KAREN CLARK & COMPANY

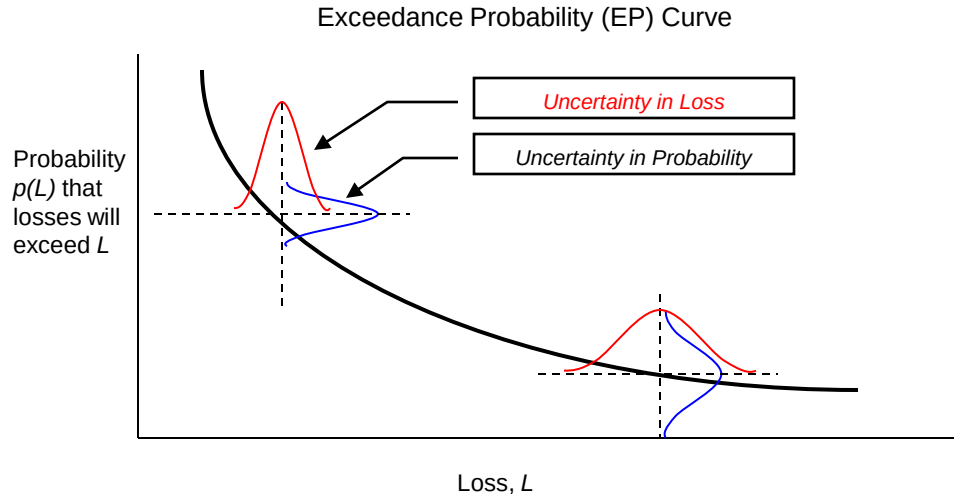
The Expanding Role of the Actuary in Catastrophe Loss Estimation and Management

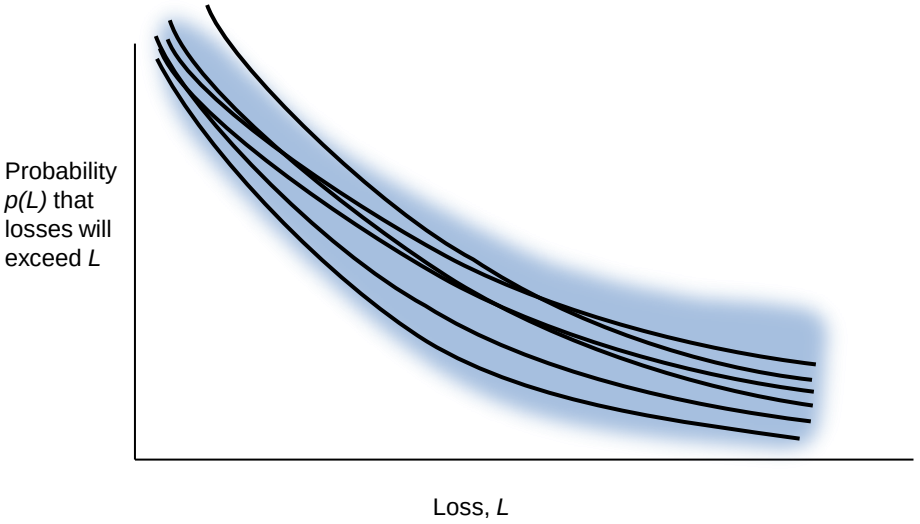
ICA Annual Meeting

Washington, DC

April 3, 2014

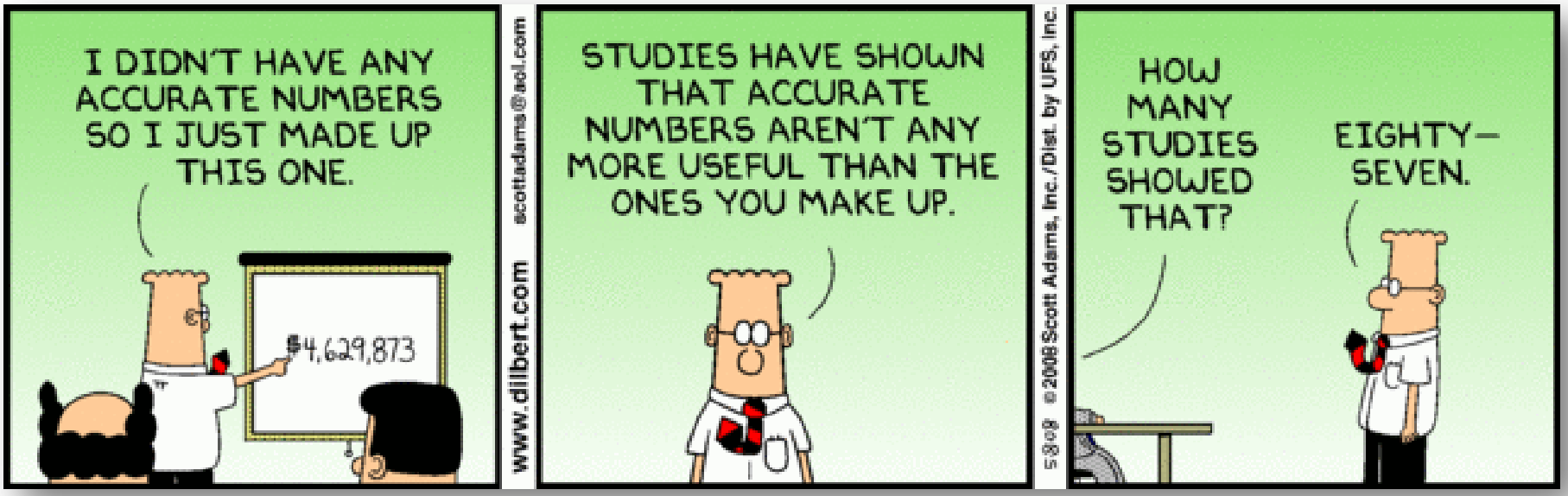
A More Realistic Representation of the EP Curve





