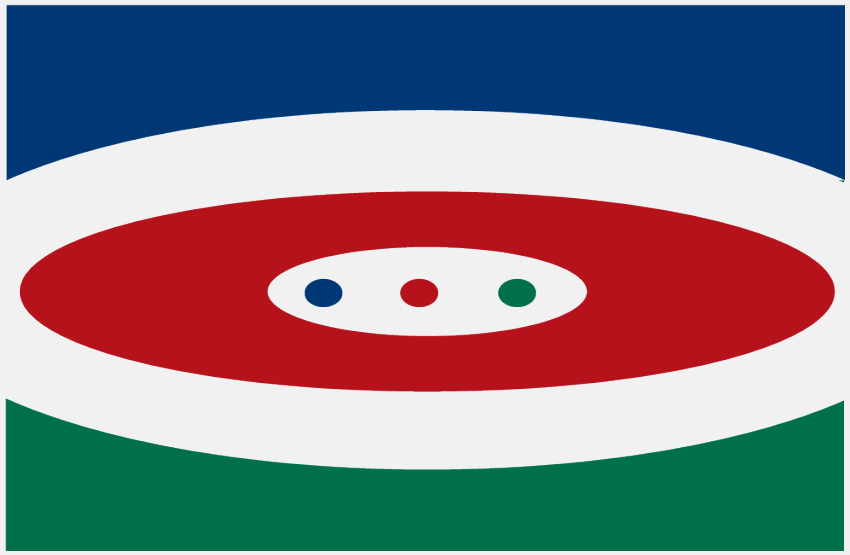
NCRB Flood Program:

Everyone lives in a flood zone, because where it rains it floods

Agenda: North Carolina Flood

NCRB-NCRF-NCIGA



01 Introduction
Corise Morrison

02 Manuals, Forms and Rules
Andy Montano

03 Flood Modeling
Brandon Katz

04 Flood Rating
Dave Evans

05 Flood Rating Example
Andy Montano

The NFIP: Solution

Goal:

To provide access to primary flood insurance to the public, while also mitigating flood risk through flood plain management standards.

Plan:

- ✓ Communities will participate voluntarily in order to obtain access to NFIP flood insurance

- ✓ Require participating communities to collaborate with FEMA to develop and adopt Flood Insurance Rate Maps (FIRMs). An area of specific focus of the FIRM is the Special Flood Hazard Area (SFHA)

The NFIP: North Carolina Results

7th

North Carolina's ranking nationally in terms of properties at risk of flood

141,000

Number of NFIP polices in North Carolina, which has almost four million households

30%

Percentage of countrywide flood losses that occur outside the high risk flood zone, according to FEMA

$24,500,000,000

Total amount of losses from Hurricanes Matthew and Florence combined

Of that, $10-13 billion were uninsured flood losses from Hurricane Florence

The NCRB: Solution

Goal:

To develop a long term, quality flood solution for the state of North Carolina that is accepted by lenders and offers residential risk coverage options that are equal to or greater than the current policy offered by the NFIP.

Plan:

- ✓ Bring in industry experts to create a property flood subcommittee
- ✓ Bring in top flood experts to help build a new flood program for North Carolina
- ✓ Match price to risk and cover residential property types

NCRB-NCRF-NCIGA

ISO

KatRisk

Milliman

Meet the: Flood Committee Members

Corise Morrison, CPCU	Jennifer Rath, ANFI	Jon Christianson	Natalie Adiutori	Bob Messier	Eric Mize	Robert Reid
Executive Director, Property Insurance	*Flood Line Manager*	*Chief Operating Officer*	*Manager, Personal Property Product Development*	*Und. Operations Personal Lines*	*Product Manager*	*Vice President of Operations*
United Services Automobile Association	Allstate Insurance Company	Palomar Specialty Insurance Company	Erie Insurance Company	State Farm Mutual Auto Insurance Company	The Hartford Insurance Company	Homeowners Choice Property and Casualty Insurance Company
*CHAIR**	*VICE CHAIR**					

NCRB Flood: The History

Dec. 2017

- ✓ Property Flood Subcommittee Established (FS)
- Proposed charter and selected Chair and Vice Chair

Feb. 2018

- ✓ Milliman presented proposal to complete a Flood Feasibility Study
- ✓ ISO presented their countrywide, stand-alone program, to include policy language and approach to rating

April 2018

- ✓ FS elected to use ISO program for forms
- ✓ FS elected to use Milliman for rating program and structure
- ✓ FS directed NCRB to continue with stand-alone program

Dec. 2018

- ✓ Milliman presented a "blind" comparison of 5 potential flood model vendors

March 2019

- ✓ NCRB Finalized Selection of 3 Vendors:
  - ISO for Forms
  - Katrisk for Modeling
  - Milliman for Rating

NCRB Flood: The History

✓ North Carolina manuals, forms and rules created
✓ Rating variables and program structure finalized
✓ Review and recommendations of program by NCRB to the following committees:
- Property Flood Subcommittee
- Property Rating Subcommittee
- Property Forms Subcommittee
- Property Committee
- Governing Committee

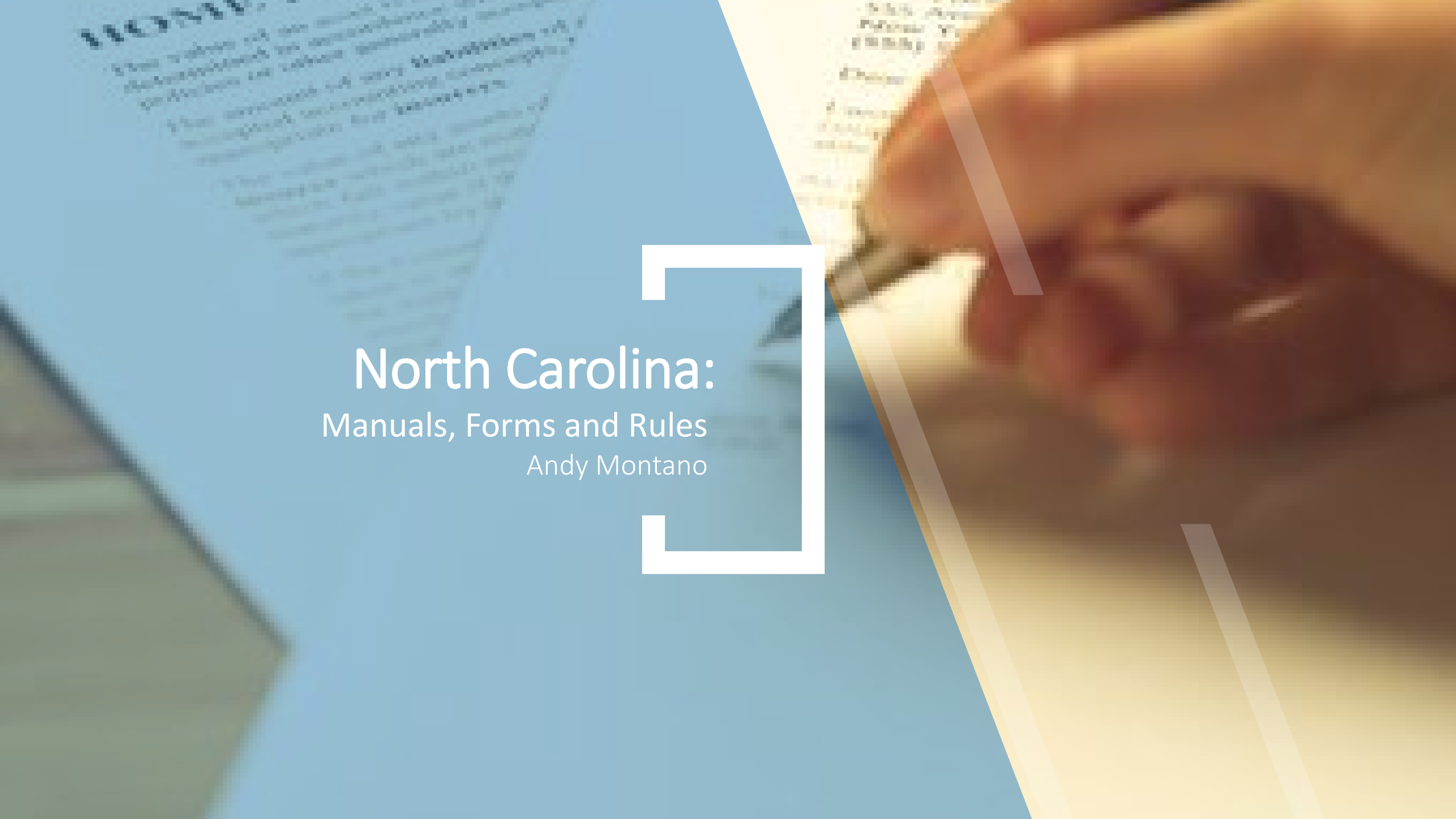
August 2019

April 2019

✓ FS determined NCRB would use latitude/longitude, granular risk rating

Sept. 2019

✓ Flood Program finalized and filed with NC DOI



North Carolina:

