CATASTROPHE MODELING & SOUTHERN CALIFORNIA EARTHQUAKE RISK

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Northridge Earthquake Symposium
Business, Insurance and Financial Implications Concurrent Session
January 17, 2014

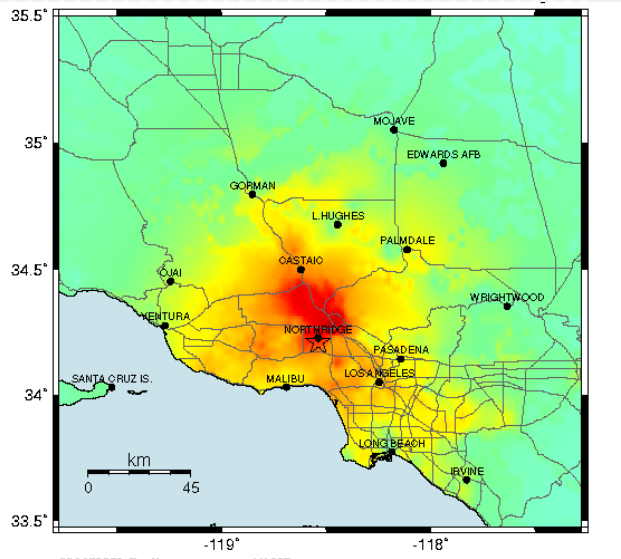
OVERVIEW

1. What are the advancements in catastrophe models since the 1994 Northridge Earthquake?

2. What can catastrophe models tell us about earthquake risk in Southern California?

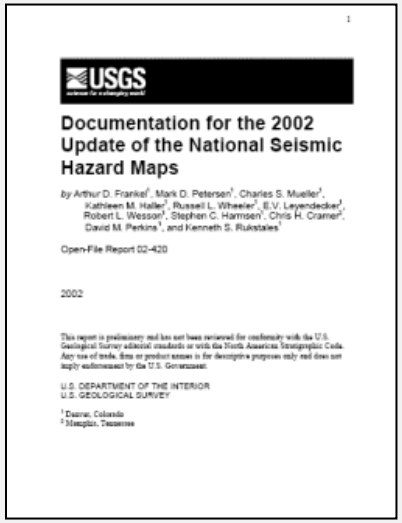
3. How can we utilize models to explore risk mitigation strategies?

THE LEGACY OF THE NORTHRIDGE EARTHQUAKE

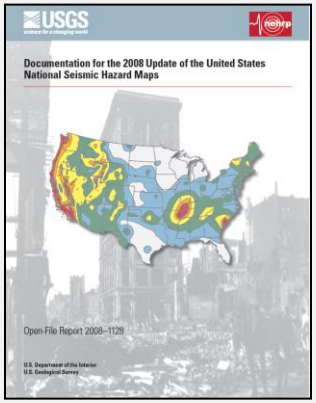


- In 1994, exposure data was incomplete and/or inaccurate
- In 1994, the probable maximum loss (PML) approach was used to manage earthquake risk
- In 1994, only 10%-12% of property insurers used catastrophe models

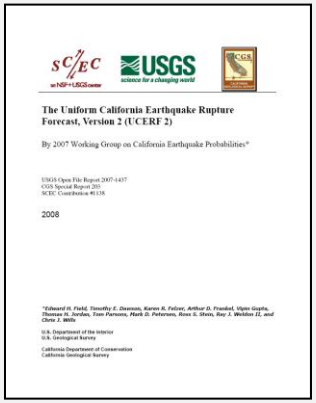
➢ The Northridge Earthquake definitively marked the end of the loss experience approach to assessing earthquake risk in California



