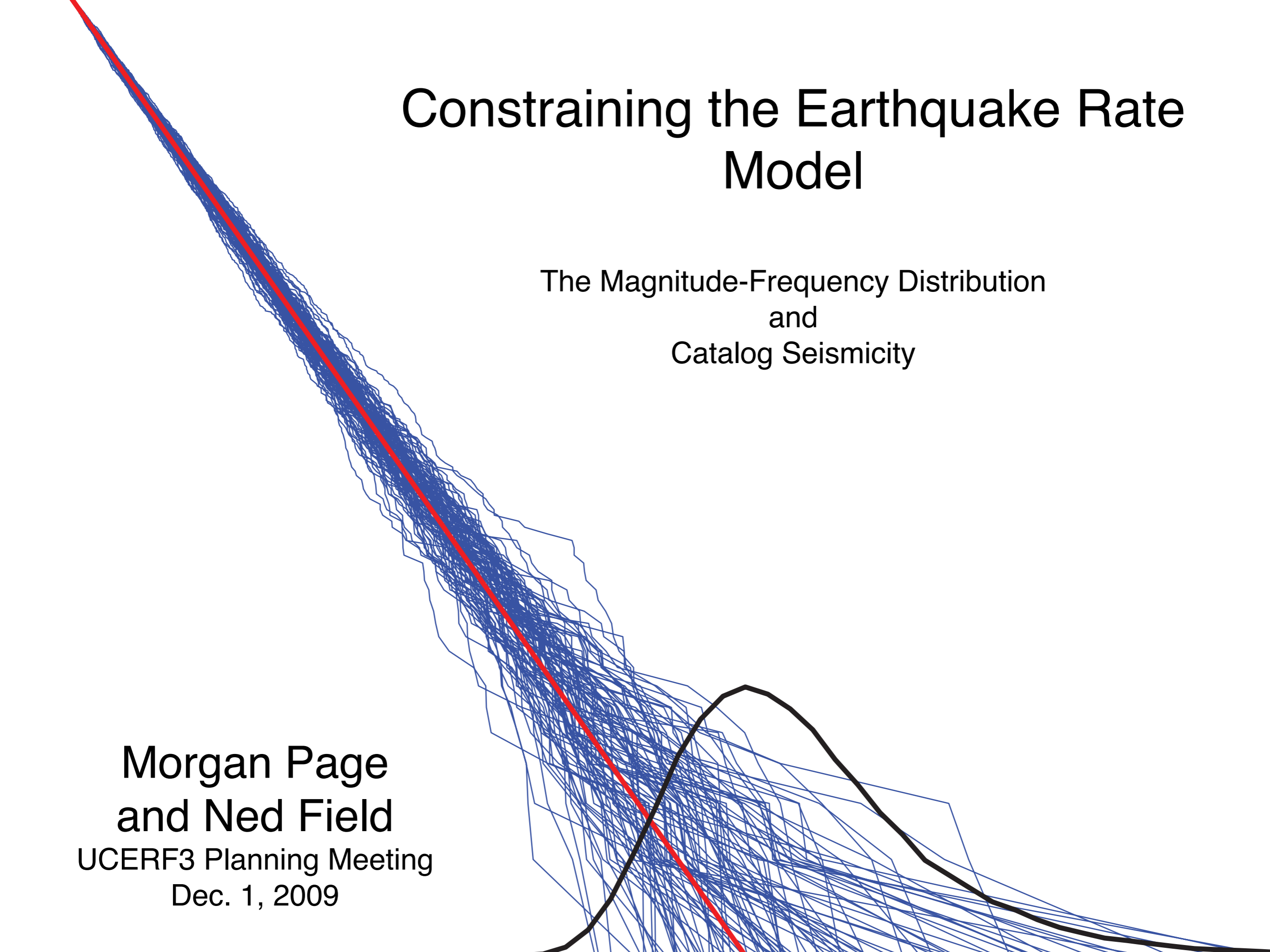


Constraining the Earthquake Rate Model

The Magnitude-Frequency Distribution
and
Catalog Seismicity

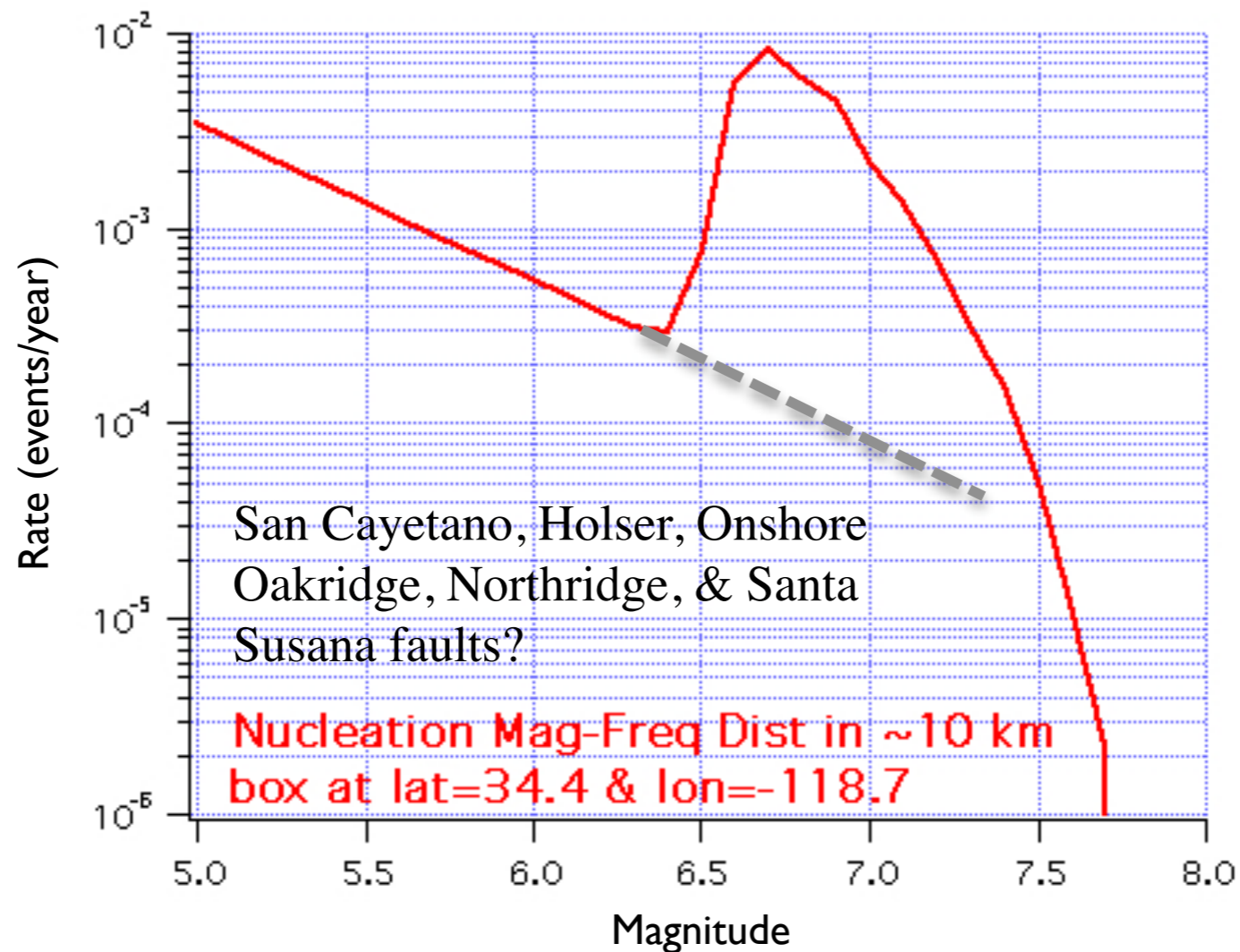
Morgan Page
and Ned Field
UCERF3 Planning Meeting
Dec. 1, 2009



