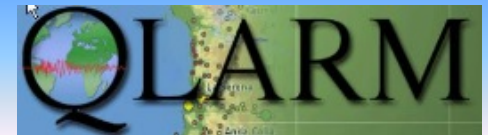# QLARM GROUP

Max Wyss
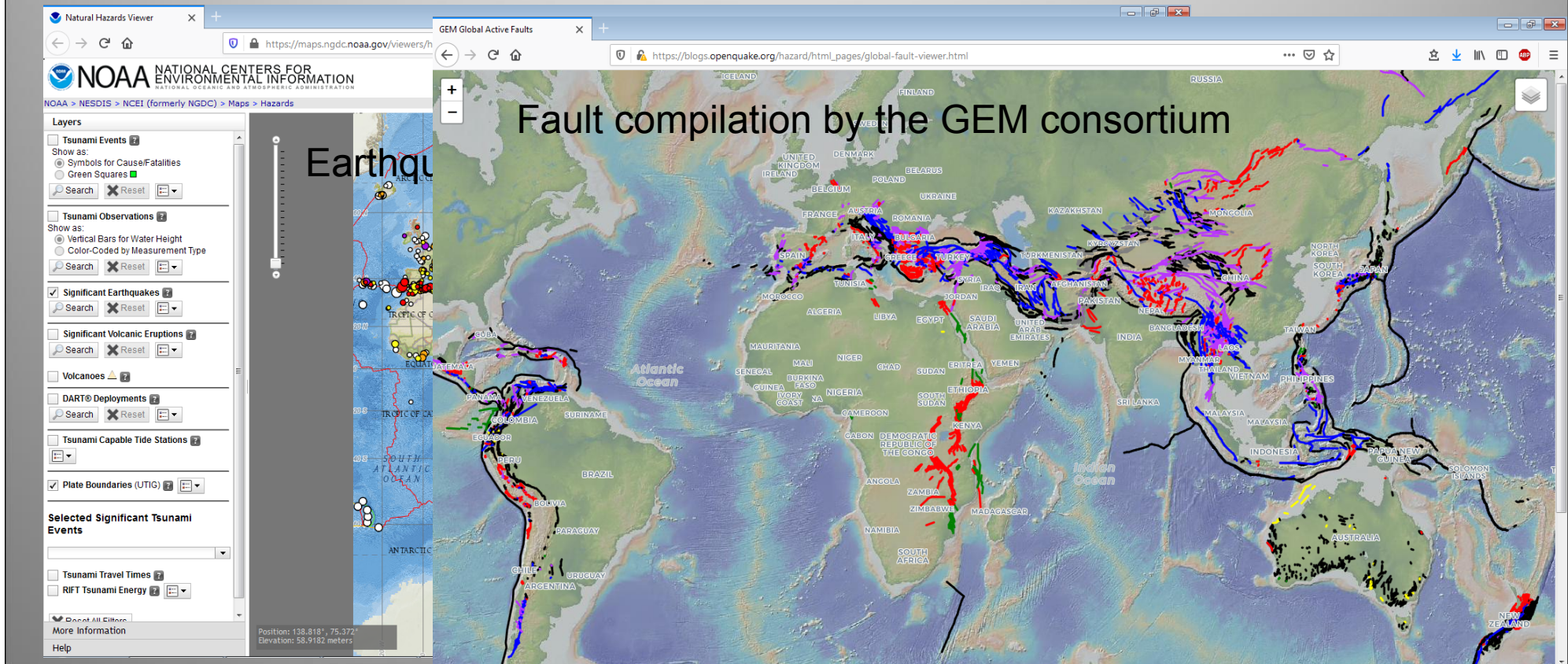Philippe Rosset
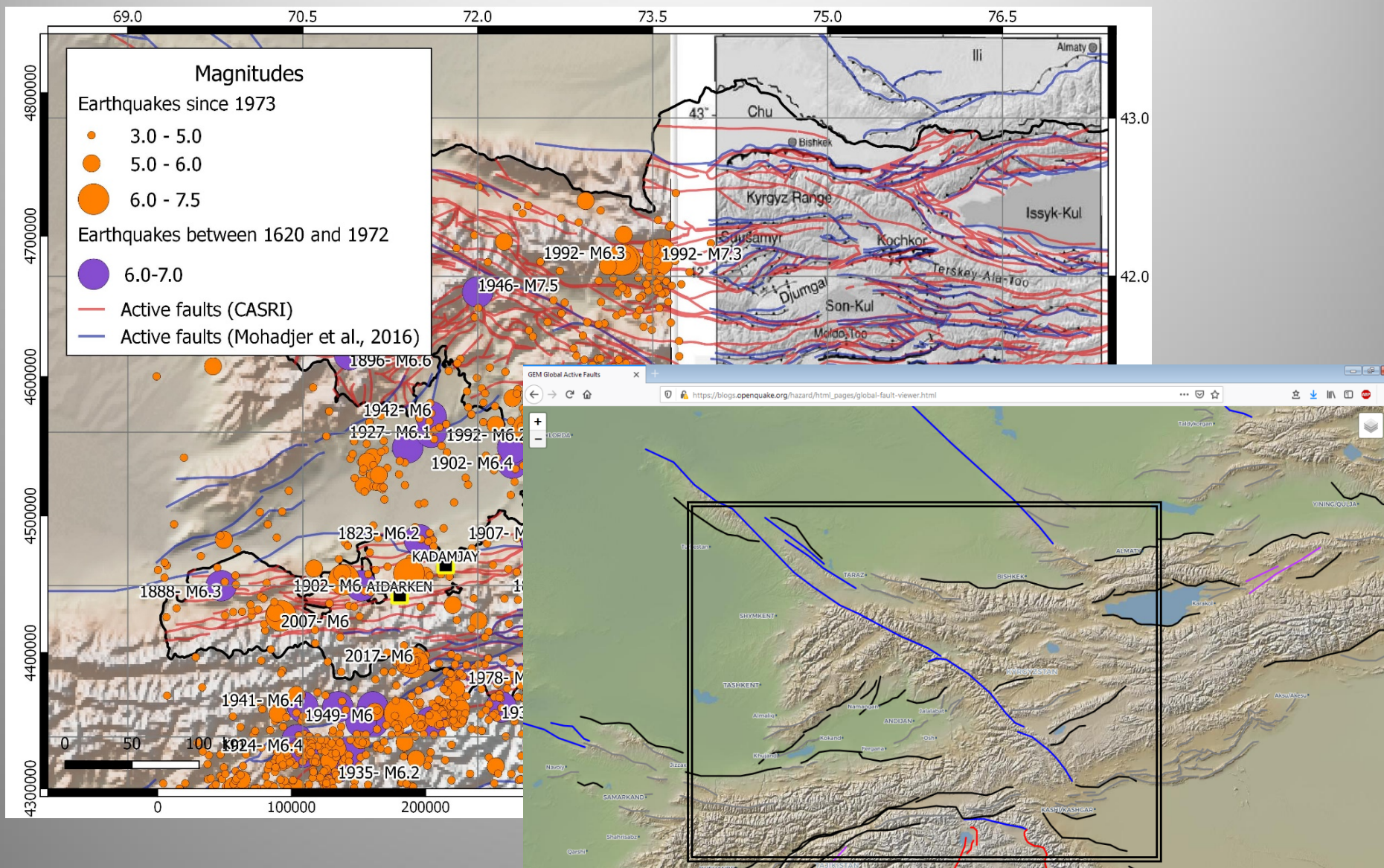Stavros Tolis
Michel Speiser

