I Main Topics for next two lectures
   A Recognition of earthquake hazards from case histories
   B Consistent lessons
   C Key questions regarding characterization of earthquakes and faulting
II Case Histories (The historic record)
   A Loma Prieta, 1989 (5:04 PM October 17, 1990; M=7.1)
      1 The location and style of the ground response and ground water
         response could have been predicted in many areas based on what
         happened in 1906
      2 Rupture was very similar to what had been mapped by Hall &
         Sarna
      3 Resilience of wood-frame construction and flaws of unreinforced
         masonry demostrated again
      4 Tremendous increase in ability/ speed to determine the location,
         extent, and energy release (i.e. physical parameters) based on
         seismologic and geodetic information
      5 Possible precursor identified after the fact - long wavelength
         radio waves (submarine communications)
      6 No precursor recognized in advance
      7 57 people killed (41 on Cypress structure). We were lucky.
      8 ~$6 billion damage. Just for comparison, the 1906 quake damage
         in 1987 dollars is estimated at ~$20 billion.
   B Parkfield "nonearthquake" and earthquake prediction1992
      1 Similar prior earthquakes of M≈6: 1881, 1901, 1922, 1934, 1966
      2 Mean interevent time of 21.8 ± 5.2 years
      3 Strain buildup comparable to 1966
      4 Earthquake forecast issued in 1985 for a 1988 (± 5 years) quake
      5 No earthquake yet
C Kalapana, Hawaii (4:48 AM November 29, 1975; M=7.12)
1 Surface rupture along Kilina fault system
2 Magnitude 5.7 foreshock at 3:36
3 Maximum tsunami height 12.2-14.6 m
4 Maximum subsidence along coast: 3.5 m
5 Small eruption at Kilauea triggered 45 after quake
6 $4.1 million in damage
7 Earthquake caused by deep-seated failure of SE flank of Kilauea
8 Earthquake similar to April 2, 1868 earthquake
http://wwwneic.cr.usgs.gov/neis/eqlists/USA/1868_04_03.html

G Key Lessons (Common elements / recurring themes)
a Earthquake effects are a function of the strength of the source, the path of the seismic waves, and the nature of the "receiver"
b Faults with prior Quaternary activity generate nearly all quakes
c Structural failures kill the most people. Securely tie houses to foundations in earthquake country!
d Shaking depends on surficial materials but generally decreases with distance from the epicenter
e Ground response can be consistent from quake to quake
f Ground rupture is devasting for structures but can be avoided
g Significant damage can occur for faults that don't rupture the surface (Coalinga, almost Loma Prieta).
h We get surprised
i We can't predict earthquakes in the short term yet

H Some key characterization questions
a What controls how large an earthquake will be?
b How do surficial deposits respond to seismic waves?
c How do buildings respond to seismic waves?
d How can we predict when and where an earthquake is likely to occur? What is the uncertainty associated with the predictions?