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MOODY'S



# Challenges and Opportunities in Managing Catastrophe Risks

## Latest Trends in Natural Catastrophe Modelling

**Dr Laurent Marescot**

Senior Director Markets and Products  
Moody's Risk Management Solutions

[Laurent.Marescot@moodys.com](mailto:Laurent.Marescot@moodys.com)

# The Raise of ~~Secondary~~ Perils

*high-frequency*

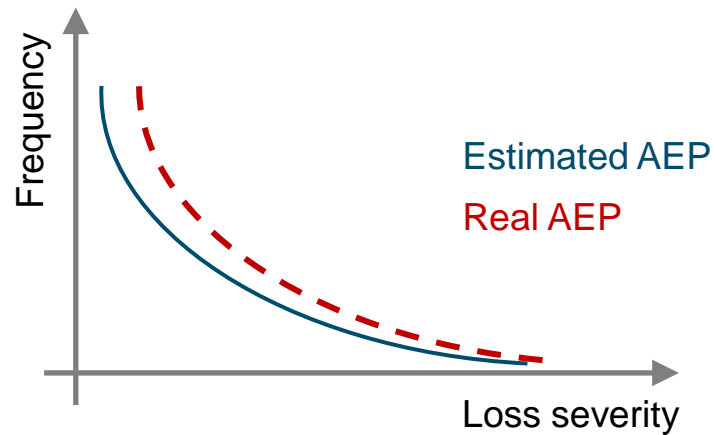


# Natcat Volatility – A Main Driver for Earnings Risk

**Earnings risk:** danger that earnings fall below expectation

Overall re-insurance earning volatility can be seen as **portfolio level**

**1-in-10 AEP / AAL**



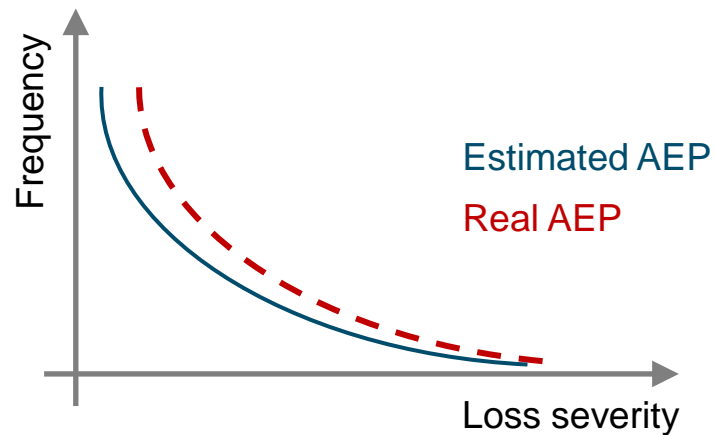
AAL: Average Annual Loss; AEP: Aggregate Exceedance Probability

