CS-11 Tornado/Hail: To Model or Not To Model

CAS Seminar on Reinsurance- June 5, 2012

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Agenda

- Understanding the severe thunderstorm peril
- Motivation for modeling severe thunderstorm
- The scope of AIR’s Severe Thunderstorm model
- Model validation

2011 Was a Record-breaking Year for Severe Thunderstorm Losses

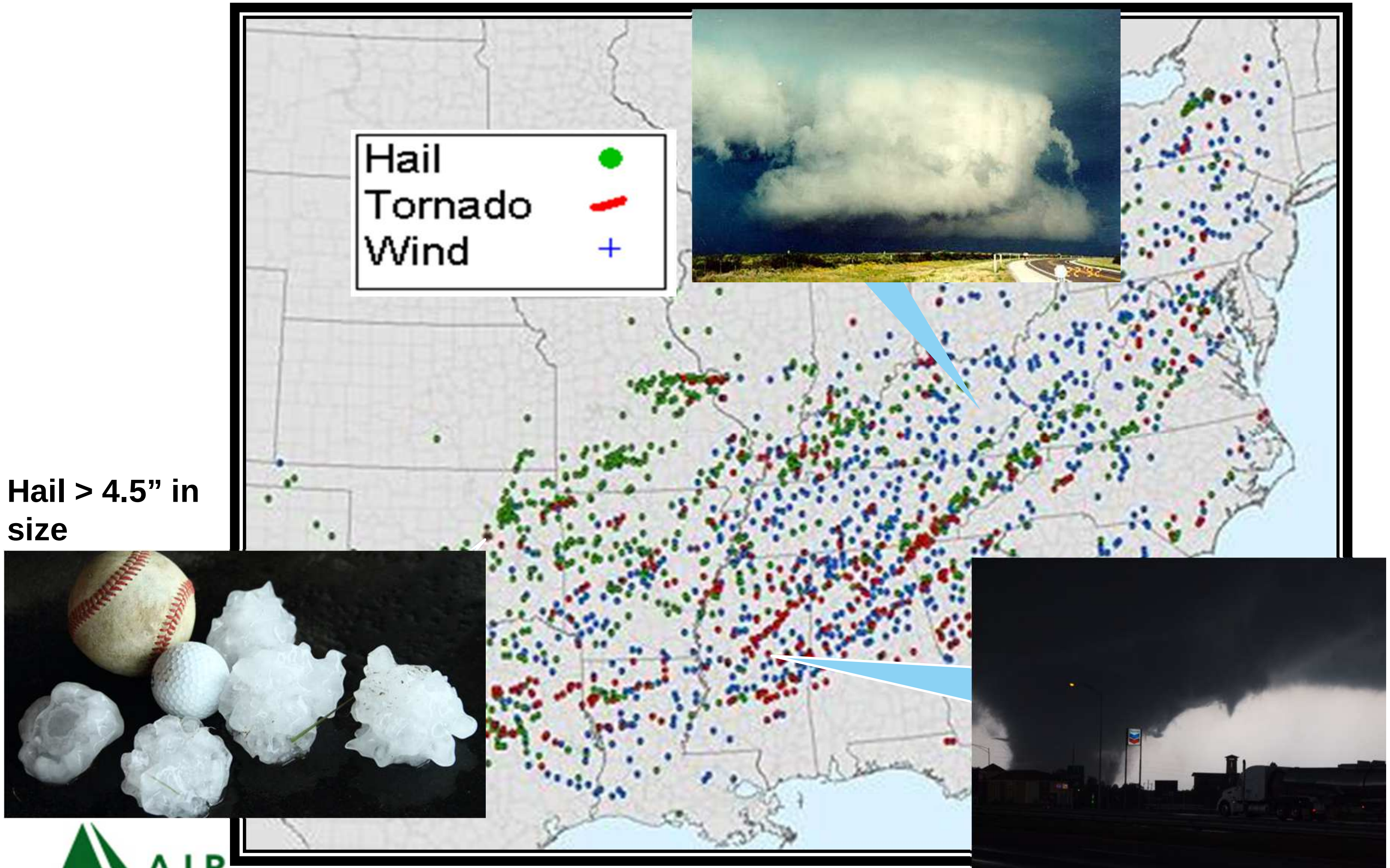
- PCS issued 24 Catastrophe Serial Numbers to severe thunderstorm events in 2011
- 18 events cost over $150 million each
- 6 events cost over $1 billion each
- Maximum reported losses
  - $7.3 billion from Apr 22–28 storms affecting AL, AR, GA, IL, KY, LA, MO, MS, OH, OK, TN, TX, VA
  - $6.9 Billion from May 20–27 storms affecting AR, GA, IA, IL, IN, KS, KY, MI, MN, MO, NC, NE, NY, OH, OK, PA, TN, TX, VA, WI
- Total losses from severe thunderstorms in 2011 exceed $26 billion
- The frequency, severity, and location of thunderstorms in 2011 led to significant losses

Over Seven Days in April 2011, Damaging Hail, Tornadoes, and Wind Devastated the American Heartland

