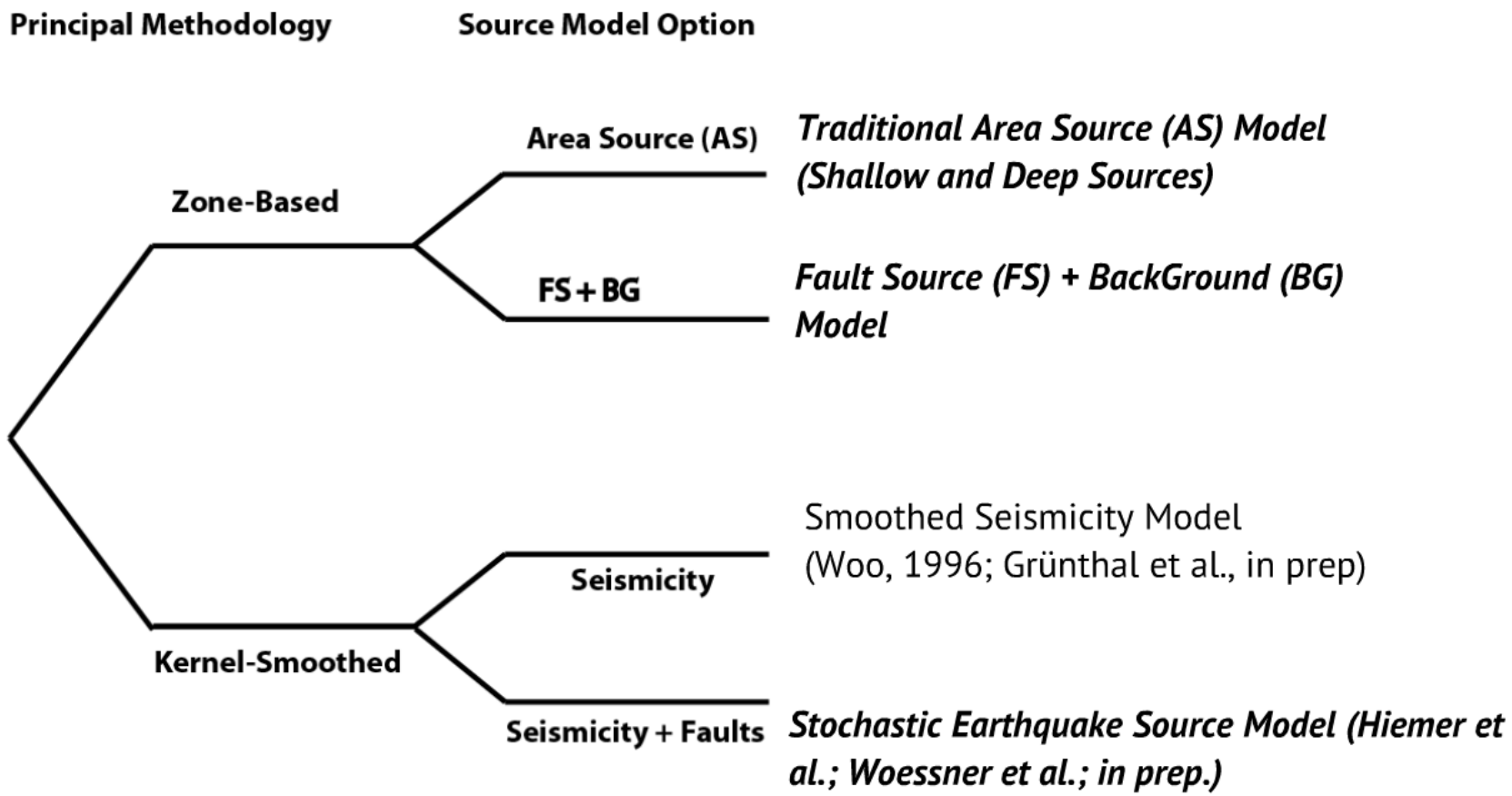


Basili etal; Barba et al., INGV

CSEP-EU: Building the SHARE Source Model: Rate Testing



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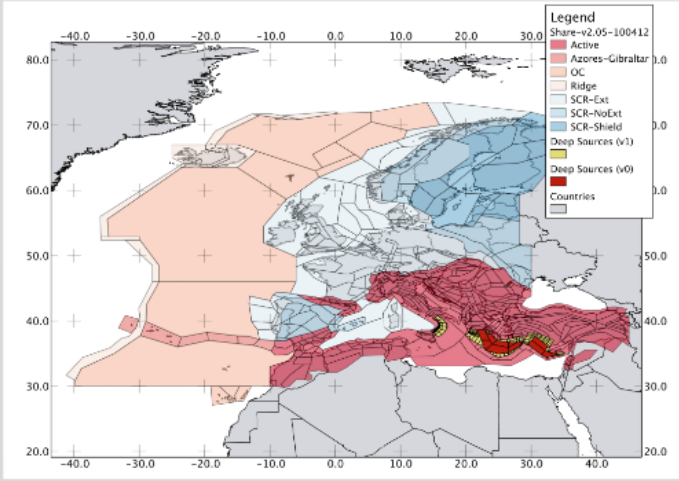
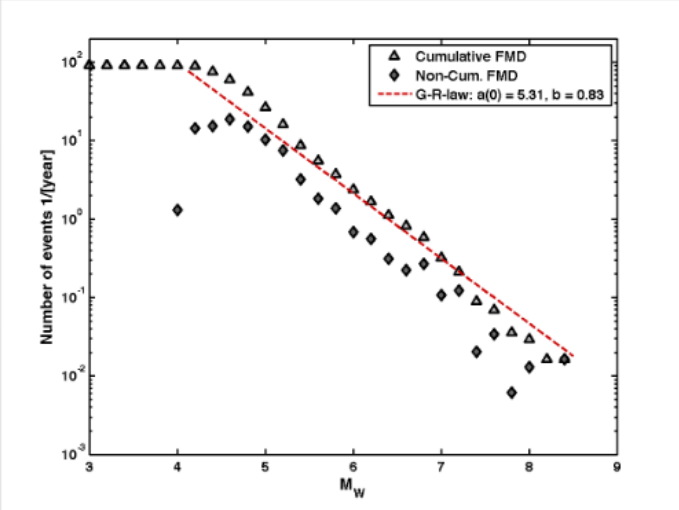
CSEP-EU: Test setup and planning

- Area source model defines the extent of the testing region
- Testing Mw≥5
  - Expected declustered annual rate from SHEEv3.2: ~30 events
- Retrospective testing period
  - 2007-2012
- End of 2012:
  - 8 Models available
- Prospective testing:
  - Start possible early 2013





CSEP-EU: Test Region Challenges and Summary

- Test catalog:
  - SHEEC is a compilation
  - No unified authorative Mw catalog available, possibilties to test against:
    - CMT / NEIC / EMSC needs magnitude conversion
    - Location accuracy
    - Evaluation needed in retrospective testing phase

- Funding within EU-projects is very limited
  - Testing planned in at EU-Testing center at ETH
  - Testing coordinated with GEM Testing group in Potsdam