Manuals, Forms and Rules

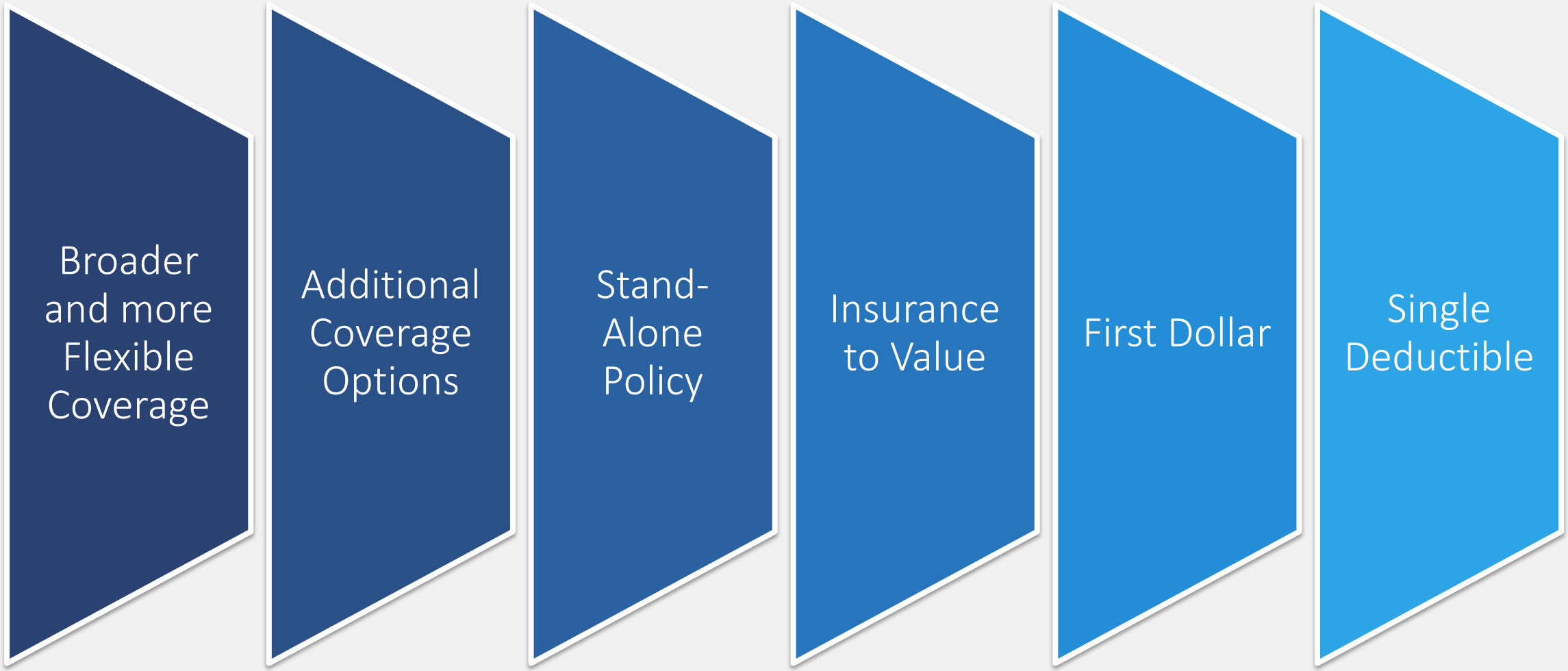
Andy Montano

NFIP vs. NCRB: Forms

The following notable differences exist between NFIP and NCRB:

Program Detail	NFIP	NCRB
Coverage A: Dwelling Limits	$250,000 Maximum	No Limit
Coverage C: Personal Property Limits	$100,000 Maximum	No Limit
Coverage D: Additional Living Expenses	Not Covered	Optional
Deductibles	Separate deductibles by coverage type	Single Deductible per Policy
Replacement Cost	Single Family Dwellings Only Detached Garage & Personal Property not covered	1-4 family dwellings, with 1 detached garage Optional Endorsements for Personal Property and Other Structures
Basement/Below Ground Areas - Dwelling	Covered	Covered
Basement/Below Ground Areas- Contents	Not Covered (exception for certain appliances)	Optional
Detached Garages/Structures	Up to 1 (Within Coverage A Limit)	1 detached garage (Within Coverage A Limit) - Optional (ex. 10% in additional to Coverage A for all structures, or scheduled structures)
Increased Cost of Compliance	$30,000 Maximum	$30,000 minimum, with higher limits available
Ordinance or Law	Not Covered	Optional

Benefits: NC Manual, Forms and Rules



Framework: Base Policy Coverages

Coverage A: Building

- ✓Includes 10% for detached garage (included in Coverage A limit)
- ✓Excludes certain structures or property (building or structure on or above a body of water)

Coverage C: Personal Property

- ✓Excludes personal property in a "below ground area" or below the lowest floor of an "elevated building", with certain exceptions
- ✓Special limits of liability for artwork, jewelry, watches, personal property used primarily for business, furs, silverware, etc.

Coverage D: Loss of Use

- ✓Available only if purchased with Coverage A and/or C

Additional Coverages

- ✓Debris Removal
- ✓Reasonable Repairs
- ✓Property Removed
- ✓Sandbags, Supplies and Labor
- ✓Tenants Building Additions and Alterations
- ✓Loss Assessment

Endorsements: North Carolina Flood Program

Endorsement Number	Endorsement Name
FD 02 01	Conforming Condition
FD 02 02	Increased Cost of Compliance Coverage Endorsement
FD 02 03	Broadened Cancellation Notice
FD 04 01	Loss Assessment Increased Limits
FD 04 02	Broadened Coverage for Dwelling and Other Structures
FD 04 03	Other Structures on the Described Location- Increased Limits
FD 04 04	Structures Rented to Others- Described Location
FD 04 05	Permitted Incidental Occupancies

Endorsements: North Carolina Flood Program

Endorsement Number	Endorsement Name
FD 04 06	Supplemental Personal Property Coverage
FD 04 07	Personal Property Replacement Cost Loss Settlement
FD 04 08	Ordinance or Law Coverage
FD 05 01	Cap on Losses From Certified Acts of Terrorism
FD 05 02	Cap on Losses From Certified Acts of Terrorism; Disclosure Pursuant To Terrorism Risk Insurance Act
FD 06 01	Mobile home Endorsement
FD 17 01	Basic Unit-Owners Coverage
FD 17 02	Broadened Unit-Owners Coverage

Endorsements: North Carolina Flood Program

Endorsement Number	Endorsement Name
FD 32 11	Deductible As Percentage of Coverage A Limit- North Carolina
FD 32 12	Deductible As Percentage of Coverage C Limit- North Carolina
FD 32 13	Special Loss Settlement- North Carolina
FD 32 29	Restriction of Individual Policies- North Carolina
FD 32 32	Amendment of Policy Provisions- North Carolina
FD DS 32	Personal Flood Policy Declarations- North Carolina

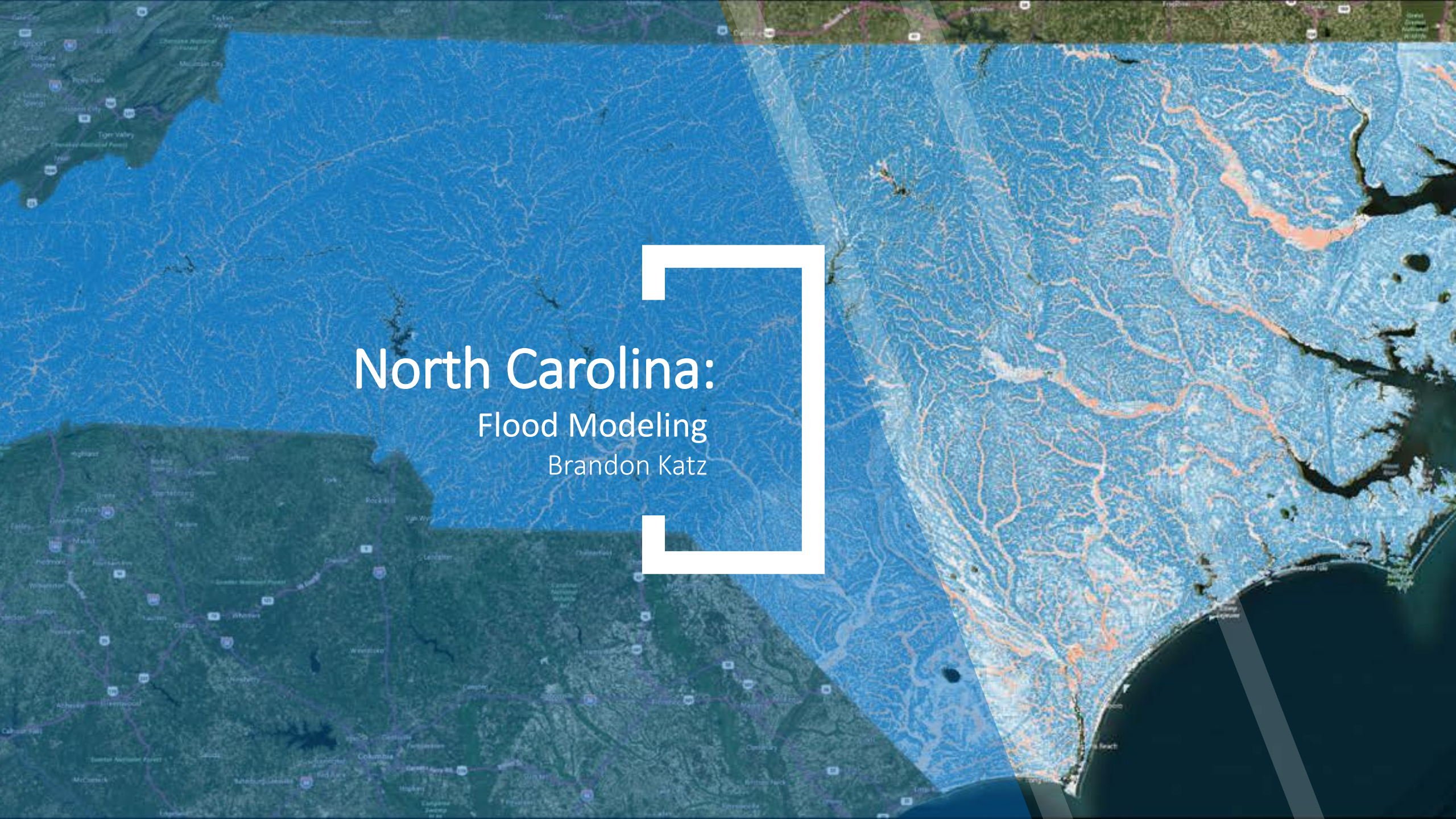
Benefits: Consumer and Industry

Consumer

- ✓ Policy looks more like a standard homeowners policy
- ✓ Provides market for consumer choice
- ✓ Higher limits available than NFIP policies

Industry

- ✓ Generally relies on court-tested policy provisions
- ✓ Provides carriers easy entry into the market
- ✓ Stand-alone policy allows for flexibility
- ✓ Lender acceptance



North Carolina:

Flood Modeling

Brandon Katz

KatRisk: Who We Are

- ✓ KatRisk is an independently owned catastrophe modeling business formed in 2012. We are composed of 12 people in the United States and Germany.
- ✓ KatRisk is self-funded with no outside investment and is therefore an independent risk modeling company that gives its clients an independent view of the modeled climate and weather-related perils.
- ✓ KatRisk is rapidly growing based on the reputation of the quality of our models as clients push into previously underserved or untapped markets; we look forward to continuing to innovate with new and existing clients.