# Earthquake scenarios

Philippe Rosset

# Data we need to define earthquake scenarios

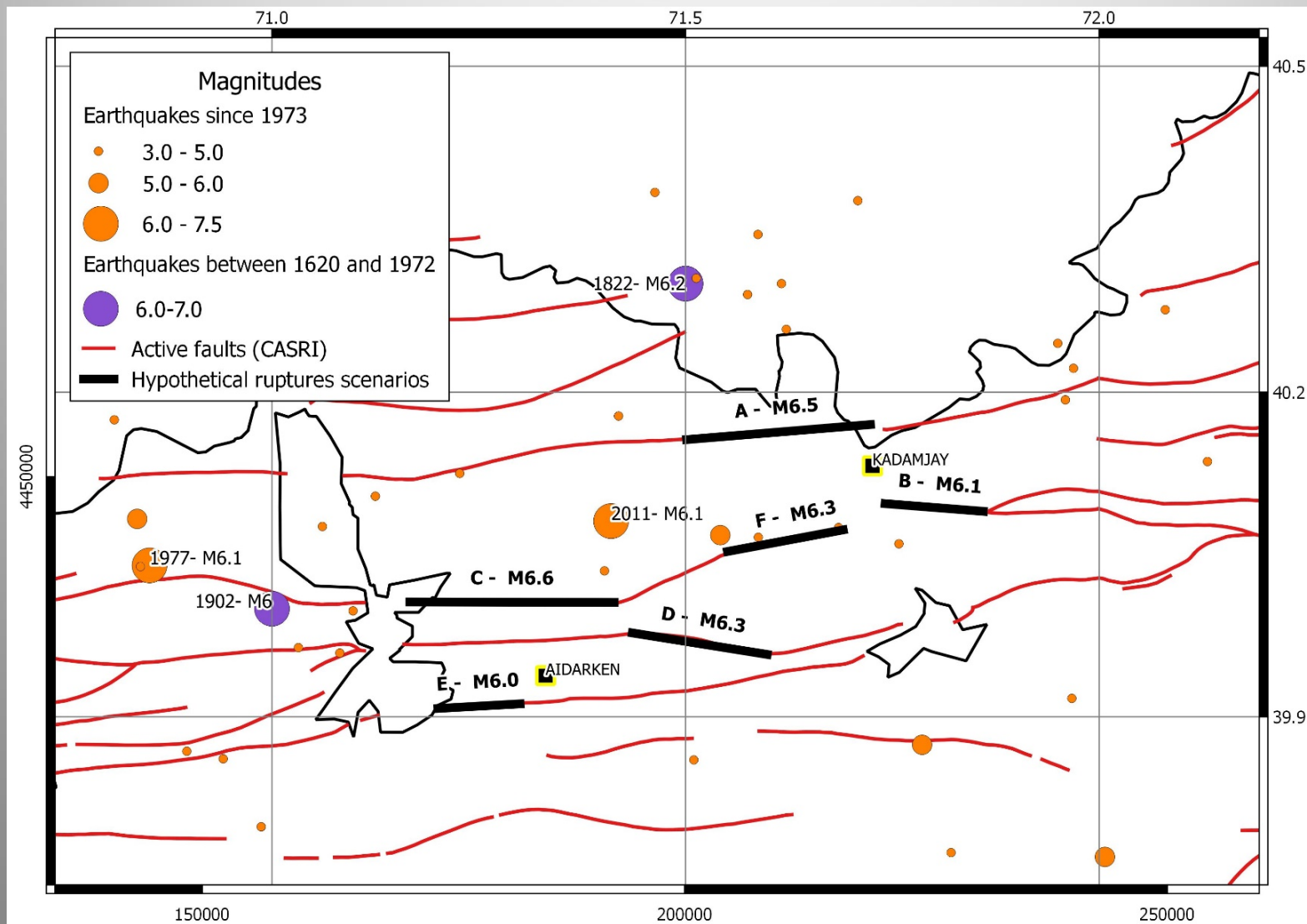- Earthquake catalogue
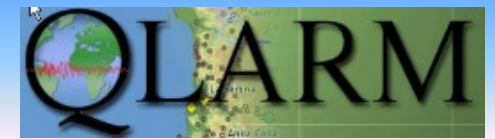- Fault catalogue
- Slip rate data
- Soil conditions



