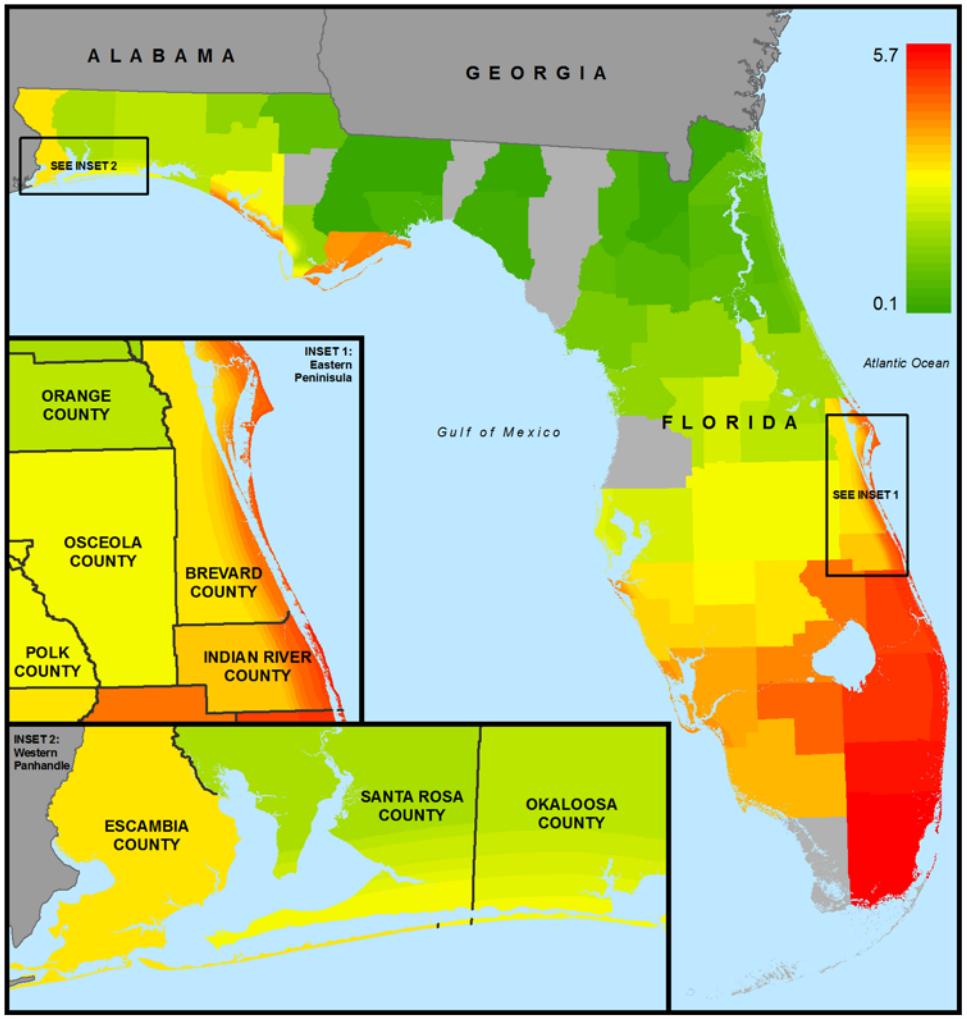
Modern Hurricane Ratemaking:
Pricing at the Location Level



Severe Weather Workshop
2013 CAS Ratemaking and Product Management Seminar
Huntington Beach, California
March 11, 2012

Matt Chamberlain, FCAS, MAAA
Actuary
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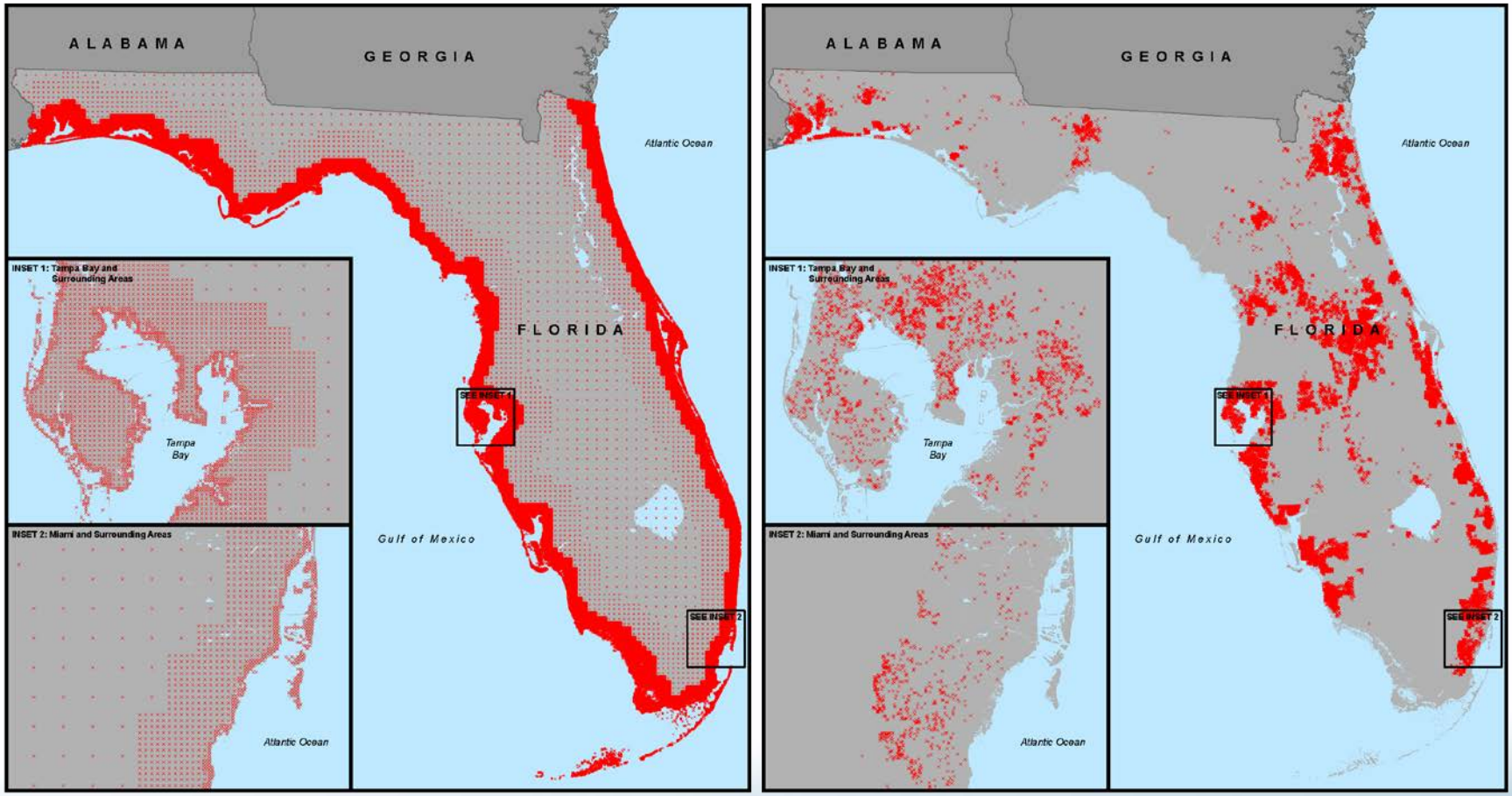
Notional Book Variable Resolution Grid Compared with Pseudobook Locations



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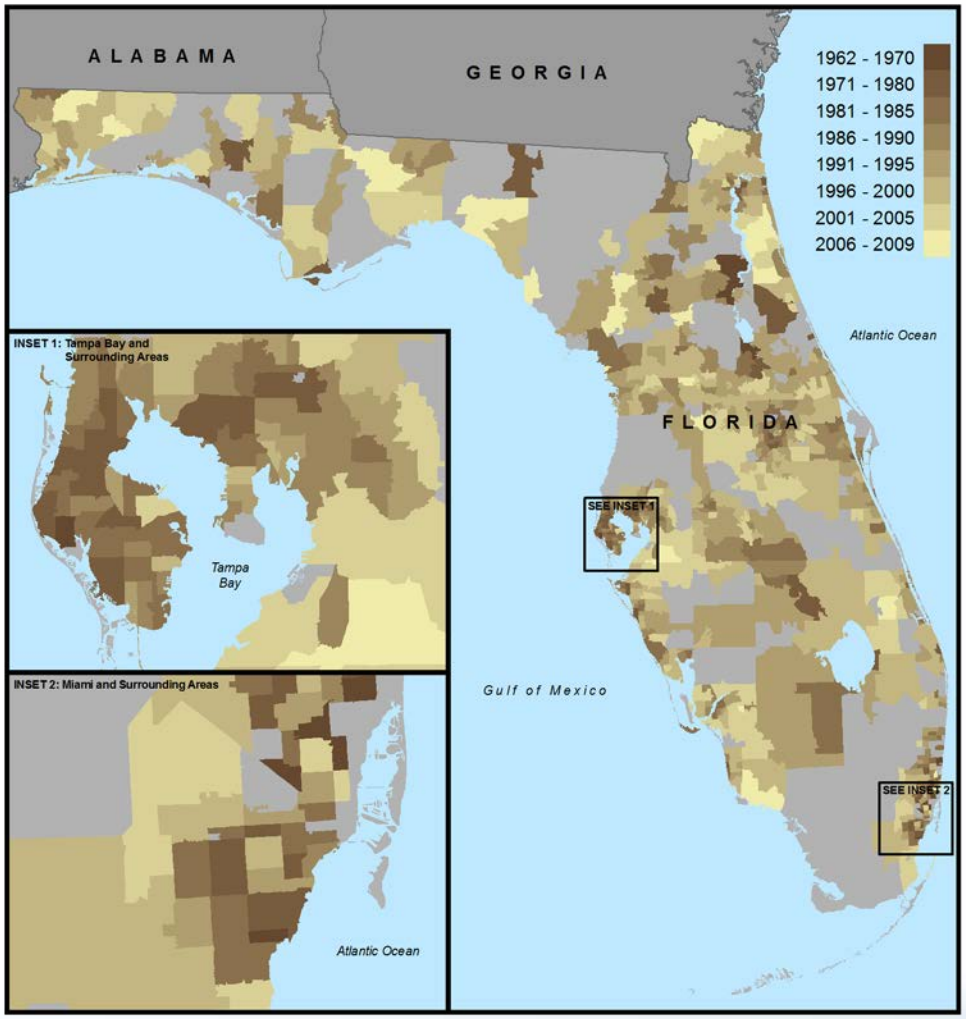
Building Characteristics Included

- Year Built
- Construction Type
- Coverage A
- Coverage B
- Coverage C
- Coverage D
- Hurricane deductible (2%)
- Number of stories
- Roof Shape
- Roof Age

