

# *Generating Long RSQSim Catalogs for CISM Analysis*

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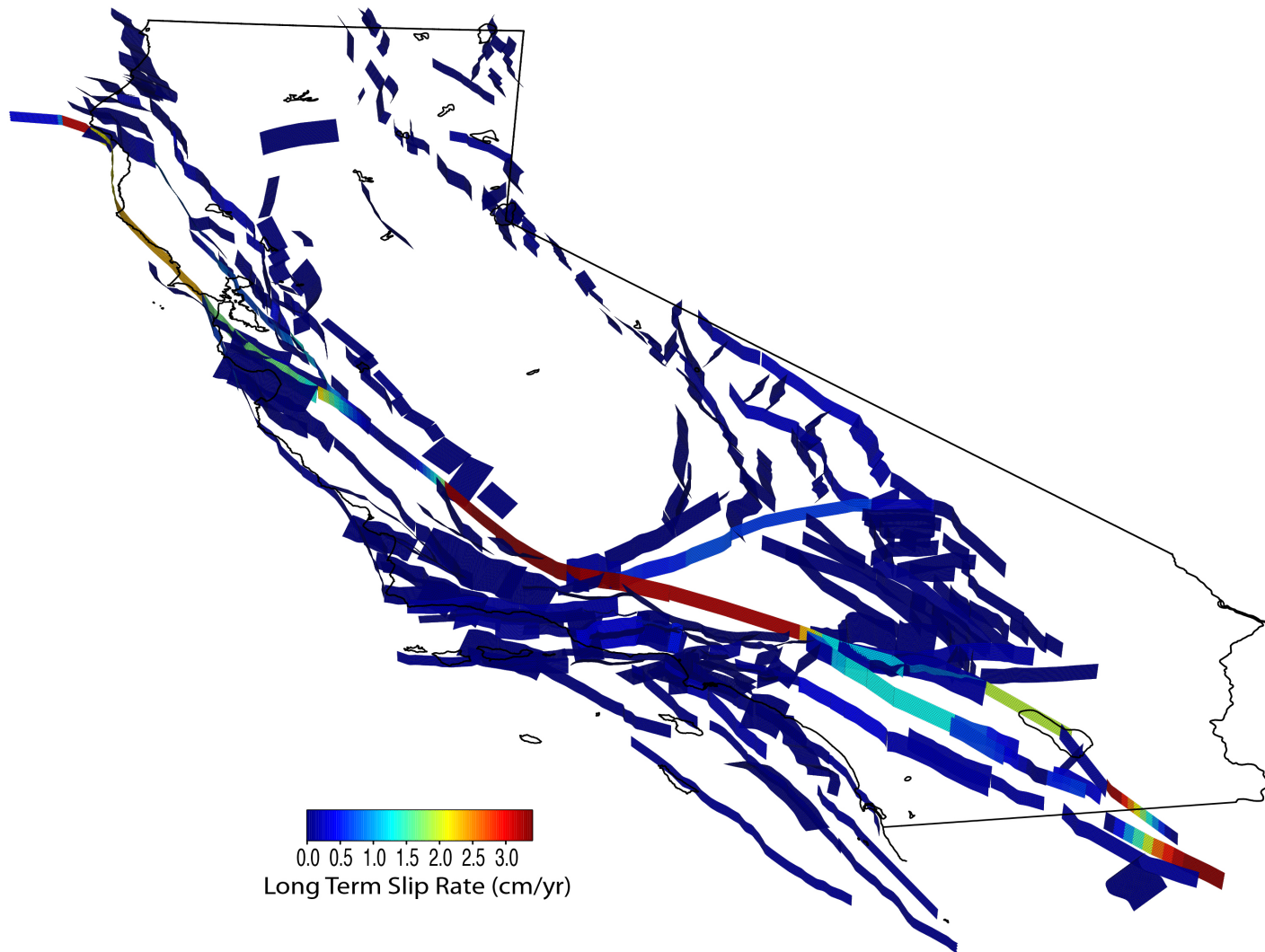
## *Main Objective*

