Cat Modelling – Real World vs. Model World

Prepared for • Club APREF, Paris

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Agenda

1. Background of PERILS

2. PERILS Data and their Application

3. Industry-Loss-Based Risk Transfer

4. Eight Thoughts about Cat Modelling

5. Discussion

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Background of PERILS

PERILS

PERILS - Data Collector & Reporting Agency

PERILS AG, Marktgasse 3,
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▶ PERILS is an independent data collector providing **industry-wide catastrophe insurance data**

▶ PERILS was incorporated in January 2009 in Zurich, Switzerland, on the initiative of the **CRO Forum**

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The Motivation to Set-Up PERILS
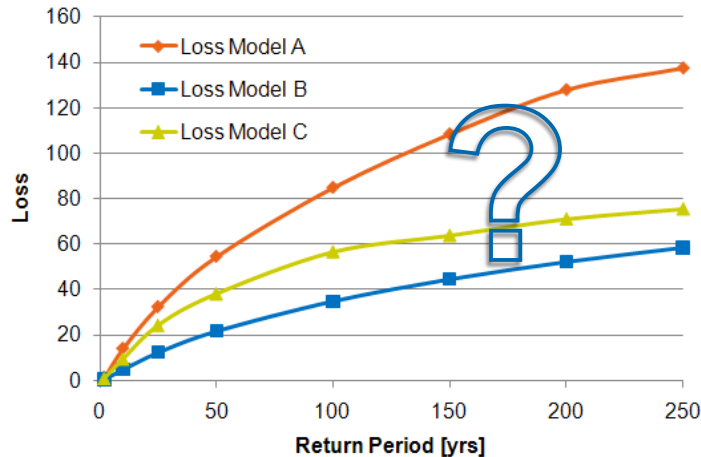
Improve Cat risk assessment

▶ Transparent and consistent insurance data needed to validate and improve risk assessment
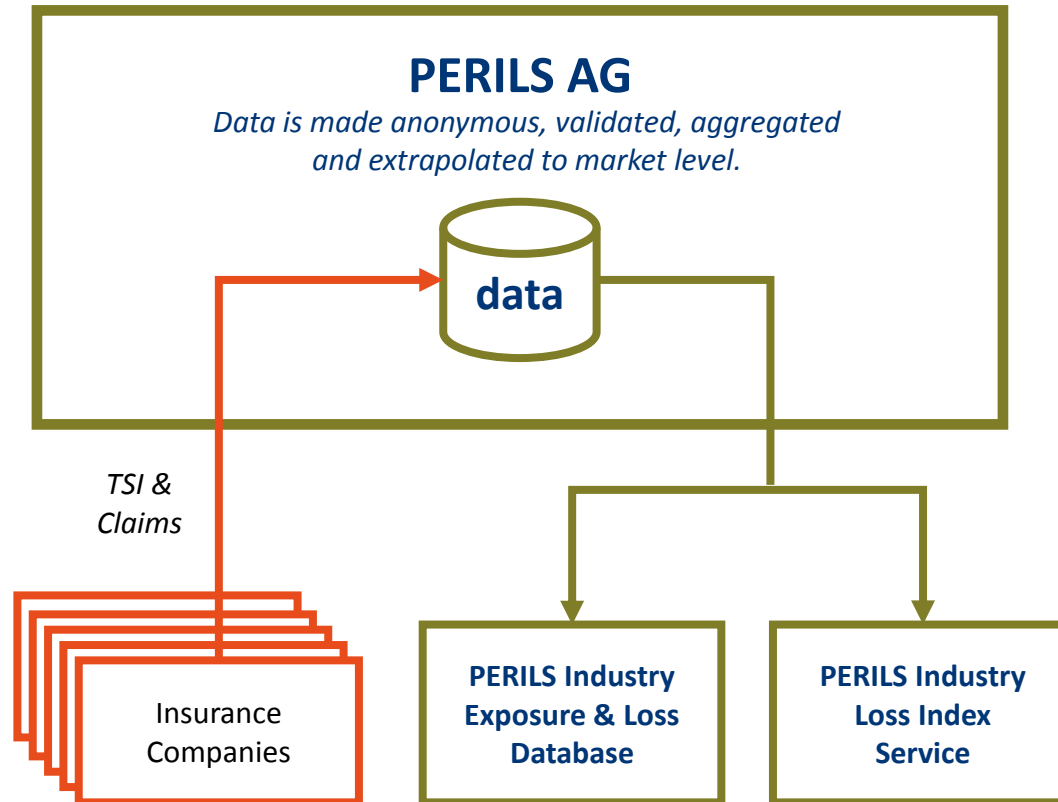
Industry Loss Warranty Re/Insurance

Collateralized Re/Insurance

Insurance-Linked Securities

Facilitate industry-loss-based risk transfer

▶ Independent and specialized reporting agency required

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Independent Data Aggregator & Reporting Agency

PERILS AG

Data is made anonymous, validated, aggregated and extrapolated to market level.

data

TSI & Claims

Insurance Companies

PERILS Industry Exposure & Loss Database

PERILS Industry Loss Index Service

PERILS is an independent reporting agency providing industry-wide catastrophe insurance data. PERILS was incorporated in January 2009 in Zurich, Switzerland, on the initiative of the CRO Forum. Founding members include Allianz SE, AXA, Assicurazioni Generali, Groupama, Guy Carpenter, Munich Re, Partner Re, Swiss Re, and Zurich Insurance Group. PERILS' purpose is to add transparency to the natural catastrophe risk landscape thereby increasing the liquidity and stability of the Nat Cat insurance market. For more info, please visit WWW.PERILS.ORG.