KatRisk: Who Are Our Clients

- ✓ We service clients ranging in size from multinational industry leaders to super regional specialty carriers primarily within the insurance and financial services industries.

- ✓ Our client base is growing, and we currently have around 45 clients licensing our flood data and models to write new flood policies, including the following:

3 of the 4 largest worldwide reinsurance brokers

2 of the top 4 worldwide non-life reinsurers

4 of the top 15 worldwide property insurers

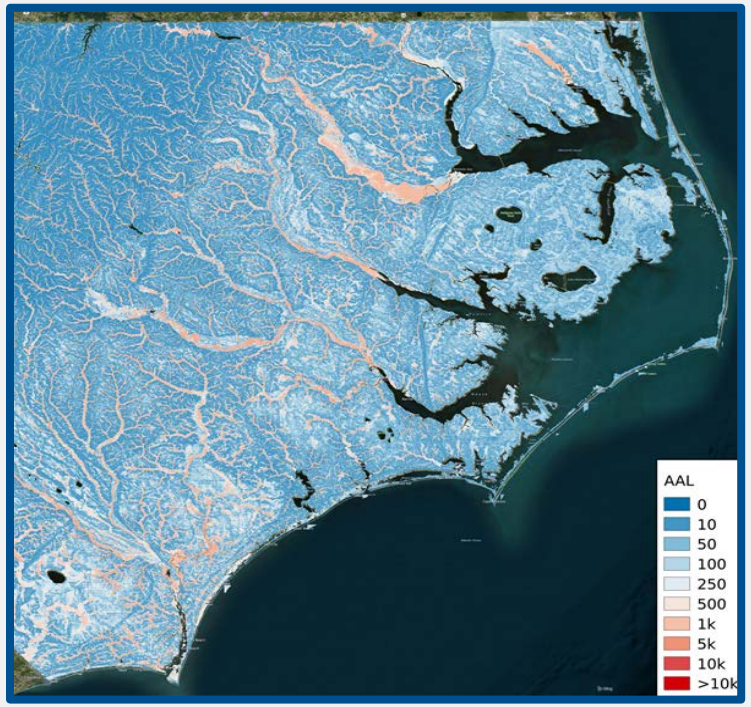
North Carolina Rate Bureau

NFIP

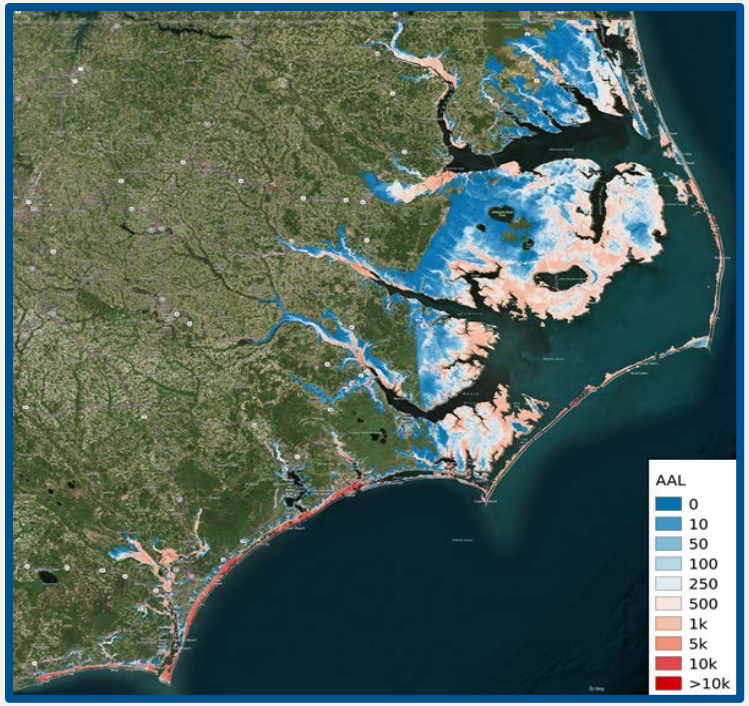
KatRisk Model: Overview

SpatialKat

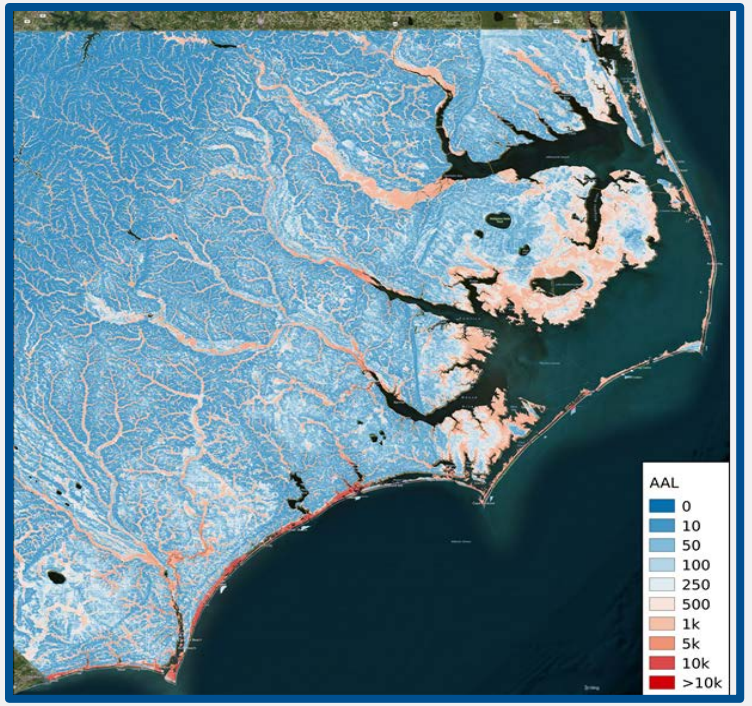
- ✓ Probabilistic Inland Flood and Hurricane Wind/Storm Surge Model
- ✓ For this analysis, the NCRB is using the Inland Flood and Storm Surge Models