2002 NSHMP
USGS OFR 2002-420

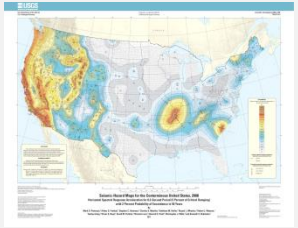


2008 NSHMP
USGS OFR 2008-1128



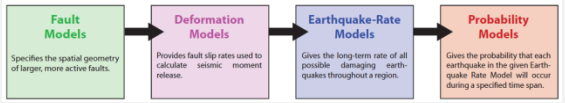
UCERF v2
USGS OFR 2007-1437

2014 NSHMP from USGS

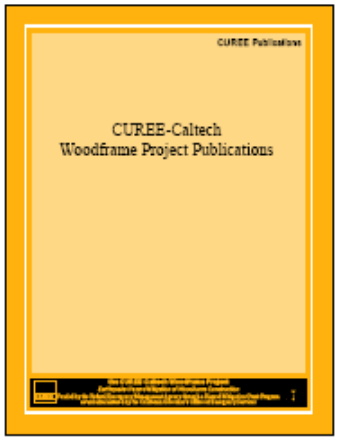


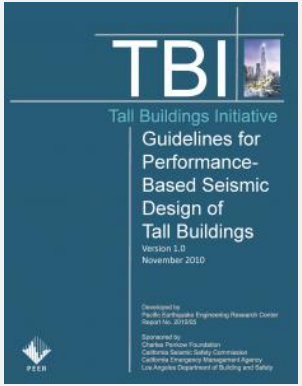
USGS
science for a changing world

UCERF3 from WGCEP



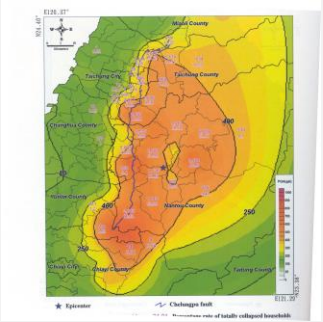
HAZARD AND VULNERABILITY RESEARCH





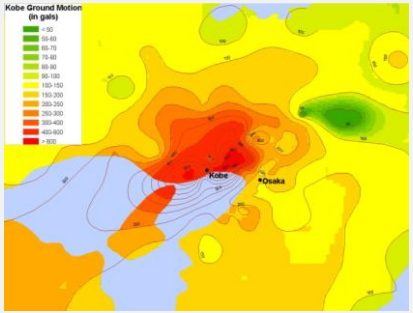
LESSONS FROM OTHER COUNTRIES

Chi-Chi, Taiwan Earthquake



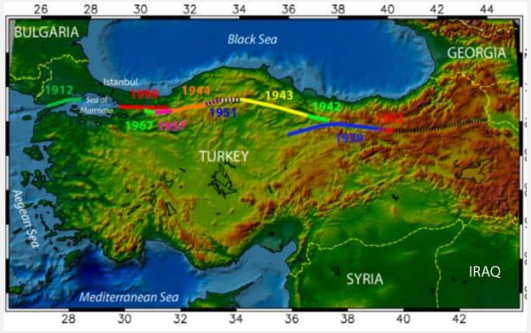
1995

Kobe, Japan Earthquake



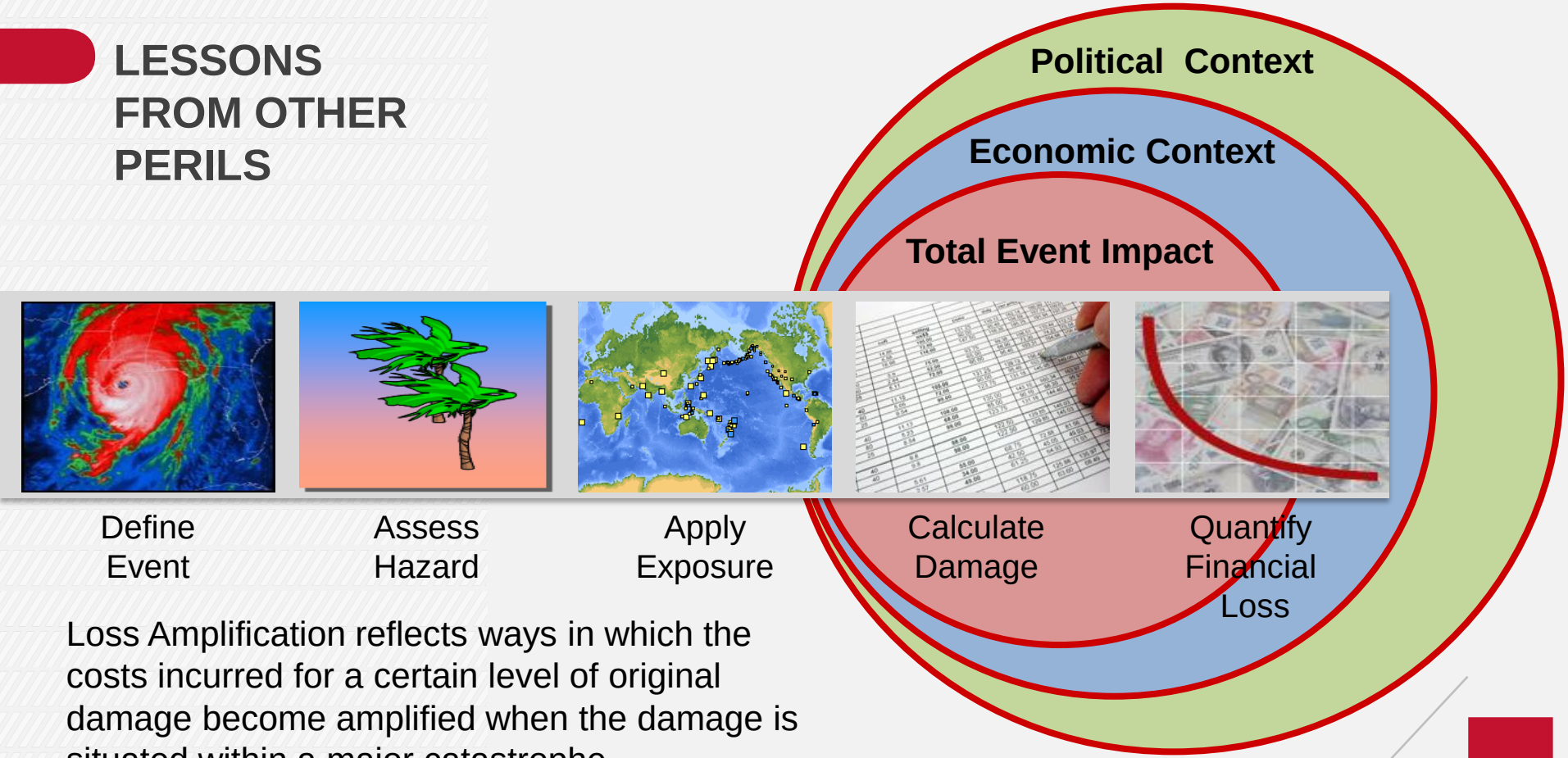
1999

Kocaeli, Turkey Earthquake



- Degree of damage clearly differs depending upon combination of hazard, exposure, vulnerability
  - Fire following earthquake
  - Industrial exposure
  - Business interruption

LESSONS FROM OTHER PERILS