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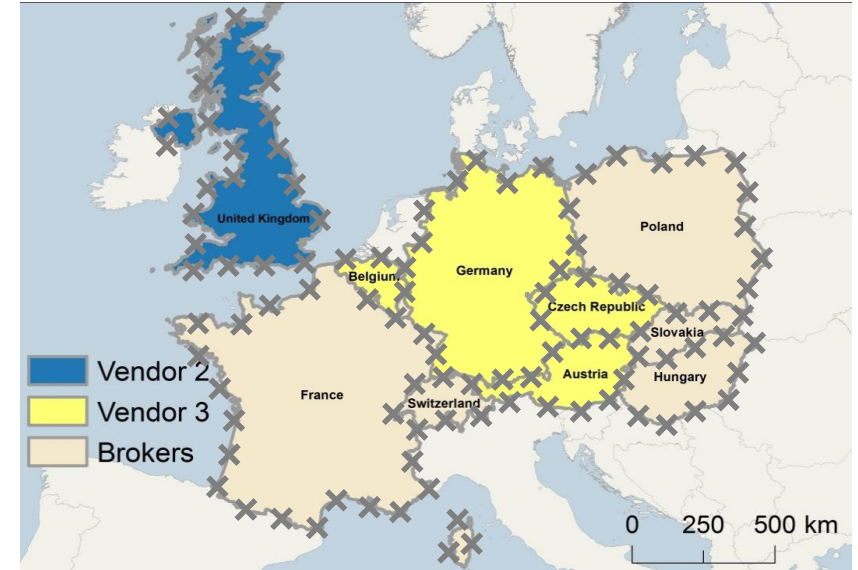
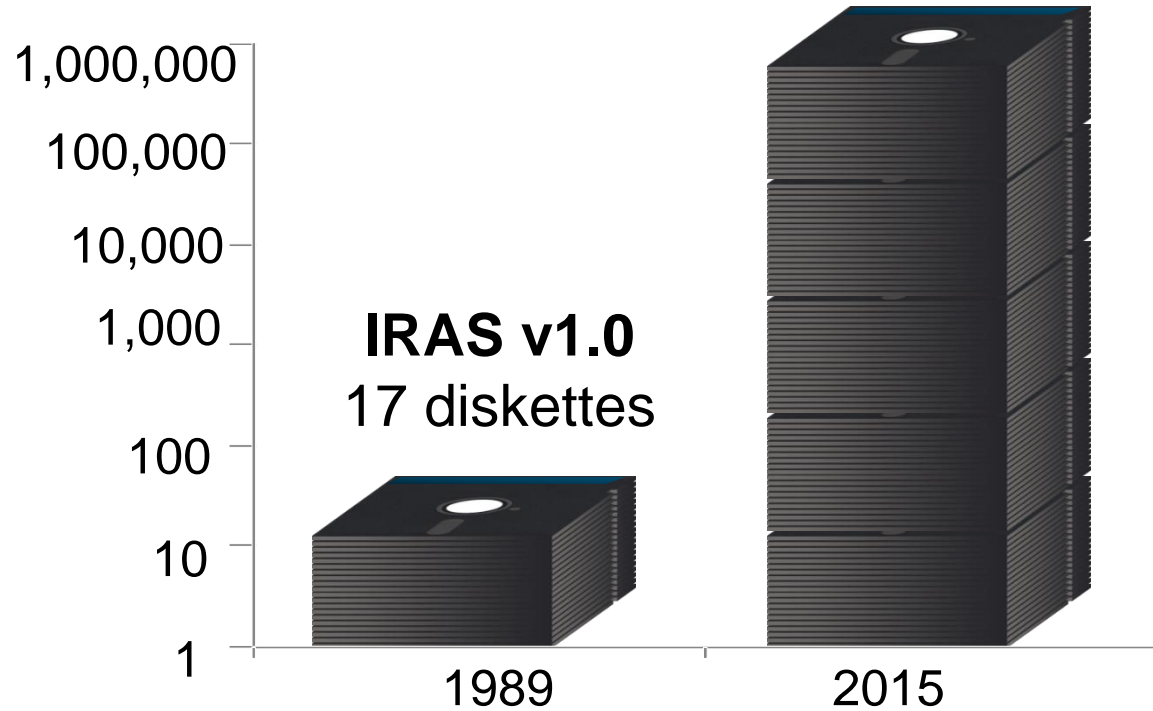
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Earnings risk **under-evaluation** mainly driven by:

- Loss history proved to be incomplete and not sufficient to understand current risk, this is why models are needed!
- **Model issues:**
  - Several peril/regions still **unmodelled**
  - Lack of **realistic physics** of the risk being modelled
  - Lack of cross-country / cross-peril **correlation**
  - Lack of critical model **analytics** and **functionalities**