Inland Flood

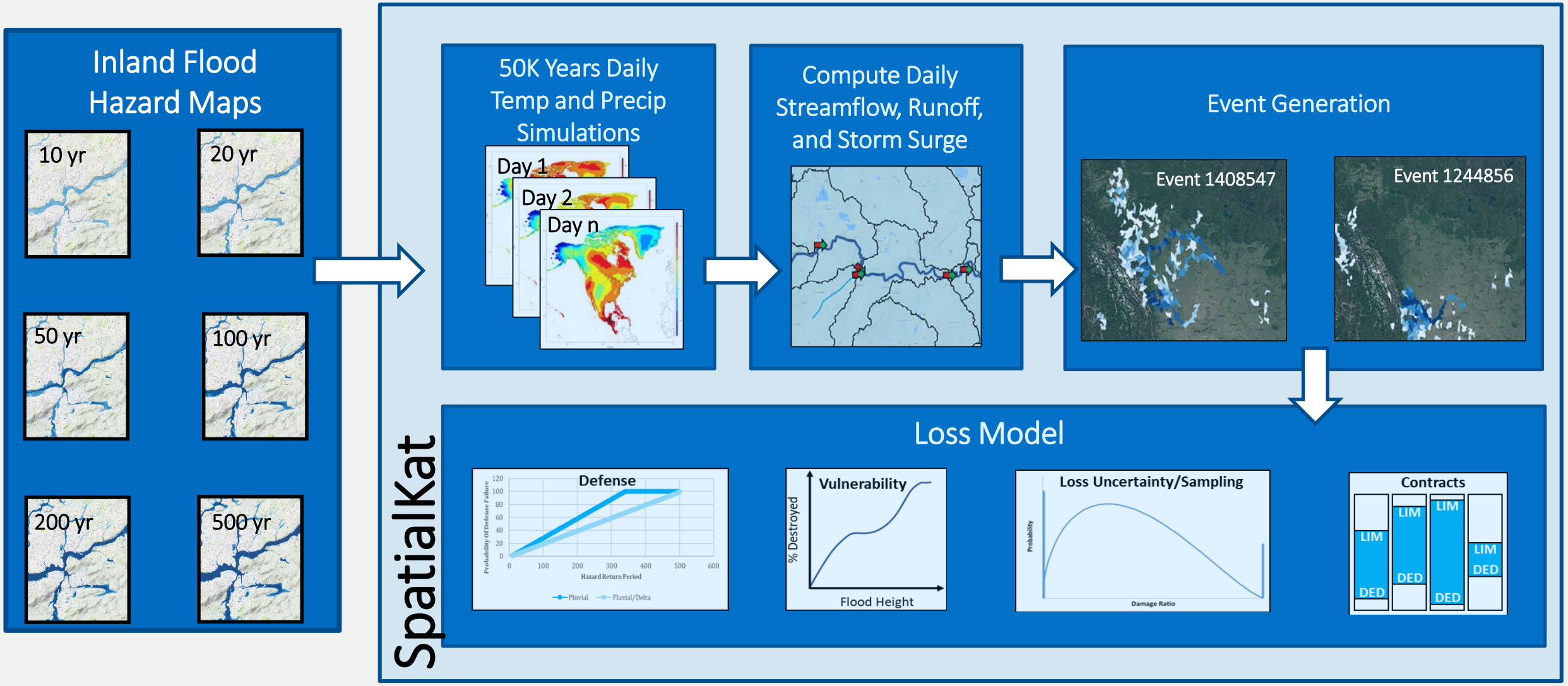


Storm Surge



Inland Flood + Storm Surge

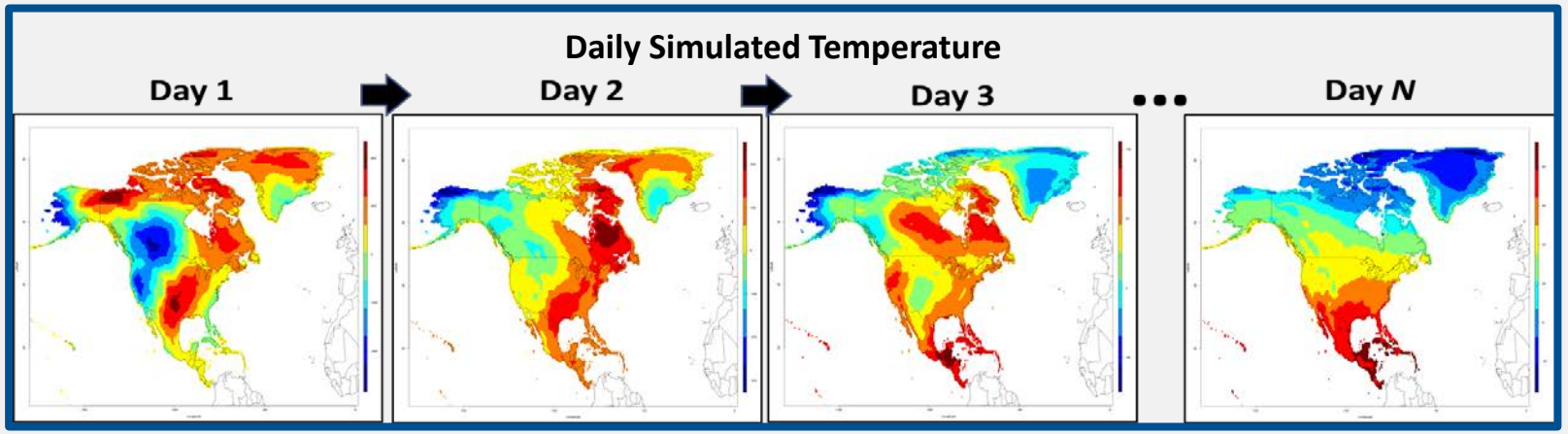
KatRisk Model: Overview

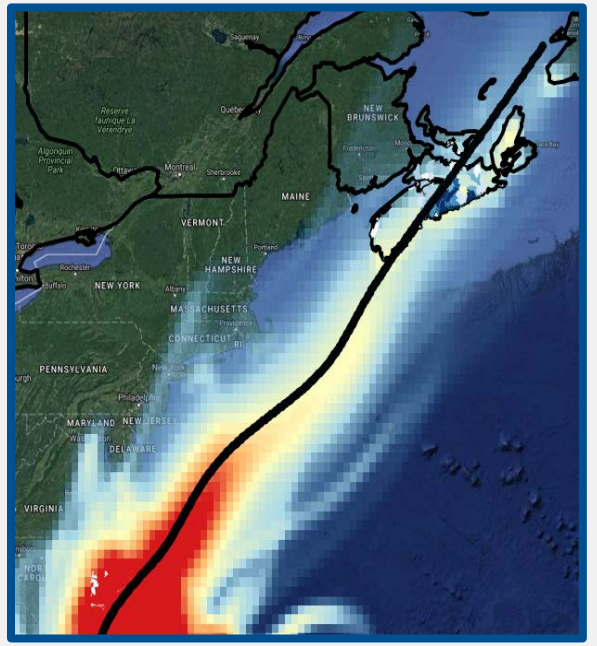


KatRisk Model: Overview

SpatialKat Unique Features

- ✓ Models all sources of flooding including precipitation-induced flooding from hurricanes and overland storms
- ✓ Accounts for flood enhancement factors such as seasonal snow melt, temperature-induced evaporation, and ground water fluctuations
- ✓ High resolution (10m)



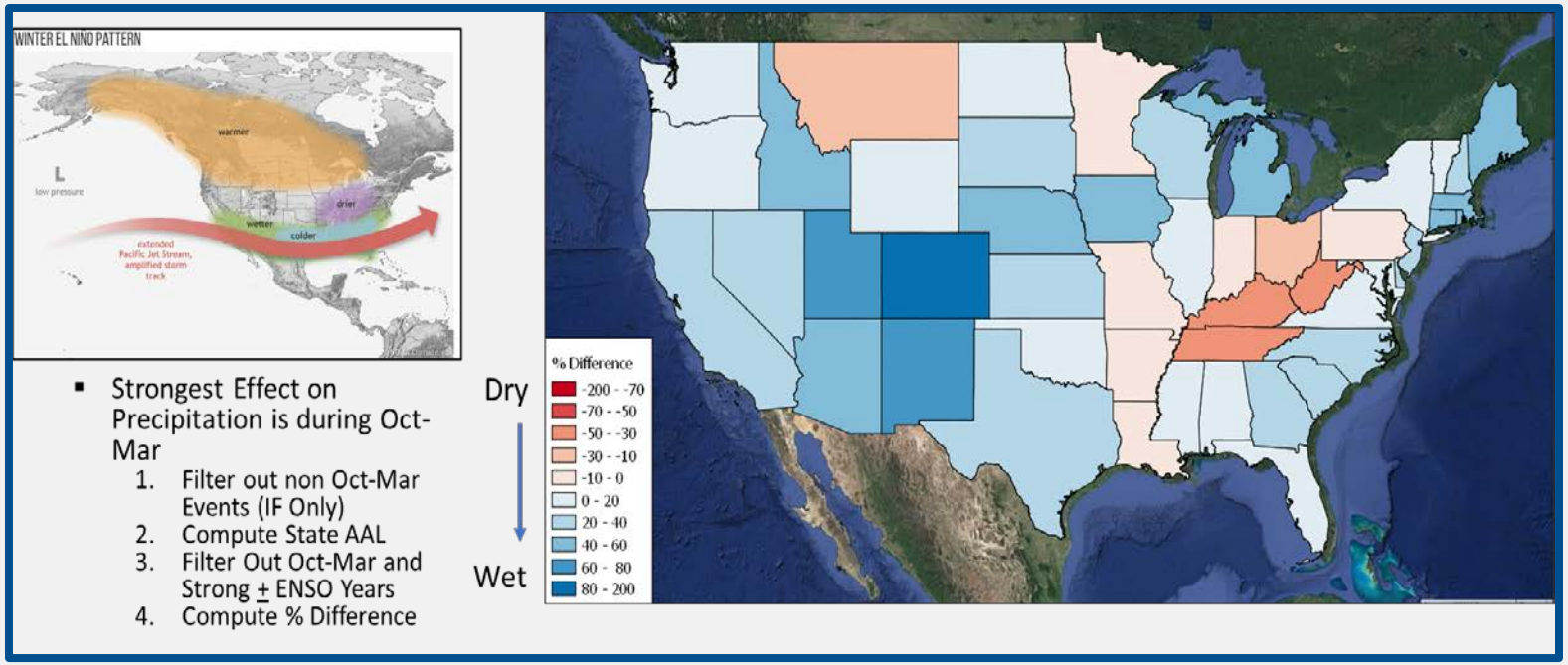


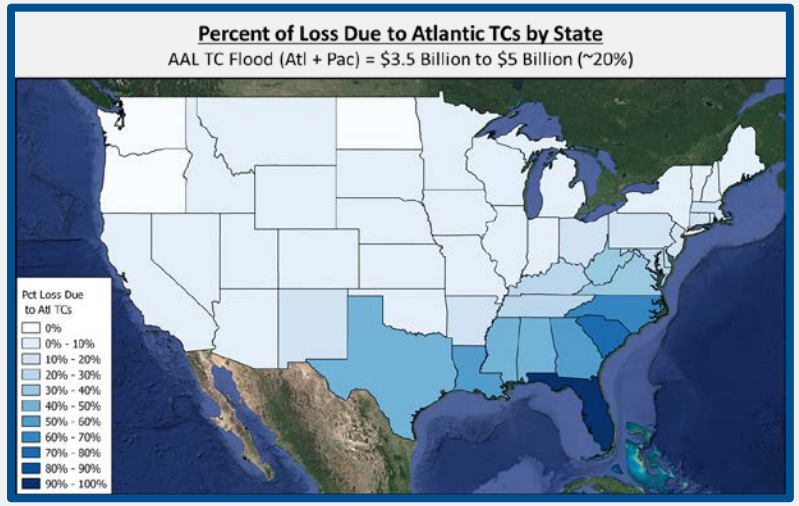
Example of Hurricane Precipitation

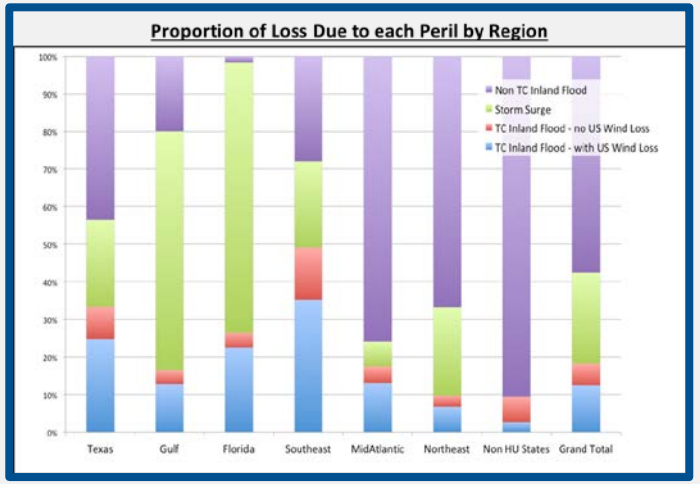
KatRisk Model: Overview

SpatialKat Unique Features

✓ Sea surface conditioning (climate states such as El Nino and the Atlantic Multidecadal Oscillation are captured in our model)