Pseudobook Distribution of Year Built



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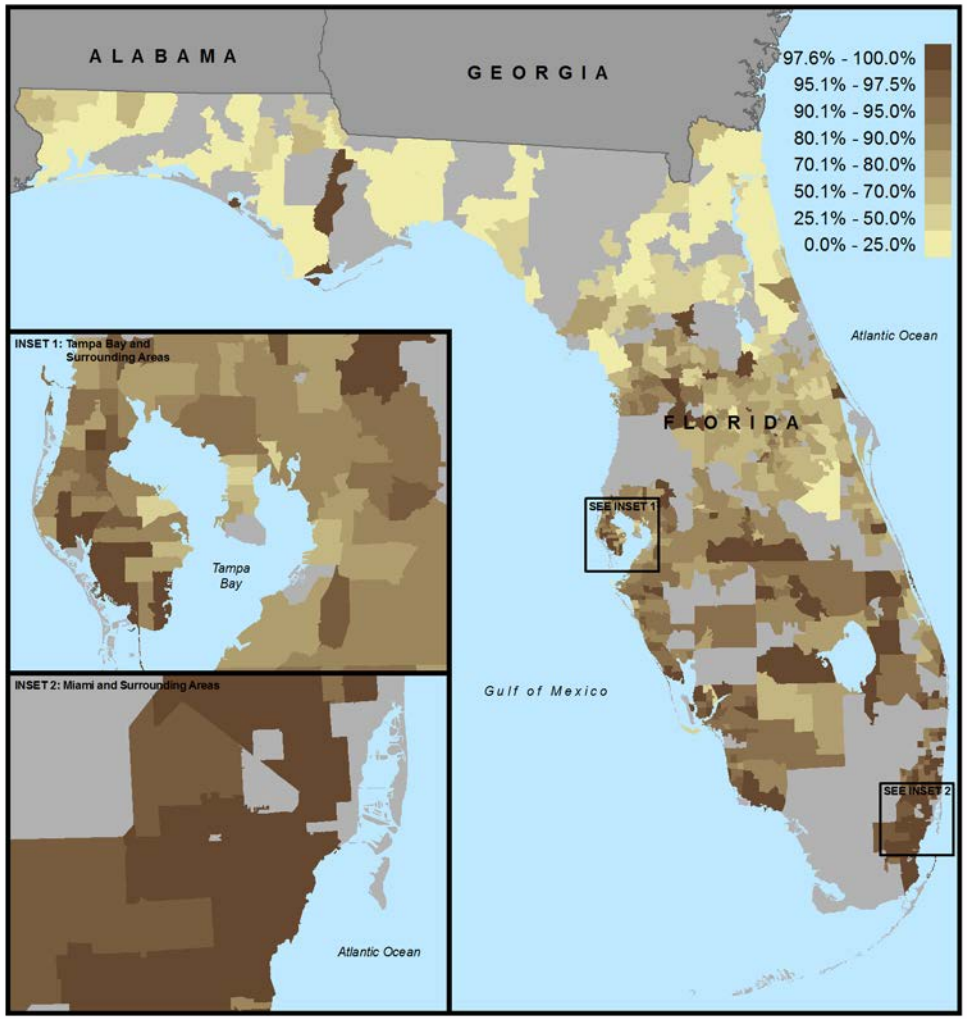
Pseudobook Distribution of Percentage Masonry Construction



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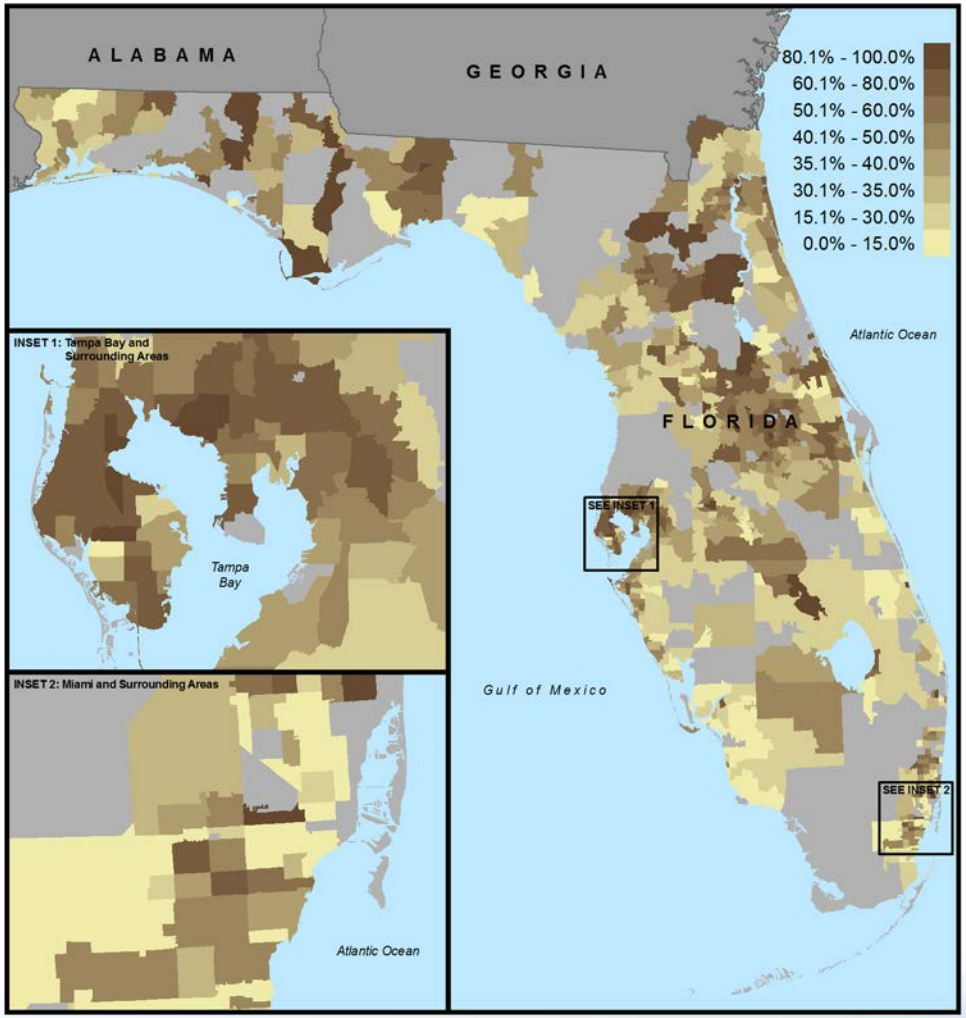
Pseudobook Distribution of Percentage Gable Roofs



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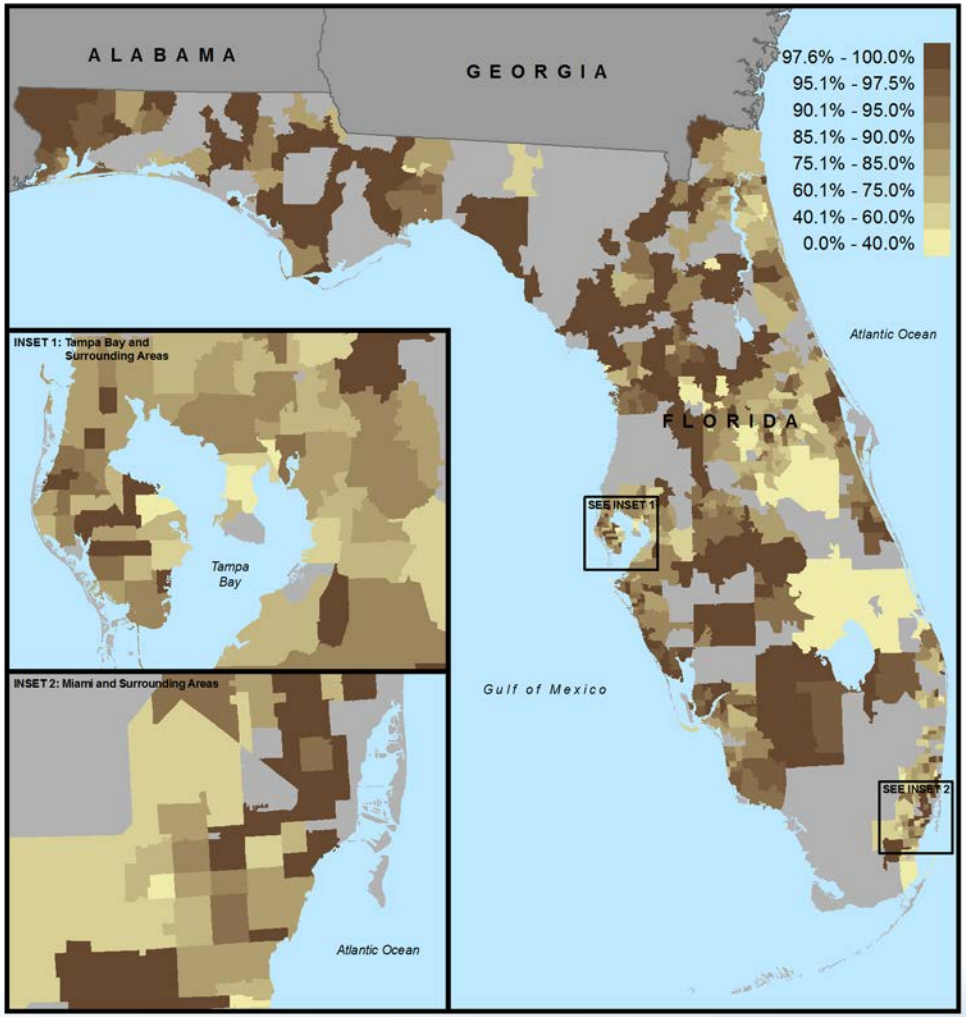
Pseudobook Distribution of One Story Construction



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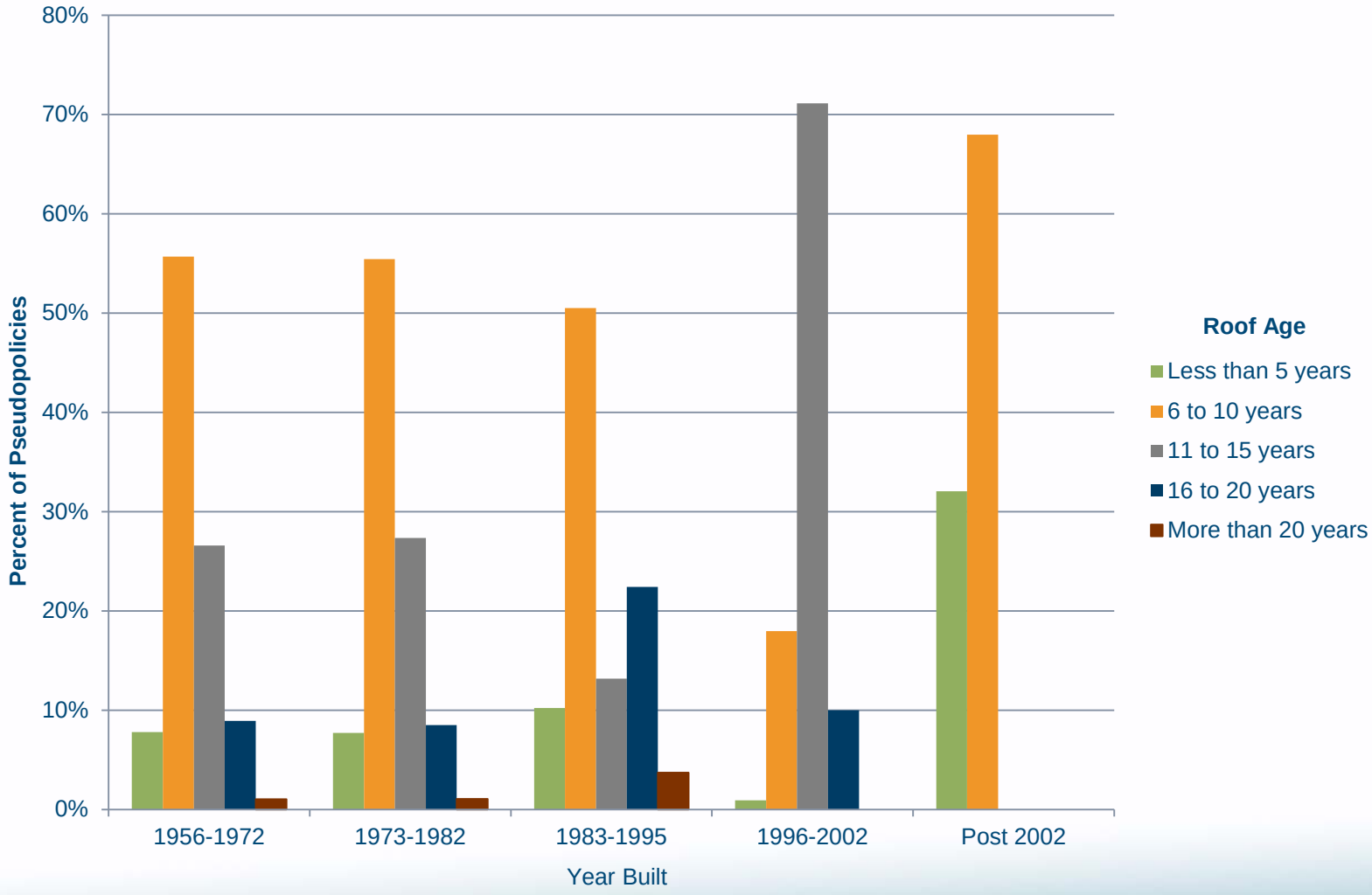
Roof Age Distribution for Pseudobook