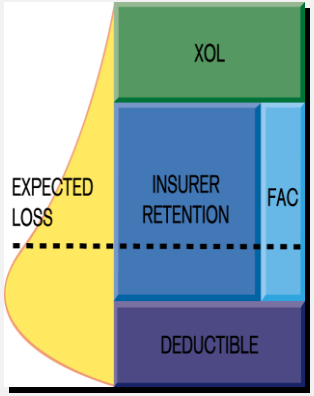
Loss Amplification reflects ways in which the costs incurred for a certain level of original damage become amplified when the damage is situated within a major catastrophe

EACH EVENT PROVIDES UNIQUE LESSONS

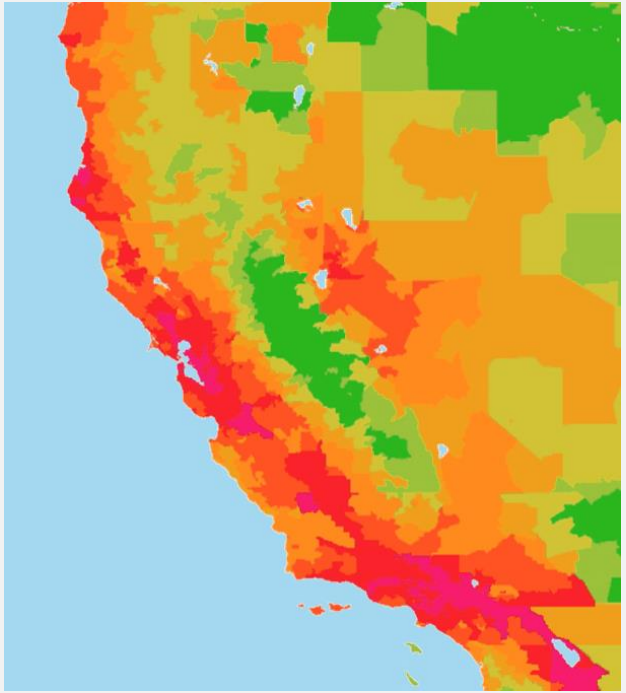
- 2010 Maule, Chile
  - Success of the Chilean seismic building code
  - Concentration of industrial risks compounds **business interruption (BI)**
- 2011 Christchurch, New Zealand
  - Some of the strongest ground motions ever recorded (above design levels)
  - Catastrophic **liquefaction** leading to red-zoning of entire suburbs
- 2011 Tohoku, Japan
  - **Tsunami** peril driving losses, with highest measured tsunami waves in a well-prepared region
  - Devastating economic and social impacts to Japan, with insurance implications worldwide (e.g., contingent BI)