Regularization of long-term model with magnitude-distribution information

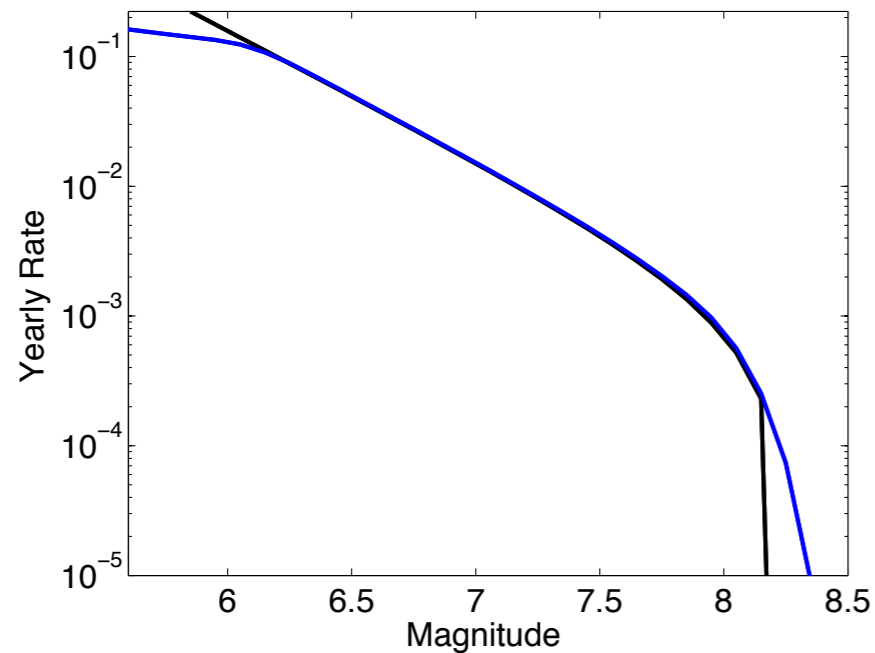
Incorporating instrumental catalog into model

UCERF2 contained regions with very strange looking magnitude-frequency distributions



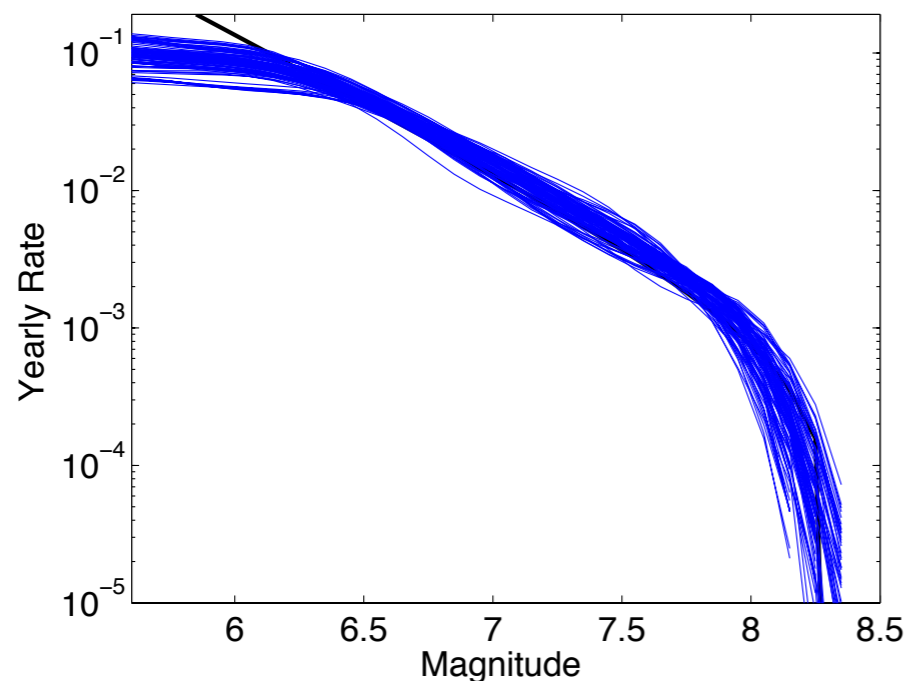
Magnitude Frequency Distributions using Generalized Inversion Approach

Cumulative Magnitude-Frequency Distribution



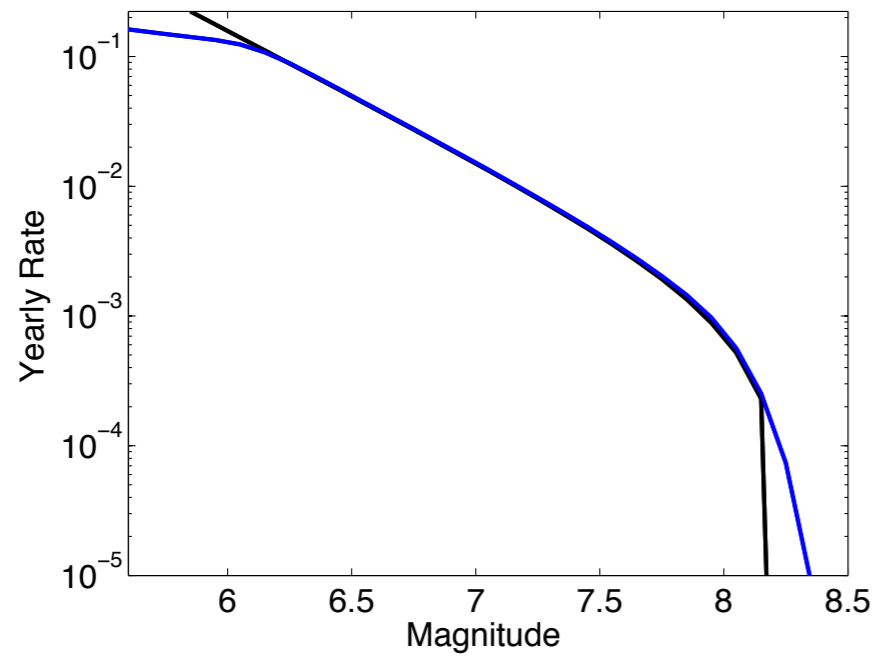
Solution can be constrained to be G-R (or any magnitude distribution)

Cumulative Magnitude-Frequency Distribution



Or the data can “choose” (no constraint)