KatRisk Model: Overview

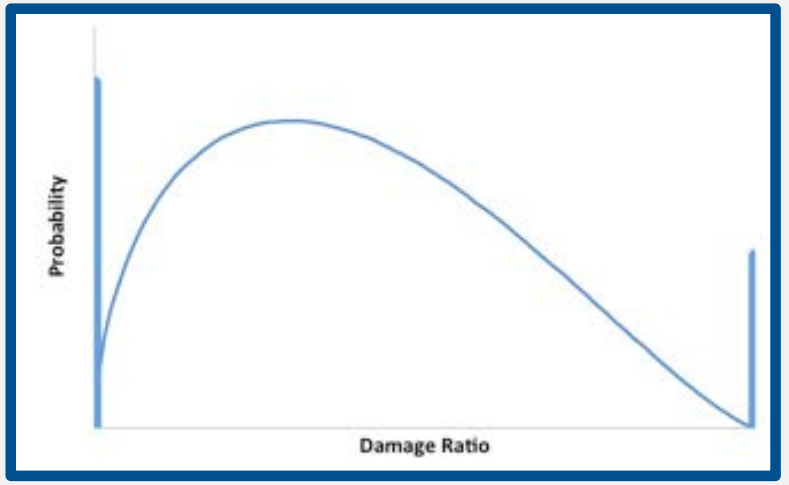
SpatialKat

- ✓ Full featured loss model including all important flood vulnerability modifiers
- ✓ Repeatable sampling using a 4-parameter beta distribution
- ✓ Stochastic Defense Module
- ✓ Financial Model

KatRisk Vulnerability Modifiers

First Floor Elevation		Unit Start/End Floor		Basement Only	
Occupancy	Construction	Number of Stories	Basement	Mobile Home Tie Down	Finished Basement
Residential	Wood	1	Yes	Yes	Yes
Commercial	Masonry	2	No	No	No
Industrial	Concrete	3	Unknown	Unknown	Unknown
Auto	Steel	>3			
Unknown	Light Metal	Unknown			
	Mobile Home				
	Unknown				

4- Parameter Beta Distribution



KatRisk Model: Overview

SpatialKat

✓ Outputs include: Average Annual Loss, ELT and EP Curves

✓ Any aggregation level including by location, portfolio, post-code, etc.

Event Loss Table (ELT)

Event ID	Loss
1574425	51,235
1574625	65,412
1000215	51,581
988878	0
…	
TOTAL	$50B

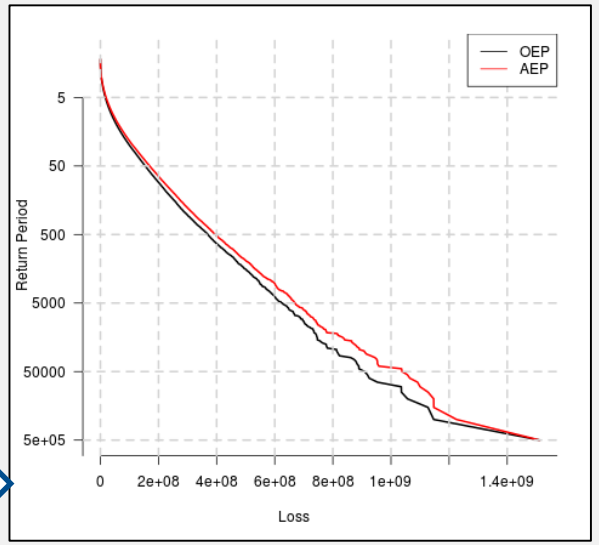
Average Annual Loss (AAL) [Pure Premium]

Assuming 50k years of events:

$$AAL = \frac{\$50B}{50k}$$

$10,000

Exceedance Probability Curve (EP)



OEP
Occurrence Exceedance Probability

- If you have, say 500k years of events:
  - Take the event with the highest loss every year and order the losses

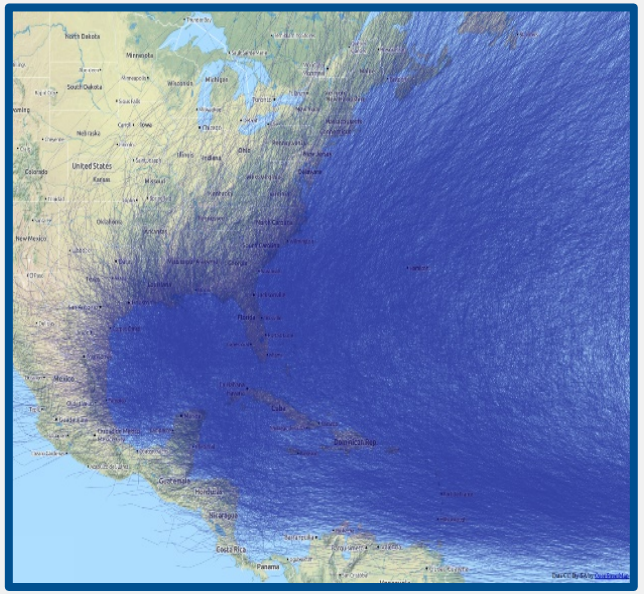
AEP
Aggregate Exceedance Probability

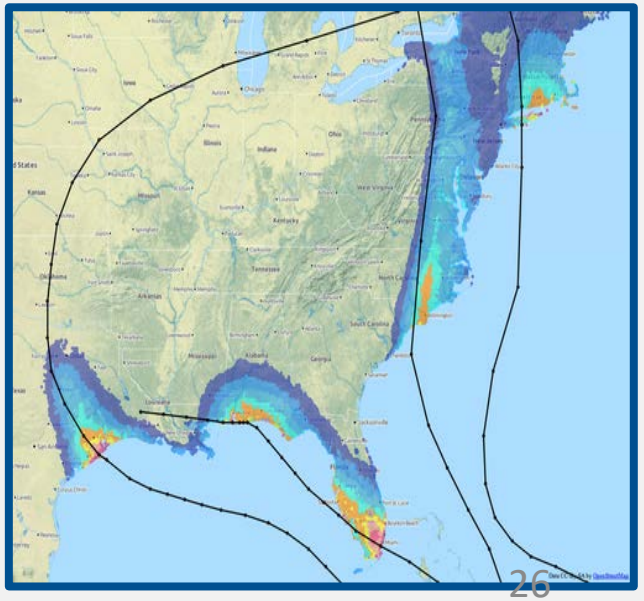
- If you have, say 500k years of events:
  - Sum all the events for each year and order the losses

KatRisk Model: Overview

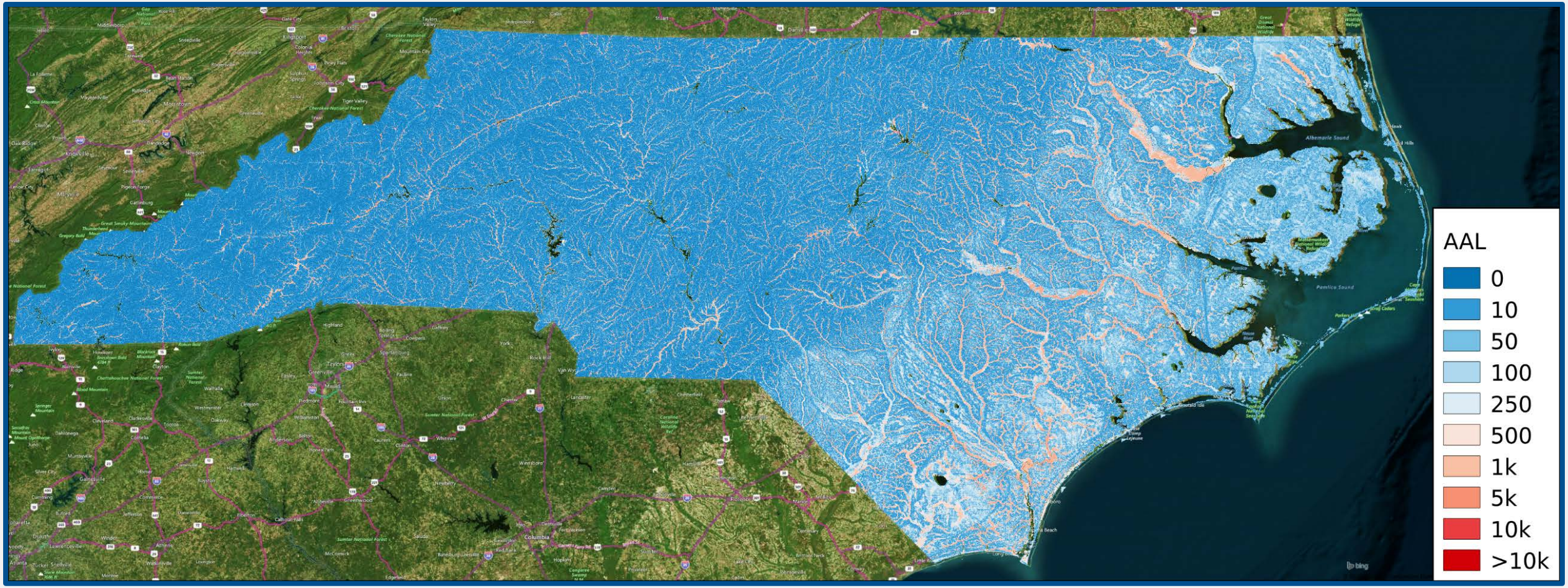
SpatialKat

- ✓ Statistics based on countrywide KatRisk exposure database
  - ✓ Number of IF events in 50K data set that impact NC
    - 115K of 2.1M (US and Canada)
  - ✓ Number of SS events in 50K data set that impact NC
    - 27K of 85K (US and Canada)
  - ✓ Percent of loss from hurricane-induced inland flooding (flooding caused by hurricane precipitation vs. flooding cause by non-hurricane precipitation)
    - Countrywide: 23%
    - North Carolina: 70%