- **Develop a physics-based forecasting model for earthquake rupture in California**
  - **Produce a suite of catalogs (~50) to investigate the epistemic uncertainty in the physical parameters used in the simulations.**
    - **One million years of simulated time**
    - **Several million M4-M8 events**
    - **Varied simulation parameters and fault models**
  - **The UCERF3 data set is used for calibration, and cross-validation of the model, as well as specification of fault geometry.**

# *Simulation Parameters*

- **Rate- and State-friction Parameters**
  - $a$ ,  $b$ , and  $D_c$  (rate and state coefficients, and the critical slip distance).
- **Other Model Parameters**
  - $\tau$  and  $\sigma$  (shear and normal stresses)
  - Earthquake slip rate
- **Adding heterogeneity of parameters and/or fault structure**
  - Vary  $a$ ,  $b$  and  $\sigma$  with depth
  - Heterogeneous  $\sigma$  (using a vonKarman correlated random field)
  - Fractal segmentation of the fault model
  - Adding deep creeping segments

# *Calibration: Long-term Slip Rates*

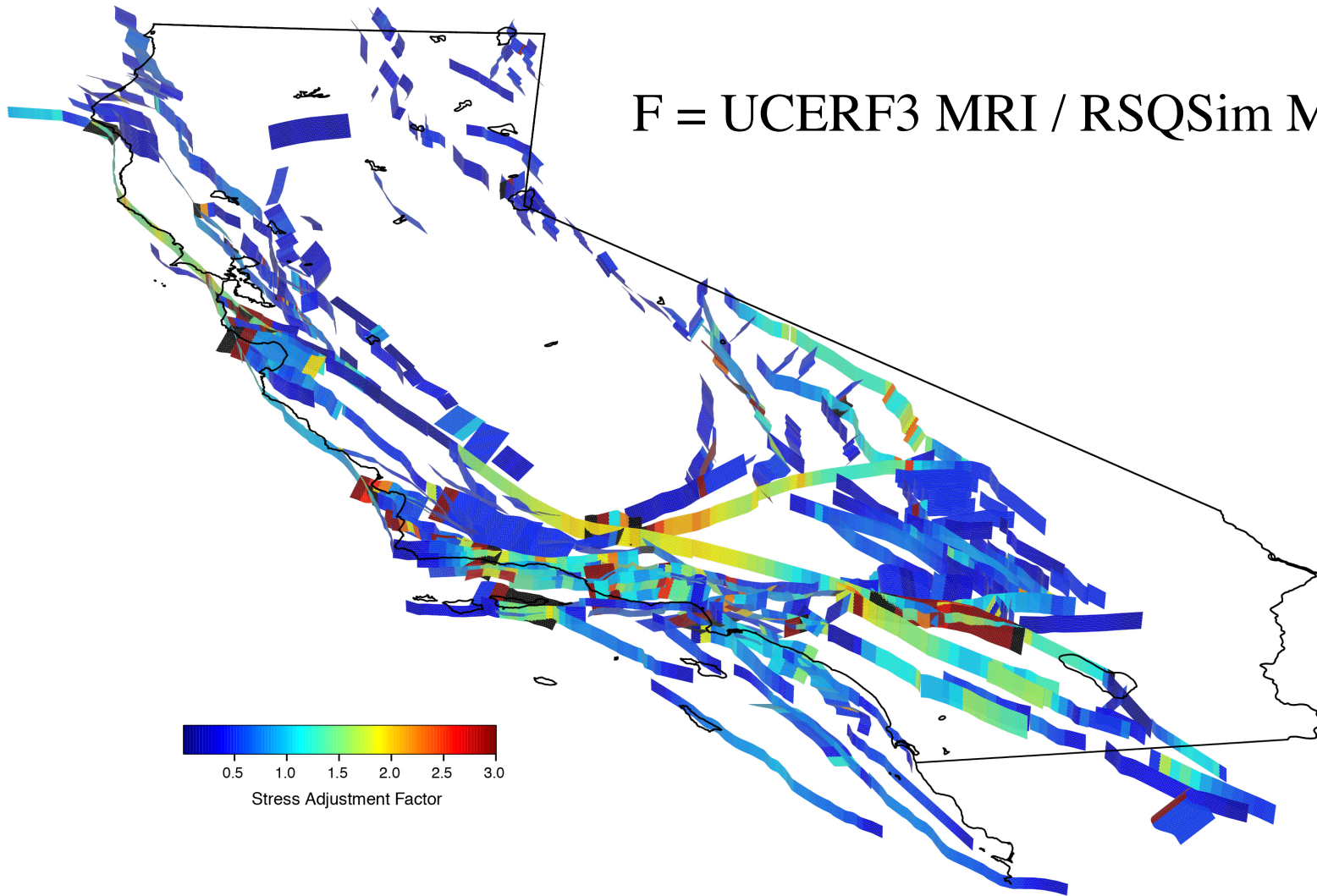


# *Calibration: Mean Recurrence Intervals*

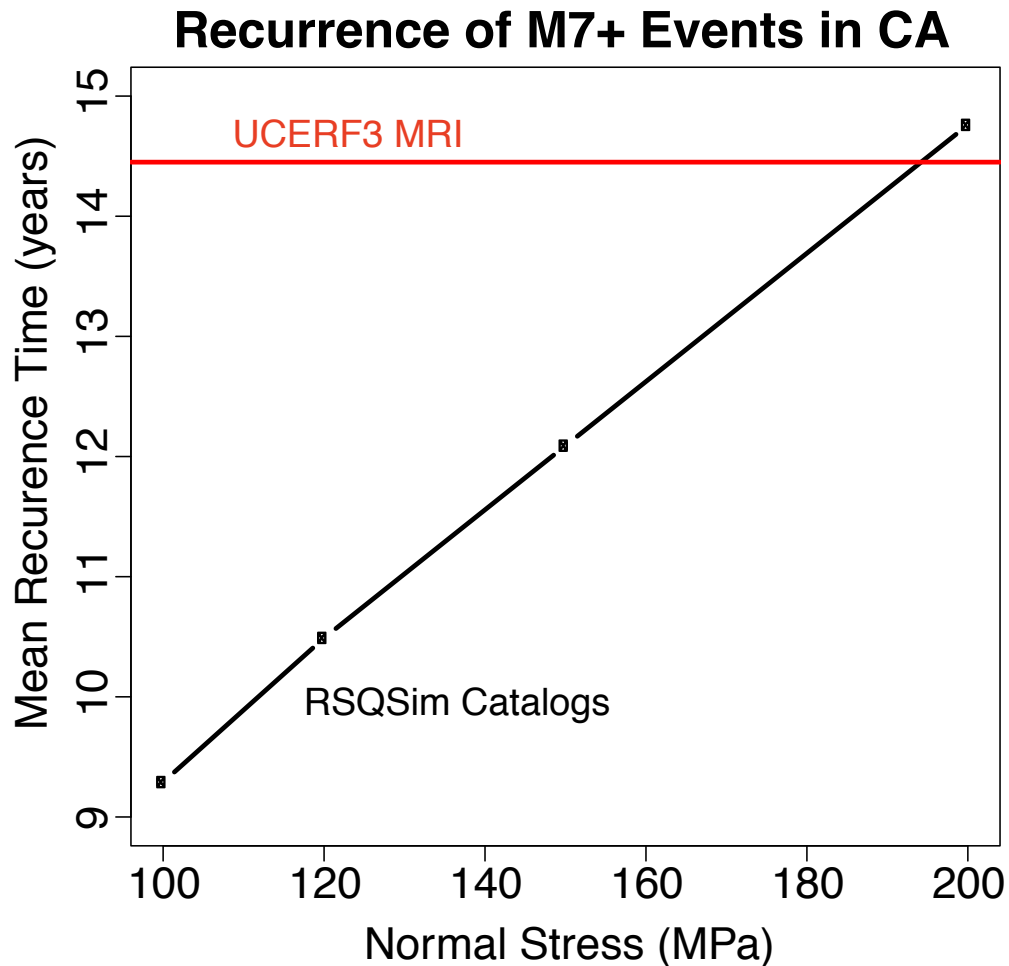
- **MRI's are calibrated by making adjustments to the normal stress.**
  - **Paleoseismic MRI's from UCERF3 data set**
  - **UCERF3 subsection MRI's**
    - **Different UCERF3 branches**
    - **Different magnitude ranges or subsets of events (superseismogenic)**