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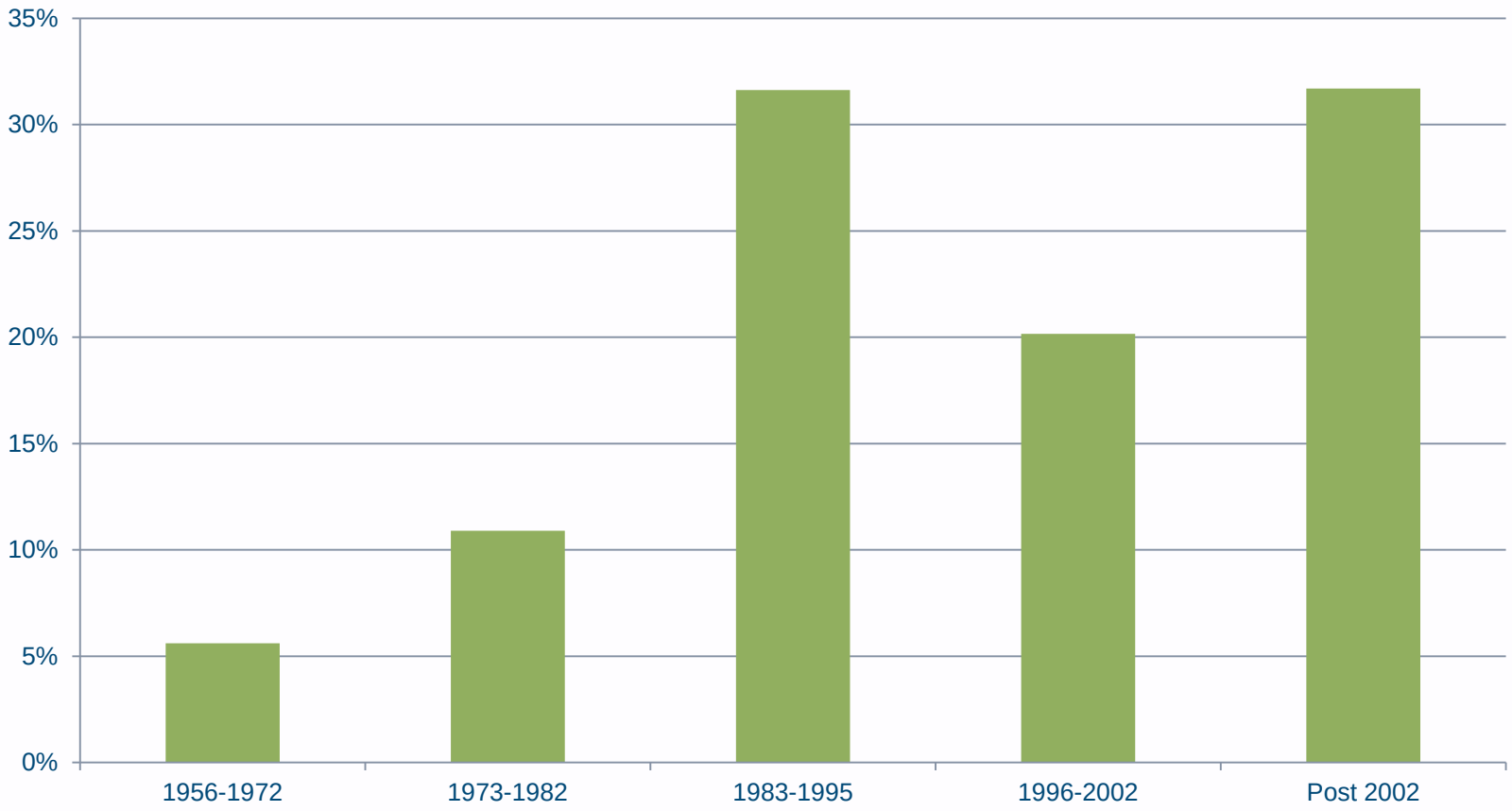
Year Built Distribution for Pseudobook



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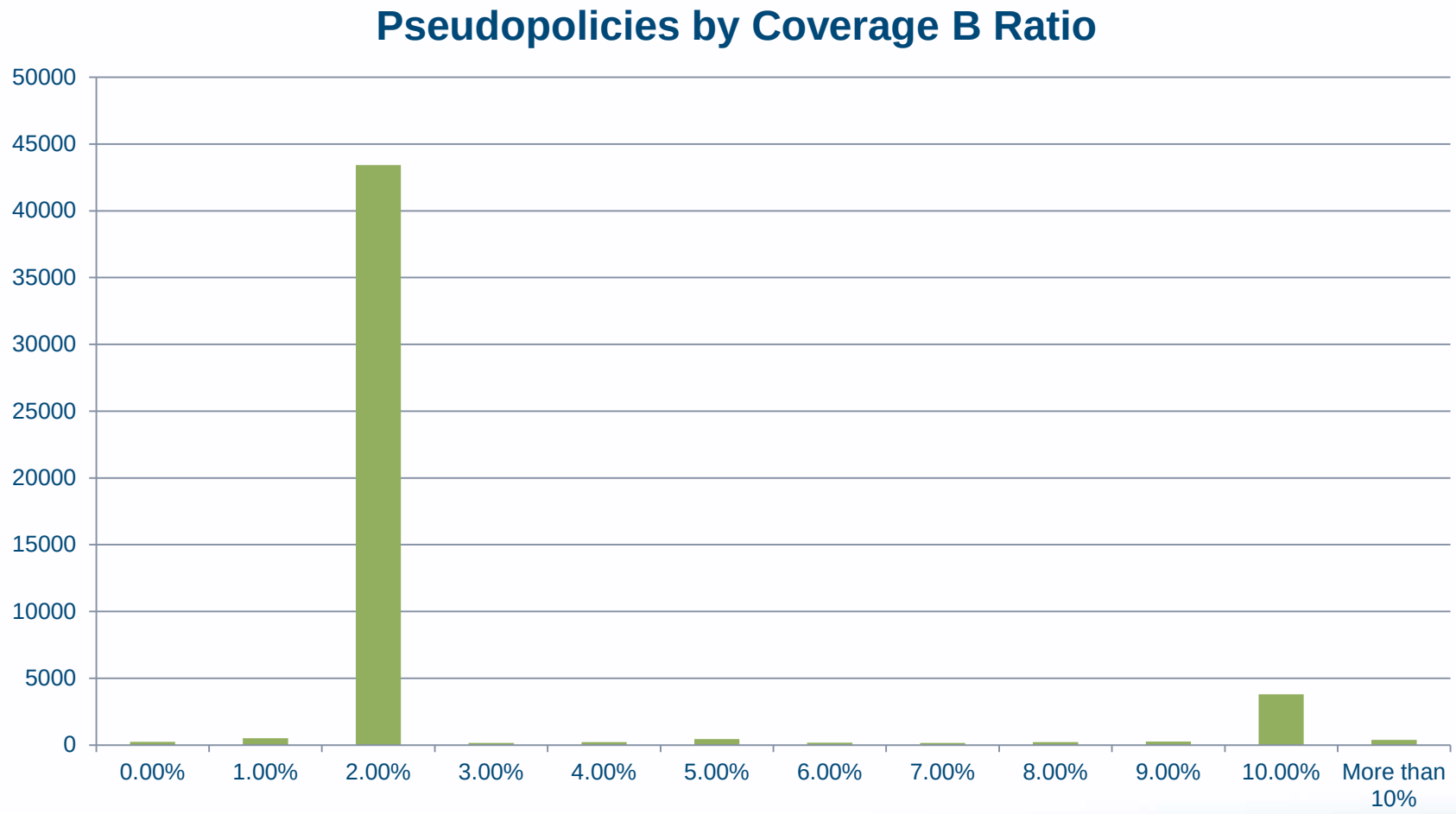
Coverage B Distribution for Pseudobook



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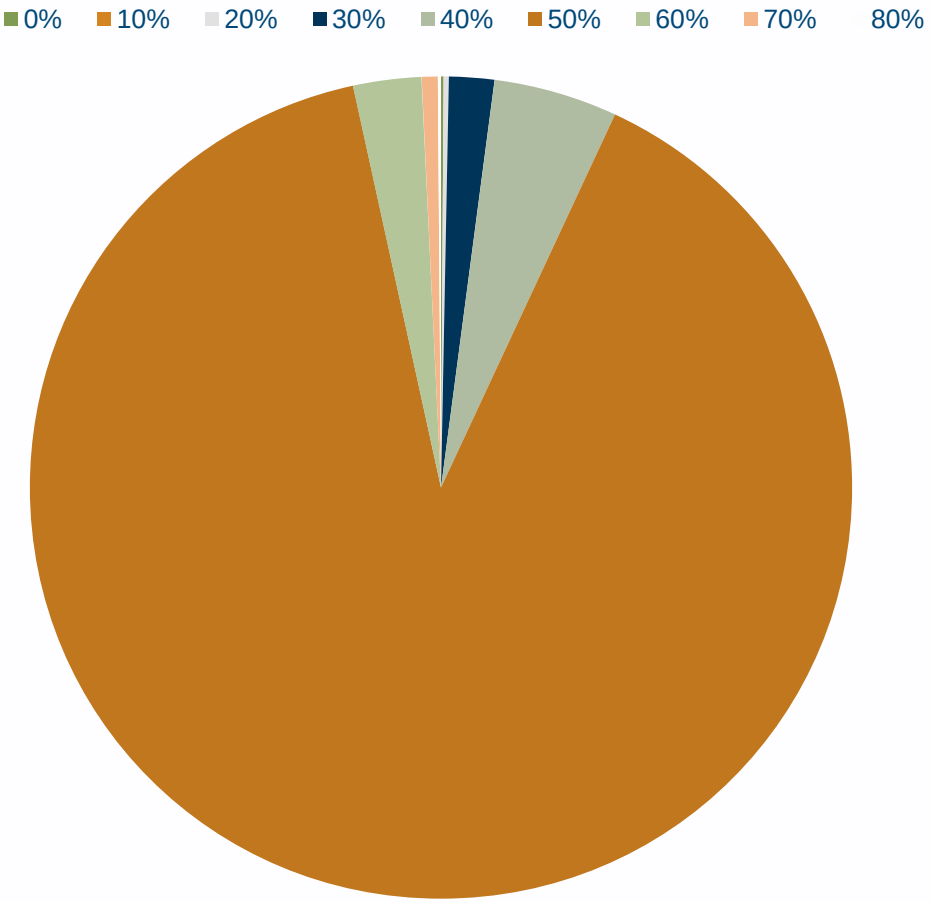
Pseudopolicies by Coverage C Ratio



