U.S. Private Flood Market

NAIC Catastrophe Risk (E) Subgroup

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Nancy Watkins, FCAS, MAAA
Principal & Consulting Actuary, Milliman

Agenda

- Flood market background
- The need for flood catastrophe models
- Flood and catastrophe model regulation
- Flood model evaluation

Flood market background

Flood risk is increasing…

Helmetta, NJ
TS Henri, August 2021

Image Source: weather.com

LaPlace, LA
Hurricane Ida, August 2021

Image Source: NPR

Waverly, TN
Flash floods, August 2021

Image Source: New York Times

"The rain broke records set just 11 days before by Tropical Storm Henri, underscoring warnings from climate scientists of a new normal on a warmed planet: Hotter air holds more water and allows storms to gather strength more quickly and grow ever larger."

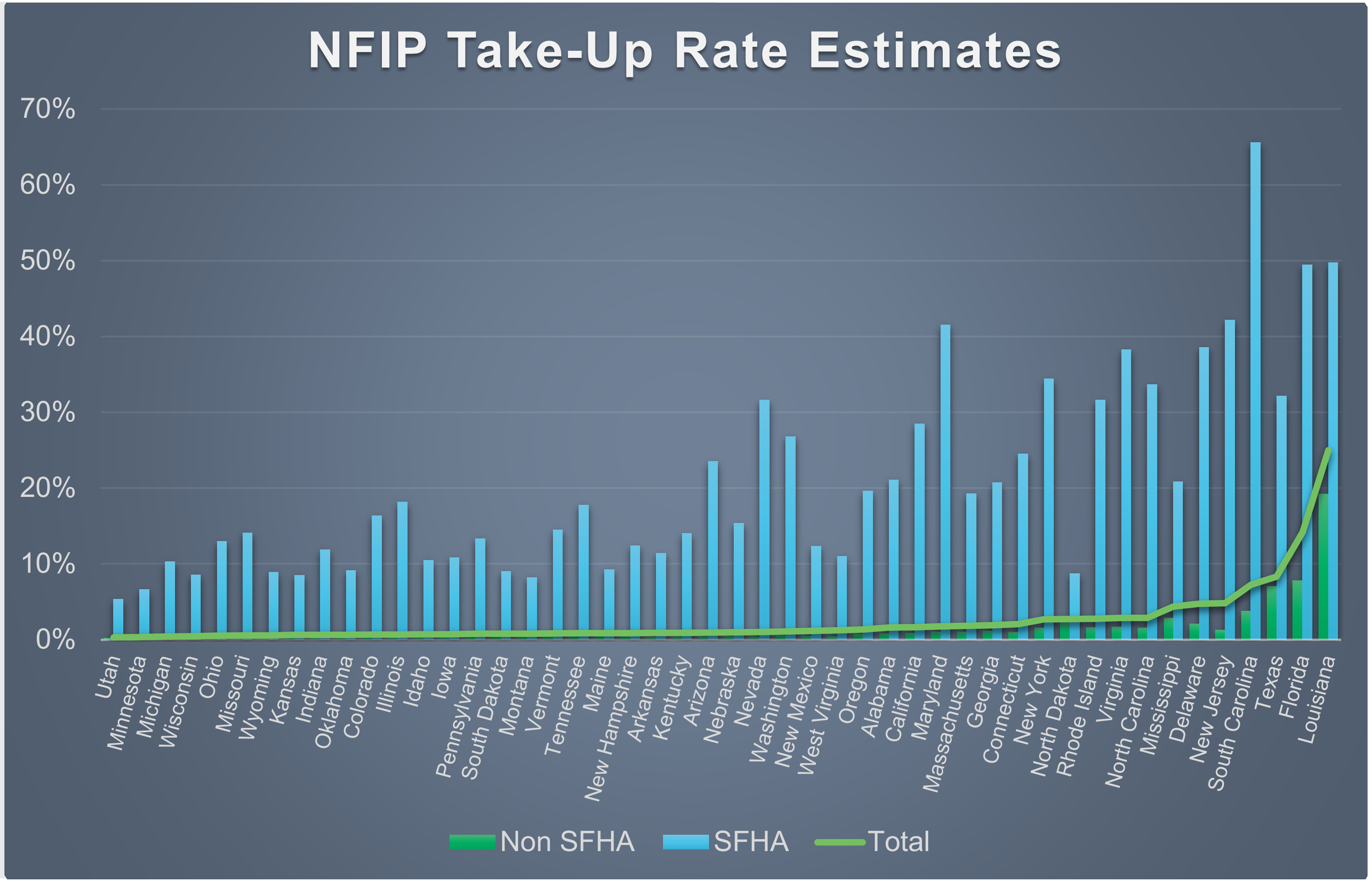
New York Times, September 7, 2021

"The United States is expected to experience as much sea level rise by the year 2050 as it witnessed in the previous hundred years…sea levels along the coastline will rise an additional 10-12 inches by 2050 with specific amounts varying regionally, mainly due to land height changes."