# *Calibration: Mean Recurrence Intervals*

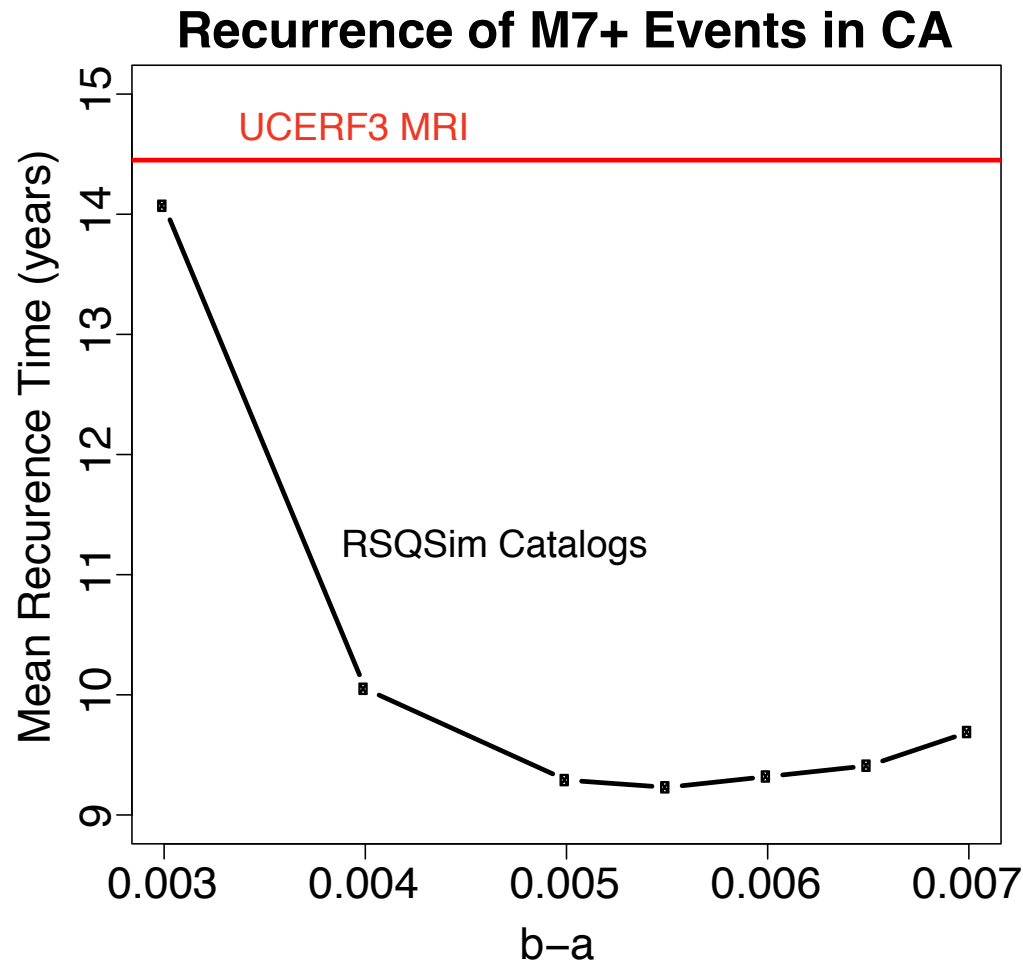
$$F = \text{UCERF3 MRI} / \text{RSQSim MRI}$$



