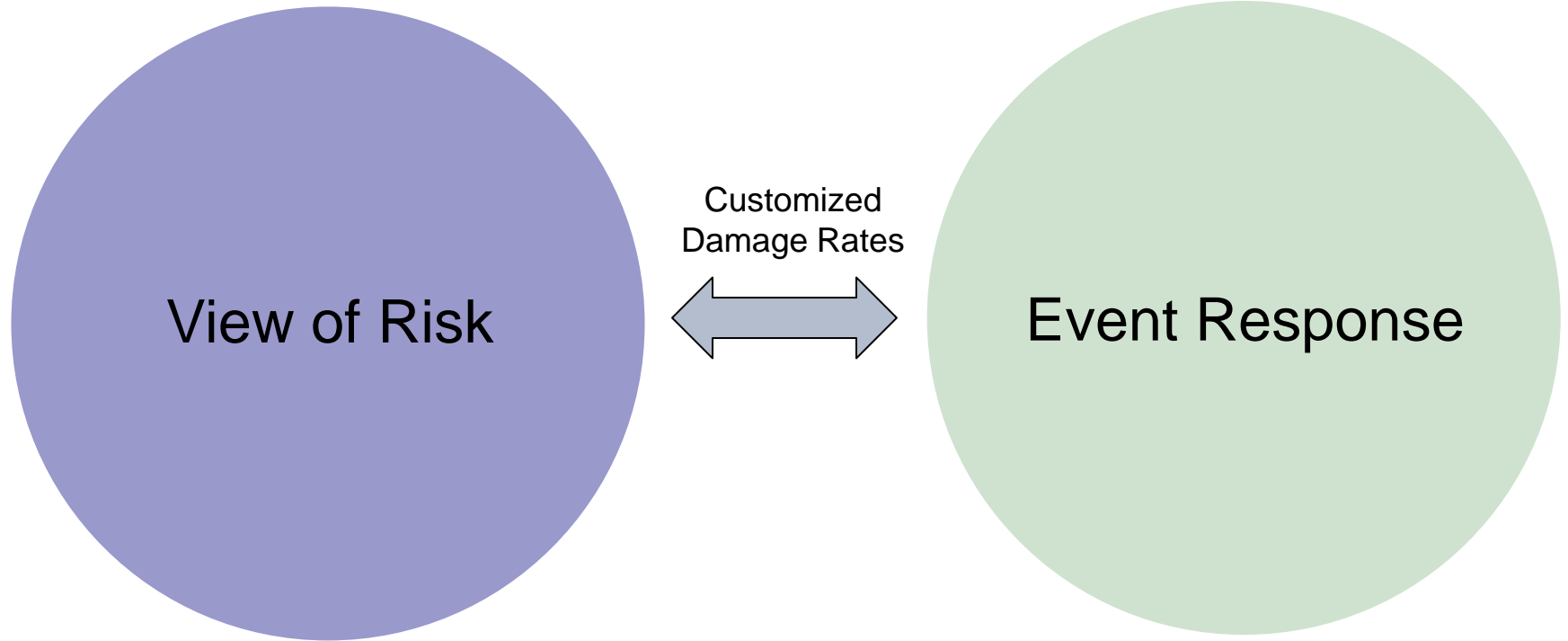




Hurricane View of Risk and Event Response

CAS Annual Meeting – November 10, 2014

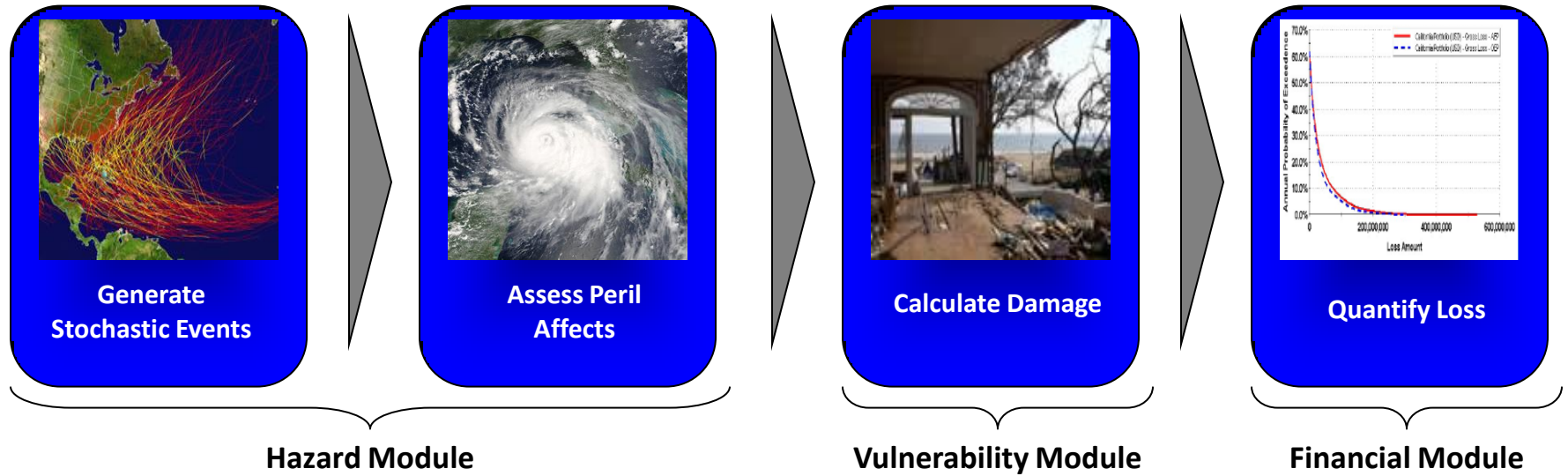
CAT Risk Management: Hurricane



Hurricane Modeling Framework

- Three modules: Hazard, Vulnerability, Financial
 - Hazard module: event frequencies, severities and intensities
 - Vulnerability module: damage assessment to exposure
 - Financial application: impact of deductibles and limits