National Oceanic and Administration Association, February 15, 2022

…but the U.S. flood insurance market is underserved

- Current U.S. residential flood insurance market
  - Estimated **4%** of SFHs have flood insurance (2021)
  - NFIP: **$3.6B** total premium on **4.8M** policies (2019)
  - Private insurers reported **$735M** in Private Flood DWP (2020) vs. **$577M** in DWP (2019)
  - About **one-third** of Private Flood DWP is estimated to be residential
  - **175** private carriers writing flood insurance (2020) vs. 152 in 2019
  - Potential U.S. residential flood insurance market is between **$37B** and **$47B** of DWP
- For comparison purposes, 2020 HO DWP was **$110B**



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What makes an insurance market sustainable?

Availability

- Insurer can manage and measure the risk
- Insurer can charge premiums that represent the cost of risk transfer

Affordability

- Policyholders are able to pay the premium

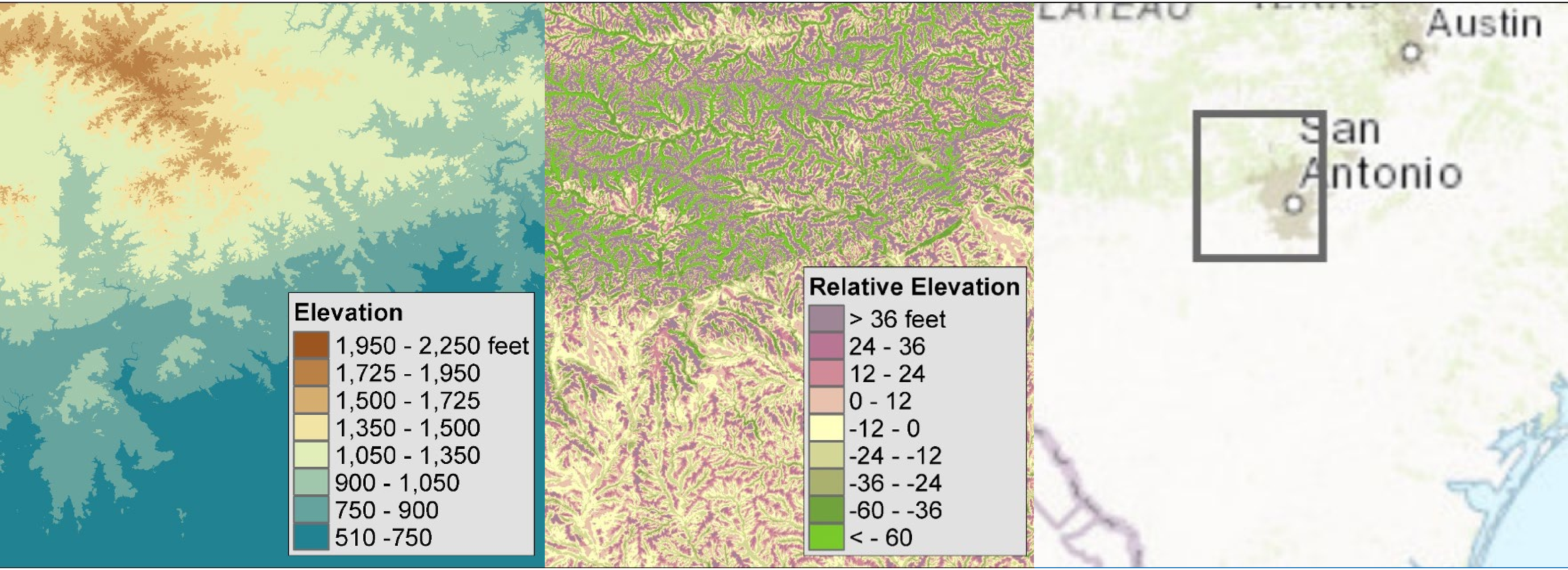