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Broad Industry Support

**Market Penetration
(% market property premium)**

	40 - 50%	50 - 60%	> 60%
Mar 2009	■		
Mar 2011		■	
Mar 2013			around 60%

► PERILS was initiated by the CRO Forum and has gained broad support by the industry

► More than 100 national insurance companies supporting PERILS with data*

► Current market coverage leads to stable extrapolation calculation

► Target is to exceed 60% market penetration

*: Due to applicable competition and antitrust laws and regulation and pursuant to contractual agreements with the data providing companies, PERILS cannot make public the identity of the insurance companies providing data or any other information that might lead to the disclosure of the identity of such companies such as the total coverage by market of such companies

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PERILS Data and their Application

Industry Exposure & Loss Database

Exposure (TSI) per CRESTA and Property LOB

Aggregate Exposure Data - Earthquake Italy - in EUR										
	Agricultural and Industrial are included in COMMERCIAL					Total Sum Insured per Coverage			Insurance Conditions	
Peril	Country	CRESTA ID	Occupancy Type	Currency	Number of Risks	Buildings Value	Contents Value	BI Value	Loss Limits	Deductibles
EQXX	ITA	ITA.14	COMMERCIAL	EUR	1,281	1,726,616,165	1,227,862,768	105,964,912	1,491,545,274	22,894,478
EQXX	ITA	ITA.14	RESIDENTIAL	EUR	1,173	463,492,663	45,887,695	53,603	273,520,472	37,683,299
EQXX	ITA	ITA.15	COMMERCIAL	EUR	2,387	4,962,314,081	3,189,505,515	469,031,530	3,037,570,542	30,691,820
EQXX	ITA	ITA.15	RESIDENTIAL	EUR	2,158	1,586,889,110	171,535,635	417,727	839,726,116	71,553,352

▶ Total Sums Insured, Building, Contents, BI, No of Risks, Loss Limits, Deductibles

▶ Per CRESTA Zones

▶ Per Property Line of Business

Event Loss per CRESTA and Property LOB, Intensity Data, Mean Damage Ratios

M5.9 Earthquake Emilia-Romagna (Italy) 20 May 2012 - in EUR - Final Estimate											
						Loss Amounts	Instrumental Intensity INGV		Mean Damage Ratios (Loss in % TSI)		
Peril	Country	CRESTA ID	Occupancy Type	Currency	Number of Losses	All Loss	Minimum	Maximum	All MDR (%)	Affected Risks (%)	Avg Loss
EQXX	ITA	ITA.42	COMMERCIAL	EUR	113	9,689,001	2.53	5.32	0.062422%	2.879512%	85,743
EQXX	ITA	ITA.42	RESIDENTIAL	EUR	38	3,759,461	2.53	5.32	0.130660%	1.312108%	98,933
EQXX	ITA	ITA.43	COMMERCIAL	EUR	14	1,657,134	2.44	4.26	0.012551%	0.467299%	118,367

▶ Event loss data, Building, Contents, BI, No of Losses, Physical Intensity Data, Mean Damage Ratios (Loss in % of TSI), % Affected Policies , Average Loss

▶ Per CRESTA Zones

▶ Per Property Line of Business

Windstorm:

Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom

Flood:
Italy, United Kingdom

Earthquake:
Italy

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Market Benchmarking – Measure your Portfolio

TSI Market Shares

Loss Market Shares

Assurances Hypothétiques SA

Market Shares Commercial Property

	Sums Insured	Loss Event A	Loss Event B	Loss Event C
FRA.31	4.5%	6.0%	7.2%	5.9%
FRA.32	2.9%	2.9%	3.0%	2.2%
FRA.33	6.0%	5.5%	6.1%	6.1%
...	...	...	...	...
FRA.64	**14.0%**	**22.5%**	**24.0%**	**18.8%**
FRA.65	5.4%	5.2%	5.3%	5.4%
FRA.66	3.0%	3.0%	2.5%	3.5%

► TSI and Loss market shares in both maps are with identical colour coding

► Some zones have clearly lower / higher loss market shares than TSI market shares

► Why?
   ► Superior or inferior risks than market average?
   ► Claims adjustment?
   ► Claims fraud?

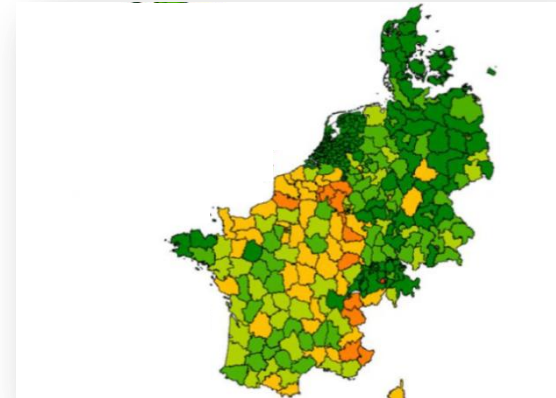► PERILS Market Data are being used to identify weak and strong spots of a portfolio

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Increased Data Availability for Better Risk Assessment

