Catastrophe Risk Management
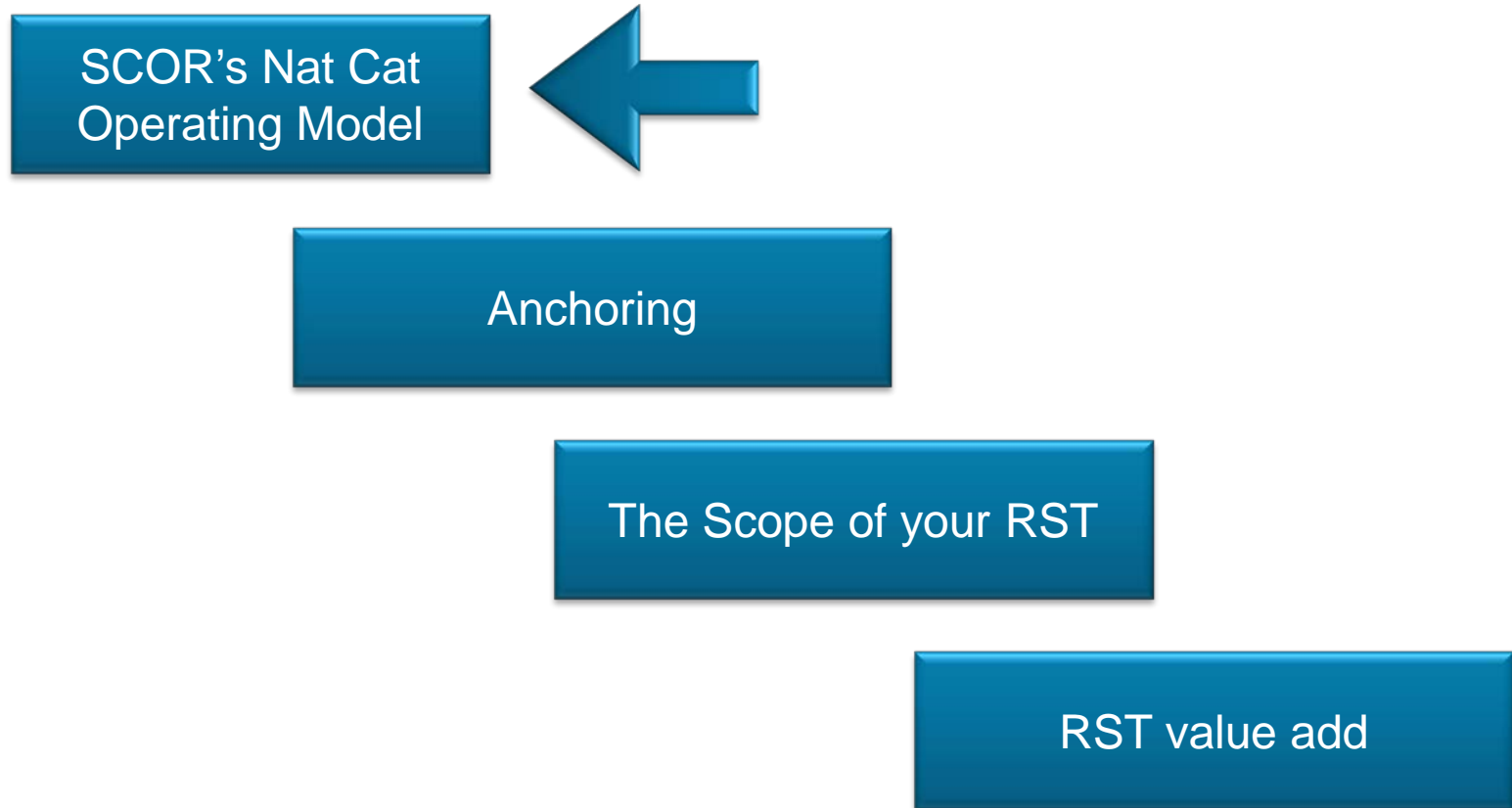## *Opportunities for embedding Solvency II*