- Wide uncertainty around scientific estimates of frequency and severity of large magnitude events in specific geographical areas
- Unknowns with respect to ground motion, dynamics of wind speeds
- "Unknowledge" about how structures respond to wind and ground motion intensity
- Model and modeling error

Given All of the Unknowns and Uncertainty Why Do We Base Risk Management Decisions on One Number?



What's the Best Way to Pick a Number?

- Just use latest vendor model version?
  - ✓ Because there is so little data and so many "unknowns" the models will never be accurate and a model update may be less credible than prior version
  - ✓ Model volatility is driven by changing assumptions and not new science in most cases
- Use multiple vendor models and "blend"?
  - ✓ Very time consuming and inefficient
  - ✓ Becoming cost prohibitive
  - ✓ "Black box" approach
- Fully understand the data and uncertainty and develop your own company specific view of risk?

Open Source, Open Platform, Multi-model Platform

- Oasis – multi-model platform with open source financial module
- RMS(One) – multi-model platform
- RiskInsight – open platform to customize and build your own model

What's the Open Platform Approach?

- A robust, fully transparent and customizable catastrophe loss modeling platform
  - ✓ Hazard component
  - ✓ Vulnerability component
  - ✓ Financial loss component
- Built-in reference models by peril region
  - ✓ US hurricane
  - ✓ US earthquake
  - ✓ Storm surge flooding
  - ✓ Severe thunderstorm
  - ✓ European windstorm
  - ✓ Japan typhoon
- Deployable in various ways
  - ✓ Traditional client/server
  - ✓ Virtual machine
  - ✓ In the cloud

What's a Reference Model?

- Catastrophe model developed by experts in the field
- All events, intensities and damage functions fully transparent
- All components properly validated and peer reviewed
- Components and assumptions customizable directly by user

Understanding Hurricanes

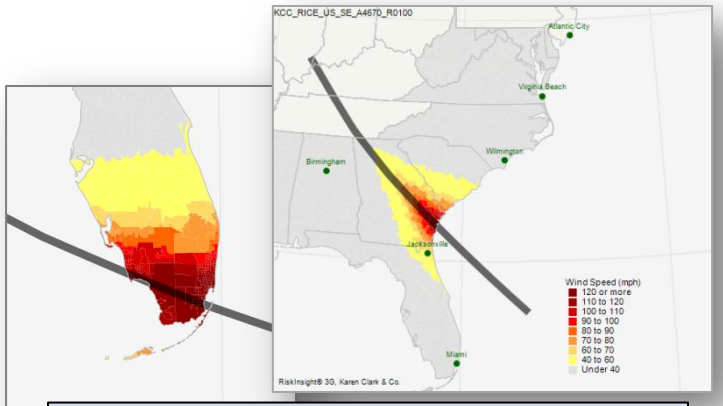
- Historical data from multiple publicly available sources
  - ✓ HURDAT database
  - ✓ Tropical cyclone reports

- Detailed windfield simulation for estimating ground level wind speeds well documented in the scientific literature

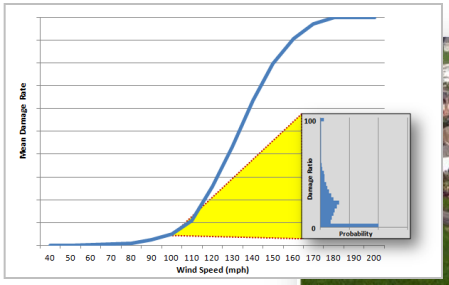
- Damage functions account for construction and occupancy types, local building practices, and year built (based on claims data, post disaster surveys, engineering judgment)

- Damage functions consider mean damage rates as well as “secondary uncertainty” or variability around the mean using distributional assumptions

Hurricane Research Division
Atlantic Oceanographic & Meteorological Laboratory
National Oceanic & Atmospheric Administration