PERILS Data –
**Event Loss per CRESTA and Property LoB**
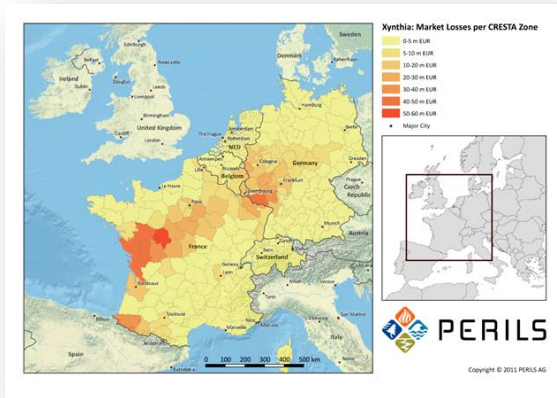
Modelled Loss Footprint
(illustrative)

vs.

► PERILS Data are being used for model validation: Real World vs. Model World

► Increased data availability leads to more realistic and robust risk assessment

► Current PERILS DB subscribers include insurers, reinsurers, brokers, modellers, and insurance-linked investment funds
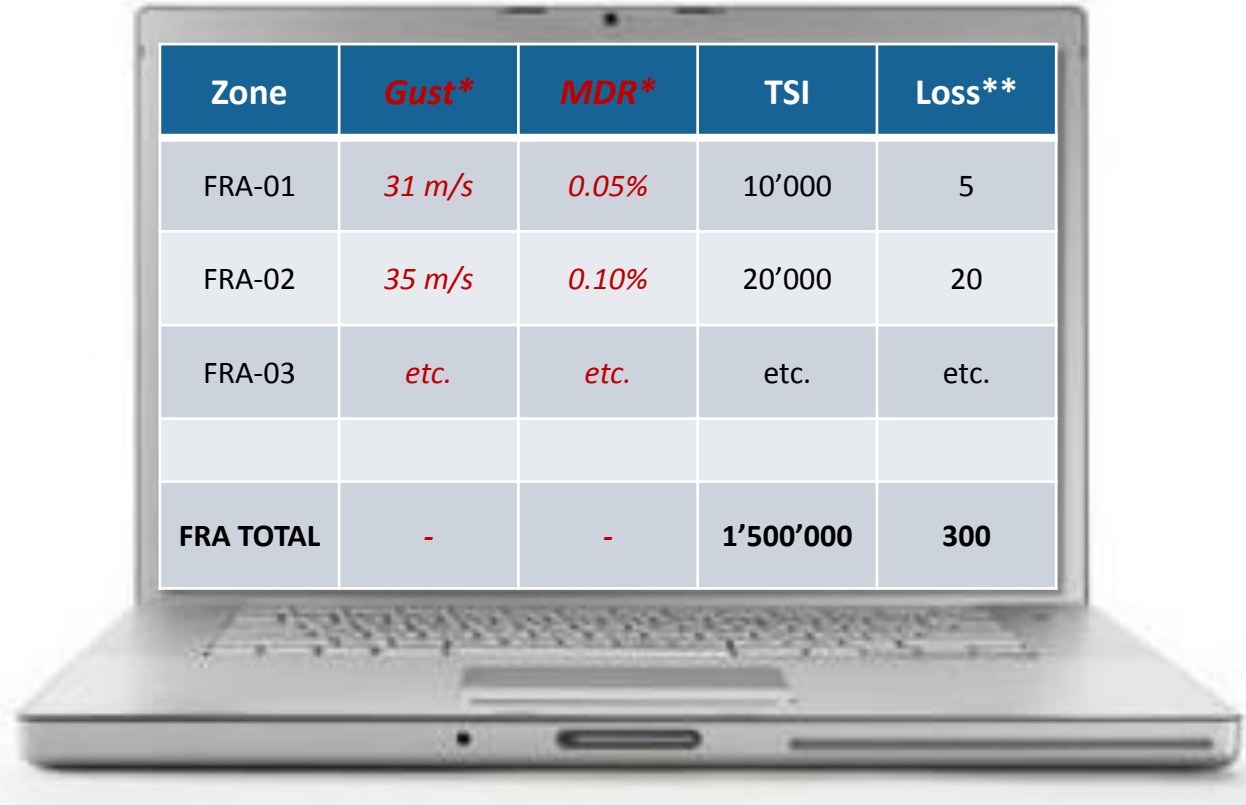
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Vulnerability – The "Dark Heart" of Cat Models

FRA - RESIDENTIAL

Loss in % TSI vs Gust Speed [m/s]