- Only long-term main shock testing planned within EU-Med. Testing regions

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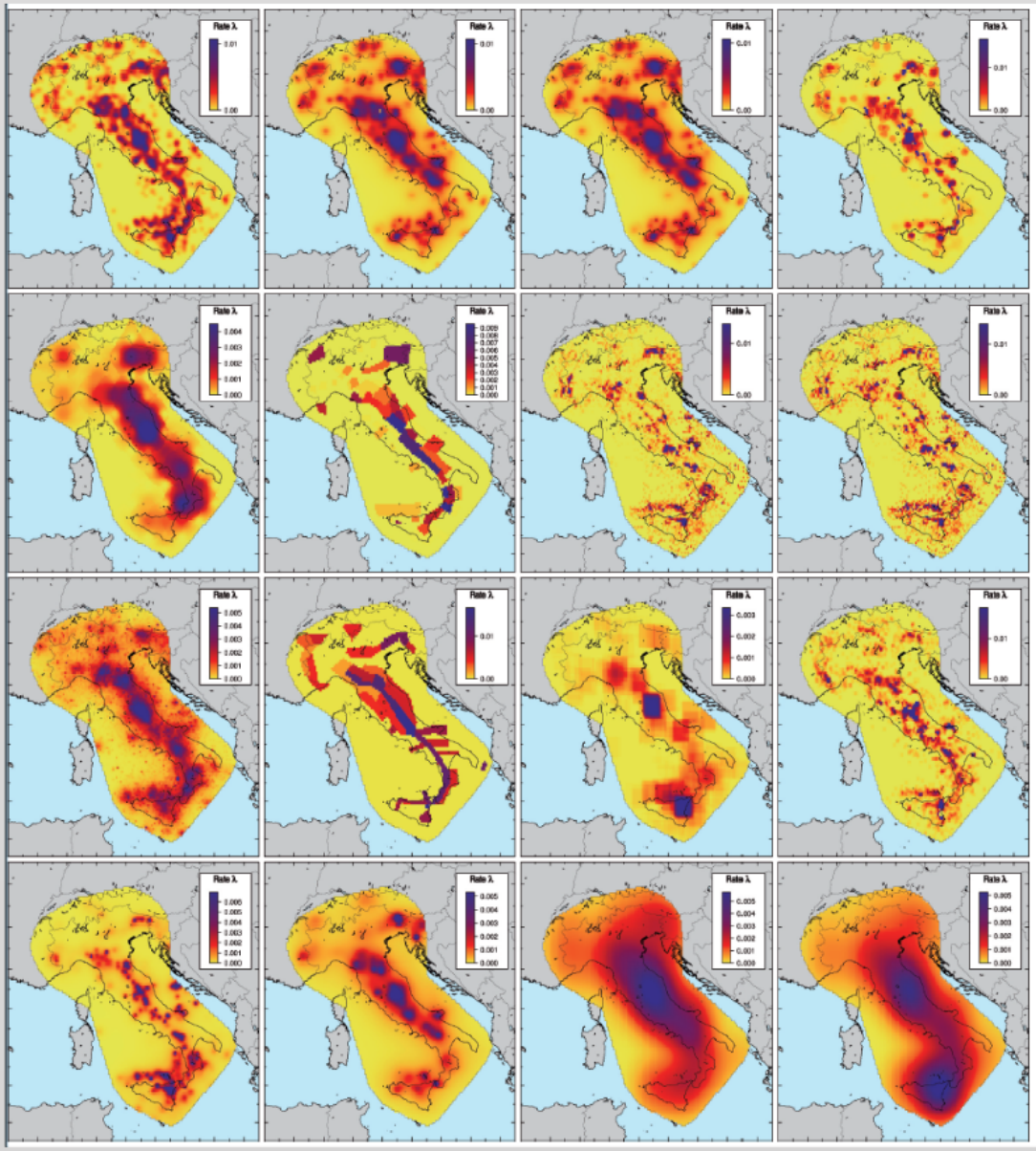
CSEP-Italy experiments

1 day, 3 month
- M 4.95+
- beginning 1 Aug 2009

5/10 yr
- M4.95+
- beginning 1 Aug 2009 (2nd round 1 Jan 2010)