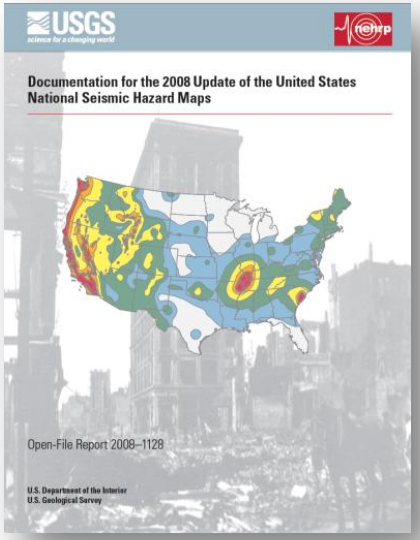


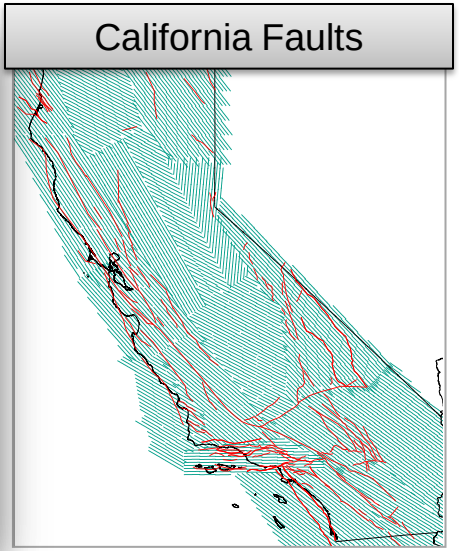
$$V_{1\min,10m}(r > R) = \left\{ gf\left(c_1 \left[\sqrt{\frac{1}{\rho e}(P_w - P_0)} - \frac{Rf}{2} \right] \left[c_2 + c_3 \ln(c_4 R) + (c_5 + c_6 \ln(c_4 R)) \ln(c_4 r) \right] \right) + 1.5 T^{c_7} T_0^{c_8} \cos(\beta) \right\}$$

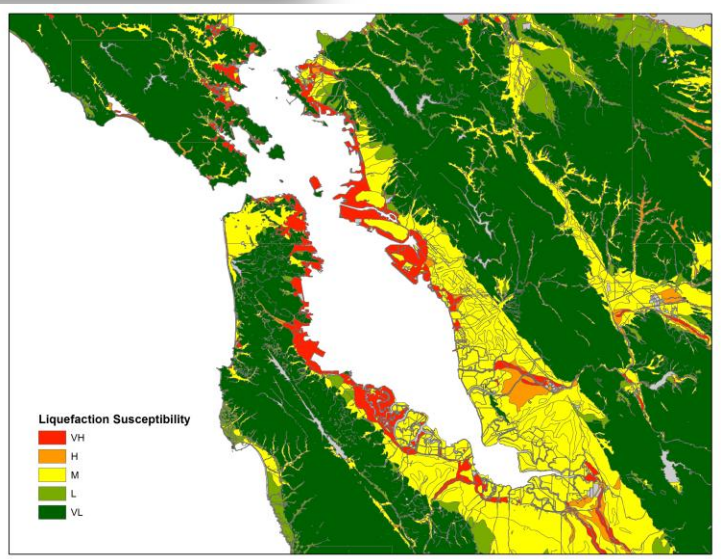


Understanding Earthquakes

- The latest research available from the USGS
  - ✓ Fault locations and parameters
  - ✓ Attenuation relationships
- Damage functions primarily based on expert engineering judgment
  - ✓ ATC
  - ✓ HAZUS
  - ✓ PEER
- High resolution soil databases
- Liquefaction susceptibility maps