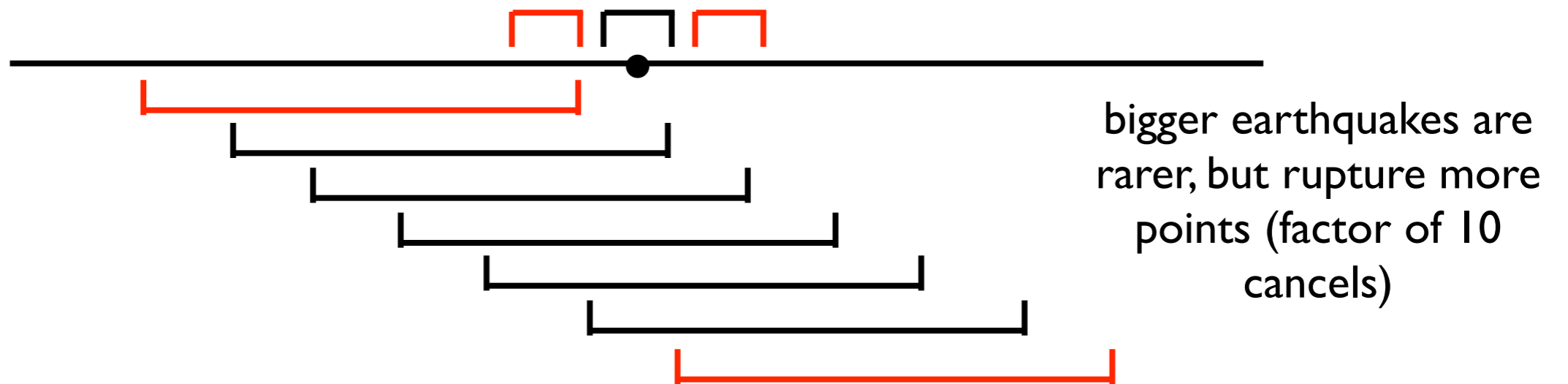
Cumulative Magnitude-Frequency Distribution



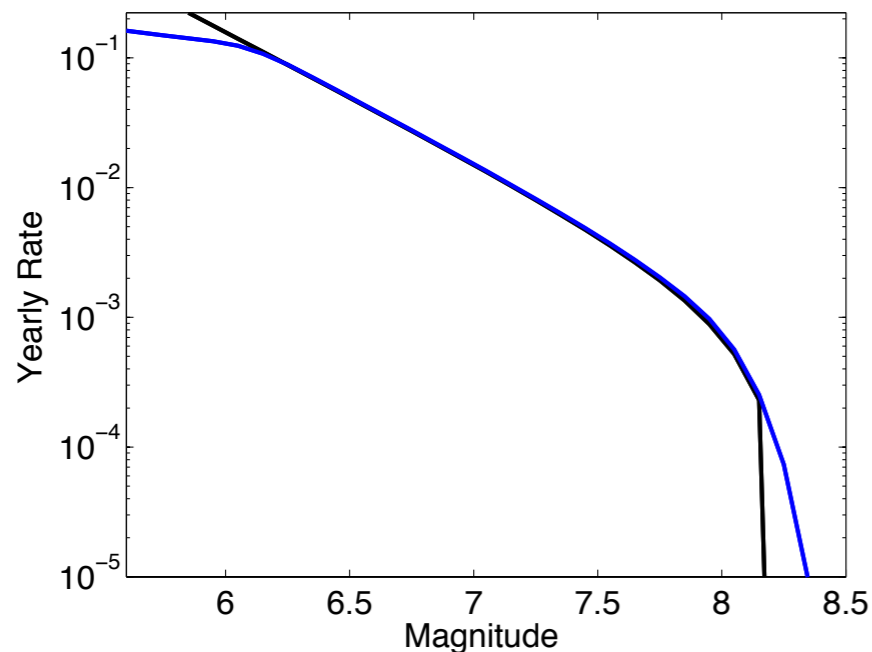
G-R constraint for the whole SSAF doesn't imply G-R nucleations at each point

In a G-R world...

If nucleations are G-R, and uniformly distributed along fault segment, then each point participates in a uniform distribution of magnitudes.

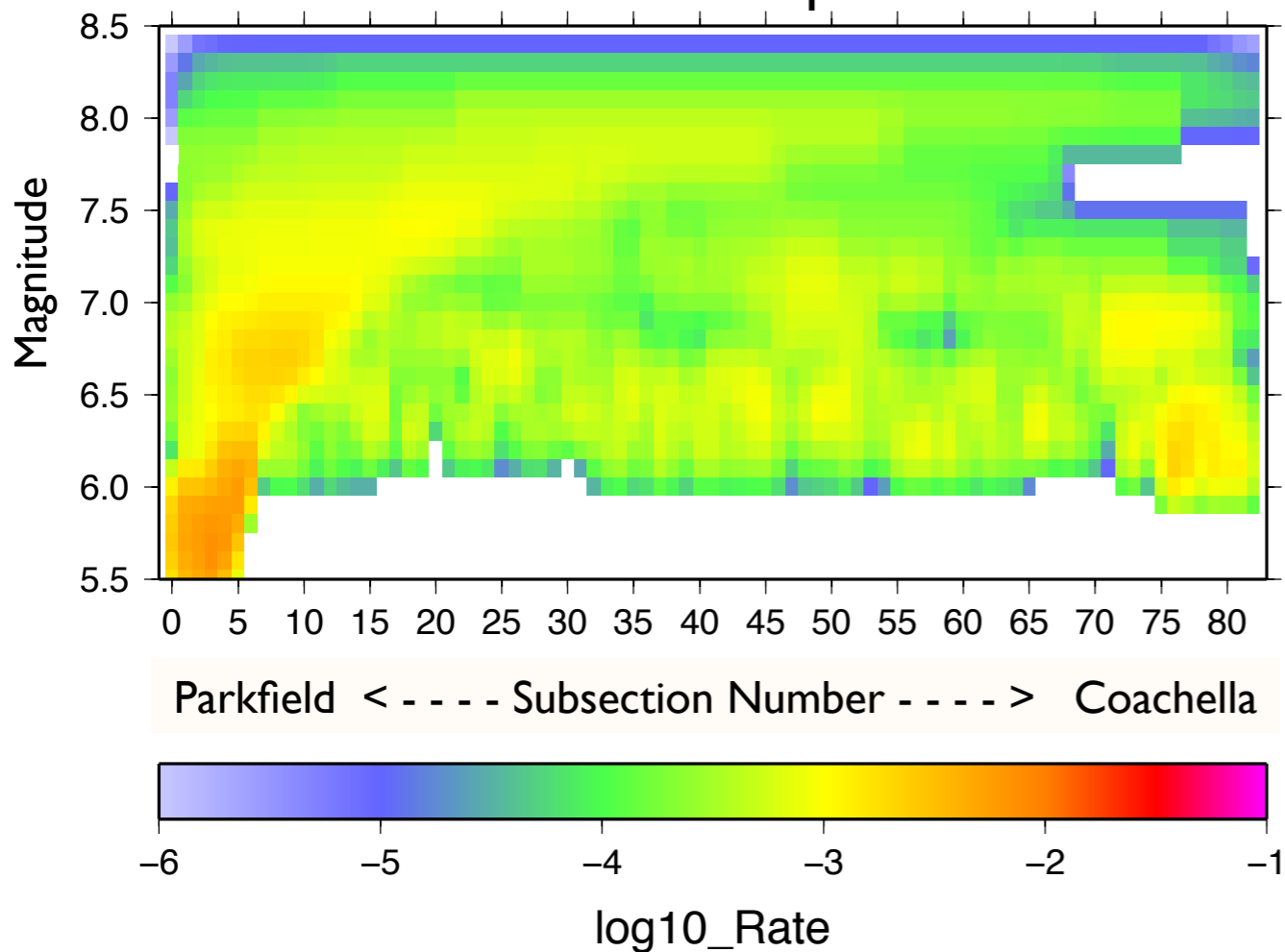


Cumulative Magnitude-Frequency Distribution



G-R constraint for the whole SSAF doesn't imply G-R nucleations at each point

Incremental Participation Rate



But we can add a stronger (nonlinear) constraint: that every fault section has G-R nucleations