Depth <= 30 km



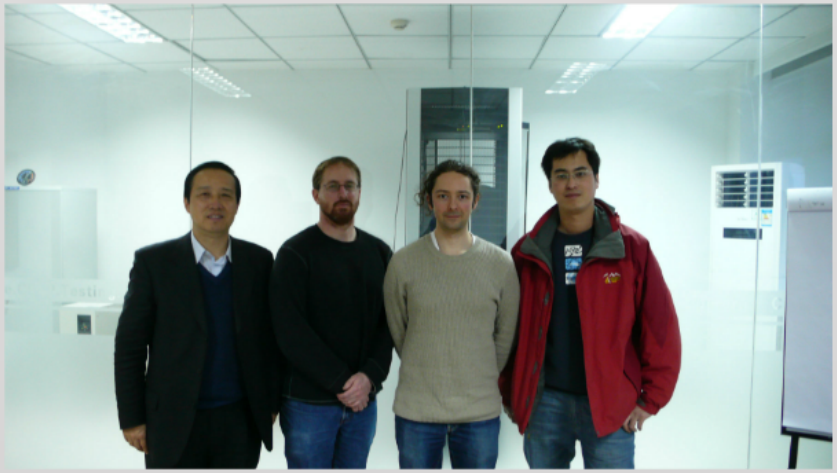
Status of CSEP-Italy experiments

- Due to “resource stretch,” experiments are not yet running in testing center, to begin this summer
- Official catalog only available up to 15 September 2011
- Through that date, 26 M3.95+ events, 0 M4.95+
- Through today, roughly ~90 M3.95+, 7 M4.95+, more likely

CSEP-Italy reminder

- 11 models for 5/10 yr experiment (16 static forecasts)
- 3 models for 1 day, 3 models for 3 month experiments (5 codes)
- Special issue of Annals of Geophysics (analogous to RELM special issue of Seismological Research Letters)
  - Details on completeness assessment
  - Details on models
  - Retrospective evaluation of time-invariant forecasts (Werner et al. 2010)

CSEP-China



- Testing center hardware and CSEP software version 11.1 operational--noactive experiment
- 2010-2012 project funded by the Sino Swiss Science & Technology Cooperation Program
- Principal Investigators:
  - ETH: A. Mignan, J. D. Zechar, S. Wiemer
  - CEA: C. Jiang, Z. Wu
- Collaborative visits in February and October 2011
- Setup of the CSEP-China collection and testing regions based on Mc analysis
- Paper by Mignan et al. in revision at BSSA

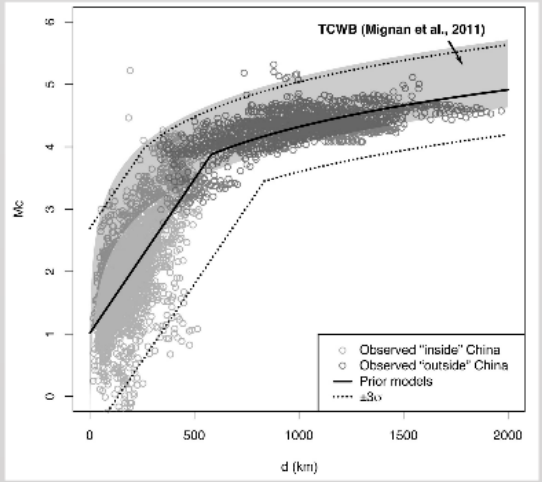
CSEP-China: BMC

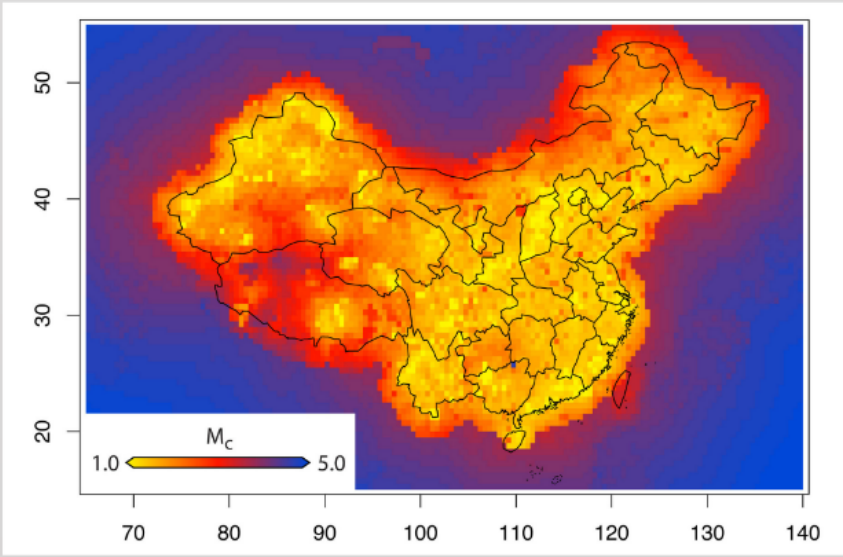
Bayesian Magnitude of Completeness (BMC) method (Mignan et al., BSSA2011)