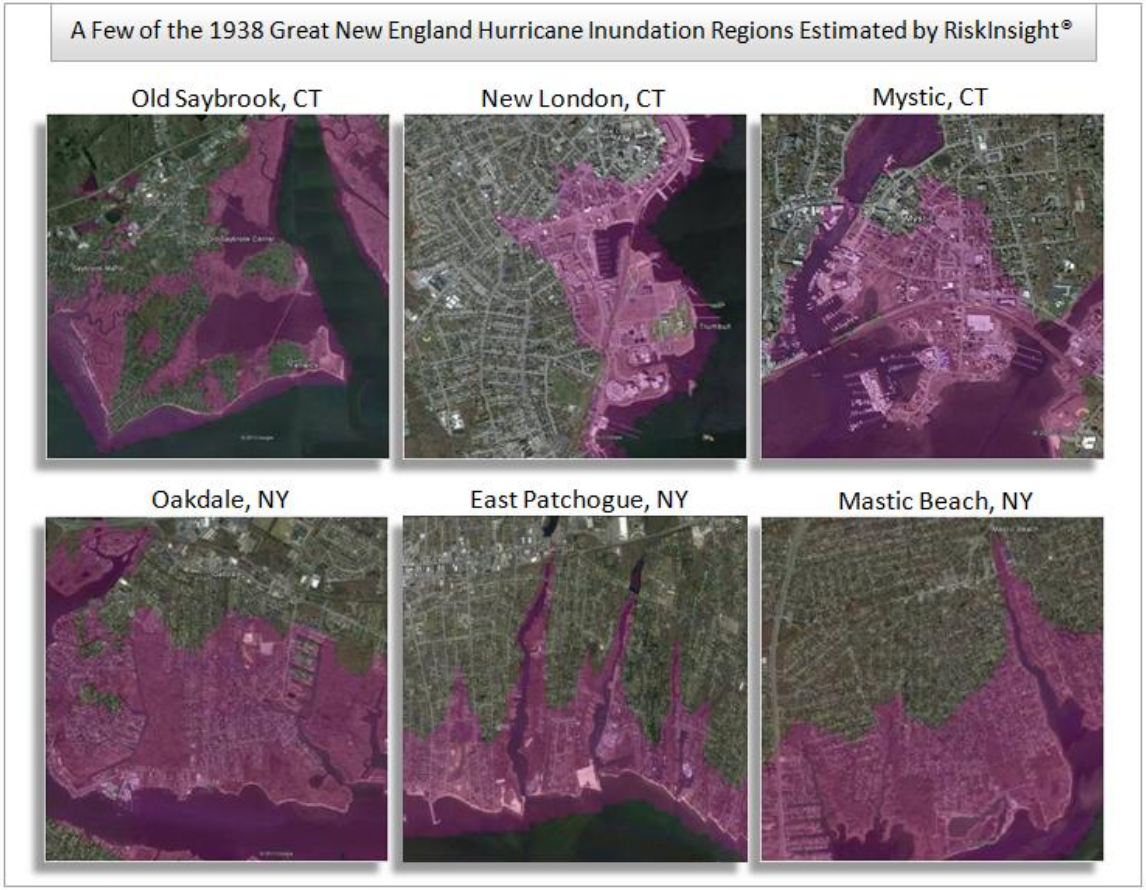






Understanding Storm Surge

- Storm surge heights related to
  - ✓ Storm parameters
  - ✓ Bathymetry
  - ✓ Tides
- High resolution elevation data
- Consideration of bays and estuaries

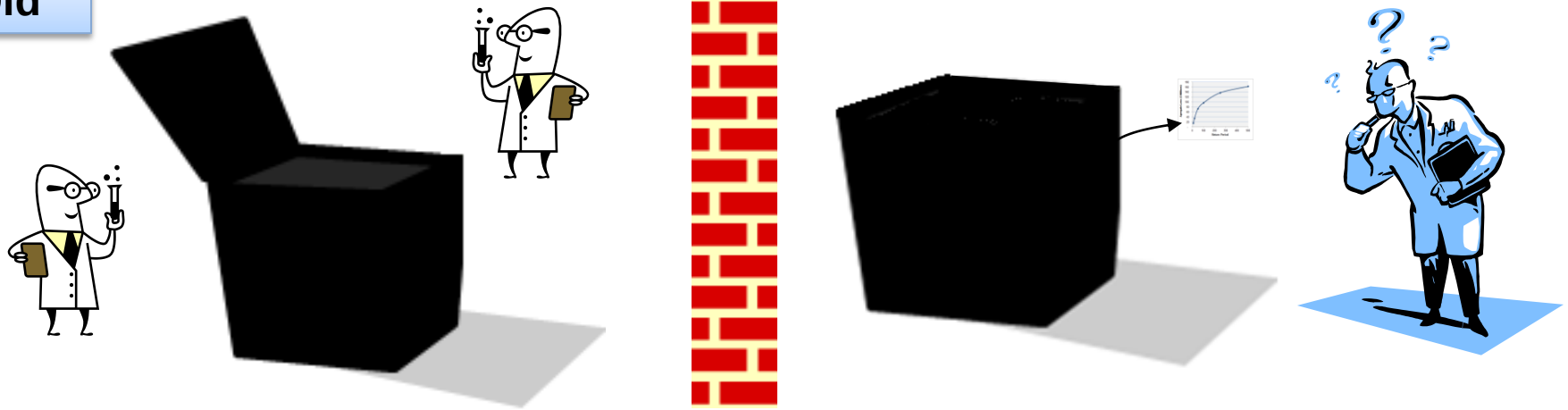


What's the Real Innovation Behind an Open Platform?

- Decoupling the software from the science

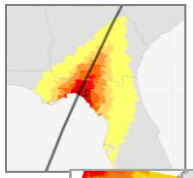
Innovation is Creating a Paradigm Shift

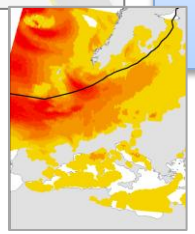
Old



New

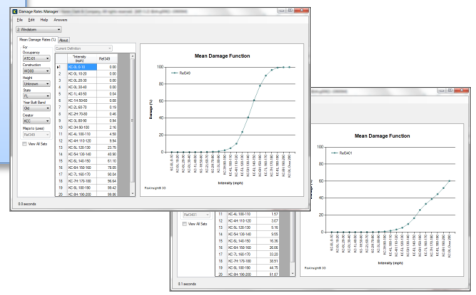
With an Open Platform You Don't Build From Scratch – Start with Robust Software Platform and Reference Models





Users can see and customize event frequency, severity, and intensity

Users can see and customize damage functions by construction, occupancy, etc.