Severe Storms April 22-28, 2011

Winds in excess of 100 mph

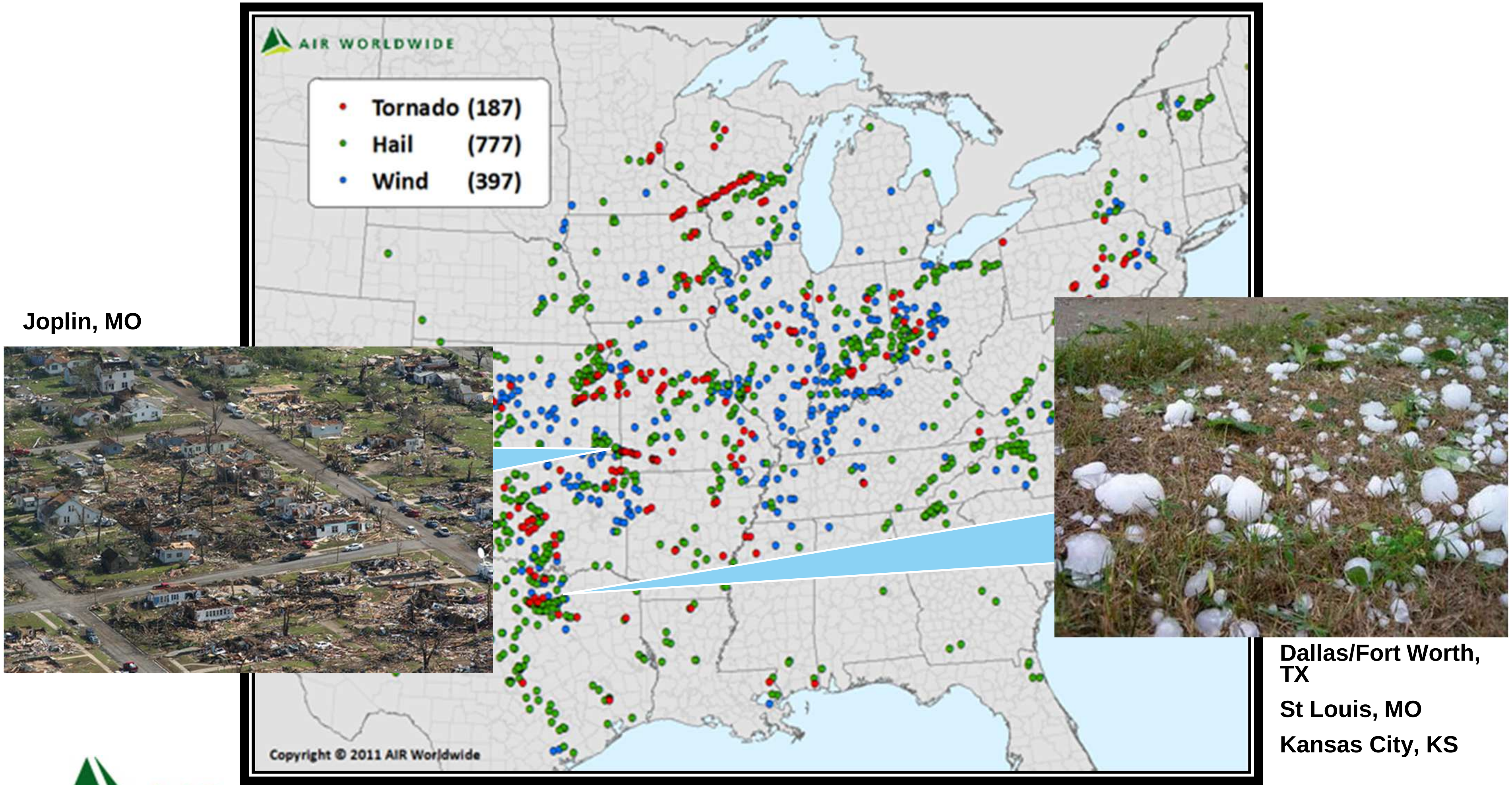
Hail > 4.5” in size



393 damaging tornadoes

Over Seven Days in May 2011, More Than 150 Confirmed Tornadoes Raged across the Heart of the Country