Reliability

- Insurer will be able to pay claims
- System will be stable over the long term

The need for flood catastrophe models

Flood risk is local

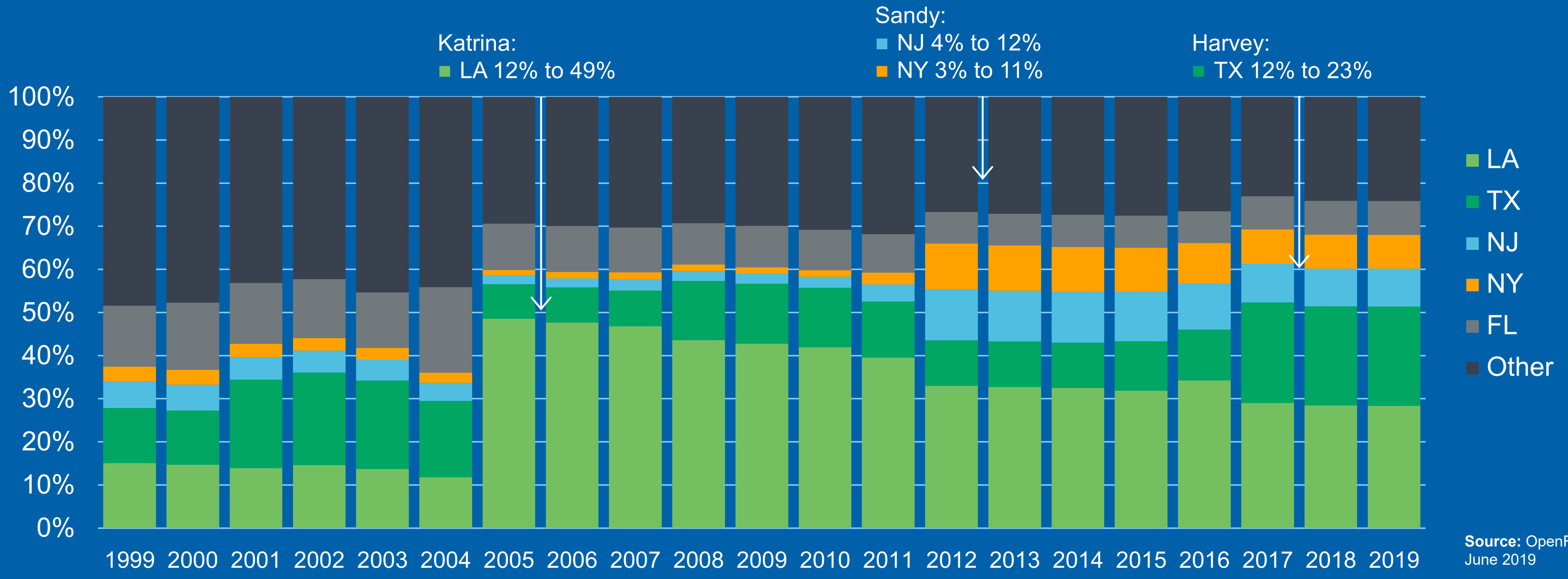
Varies greatly over short distances and requires granular rating



Flood risk is catastrophic

Requires advanced catastrophe models for risk measurement and management

Cumulative percentage by state: NFIP paid loss since 1980



Source: OpenFEMA data June 2019

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National Flood Insurance Program

Supplementing historical experience with advanced catastrophe models

FEMA is updating the NFIP risk rating methodology through the implementation of a new pricing methodology called Risk Rating 2.0.

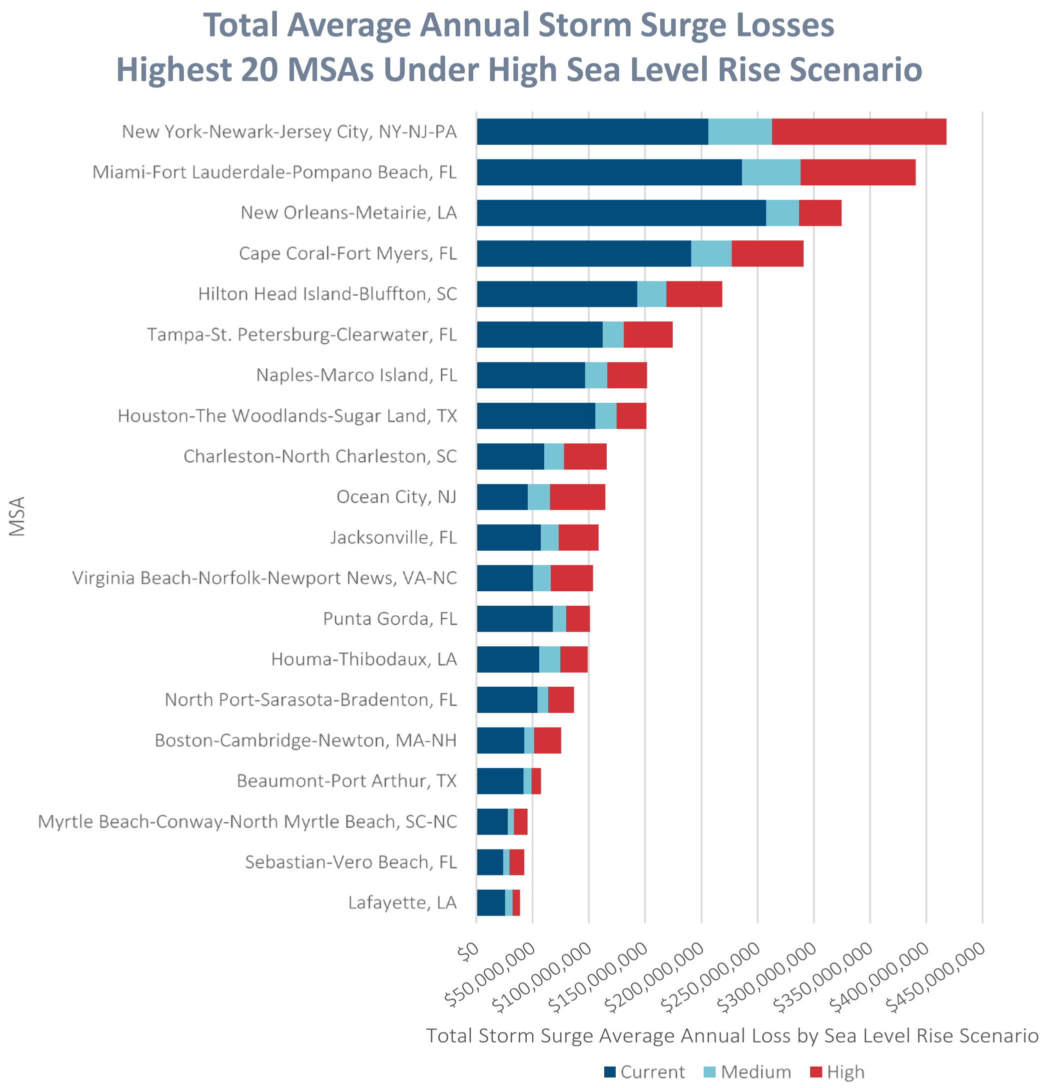
The methodology leverages industry best practices and cutting-edge technology to enable FEMA to deliver rates that are actuarily sound, equitable, easier to understand and better reflect a property's flood risk.