Fault compilation by the GEM consortium

# Available data at the regional scale in Kyrgyzstan

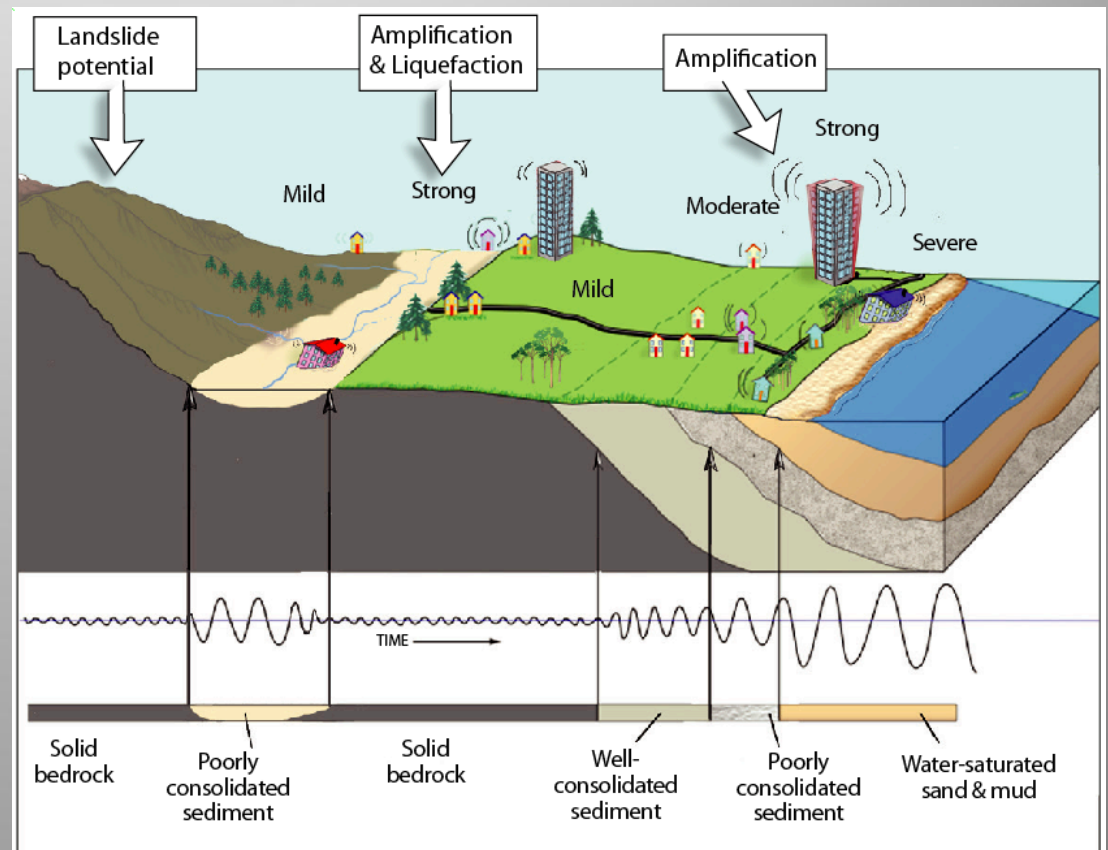## Relation between fault length/surface and magnitude