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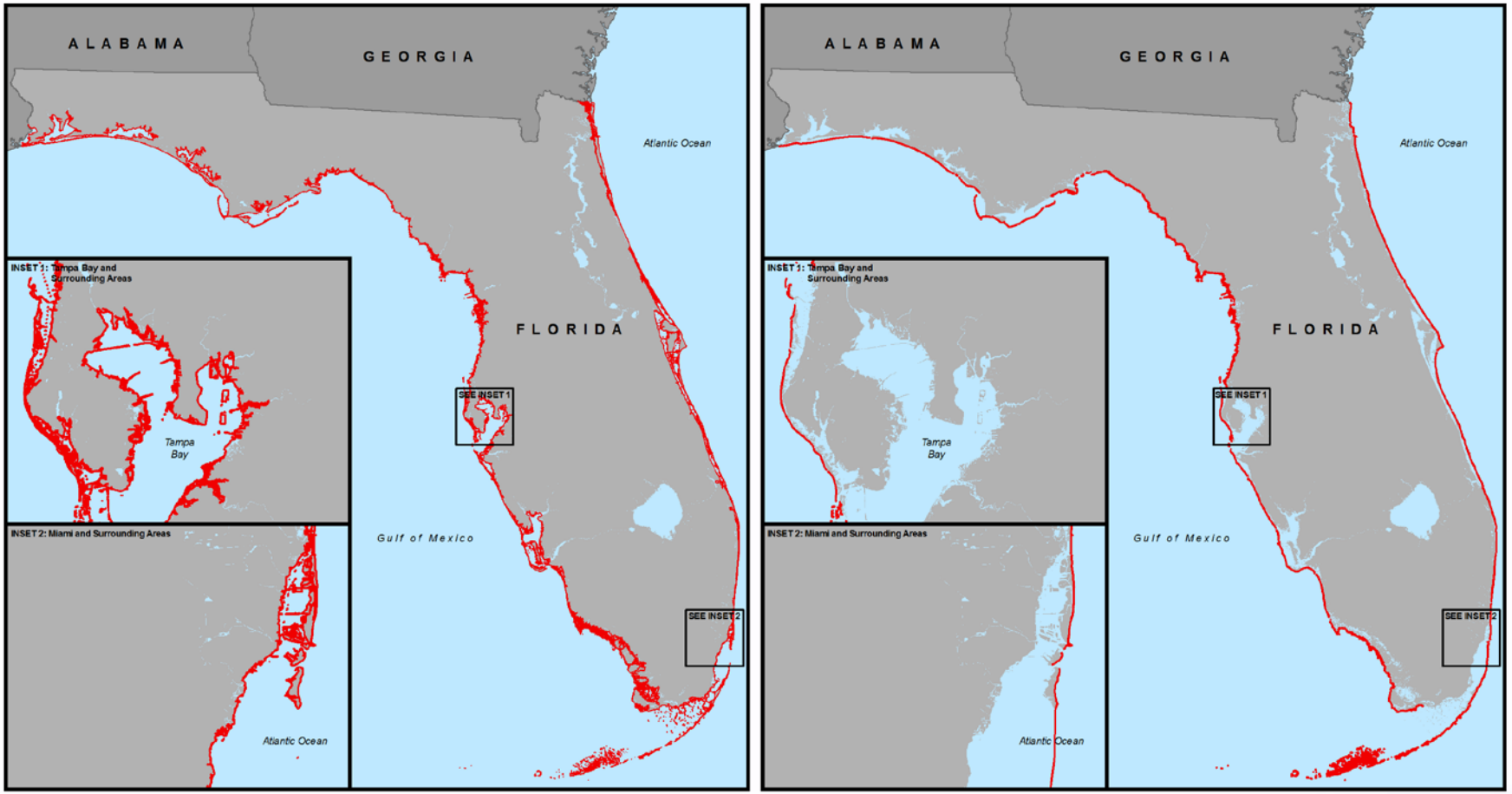
Two Approaches to the Coastline



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Preliminary Regression Model

- Coverages B, C, and D expressed as percentage of Coverage A
- A small number of pseudopolicies with Coverage B not equal to 2% or 10% of Coverage A were dropped.
- Year Built and Roof Age combined
- What is the right relationship with DTC?
- Initial choice of DTC bins

Definition of Distance-to-Coast (DTC) Bins

- Less than 0.25 miles
- 0.25 – 0.50 miles
- 0.50 - 0.75 miles
- 1.00 – 1.50 miles
- 1.50 – 2.00 miles
- 2.00 – 2.50 miles
- 2.50 – 3.00 miles
- 3.00 – 4.00 miles
- 4.00 – 5.00 miles
- Greater than 5.00 miles

Year Built and Roof Age Bands

- Often known from model vendor
- If not, can be determined by looking for discontinuities

EQECAT's Year Built Bands:

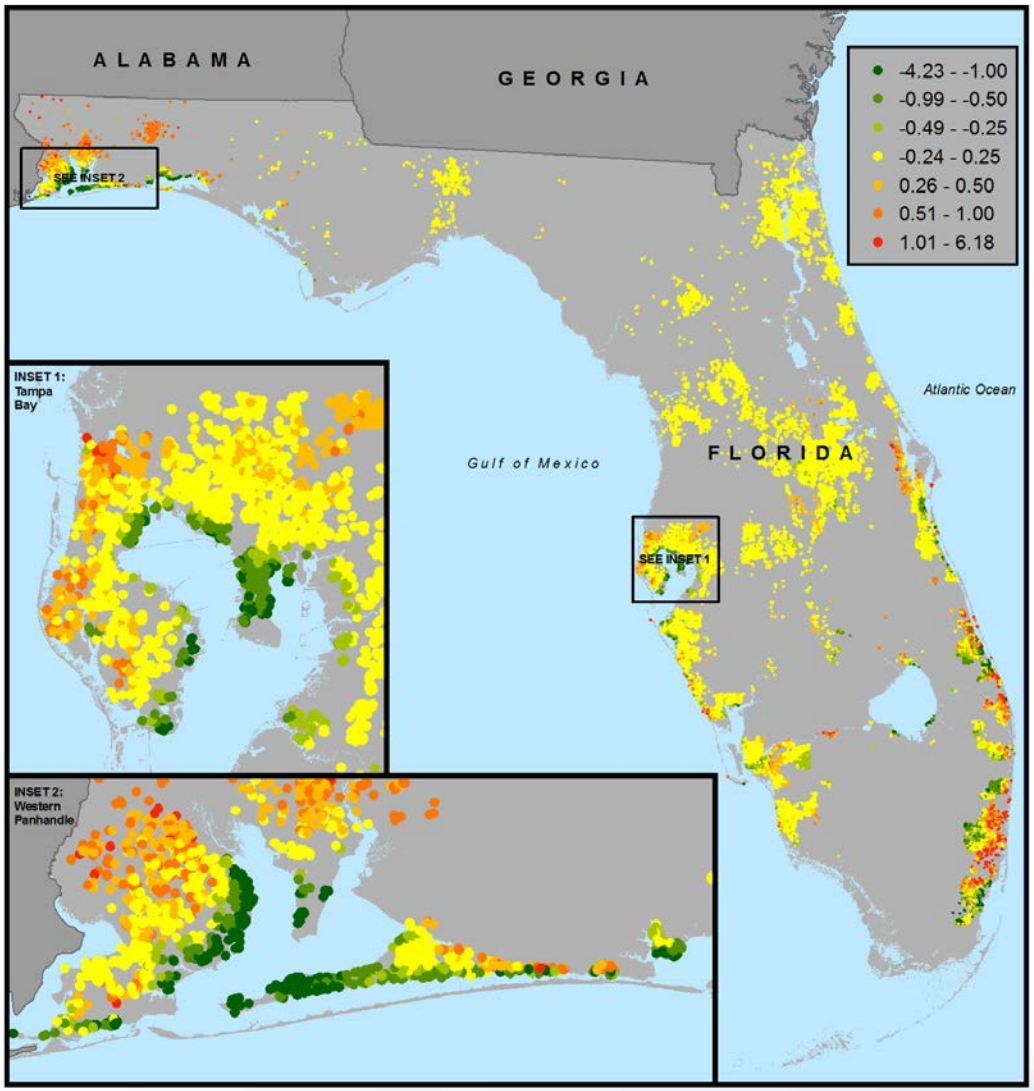
Era							
Pre 1955	1956-1972	1973-1982	1983-1995	1996-2002	Post 2002		
					Non-HVHZ&WBD	Florida WBD	Florida HVHZ

EQECAT's Roof Age Bands:

- Unknown
- Less than 5 Years
- 6 to 10 Years
- 11 to 15 Years
- 16 to 20 Years
- More than 20 Years

Preliminary Model Error

- Model uses single set of DTC factors
- Exhibits spatial autocorrelation
- Banding is driven by definition of coastline and regional variation in decay rates



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Revised Model

- Modeling is an iterative process
- A continuous distance to coast term added for all coastal counties, varying by county
- Distance to coast capped at 10 miles
- For many counties, continuous term is insignificant according to Chi squared test
- In some counties, continuous term is positive (nonphysical)
- The continuous DTC term is dropped for these counties and the model is rerun