Reads detailed exposure files

Exposure

Superimposes intensity footprints on detailed exposures

Hazard

Applies damage functions and secondary uncertainty

Vulnerability

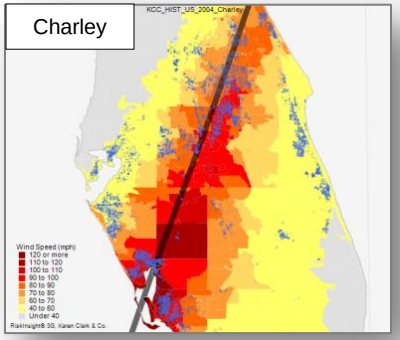
Accounts for detailed policy conditions and reinsurance terms

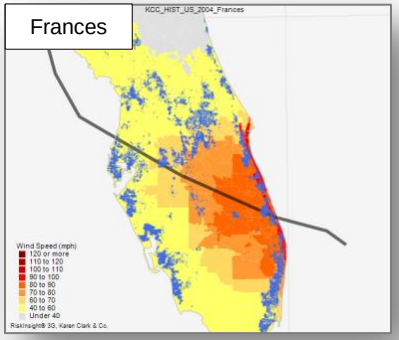
Financial Loss

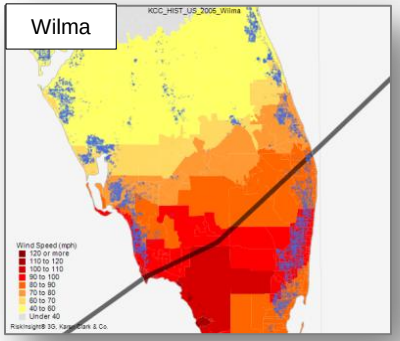
Losses by event by location

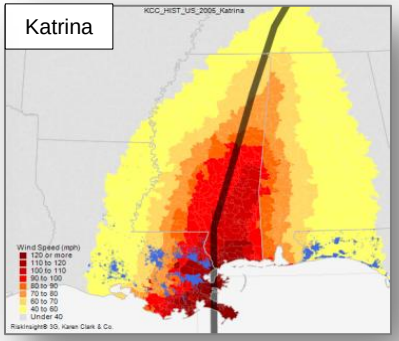
Open Loss Modeling Platform

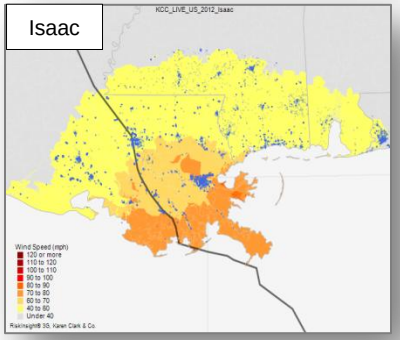
With an Open Platform, You Can Leverage Your Own Claims Data for Competitive Advantage

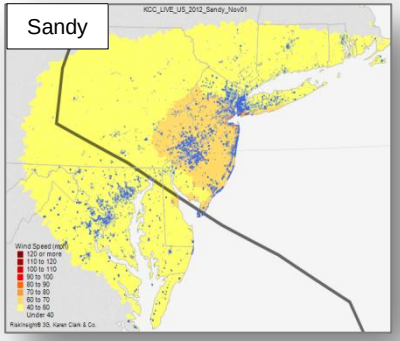


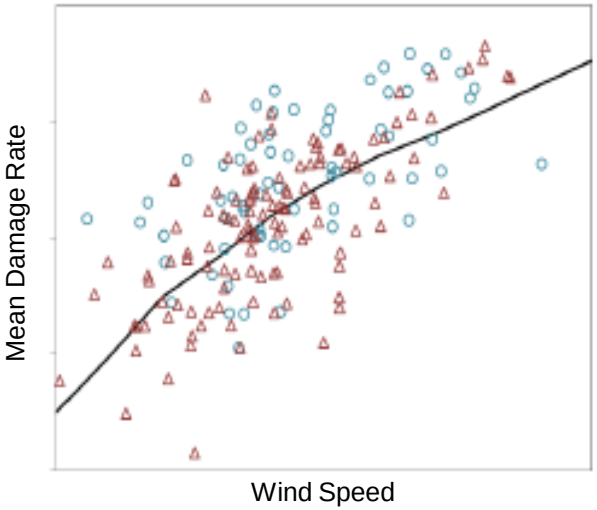


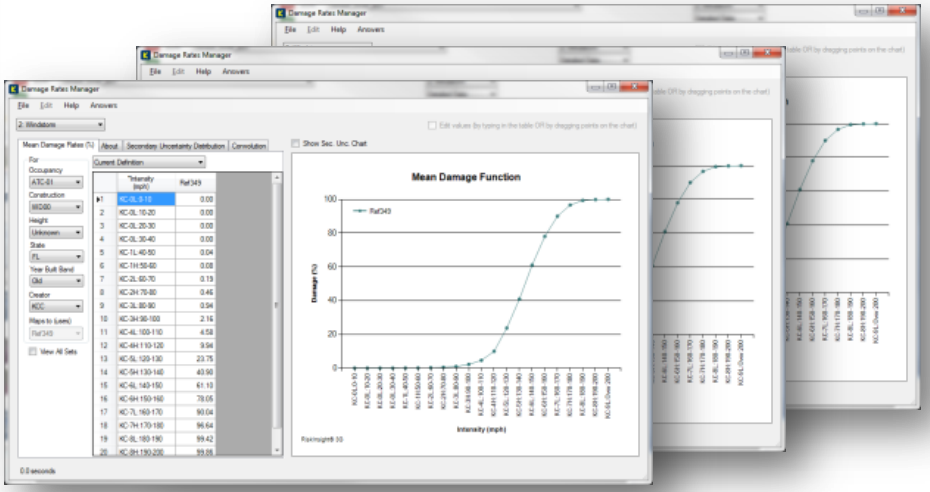












You Can Customize Event Frequency to Directly Test Different "Near Term" Views

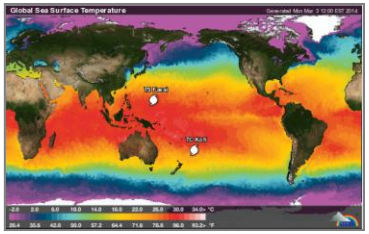
Reference Event Loss Table (ELT)