# Site amplification and soil conditions

# Data we need to estimate shaking amplification due to soil conditions

- Geological mapping at the largest possible scale
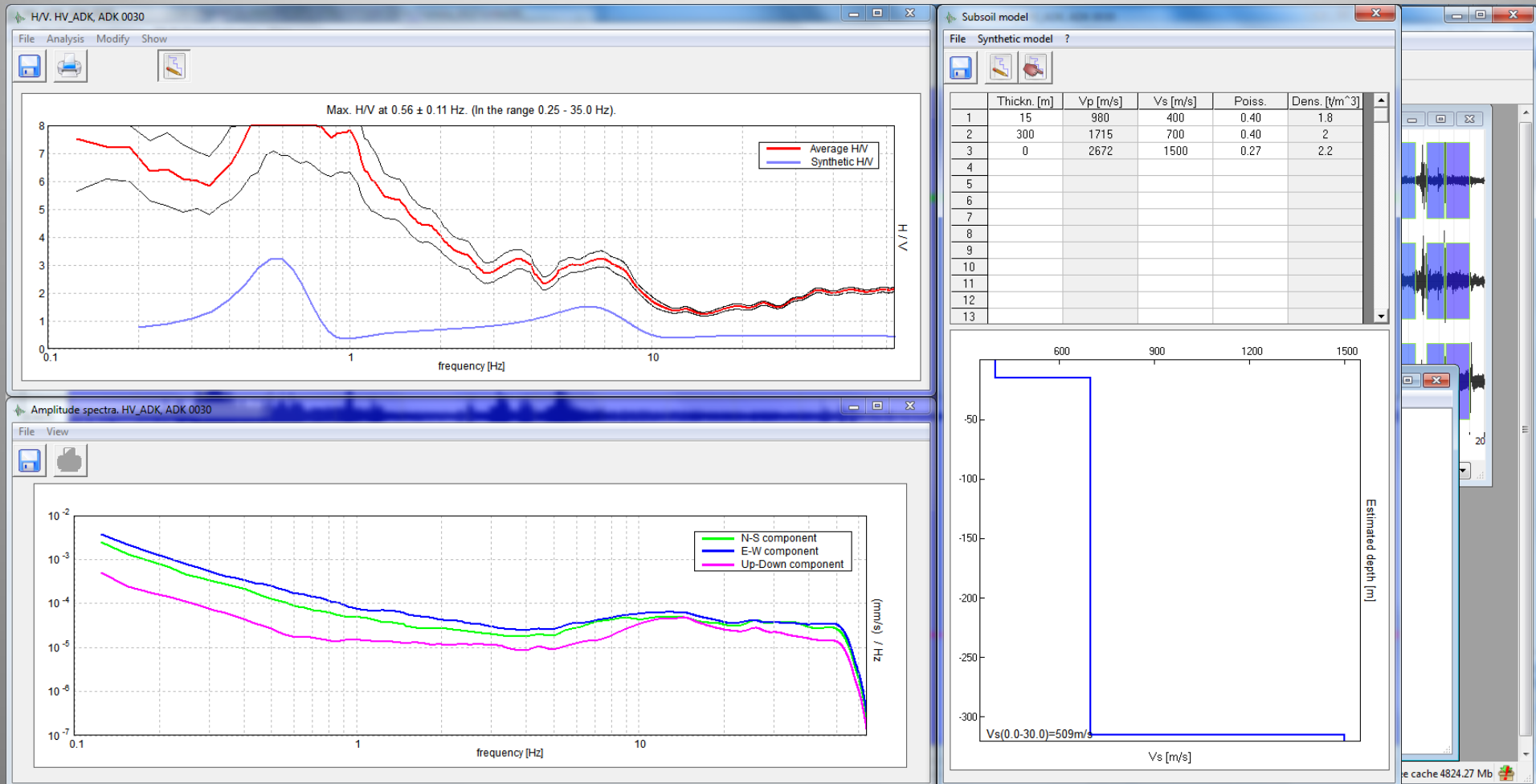- Borehole data
- Geophysical measurements

# What we did during the Kirghiz project



Loose soils can amplify seismic waves. For this reason, resonance frequencies, $f_0$, of ambient noise have been determined for 82 sites.

Inversion of the obtained horizontal to vertical ratio spectra from ambient noise for first approximation of soil classification $Vs_{30}$