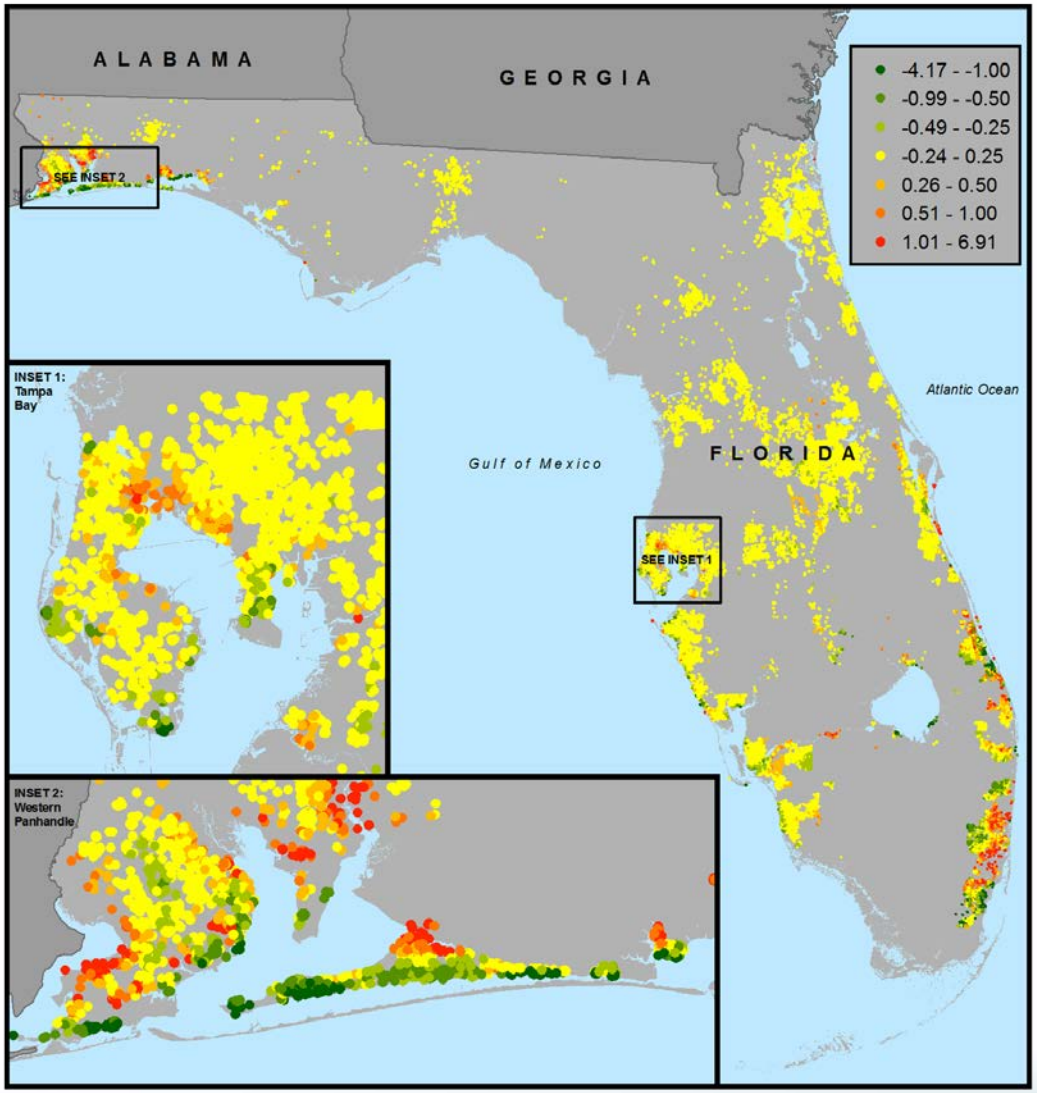
Counties with Continuous DTC Adjustment Term

- Indian River
- Gulf
- Brevard
- Okaloosa
- Nassau
- Santa Rosa
- Bay
- Flagler
- Manatee
- Saint Johns

Counties Where Coastline Was Adjusted

- Escambia
- Santa Rosa
- Okaloosa
- Pinellas
- Hillsborough

Revised Model Model Error



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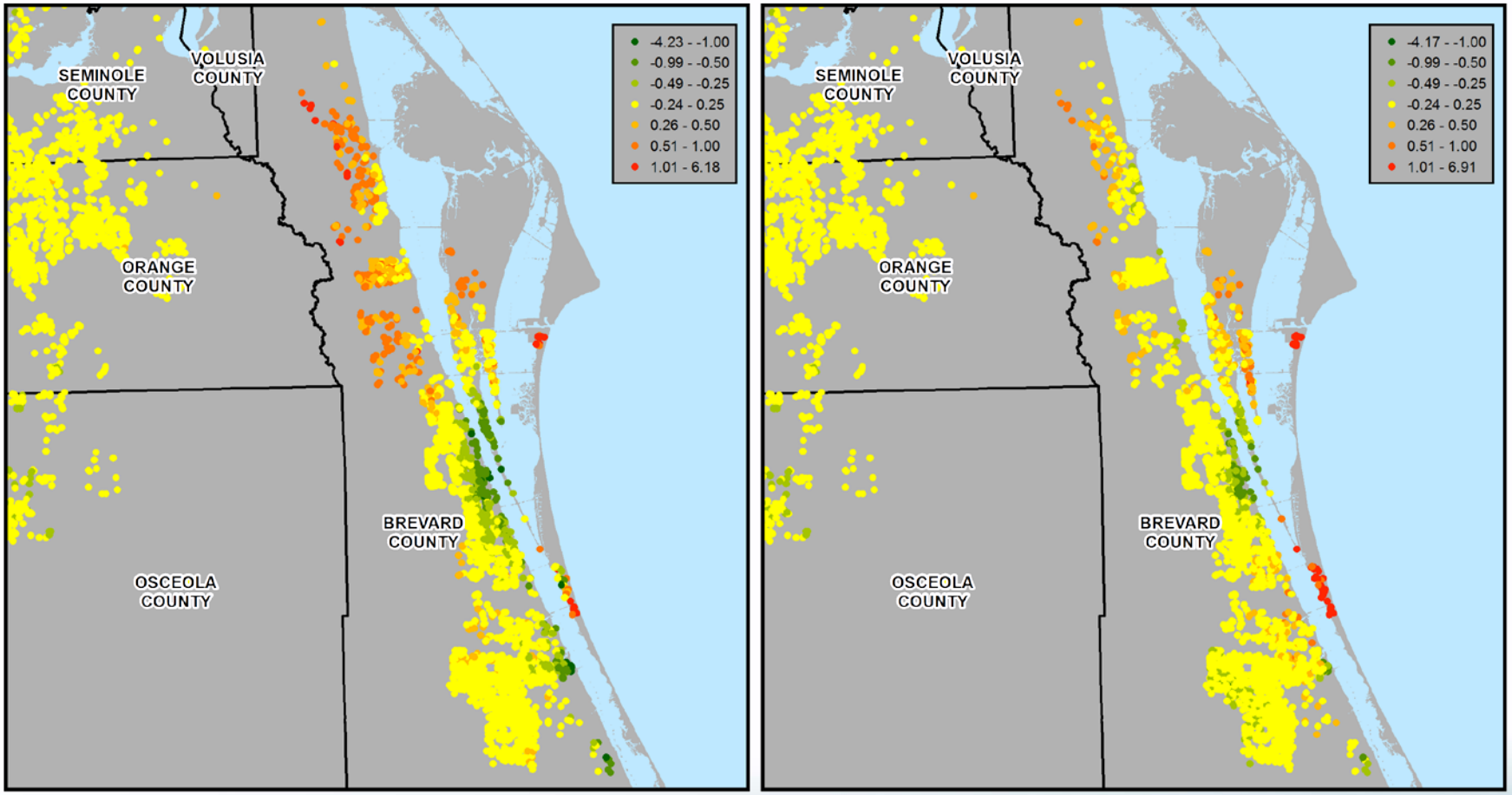
Comparison of Preliminary and Revised Model Error (Brevard County)



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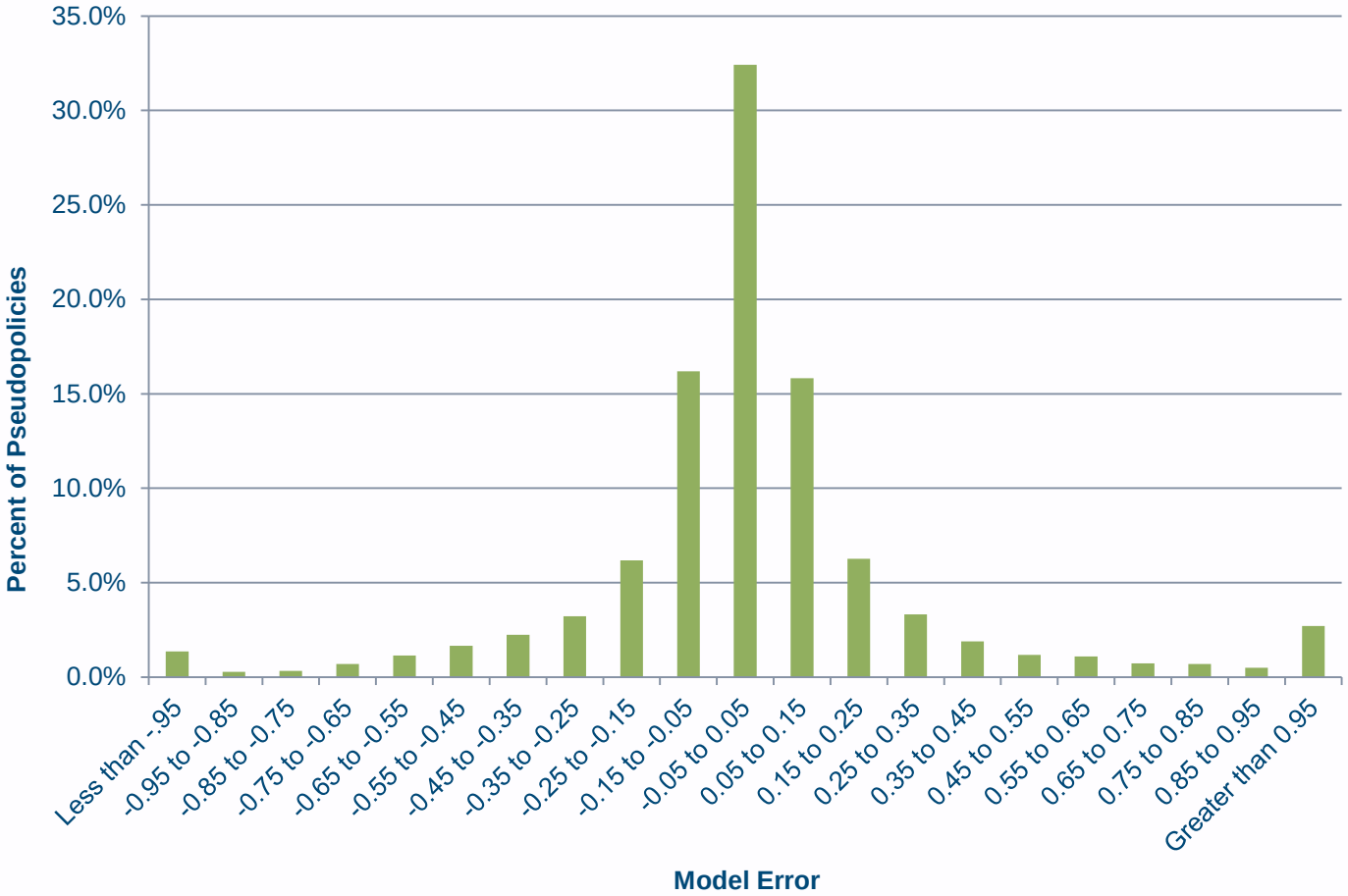
Model Error Histogram

- 80% of locations within 0.25 of model burn rate
- 94% of locations within 0.75 of model burn rate



