C-19: Recent CATs and Their Effects on CAT Modeling

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- The Casualty Actuarial Society is committed to adhering strictly to the letter and spirit of the antitrust laws. Seminars conducted under the auspices of the CAS are designed solely to provide a forum for the expression of various points of view on topics described in the programs or agendas for such meetings.
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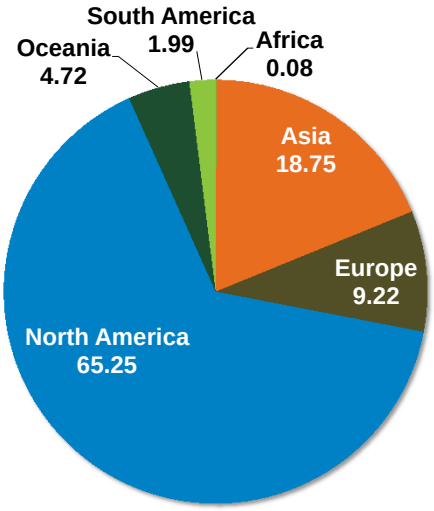
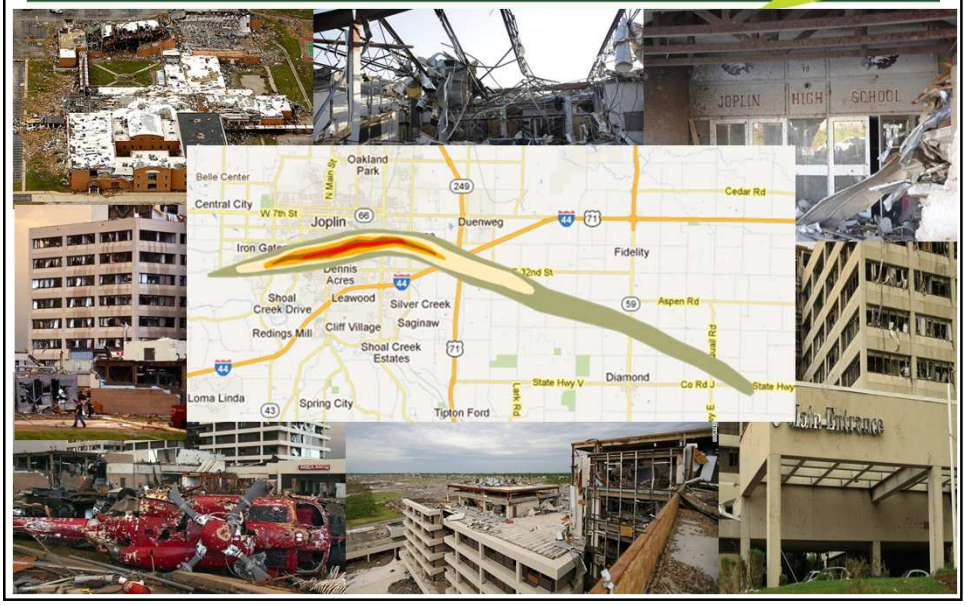
Distribution of Global Insured Losses by Continent from 2000 through 2011



Models Can Be Validated in a Number of Ways

- Validation against market pricing ✗
- Real-time loss validation ✓
- Component-level validation ✓✓
- Industry and company loss validation ✓✓

The 2011 Season Is a Reminder of the Catastrophic Potential of Severe Thunderstorms



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.

