QLARM

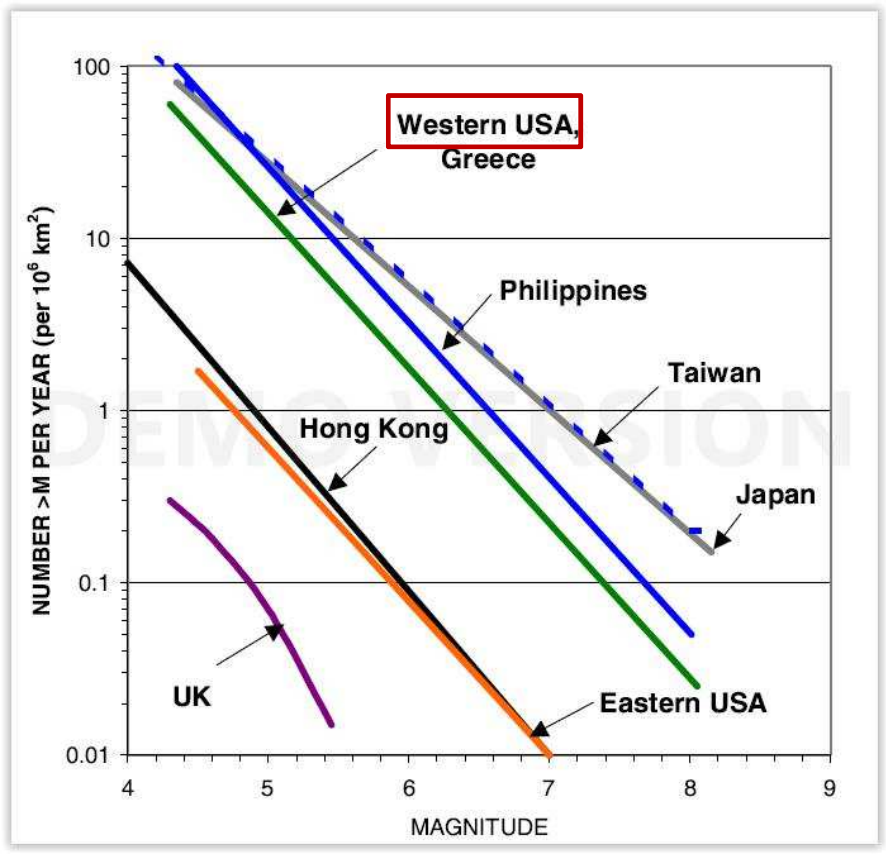
Some properties of b-values

Thank you for allowing quick information on some b-value properties.

Max Wyss
International Centre for Earth Simulation Foundation, Geneva and San Francisco