OUTPUTS OF CATASTROPHE MODELS

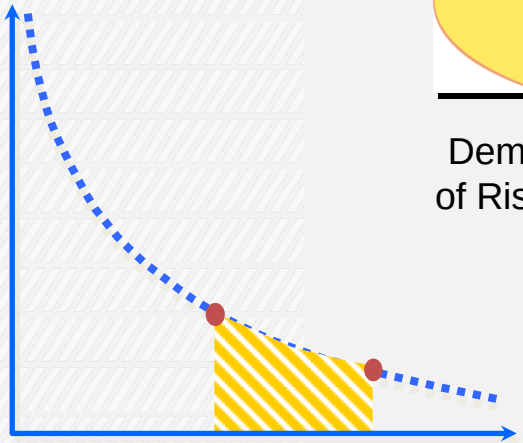
Who is expected to pay?



Demographics of of Risk (Gross/Net)



Geography of Risk

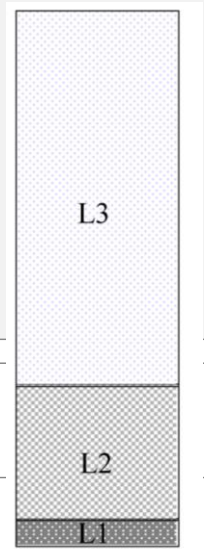


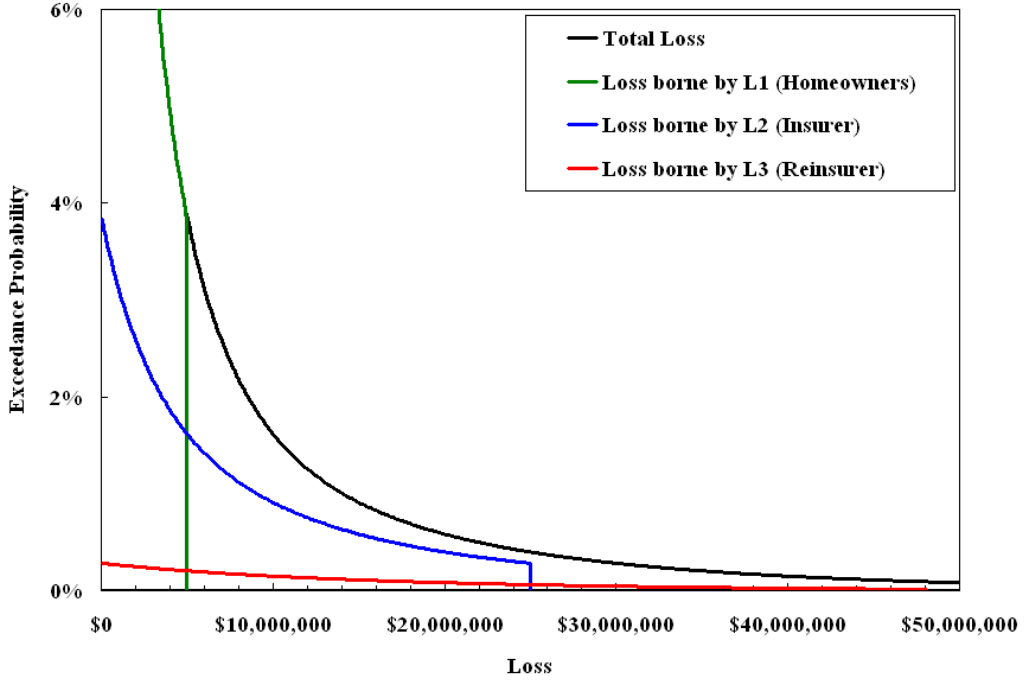
Probability of Risk (EP Curve)