	EventID	State	County	LOB	Gross Loss	Rate
▶1	KCC_RICE_US_FLNE_A4330_R0004	All	All	All	476,916	.001828
2	KCC_RICE_US_FLNE_A4330_R0005	All	All	All	1,275,943	.001463
3	KCC_RICE_US_FLNE_A4330_R0010	All	All	All	15,240,203	.001135
4	KCC_RICE_US_FLNE_A4330_R0020	All	All	All	49,160,531	.000498
5	KCC_RICE_US_F					
6	KCC_RICE_US_F					
7	KCC_RICE_US_I					
8	KCC_RICE_US_I					
9	KCC_RICE_US_I					
10	KCC_RICE_US_I					
11	KCC_RICE_US_I					

Reference Year Loss Table (YLT)

	Year	Day	State	County	LOB	Sim_ID	CE_EventID
▶1	1	281	All	All	All	1	KCC_RICE_US_TX_A3070_R0020
2	1	261	All	All	All	2	KCC_RICE_US_FLNW_A3770_R00
3	2	219	All	All	All	3	KCC_RICE_US_SE_A4800_R0050
4	2	259	All	All	All	4	KCC_RICE_US_TX_A2980_R0020
5	2	217	All	All	All	5	KCC_RICE_US_FLSO_A4320_R000
6	2	270	All	All	All	6	KCC_RICE_US_TX_A2960_R0005
7	5	200	All	All	All	7	KCC_RICE_US_GULF_A3450_R005
8	5	269	All	All	All	8	KCC_RICE_US_TX_A3050_R0020
9	7	338	All	All	All	9	KCC_RICE_US_SE_A4740_R0005
10	7	342	All	All	All	10	KCC_RICE_US_GULF_A3440_R000
11	7	252	All	All	All	11	KCC_RICE_US_FLNW_A3950_R00

Start with a complete catalog including reference event rates



Directly access and refine frequency assumptions

- Event rates can be modified based on proprietary view of climate risk or to address different view of localized hazard, for example

Climate Adjusted ELT

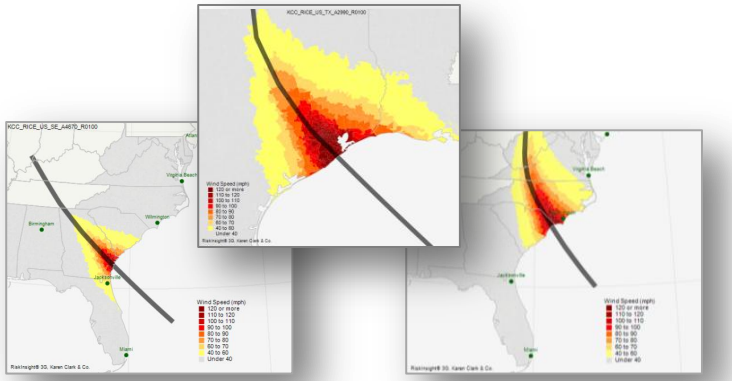
	EventID	State	County	LOB	Gross Loss	Rate
▶1	KCC_RICE_US_FLNE_A4330_R0004	All	All	All	476,916	.001828
2	KCC_RICE_US_FLNE_A4330_R0005	All	All	All	1,275,943	.001463
3	KCC_RICE_US_FLNE_A4330_R0010	All	All	All	15,240,203	.001135
4	KCC_RICE_US_FLNE_					
5	KCC_RICE_US_FLNE_					
6	KCC_RICE_US_FLNE_					
7	KCC_RICE_US_FLNE_					
8	KCC_RICE_US_FLNE_					
9	KCC_RICE_US_FLNE_					
10	KCC_RICE_US_FLNE_					
11	KCC_RICE_US_FLNE_					