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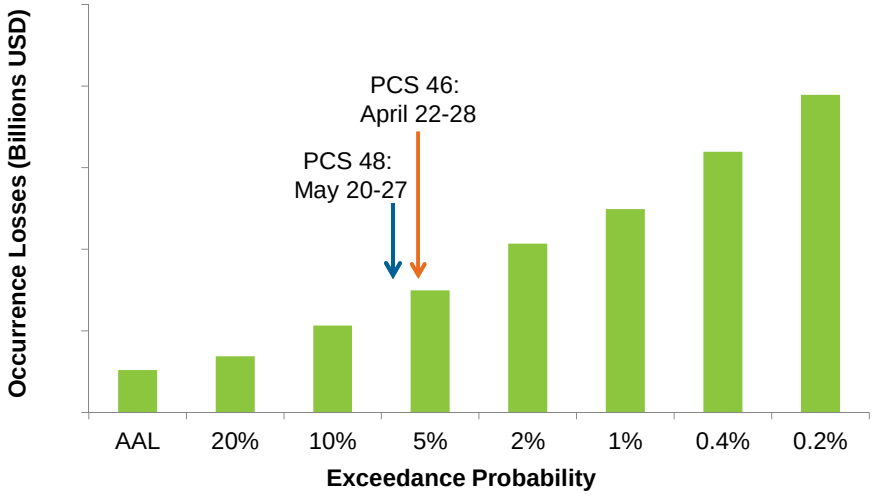
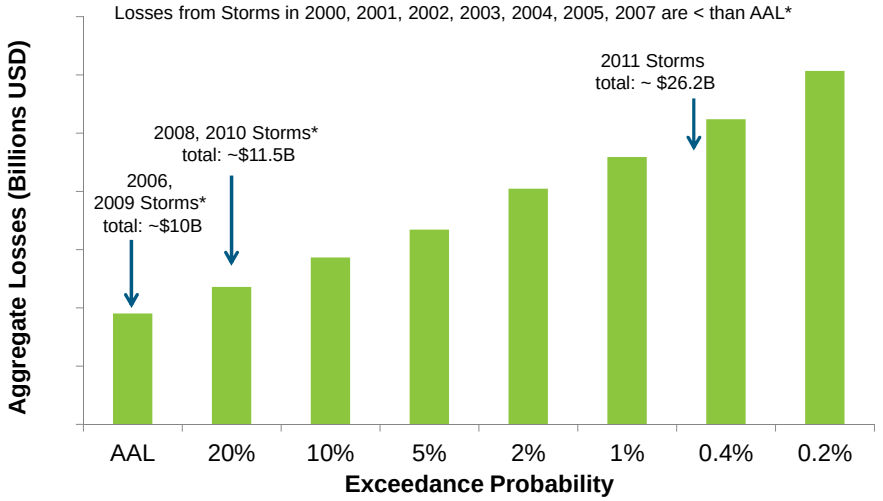
Occurrence Losses from the Major Severe Thunderstorm Events of 2011 Were Not Extreme Outliers



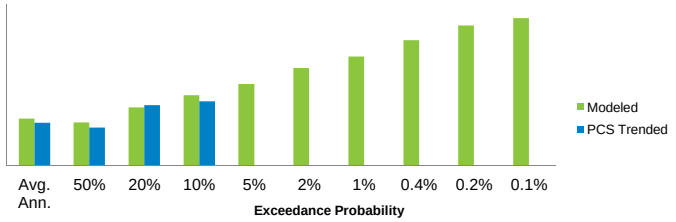
Cumulative Losses from Severe Thunderstorms in 2011 Have an Exceedance Probability of About 0.5%



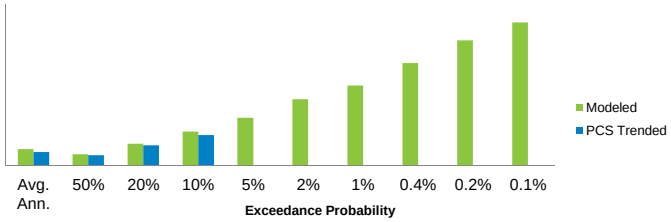
* Trended to Present Dollars

Total Aggregate Losses Validated Against PCS Data

Aggregate Severe Thunderstorm Total Losses (PCS: 1990-2011)