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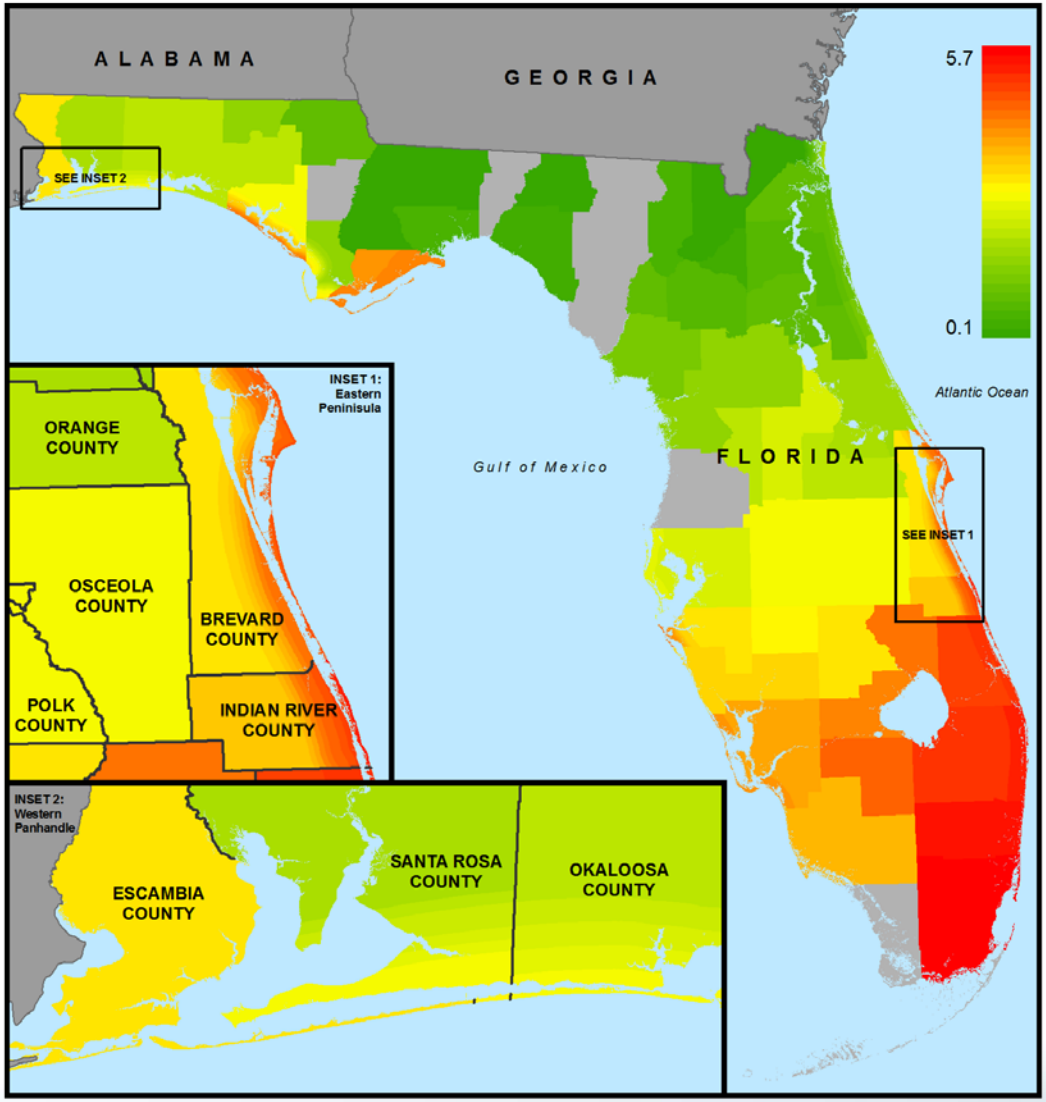
Revised Model Burn Rates



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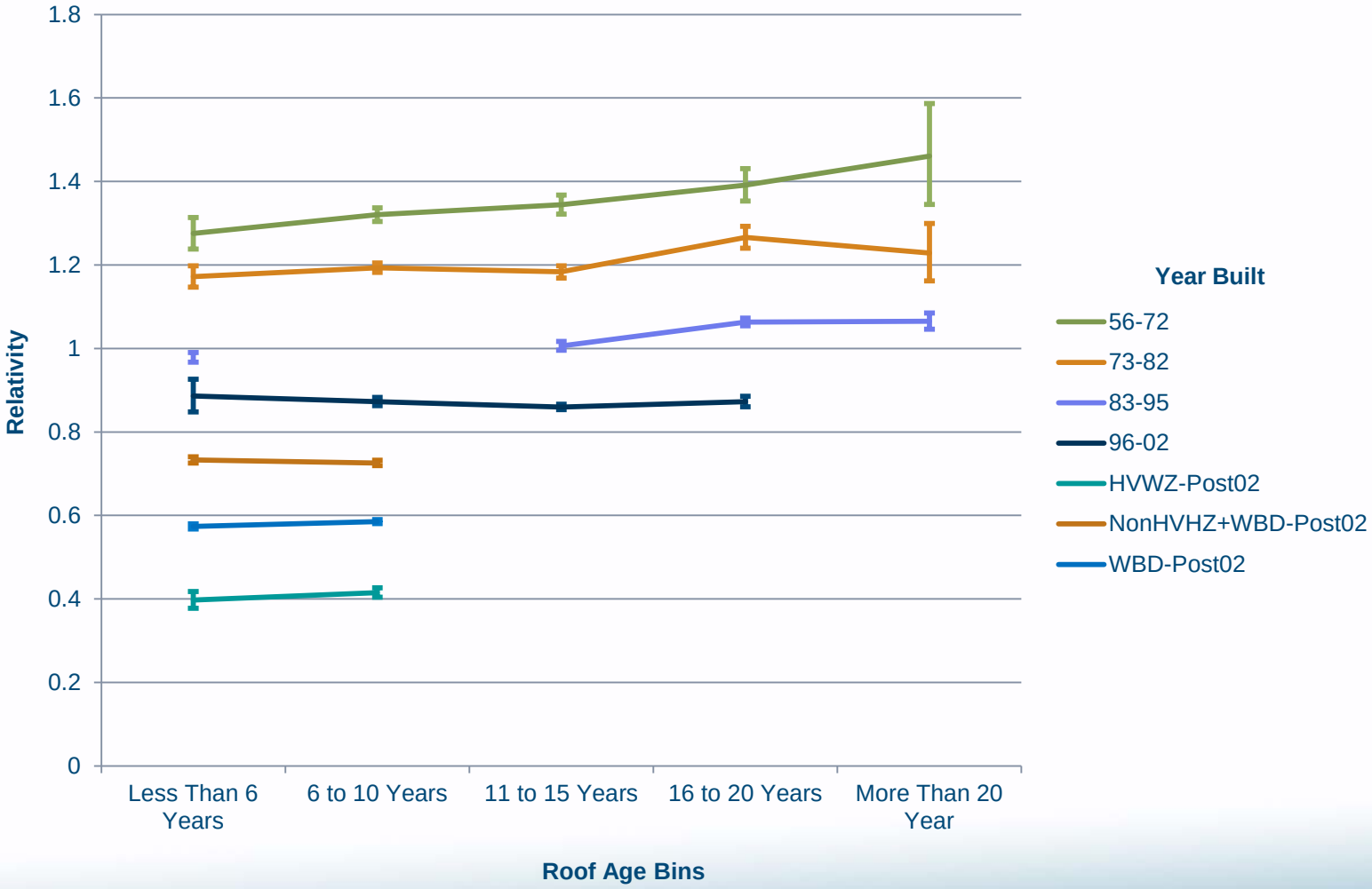
Revised Model Year Built Factors



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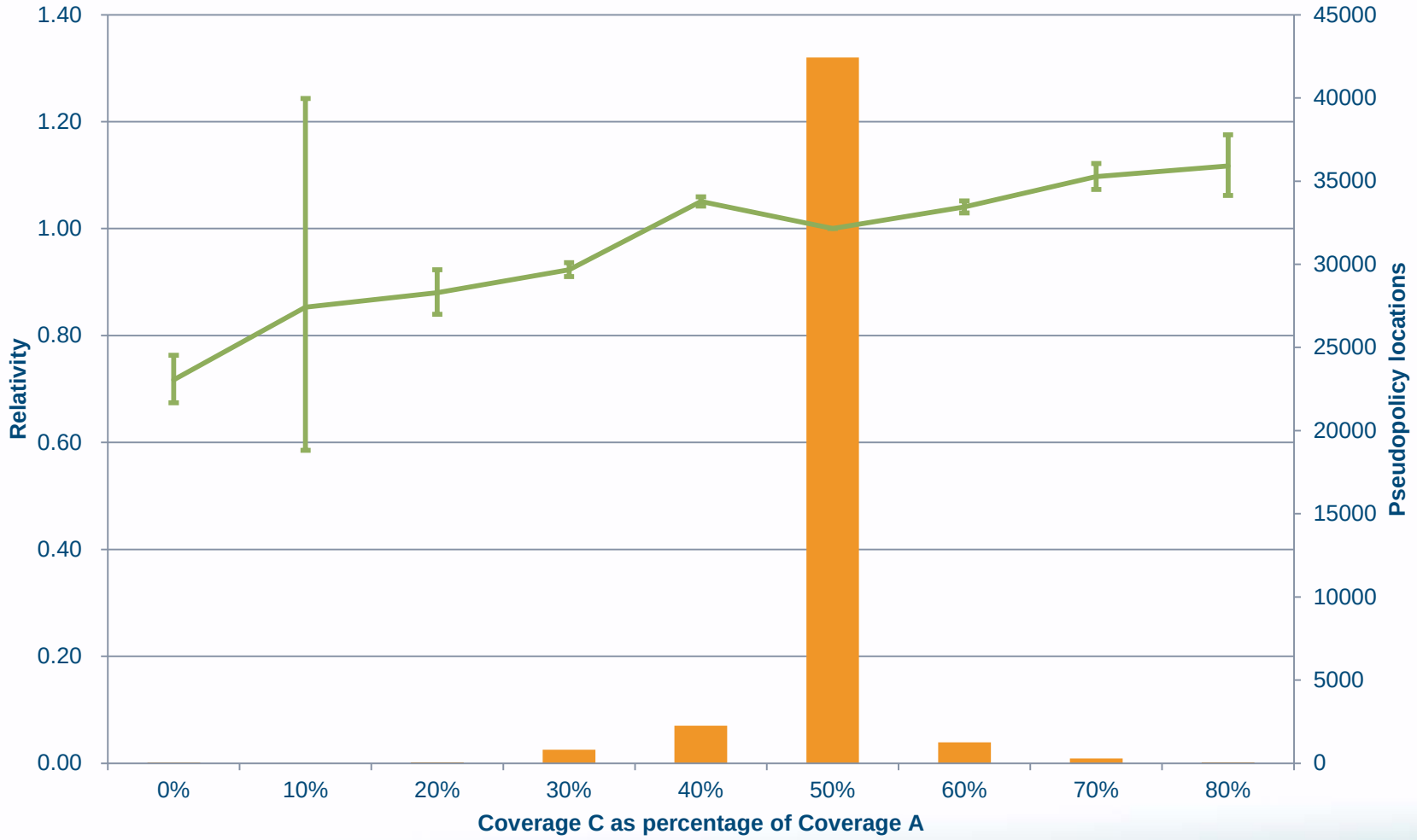
Revised Model Coverage C Factors