# The Computing Power Limit in Catastrophe Modelling

**RMS® RiskLink 15**  
600,000+ diskettes



**On-premise flood model (2015)**

**~8'000 stochastic events**

3 countries only, disconnected

Resolution from 50 m to 1 km

# Moving Modelling to the Cloud



## Modelling Inland Flood (2016 - 2023)



### Complete and Consistent

**>900'000 stochastic events**

1 single, pan-continental event set

50,000-year simulation

### High Resolution

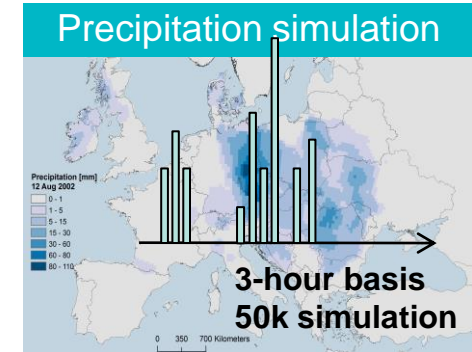
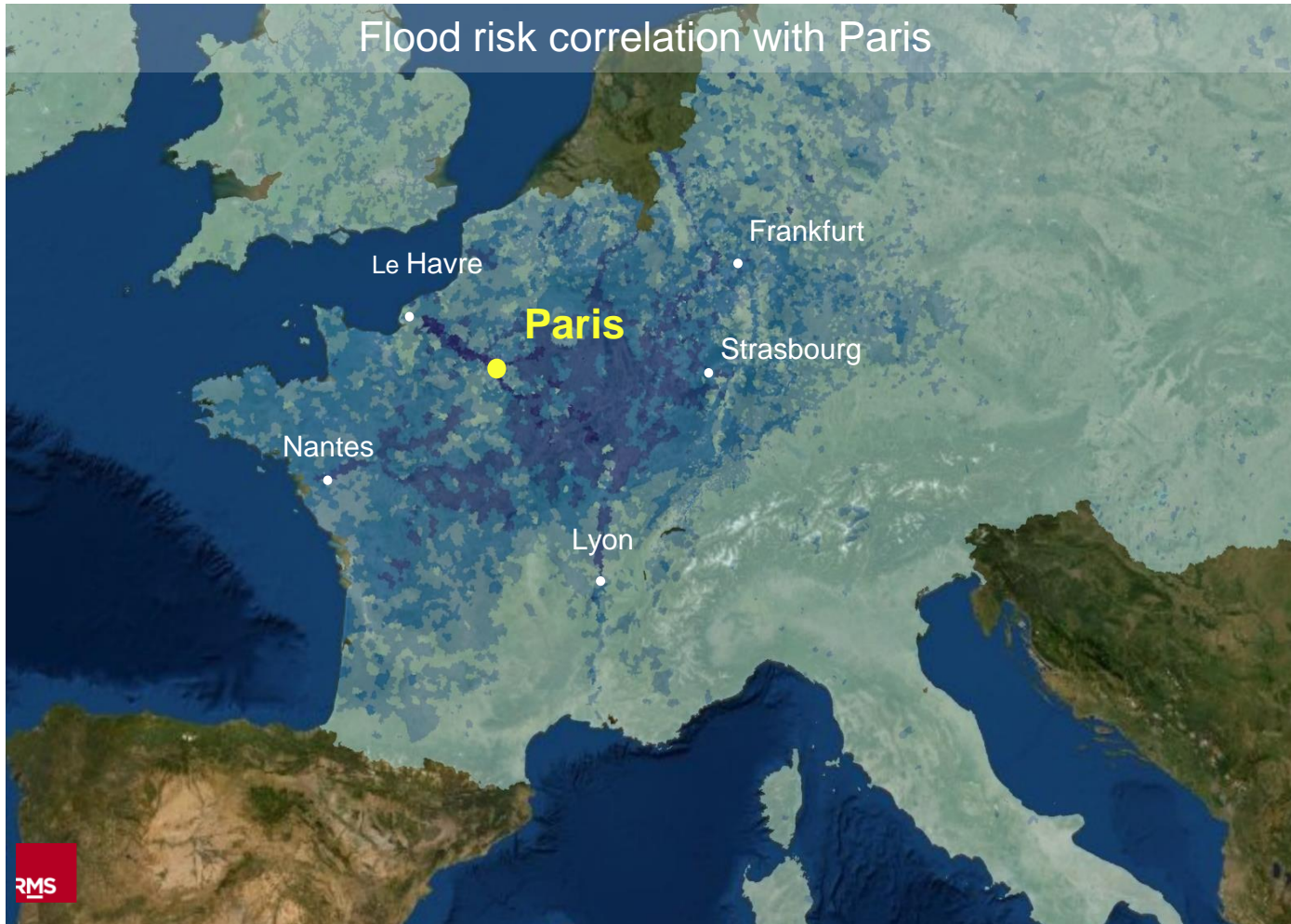
> 1 bn cells