- Modules operate in concert, cannot be separated

Exposure data **completeness** and **quality** critical inputs to the process



View of Risk: Considerations



CAT Models are calibrated to the **industry**

View of Risk: Historical Loss Restatement

1926 ----- *Changes* -----> 2006

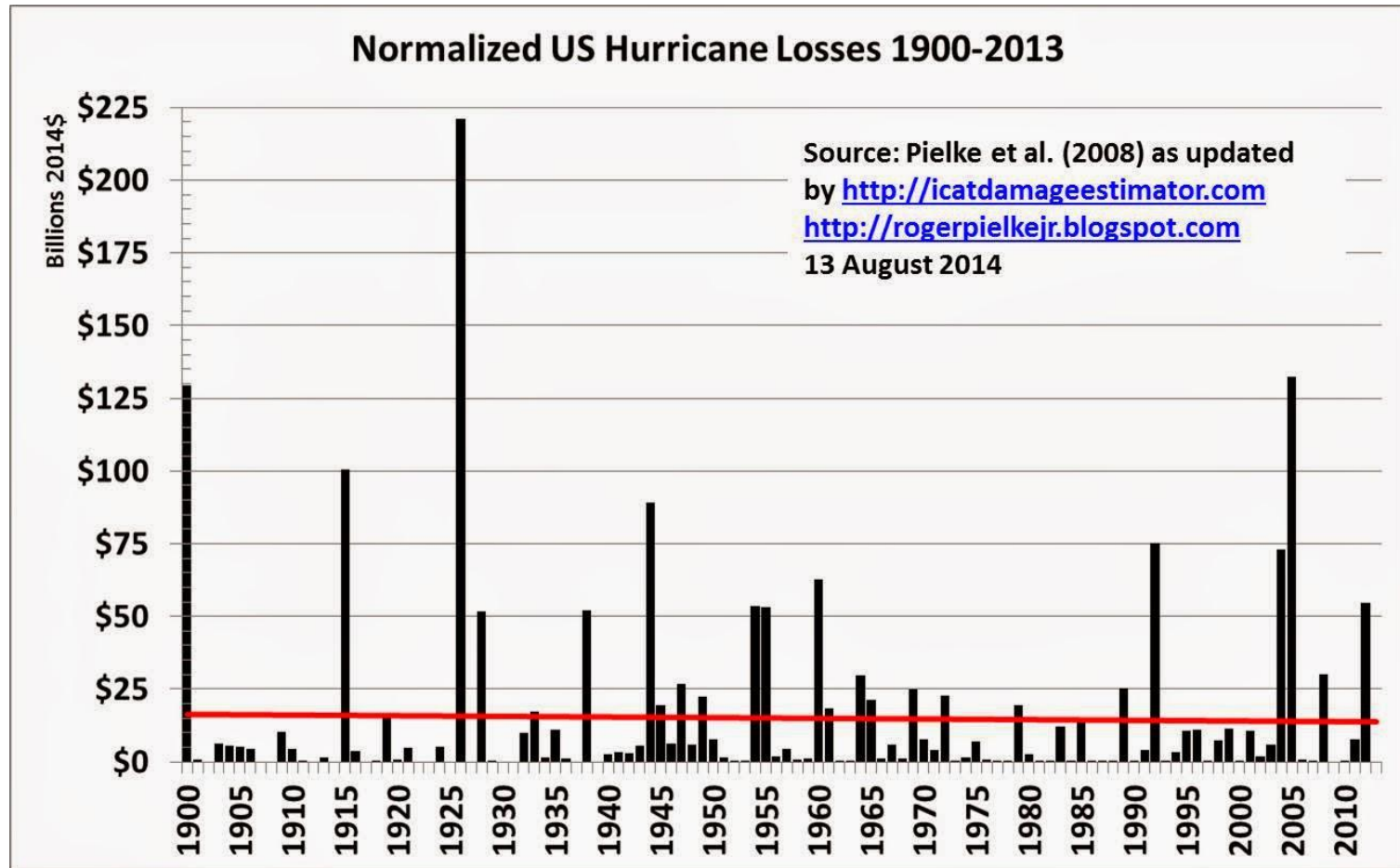


- Inflation: Construction costs
- Wealth: Structures have changed (bigger, better)
- Amount of Building Stock
- Company changes