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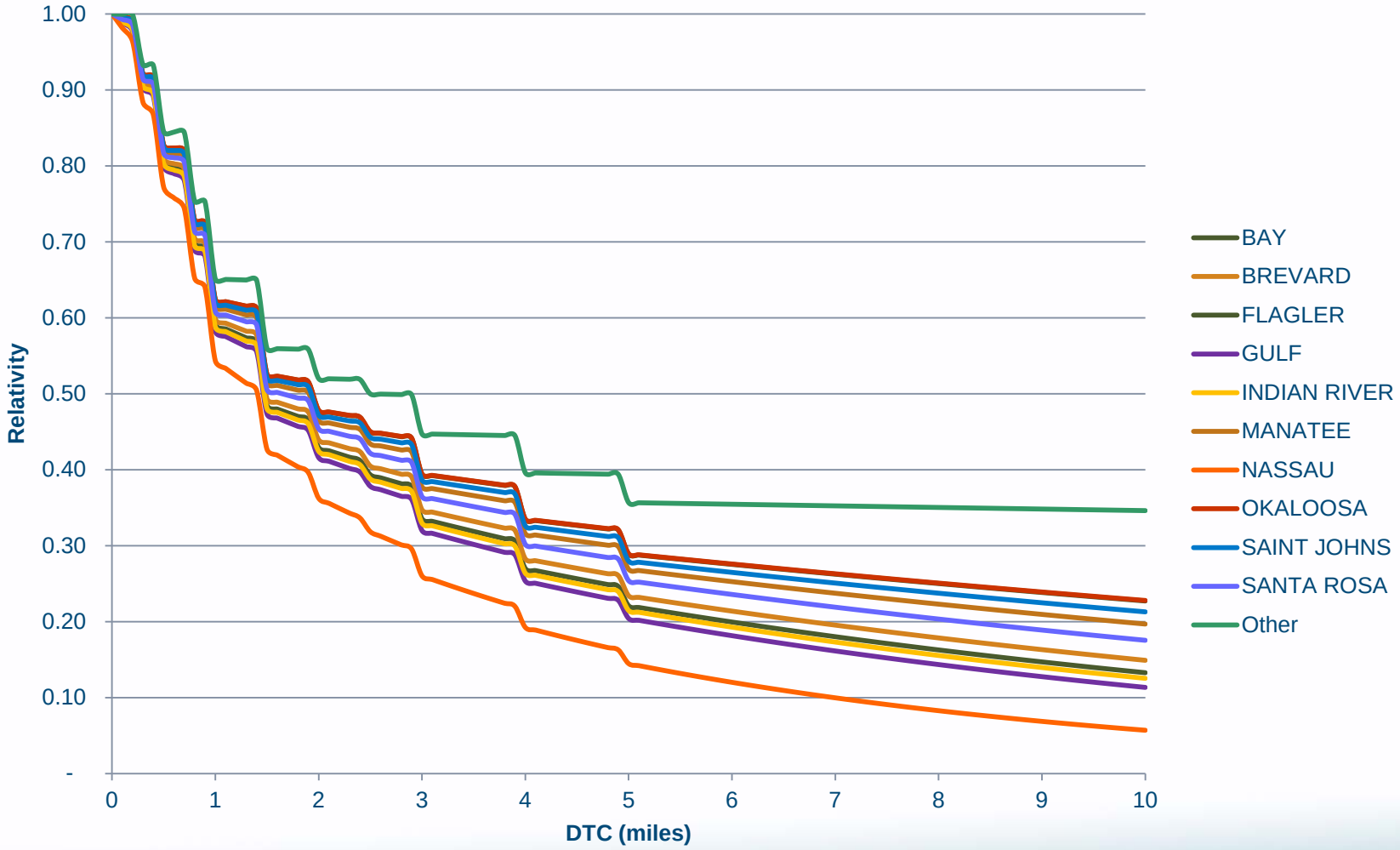
Revised Model – Other Factors

- Frame/Masonry ratio = 1.490 +/- 0.008
- Hip/Gable ratio = 0.953 +/- 0.004
- 2%/10% Coverage B ratio = 0.923 +/- 0.007
- 20%/10% Coverage D ratio = 1.029 +/- 0.007
- 2 Story/ 1 Story ratio = 1.007 +/- 0.005

P Value < 10^{-17} except for 2 Story/1 Story ratio, which has P value of 0.012

Revised Model – Decay Rates



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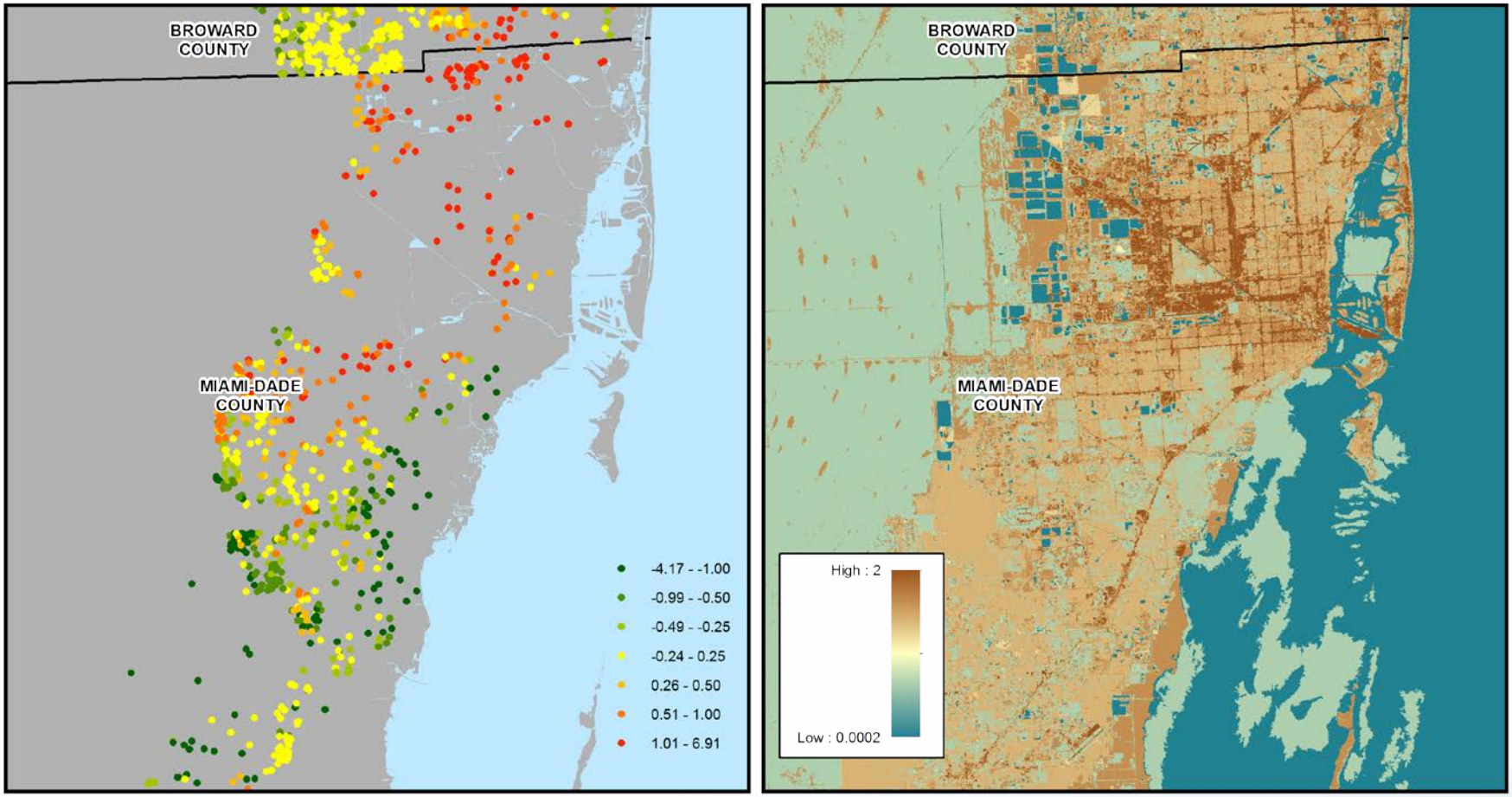
Revised Model Error compared to Surface Roughness in Miami-Dade County



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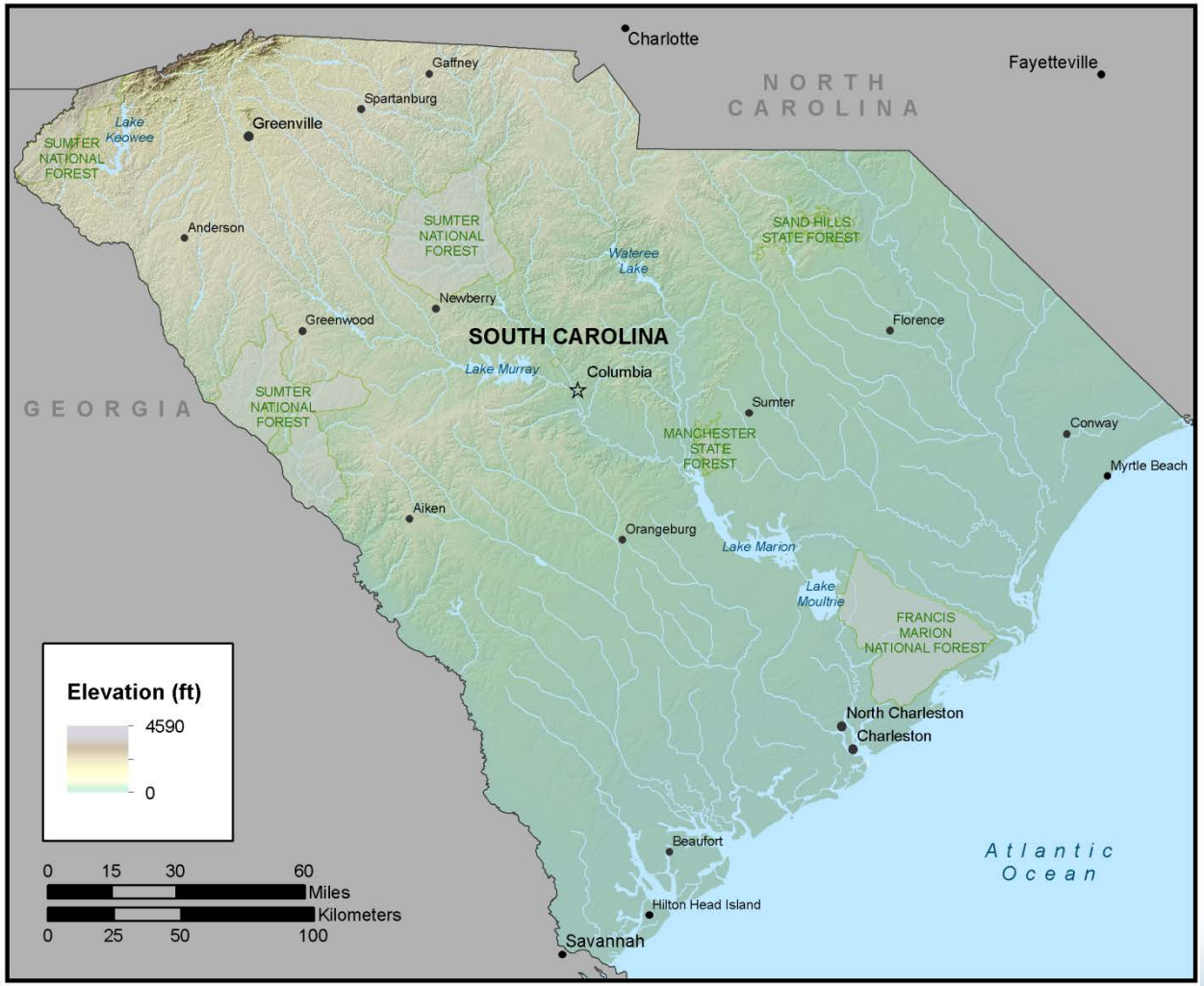
Review of Florida Model

- This presentation is schematic
- Wind Mitigation Credits can be held constant
- Is the coastline used optimal?
- Improvement of inland decay (greater than 10 miles)
- Improvement of inland counties (e.g. Hendry)
- Land Use/Land Cover (surface roughness)
- Model fit in southeastern Florida