# Zonation in terms of predominant resonance frequency of the soil $f_0$
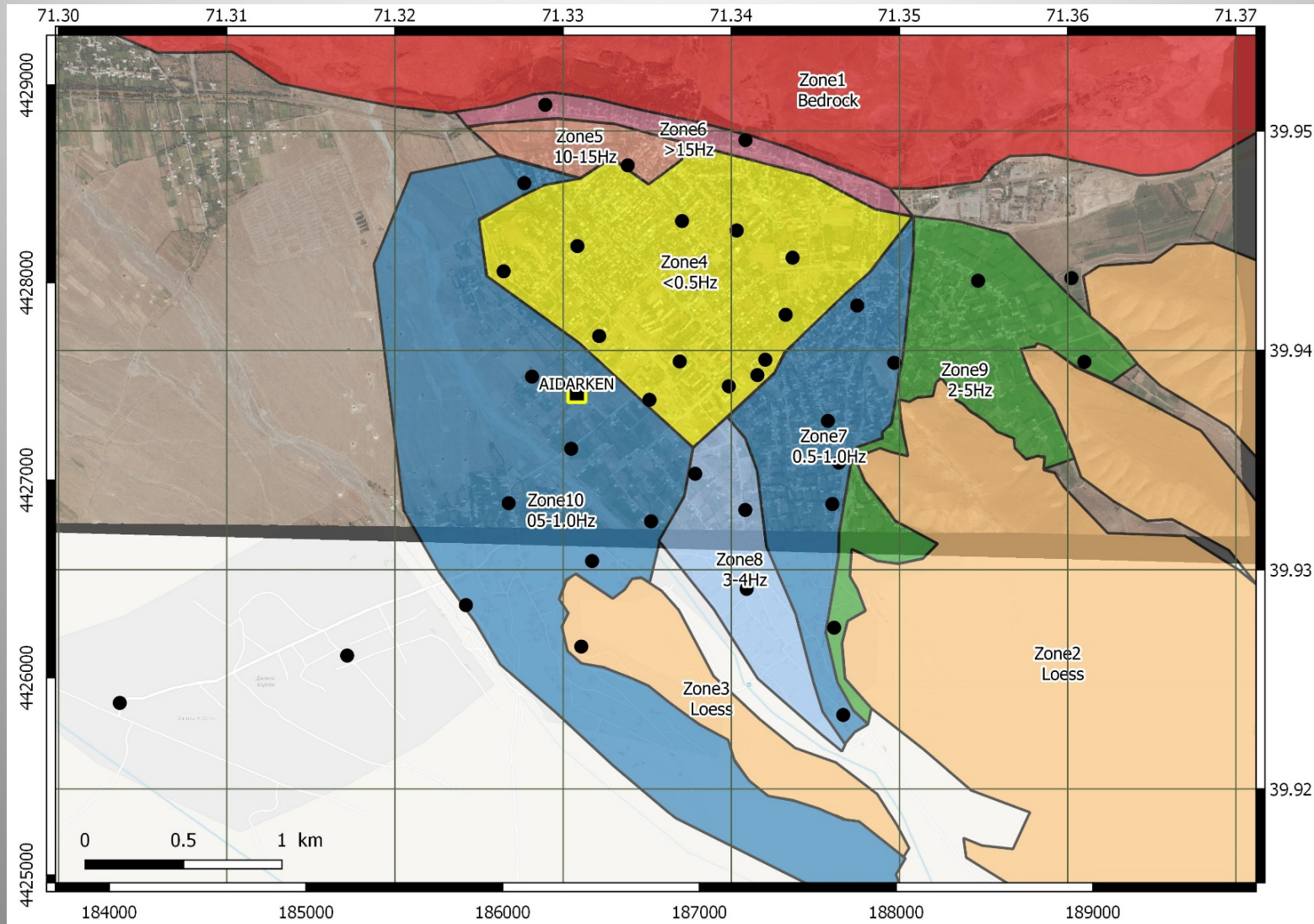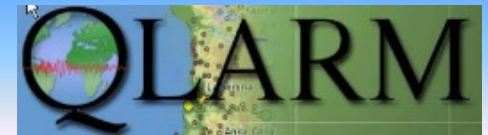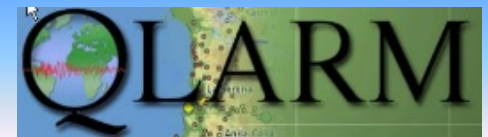
# Collecting Data on Site

Stavros V. Tolis

# Seismic Risk Analysis in Kyrgyzstan
# Kadamjay and Aidarken towns, Batken Oblast

## Data available:

- Census data

- Research papers
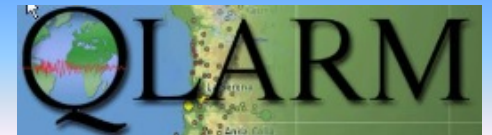
- Open access reports

- Online satellite images

**AIDARKEN**

**AIDARKEN**

# Neighborhood scale

# Residential buildings?



Barns and/or structures for livestock

Monumental entrances

# World Housing Encyclopedia



Buildings with hollow clay tile load-bearing walls and precast concrete floor slabs

Single-family brick masonry house

2story unreinforced brick masonry building with wooden floors

Houses with mud walls and thatch roofs

Dec. 2019

# Buildings with defects



Dec. 2019                                     Geneva

# Poor quality of construction details

# Poor maintenance of buildings



Dec. 2019

Geneva

# Differential settlements – Low quality of foundations



Dec. 2019                                    Geneva
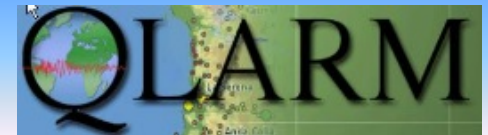
therefore,

**Collecting Data on Site: PRICELESS**

# A couple of new facts I discovered

Max Wyss

# (A) Impact of earthquakes on the rural and poor

**1) Consequences** of difference in building strength between rural/poor and city/rich populations when earthquakes strike

**Buildings in cities (the rich) are stronger than those in villages (the poor)**
**Corollary: Poor people suffer more in earthquakes**

Buildings in rural areas and poor neighborhoods are more likely to collapse than those in districts of the rich