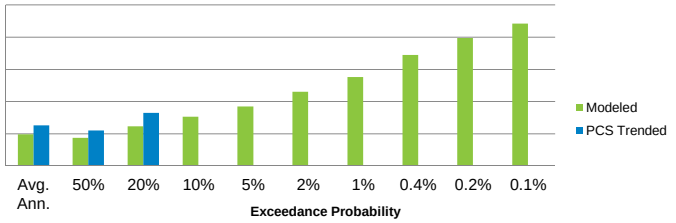


Occurence Severe Thunderstorm Total Losses (PCS: 1990-2011)

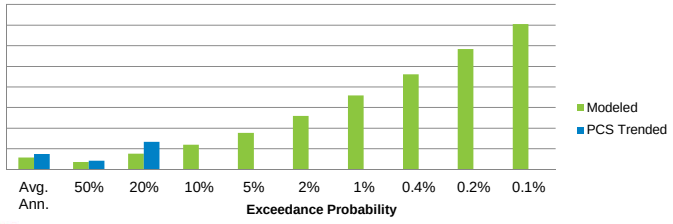


Commercial Losses Validated Against PCS Data

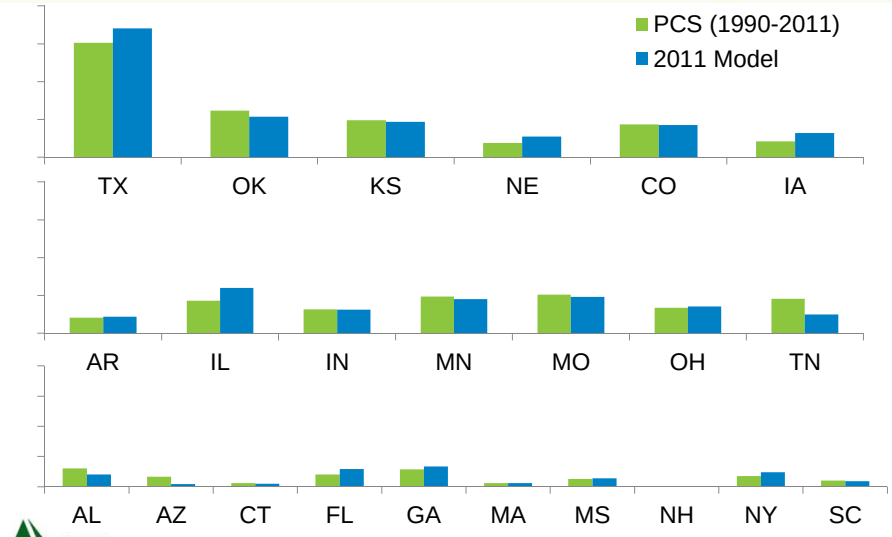
Aggregate Severe Thunderstorm Commercial Losses (PCS: 1998-2011)



Occurence Severe Thunderstorm Commercial Losses (PCS: 1998-2011)



Regional Comparison of Annual Average Losses



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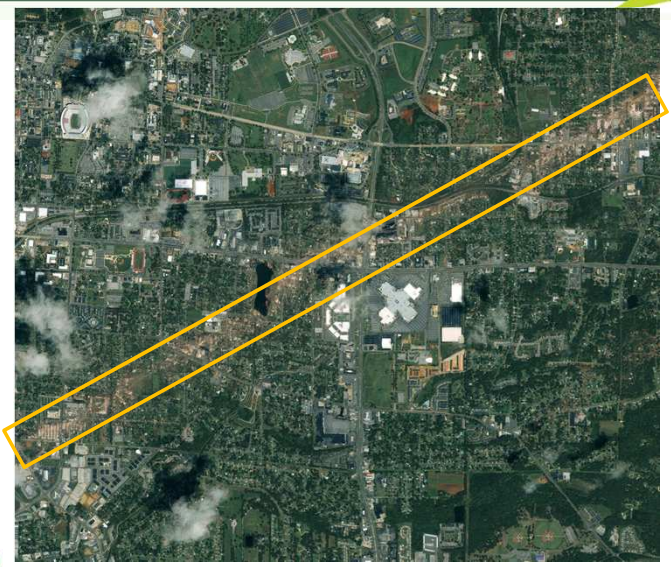
'Micro' Scale of Events Poses a Major Challenge of Modeling Severe Thunderstorm Risk