Severe Storms May 20–27, 2011



Joplin, MO

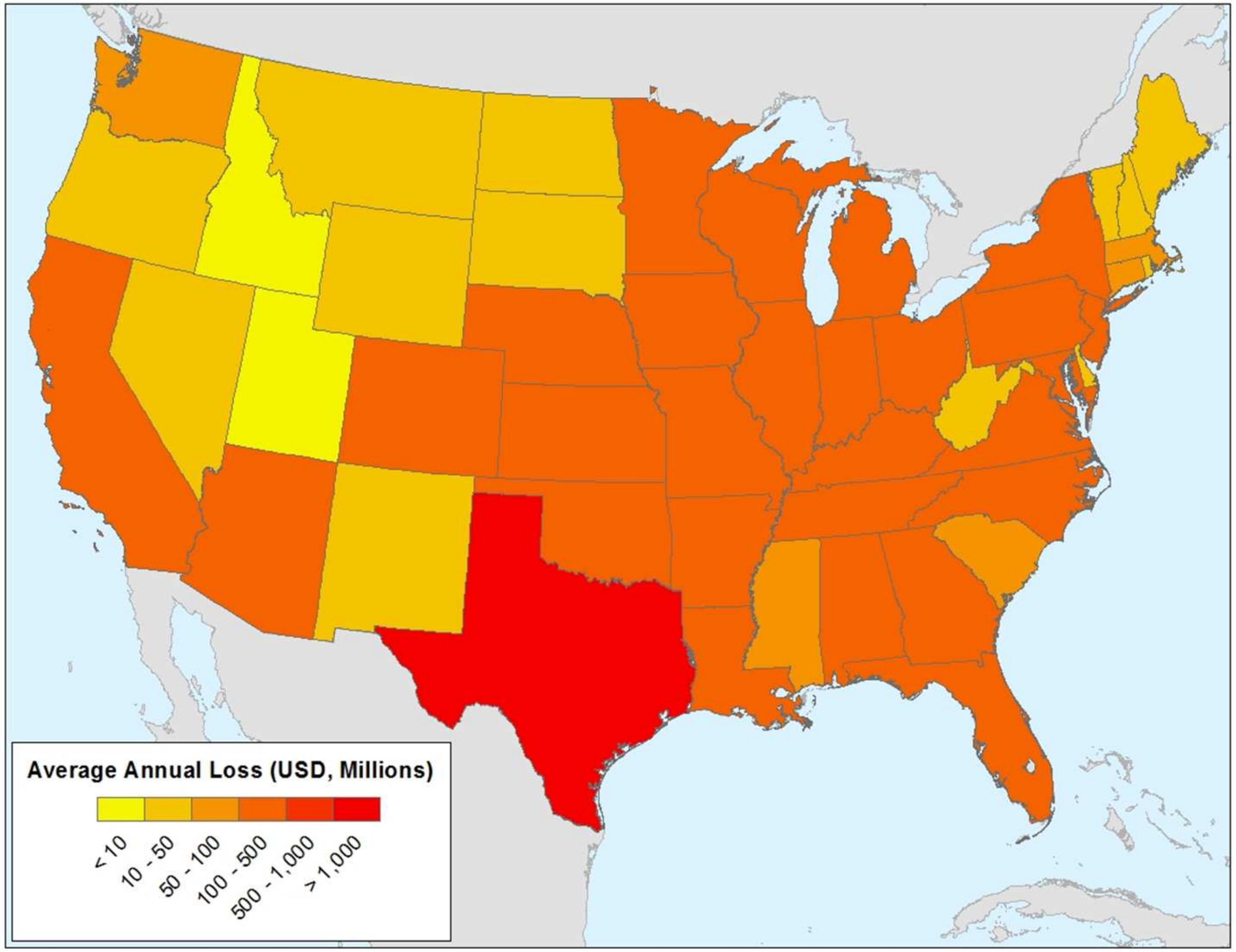
Dallas/Fort Worth, TX

St Louis, MO

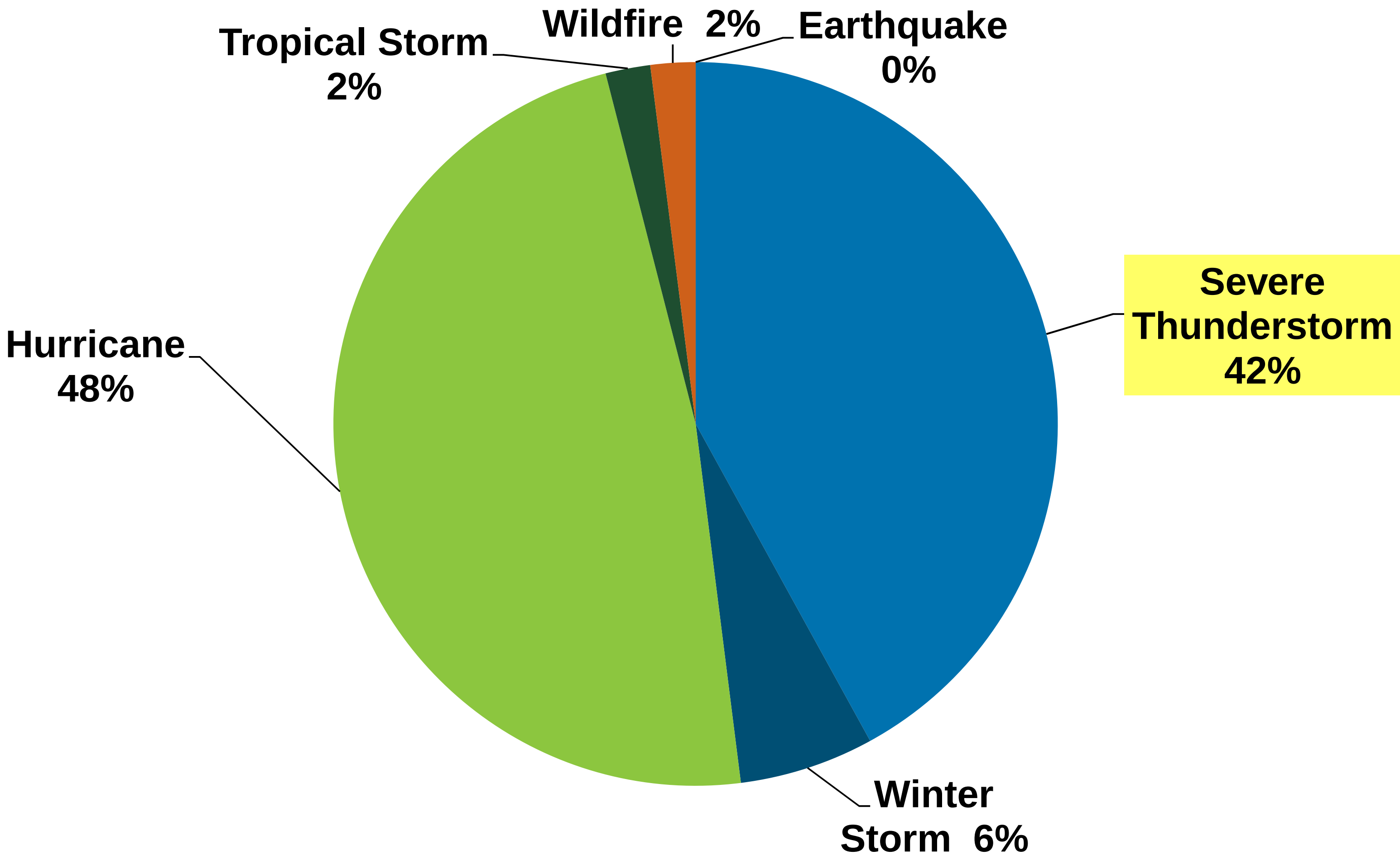
Kansas City, KS

All 48 Contiguous States Are Affected by Severe Thunderstorms

