Challenge in modeling US Flood

CAS Presentation

AIR WORLDWIDE®

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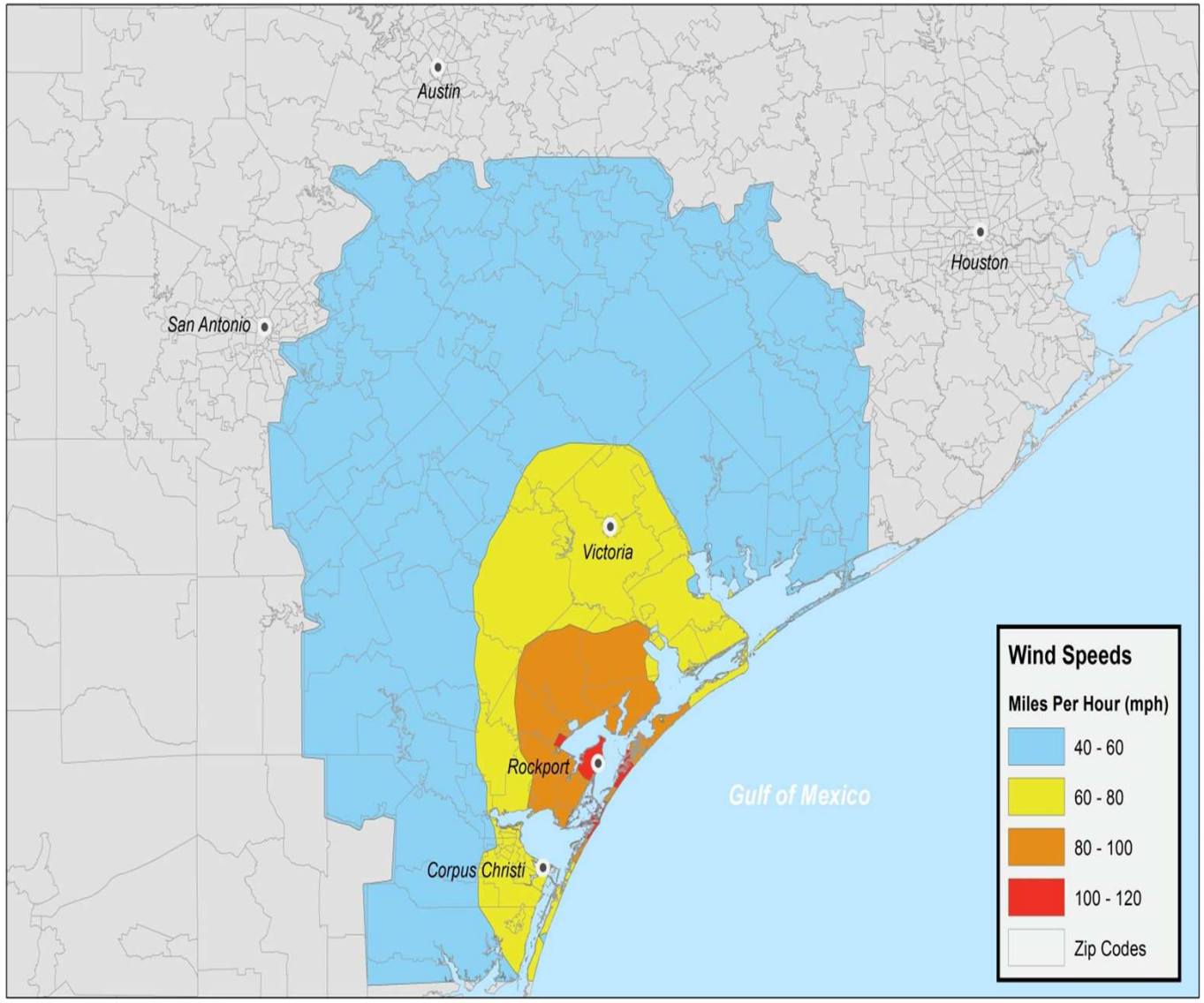
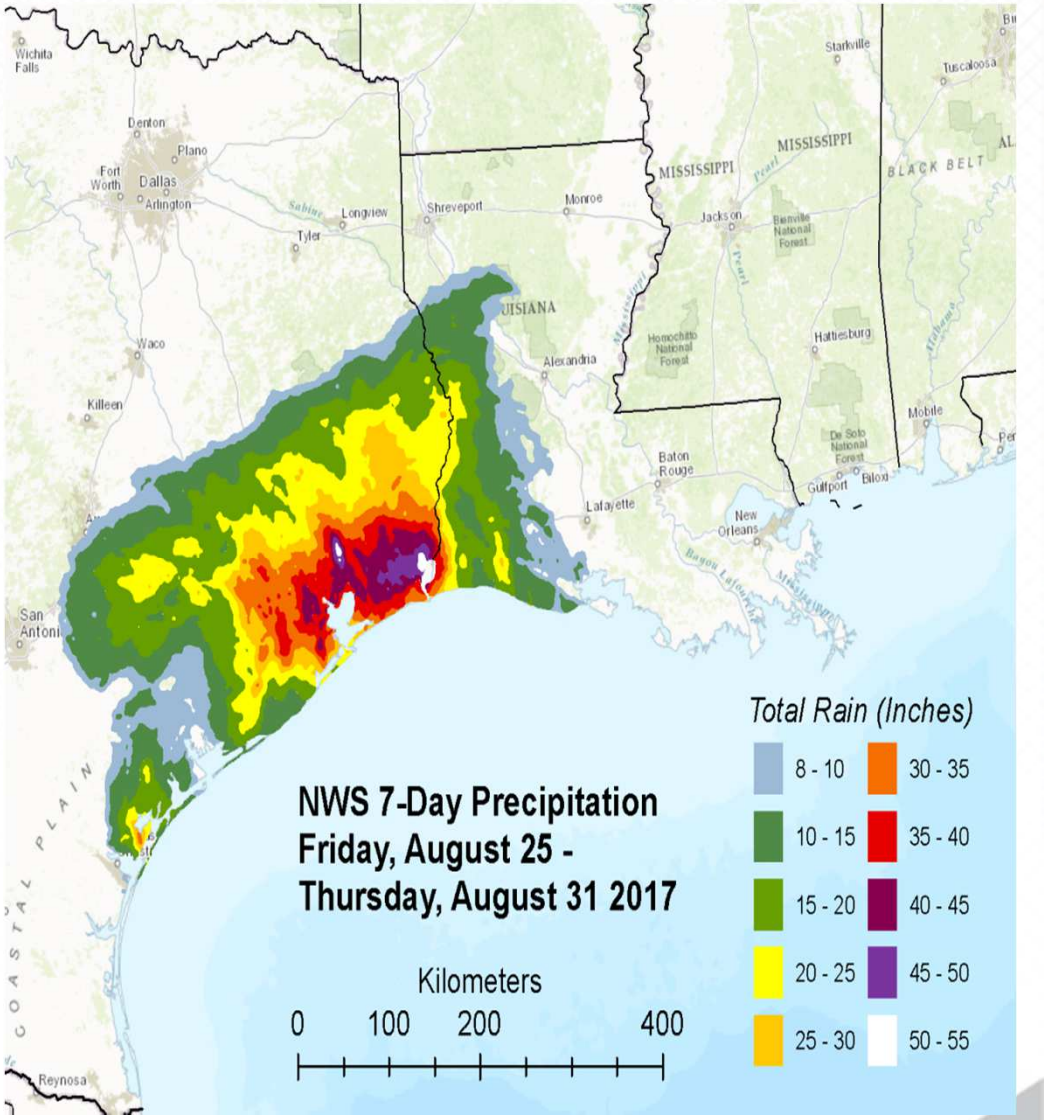
Damaging Winds Centered Around Landfall Location Near Rockport



Damage Survey from Rockport, TX Shows the Extent of the Wind Damage

But Subsequent Flooding Devastated the Region, Centering to the North Around Houston

- Harvey stalled following landfall and it proceeded to rain for 4+ days
- >50'' of rain fell in some places and many areas received >40'' of rain




CNN

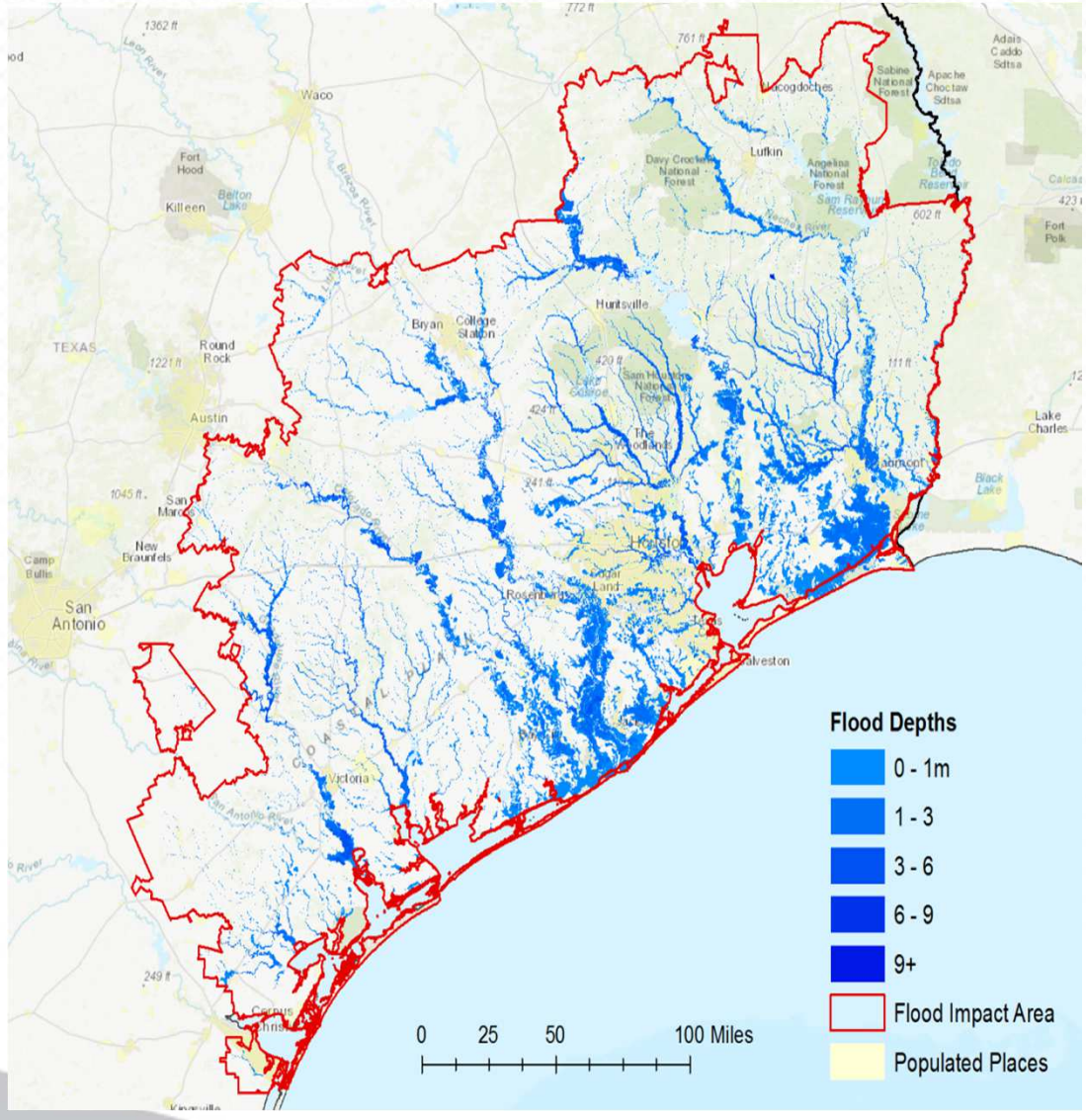

South Loop W
CNN


EXPLORER K2
INTEX
X 8992 JV
CNN


Before
CNN


CNN

Inundation Map for Harvey Shows Flooded Metro Areas and Significant Penetration Inland