Legend: ◆ Xynthia ■ ▲ ✕
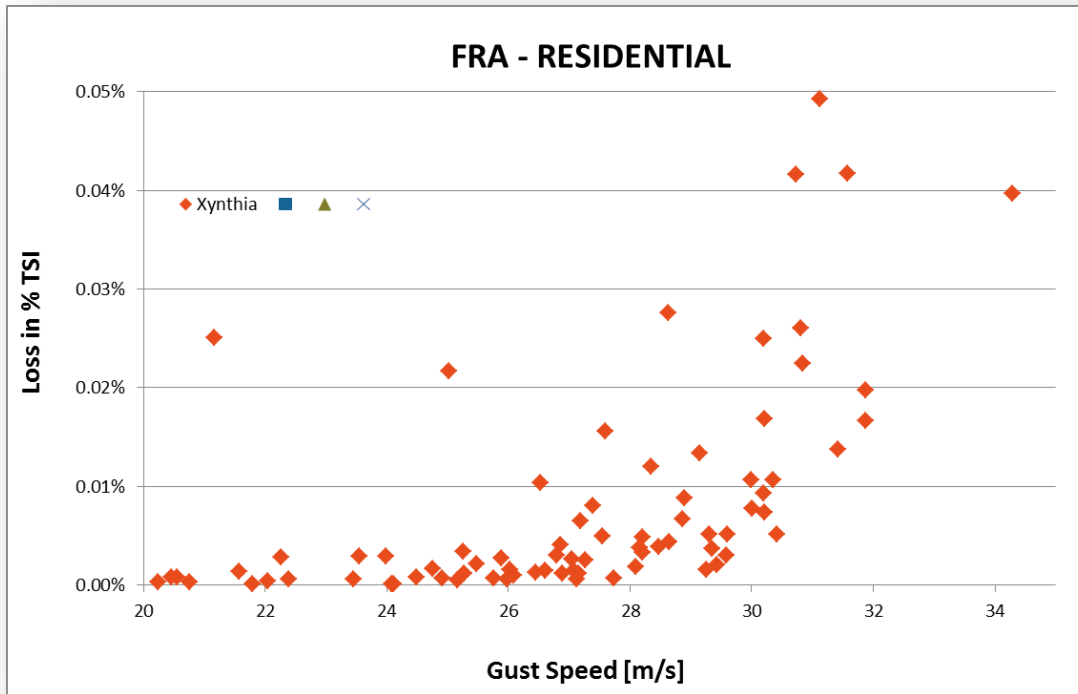
► **Vulnerability functions are a critical component of any Cat model**

► **Big variations in model results are evidence of a lack of adequate data to calibrate vulnerability**

► **PERILS provides this data and helps to make Cat models more realistic and robust**

Mean Damage Ratios vs. Gust Speed.

Windstorm Xynthia.

France Residential Property.

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PERILS Data Application – Scenario Loss Calculation

Zone	Gust*	MDR*	TSI	Loss**
FRA-01	31 m/s	0.05%	10'000	5
FRA-02	35 m/s	0.10%	20'000	20
FRA-03	etc.	etc.	etc.	etc.
FRA TOTAL	-	-	1'500'000	300

* from PERILS DB   ** calculated

▶ PERILS data enable own scenario loss model based on
  ▶ PERILS-derived vulnerability data
  ▶ PERILS gust speeds

▶ Rapid event loss estimation

▶ Own and vendor-model-independent view

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Industry-Loss-Based Risk Transfer

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Structured Industry Loss Triggers to Reduce Basis Risk

Country weights
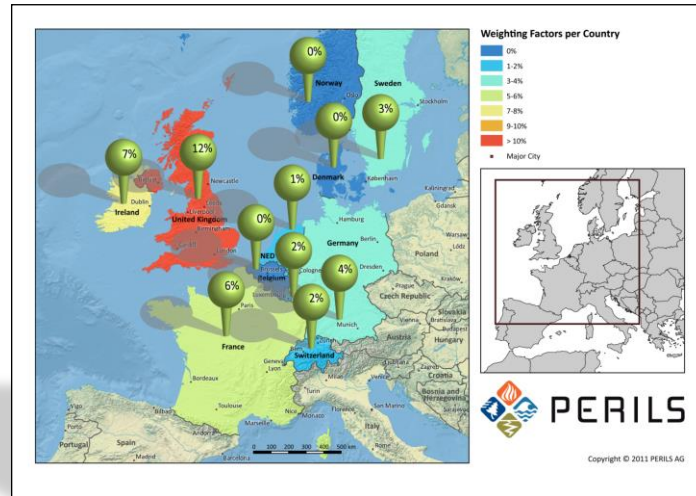
CRESTA, LoB weights
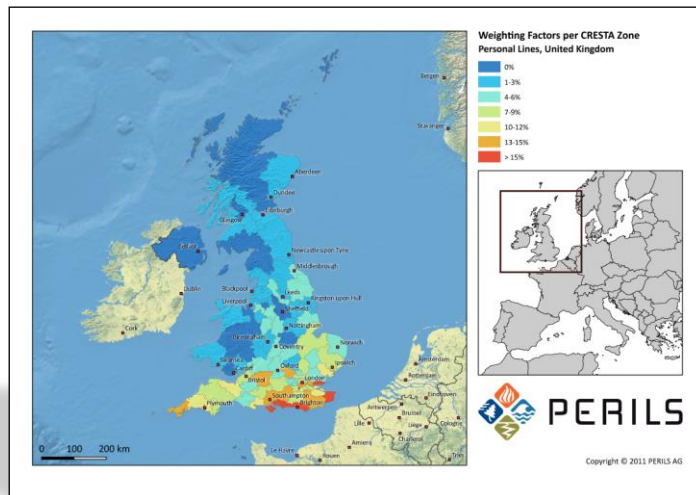