PCS Losses, 1990-2011, Trended to 2011 Dollars

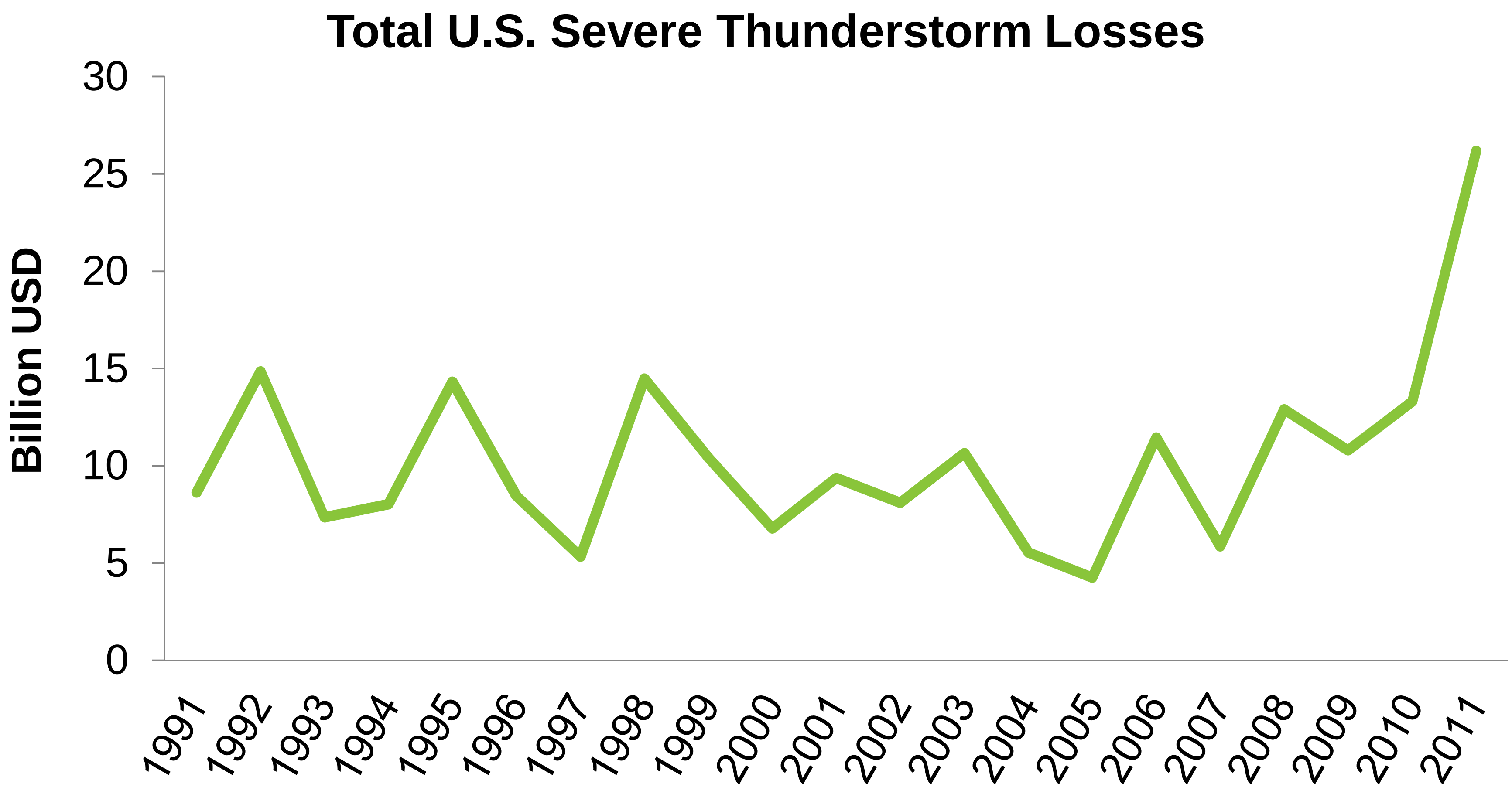


Severe Thunderstorms Have Accounted for 42% of All U.S. Catastrophe Losses from 2001 to 2011