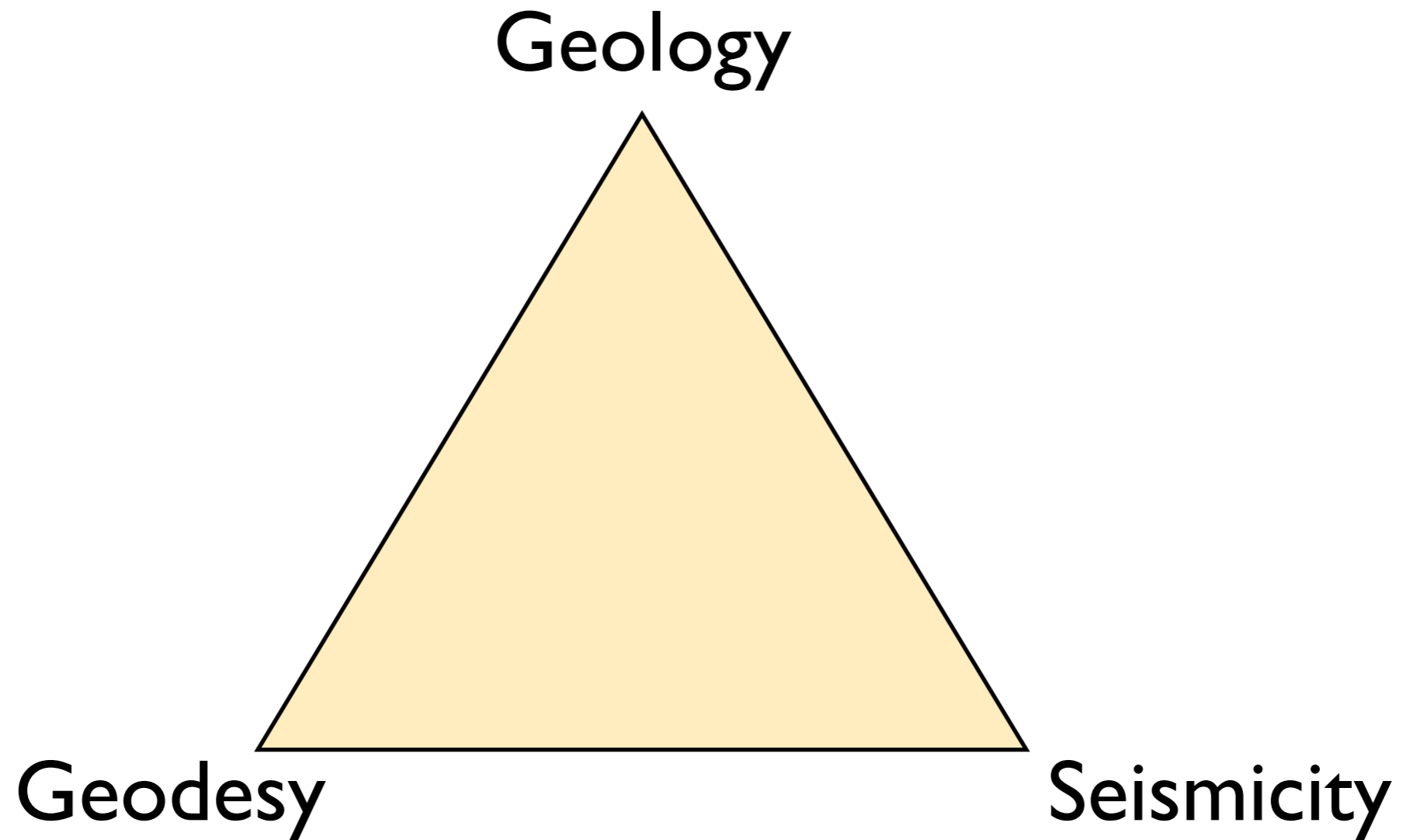
(constrain participation probability to be uniform)

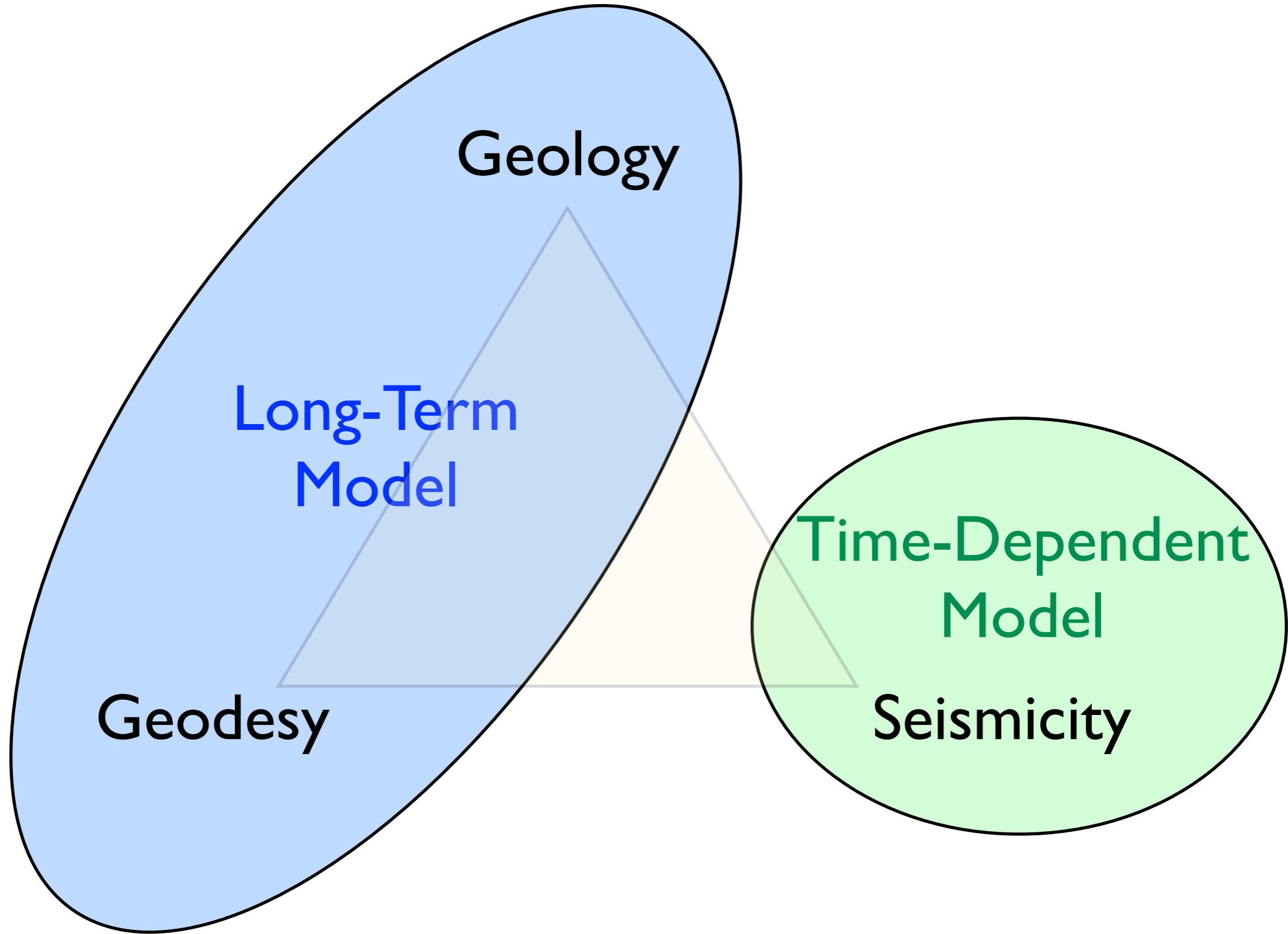
Regularization of long-term model with magnitude-distribution information