Photos courtesy of Dr. Phil Klotzbach, Colorado State University

View of Risk: Experience Period

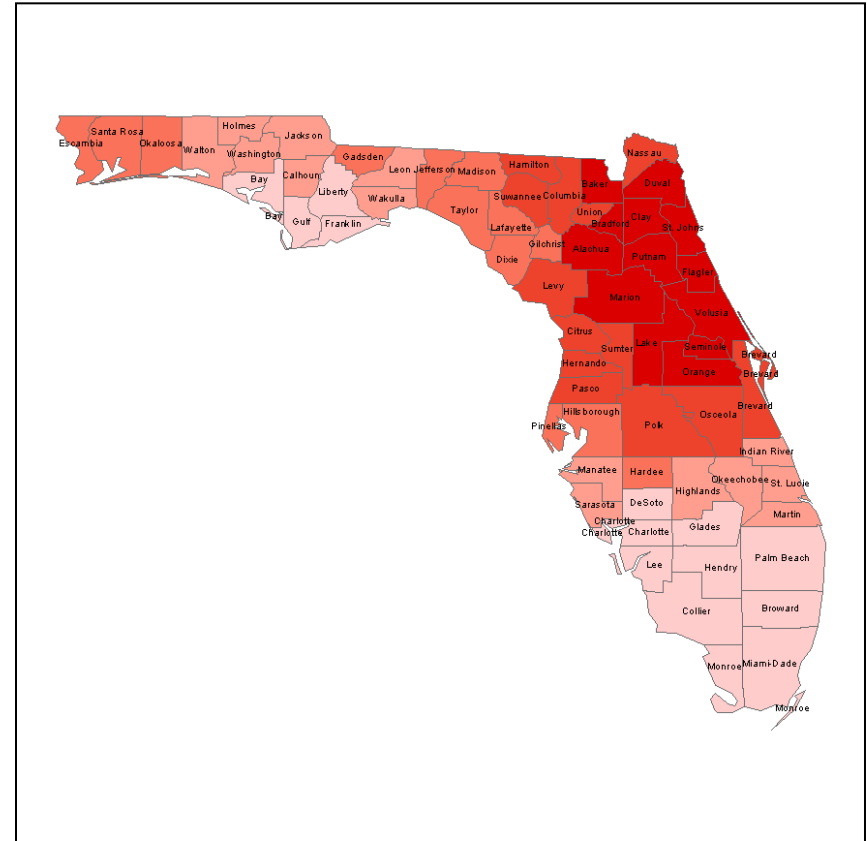
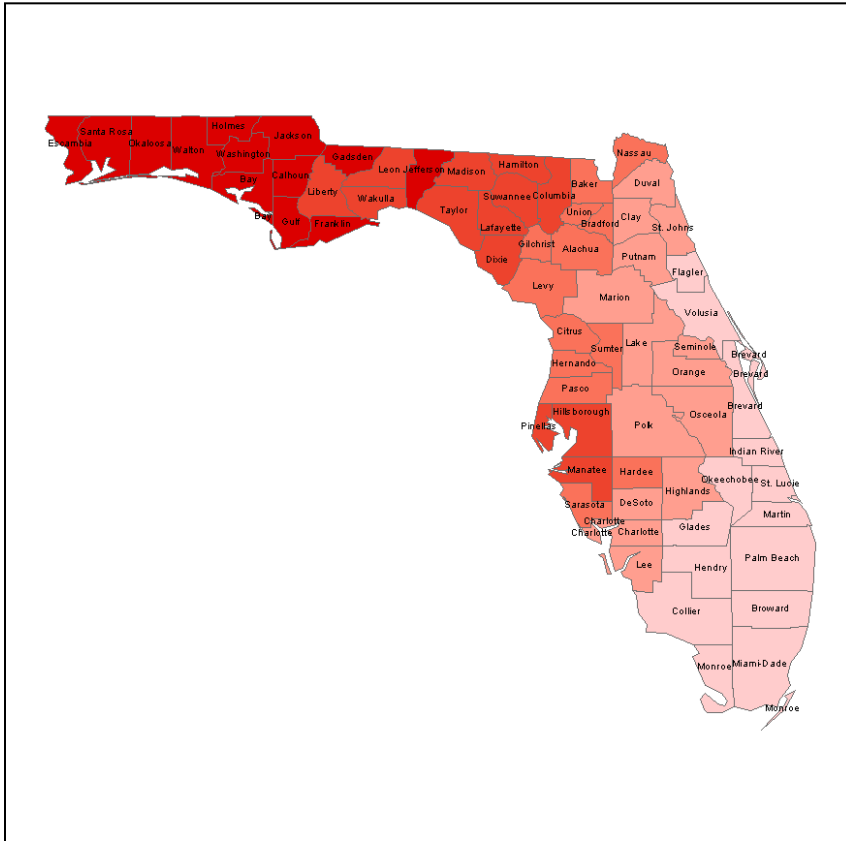


What years are in your experience period and what types of events are you missing?