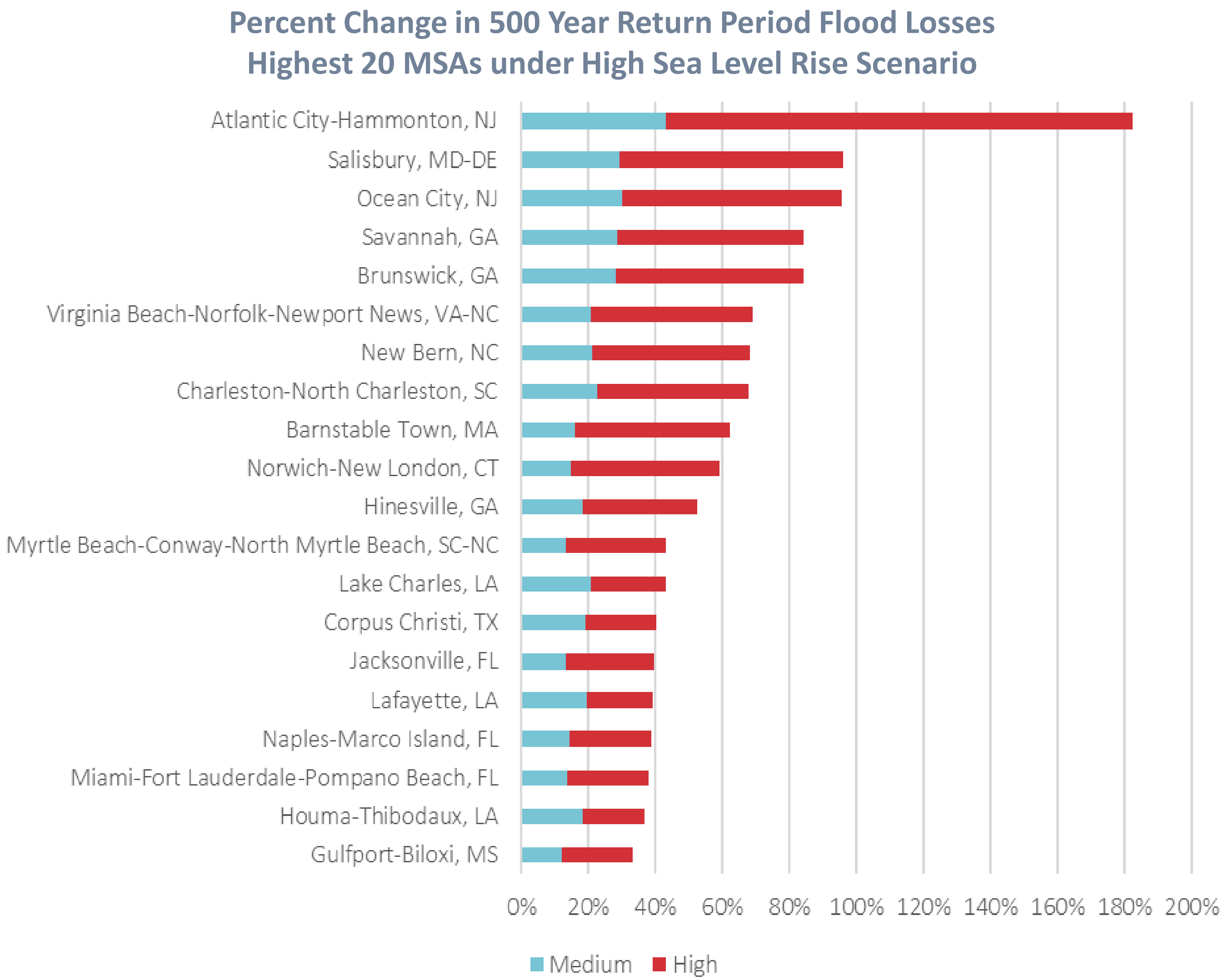
Risk Rating 2.0 was implemented for new policies in October 2021 and will apply to renewal policies in April 2022.