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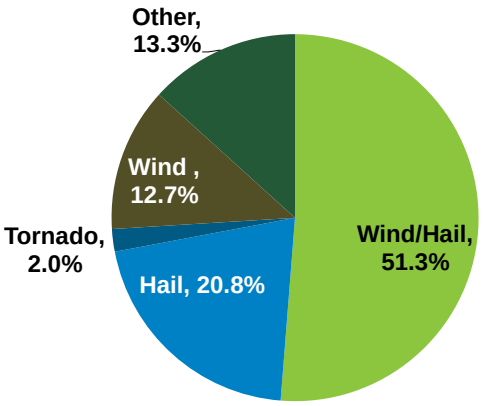
Highlights of the Next Generation AIR Severe Thunderstorm Model

- Updated stochastic catalog with more recent historical data and comprehensive coverage
- Better definition of micro-events
- Updated vulnerability module with secondary risk characteristics and year-built variability
- AIR is in a unique position to analyze detailed claims data for more than 50% of the industry



2011 Severe Thunderstorm Claims by Sub-Peril

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Tohoku Earthquake Highlighted Need for Robust Tsunami Modeling Going Forward

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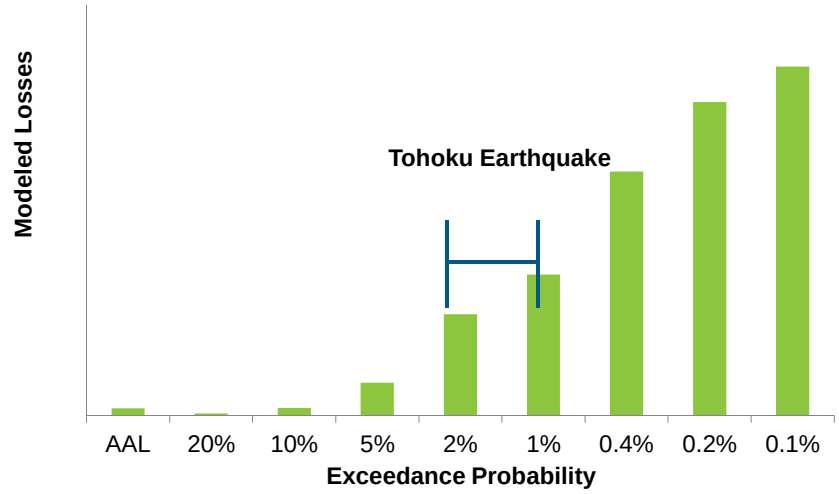
AIR's Loss Estimate with Tsunami is $20 Billion - $30 Billion (1.5-2.5 Trillion JPY)



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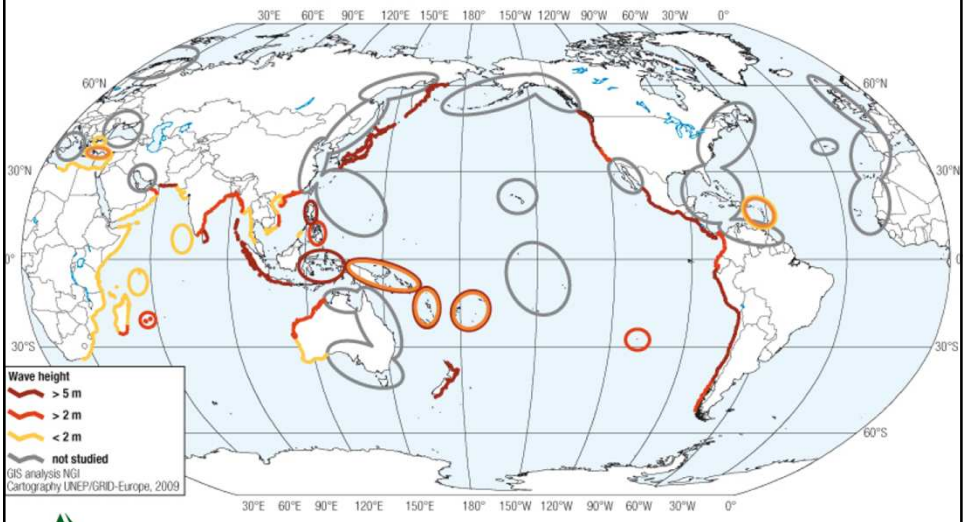
Global Tsunami Hazard Map Shows Risk Is Concentrated Around Ring of Fire