Capital Modelling and Risk Management Seminar
10 December 2015

Junaid Seria
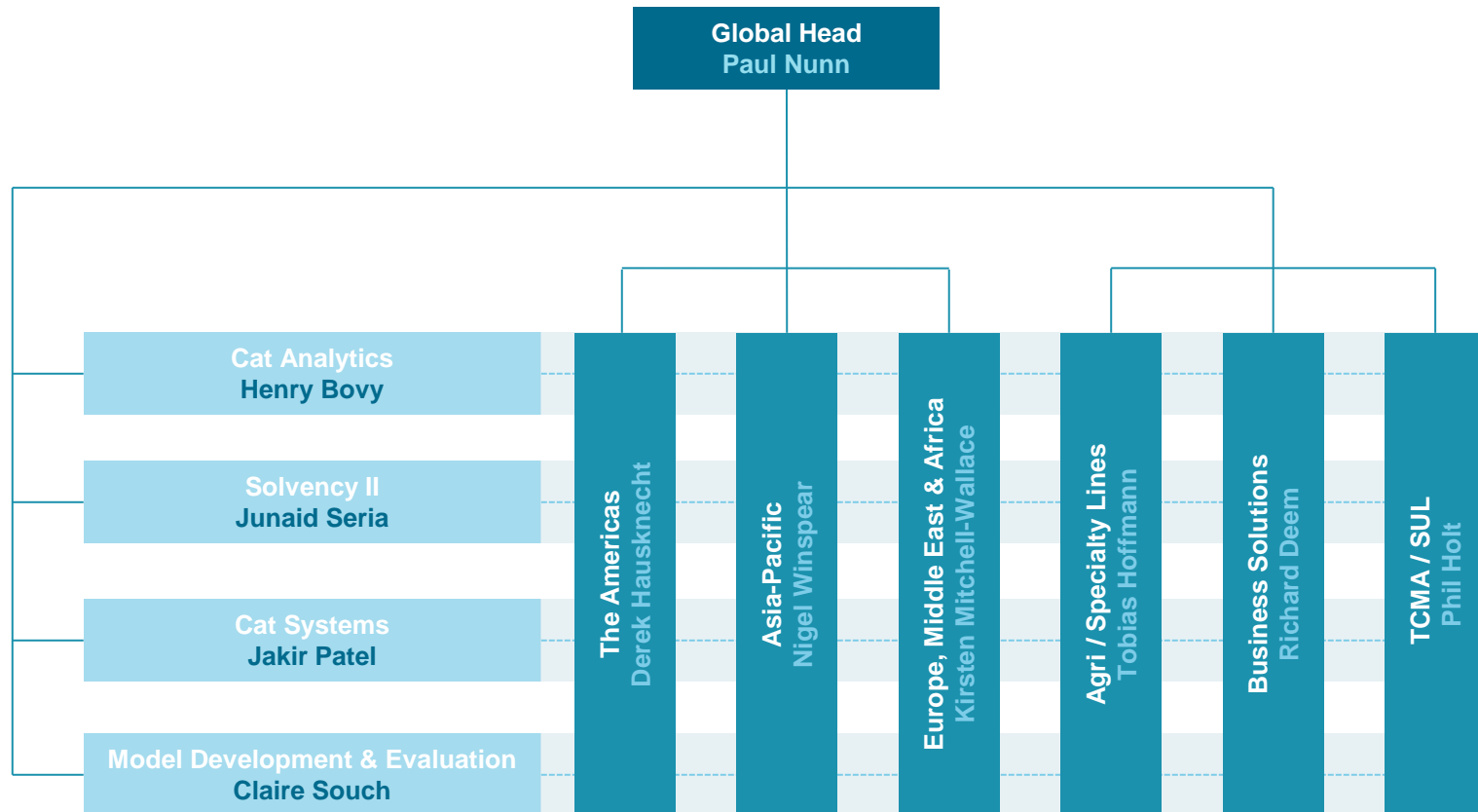Solvency II Nat Cat Actuary

Agenda / Key messages

1. The Operating Model is key to embedding Solvency II – we share a few examples

2. Post Internal Model Approval, Reverse Stress testing is arguably the most important validation tool.

3. In the context of significant regulatory reporting requirements, Cat Models provide a *quick* and *easy* method for identifying extreme loss scenarios. We typically think, "Job done!" – this is a problem!