Climate Adjusted YLT

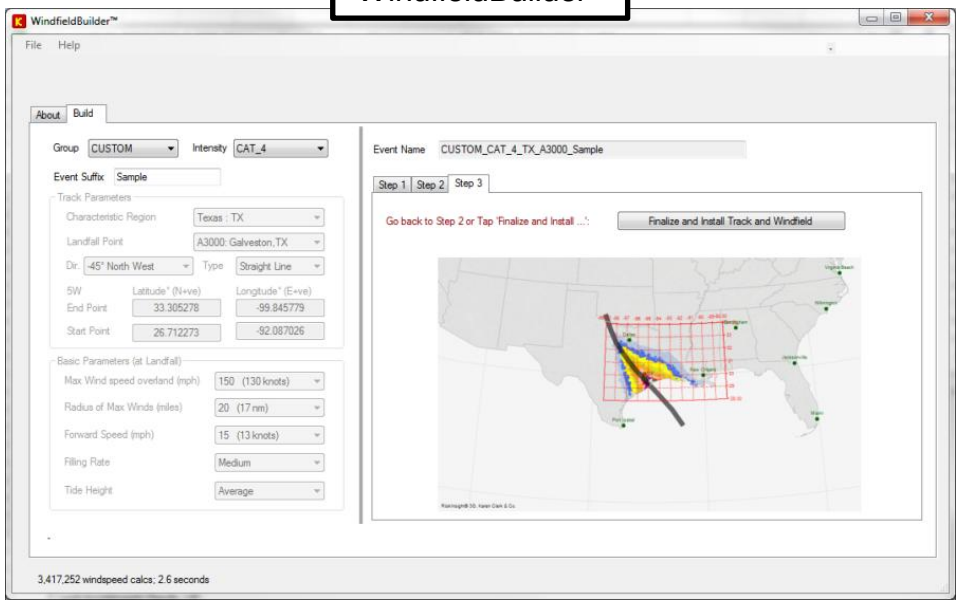
	Year	Day	State	County	LOB	Sim_ID	CE_EventID
▶1	1	281	All	All	All	1	KCC_RICE_US_TX_A3070_R0020
2	1	261	All	All	All	2	KCC_RICE_US_FLNW_A3770_R00
3	2	219	All	All	All	3	KCC_RICE_US_SE_A4800_R0050
4	2	259	All	All	All	4	KCC_RICE_US_TX_A2980_R0020
5	2	217	All	All	All	5	KCC_RICE_US_FLSO_A4320_R000
6	2	270	All	All	All	6	KCC_RICE_US_TX_A2960_R0005
7	5	200	All	All	All	7	KCC_RICE_US_GULF_A3450_R005
8	5	269	All	All	All	8	KCC_RICE_US_TX_A3050_R0020
9	7	338	All	All	All	9	KCC_RICE_US_SE_A4740_R0005
10	7	342	All	All	All	10	KCC_RICE_US_GULF_A3440_R000
11	7	252	All	All	All	11	KCC_RICE_US_FLNW_A3950_R00

You Can Customize Event Severity and Intensity for Different Climate Change Scenarios

Start with a complete catalog of reference events



WindfieldBuilder®



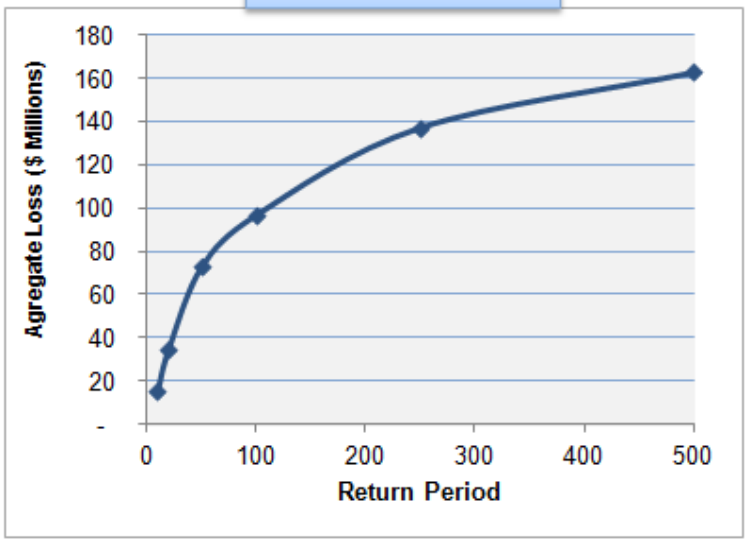
Robust simulation tools enable you to create proprietary footprints

- Embedded tools allow you to simulate realistic event scenarios
- Add or substitute your proprietary events in the reference catalogs

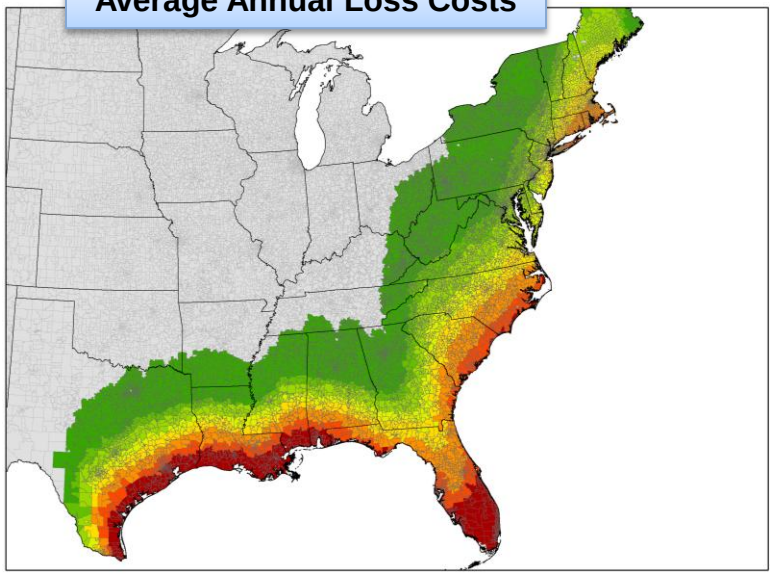
With an Open Platform You Control the Assumptions Driving the Model Output