max@maxwyss.ch

Information in b-values averaged over large areas limited, but no zero



From Free et al., 2004

Asperities are characterized by low b-values, mean magnitude ~ 1/b

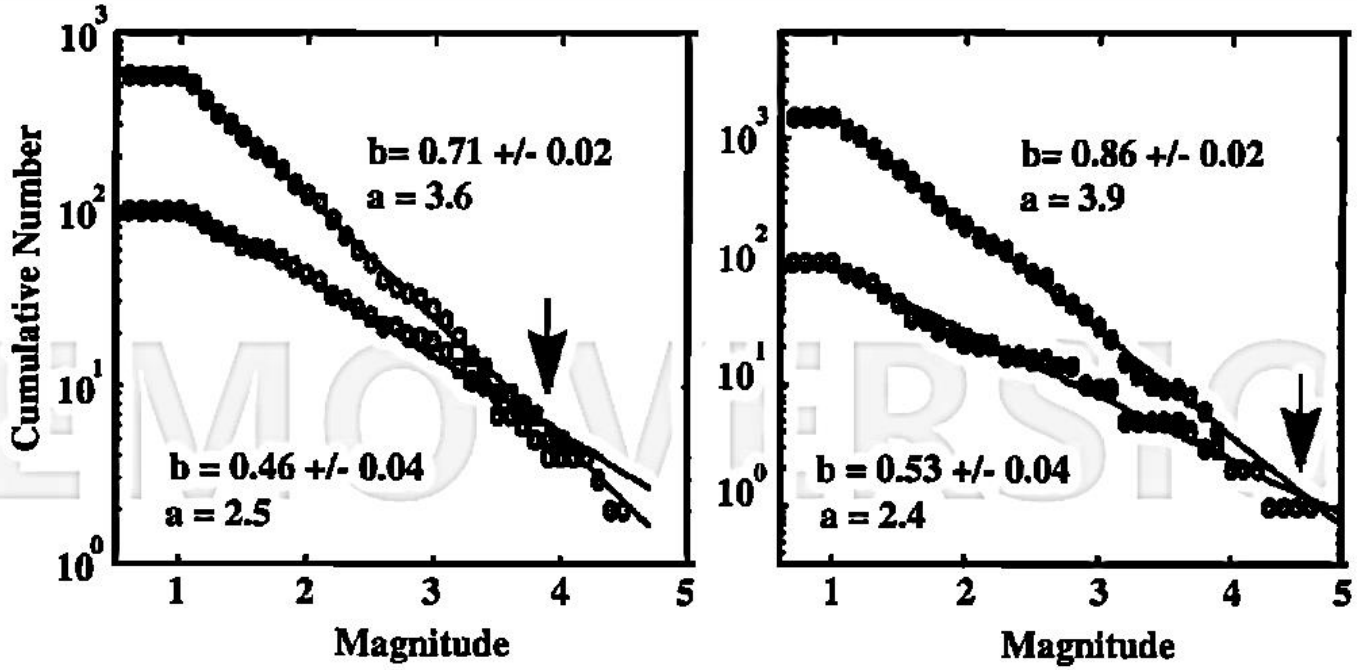


Figure 7. (left) Frequency-magnitude relationship for the entire segment of the Parkfield rupture (20 x 15 km) and the asperity only (R = 3 km), and (right) for the entire segment of the Morgan Hill rupture (25 x 12 km) and its asperity (R=3 km).

Wiemer & Wyss, 1997

Asperities play a key role in generating earthquakes: They must be understood

B-Value examples

Locked vs creeping patches Hayward fault, CA (Wyss, 2001)