Easy to incorporate G-R everywhere, if we think it is a viable model

Incorporating instrumental catalog into model

Holy Triumvirate of PSHA





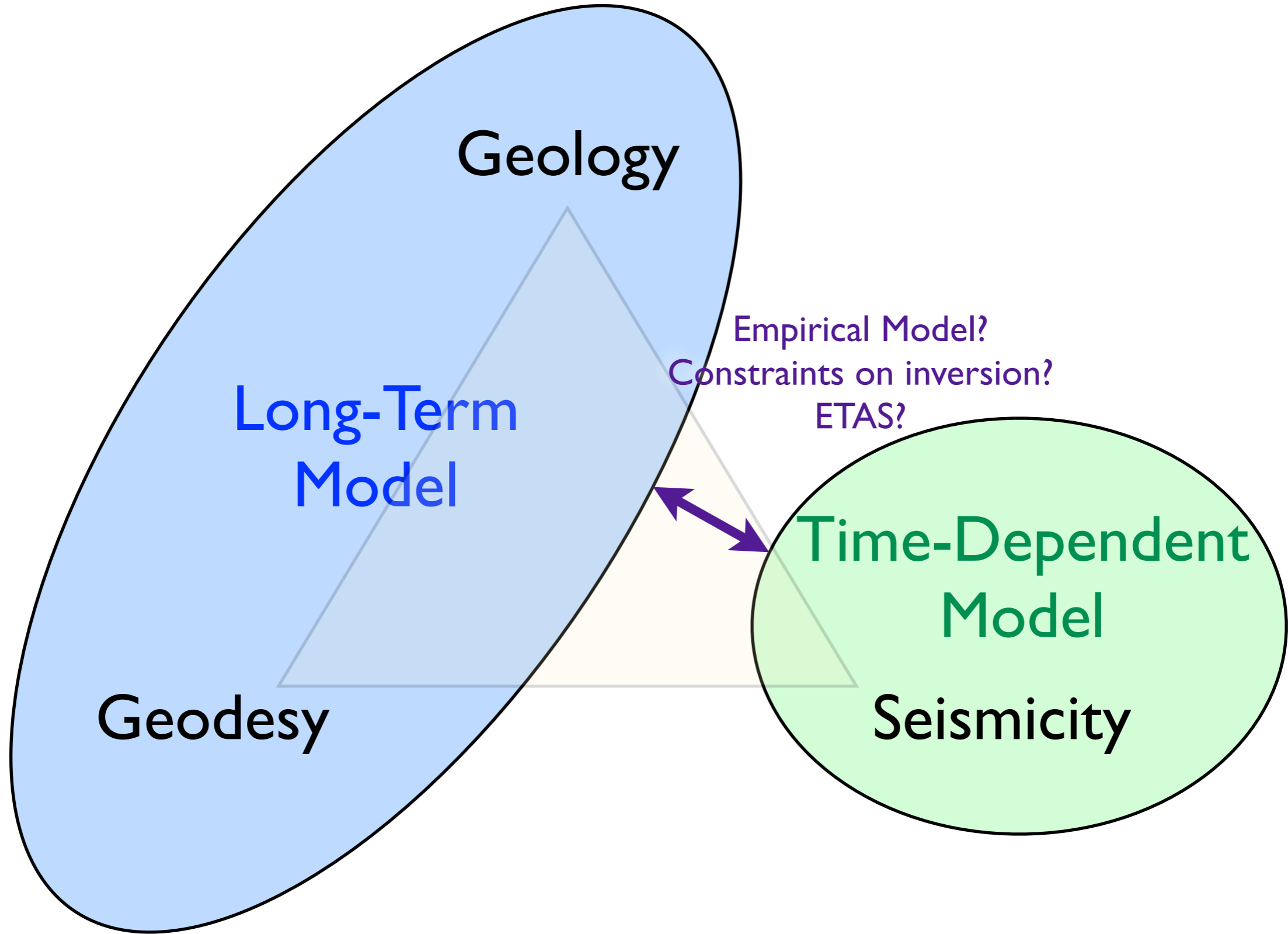
Geology

Long-Term
Model