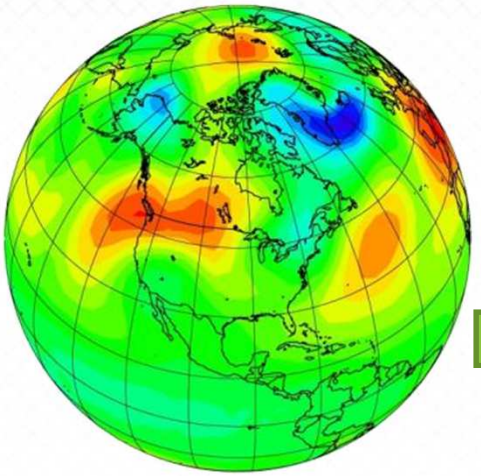


Different approaches to modeling Flood

- Assume FEMA maps are absolutely correct
- Create a natural model to simulate flooding
- Create a statistical model to approximate flood height

Precipitation Is Simulated by Coupling Global Circulation and Numerical Weather Prediction Models

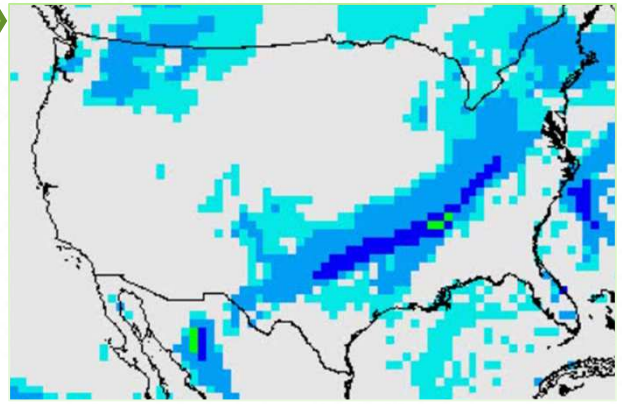
Global Circulation Model



~ 300 km x 300 km

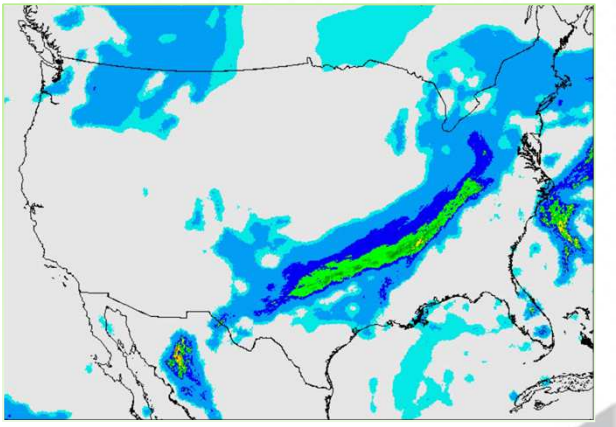
Precipitation pattern is consistent with observed data at multiple scales