As part of the rate development process, FEMA supplemented NFIP's historical loss experience with commercial catastrophe models for inland flood and storm surge.

Description of RR 2.0 methodology and data sources: https://www.fema.gov/flood-insurance/risk-rating

Flood models are used to estimate the effect of sea-level rise





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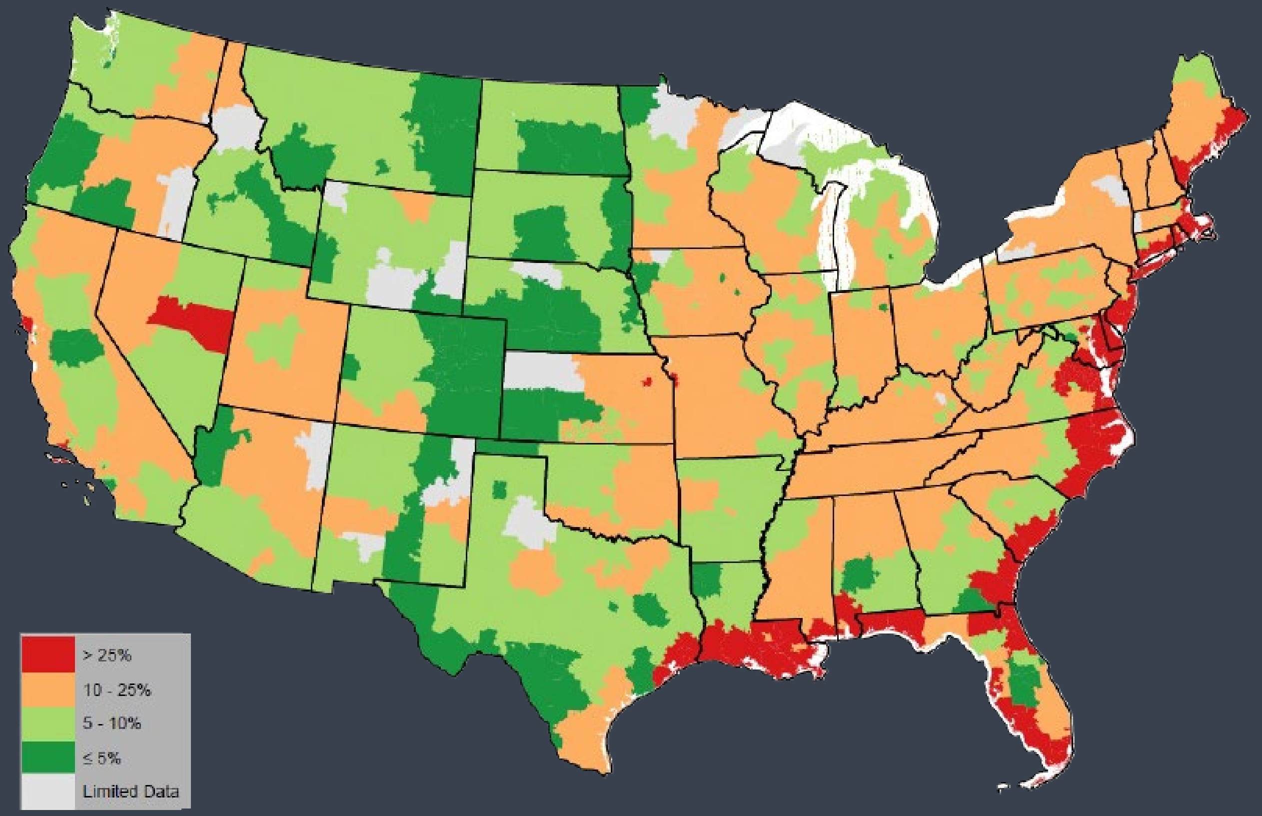
https://www.soa.org/globalassets/assets/files/resources/research-report/2020/soa-flood-report.pdf

Flood models are necessary for climate-readiness

Under a high climate scenario, an estimated 750k single-family properties in the US will face major repricing by 2050



https://www.milliman.com/en/insight/unpriced-costs-of-flooding-an-emerging-risk-for-homeowners-and-lenders

Flood and catastrophe model regulation

Catastrophe model treatment varies widely among states

Prohibition of the use of catastrophe models for some or all purposes in establishing rates

Silent on the use of catastrophe models

Questionnaires and case-by-case model validation

Regulations piggybacking on other state reviews

Statewide body for scientific and technical review of catastrophe models

How different states treat catastrophe models

Florida

Models used in rate filings must be accepted by Florida Commission on Loss Projection Methodology, which conducts extensive reviews of hurricane and now flood models

South Carolina

Models must be approved in South Carolina; historically have followed Florida’s lead

Hawaii

Models must be accepted but historically have not been reviewed frequently, resulting in the requirement to use old models

California

Not allowed for setting overall rate levels (except for Earthquake and Fire Following Earthquake). Allowed for setting rate relativities, granular territory definitions, underwriting/tiering.

