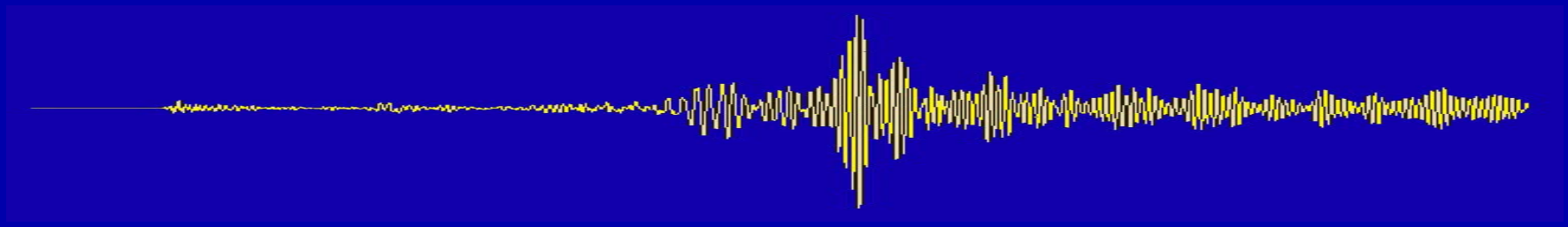
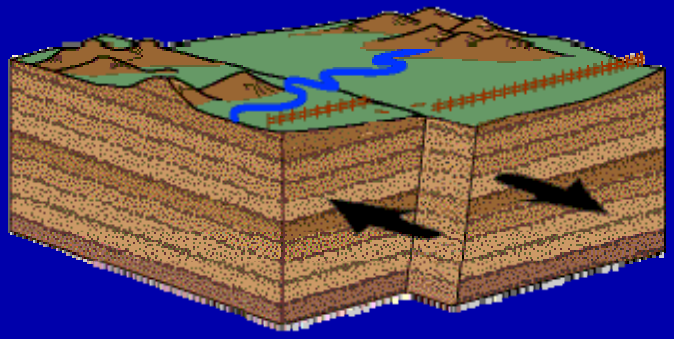
12.103
Strange Bedfellows: The Science and Policy of Natural Hazards

Earthquake Kinematics

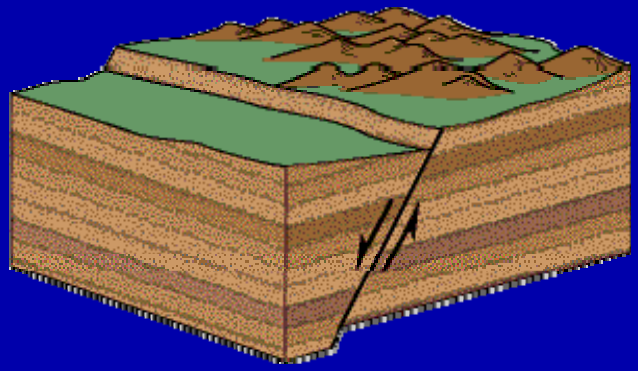


Spring 2008

strike-slip fault



normal fault



reverse (thrust) fault

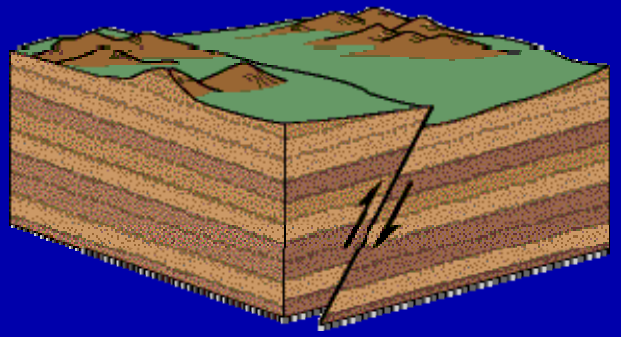


Image courtesy of USGS.

Faults

Faults

$\hat{n}$: normal vector

$\hat{d}$: slip vector

Faults

Faults - Seismic Moment

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Please see:
http://epscx.wustl.edu/seismology/book/chapter4/chap4_sr/4_4_05_s.jpg

Seismic Moment:

$$M_0 = \mu \overline{D} A$$

Focal Mechanisms:
geometry of faulting during an earthquake

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Earthquake magnitude

general form:

$$M = \log\left(A/T\right) + F\left(h,\Delta\right) + C$$

Richter (local) magnitude:

$$M_L = \log A + 2.76 \log \Delta - 2.48$$

A: S-wave amplitude (mm)
Δ: distance epicentre-seismograph (km)

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Please see:
http://epscx.wustl.edu/seismology/book/chapter4/chap4_sr/4_6_01_s.jpg

Earthquake magnitude

body wave magnitude:

$$m_b = \log(A/T) + Q(h,\Delta)$$

A: P-wave amplitude (μm)
T: dominant period of the signal (s)
Q: empirical factor depending on distance (Δ) and depth (h)
Saturation: m_b~6.0

surface wave magnitude:

$$M_S = \log(A/T) + 1.66\log\Delta + 2.0$$

A: Surface wave amplitude (μm)
T: dominant period of the signal (s)
Δ: distance earthquake-seismograph (°)
Saturation: Ms~8.3

Earthquake magnitude

moment magnitude:

$$M_w = \frac{\log M_0}{1.5} - 10.73$$

M_0: scalar seismic moment from modeling of seismograms

no saturation!

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Spring 2010