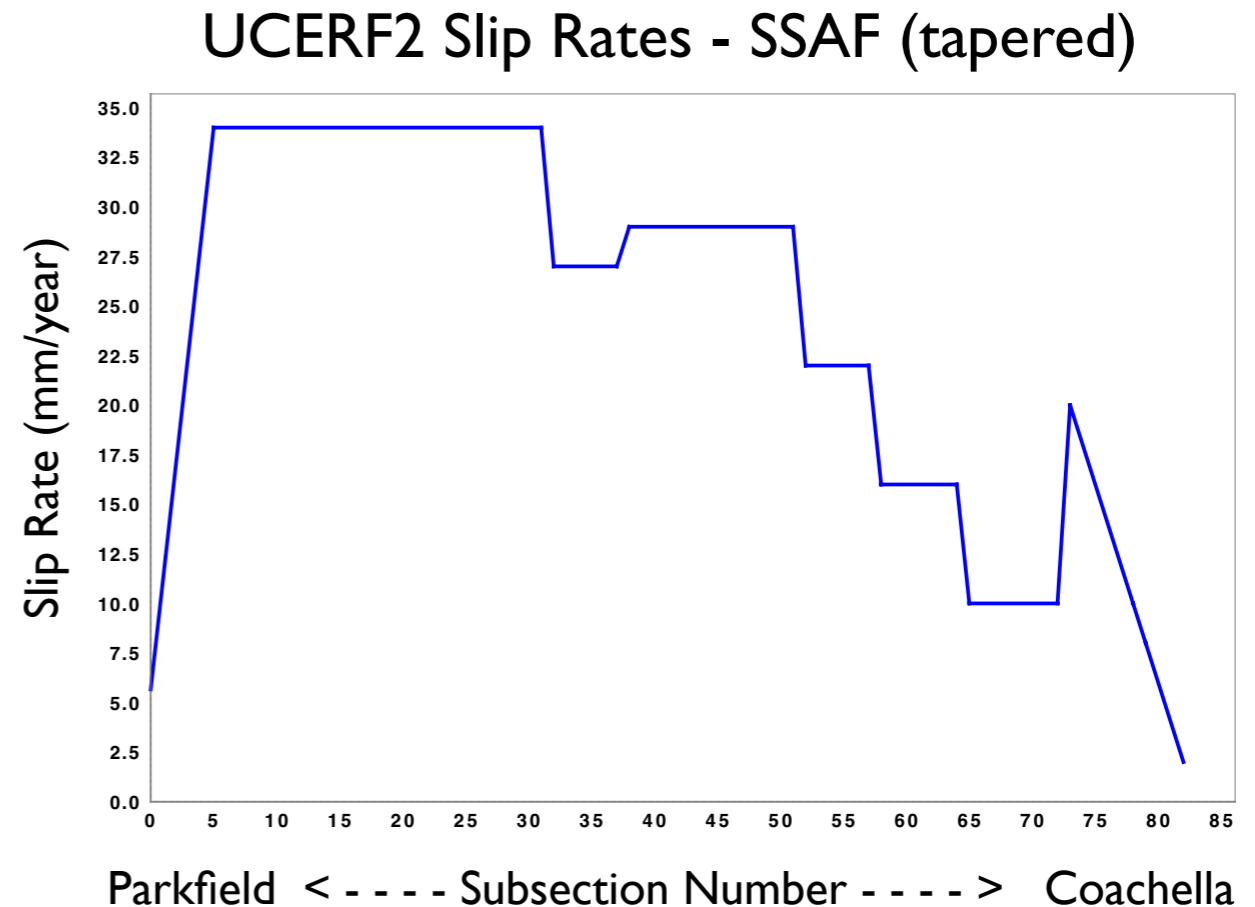
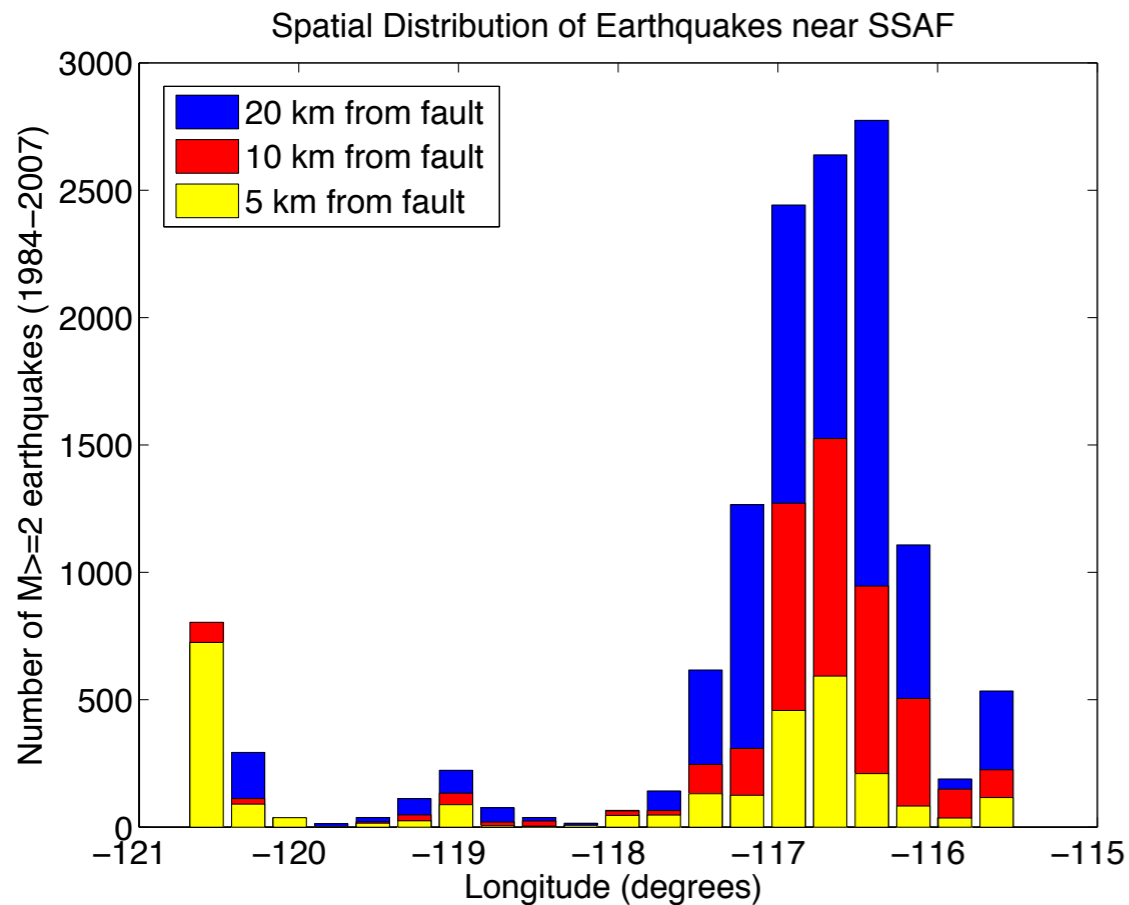
Geodesy

Time-Dependent
Model

Seismicity

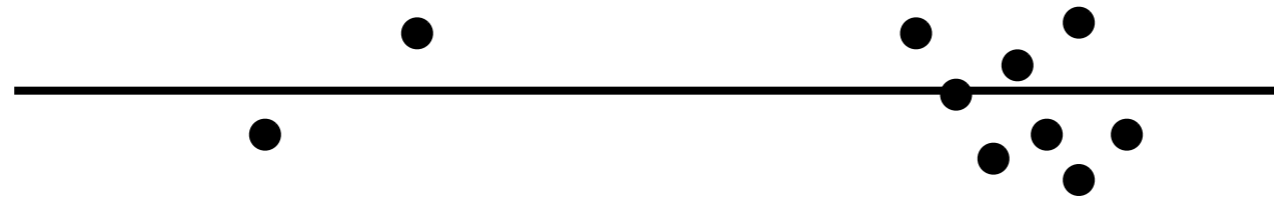


The instrumental catalog and the long-term slip rates are very different...