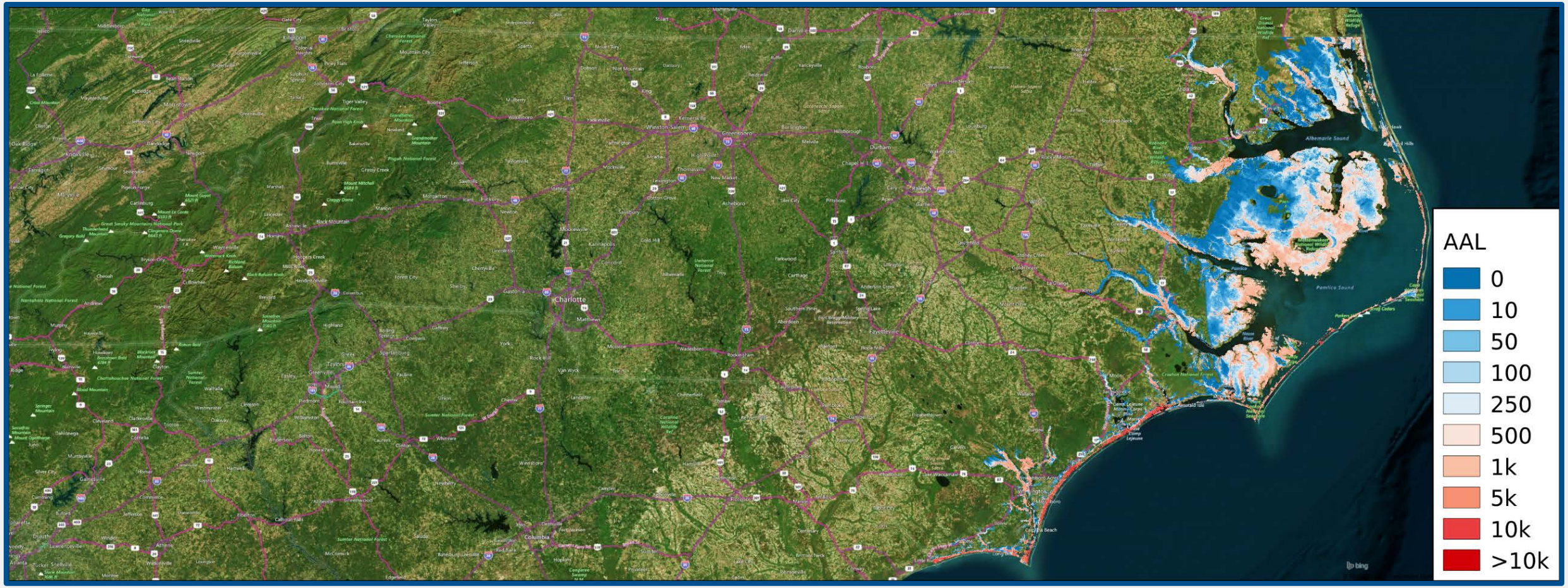




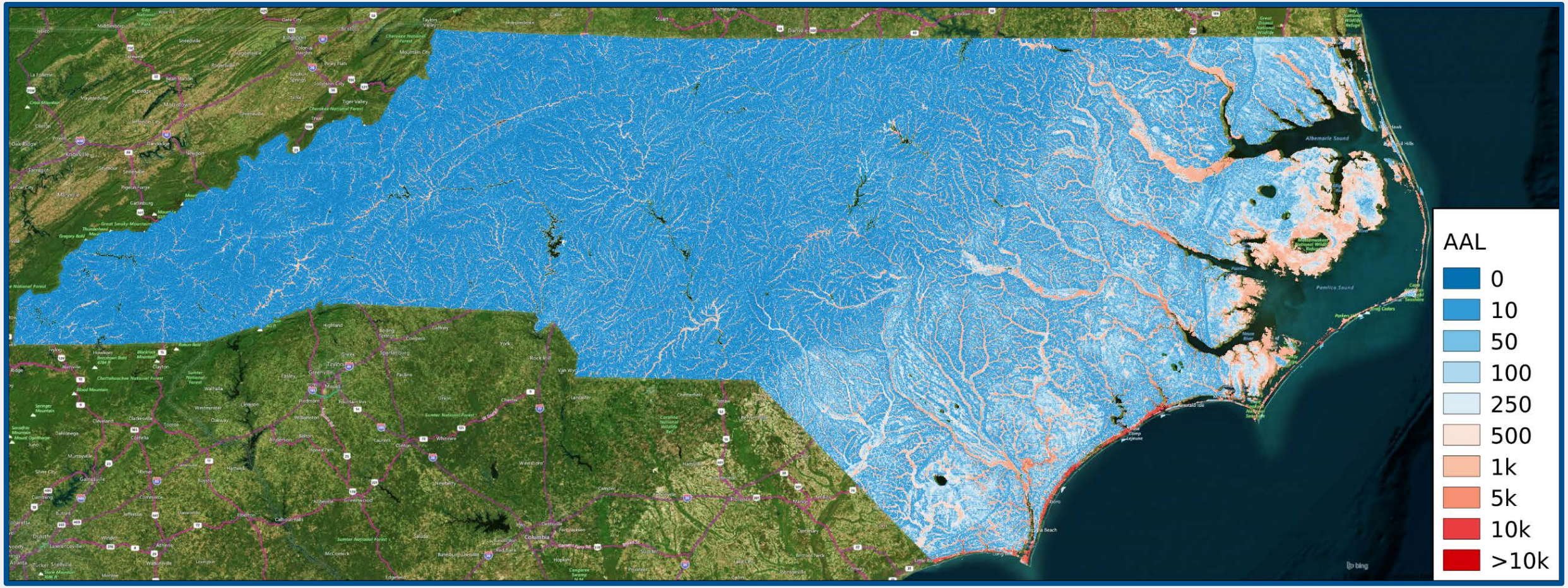
Inland Flood: Ground Up Loss



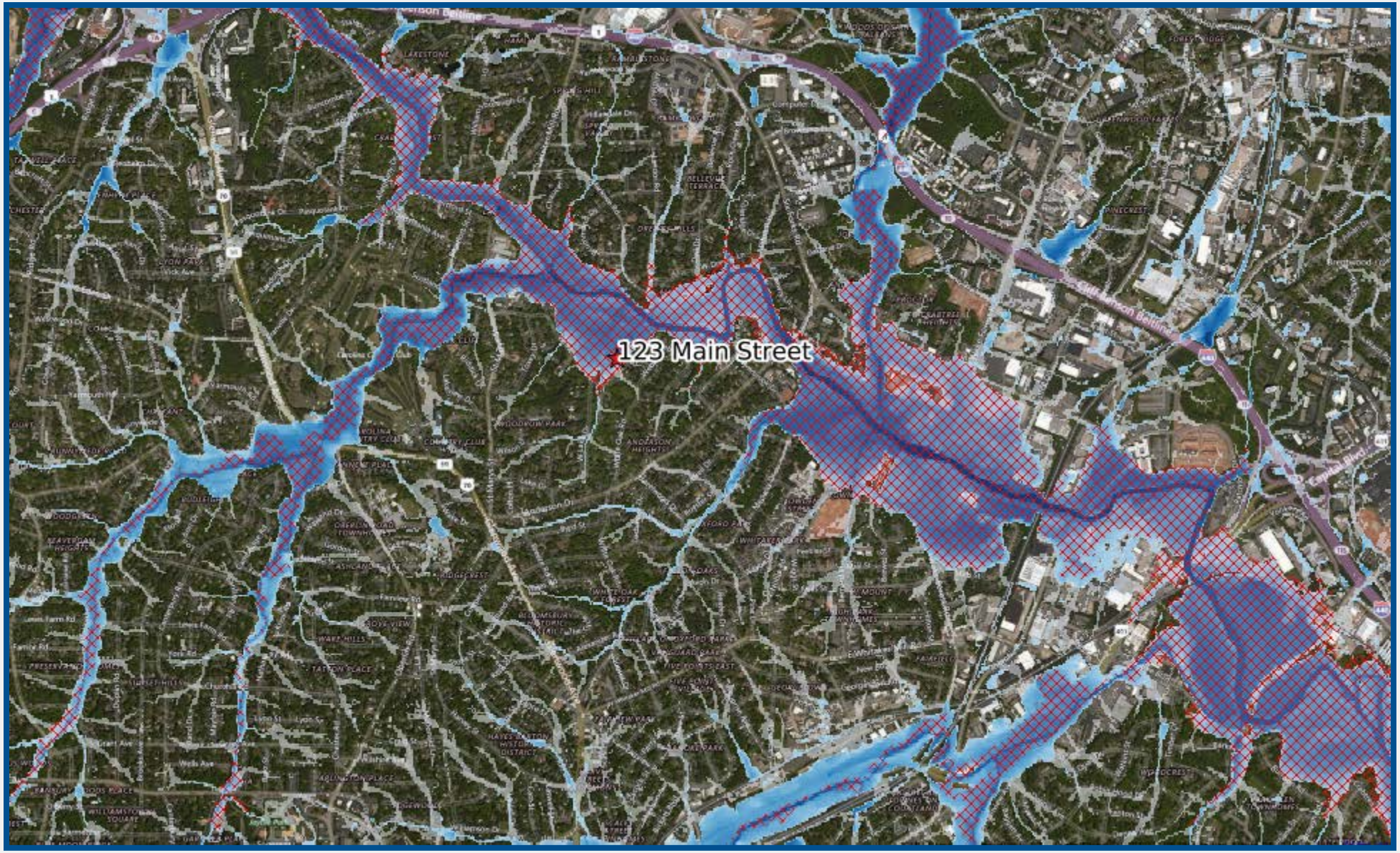
Storm Surge: Ground Up Loss



Inland Flood + Storm Surge: Ground Up Loss



High Risk Flood Zone: Flood Map



North Carolina:

