Foreshock-Centric Short-Term Earthquake Hazard Forecasts

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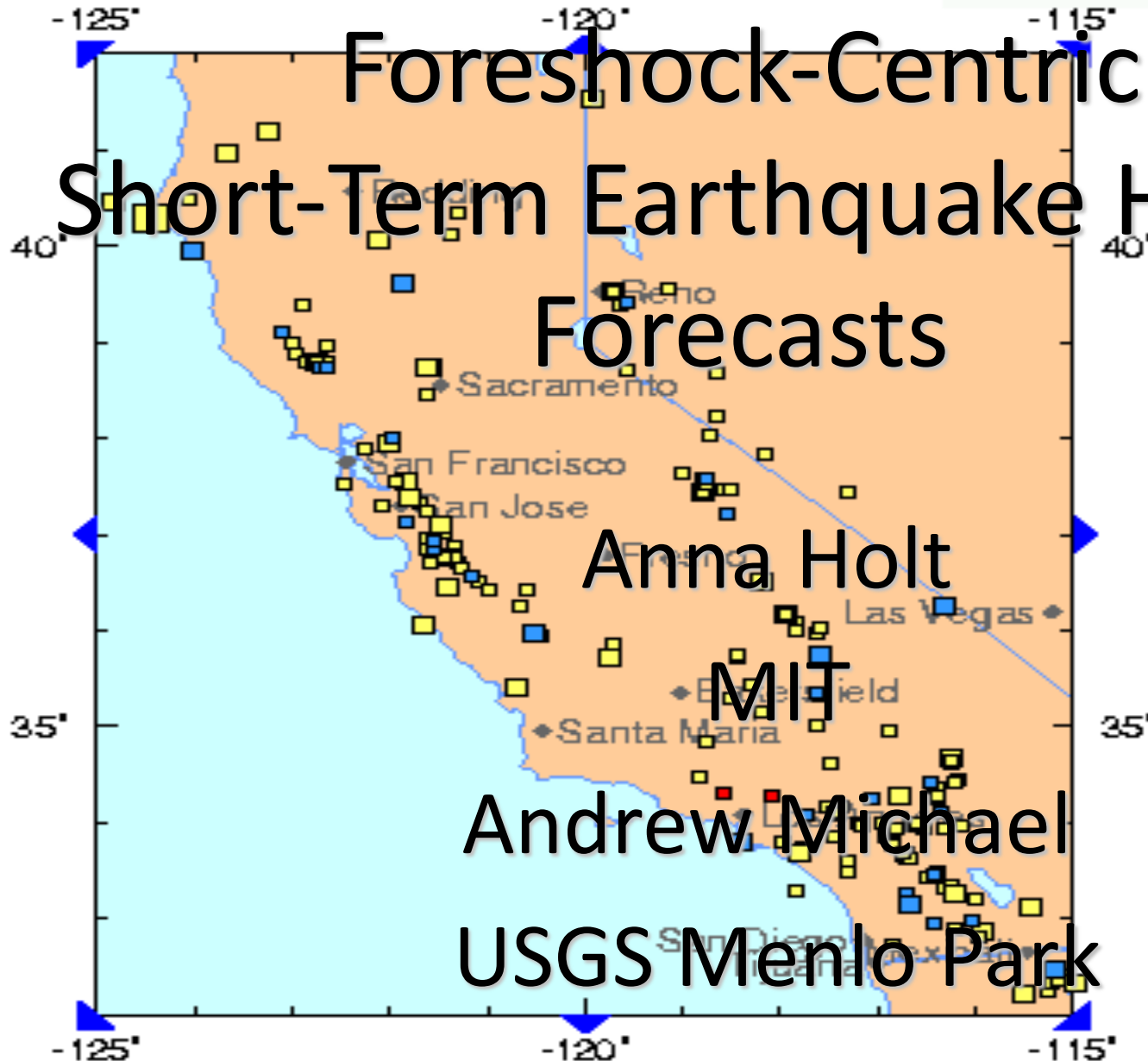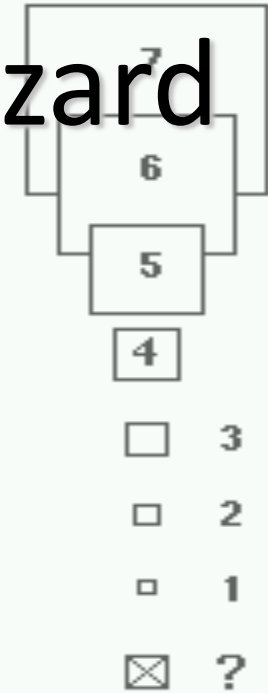
A Little About Me

I will be a sophomore at MIT in the fall

When I was in first grade I told everyone I was going to go to MIT and study earthquakes!