4. We outline a few ways to extract greater value from the reverse stress testing exercise

Agenda

SCOR's Nat Cat Operating Model ←

Anchoring

The Scope of your RST

RST value add

Global Nat Cat Modelling Team
Nat Cat Operating Model

Global Head
Paul Nunn

Cat Analytics
Henry Bovy

Solvency II
Junaid Seria

Cat Systems
Jakir Patel

Model Development & Evaluation
Claire Souch

The Americas
Derek Hausknecht

Asia-Pacific
Nigel Winspear

Europe, Middle East & Africa
Kirsten Mitchell-Wallace

Agri / Specialty Lines
Tobias Hoffmann

Business Solutions
Richard Deem

TCMA / SUL
Phil Holt

Wisdom of the Crowds
Nat Cat Operating Model

- Clear Solvency II mandate

- Engaged with industry to extract industry perspectives:

  - RMS Joint Development Partner

  - OASIS Directorship and Oasis Support Project

  - Lloyd's Exposure Management WG

  - PhD Sponsorships

  - SCOR Corporate Foundation for Science

  - Nat Cat Industry initiatives

    - Institute of Risk Management (Nat Cat Comms WG)

    - Institute of Actuaries (Nat Cat Validation WG)

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Highlights
Nat Cat Operating Model & Group ERM Framework

However, we cannot succeed unless we are integrated within the Group ERM Framework
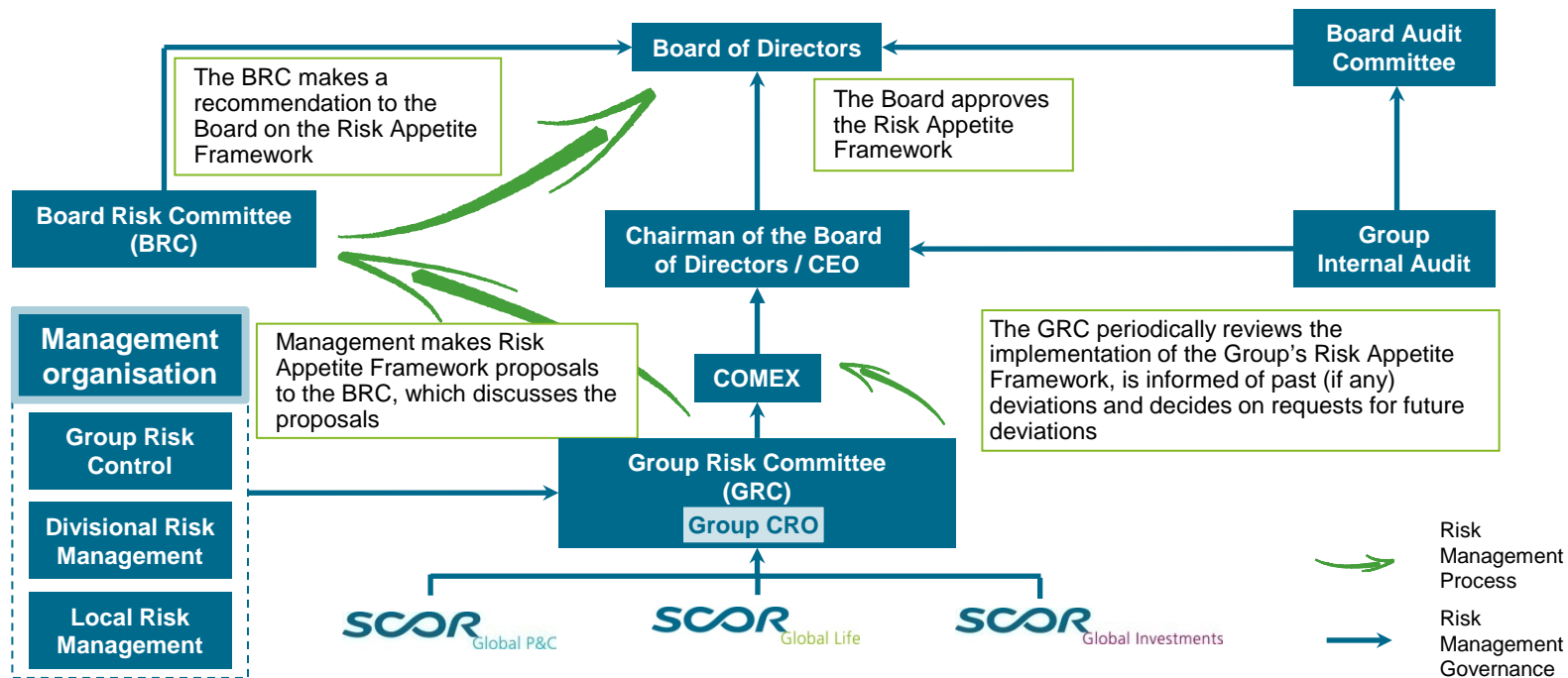
1. Embedded ERM Framework