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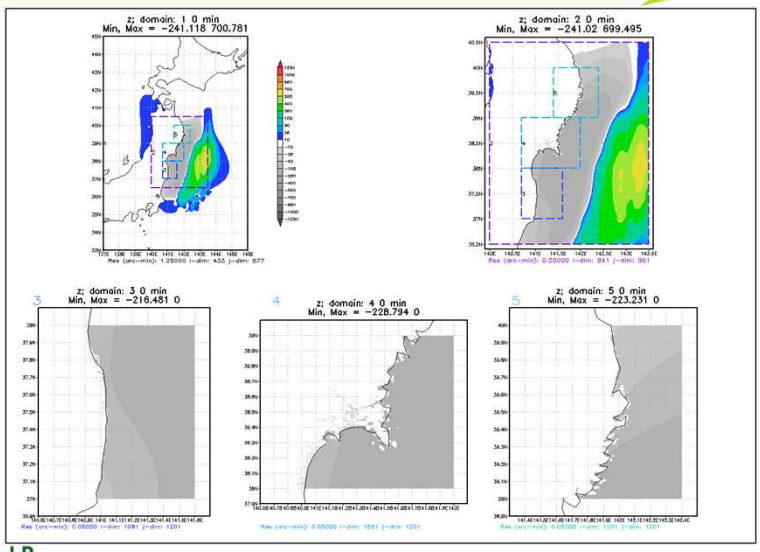
AIR Is Using State-of-the-Art Simulation Models for Probabilistic Tsunami Modeling



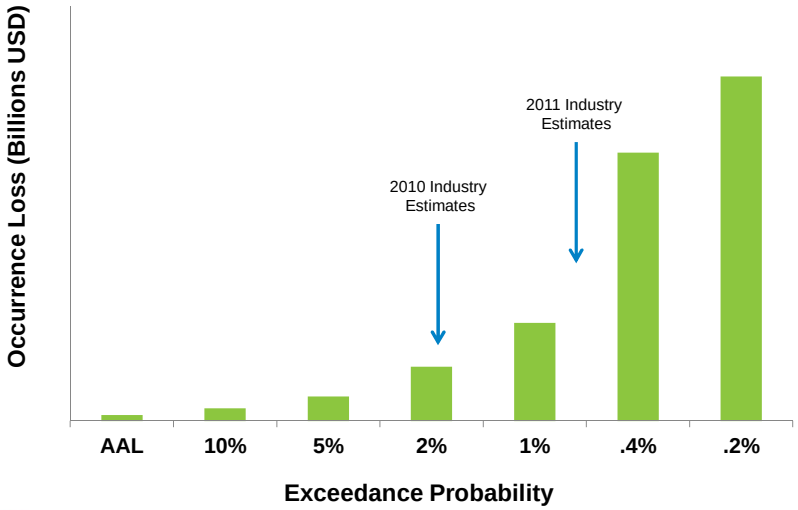
AIR Is Conducting New Research in Fire-Following Earthquake Model

- High resolution (1km x 1km) grid-based modeling, allowing for a more detailed understanding of risk within a region
- Enhanced modeling of building-to-building fire spread accounting for intra-block fire-breaks (such as wide spaces between buildings, or non-combustible buildings) which may limit spread within a block to just a few structures
- Capture fire following risk for complex industrial facilities that are particularly vulnerable to fire following risk (e.g. oil refineries)

Source: EPA/STR

Source: EERI Earthquake Clearinghouse

Industry Loss Levels from the Christchurch Earthquakes Were Contemplated in AIR's Model

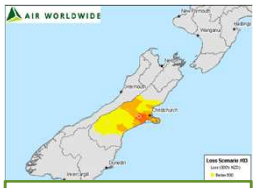


How Easy Is It to Estimate New Zealand AAL from Historical Events?