I'm from Kansas…never felt one but keep hoping ;-)

Outside of class I :

volunteer at the Paul Revere House

Am on MIT's Panhellenic Council

Enter Iron Chef Competitions

Debate Foreign Policy with Anyone Who Will Listen to Me

Treatment of Foreshocks

- Are we comparing apples to apples or apples to oranges?

Are foreshocks mainshocks with larger-than-normal aftershocks?

Or are they different from mainshocks?

Useful to treat them as separate type of event

Agnew-Jones in Theory

(Zero Dimensional Model)

P(C)=Probability of a characteristic earthquake

P(B)=Probability of a background earthquake

P(F)=Probability of foreshock

$$P(C \mid F \cup B) = P(F)/P(F)+P(B)$$

Agnew Jones in Application

Inputs:

P(C) = Probability of the characteristic mainshock at a given time.

P(B) = Probability of a background earthquake

P(FIC) = Probability of a foreshock, given a characteristic mainshock

Compute:

P(CIF∪B) = Probability of a characteristic mainshock given an event that may be either a foreshock or background event.

$$P(C \mid F \cup B) = \frac{P(F)}{P(F) + P(B)}$$

$$P(F) = P(F \mid C)P(C)$$

$$P(C \mid F \cup B) = \frac{P(F \mid C)P(C)}{P(F \mid C)P(C) + P(B)}$$

The Problems

Mainshock-Centric Calculation

Different Faults= Different Background Rates!
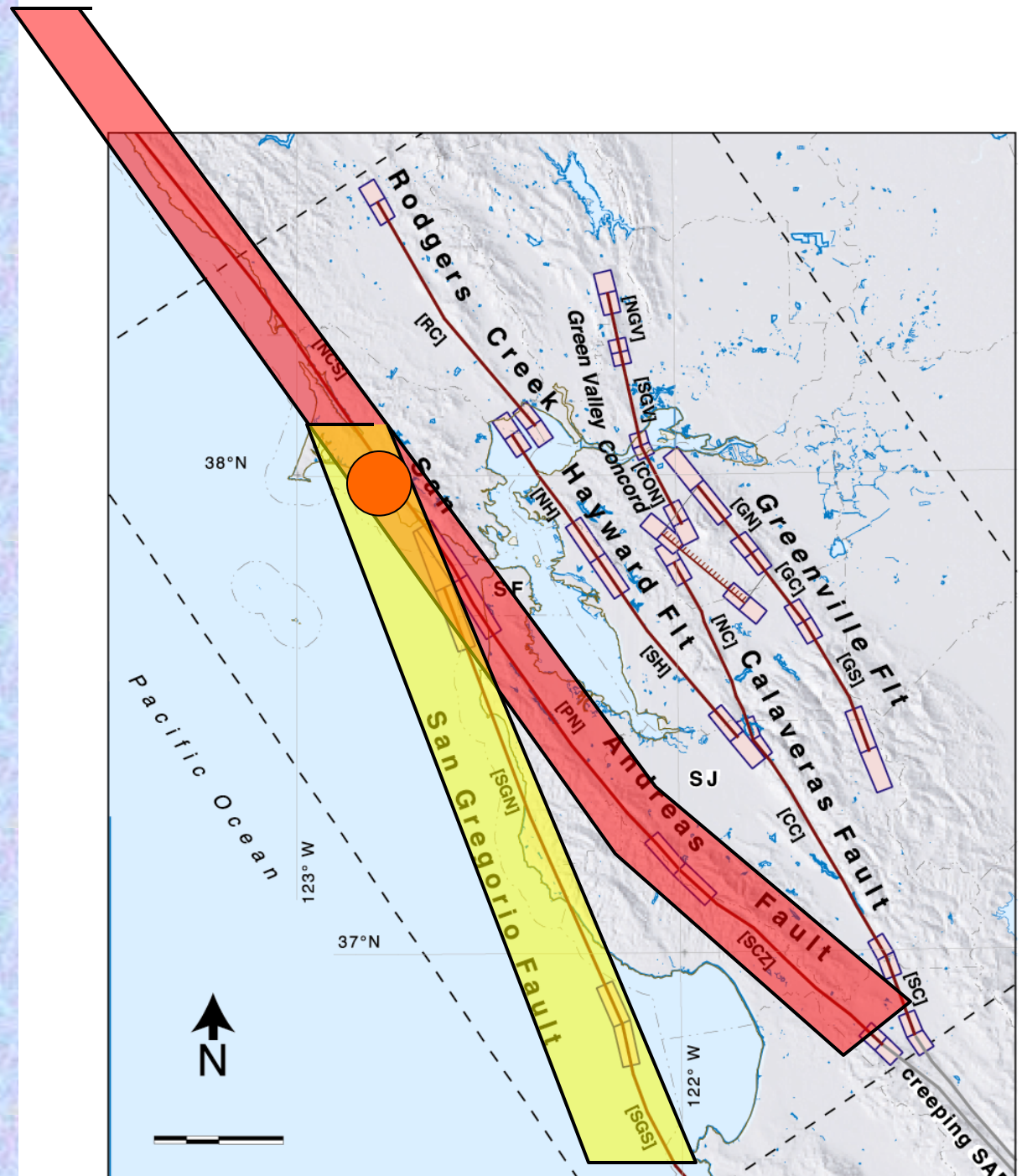
Different Mainshock Probabilities!