Source: PCS, trended to 2011

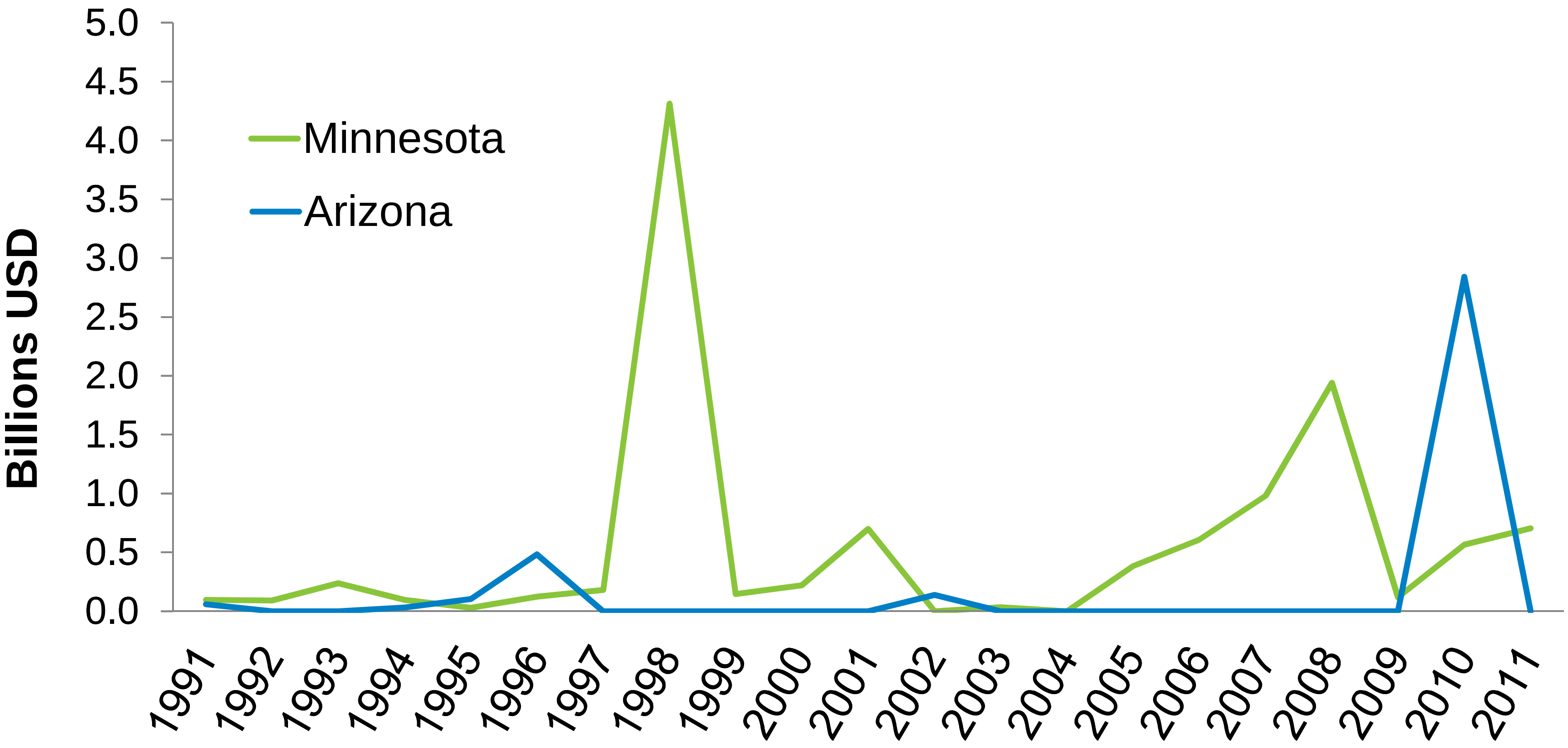
Insured Losses from Severe Thunderstorm Can Be Very Volatile from Year to Year



Source: PCS, trended to 2011

Loss Volatility Is Amplified at Higher Levels of Geographic Resolution

Severe Thunderstorm Losses (PCS)



Source: PCS, trended to 2011

Historical Event Analysis Is Not Sufficient for Managing Severe Storm Risk

- Volatility of historical loss data
  - Frequency: active vs. inactive periods
  - Severity: minor vs. severe event
- Limited nature of claims data
  - Geographic distribution of historical activity
  - Constantly changing landscape of exposure data
    - New property development
    - Building materials and design practices continue to evolve

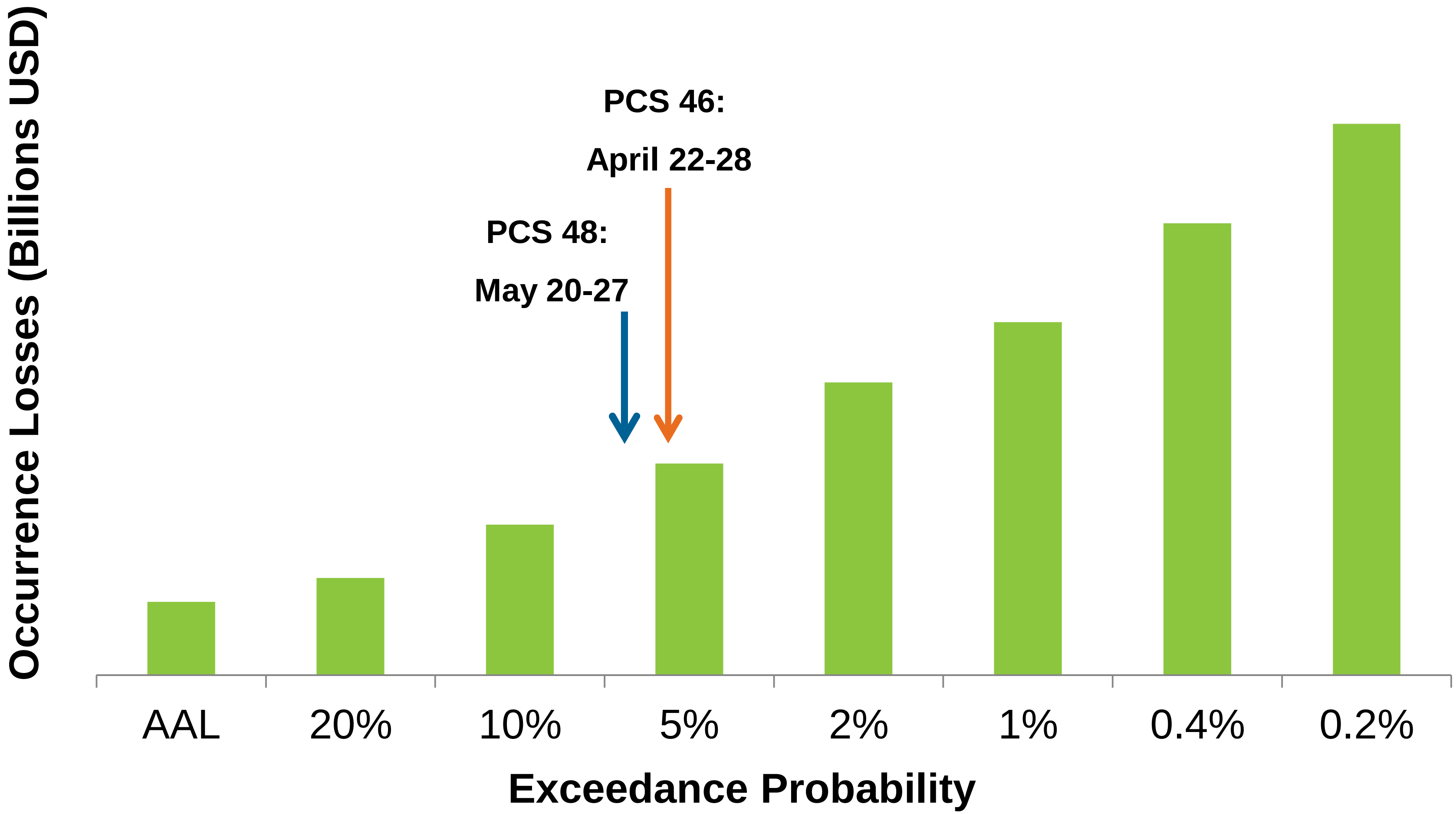
Historical Data From the Severe Thunderstorm Database Are Used to Generate the Model Event Set