Numerical Weather Prediction Model



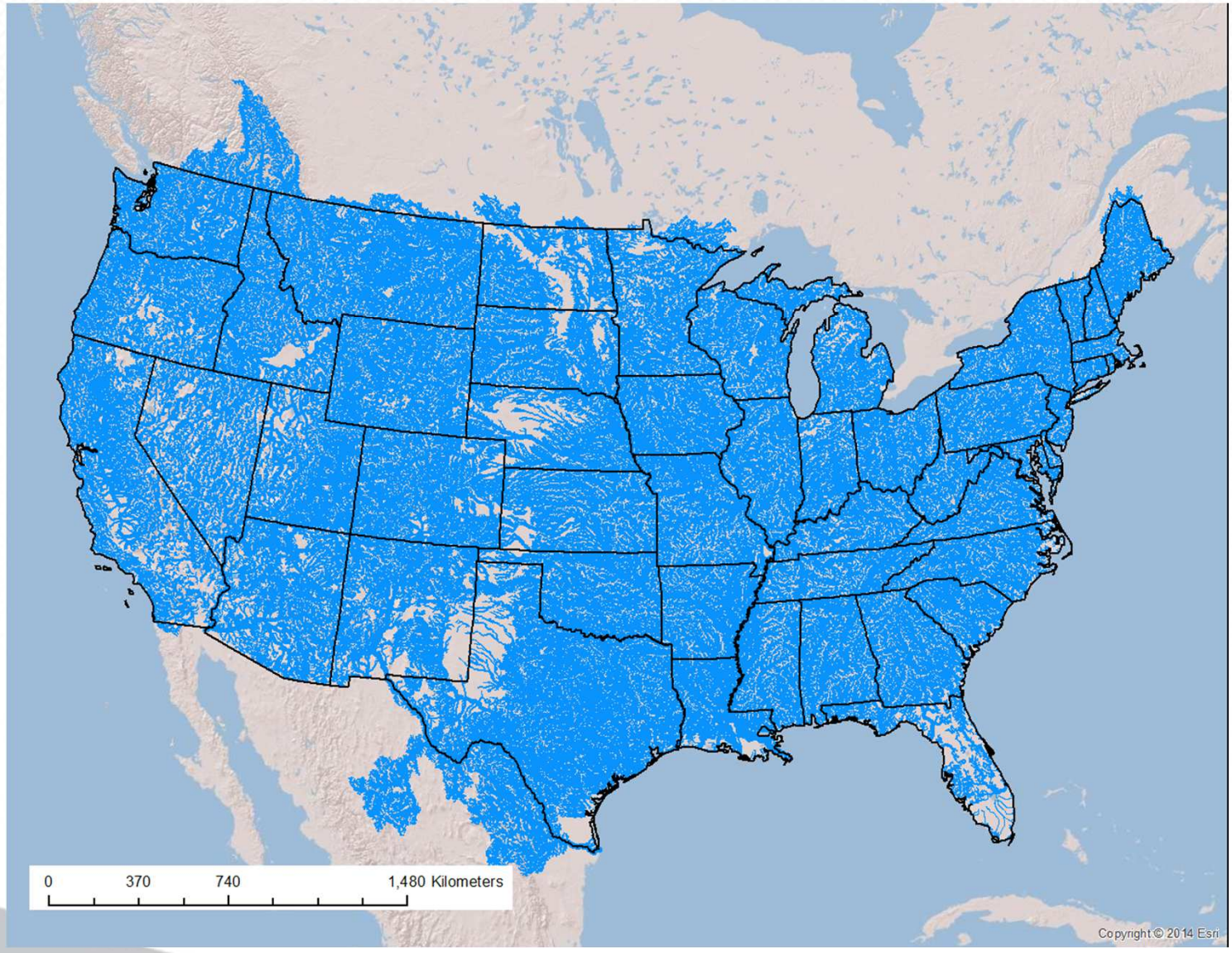
64 km x 64 km

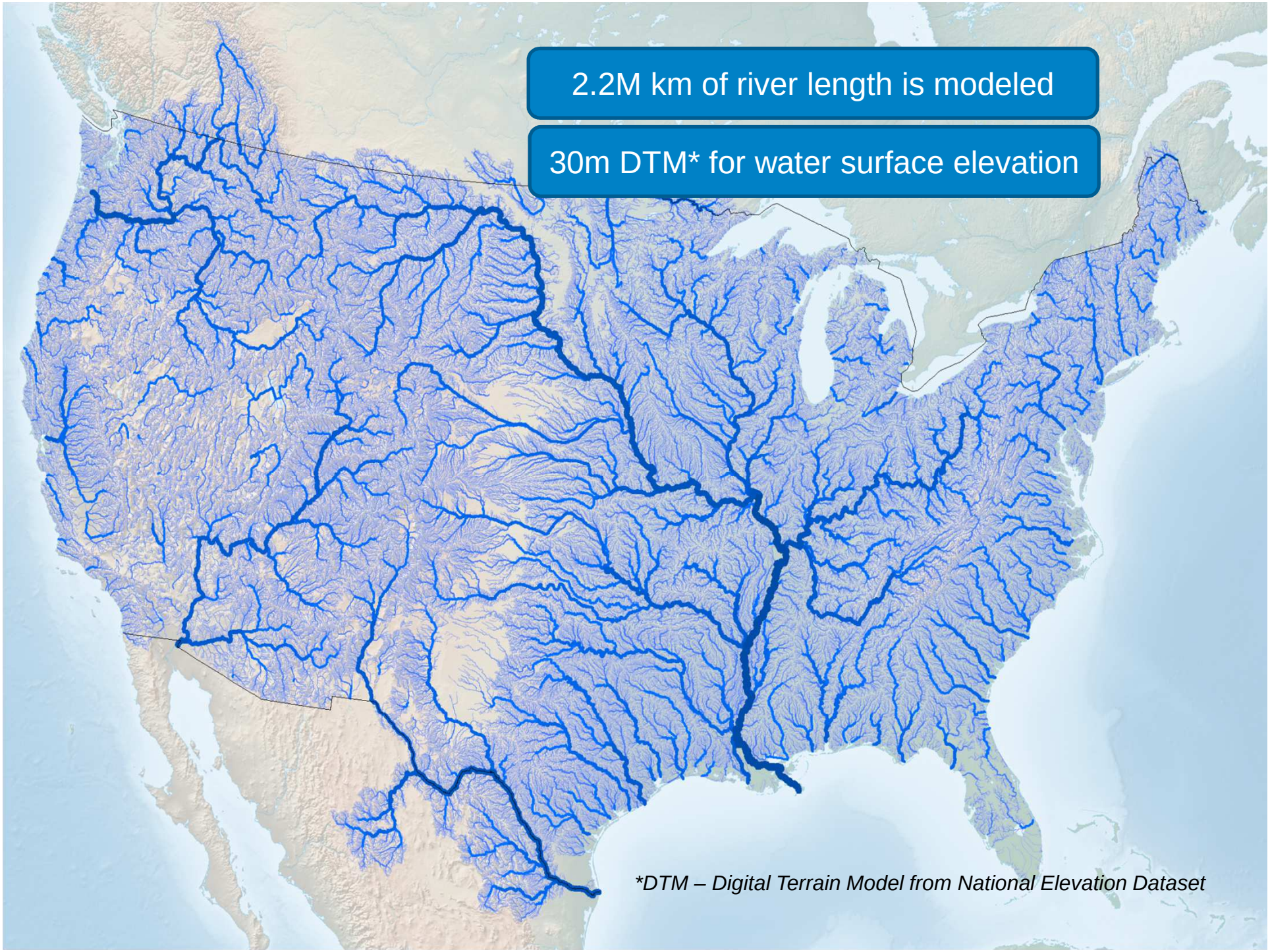
Downscaled



8 km x 8 km

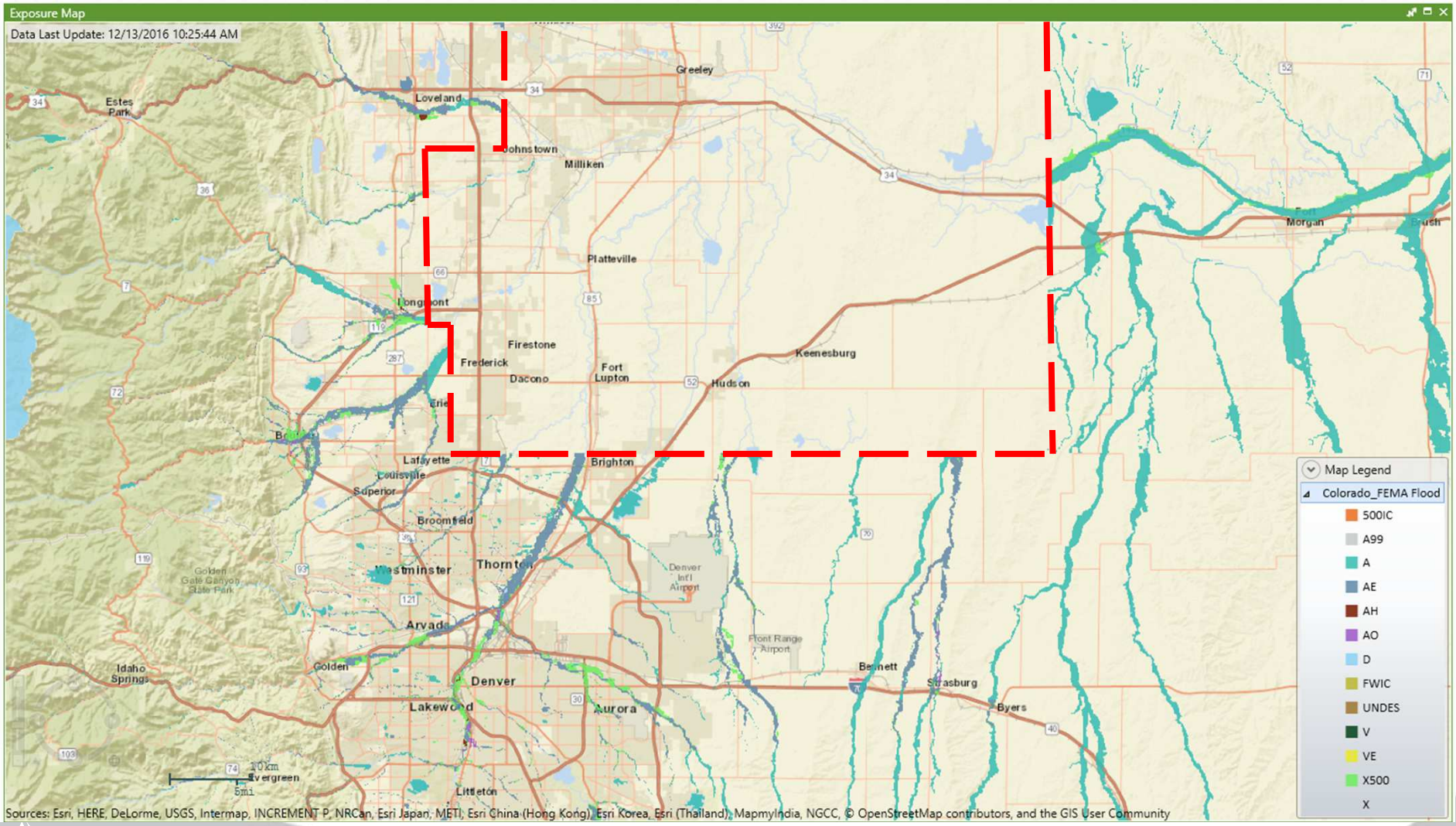
A Model that Is Robust at Multiple Scales Is Necessary for Developing Accurate Views of Risk



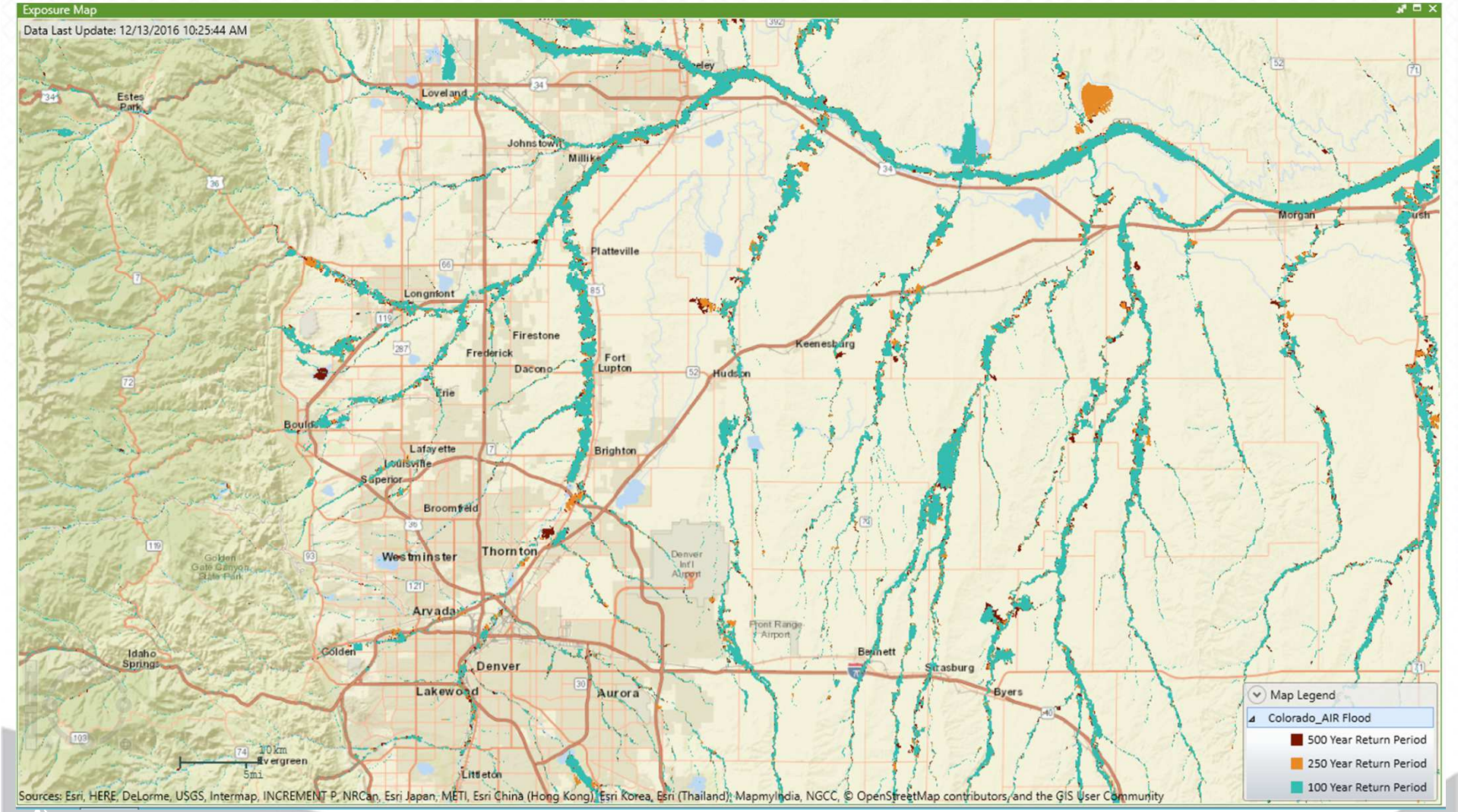

2.2M km of river length is modeled
30m DTM* for water surface elevation
*DTM – Digital Terrain Model from National Elevation Dataset