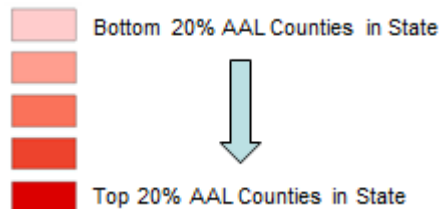
View of Risk: Geographic Hazard Distribution

Model A

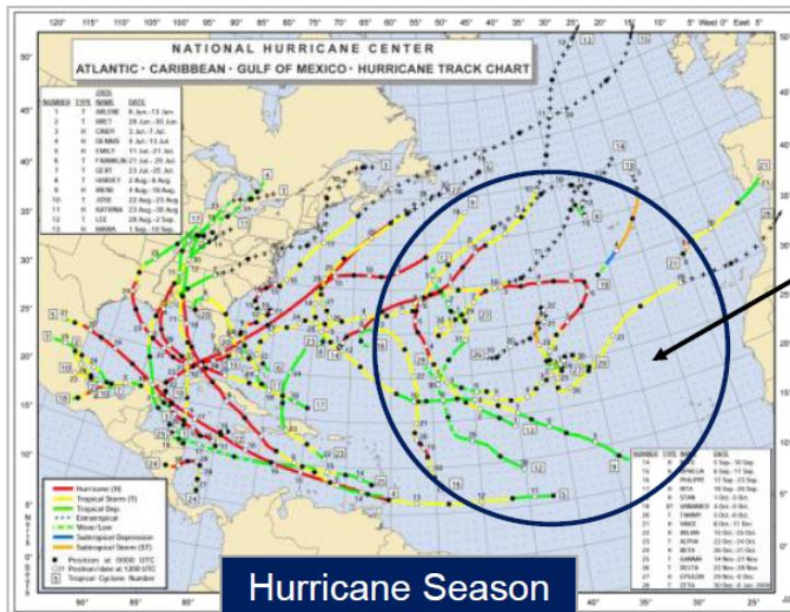
Model B



Illustrative data only



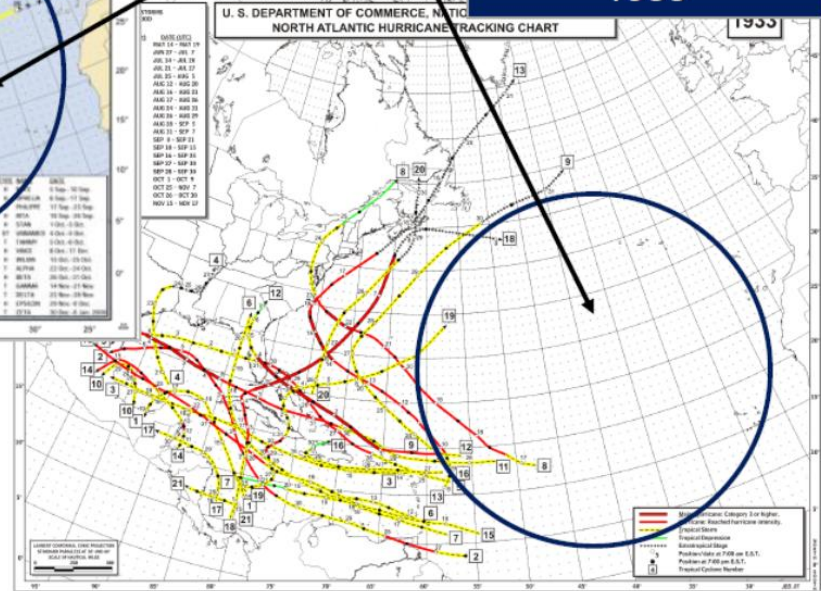
View of Risk: Event Frequencies



Hurricane Season 2005

Open Atlantic Ocean Differences

Hurricane Season 1933

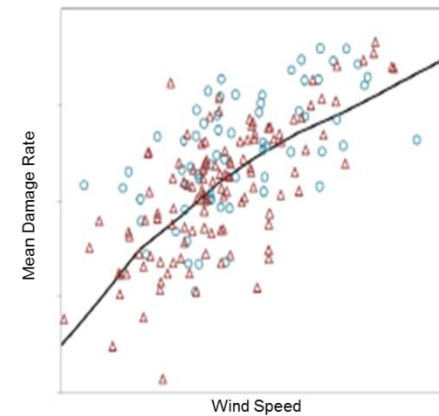
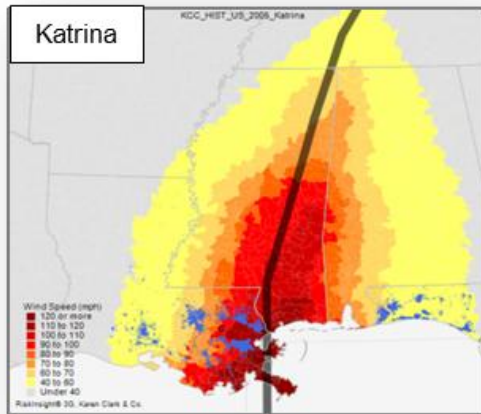


Source: NOAA
Courtesy of KCC

Frequency Considerations

- Specialized knowledge (Meteorology)
- Observational bias in historical data
- Long Term vs. Near Term (sea surface temperatures)
- Landfall vs. all events