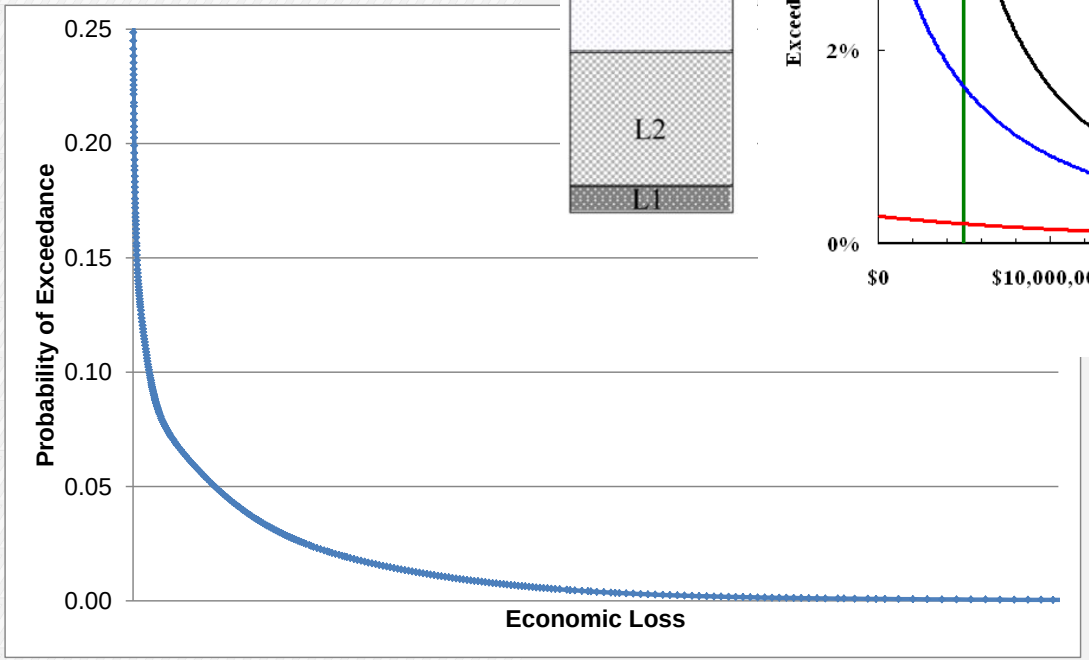
What is the expectation of risk?

Where is the greatest (and least) expectation of risk?