FEMA Coverage Has Gaps

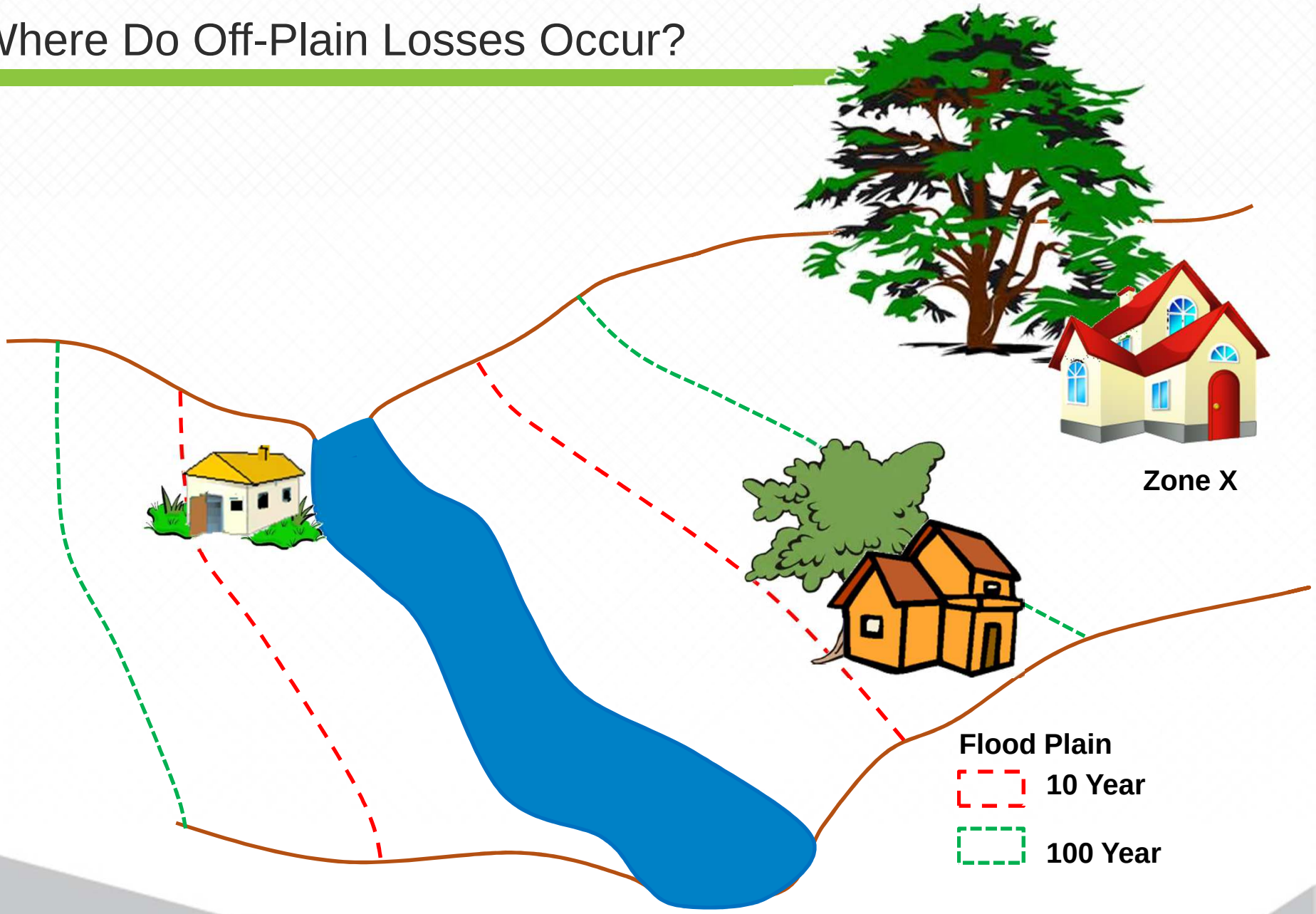
Gaps in FEMA Flood Maps



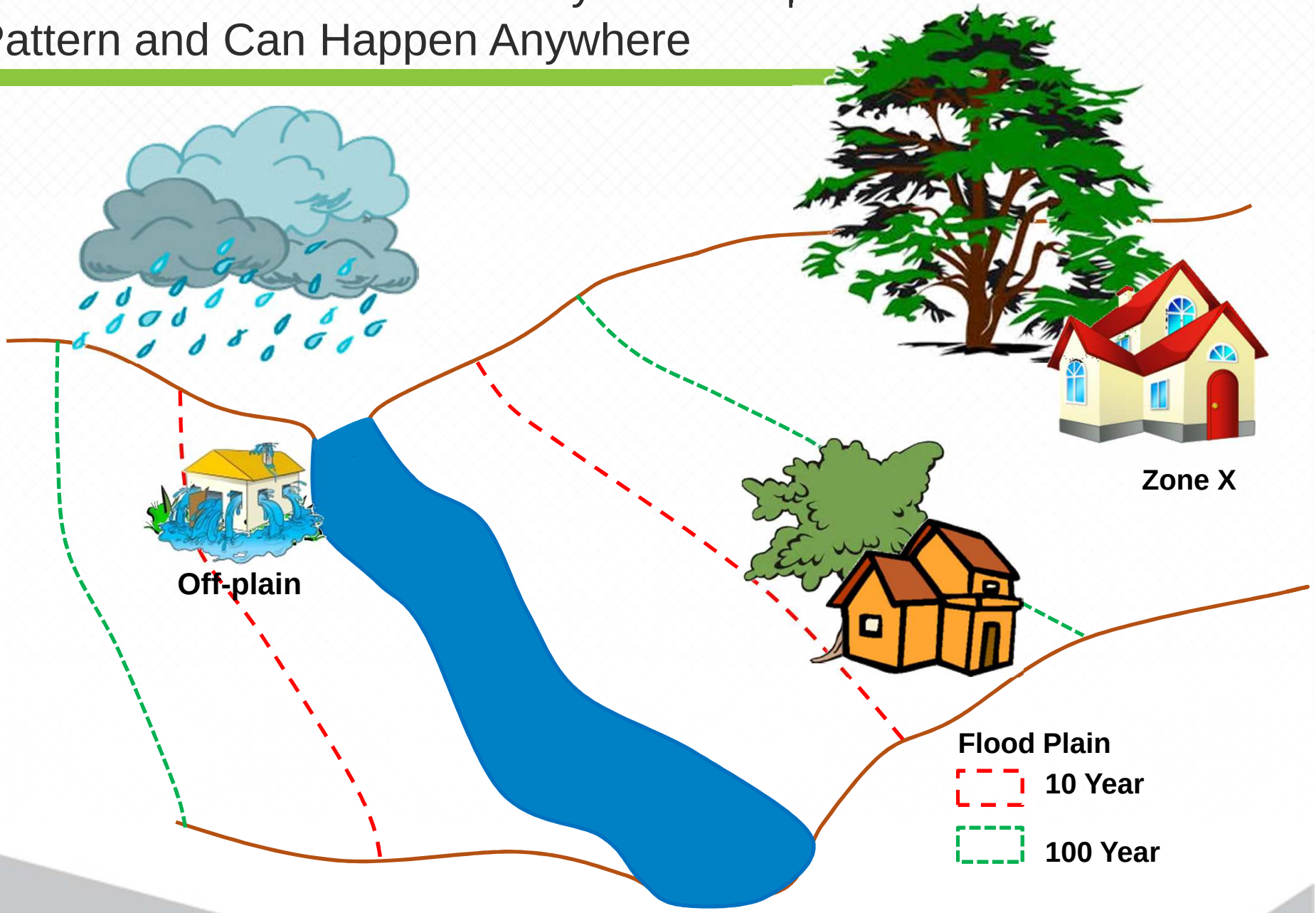
AIR Has Full Coverage of the Lower 48



Where Do Off-Plain Losses Occur?



Off-Plain Losses Are Driven by the Precipitation Pattern and Can Happen Anywhere



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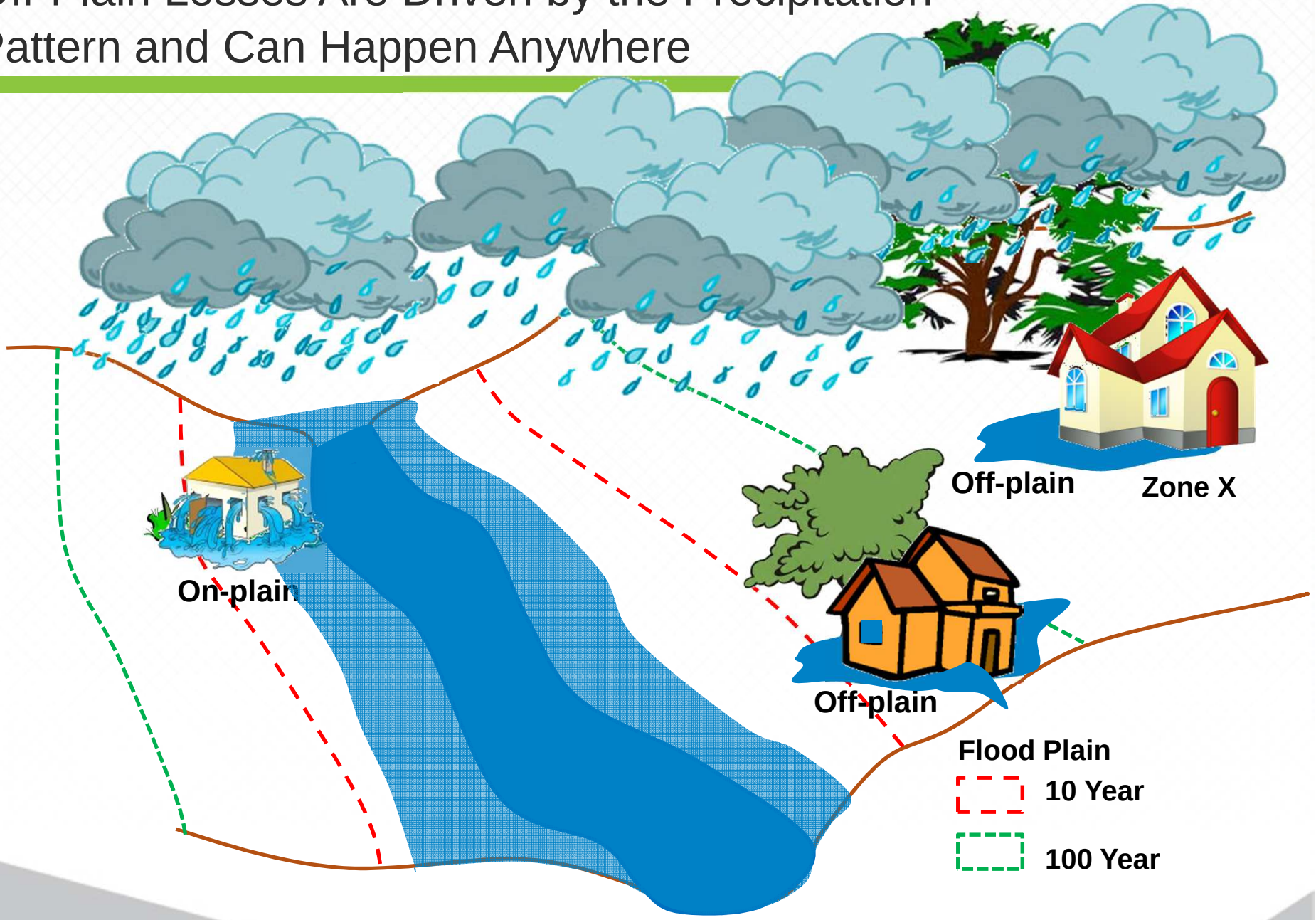
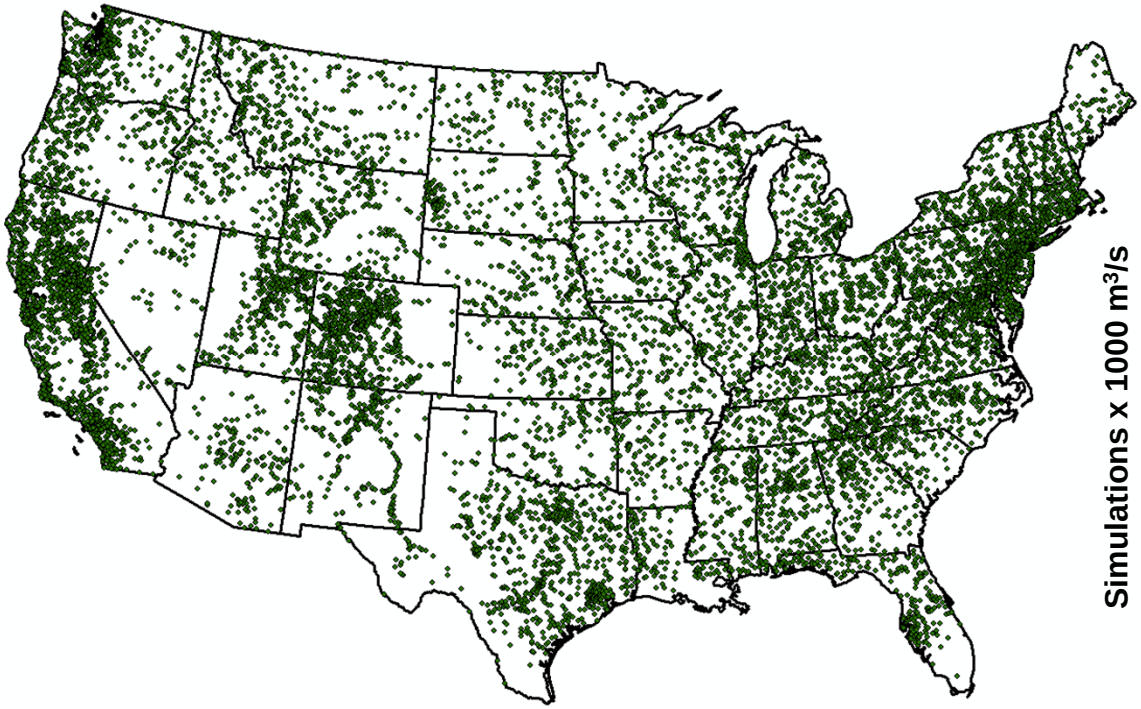
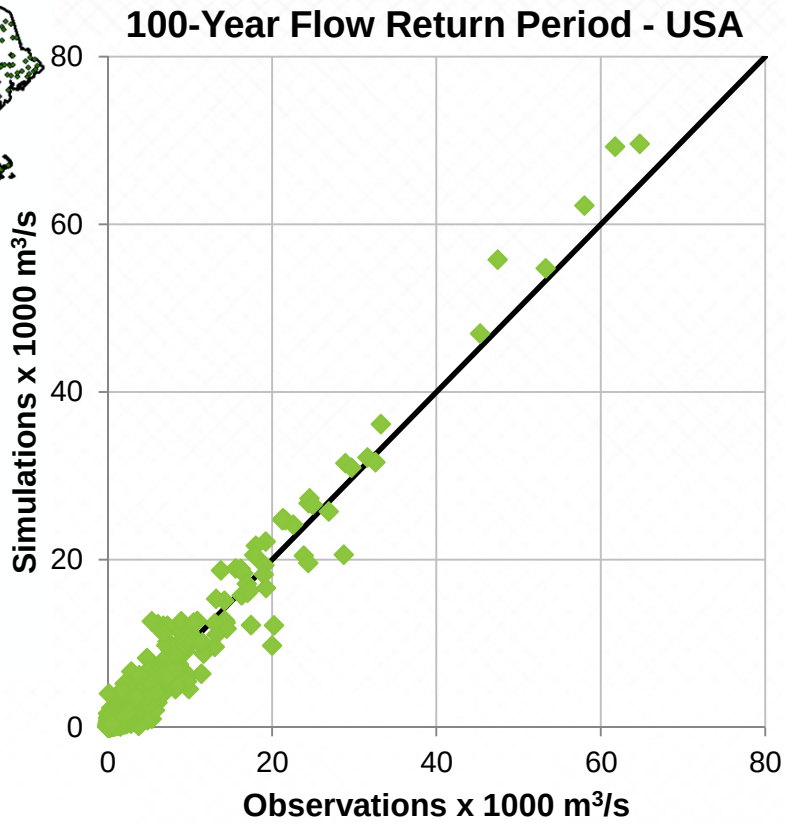
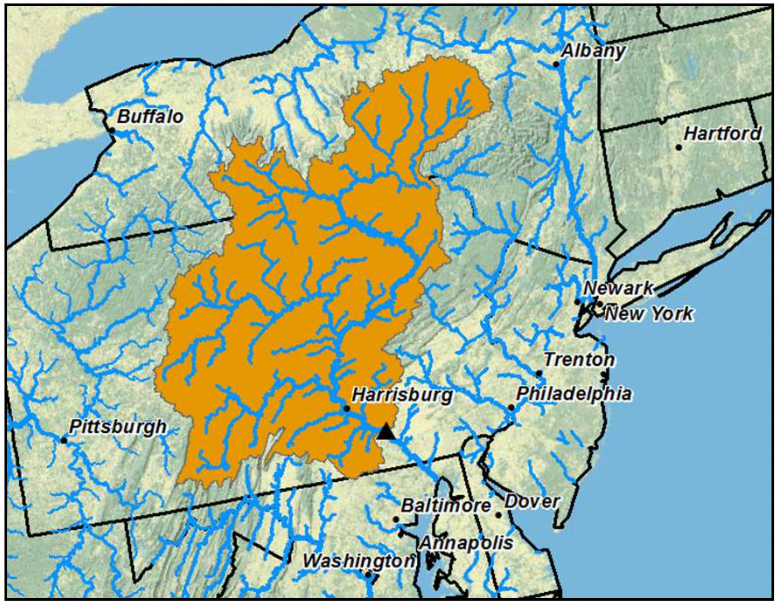