- Severe Thunderstorm Database maintained by the Storm Prediction Center (SPC), which is part of NOAA
- Information based on reported sightings available starting from the 1950's
- Over 250,000 microevents since 1974, including more than
  - ✓ 25,000 tornadoes
  - ✓ 100,000 hail storms
  - ✓ 130,000 wind storms
- The historical data come in separate files and are grouped by AIR into macroevents based on geographic distribution and date of occurrence
- More than 2,400 historical macroevents have been generated based on these events

Reasonable Expectations of Severe Thunderstorm Catastrophe Models

- Expected losses and distributions of potential losses down to a granular scale
- As severe thunderstorm risk is largely an "aggregate" issue, a simulation-year methodology is important to enable appropriate quantification of loss potential within simulated years
- Every year and event is a scenario, which can be used in understanding the range of potential outcomes and drivers of risk
- While the model is comprised of simulated events and years, the primary outputs are distributions of potential *losses*

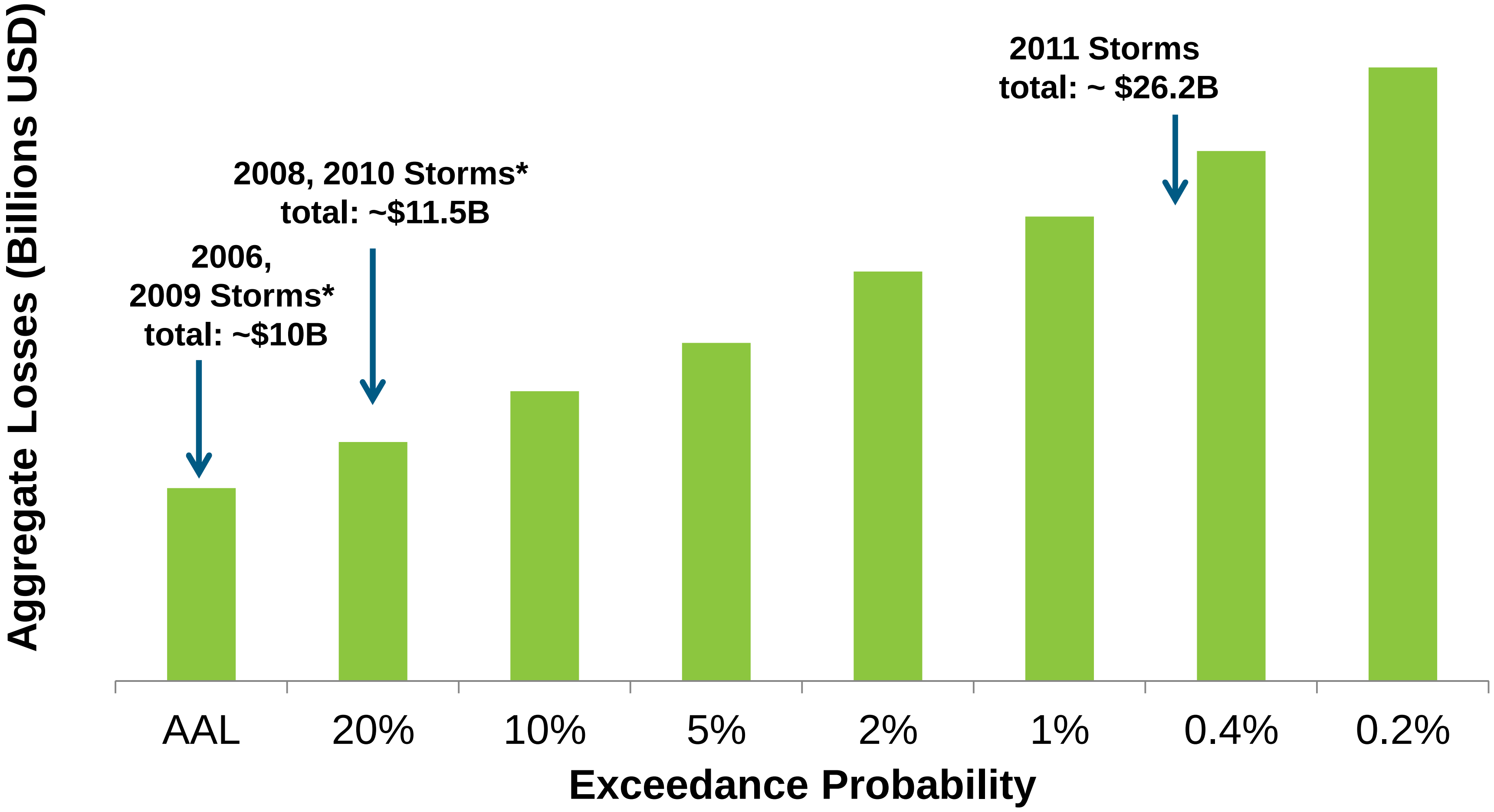
Occurrence Losses from the Major Severe Thunderstorm Events of 2011 Were Not Extreme Outliers