► PERILS industry loss data are being used as objective and independent triggers in industry-loss-based risk transfer
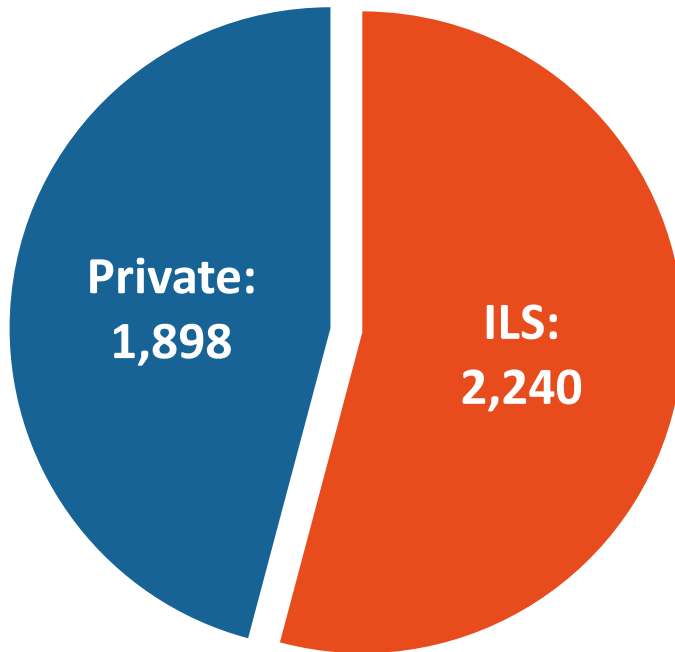
► Breakdown into country and CRESTA losses

► Custom-made triggers (weightings per country, CRESTA, or LoB) to reduce basis risk

Additional Liquidity through PERILS Industry Data

USD 4'138 M

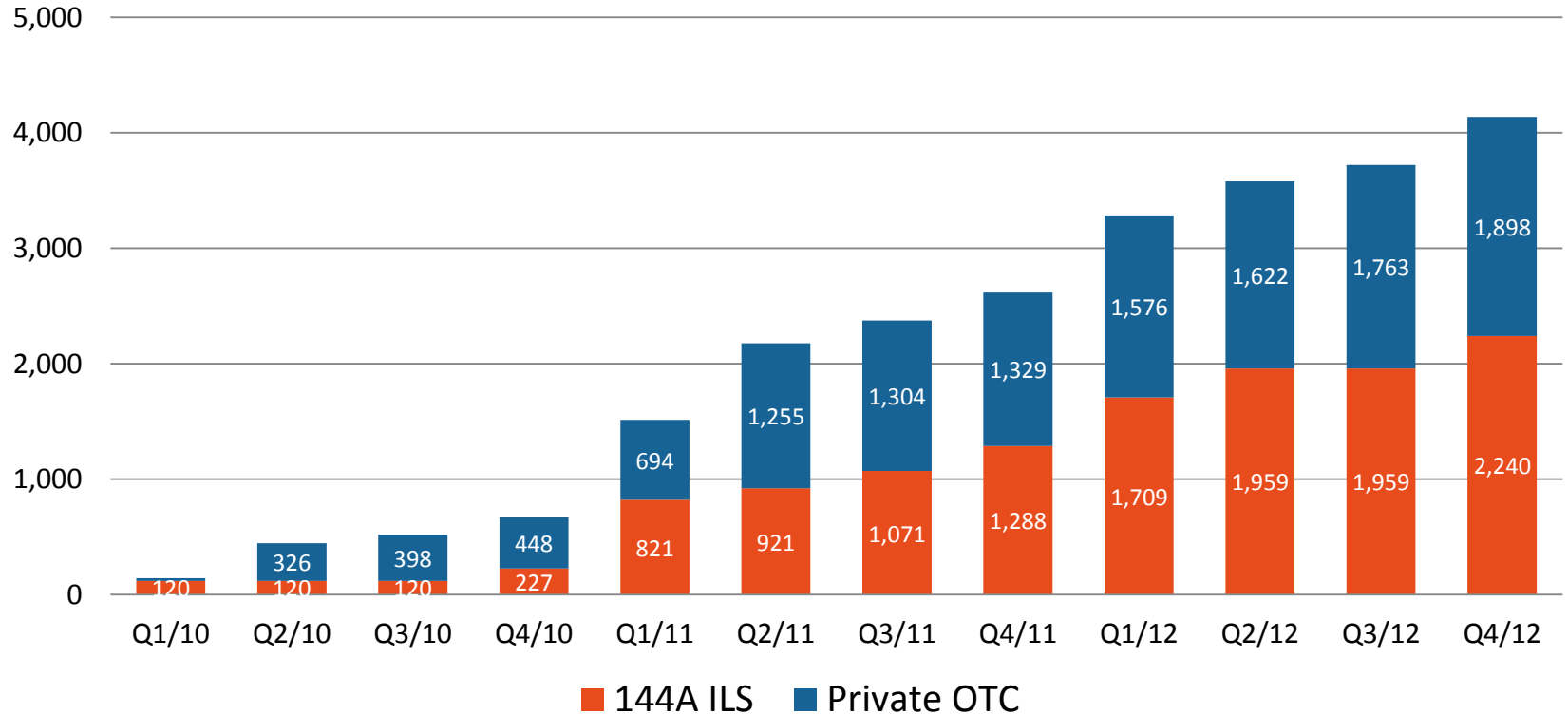**PERILS-based limits at risk as at 31 Dec 12**

Private: 1,898

ILS: 2,240

PERILS data facilitate additional liquidity in the Nat Cat Market

► PERILS industry loss data are used as triggers in industry-loss-based risk-transfer

 ► 144A ILS (Cat Bonds)

 ► ILW (Industry Loss Warranty)