2. Embedded Risk Appetite Framework

3. Solvency Management

4. Risk Tolerances – Solvency Target

5. System of Limits – Extreme Scenarios

6. Footprint Scenarios

7. SCOR's Dynamic Portfolio Management system allows daily roll-up of the entire global property cat portfolio

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1. Embedded ERM Framework
Nat Cat Operating Model & Group ERM Framework

ERM is embedded in decision making

- ❑ The Management and the Board are deeply involved in steering the Group's risk profile
- ❑ For specific strategic decisions such as an acquisition or significant initiatives, Risk Management actively assesses risks to support Management and Board decision making

ERM development over the "Optimal Dynamics" horizon

- ❑ SCOR's Risk Appetite Framework continues to evolve to enhance management of risk and capital
- ❑ SCOR more systematically uses economic metrics across the organization

2. Embedded Risk Appetite Framework
Nat Cat Operating Model & Group ERM Framework

Optimal Dynamics		
Risk appetite	❑ A mid-level risk profile (after hedging) with a focus on the belly of the risk distribution, avoiding exposure to extreme tail events, but aligned with the increased size, diversification and capital base of the Group ❑ Volatility is controlled through diversification and Capital Shield Strategy	
Risk preferences	❑ Business focus on selected reinsurance risks ❑ Most mainstream insurance risks covered in Life and P&C, with a recalibration reflected in an increase in longevity risk and a slight increase in Nat Cat risk ❑ Low appetite for interest rate risk (at least in the short term) and D&O for Financial Institutions and no appetite for operational risk, clients' asset risk and GMDB[1] new business	
Risk tolerances	**Solvency target**	**Capitalization level** SCR, Buffer capital and flexible solvency target driving a process of gradual escalation and management responses
	System of limits	**Risk drivers _(probabilistic)_** Post-tax net 1:200 annual aggregate loss for each risk driver ≤ 20% Available Capital
		Extreme scenarios _(probabilistic)_ Post-tax net 1:200 annual per-event loss for each risk ≤ 35% Buffer Capital
	Limits per risk in the underwriting and investment guidelines	
Footprint scenarios	Impact assessment of **past events (deterministic)**	

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3. Solvency Management
Nat Cat Operating Model & Group ERM Framework

❏ The management responses reflect the dynamic process which enables SCOR to steer its risk and capital positions towards the optimal area.

Buffer scale (left axis):
- 4 buffers = Max buffer ~300% SR[1] — Over capitalised
- Sub-Optimal +
- Starting Point 2014 SR[1] =231%
- 2.4 buffers ~220% SR[1]
- Optimal
- 1.7 buffers ~185% SR[1] — Comfort
- 1 buffer ~150% SR[1]
- Sub-Optimal
- 1/2 buffer = Min buffer ~125% SR[1] — Alert
- 100% SR[1]
- GROUP SCR