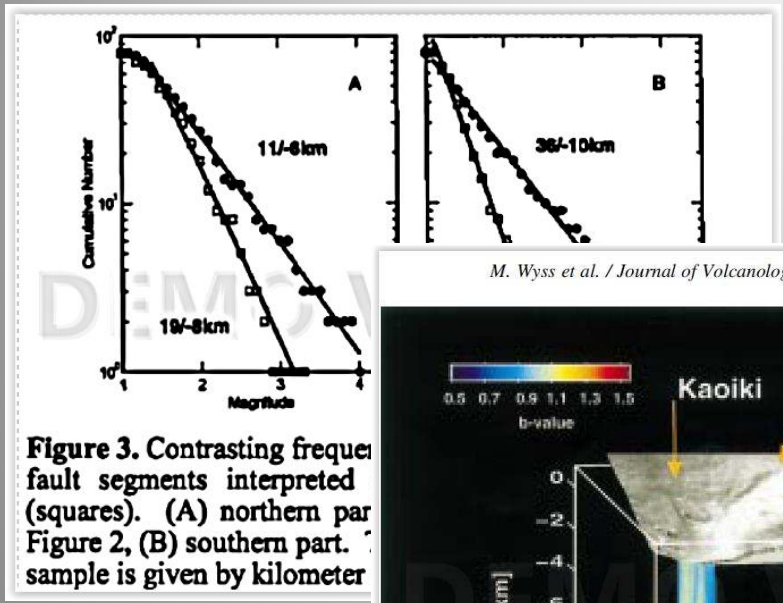
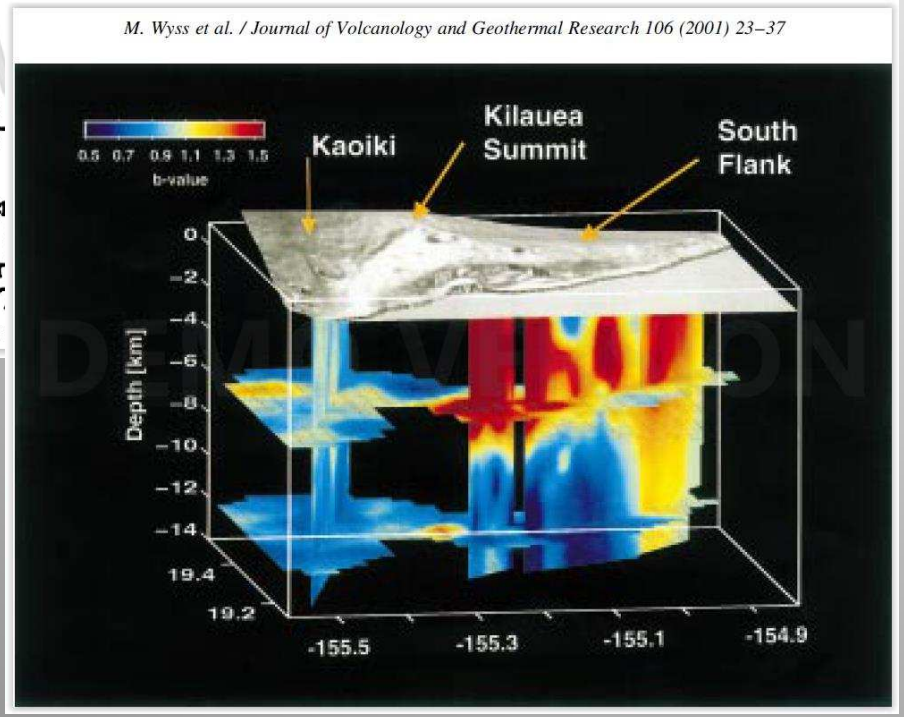
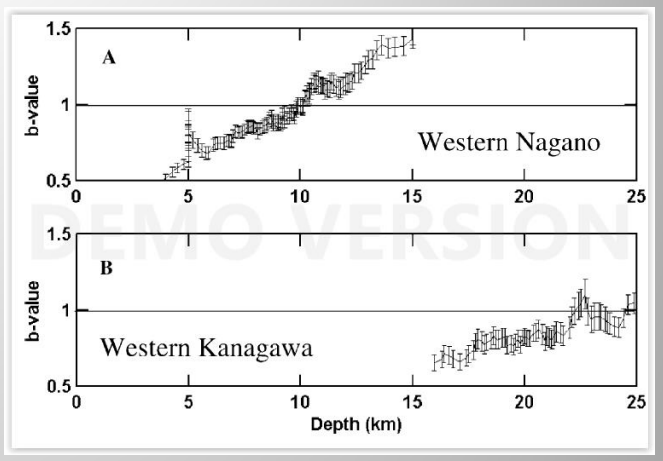


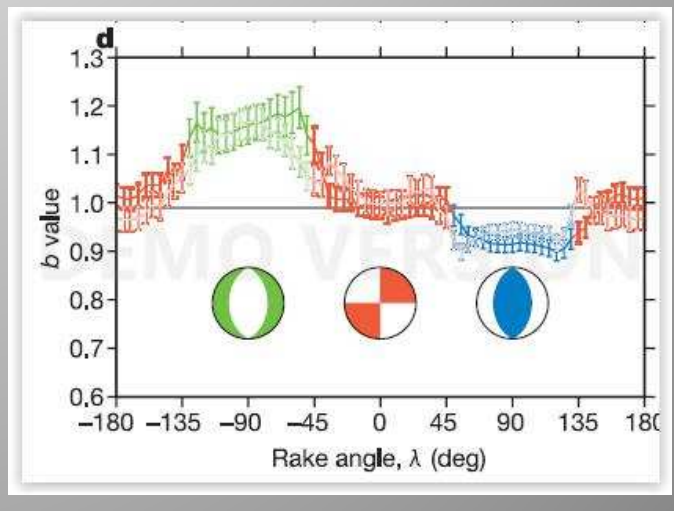
Figure 3. Contrasting frequer
fault segments interpreted
(squares). (A) northern par
Figure 2, (B) southern part.
sample is given by kilometer