Modeled Flow Quantiles Match Well with Observed Flow Quantiles

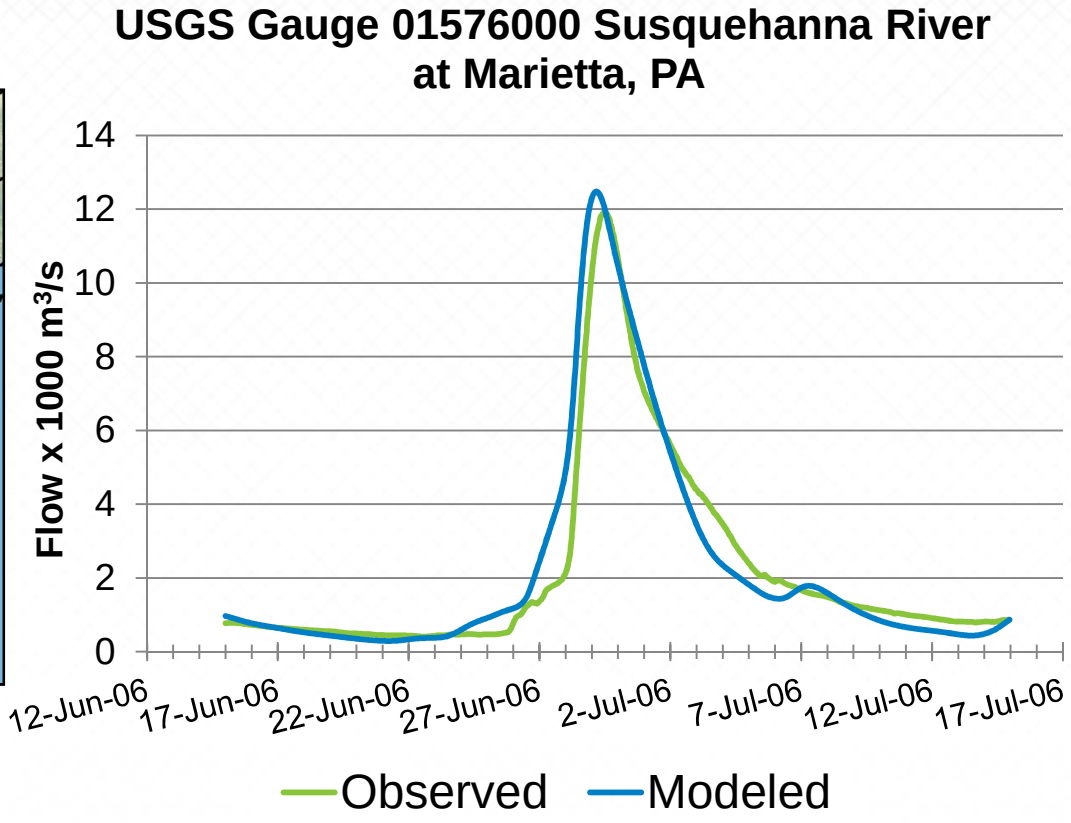




Historical Events Are Validated Using Observed Gauge Station Flow



Drainage Area 67,314 km²

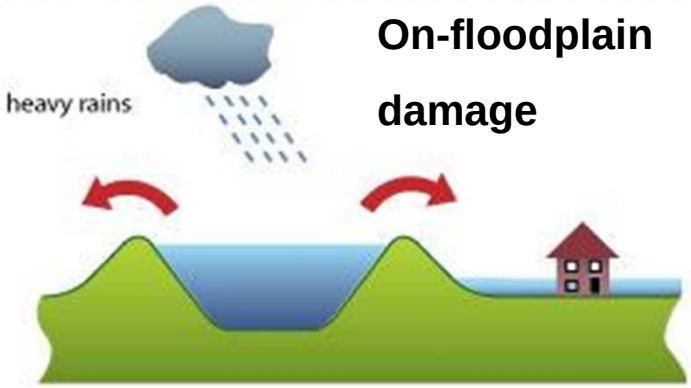


Claims

- NFIP has been in existence since 1968
- Flood is common exclusion
  - “Sewer backup”
  - Surge

The AIR Inland Flood Model Includes Separate Damage Functions for Modeling On- and Off-Floodplain Losses

On-floodplain damage

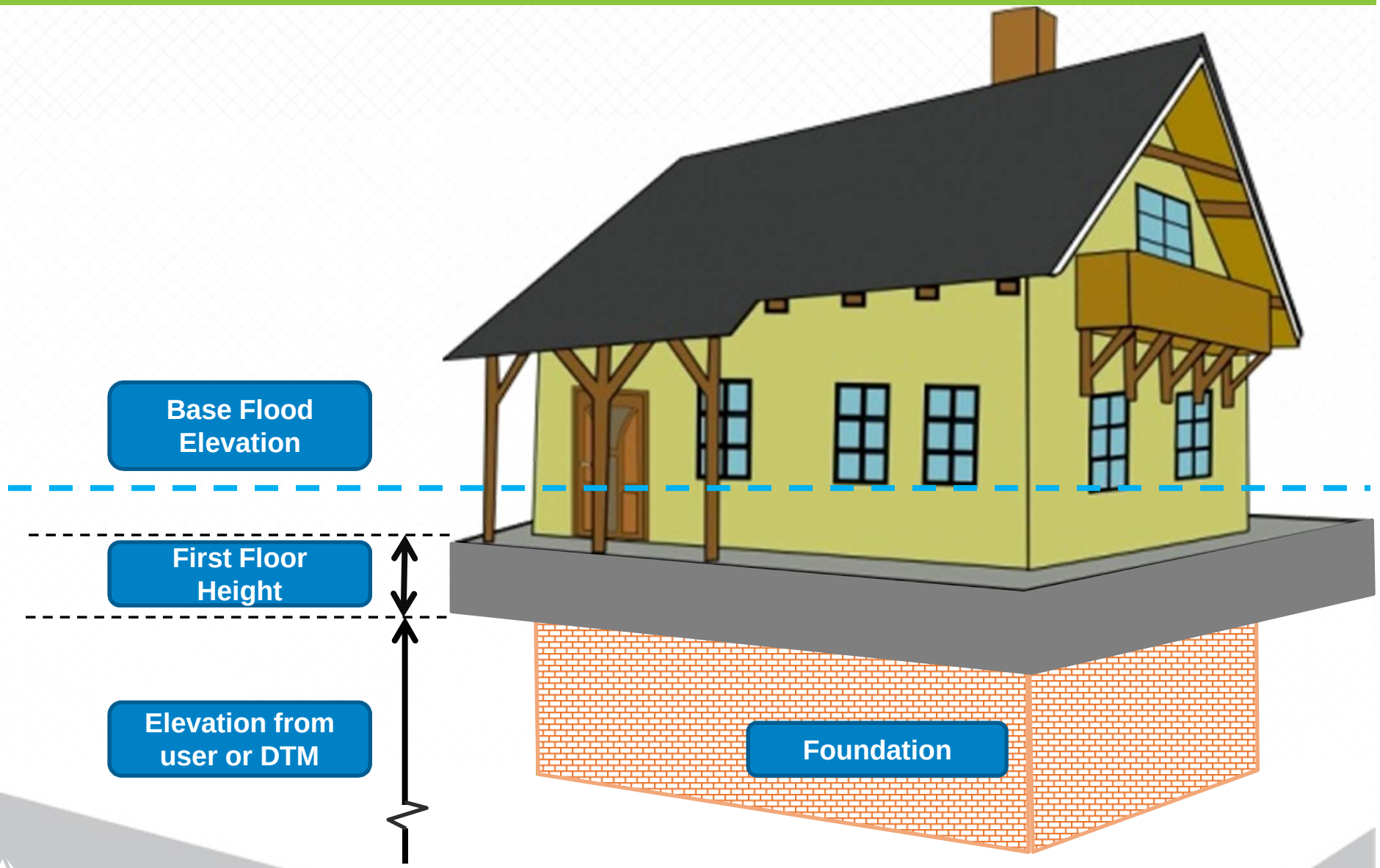


Off-floodplain damage

Industry issue: Lack of data capture / data quality

- Address accuracy
  - North / South 456 Main Street
  - “In the river”
- Secondary Modifiers
  - First floor height
  - Basement type
  - Service equipment
  - Flood Defenses
  - “Flood certificate”