# *Sensitivity to Normal Stress*



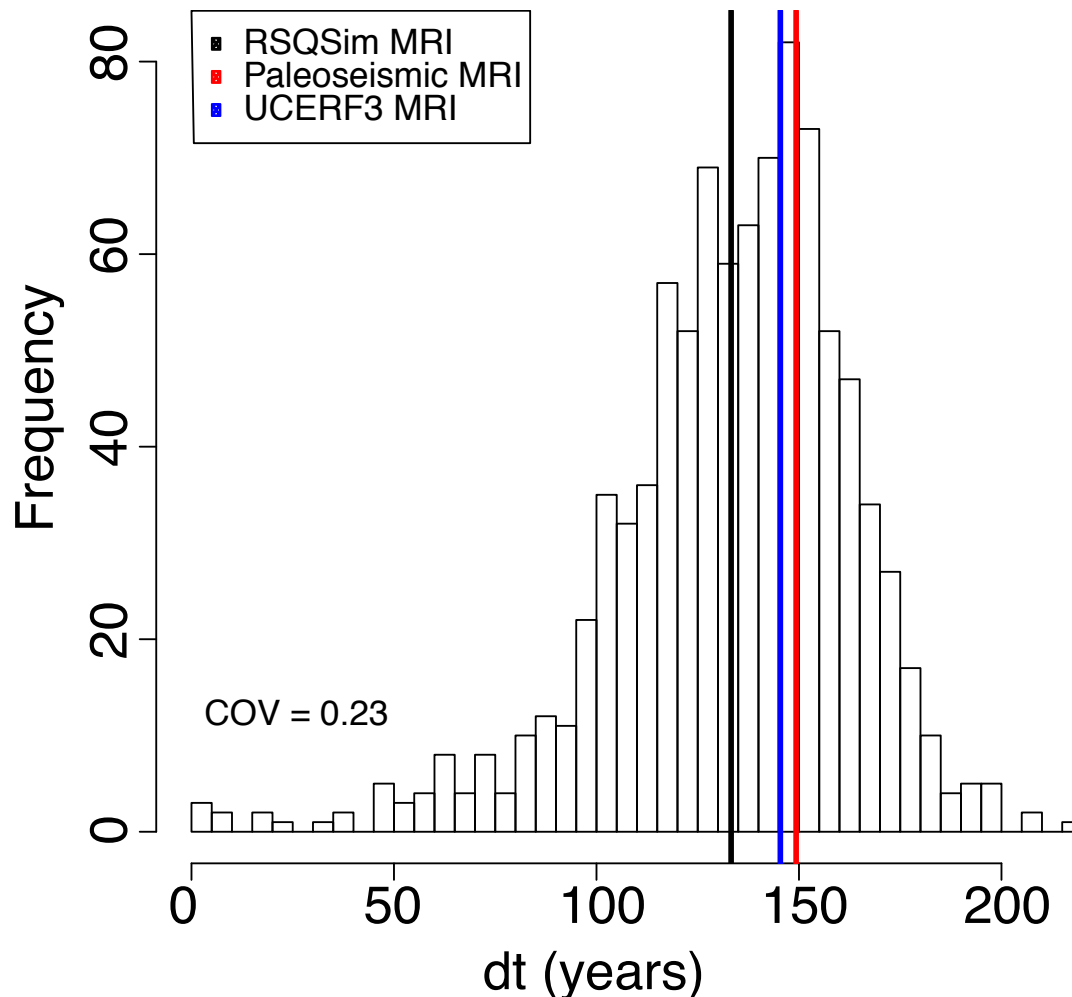
# *Sensitivity to Constitutive Parameters*