SOUTHERN CALIFORNIA EARTHQUAKE RISK







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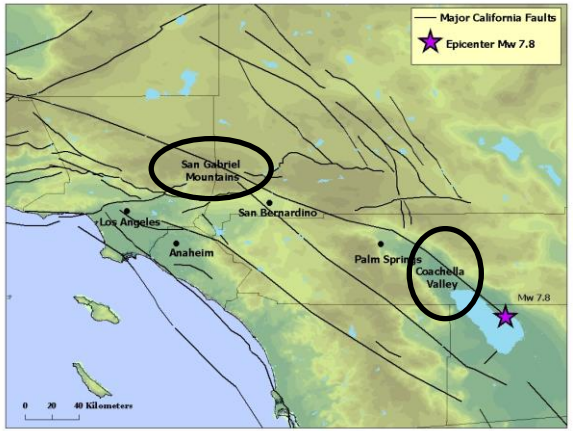
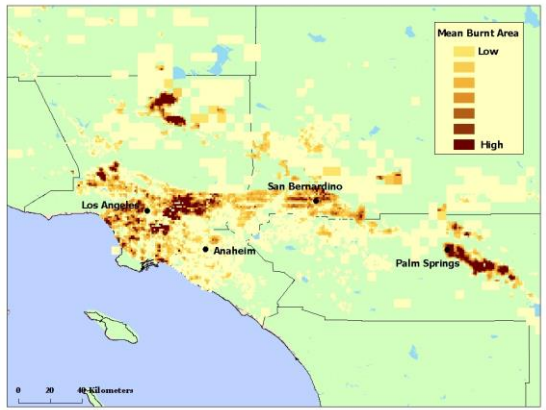
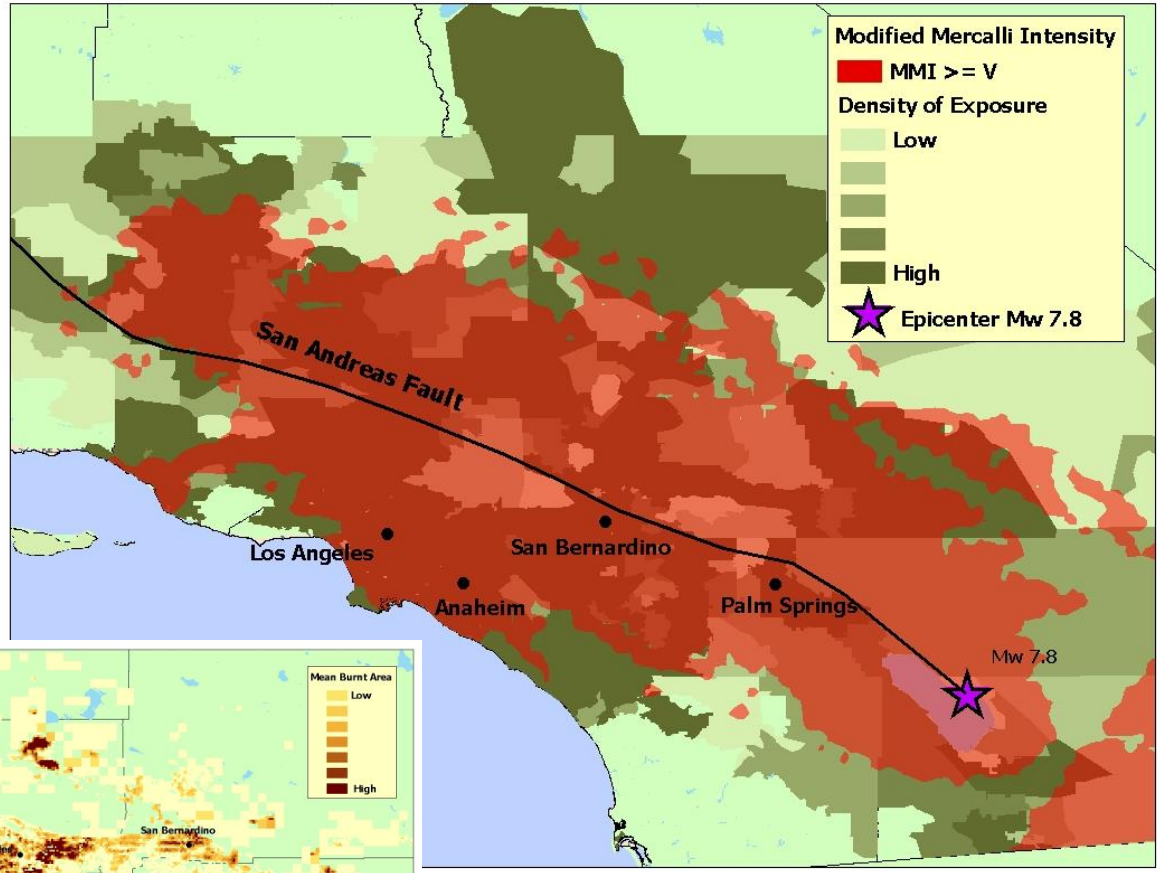
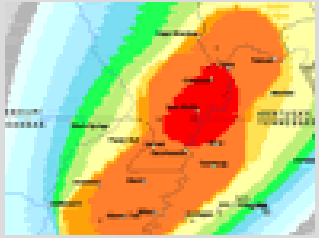


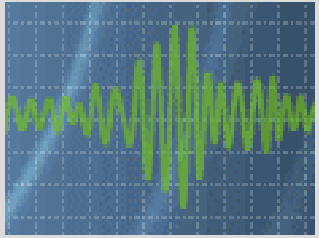




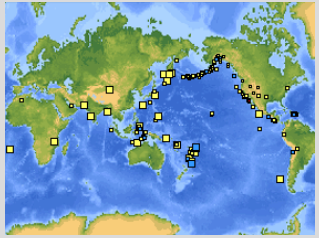
Catastrophe Model: A Tool to Explore Loss Reduction Strategies