Another approach: South Carolina



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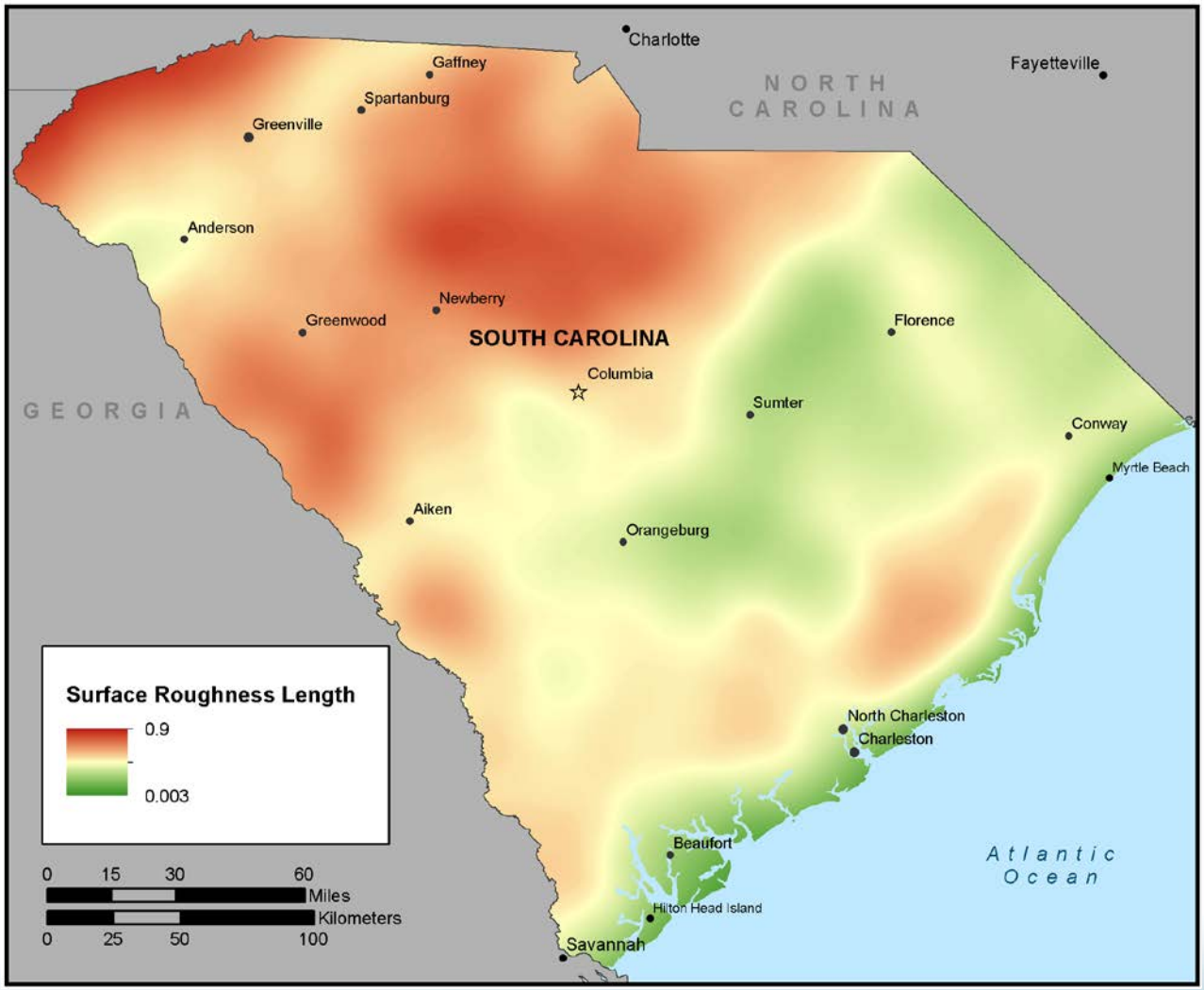
Surface Roughness in South Carolina



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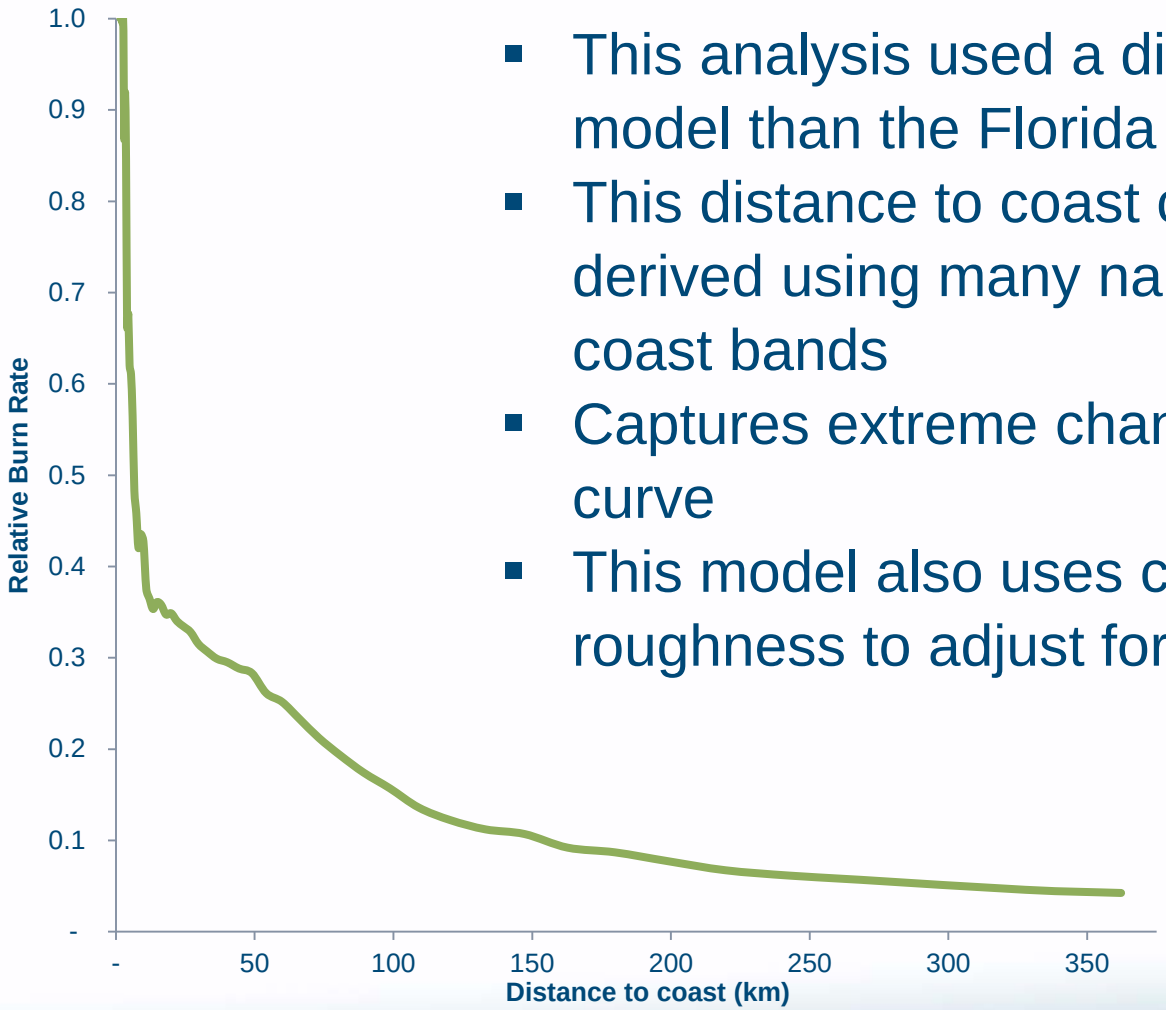
Relative Burn Rates by Distance to Coast in South Carolina



- This analysis used a different catastrophe model than the Florida analysis
- This distance to coast curve has been derived using many narrow distance to coast bands
- Captures extreme changes in slope of curve
- This model also uses county and surface roughness to adjust for other features

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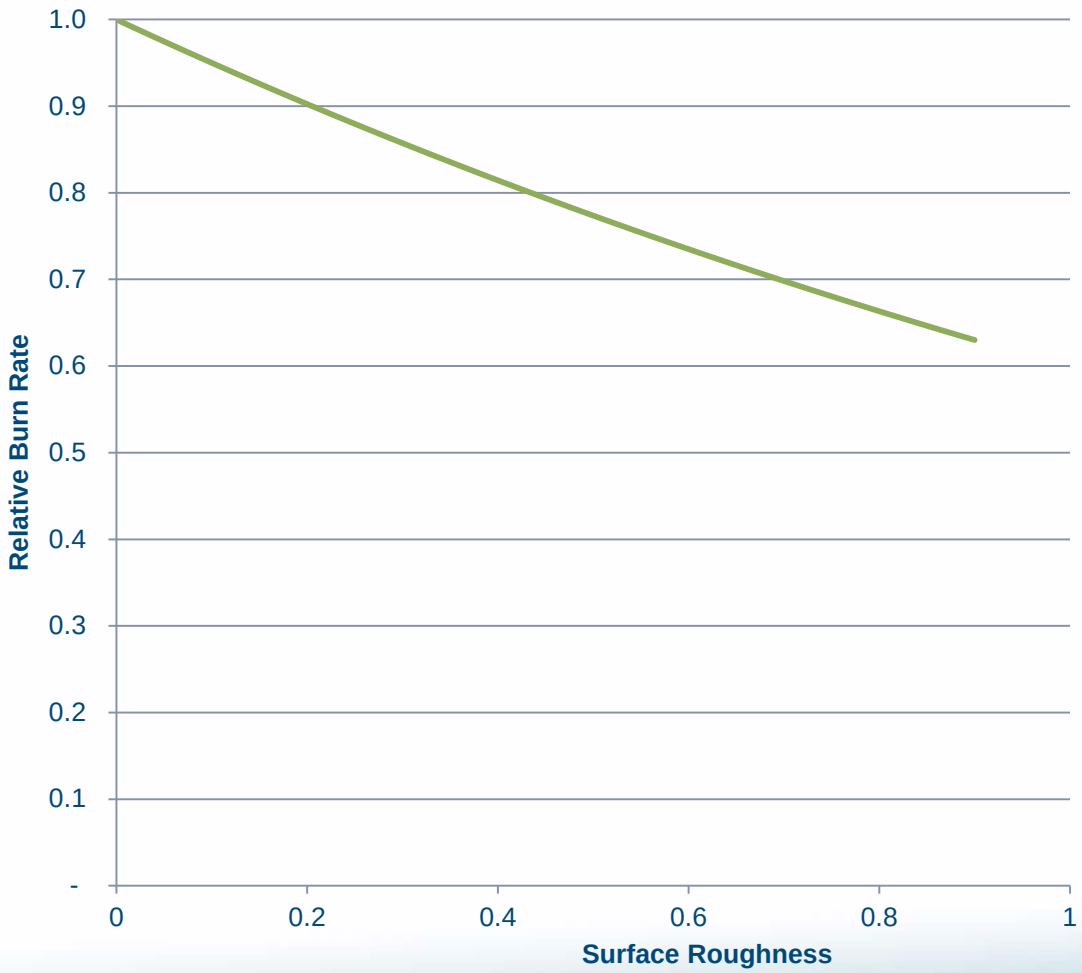
Impact of Surface Roughness on Burn Rate



- First step is regression using categorical variables
- However, in this case the linear approximation is excellent
- Surface roughness is a second order effect in this model

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Limitations and Further Work

- Everything I have said today is an approximation
- Compare assumptions underlying different catastrophe models
- Other perils (Severe Convective Storm, Storm Surge)
- Surface Roughness in Florida or Louisiana?
- Model blending