# Result From One MRI Calibration Round

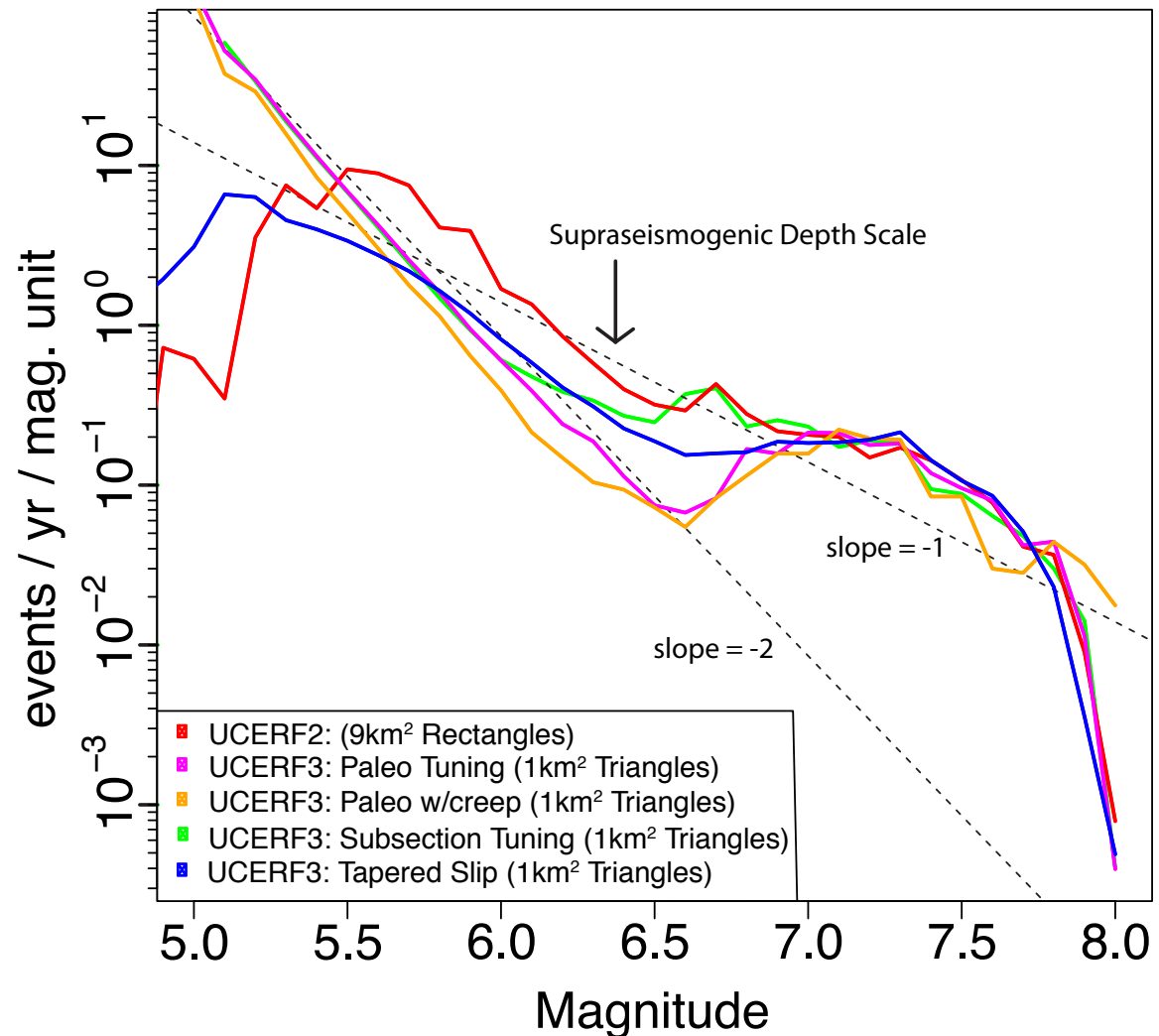
## Recurrence Time Distribution: SSAF– Mojave (subsection 9)



# Magnitude Frequency Distributions

## MFD Comparison for U2 & U3 RSQSim Catalogs

- High b-values
- characteristic bulge



*Thank you!*

# *Catalog Metrics*

- **Magnitude Frequency Distribution**
  - Whole- system
  - Region and fault-specific
- **Scaling Relations**
  - Magnitude-Area
  - Slip-Area
  - Stress drop-Magnitude
- **Rupture Speed**
- **Recurrence time distributions**
  - Mean recurrence intervals for specific sites/faults/subsections

# *Progress*

- **Tested RSQSim on Blue Waters**
- **Developed new calibration methods and tests**
- **Determined a set of parameters for the suite of million-year simulations**
- **Run a mini-parameter sweep (with the help of the interns)**