Define Earthquake



Assess Earthquake Ground Motion



Apply Exposure

Calculate Damage

Quantify Financial Loss

Stochastic Event Module

Hazard Module

Geocoding/ Exposure Module

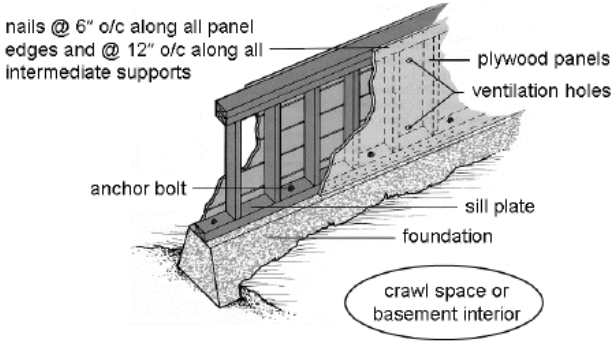
Vulnerability Module

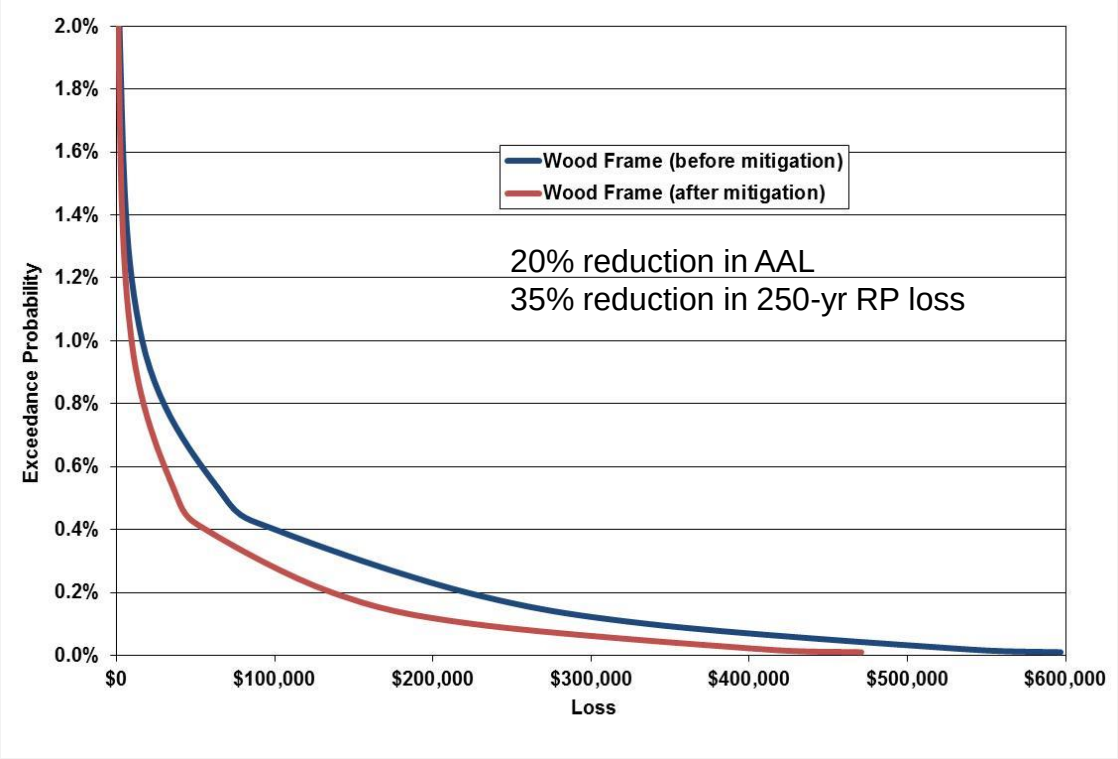
Financial Analysis Module

Modify inventory to explore impacts of land use policy

Modify vulnerability to explore impacts of individual mitigation strategies

QUANTIFYING IMPACTS OF WOOD FRAME RETROFIT





CONCLUSIONS

1. Catastrophe models have significantly advanced over the past twenty years
    - In response to new science
    - In response to significant worldwide cat events
2. Catastrophe models can educate various stakeholders on Southern California earthquake risk
    - Through standard outputs (spatially, probabilistically)
3. Models can be used to explore risk mitigation strategies
    - By changing modeling assumptions (exposure, vulnerability, financial)

THANK YOU