The rural poor population is between 4 and 10 times more likely to die in an earthquake than the more affluent population
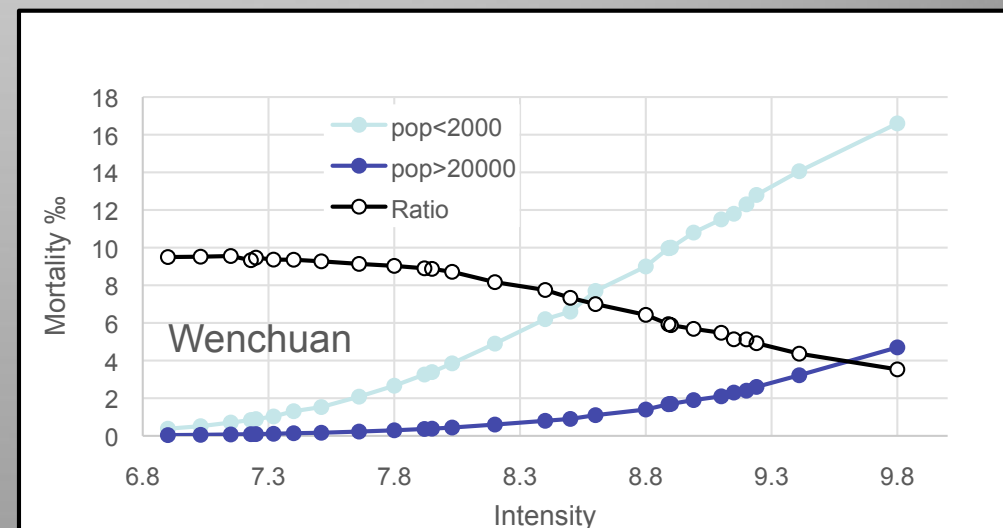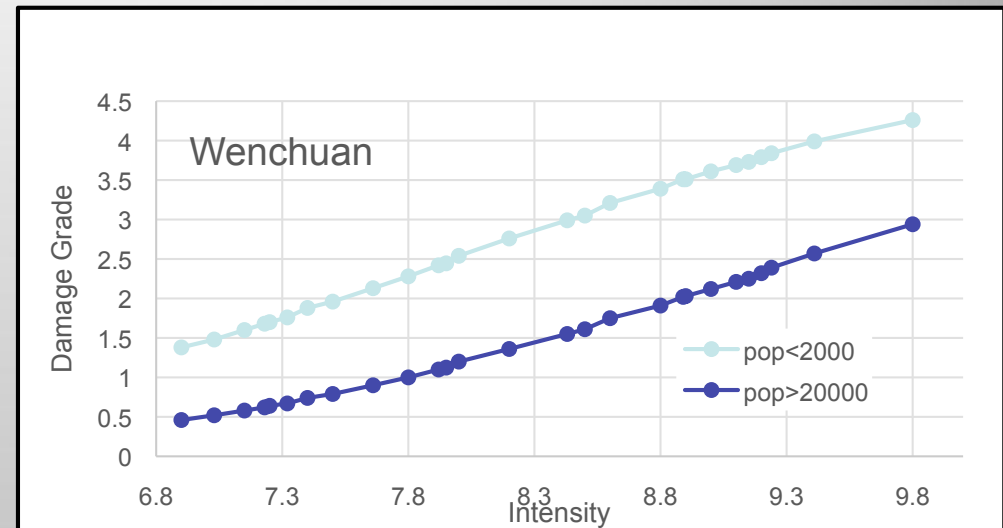