Spatial resolution 40m

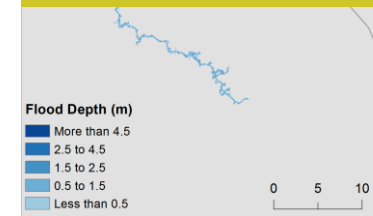
Location level analytics

# Recent Catastrophe Model Advances

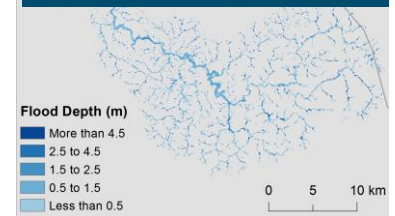
## Capturing the Realistic **Physics** and **Correlation** of the Risk



Fluvial risk modelling



Pluvial risk modelling



Defense modelling



Inundation modelling



# Recent Catastrophe Model Advances

## Enabling New Key **Analytics**

**> 40%**

of claims in Europe happen outside the main floodplains

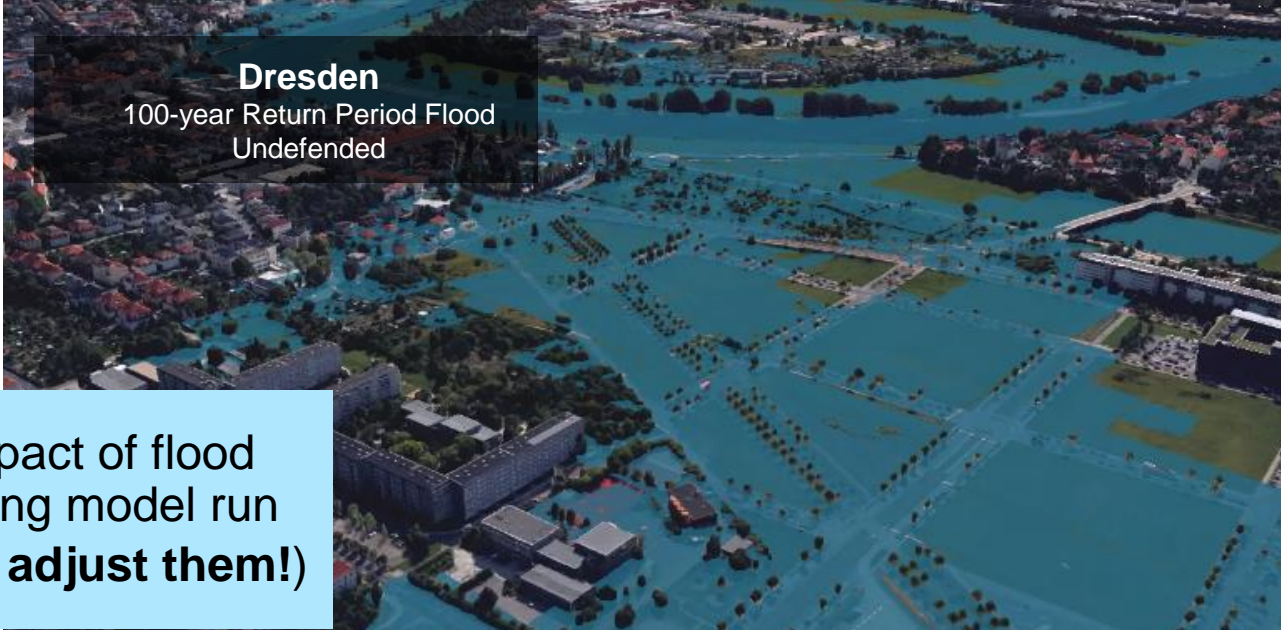
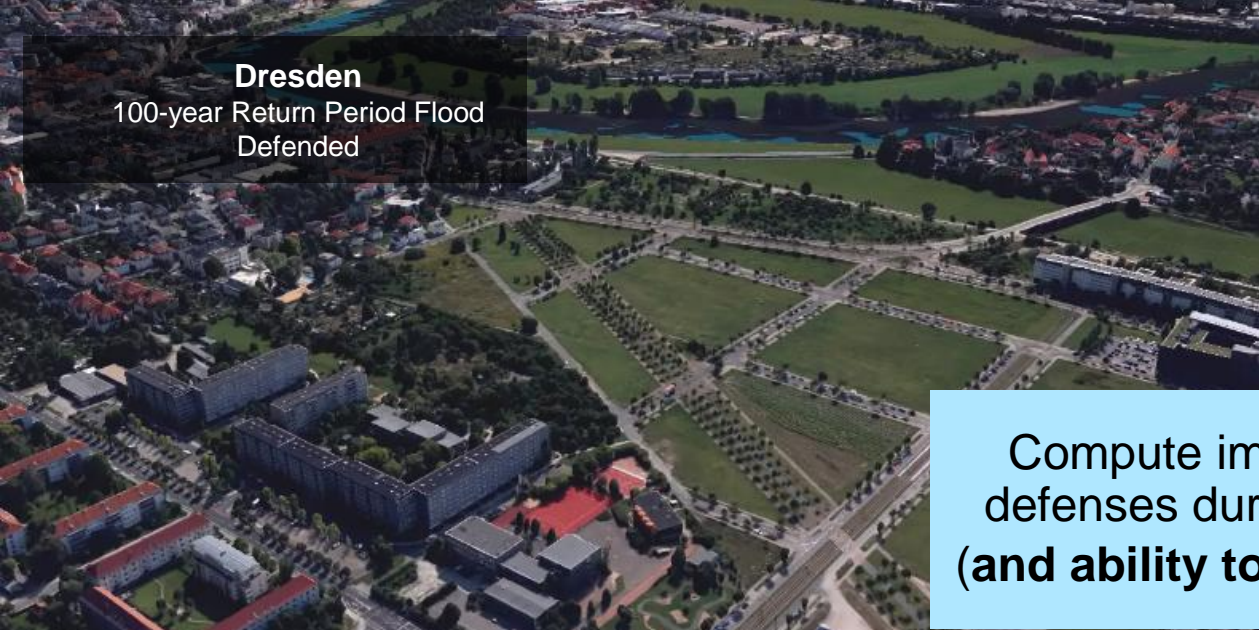
### Isolating fluvial /pluvial components An example from a French insurer