View of Risk: Customize Damage Rates

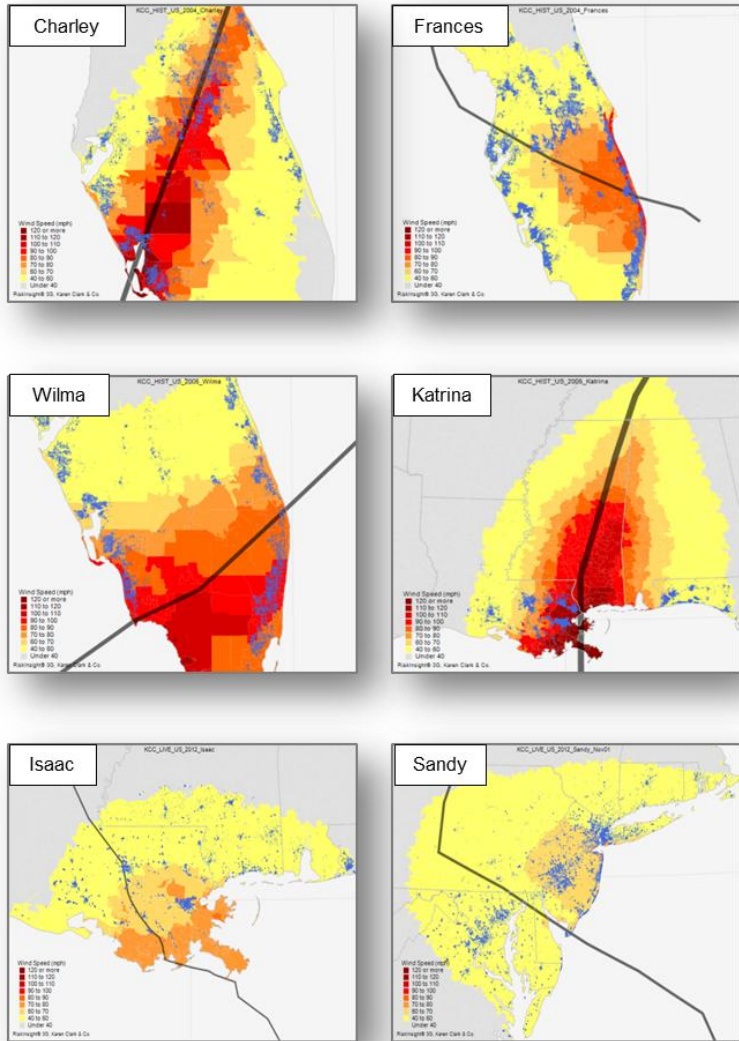


Need detailed, accurate claims data for individual events: location level geography and granular exposure characteristics

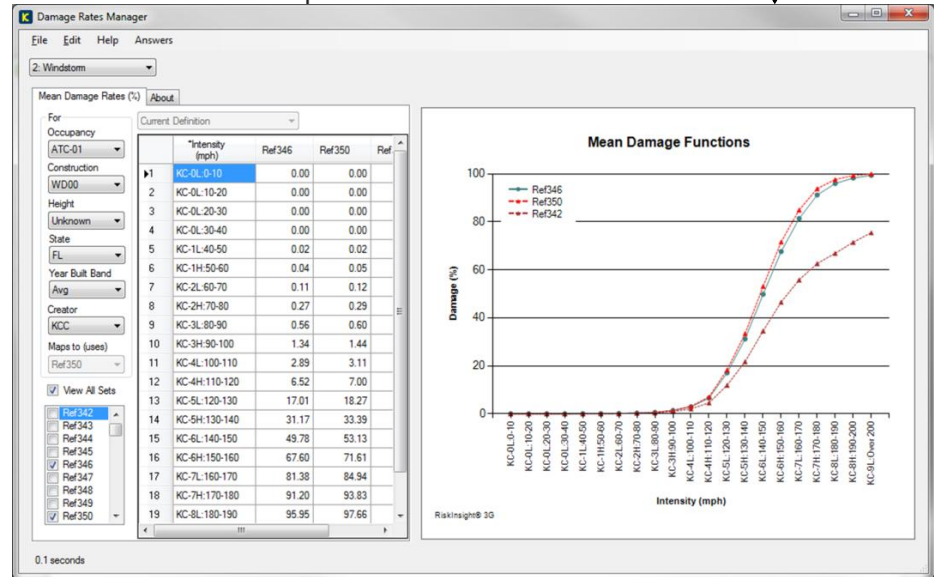
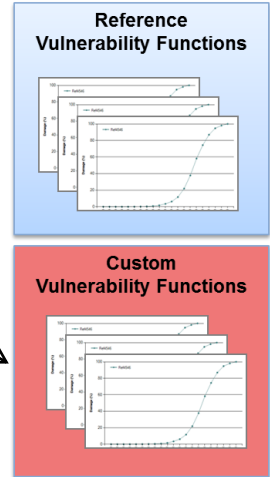
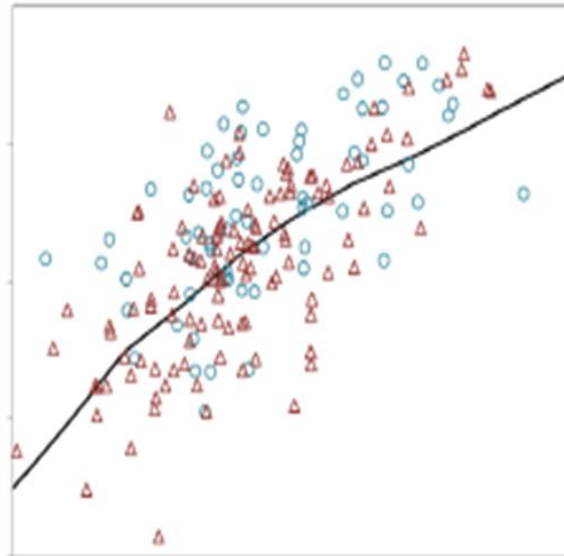
Process to Customize:

1. Geospatially intersect claims data with hurricane wind field to get an implied wind speed for each claim
2. Calculate damage rates for each claim (Loss/Total_Insured_Value)
3. Plot damage rates vs. wind speeds and compare to relationships in model
4. Repeat at various levels of granularity with respect to exposure characteristics: occupancy, construction, year built, number of stories, etc...
5. Make adjustments where there are clear differences

View of Risk: Customize Damage Rates



Mean Damage Rate



Courtesy of KCC

Event Response: Event Quantification Methods

Frequency & Severity	<ul style="list-style-type: none">• Estimate based on historical experience• Break estimate into component pieces• Use Frequency for claim deployment
RiskInsight	<ul style="list-style-type: none">• Fully customizable• Adjust NOAA footprints in WindfieldBuilder®• Adjust damage functions directly to mirror company experience
Catastrophe Models	<ul style="list-style-type: none">• Modeling Vendors release event scenarios in real-time for modeled perils
Market Share	<ul style="list-style-type: none">• Estimate of company share of industry loss based on market share

A Variety of Tools Help to Create a Useful Range

Event Response: Hurricane Footprint Development

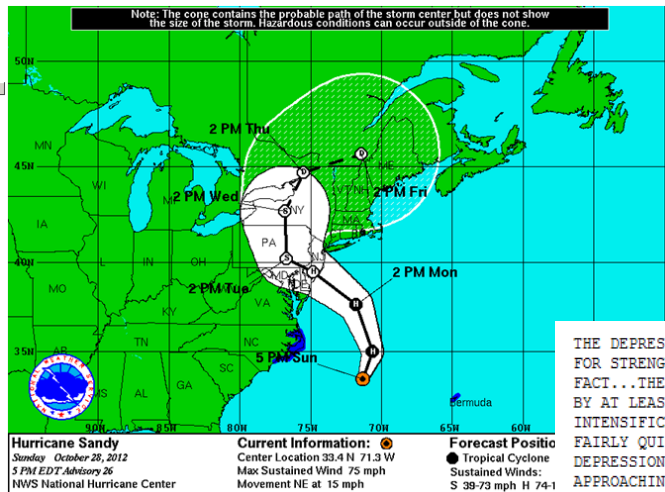
NHC Advisory

Model inputs from NHC include forecasted track and radius of wind

Forecasted Track

Custom Track

Use custom tools to generate a wind field based on forward speed and radius of winds



Discussion

THE DEPRESSION IS LOCATED IN AN ENVIRONMENT THAT IS HIGHLY CONDUCTIVE FOR STRENGTHENING...AT LEAST DURING THE NEXT 36 TO 48 HOURS. IN FACT...THERE IS A 50/50 CHANCE THAT THE DEPRESSION WILL STRENGTHEN BY AT LEAST 25 KT DURING THE NEXT 24 HOURS BASED ON THE RAPID INTENSIFICATION INDEX. THEREFORE...THE OFFICIAL FORECAST SHOWS FAIRLY QUICK STRENGTHENING DURING THE NEXT 48 HOURS...AND THE DEPRESSION COULD BE ON THE CUSP OF BECOMING A HURRICANE AS IT IS APPROACHING JAMAICA. AFTER 48 HOURS...VERTICAL SHEAR IS EXPECTED TO INCREASE SUBSTANTIALLY...AND NEARLY ALL THE GLOBAL MODELS SUGGEST THAT THE CYCLONE WILL TAKE ON MORE HYBRID CHARACTERISTICS...SUCH AS AN EXPANDING WIND FIELD TO THE NORTH AND ITS INTERACTION WITH A MID- TO UPPER-LEVEL LOW. THE OFFICIAL FORECAST THEREFORE SHOWS THE CYCLONE BECOMING A SUBTROPICAL STORM BY DAY 5.

FORECAST POSITIONS AND MAX WINDS

INIT	22/1500Z	13.5N	78.0W	25 KT	30 MPH
12H	23/0000Z	13.7N	78.3W	35 KT	40 MPH
24H	23/1200Z	14.3N	78.1W	45 KT	50 MPH
36H	24/0000Z	15.7N	77.6W	55 KT	65 MPH
48H	24/1200Z	17.4N	77.0W	60 KT	70 MPH
72H	25/1200Z	20.5N	76.0W	55 KT	65 MPH...INLAND OVER CUBA
96H	26/1200Z	24.5N	74.5W	55 KT	65 MPH...OVER WATER
120H	27/1200Z	27.0N	73.0W	50 KT	60 MPH...SUBTROPICAL