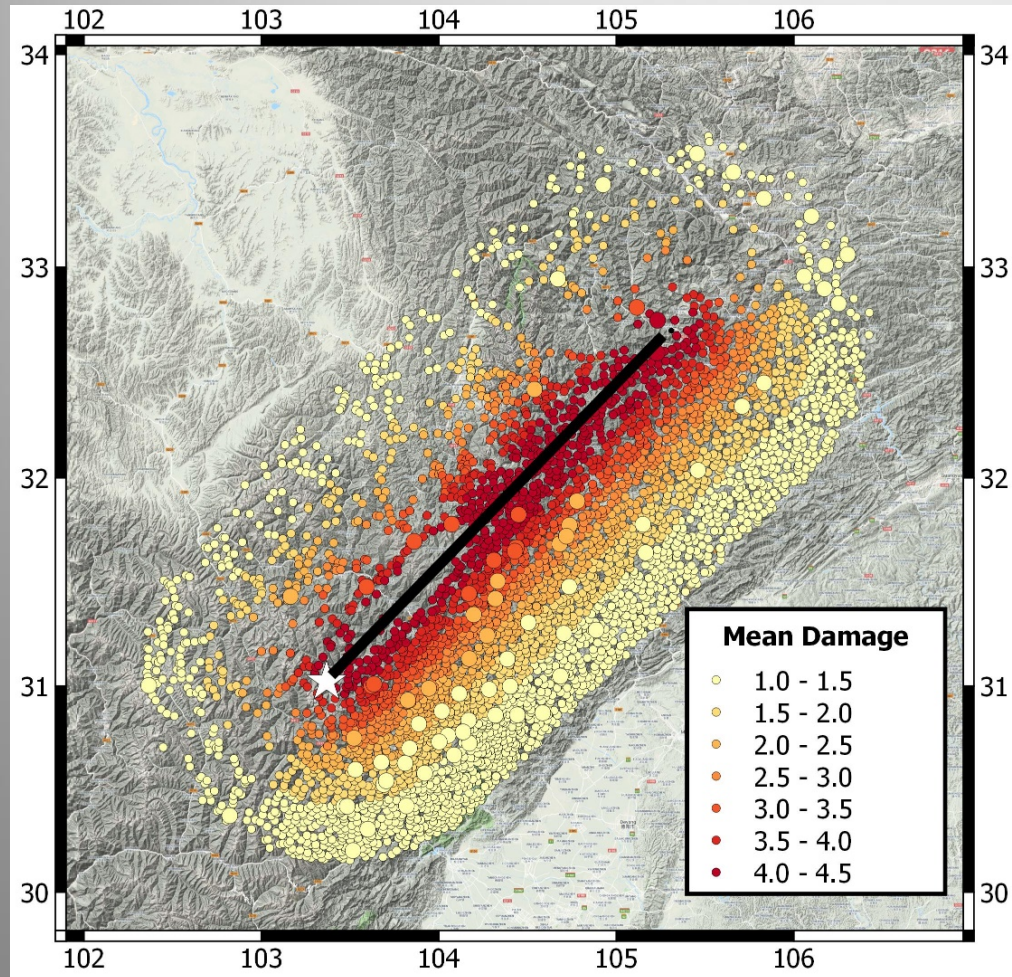
**2) NEW
Between 80%-100% of all earthquake fatalities
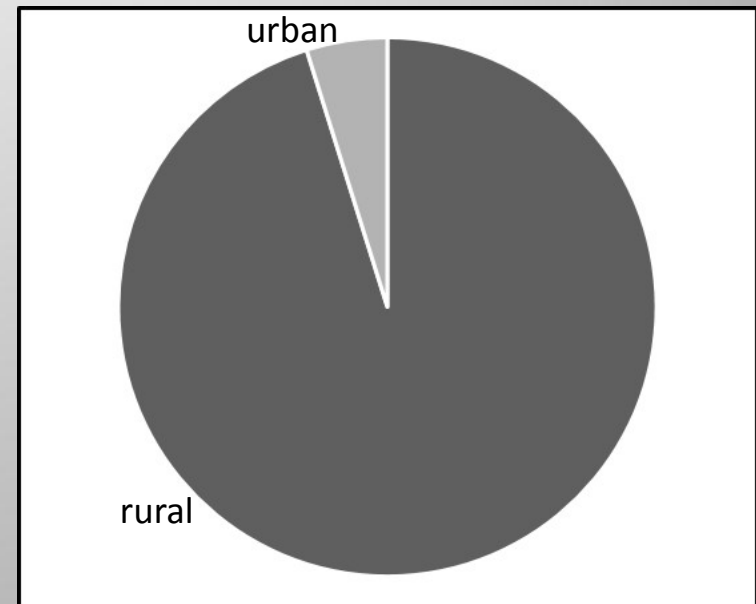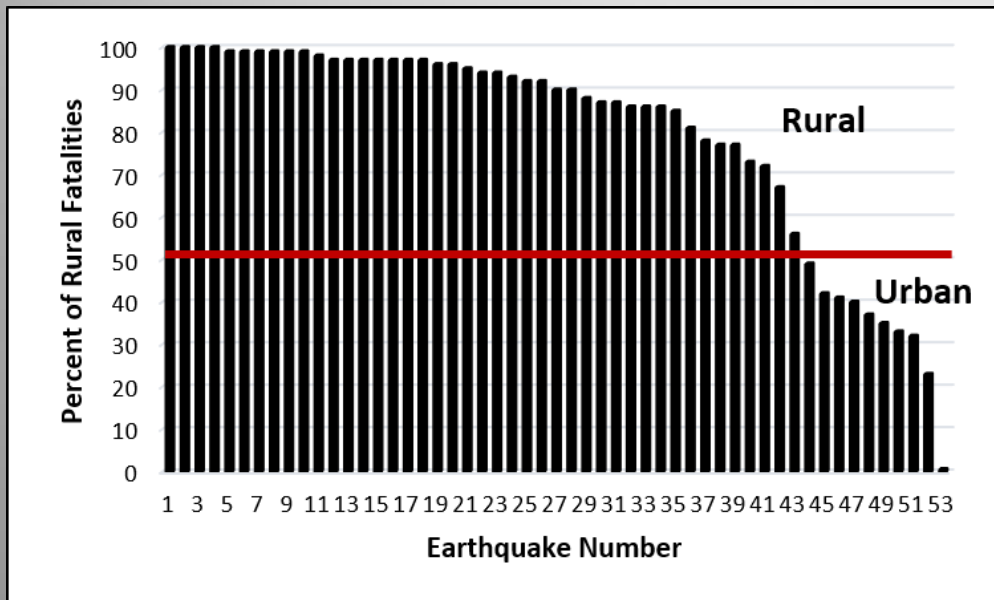occur in the rural population**