Note: Version 14 with 2011 exposure

Cumulative Losses from Severe Thunderstorms in 2011 Have an Exceedance Probability of About 0.5%

Losses from Storms in 2000, 2001, 2002, 2003, 2004, 2005, 2007 are < than AAL*



* Trended to Present Dollars

AIR's Severe Thunderstorm Catalog Contains Years that Resemble Losses of 2011

Year 8898	Total Losses: $21.7 Billion
Northeast Severe Thunderstorm	$216M
Upper Midwest Severe Thunderstorm	$323M
Southeast Severe Thunderstorm	$2,109M
Midwest Severe Thunderstorm	$149M
Midwest Severe Thunderstorm	**$7,793M**
Texas Severe Thunderstorm	$162M
Southwest Severe Thunderstorm	$94M
Midwest Severe Thunderstorm	$84M
Midwest Severe Thunderstorm	**$9,201M**
Plains Severe Thunderstorm	$51M
Southwest Severe Thunderstorm	$175M
Upper Midwest Severe Thunderstorm	$77M
Upper Midwest Severe Thunderstorm	$162M
Upper Midwest Severe Thunderstorm	$116M
Upper Midwest Severe Thunderstorm	$132M
Texas Severe Thunderstorm	$78M
Midwest Severe Thunderstorm	$93M
Upper Midwest Severe Thunderstorm	$292M
Southeast Severe Thunderstorm	$75M
Gulf Severe Thunderstorm	$56M

Using Single Peril Analyses Will Lead to Underestimation of Catastrophe Risk

	EV	5%	2%	1%	0.40%	0.20%	0.10%
Hurricane							
	78,508,811	339,071,187	503,429,518	693,817,715	959,262,565	1,092,055,628	1,303,179,422
	EV	**5%**	**2%**	**1%**	**0.40%**	**0.20%**	**0.10%**
Earthquake							
	27,120,338	158,879,967	264,089,927	405,934,077	742,971,254	983,646,511	1,141,000,940
	EV	**5%**	**2%**	**1%**	**0.40%**	**0.20%**	**0.10%**
Severe Thunderstorm							
	60,308,841	196,058,211	312,291,274	504,203,661	715,506,615	960,019,277	1,166,591,807

	EV	5%	2%	1%	0.40%	0.20%	0.10%
Combined Perils							
	129,915,455	430,705,438	655,847,183	866,008,366	1,116,176,497	1,318,694,700	1,685,204,827

Understanding Large Aggregate Loss Years Helps Evaluate Alternative Reinsurance Options

Year 5063	$1.227B
$942M	Florida Hurricane
$125M	Texas Severe Thunderstorm
$33M	Midwest Severe Thunderstorm
$30M	Gulf Severe Thunderstorm
$12M	Texas Severe Thunderstorm
$11M	Plains Winter Storm
$10M	Texas Severe Thunderstorm
$10M	Upper Midwest Winter Storm

$200M + in Aggregate Severe Storm Losses

Year 6753	$1.226B
$400M	Florida Hurricane
$363M	Texas Severe Thunderstorm
$332M	Florida Hurricane
$23M	Midwest Severe Thunderstorm
$12M	California Wildfire

Year 2521	$1.222B
$638M	California Earthquake
$311M	California Earthquake
$132M	Texas Severe Thunderstorm
$19M	Gulf Hurricane
$19M	Southeast Severe Thunderstorm
$18M	Midwest Winter Storm
$15M	California Wildfire