66
FORECASTER BERG/AVILA

NNNN

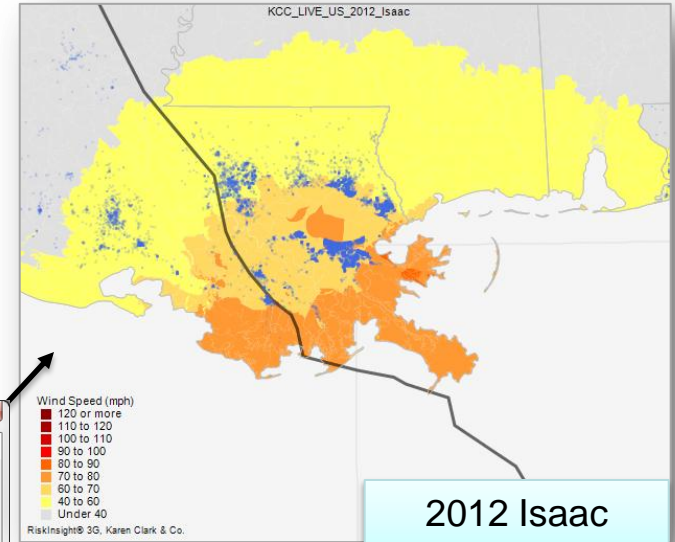


NHC cone of uncertainty guides any right/left track scenarios

Event Response: Custom Track via RiskInsight



WindfieldBuilder automatically imports the latest National Hurricane Center data for active storms and simulates detailed wind footprints for analysis



2012 Isaac

WindfieldBuilder™

File Help

About Import

Source: UNISYS Storm Year: 2012 Event Name: 18.SANDY Advisory: ADV 030 Update URLs

http://weather.unisys.com/hurricane/atlantic/2012/SANDY/track.dat Refresh from Website Paste UNISYS data

Date: 22-29 OCT 2012
Hurricane-2 SANDY

ADV	LAT	LOX	TIME	WIND	PR	STAT
1	13.50	-78.00	10/22/15Z	25	1003	TROPICAL DEPRESSION
1A	13.50	-78.50	10/22/18Z	25	1003	TROPICAL DEPRESSION
2	12.50	-78.50	10/22/21Z	35	999	TROPICAL STORM
2A	12.70	-78.70	10/23/00Z	40	998	TROPICAL STORM
3	12.70	-78.60	10/23/03Z	40	998	TROPICAL STORM
3A	12.90	-78.70	10/23/06Z	40	998	TROPICAL STORM
4	13.30	-78.60	10/23/09Z	40	998	TROPICAL STORM
4A	13.40	-77.90	10/23/12Z	40	997	TROPICAL STORM

UNISYS (NHC) Import

If necessary, tap [Refresh from Website]. This will download the NHC data from the selected event from the UNISYS web site.

To import the downloaded data

- Enter the value for Rmax (Radius of Maximum Winds)
- Tap [Import]

The UNISYS format is a hybrid text file. Starting in the fourth line it contains the following values:

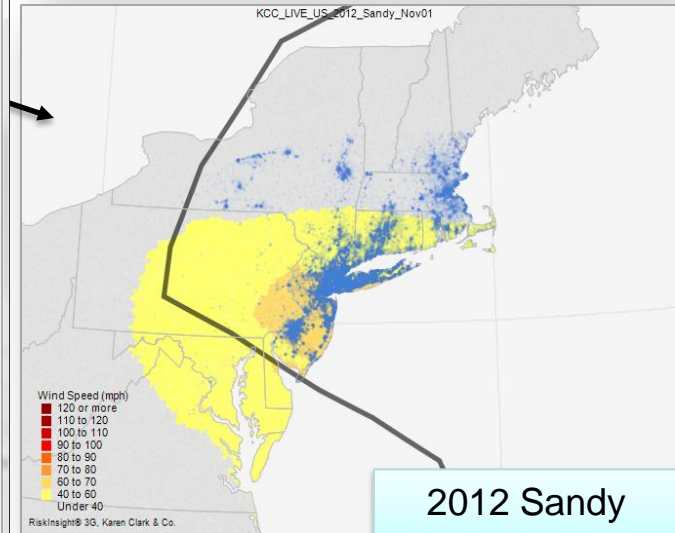
- ADV: Advisory

Please complete the following

Season Year: 2012
Storm#: 18
Name: SANDY
Year: 2012
Rmax: 45 < Estimate

Import

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2012 Sandy

Event Response: Custom Track via RiskInsight

The screenshot displays the WindfieldBuilder™ software interface. The main window has a menu bar with 'File' and 'Help'. Below the menu bar are tabs for 'About' and 'Build'. The 'Build' tab is active, showing configuration options for a custom track.