Model AAL = 561mNZD

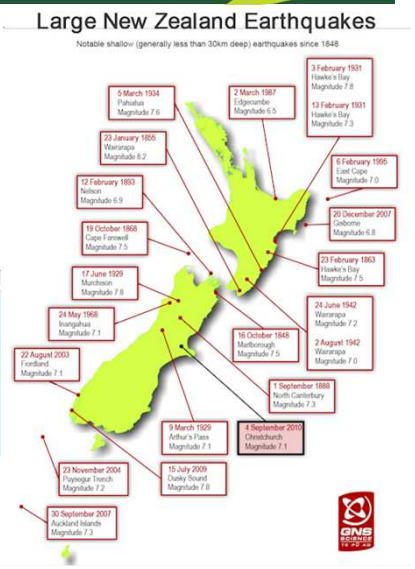
Historical AALs:

- 1900 – 2009: 409mNZD
- 1900 – 2010: 454mNZD
- 1900 – 2011: 545mNZD

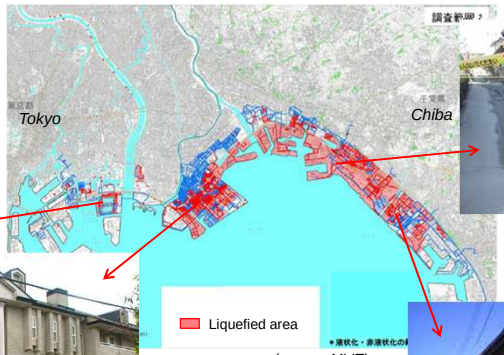


September 2010 earthquake
$2.7B - $6.0B (NZD)

February 2011 earthquake
$5.0B - $11.5B (NZD)



Liquefaction Observed in Tohoku is Consistent with Past History



(source: MLIT)

(photo credit: takezo)

(photo credit: tabi)

(photo credit: yojigen-blog)

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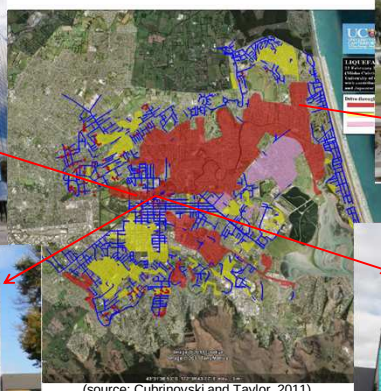
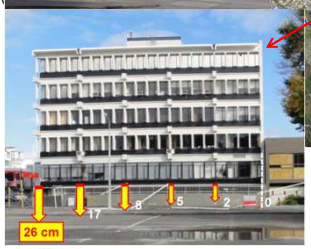
But What Happened in Christchurch is Unprecedented



(source: Cubrinovski and Taylor, 2011)

(Cubrinovski et al. 2011)



(Cubrinovski&McCahon, 2011)