# The sum of fatalities in small settlements far exceeds those in cities



Map of the Wenchuan M8 earthquake:

There are thousands of small settlements but few medium size ones and no large cities.

# Estimates of % of rural fatalities in 53 earthquakes



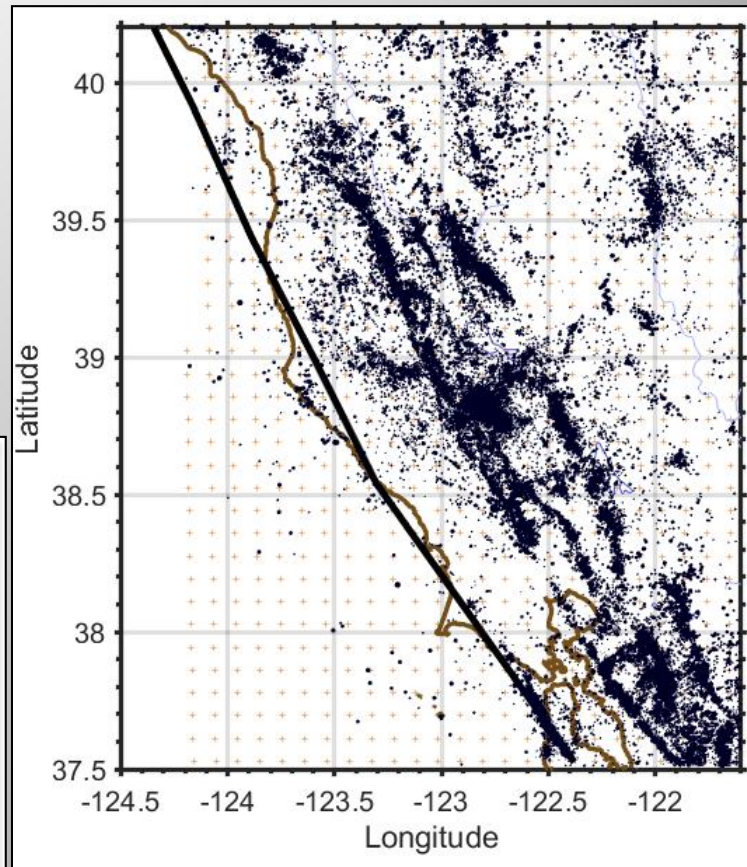In most great earthquakes 80% to 100% of those killed are rural, not city dwellers.
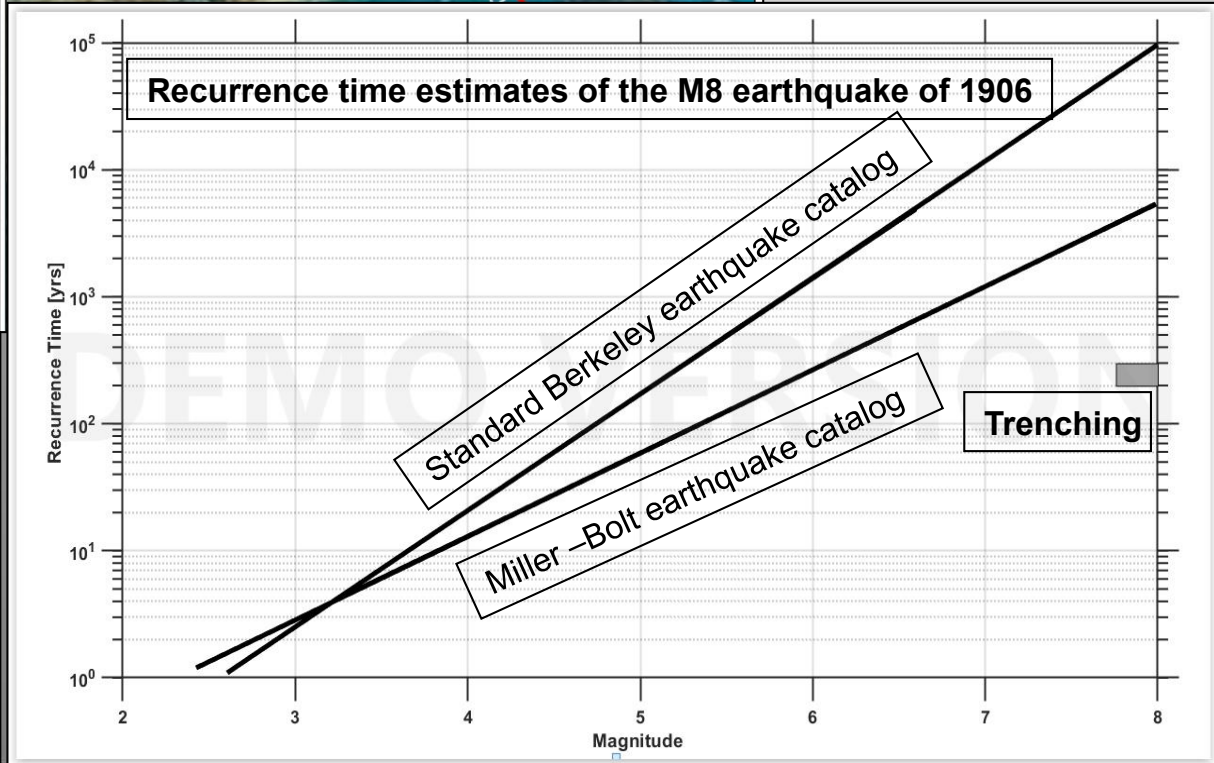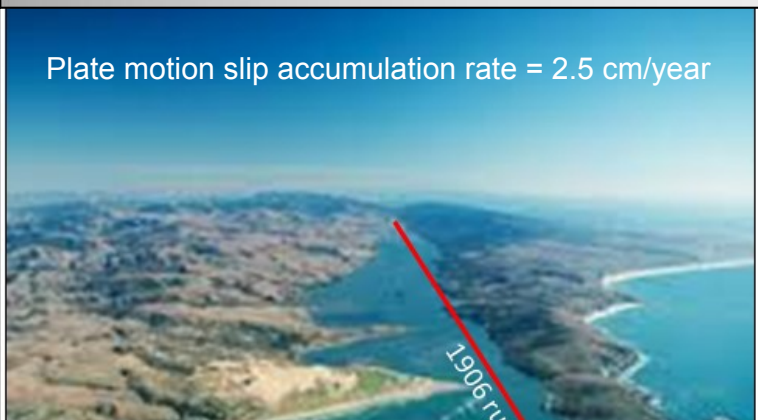
# (B) STILL UNKNOWN TO MOST

The probability of large earthquakes cannot be estimated from the rate of occurrence of small ones, as practitioners of seismic hazard assessment assume

The psychology of holding on to a myth

Recurrence time of a M8 earthquake along the break of the 1906 M8 rupture

Thank you for your patience