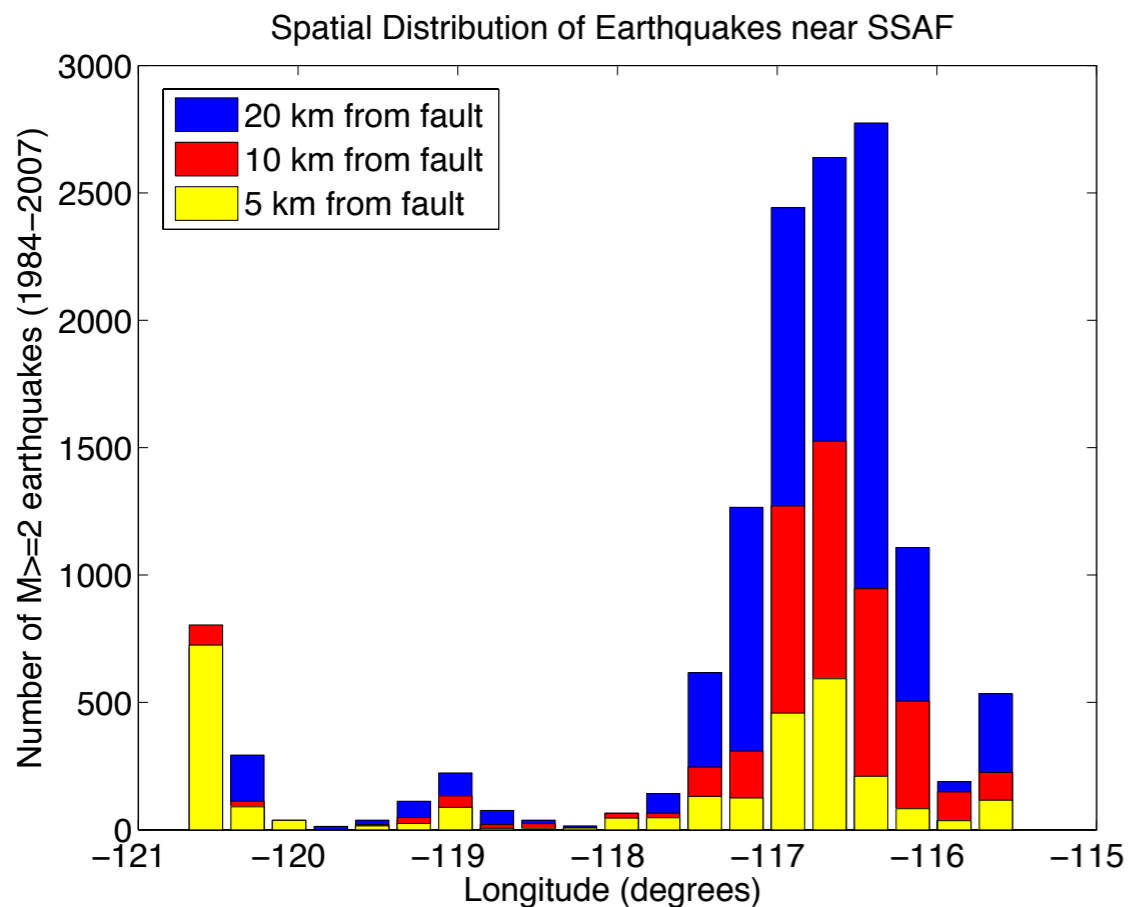


as they should be, since they describe different time scales.

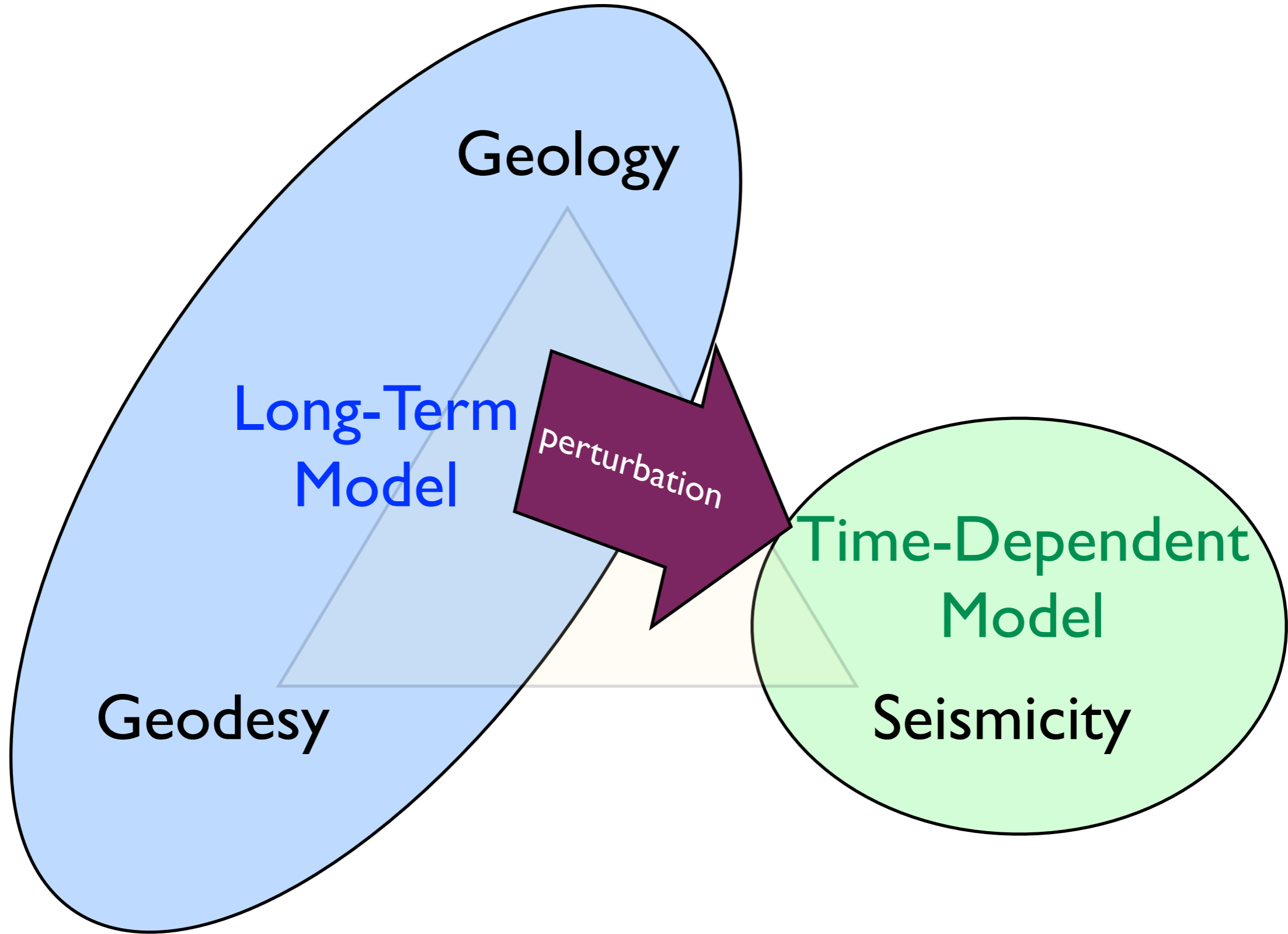
We have to be careful...