Commune / IRIS Zone	Combined	Fluvial	Pluvial	Pluvial Contribution	AEP (200 yr)
	AAL	AAL	AAL		AAL
	GR Loss	GR Loss	GR Loss		
A	15,695	15,321	373	2%	792,661
B	7,366	6,946	419	6%	236,837
C	12,805	12,152	653	5%	762,186
D	8,259	7,862	398	5%	451,320
E	12,436	-	12,436	100%	536,034
F	31,475	20,952	10,523	33%	694,811
G	851	166	684	80%	18,775
H	12,003	-	12,003	100%	794,901
I	17,280	14,936	2,345	14%	744,843
J	42,252	42,229	23	0%	1,358,599
K	5,011	1,559	3,452	69%	215,978
L	29,323	29,040	283	1%	942,848
M	28,921	14,997	13,924	48%	638,423
N	6,234	3,000	3,234	52%	412,819
O	3,519	2,874	645	18%	210,719

AAL: Average Annual Loss; AEP: Aggregate Exceedance Probability

# Recent Catastrophe Model Advances

Ability to Create **Own Views of Risk**



Compute impact of flood defenses during model run (and ability to adjust them!)

# Recent Catastrophe Model Advances

## Better Representing **Uncertainty** and **Extreme** Events

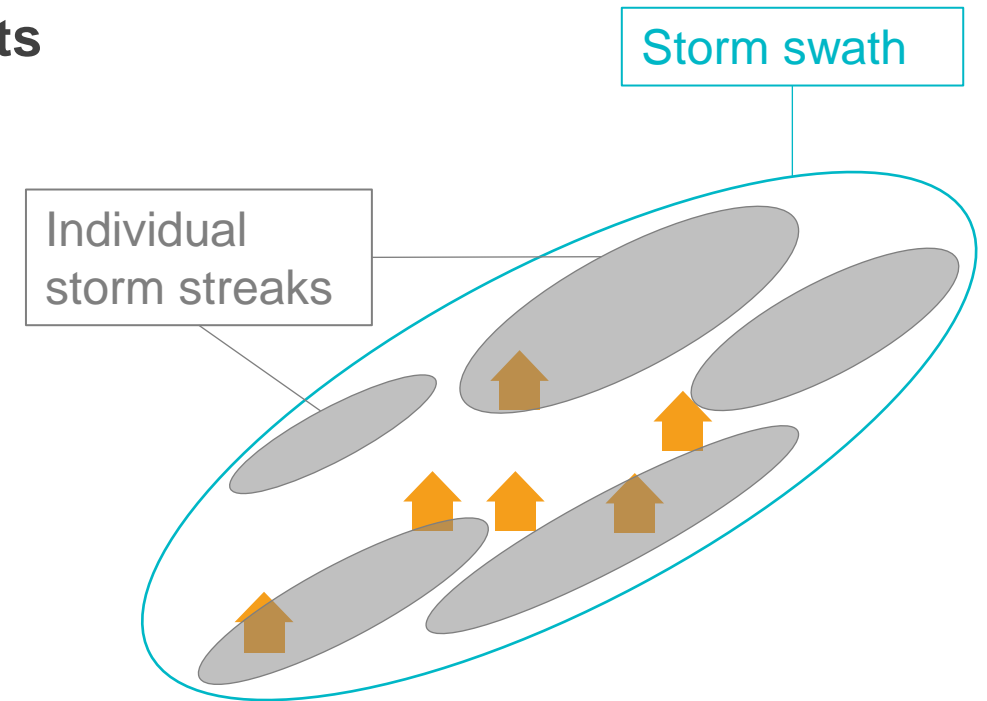
Hail



Straight-line Wind



Tornado



## Severe Convective Storm Europe

**8 millions** stochastic events

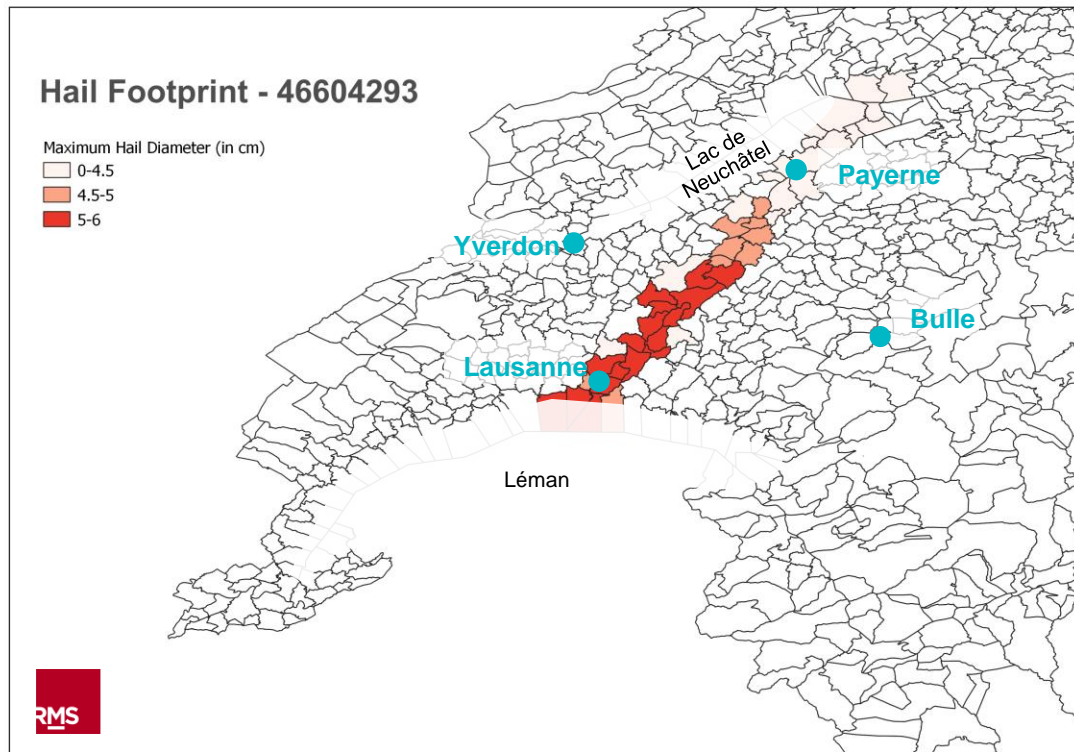
1 single pan-continental event set

50,000-year simulation

# Recent Catastrophe Model Advances

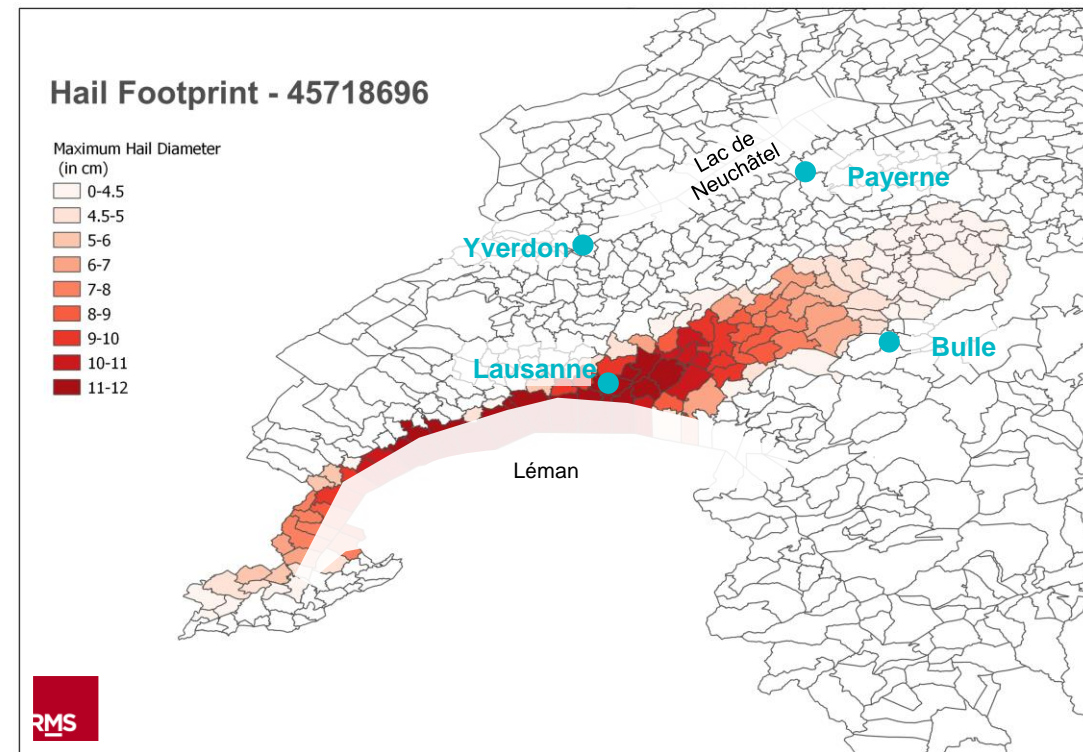
## Examples for the Lausanne Region

### Hail max 6 cm (Lausanne Region\*)



Claim Value ECA Vaud (CHF)	Return Period Loss ECA Vaud (years)	Number of Claims	Average Claim (CHF)
<b>140 million</b> (85% over Lausanne*)	60	37,000	3,700