New York

Does not allow catastrophe models

Flood model evaluation

Evaluation of emerging models

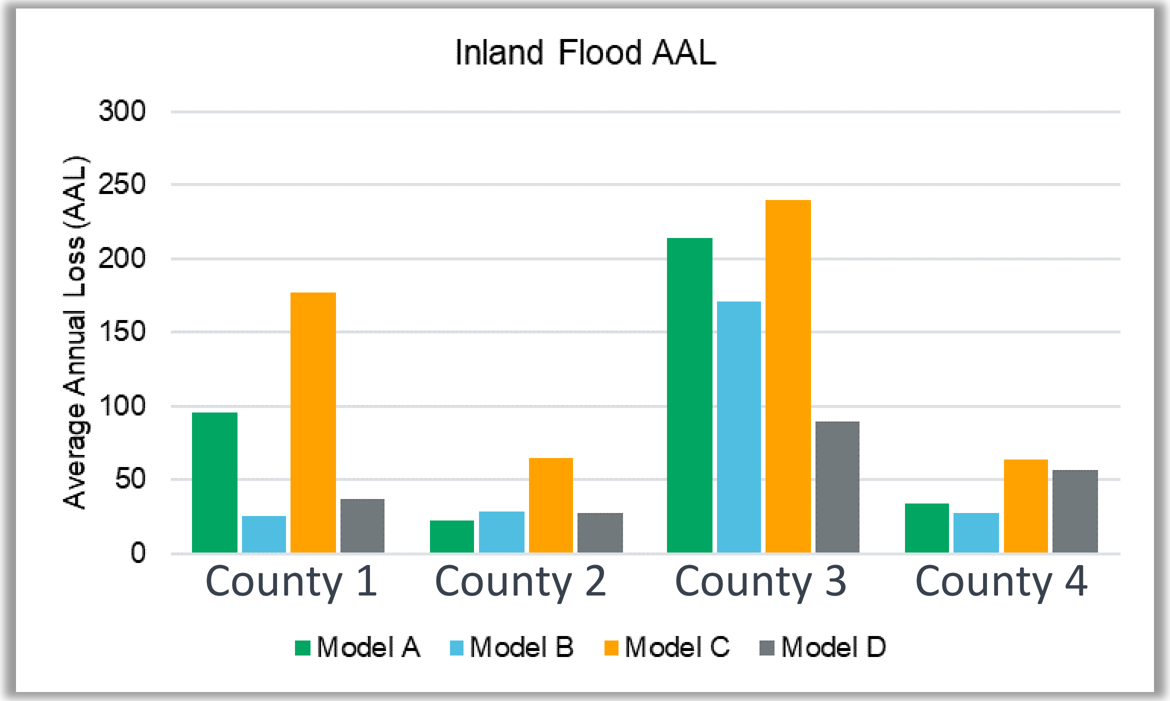
Specific actuarial techniques

- Calibration versus out-of-sample validation
- Reasonability checking
  - Is the aggregate AAL believable?
  - How often does it produce unreasonable location level AALs?
  - Does it produce logical relationships with risk?
  - Does it produce discontinuities?
- Does it reflect important variables that alter vulnerability?
- Does it include all important sub-perils?
- How does it compare to other models (if available)?
- Give special consideration to outliers

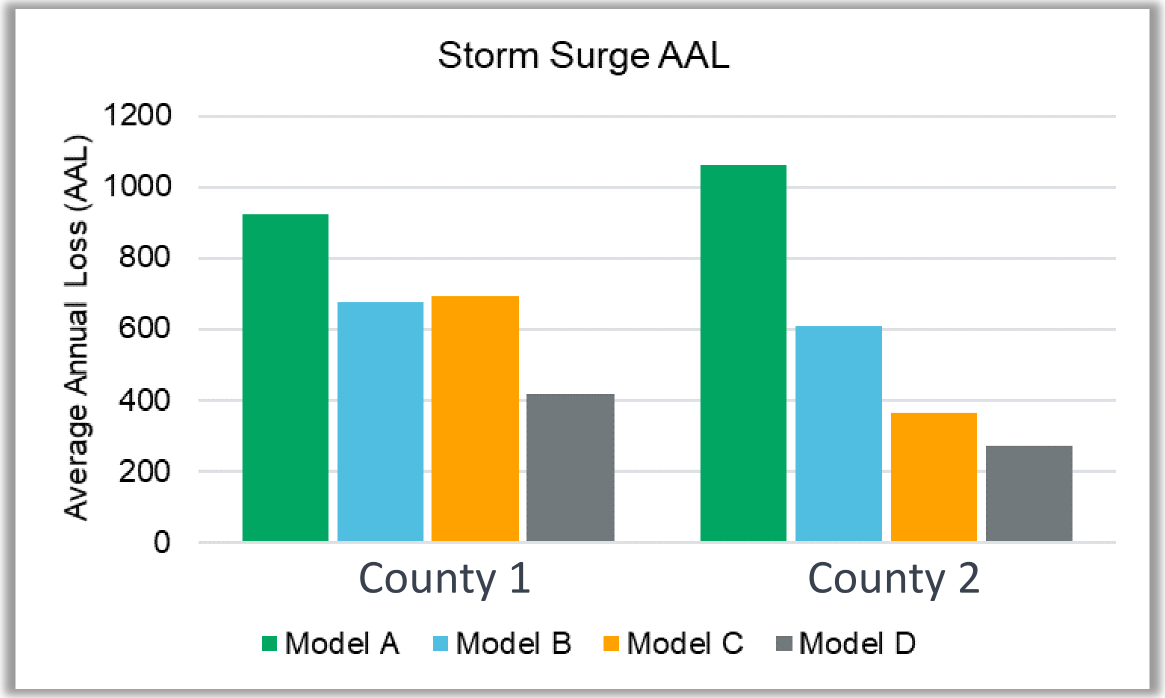
Example: Annual Average Loss (AAL) by model