Secondary Modifiers Play a Key Role in the Accuracy of Loss Estimates



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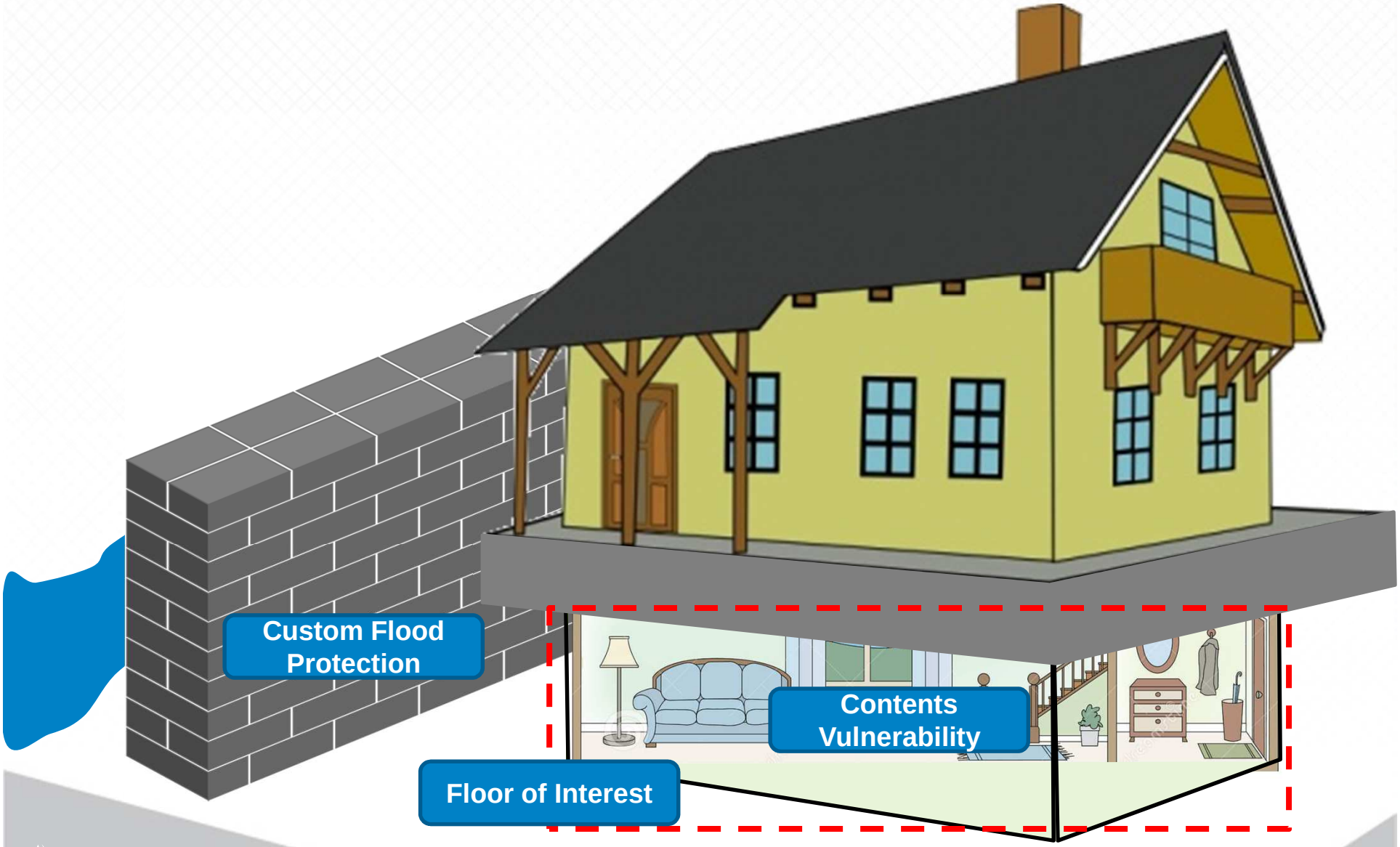

2017 CAS In Focus Seminar

ISO Commercial Property Flood Loss Costs

October 2, 2017

ISO
Verisk Insurance Solutions

SERVE | ADD VALUE | INNOVATE

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Loss Cost Page

Cape May County:

		Flood Zone			
Coverage	Construction	A	X500	X	D
Building	Frame and Non-Combustible	###	###	###	###
	Joisted Masonry and Masonry Non-Combustible	###	###	###	###
	Modified Fire Resistive and Fire Resistive	###	###	###	###
Contents	Frame and Non-Combustible	###	###	###	###
	Joisted Masonry and Masonry Non-Combustible	###	###	###	###
	Modified Fire Resistive and Fire Resistive	###	###	###	###

All Other Counties:

		Flood Zone			
Coverage	Construction	A	X500	X	D
Building	Frame and Non-Combustible	###	###	###	###
	Joisted Masonry and Masonry Non-Combustible	###	###	###	###
	Modified Fire Resistive and Fire Resistive	###	###	###	###
Contents	Frame and Non-Combustible	###	###	###	###
	Joisted Masonry and Masonry Non-Combustible	###	###	###	###
	Modified Fire Resistive and Fire Resistive	###	###	###	###

Flood Zone and Construction Map

For NFIP Flood Zone:	Use Flood Zone:
A, AE, A1-A30, A99, AH, AHB, AO, AOB, V, VE, V1-V30, AR, AR/AE, AR/A1-30, AR/AH, AR/AO, or AR/A	A
X (shaded), B, or X500	X500
X (unshaded) or C	X
D, unmapped, or communities that do not participate in NFIP	D

Construction Groups:
Frame and Non-combustible
Joisted Masonry and Masonry Non-combustible
Modified Fire Resistive and Fire Resistive

Flood Base Loss Cost Development

- Flood Base Loss Costs are based on the following components:
  a. Flood Zone Loss Costs
  b. Base Deductible Adjustment
  c. Non-modeled Flood Load
  d. Loss Adjustment Expense Factor
  e. Construction Relativity
- Flood Base Loss Costs = a x b x c x d x e

Flood Zone Loss Costs

1. Calculate census block weighted average loss cost for each ZIP code/flood zone group combination.
2. Allocate exposure reported under ISO's statistical plans to ZIP code/flood zone group.
3. Calculate state-wide exposure weighted average loss cost for each flood zone group.

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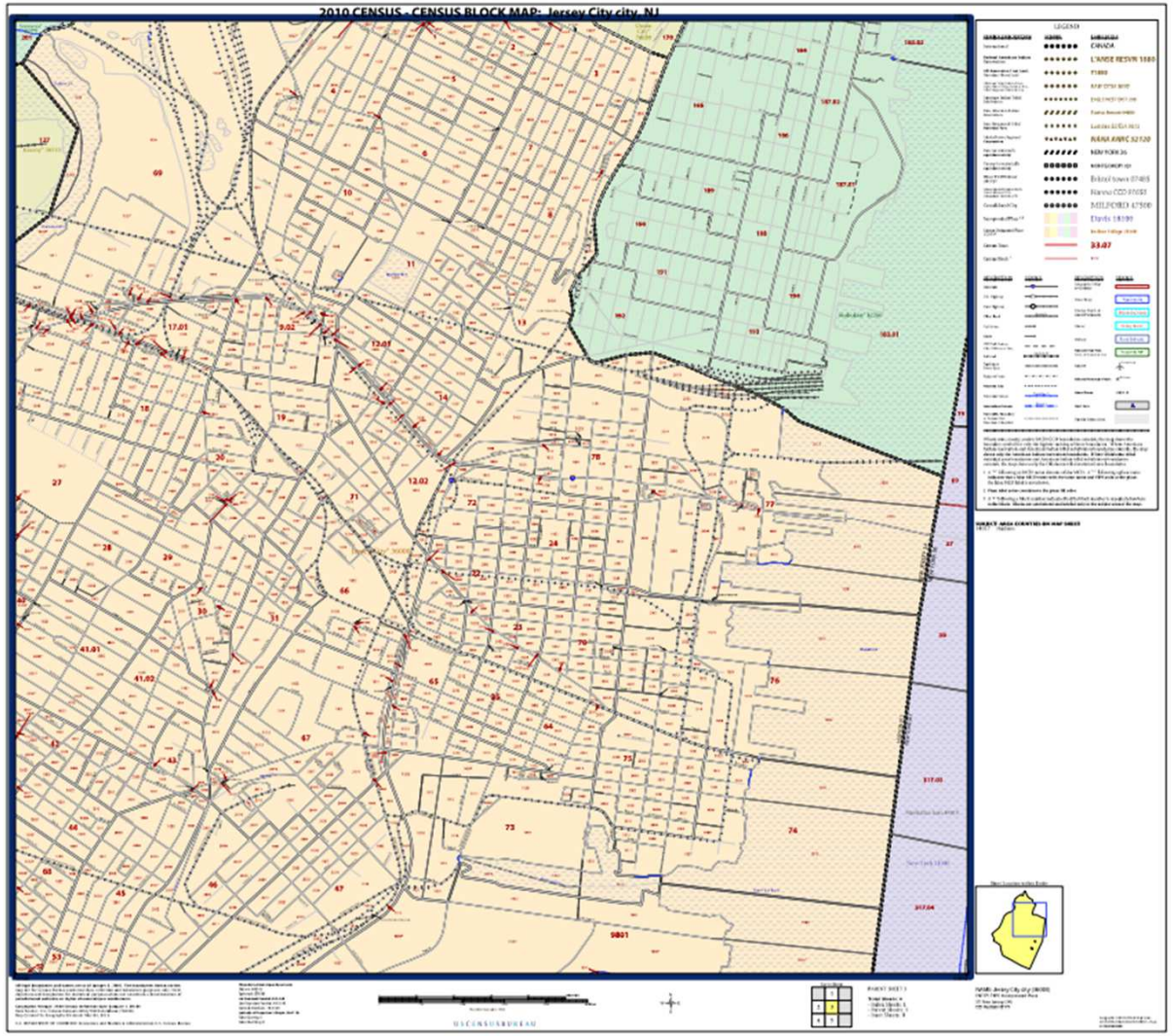
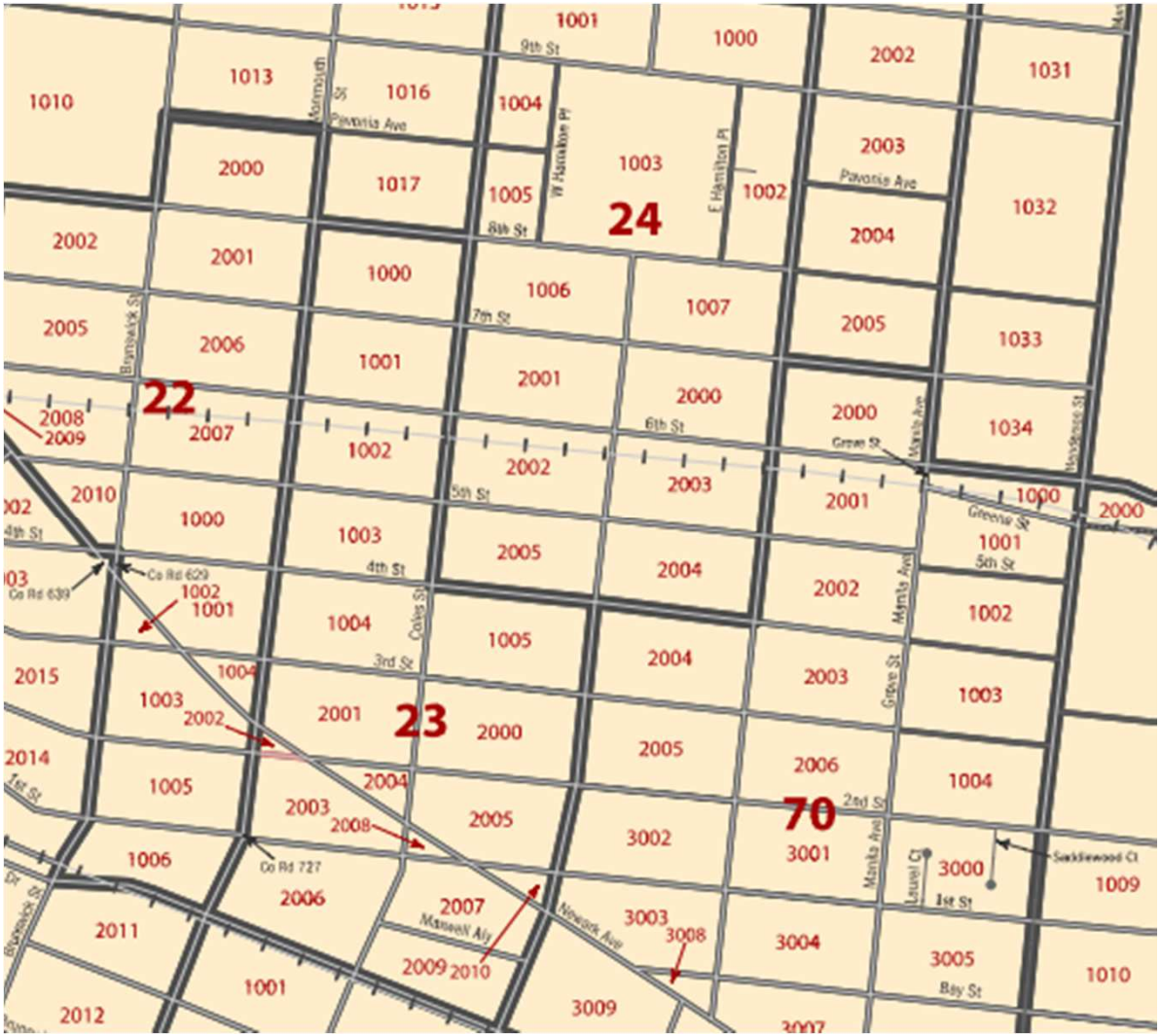
Census block map