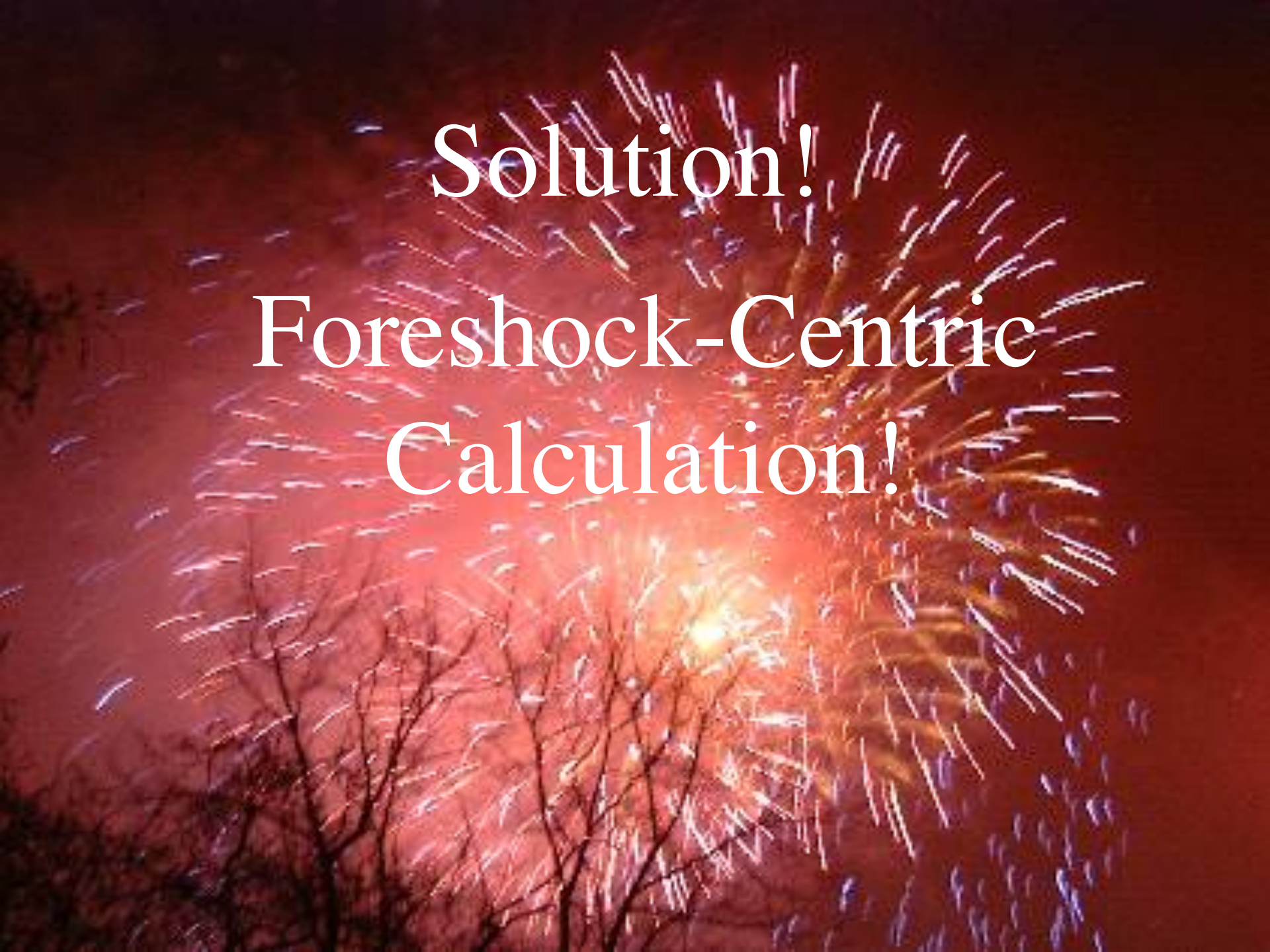Not always know what mainshock most likely

Which Mainshock?

