Fault Displacement Modeling &
Data Needs for Displacement Hazard Maps

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Start from: Approach and models in Petersen et al. (2011, BSSA)

Supported by: CGS, PEER, USGS, SCEC
Continuing support: UCLA collaboration via CEC, CGS, USGS, CalTrans, SCEC
Model Improvements & New Modeling Ideas Using FDHI Database

\[ \lambda(D \geq D_0)_{xyz} = \alpha(m_0) \int_{m,s} f_{M,S}(m,s) P[sr \neq 0|m] \int_{r} P[D \neq 0|z,r,sr \neq 0] P[D \geq D_0|l/L,m,D \neq 0] f_R(r) \, dr \, dm \, ds \]

Re-evaluate component models (field-based measurements):
- Can we improve existing models or shall we model data differently?
- Displacement models \((P[D \geq D_0|l/L,m,D \neq 0])\)
- Rupture probability \((P[D \neq 0|z,r,sr \neq 0])\)

How to use pixel-based deformation data?
- Probabilistic strain analysis (Chris), or
- Total displacement + zone width, or
- Shapes of strain or displacement profiles across fault?

New database on-fault data vs. Petersen et al. (2011 BSSA) bilinear model
Data Needs for Probabilistic Displacement Hazard Maps

Uncertainty in location of surface rupture for future events, $f_R(r)$

- **Epistemic uncertainty:**
  - Depends on the fault map used in PFDHA

- **Aleatory variability:**
  - Paleoseismic studies (trenches with multi events)

Handling multiple branches

- Partition displacement (within event)
- Assign likelihood of rupture (between events)

Handling fault geometric details (bends, vertices)

- Level of detail depends on application
- Rely on GIS (polyline-based) for mapping?

(Chen and Petersen, 2011, Earthquake Spectra)