https://www.census.gov/geo/maps-data/maps/block/2010/

Census block map



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Base Deductible Adjustment and Loss Adjustment Expense Factor

- Base Deductible Adjustment Factor was applied to ground-up loss costs to reflect ***$500*** base deductible in the base policy.
- Loss Adjustment Expense Factor was selected and applied to the modeled loss costs since the model doesn't account for the loss adjustment expense.
  - The data underlying the selection is based on ten years of Insurance Expense Exhibit (IEE) databases acquired from A.M. Best

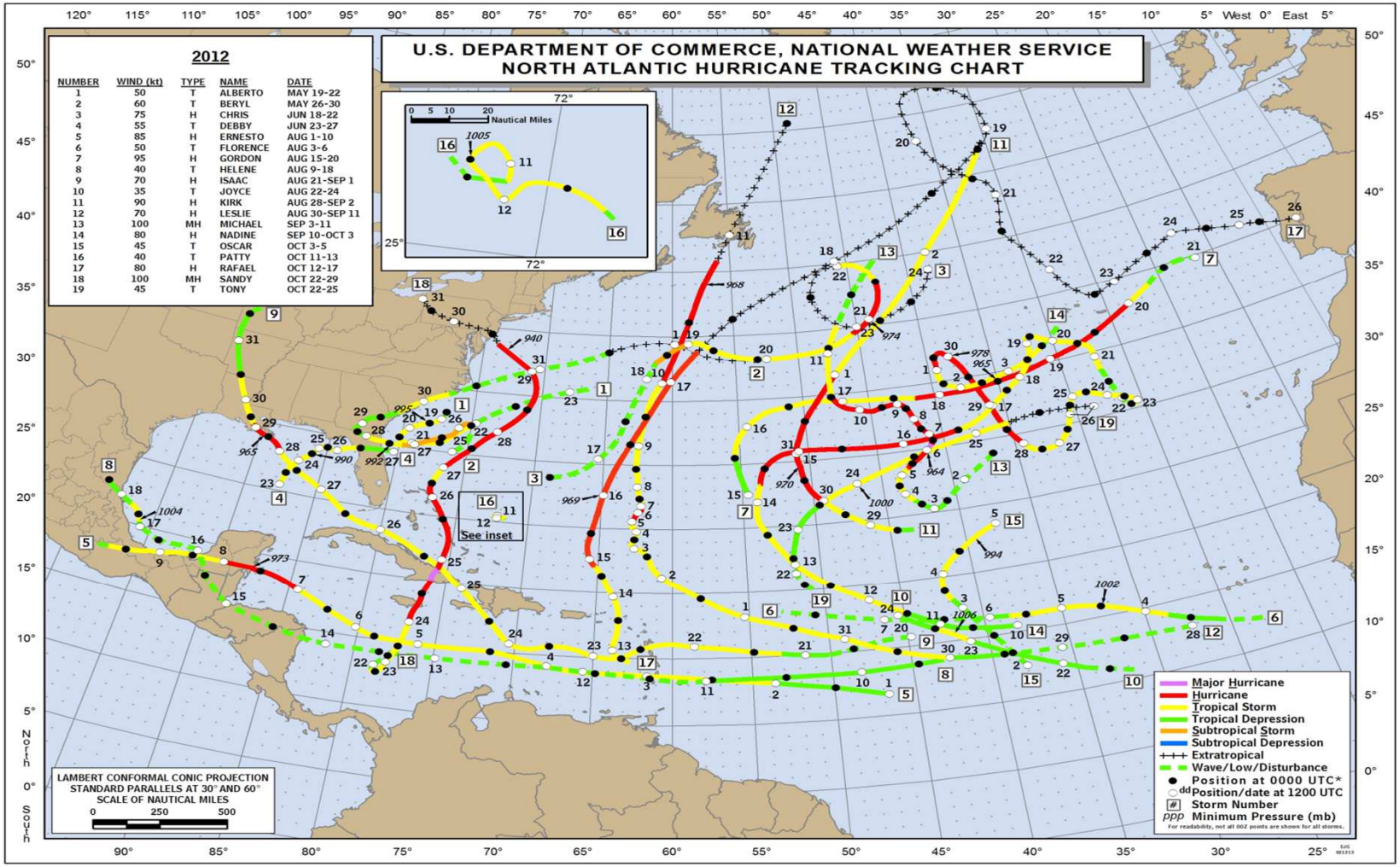
Non-modeled Flood Load

- Non-modeled losses include losses as a result of
  - precipitation due to tropical storms and hurricanes
  - storm surge due to tropical storms
  - winter storm surge in applicable states
- Non-modeled flood load is ***state specific*** and is adjusted by the following formula:

  1 + [Selected non-modeled loss percentage/ (1- Selected non-modeled loss percentage)]

Non-modeled Flood Load – contd.

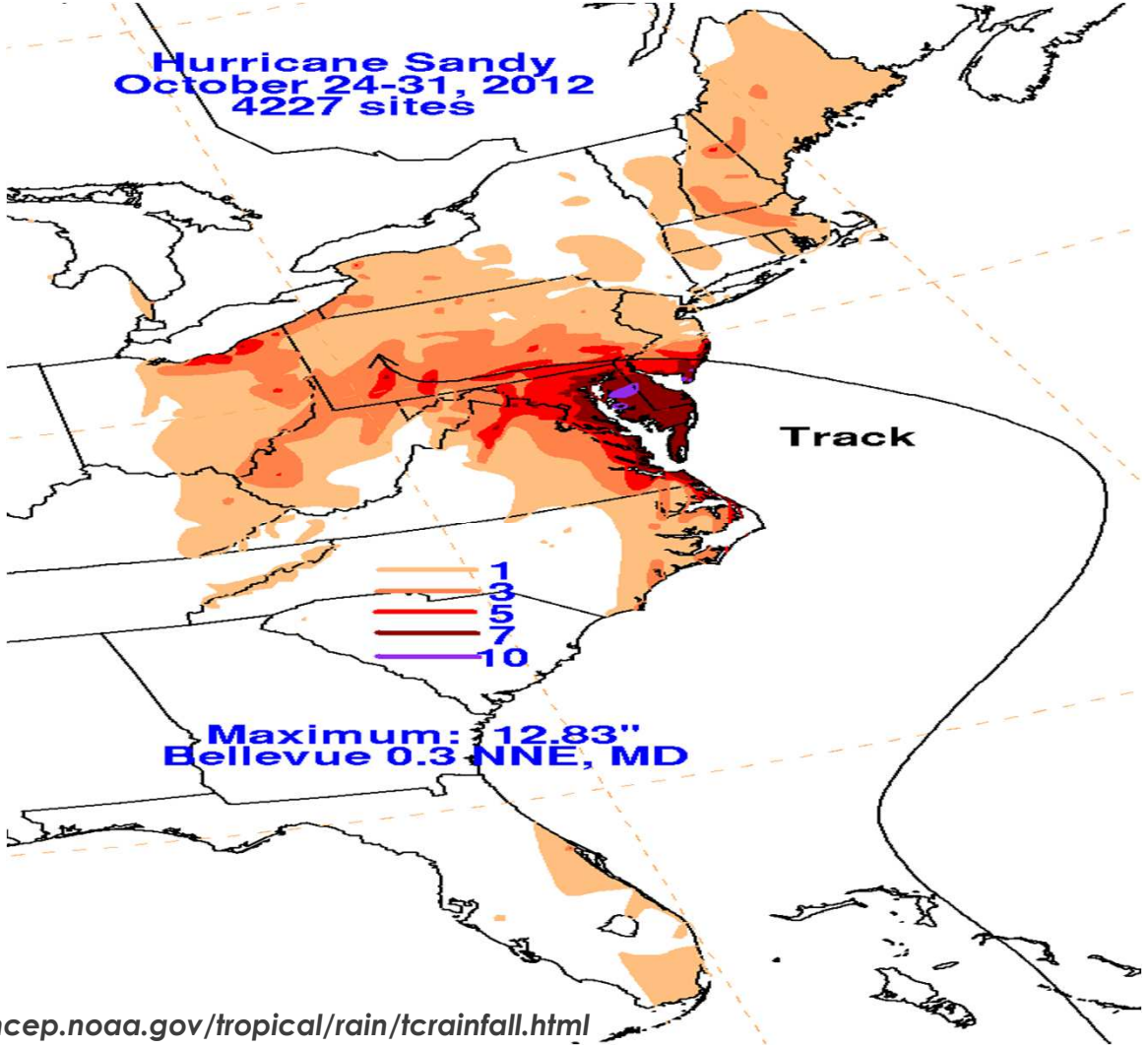
National Hurricane Center



http://www.nhc.noaa.gov/data/#tracks_all

Non-modeled Flood Load – contd.