 ► Collateralized R/I

 ► Risk Swaps

► USD 4.1 bn of PERILS-triggered limits at risk as at 31 Dec 2012

► More than 100 PERILS-based transactions placed since 1 Jan 2010

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PERILS-based EU Windstorm Capacity – Strong Growth

PERILS-based EU Windstorm Capacity, USD Mio

Chart data (USD Mio):

Quarter	144A ILS	Private OTC
Q1/10	120	
Q2/10	120	326
Q3/10	120	398
Q4/10	227	448
Q1/11	821	694
Q2/11	921	1,255
Q3/11	1,071	1,304
Q4/11	1,288	1,329
Q1/12	1,709	1,576
Q2/12	1,959	1,622
Q3/12	1,959	1,763
Q4/12	2,240	1,898

Legend: ■ 144A ILS ■ Private OTC

PERILS data facilitate additional liquidity in the Nat Cat Market

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Eight Thoughts about Cat Modelling

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# Thought 1: Models are never right (= are always wrong)

Model A

Model B

Model C

► Recent examples: Tohoku EQ, NZL EQ, Katrina, etc.

► When you use models as absolute benchmarks, you risk to be awfully wrong

   ► More critical in risk management than in pricing

► Suggestion: use models as "consistently wrong" relative benchmarks, e.g.

   ► to make y-o-y comparison of portfolio developments

   ► to select relatively better priced layers

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# Thought 2: There is a bias towards the cheapest model

Share Calculation Agents, % nat cat deals issued
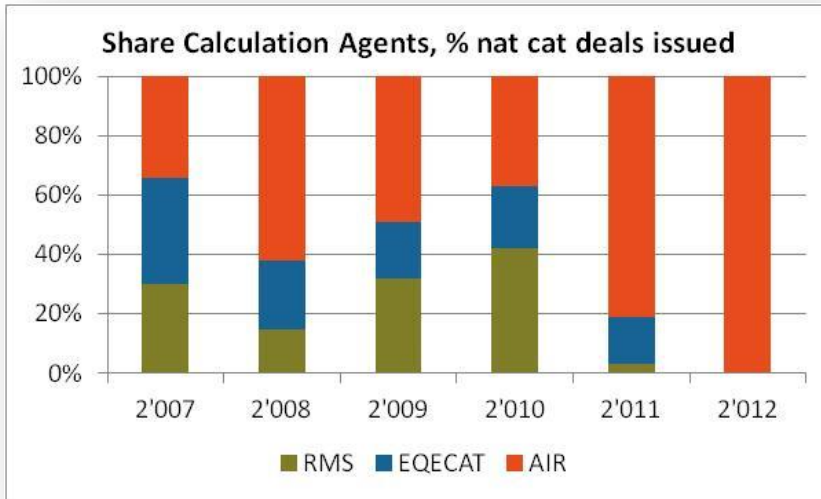
% of issued 144A ILS deals.

Can you find the average height of Americans based on a sample of NBA players?

► If model updates result in a more conservative risk assessment (higher RoL, higher PML) the reaction is **loud and generally negative**

► If model updates result in a more optimistic risk assessment (lower RoL, lower PML) the general market reaction is **silence**

Thought 3: On the EP-curve, it's the X-axis which counts
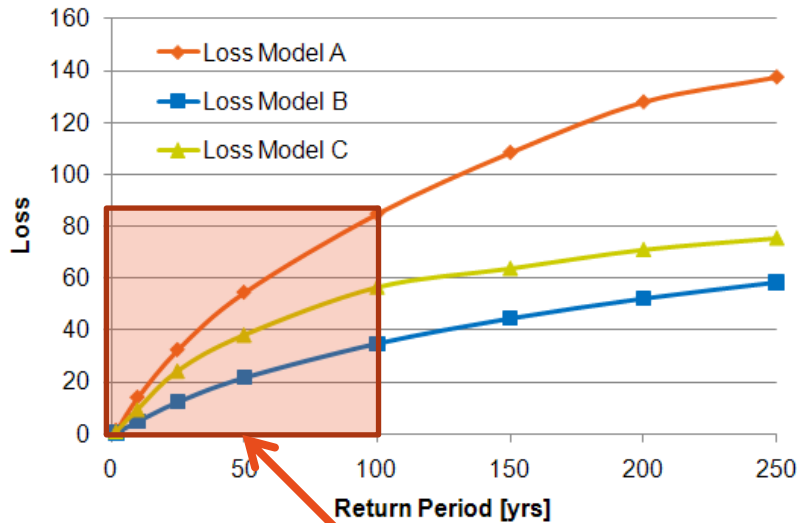
This is where the pricing action happens !

Example Loss "20":
Model B = 2% expected loss on line
Model A = 10% expected loss on line

► For pricing purposes, EP curves beyond say the 100-year level have limited use

► So why show them in model comparisons?