Different faults have
- Different background rates
- Different mainshock probabilities
- Different resulting probabilities.
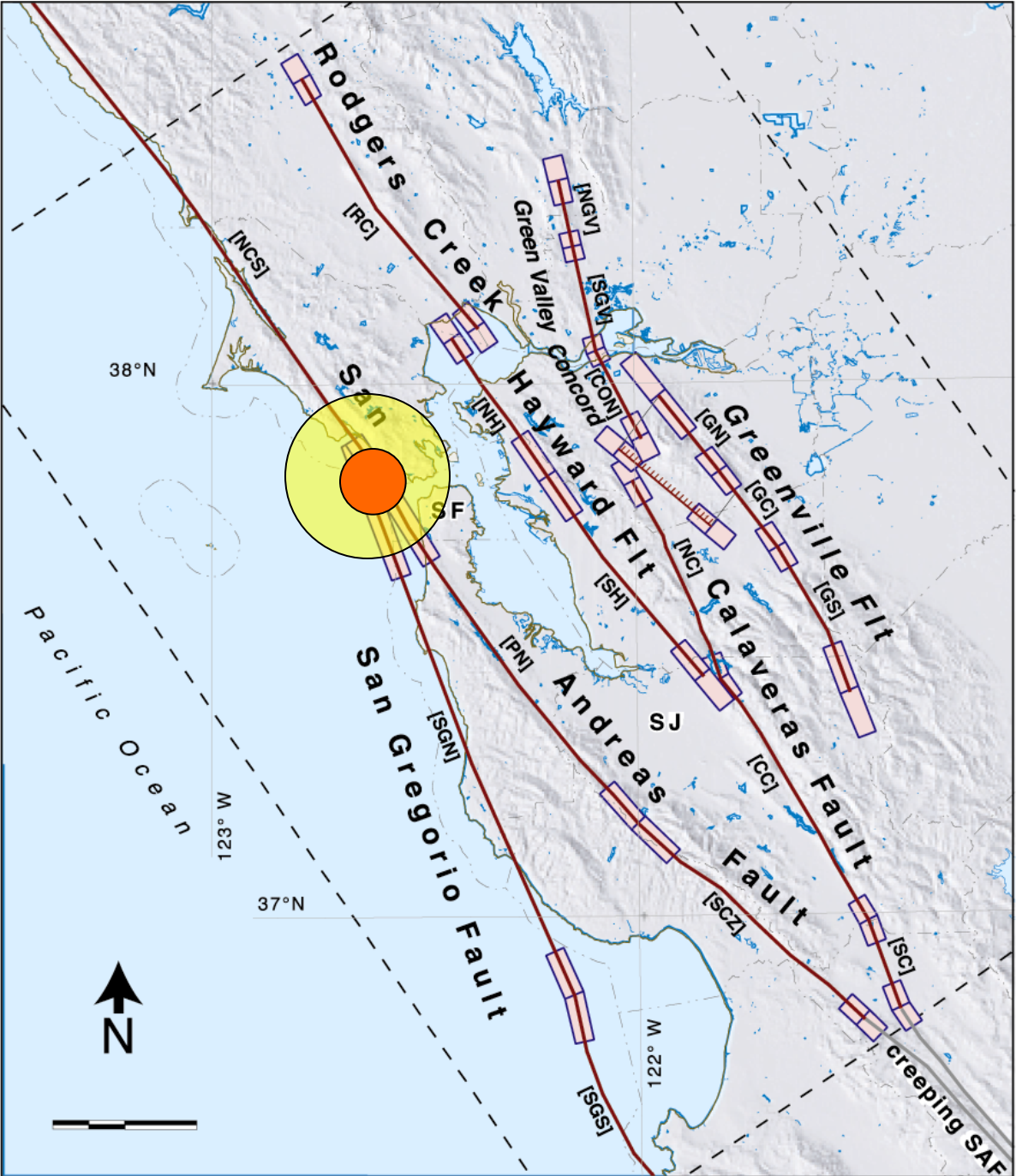
Problem: Mainshock Centric Calculation!

Solution!

Foreshock-Centric Calculation!

More limited than just occurring near the mainshock rupture.

Foreshock-Centric Calculations: A How-To

Integrate Background Event Probability around Foreshock Hypocenter

Integrate Mainshock Nucleation probability

Use Some Standard Observations/Laws

Current Status

Program: Completed!!!!

Historical Test of Accuracy: In Progress