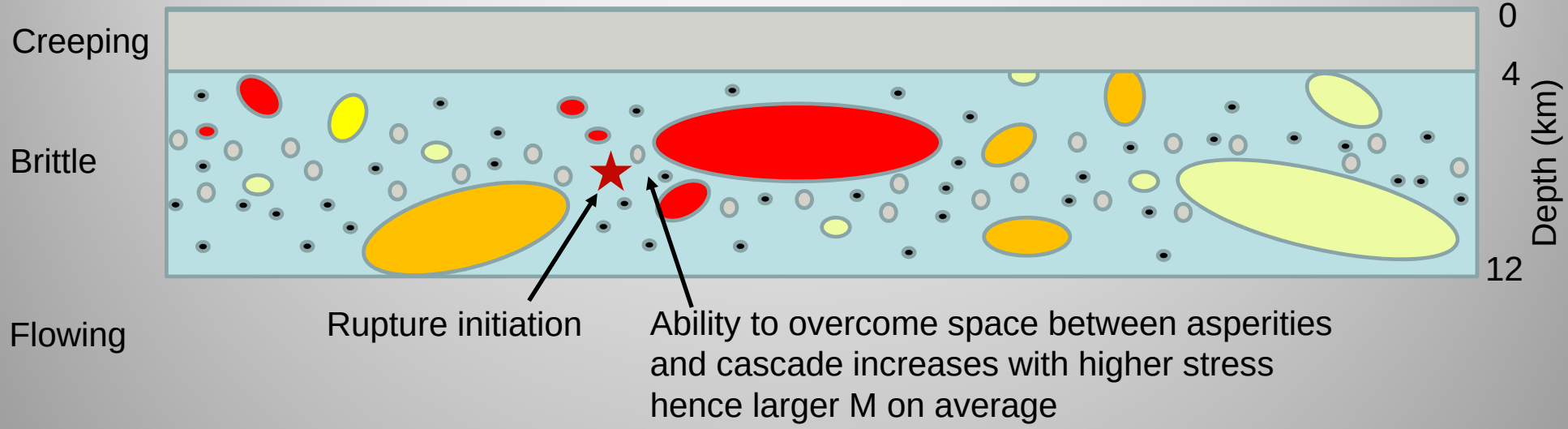
b-value function of depth (Wyss & Matsumura, 2002)