Assuming spatially uniform nucleation probabilities leads to weird triggering behavior



The catalog can be used to constrain (next-event) nucleation probabilities, assuming G-R nucleations (*the inversion does not solve for hypocenters*)



Geology

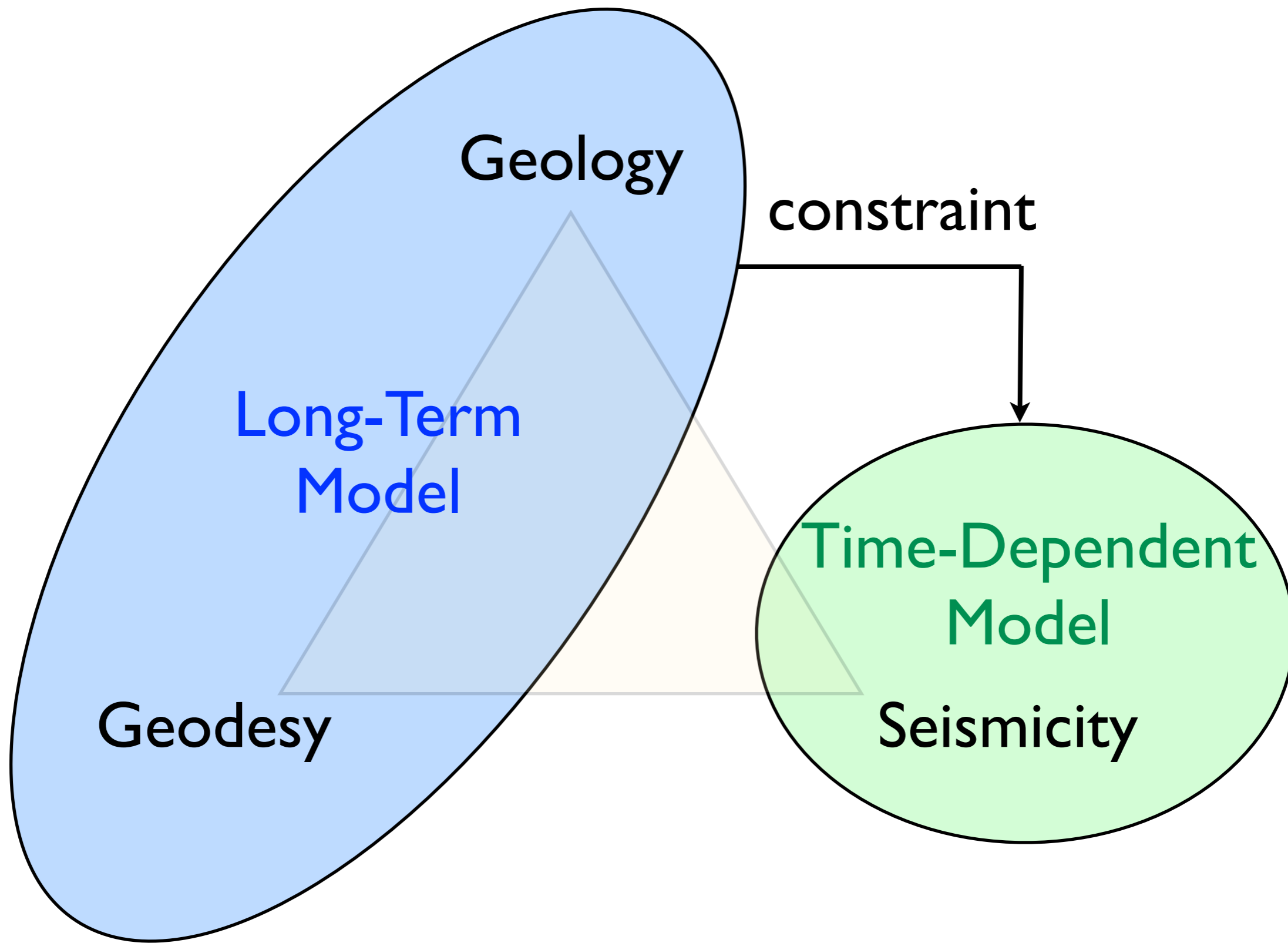
Long-Term Model

Geodesy

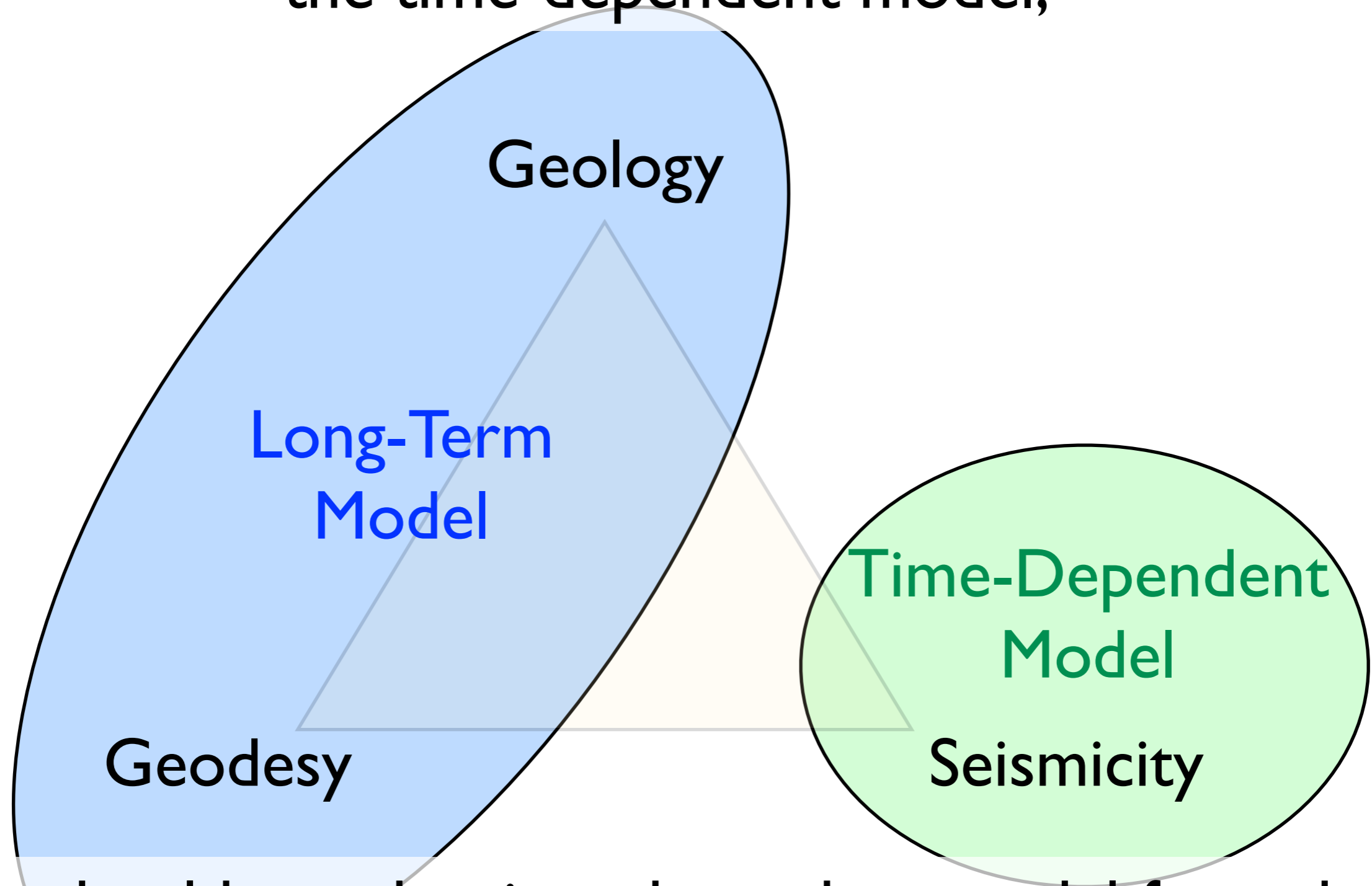
perturbation

Time-Dependent Model

Seismicity



Rather than perturbing the long-term model to give us the time-dependent model,



we should run the time-dependent model from the seismicity, and use the long-term model to constrain its long-term average behavior.