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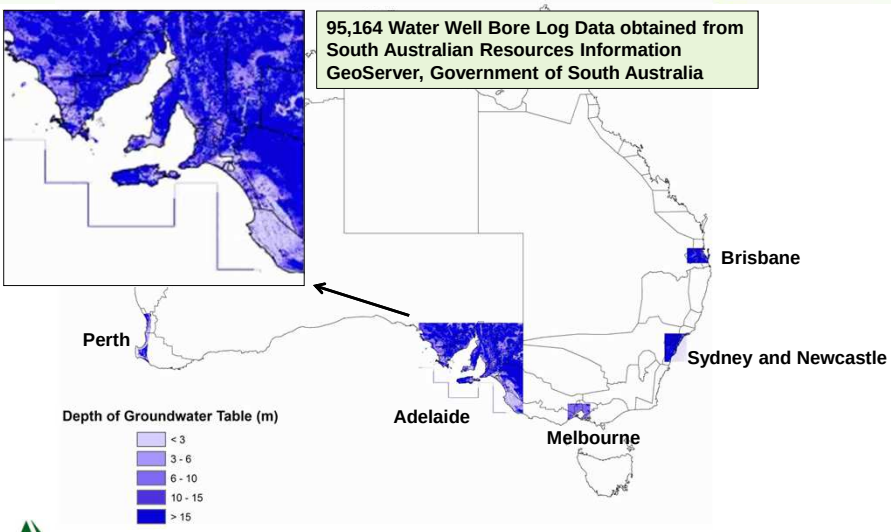
AIR is Explicitly Implementing Liquefaction With All Upcoming Model Updates



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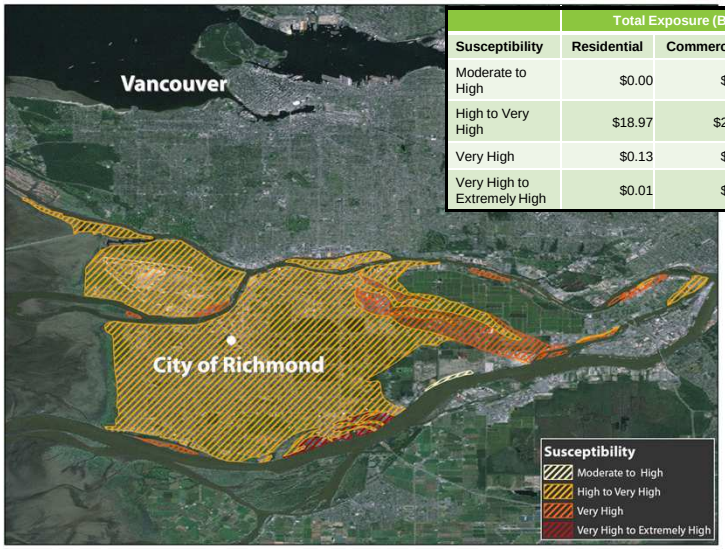
Liquefaction Susceptibility in the Richmond Region of Greater Vancouver, British Columbia, Canada



	Total Exposure (Billions USD)		
Susceptibility	Residential	Commercial	Auto
Moderate to High	$0.00	$0.00	$0.00
High to Very High	$18.97	$23.42	$2.78
Very High	$0.13	$4.51	$0.02
Very High to Extremely High	$0.01	$0.38	$0.00

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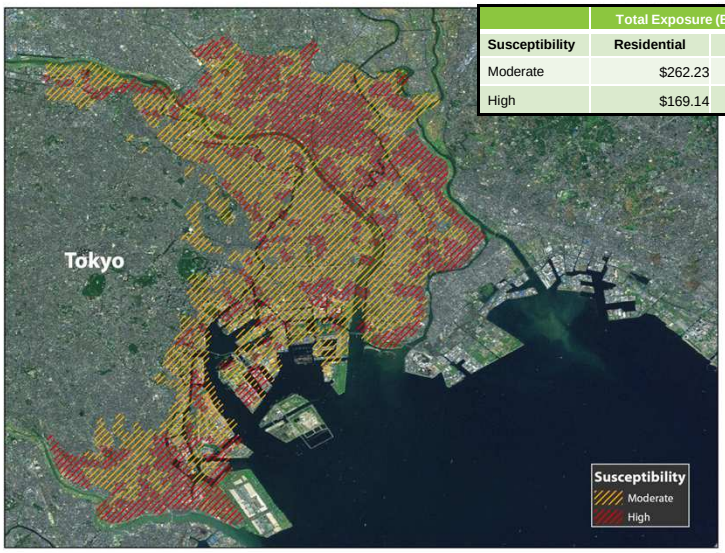
Liquefaction Susceptibility in Tokyo, Japan