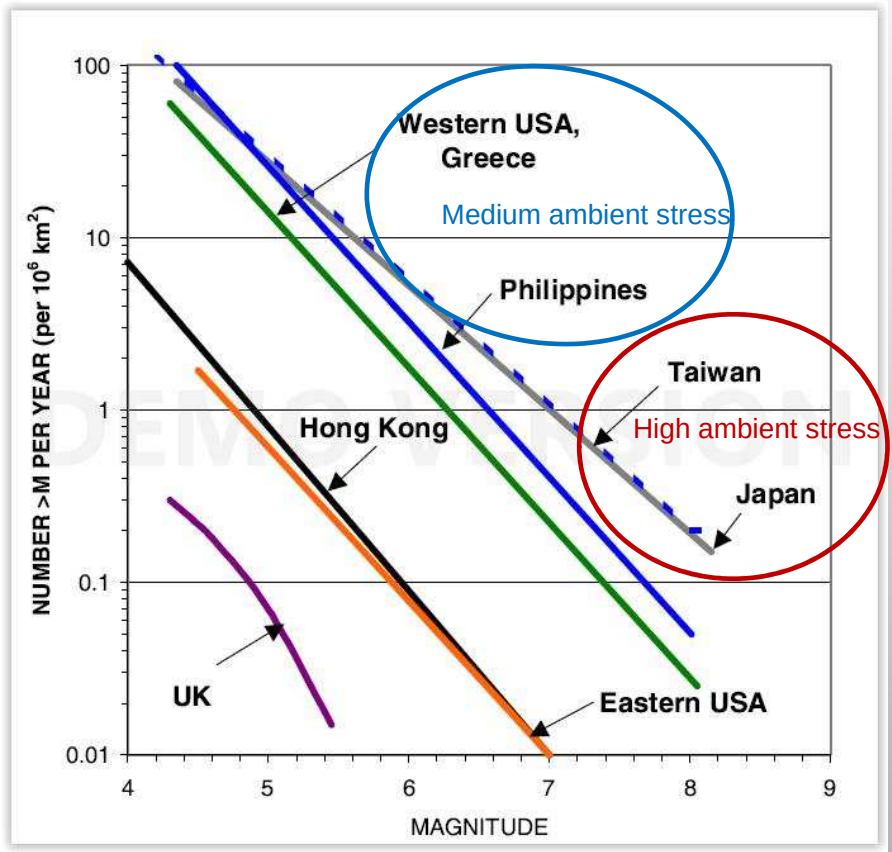


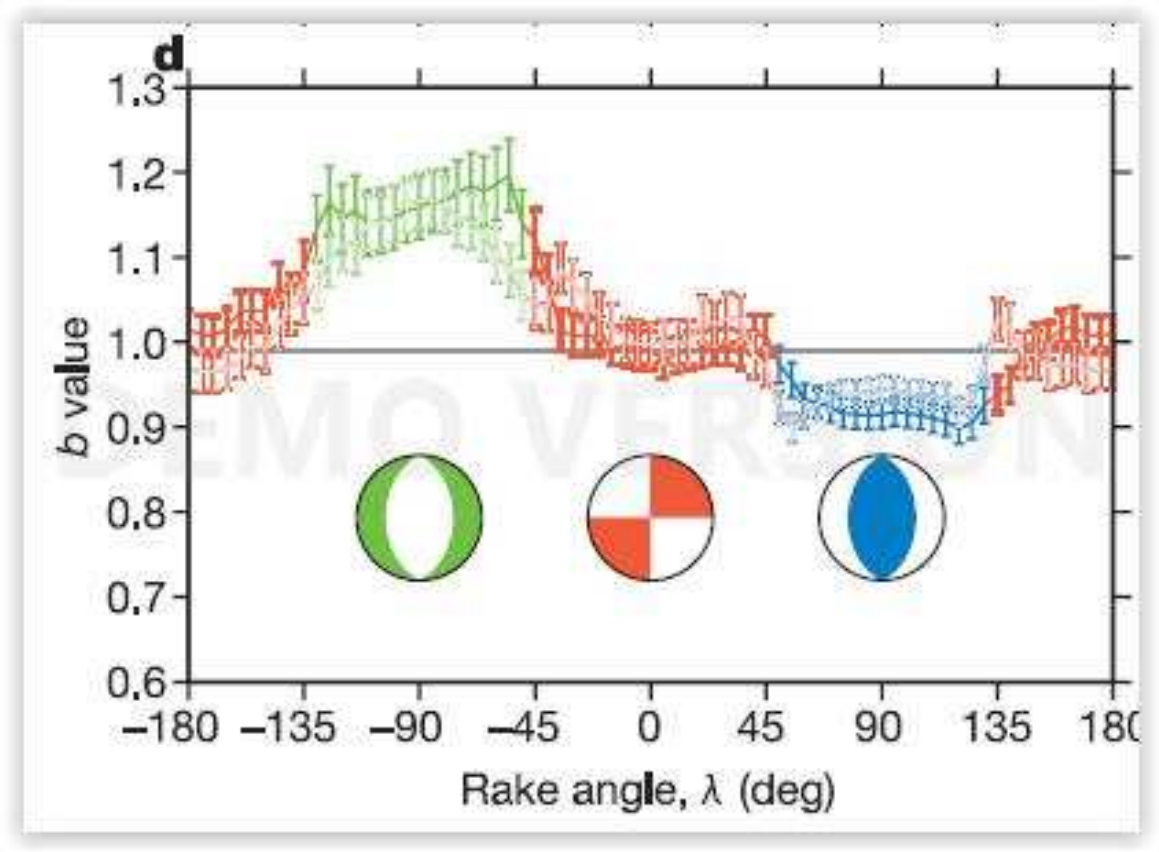
b-value function of ambient stress (Schorlemmer, Wiemer & Wyss, 2005)