- ✓ Event Loss Tables (ELT)
- ✓ Year Loss Tables (YLT)
- ✓ Average Annual Losses (AALs)
- ✓ EP Curves

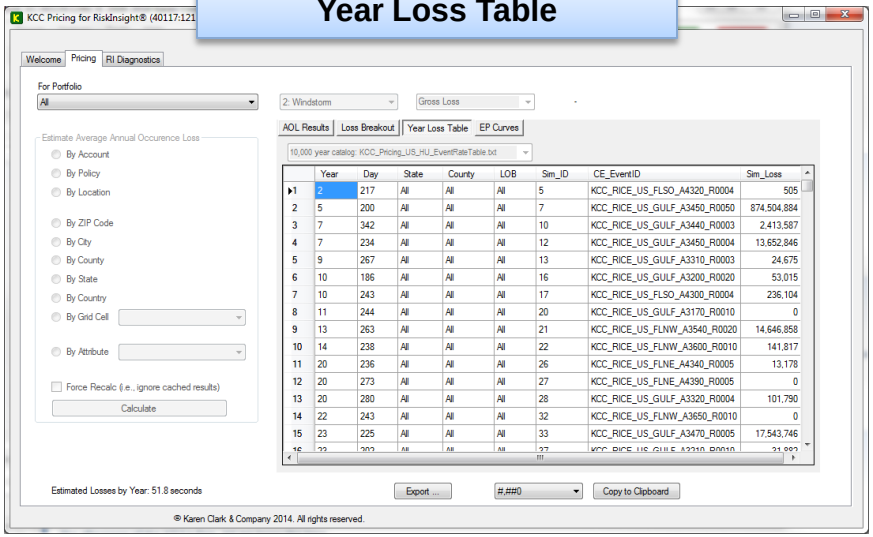
Aggregate EP Curve



Average Annual Loss Costs

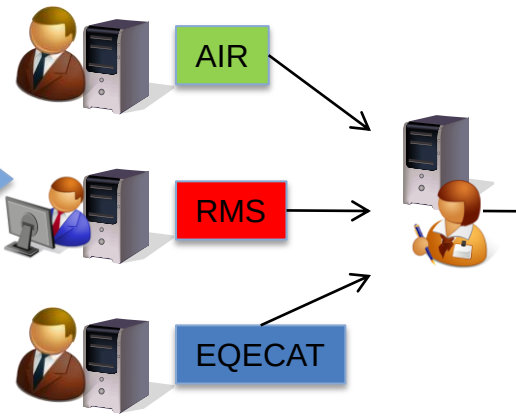


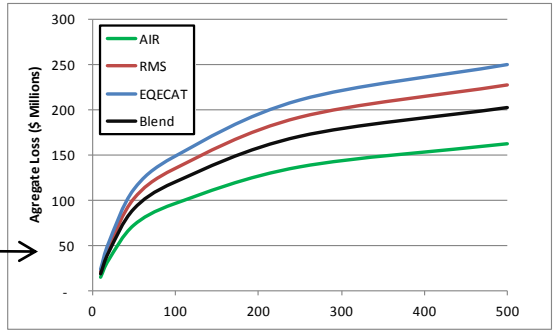
Year Loss Table

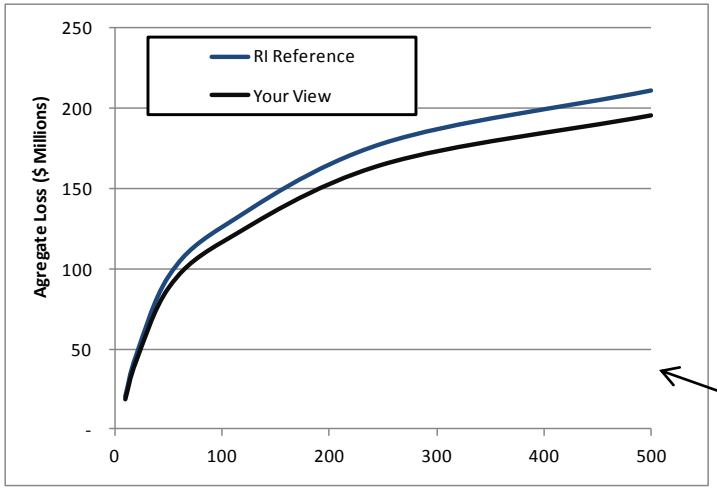


Customizing Your Own Models With an Open Platform Is More Efficient Than Model Blending

Current techniques for model blending are costly and inefficient







Embedded tools enable you to more efficiently create your proprietary view

- Straightforward adjustments to the reference catalog event frequency and severity allow you to develop your proprietary curve
- Run one model to produce multiple views

RiskInsight

Summary—How Are You Going to Own the Risk?

- Cannot simply rely on the three vendor models—they will never produce accurate EP curves or PMLs
  - ✓ Too many unknowns due to lack of data
  - ✓ You need to pick the number
- New tools and platforms cannot eliminate the uncertainty but they can lead to better, more consistent business decisions in light of the uncertainty
  - ✓ Consistency
  - ✓ Transparency
  - ✓ Control
- Newer tools empower you to better understand the ***risk*** and to build a robust and proprietary view of cat risk demanded by CEOs, boards of directors, and external stakeholders such as rating agencies, regulators, and investors