	Total Exposure (Billions USD)	
Susceptibility	Residential	Commercial
Moderate	$262.23	$454.35
High	$169.14	$116.67

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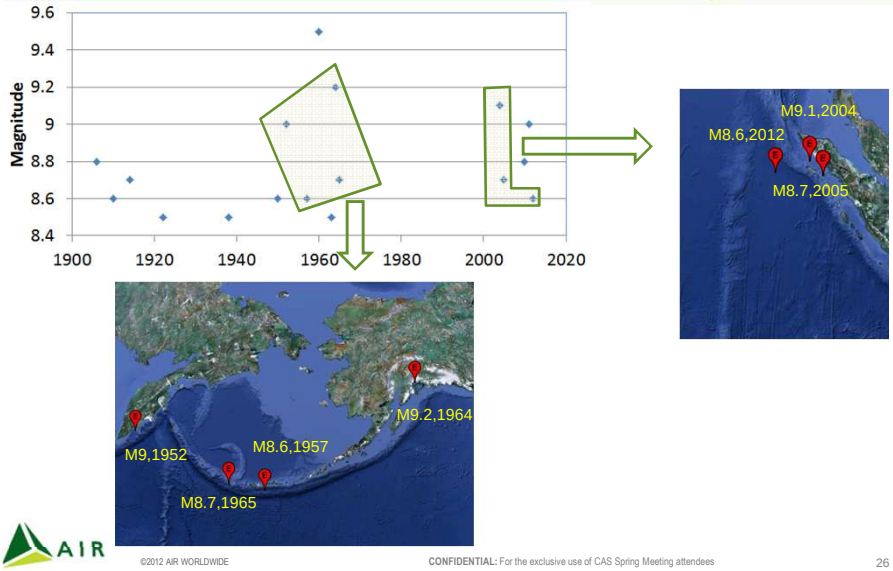
Temporal Distribution of M≥8.5 Earthquakes Since 1900



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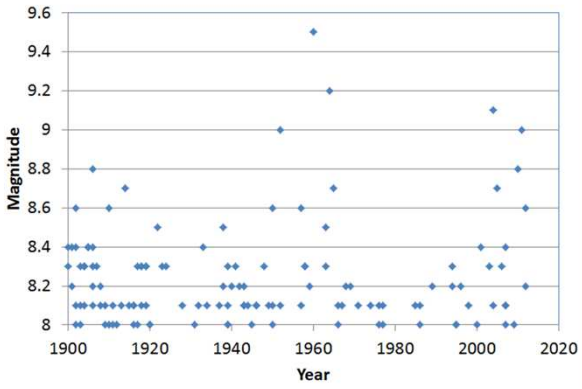
A Stochastic Simulation Yields a 2-in-100,000 Chance of Observing the Historical Pattern, But…



Stochastic Simulation of M8.5 - 9.0 on 20 Subduction zones

- T = 250 – 1000 years
- 10,000,000 years of simulation
- Four constraining time windows pattern
- 2000 random set

Results

- 2 in 100,000 chance to observe the pattern in a century

...Michael (2011) Examined the Data for the Clustering Symptoms Rather than Searching for a Pattern

… None of the tests [Kolmogorov-Smirnov tests] find significant clustering once aftershocks have been removed from the data. Thus, the temporal distribution of large, global earthquakes is well described by a Poisson process plus localized aftershock activity …

Andrew J. Michael, USGS: Geophysical Research Letter 2011

If there is a temporal correlation between large magnitude earthquakes, it needs to be established based on:

- Statistics of data
- Physical models that describe the potential correlation between the occurrences of distant large earthquakes

Implications of Recent Catastrophes on Modeling and Risk Management

- Account for (Un)Known Unknowns () in a deterministic way if not in a probabilistic way
- Account for non-modeled perils
- Improve uncertainty modeling and recognize uncertainty in catastrophe model output
- Exposure data quality must continue to improve

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