Schematic vertical strike-slip fault zone with asperities of various levels of stress concentration
Peak activity at 8 km depth




100
10
1
0.1
0.01
NUMBER >M PER YEAR (per 10^6 km^2)
4
5
6
7
8
9
MAGNITUDE
Western USA,
Greece
Medium ambient stress
Philippines
Taiwan
High ambient stress
Hong Kong
Japan
UK
Eastern USA

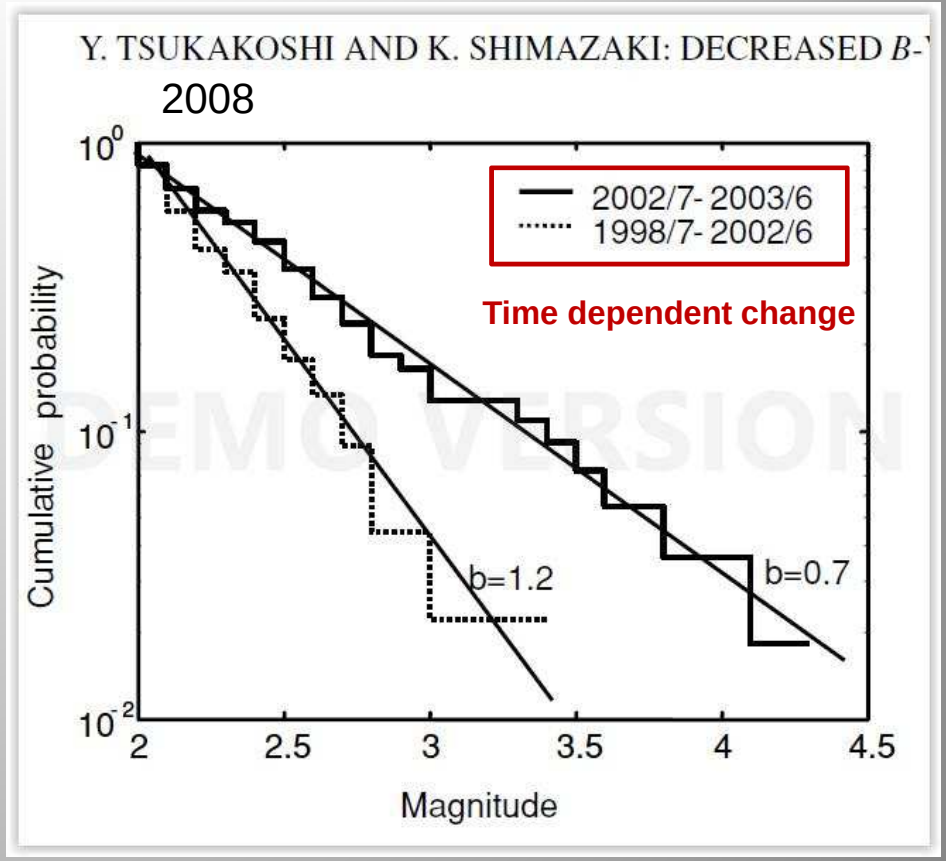

d
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
b value
–180
–135
–90
–45
0
45
90
135
180
Rake angle, λ (deg)

Solid data and simple model

Miyagi earthquake 26 July 2003 radius = 30 km

A change took place 11 months before the main shock.
(Not a “short-term” precursor.)

Model:
Decreased b-value > larger eq on average > higher ambient stress.



It seems that quality of data are needed, and a physical model, to persuade sceptics

max@maxwyss.ch