Flood Rating

Dave Evans

	Step	Sample Inputs	Coverage Value A	C	D	Rating Source
(A)	Grid Base Risk AAL		208.350	208.350	208.350	KatRisk Grid Results
(B)	Coverage Off-balance	Without Storm Surge Exposure	0.00332	0.00596	0.00426	Exhibit 3, page 5
(C)	Coverage Value		200,000	100,000	60,000	
(D)	Coverage Base Rate		138.34	124.18	53.25	(A) x (B) x (C) divided by 1,000
(1)	Deductible (Note 1)	2.0%	0.868	0.876	[redacted]	Exhibit 4, page 4 and 8
(2)	Coverage A ITV (Note 2)	100%	1.000	[redacted]		Exhibit 4, page 3
(3)	Construction	Masonry	0.850	1.000	0.830	Exhibit 4, page 27
(4)	First Floor Height (Note 3)	FFH = 1, Group 2	0.801	0.807	0.737	Exhibit 4, page 17 to 19
(5)	Number of Stories	2	0.630	0.550	0.580	Exhibit 4, page 23
(6)	Floor of Interest	1	1.000	1.000	1.000	Exhibit 4, page 17 to 19
(7)	Type of Below Ground Area Finish	Finished Basement	1.560	1.410	1.590	Exhibit 4, page 25
(8)	Tie Down (Note 4)	N/A		1.000	1.000	Exhibit 4, page 29
(9)	Building Equipment Lower than First Floor (Note 5)	N	[redacted]	[redacted]	1.000	Exhibit 4, page 32
(10)	Ordinance or Law	N	1.000	1.000	1.000	Exhibit 5, page 2
(11)	Personal Property Replacement Cost (Note 6)	Y	[redacted]	1.000	[redacted]	Exhibit 5, page 1
(12)	Other Structures Coverage Indicator (Note 7)	Y	0.984	[redacted]		
(13)	Coverage Premium		79.10	68.09	30.03	Product of (D) and (1) to (12)
			A	tional Coverages		
(14)	Other Structures Percent of Coverage A		10%			
(15)	Other Structures Coverage Premium		8.04			(13A) * (14)
(16)	Loss Assessment Limit		10,000			
(17)	Loss Assessment Coverage Premium		6.00			Product of (16) and Coverage A Factors (A), (B), (1) divided by 1,000
(18)	Increased Cost of Compliance Factor		0.0006			Exhibit 5, page 3
(19)	Increased Cost of Compliance Coverage Premium	,000	1.42			((18) * (13A)) * (ICC Coverage / 1,000)
(20)	Sum of Coverage Premiums					
(21)	Loss Cost Multiplier	Storm Surge Percent				Exhibit 3, page 2
(22)	Premium Subtotal		$738			(20) * (21)
(23)	Minimum Premium	Homeowners	$200			Exhibit 3, page 1
(24)	Total Premium		$738			Max((22), (23))

Notes:
1. Does not apply to Coverage D. Deductible Percent of Value calculated as Deductible / (Cov A Value + Optional Other Structures Limit + Cov C Limit).
2. Only applies to Coverage A. ITV calculated as Deductible Percent of Value + Building Limit / Building Value.
3. Use a factor of 1.000 for Condominium Unit-owners and Tenants located above the first floor.
4. Applies to Mobile Home only
5. Does not apply to Coverage C.
6. Only applies to Coverage C.
7. Only applies to Coverage A.
8. Final LCM calculated as (Storm Surge Percent) * Storm Surge LCM + (1 - Storm Surge Percent) * Inland Flood LCM.

NFIP vs. NCRB: Rating

In addition to reflecting North Carolina specific rates, the following notable differences exist between the NFIP and the North Carolina flood product:

Rating Characteristic	NFIP	NCRB
Geographic Rating Granularity	Base Flood Elevation (BFE) in SFHA	30 Meters Statewide
Modern Multiplicative Rating Algorithm	No	Yes
Transparent Impacts of Property Characteristics	No	Yes
Insurance to Value	No	Yes

North Carolina: Flood Rating Overview

- Grid Rating System
- Similar in structure to ISO product approved in most states
- Rating Factors based on KatRisk Model and developed to be appropriate for ISO forms and KatRisk modeled losses

Flood Rating Factors: Property Characteristics

- ✓ Developed an Exposure set specifically for Rate Development
- ✓ Utilized a Generalized Linear Model, targeting Ground Up Loss and controlling for geographic risk
- ✓ Used training dataset to ensure rates matched modeled loss
  - ✓ Added interactions based on storm surge exposure and overall risk
- ✓ Indicated Rates developed and validated on holdout dataset for:

Basement Type

Construction

First Floor Height

Floor of Interest

Number of Stories

Tie Downs

Other Structures Coverage

Flood Rating Factors: Coverages

- ✓ Used Rate Development Exposure Set
- ✓ Calculated impact of Deductible on Loss Elimination Ratio across all Insurance to Value combinations
- ✓ Calculated impact on Insurance to Value after accounting for losses eliminated by Deductible
- ✓ Resulting Deductibles and Insurance to Value work together to determine impact of all Limit, Value and Deductible combinations
- ✓ Allows factors based on Property Characteristics targeting Ground Up Loss to ultimately match the Gross Loss

Flood Rating: Additional Analysis

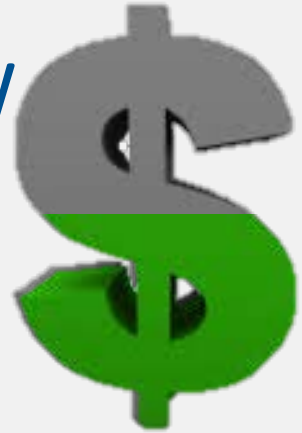
- ✓ Account for Coverage differences such as Detached Garage Coverage and interactions with Other Structures
- ✓ Develop rates for non-modeled components such as Loss Assessments, Building Equipment Lower than the First Floor, and Increased Cost of Compliance Coverage
- ✓ All modeled rating factors further validated by comparing to established losses on a realistic exposure set (i.e. a market basket)

Flood Rating: Compared to NFIP

OUTSIDE OF HIGH RISK FLOOD ZONE,

95%

OF RESIDENCES SAW A LOWER RATE!



INSIDE HIGH RISK FLOOD ZONE,

40%

OF RESIDENCES SAW A LOWER RATE!

Rating Factors: Comparison

Limits for Coverage A/B/C/D	$200K/20K /100K/60K
Replacement Value of Dwelling	$200K ITV = 100%
First Floor Height	1 Ft
# Stories	2 without basement

Premium: $1,022

Limits for Coverage A/B/C/D	$100K/20K /100K/60K
Replacement Value of Dwelling	Same as House A ITV = 50%
First Floor Height	Same as House A
# Stories	Same as House A

Premium: $921

Limits for Coverage A/B/C/D	Same as House A
Replacement Value of Dwelling	$400K ITV = 50%
First Floor Height	Same as House A
# Stories	Same as House A

Premium: $1,478

Limits for Coverage A/B/C/D	Same as House A
Replacement Value of Dwelling	Same as House A ITV = 100%
First Floor Height	8 Ft
# Stories	Same as House A