Tropical Cyclone Rainfall Data



http://www.wpc.ncep.noaa.gov/tropical/rain/tcrainfall.html

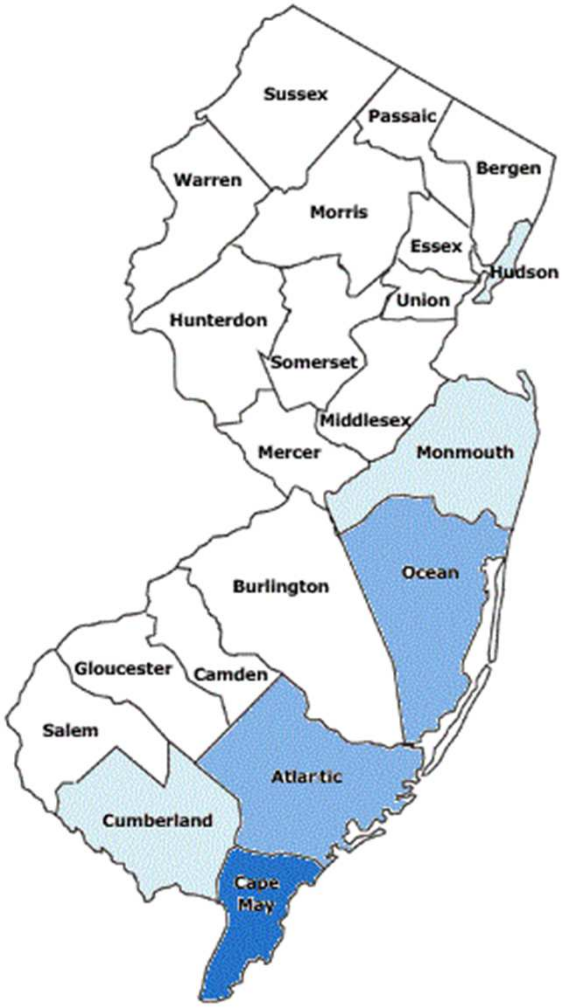
Construction Relativity

For Countrywide:

Construction Type	Flood	Surge	Combined
Masonry	M_F	M_S	M_F
Wood Frame	W_F	W_S	W_F
Reinforced Concrete	R_F	R_S	R_F

For Example New Jersey:

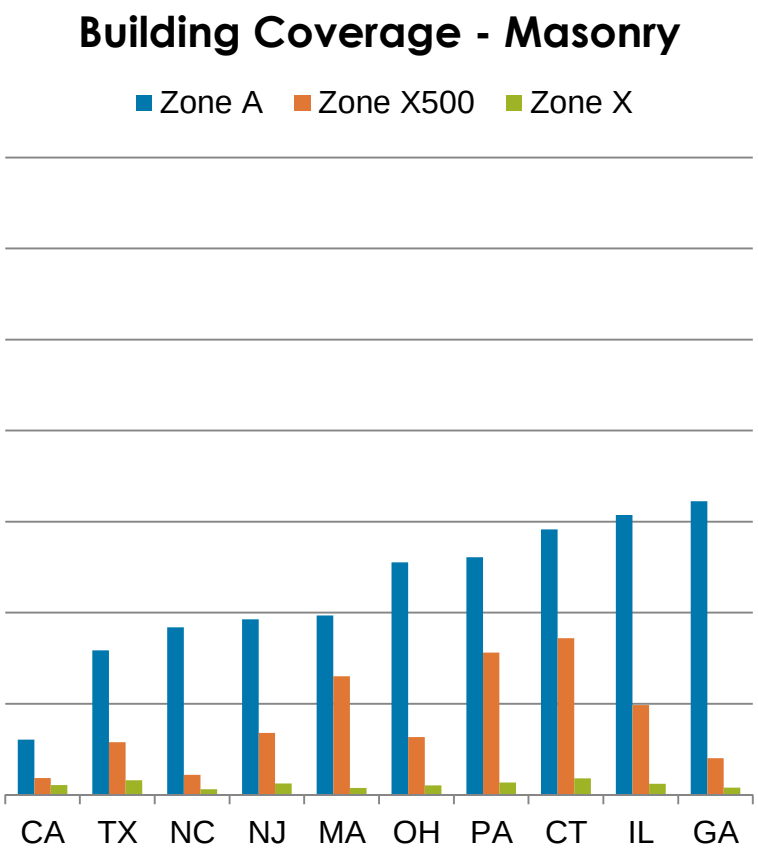
Construction Type	Cape May County	All Other Counties
Masonry	M_{CM}	M_{AO}
Wood Frame	W_{CM}	W_{AO}
Reinforced Concrete	R_{CM}	R_{AO}

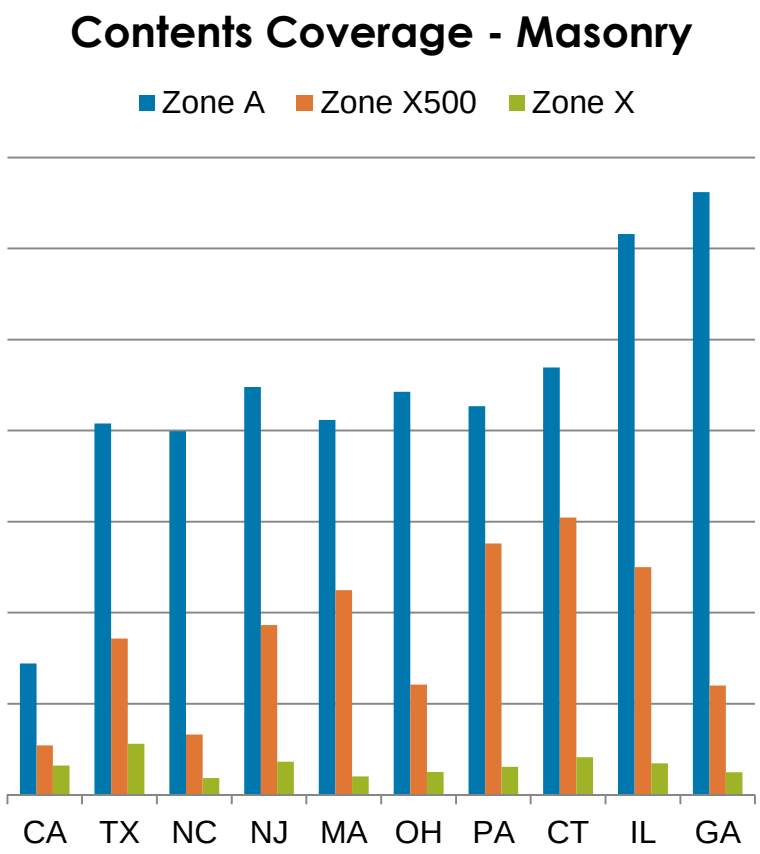


Deductible and Insurance-To-Value Factors

- Flood Deductible Options:
  - Factors are provided for flat dollar deductible amount from $500 up to $1,000,000
- Flood Insurance-To-Value Options:
  - Listed as 1% through 4%, then in increments of 5% from 5% through 80%. 90% and 100% coinsurance levels are also reflected on the table
- Factors can be used to rate ground-up and excess of NFIP polices

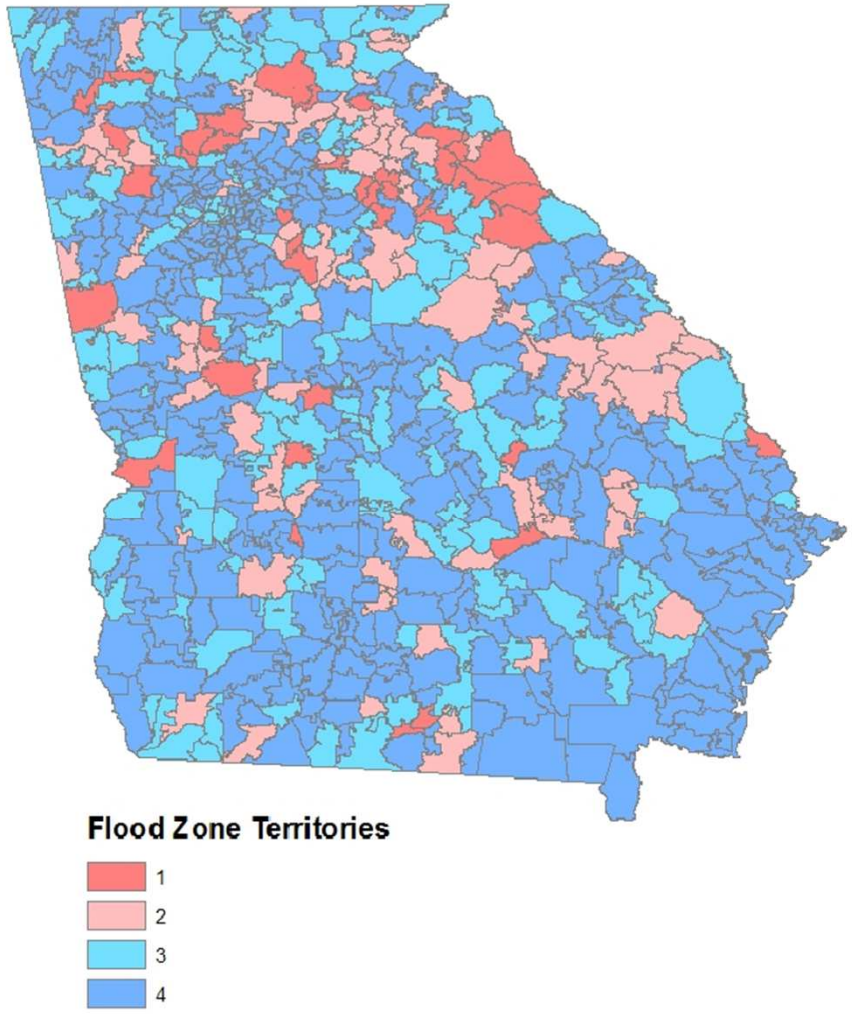
Flood Base Loss Cost by States





Future Improvements – Territorial Refinement

- Territories defined based on ZIP code
- Reflect high variation in loss costs within flood zone in a given state



Future Improvements – Secondary Rating Variables

- Develop modification factors for the following rating variables:
  - Year Built
  - Number of Stories
  - 1st Floor Height
  - Occupancy Type
  - Floor of Interest
  - Basement/Foundation Type

Rating Variable Comparison

Base Loss Costs	ISO	NFIP
NFIP Flood Zone	X	X
State Differentials	X	
Construction Differentials*	X	
Elevation	X#	X

* NFIP rates pre- and post- FIRM buildings differently
\# Available in secondary rating variables

Questions?

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