► The pricing action happens at much higher frequencies

► It's the difference on the x-axis which counts

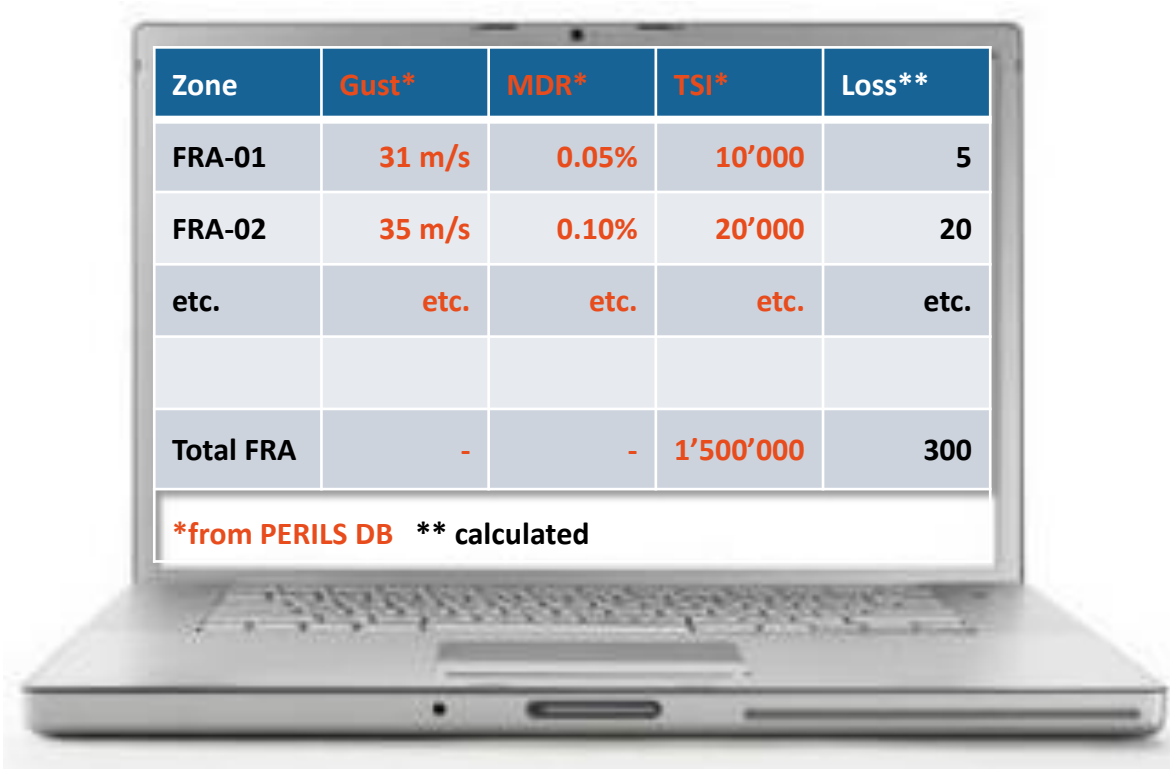# Thought 4: Big events usually have unmodelled surprises

► All mega-events had their "unknown unknowns"

  ► 9/11

  ► Katrina (flooding)

  ► Christchurch EQs (soil liquefaction)

  ► Tohoku EQ (seismology, tsunami)

  ► Thai Floods (extent, industrial parks, interconnections)

► Advisable to keep this in mind when making risk management decisions based on models (for pricing maybe less critical)

► Black swans are astonishingly frequent in Cat insurance

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Thought 5: There are no un-exposed layers
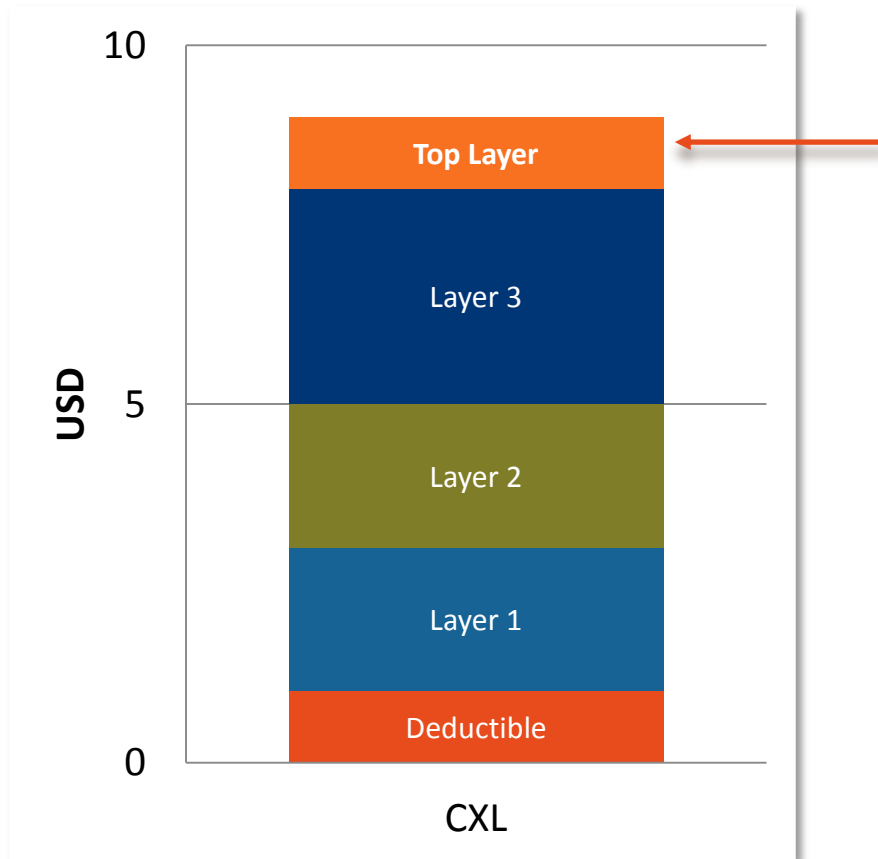
► Règle d'or: there are no un-exposed layers, whatever the model says

   ► or why would a cedant buy it?