Average AAL impacts the rate level

Wide disparities exist across different models for inland flood



Storm surge also shows sizeable variation of AALs across models



Example: Inspection of individual risks

Which modeled AALs are most reasonable?

Beach house

Model A	Model B	Model C
$1,000	$30	$20,000

Inland property

Model A	Model B	Model C
$1,500	$3	$30

Example: Correlation among models

Higher agreement in relative risk for storm surge than inland flood

Inland flood (4 counties)

	Model A	Model B	Model C	Model D
Model A	1.00	0.26	0.36	0.33
Model B		1.00	0.30	0.23
Model C			1.00	0.34
Model D				1.00

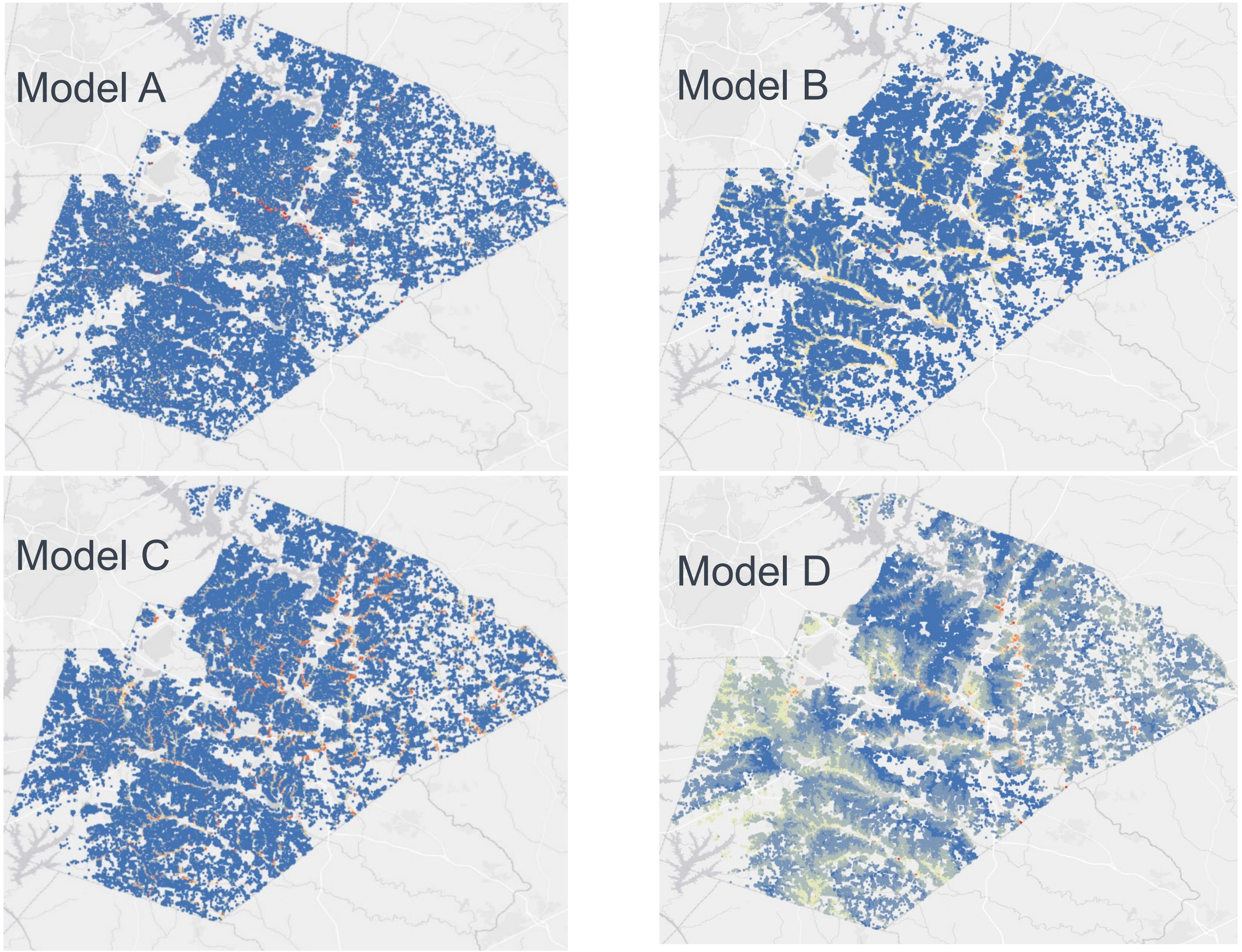
None of the models are highly correlated for inland flood