Configuration Options:

- Group: CUSTOM
- Intensity: CAT_3
- Event Suffix: Trial1
- Event Name: CUSTOM_CAT_3_TX_A3030_Trial1
- Track Parameters:
 - Characteristic Region: Texas : TX
 - Landfall Point: A3030: Gilchrist, TX
 - Dir: -45° North West
 - Type: Straight Line
 - SW: End Point (Latitude: 33.548037, Longitude: -99.478449)
 - SE: Start Point (Latitude: 26.955619, Longitude: -91.699789)
- Basic Parameters (at Landfall):
 - Max Wind speed overland (mph): 125 (109 knots)
 - Radius of Max Winds (miles): 20 (17 nm)
 - Forward Speed (mph): 15 (13 knots)
 - Filling Rate: Medium
 - Tide Height: High

Windfield Frame:

- Latitude: Max (Default), Min (Default)
- Longitude: Max (Default), Min (Default)
- Use Defaults
- Preview

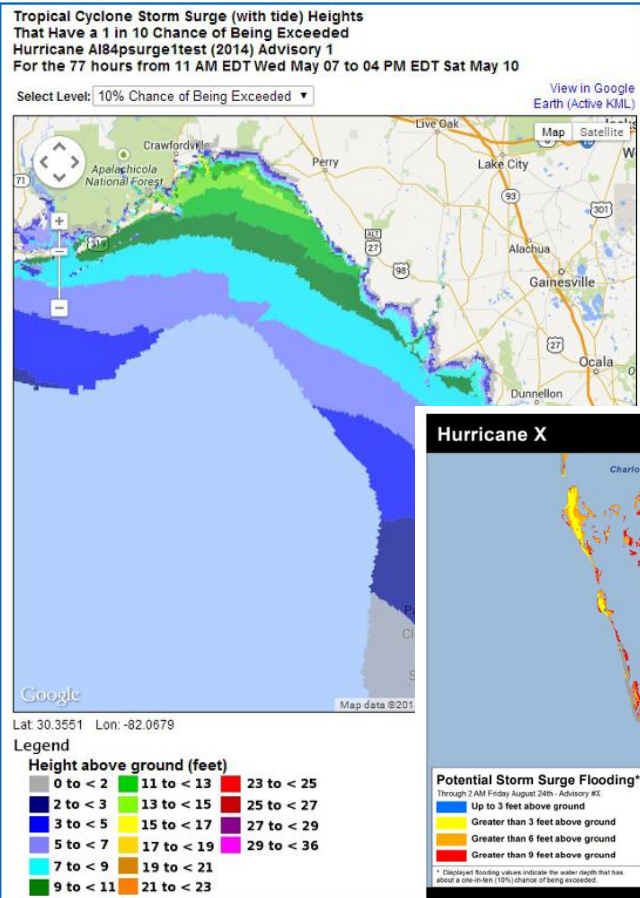
Map Interaction:

- Buttons: Generate New Track, Edit Track
- Instruction: Tap [Generate New Track] and then edit it in an interactive map
- Map Window: RiskInsight® 3G Map showing a track over Texas. A dialog box asks 'Save changes?' with 'Yes' and 'No' buttons.

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Event Response: Storm Surge & Rainfall Accumulation

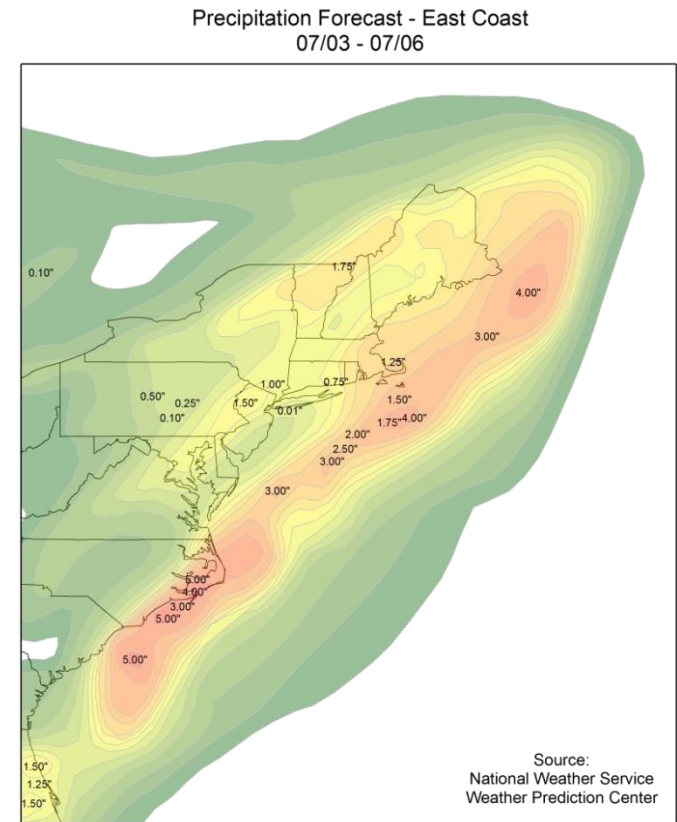
Different vendors offer storm surge footprint solutions



Example 1. Static example of the Probabilistic Storm Surge Height product is interactive with pan and zoom capability.

- NHC produces storm surge scenarios in real-time
- Other vendors may also issue guidance during an event

National Weather Service publishes rainfall accumulation maps



Hurricane CAT Risk Management

View of Risk

- CAT Models are a starting point
- How is your company different?
- Model components should be reviewed for reasonability
- Internal debate is key
- Implementation is challenging

Event Response

- Create rigorous framework
- Early event monitoring
- Timely communication with key stakeholders is paramount
- Think in terms of ranges
- Don't forget smaller perils