### Hail max 12 cm (Lausanne Region\*)



Claim Value ECA Vaud (CHF)	Return Period Loss ECA Vaud (years)	Number of Claims	Average Claim (CHF)
<b>3,400 million</b> (54% over Lausanne*)	25,000	76,200	44,600

# Recent Catastrophe Model Advances

Ability to Model the Complex Hazard Factors Influencing Losses

## North America Wildfire

**93 millions** stochastic events  
50,000-year simulation  
Spatial resolution 50m



Heat Intensity

Wind-Borne Embers

Slope

Smoke

Distance to Flammable Vegetation

Rate of Fire Spread

Fuel Type

# Recent Catastrophe Model Advances

Ability to Model the Complex Vulnerability Factors Influencing Losses

(well... didn't burn)



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Wildfire Primary Modifiers
Occupancy
Construction
Number of Stories
Year Built
Floor Areas



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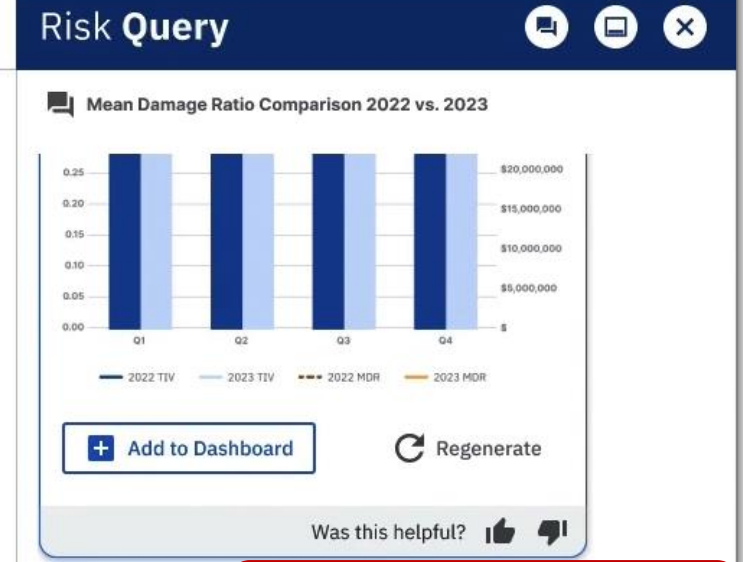
  

Wildfire Secondary Modifiers
Roof System Covering
Roof Shape
Roof Age / Condition
Roof Vents
Ember Accumulators
Suppression
Sprinkler Presence
<b>And others...</b>





# Generative AI New Ways of Working with Models



MK "Which region is driving the increase in Flood mean damage ratio in Q3 2023?"

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Portfolios and flood modeled results were broken down by the four regions and the Q3 portions were compared between the enforced portfolio vs. 2022 portfolio.

Europe region experienced an increase in flood total insured value but also experienced higher flood modeled losses, resulting in higher mean damage ratio, in comparison to Q3 2022.

Was this helpful?

Compare the flood mean damage ratio by region for Quarter 3 Year 2022 and Quarter 3 Year 2023 with a bar plot

Compare the flood mean damage ratio by Line of Business for Quarter 3 Year 2022 and Quarter 3 Year 2023 with a bar plot

Other suggestions

<https://www.rms.com/risklabs>

# Final Thoughts...

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**New technologies** and **recent CAT modelling advances** help...

## Addressing challenges

- ▶ Natcat volatility, earnings risk
- ▶ Complexity around «secondary perils»

## Delivering new insights

- ▶ More comprehensive and realistic views of risk
- ▶ New analytics to better understand complex risks
- ▶ New tools to improve risk management workflows

## Unlocking new opportunities

- ▶ Grow the industry, profitably
- ▶ Maintain industry's relevance for society

Where a center of excellence like ECCE could help

**Risk Modeling and Assessment**, incl. independent benchmarking on extreme events

**Cross-Disciplinary Research**: climate science, engineering, economics, and risk management

**Policy Recommendations**: risk mitigation strategies and regulations

**Resilience Studies**: infrastructure improvements, early warning systems, incentivization

**Educational Programs**, across a broad range of stakeholders

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**Thank you**