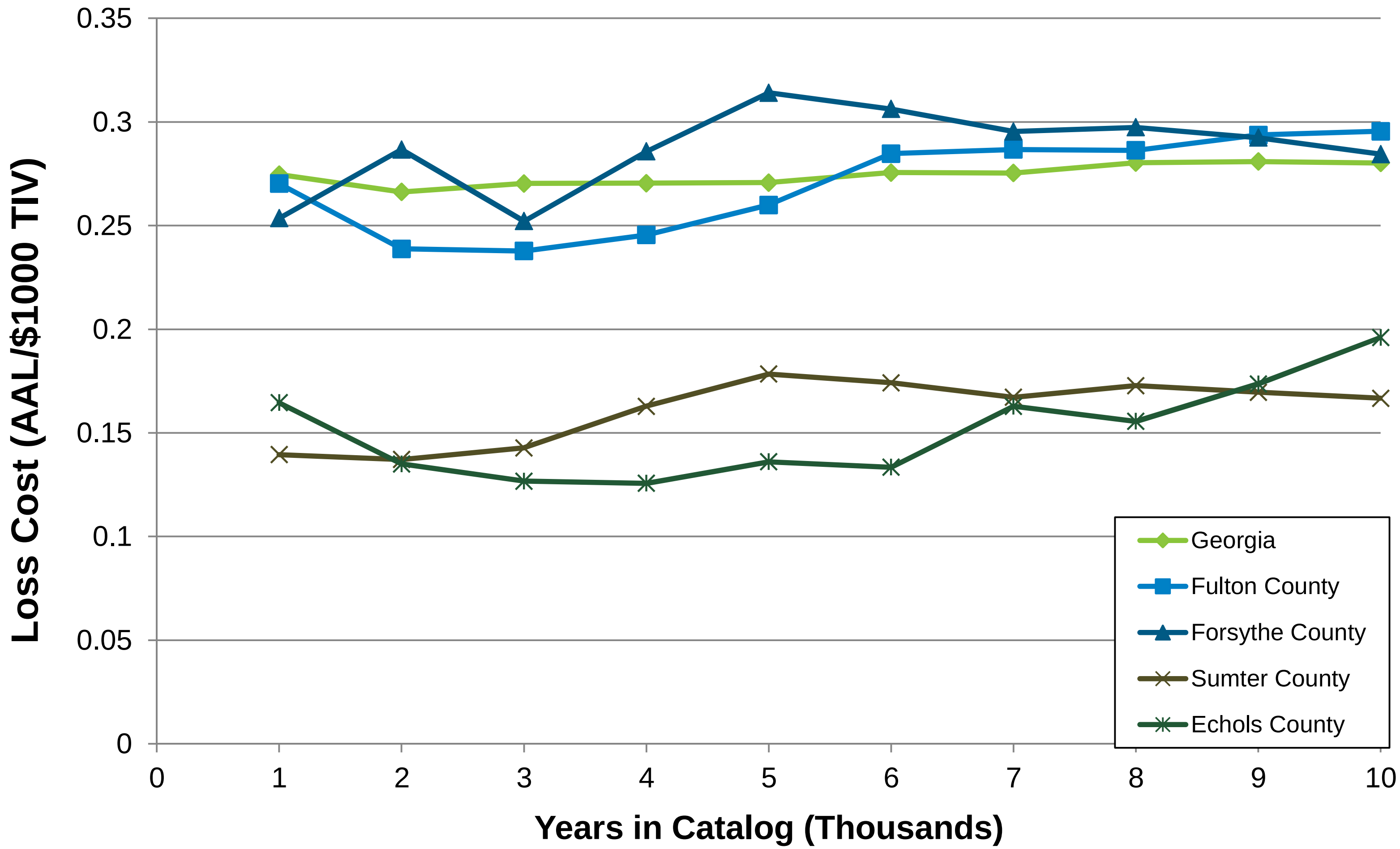
Severe Thunderstorm impacts aggregate

Models Can Be Used to Identify Components of the Portfolio That Are Driving Severe Thunderstorm Risk

State and County	% of Total TIV	Rank TIV	% of Total AAL	Rank AAL	% of Total 1% TVaR	Rank 1% TVaR
Bergen, NJ	2.9%	1	2.4%	2	8.0%	1
Travis, TX	2.1%	2	2.1%	3	7.4%	2
Cuyahoga, OH	1.7%	7	2.1%	4	4.8%	3
Suffolk, NY	2.3%	3	2.7%	1	3.7%	4
Coweta, GA	1.1%	16	1.6%	9	3.7%	5
Baltimore, MD	1.7%	8	1.8%	6	3.5%	6
Oklahoma, OK	0.7%	4	1.8%	5	3.5%	7
Dallas, TX	1.6%	11	1.6%	8	3.1%	8
Lackawanna, PA	1.7%	9	1.5%	11	2.9%	9
Fairfield, CT	1.2%	14	1.0%	14	2.6%	10

AIR

Severe Thunderstorm Model Is Appropriate for Use at the State and County Levels



Results are based on a sample company's actual exposure in Georgia

Severe Thunderstorm – What's Modeled and Not Modeled

Modeled Perils

- Tornadoes
- Straight-line winds (>58mph)
- Hail (> 1'' in diameter)

Non-Modeled Perils

- Storm-induced flooding
- Loss from lightning strikes or resulting fires

Modeled Coverages

- Coverage A - Dwelling
- Coverage B - Other Structures
- Coverage C - Contents / Personal Property
- Coverage D - Additional Living Expense / Business Interruption

Non-Modeled Loss Components

- Loss adjustment expenses
- Hazardous waste removal
- Loss inflation due to political pressure

Note: AIR only models events above $25 million in industry loss, consistent with the PCS definition

Care Should Be Taken in Validating Modeled Losses

- Validation should only consider catastrophic events
- The model includes tail scenarios that have not yet occurred
- The granular nature of the peril contributes to the volatility in losses and, not surprisingly, results in disagreements between actual and modeled losses
- Modeled losses for catastrophic events must be combined with actual losses from non-catastrophic events in order to get a complete view of the risk from severe thunderstorms

Key Summary Points

- Severe thunderstorm events are localized in nature, widespread throughout the U.S., and have produced significant losses
- There are substantial limitations to solely using historical loss data in managing severe thunderstorm risk
- A catastrophe model provides a more reliable view of the risk and can help manage severe thunderstorm risk across multiple functional areas
- AIR's model addresses the catastrophic portion of severe thunderstorm losses