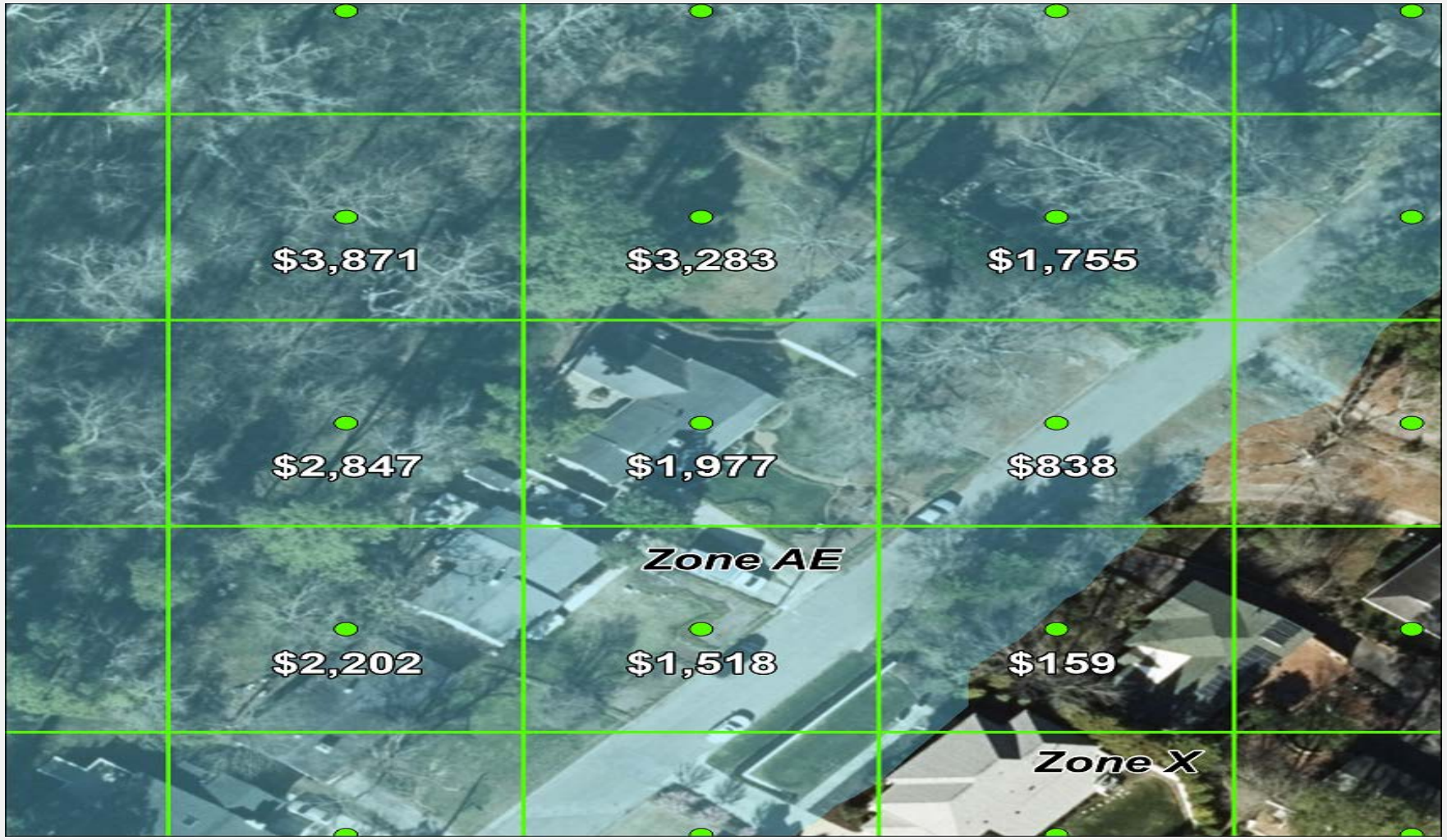
Premium: $296

Limits for Coverage A/B/C/D	Same as House A
Replacement Value of Dwelling	Same as House A ITV = 100%
First Floor Height	Same as House A
# Stories	1 with finished basement

Premium: $2,584

Granular: Flood Rating

Flood risk varies significantly within and across flood zones



Rating Example:

123 Main Street

Rating Example: 123 Main Street

Collect information from Insured

Insured

Insurance Company

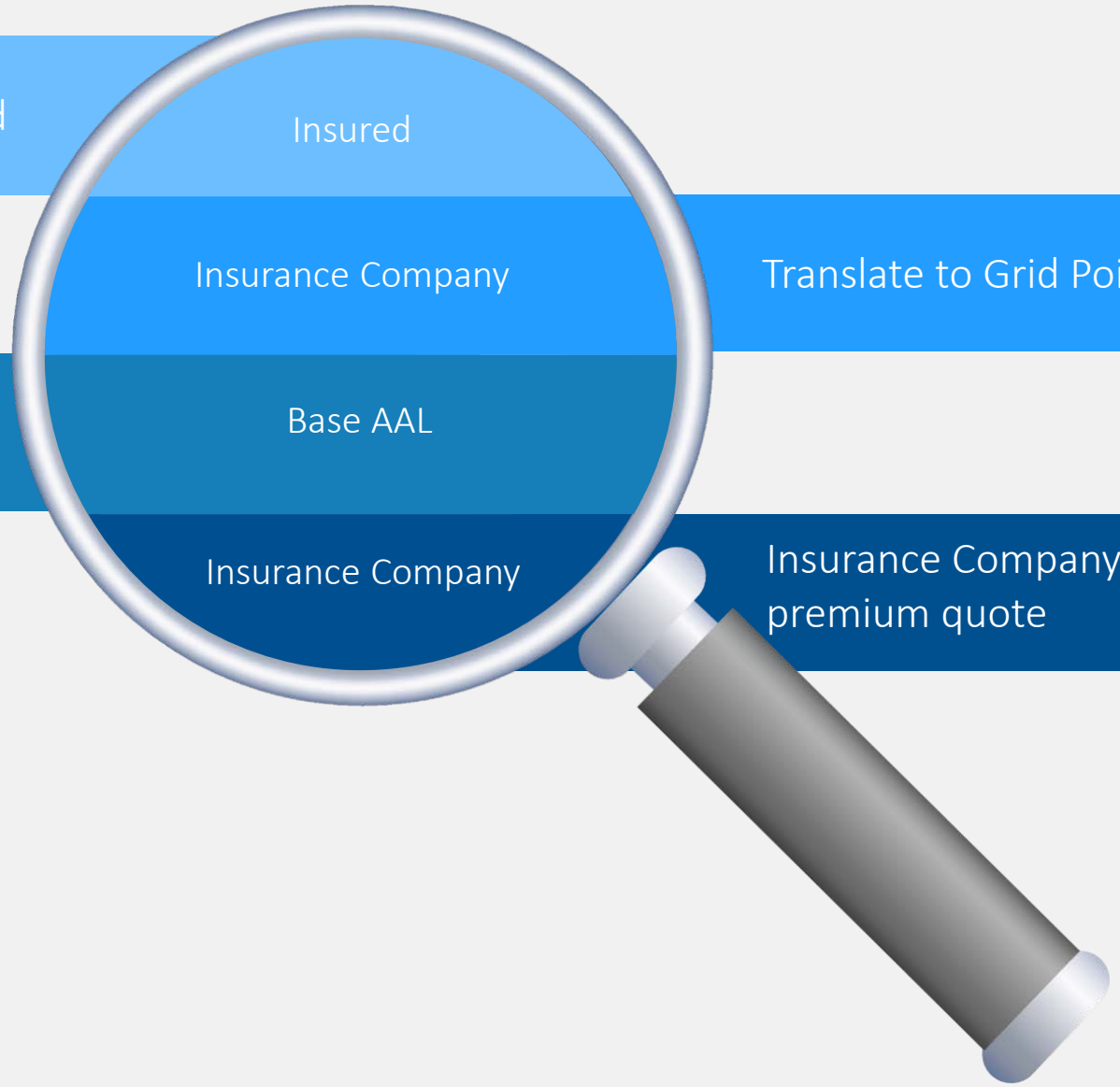
Translate to Grid Point

Tool will provide additional risk-related information

Base AAL

Insurance Company

Insurance Company generates premium quote



Policy Information

- Name: John Doe
- AOI: $350,000
- Address: 123 Main Street
- Deductible: $2,500

Risk Information

- Construction: Masonry
- Number of Stories: 2
- Basement: Finished
- First Floor Height: 3 Ft

Latitude and Longitude based on address provided.

Returned: DATA

Grid ID

Base Average Annual Loss

Special Flood Hazard Area Indicator

Storm Surge Indicator

CRS

Community Rating System ID

	Step	Sample Inputs	Coverage Value A	Coverage Value C	Coverage Value D	Rating Source
(A)	Grid Base Risk AAL		208.350	208.350	208.350	KatRisk Grid Results
(B)	Coverage Off-balance	Without Storm Surge Exposure	0.00332	0.00596	0.00426	Exhibit 3, page 5
(C)	Coverage Value		200,000	100,000	60,000	
(D)	Coverage Base Rate		138.34	124.18	53.25	(A) x (B) x (C) divided by 1,000
(1)	Deductible (Note 1)	2.0%	0.868	0.876		Exhibit 4, page 4 and 8
(2)	Coverage A ITV (Note 2)	100%	1.000			Exhibit 4, page 3
(3)	Construction	Masonry	0.850	1.000		Exhibit 4, page 27
(4)	First Floor Height (Note 3)	FFH = 1, Group 2	0.801	0.807	0.73	Exhibit 4, page 17 to 19
(5)	Number of Stories	2	0.630	0.550	0.580	Exhibit 4, page 23
(6)	Floor of Interest	1	1.000	1.00	1.000	Exhibit 4, page 17 to 19
(7)	Type of Below Ground Area Finish	Finished Basement	1.560	1.41		Exhibit 4, page 25
(8)	Tie Down (Note 4)	N/A	1.000		1.000	Exhibit 4, page 29
(9)	Building Equipment Lower than First Floor (Note 5)	N	1.000		1.000	Exhibit 4, page 32
(10)	Ordinance or Law	N	1.000	1.000	1.000	Exhibit 5, page 2
(11)	Personal Property Replacement Cost (Note 6)	Y		00		Exhibit 5, page 1
(12)	Other Structures Coverage Indicator (Note 7)	Y	0.984			
(13)	Coverage Premium		79.12	68.09	30.03	Product of (D) and (1) to (12)
			Additional Coverages			
(14)	Other Structures Percent of Coverage A		10%			
(15)	Other Structures Coverage Premium		8.04			(13A) * (14)
(16)	Loss Assessment Limit		10,000			
(17)	Loss Assessment Coverage Premium		6.00			Product of (16) and Coverage A Factors (A), (B), (1) divided by 1,000
(18)	Increased Cost of Compliance Factor		0.0006			Exhibit 5, page 3
(19)	Increased Cost of Compliance Coverage Premium	30,000	1.42			((18) * (13A)) * (ICC Coverage / 1,000)
(20)	Sum of Coverage Premiums		192.68			
(21)	Loss Cost Multiplier	Storm Surge Percent = 0.00				Exhibit 3, page 2
(22)	Premium Subtotal		$738			(20) * (21)
(23)	Minimum Premium	Homeowners	$200			Exhibit 3, page 1
(24)	Total Premium		$738			Max((22), (23))

Notes:
1. Does not apply to Coverage D. Deductible Percent of Value calculated as Deductible / (Cov A Value + Optional Other Structures Limit + Cov C Limit).
2. Only applies to Coverage A. ITV calculated as Deductible Percent of Value + Building Limit / Building Value.
3. Use a factor of 1.000 for Condominium Unit-owners and Tenants located above the first floor.
4. Applies to Mobile Home only
5. Does not apply to Coverage C.
6. Only applies to Coverage C.
7. Only applies to Coverage A.
8. Final LCM calculated as (Storm Surge Percent) * Storm Surge LCM + (1 - Storm Surge Percent) * Inland Flood LCM.

Recap: North Carolina Flood

"We wouldn't ever have imagined flooding like we've seen with this storm. Our home and everything in it was taken by the flood. Since we sit so far above historical flood levels, removing or insuring our belongings never happened."

- Old River Farms
After Hurricane Florence