Storm surge (2 counties)

	Model A	Model B	Model C	Model D
Model A	1.00	0.88	0.85	0.81
Model B		1.00	0.85	0.91
Model C			1.00	0.83
Model D				1.00

Significantly higher correlation among storm surge AALs

Example: Spatial analysis of inland flood



- Model A shows limited high AALs
- Model B shows high AALs farther away from rivers
- Model C shows more high-AAL locations, generally very close to rivers
- Model D shows high AALs the farthest away from rivers

AALs

- 0 - 25
- 26 - 50
- 51 - 100
- 101 - 200
- 201 - 500
- 501 - 1,000
- 1,001 - 5,000
- 5,001 - 35,832

Proposal for catastrophe model clearinghouse

Multi-disciplinary panel to develop standards, select expert reviewers, and manage model review process

Third-party experts chosen by panel to perform confidential reviews

- Consistent professional review team for all models for a given peril
- Expert team would depend on nature of model but could include engineers, scientists, technologists, actuaries, claims experts, other professionals

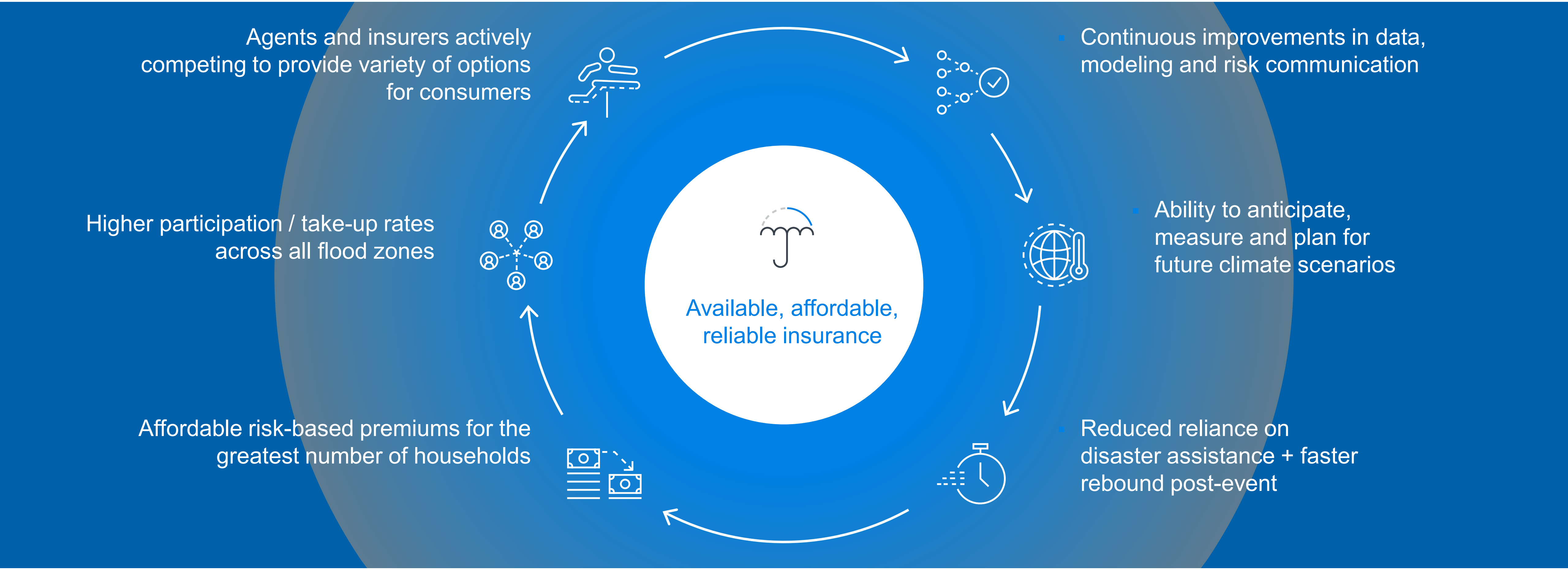
Voluntary participation by states who wish to rely on expert model review

- Retention of state-level control of ultimate determination of acceptability
- States may add filing-specific questions regarding model usage

Potential clearinghouse deliverables

- Standardized modeler disclosures
- Market basket output for state level regulatory analysis, comparison
- Third-party expert reports reviewing model compliance with standards, suitability for specific purposes

Vision for sustainable private flood insurance market



Thank you

Nancy Watkins
nancy.watkins@milliman.com