► The cedant usually knows more about its own portfolio than the model does

Thought 6: Build your own model

Zone	Gust*	MDR*	TSI*	Loss**
FRA-01	31 m/s	0.05%	10'000	5
FRA-02	35 m/s	0.10%	20'000	20
etc.	etc.	etc.	etc.	etc.
Total FRA	-	-	1'500'000	300

*from PERILS DB ** calculated

► Start with a deterministic model (scenario loss model)

► Build-up own and vendor-model-independent view

  ► **Increases understanding of Cat models**

  ► **Emancipates you from vendors**

  ► **Makes you a competent vendor model user**

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Thought 7: Don't forget the actuary

As-if Losses
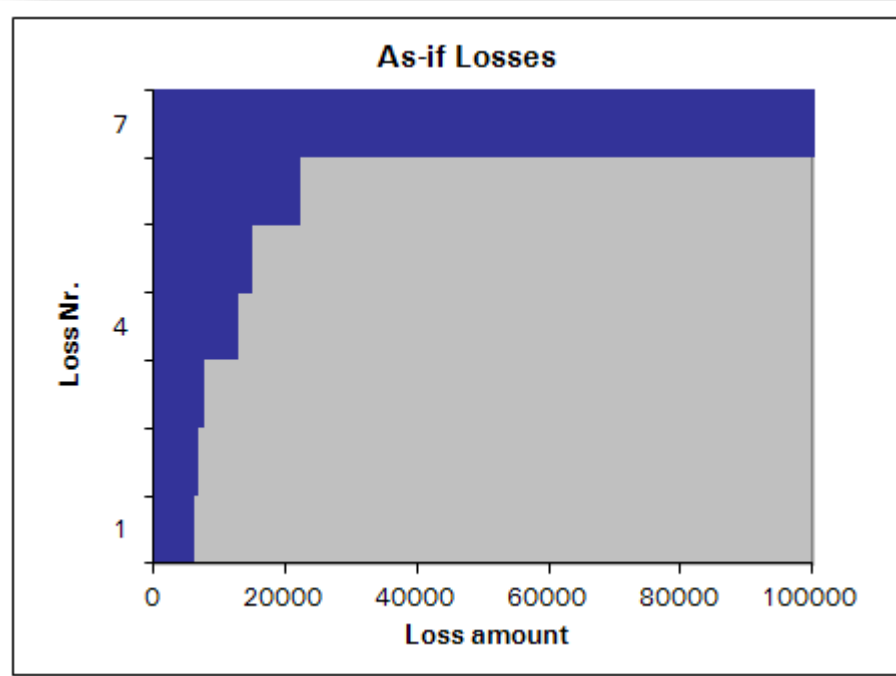
- ► There are not only probabilistic Cat models to assess Cat risk

- ► A 20-year loss history brings you a long way for the high-frequency part of the risk assessment

- ► Actuarial methods such as burning cost and as-if-today indexed loss fitting (e.g. Pareto) give alternative views

- ► Advisable to use both, probabilistic Cat models and actual loss history

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Thought 8: Cat models are good for You !

Cat model IS GOOD FOR YOU.
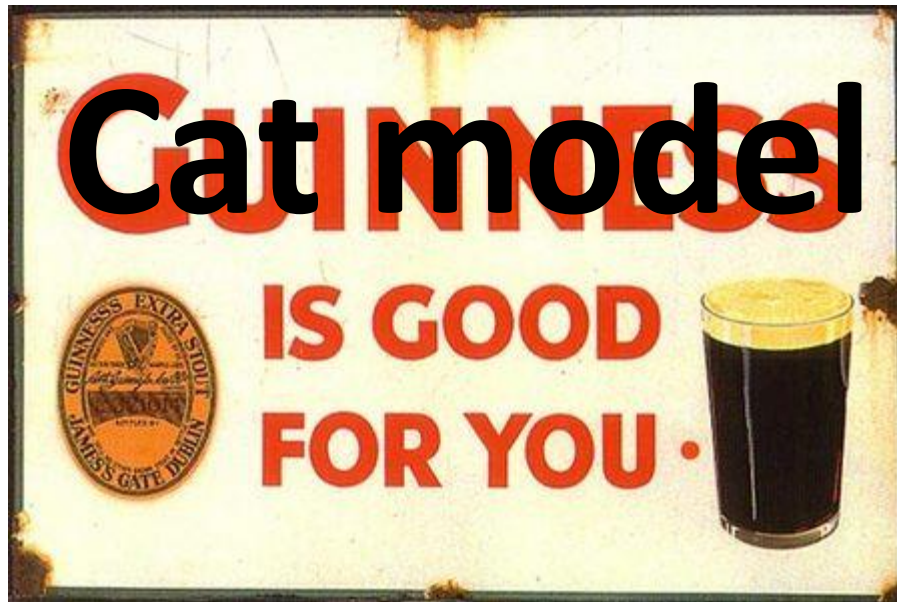
► Without Cat models…

► … Cat biz would be even more cyclical than it already is

► … the industry would not have been able to manage the recent large events as well as it did

Conclusions (despite everything):

► Cat models are good for you!

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Discussion