- Avoids shortcomings of previous FMD-based mapping methods: (1) no gap in space, (2) no arbitrary definition of the Mc spatial resolution
- Still FMD-based (in contrast with PMC), thus consistent with subsequent forecast models based on the validity of the GR law
- Application to Mainland China using the China Earthquake Network Center (CENC) catalog

BMC method

- Prior model based on relationship between Mc and distance d to 4th seismic station (~density of seismic stations)
- Bayes' Theorem to combine prior Mc and observed Mc
- BMC map = Posterior Mc map (+ uncertainty map)





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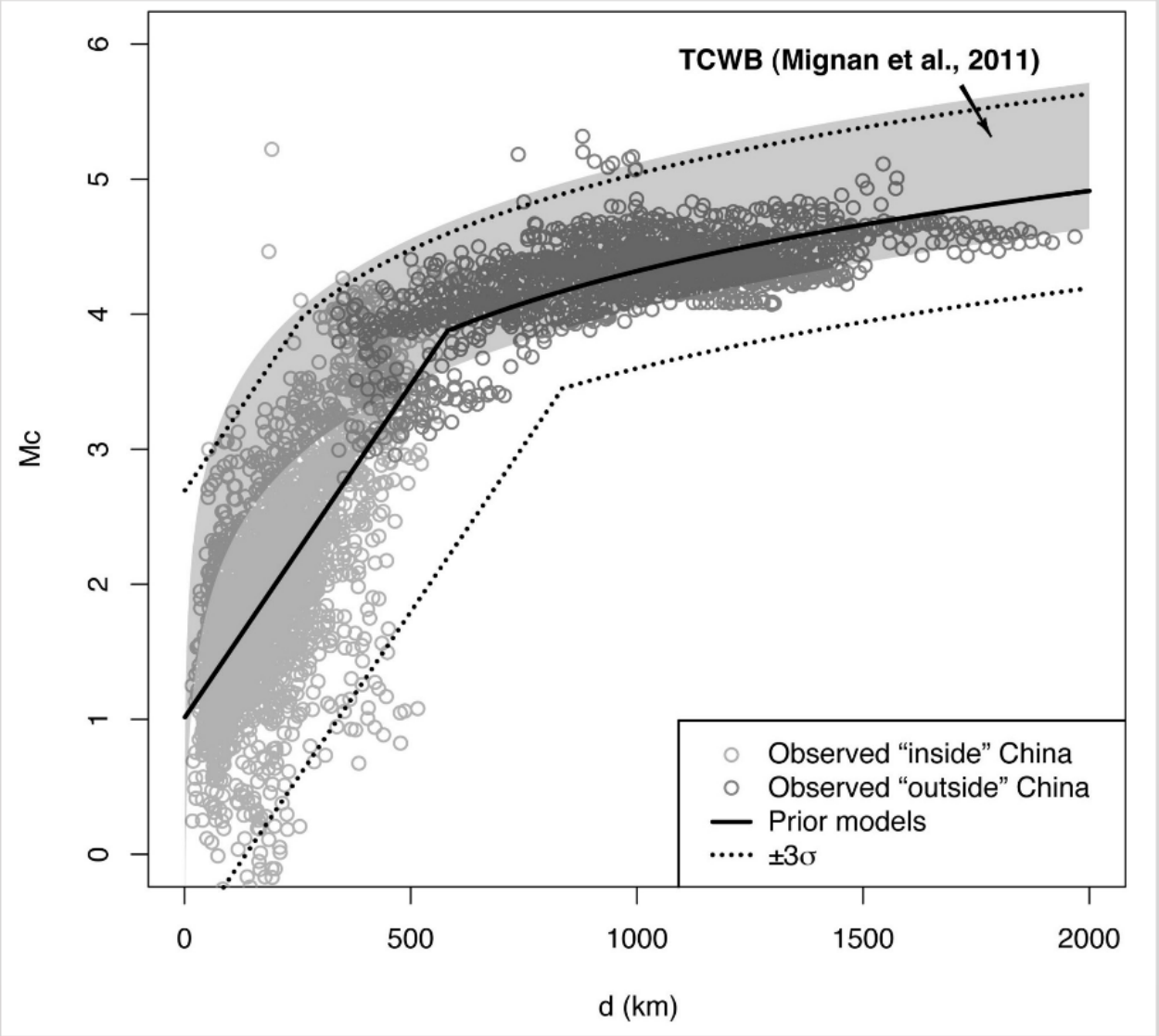
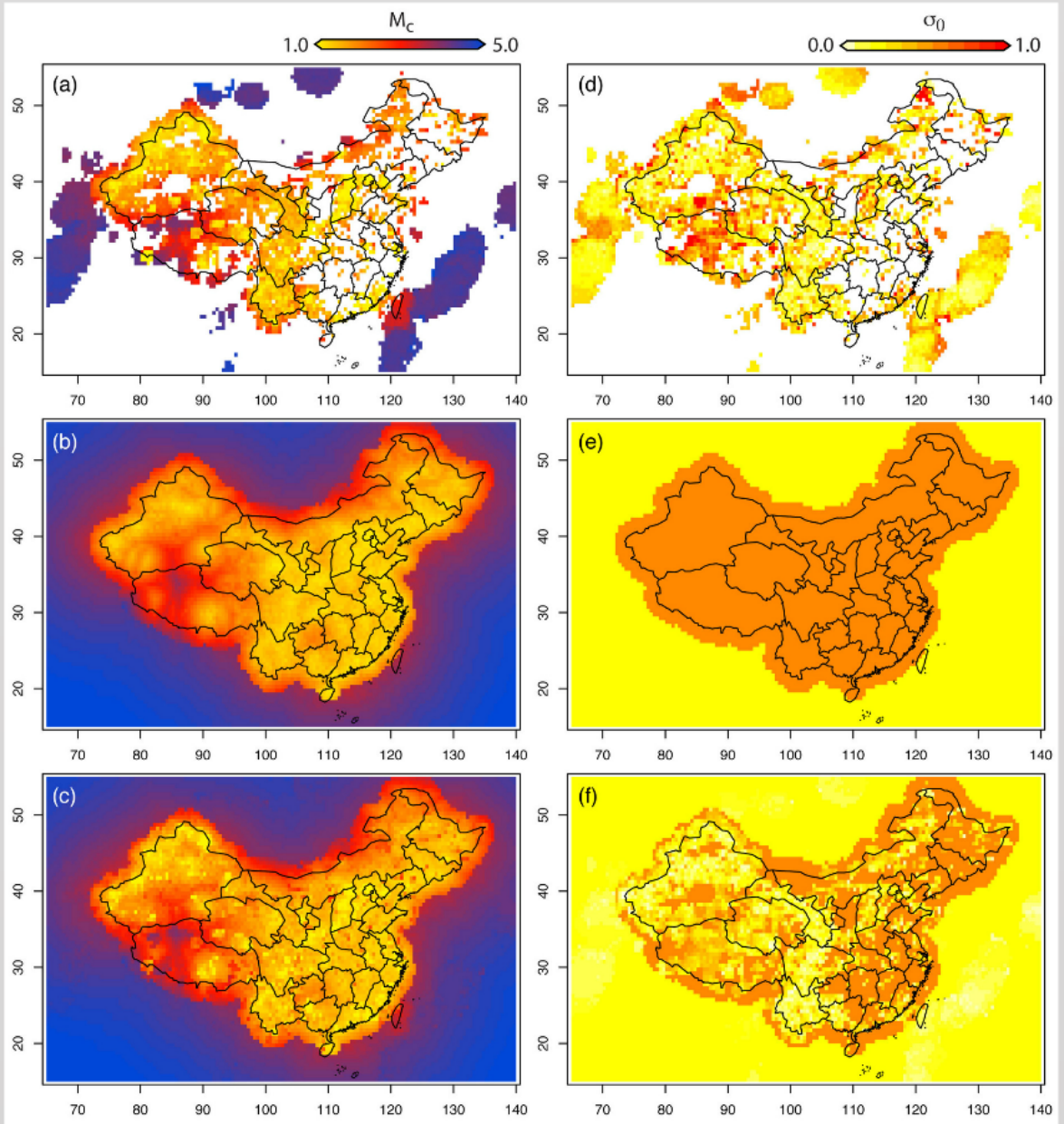
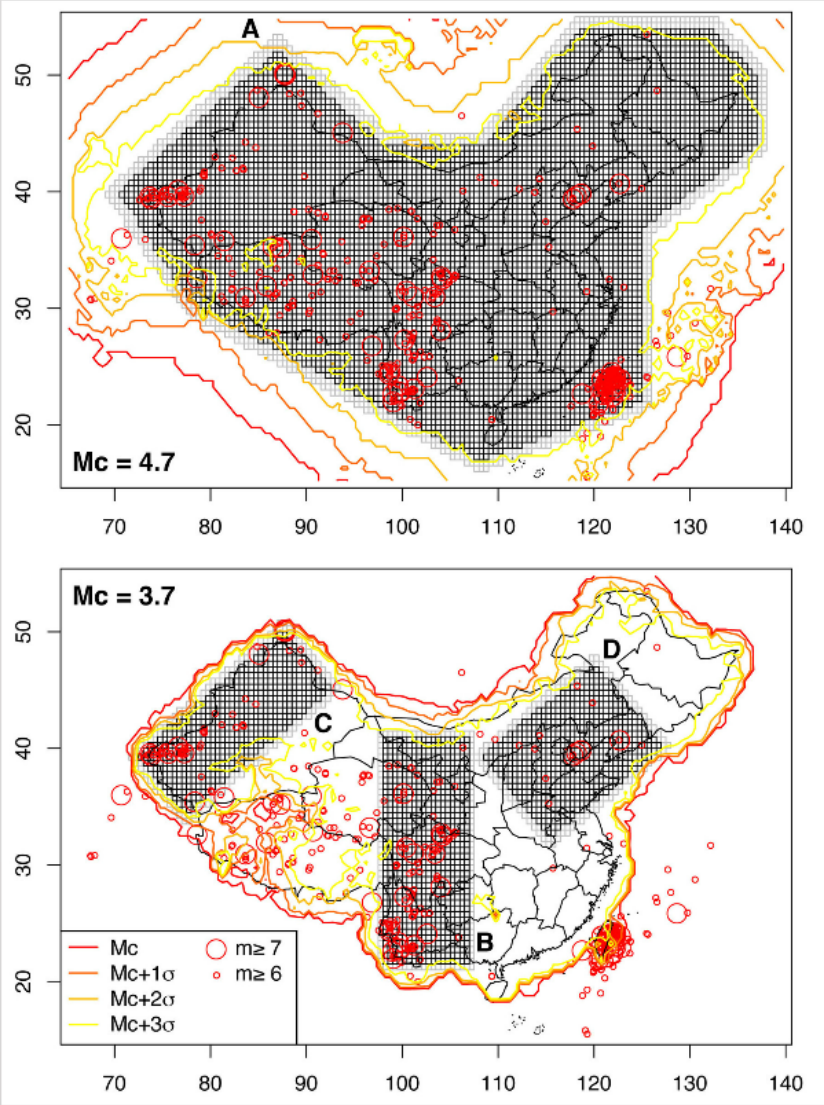


CSEP-China: BMC results

- BMC results:
  - (a) Observed Mc
  - (b) Predicted Mc (prior)
  - (c) Posterior Mc
  - (d,e,f) standard dev.



CSEP-China: Region Setup

- Different regions proposed based on Mc(BMC)+n (conservative estimates)
- Potential testing areas:
  - A: All China
  - B: North-South Seismic Belt (official region)
  - C: Northern Xinjiang Seismic Belt
  - D: North China Seismic Belt
- Ongoing / Next steps (at ETH & CEA):
  - TripleS forecast with negative binomial rate distribution (instead of Poisson)
  - Retrospective analysis of seismicity preceding the 2008 Mw=7.9 Sichuan earthquake using different forecasting techniques
  - Strain rate map combining GPS and seismicity? (ongoing work in Western US, method applicable to China)
  - + STEP forecast (at GNS & CEA)