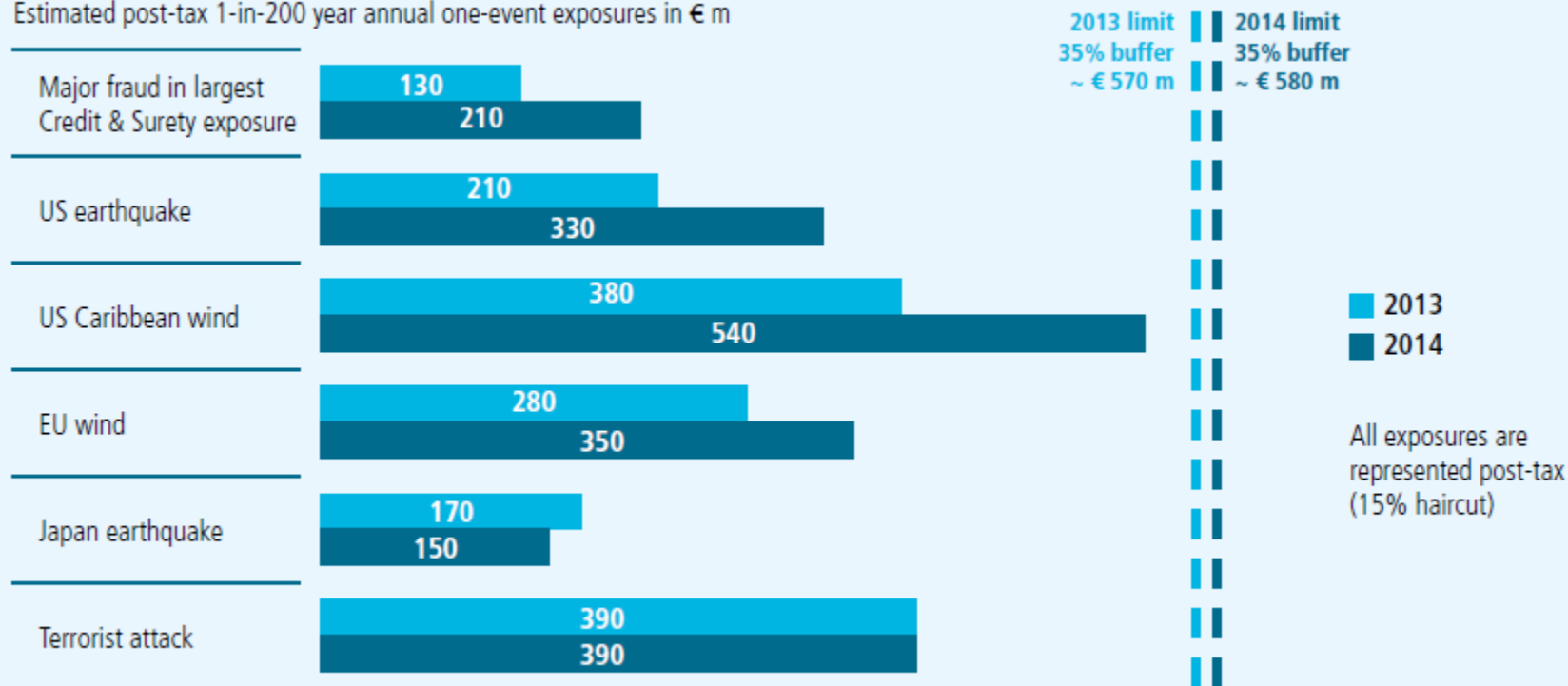| Action	Possible management responses (examples)	Escalation level
Redeploy capital	✓ Consider special dividends ✓ Consider acquisitions ✓ Buyback shares / hybrid debt ✓ Increase dividend growth rate ✓ Reconsider risk profile, including capital shield strategy ✓ Enlarge growth of profitable business	Board/AGM
Fine-tune underwriting and investment strategy	✓ Permanent check and optimization to remain in the optimal zone	Executive Committee
Re-orient underwriting and investment strategy towards optimal range	✓ Improve selectiveness in underwriting and investment ✓ Improve the composition of the risk portfolio ✓ Optimize retrocession and risk-mitigation instruments e.g. ILS ✓ Consider securitizations	Executive Committee
Improve efficiency of capital use	✓ Issue hybrid debt ✓ Reduce and / or issue stock dividends ✓ Reconsider risk profile, including more protective capital shield ✓ Slow down growth of business ✓ Consider securitizations	Board/AGM
Restore capital position	✓ Consider private placement / large capital relief deal ✓ Consider rights issue (as approved by the AGM) ✓ Restructure activities	Board/AGM
Below minimum range - submission of a recovery plan to the supervisor[2]		Board/AGM

4. System of Limits – Extreme Scenarios
Nat Cat Operating Model & Group ERM Framework

Estimated post-tax 1-in-200 year annual one-event exposures in € m

Scenario	2013	2014
Major fraud in largest Credit & Surety exposure	130	210
US earthquake	210	330
US Caribbean wind	380	540
EU wind	280	350
Japan earthquake	170	150
Terrorist attack	390	390

2013 limit
35% buffer
~ € 570 m

2014 limit
35% buffer
~ € 580 m

■ 2013
■ 2014

All exposures are represented post-tax (15% haircut)

System of Limits — figures in € millions (as GRC 24 February 2015)	Risk P / C	Action	Group 2015 Exposure	SGP&C 2015 Exposure	2015 Limit
Risk Driver (1-in-200 post-tax net annual aggregate view)					
NatCat	● / ●				
Terrrorism	● / ●				
Long-tail reserves deterioration	● / ●				

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5. Footprint Scenarios – Impact Assessment
Nat Cat Operating Model & Group ERM Framework

Footprint scenarios are an <u>innovative</u> and <u>complementary</u> risk management tool

- ❑ Whereas risk drivers and extreme scenarios are probabilistic-based, the *footprint approach* consists in carrying out an impact assessment on the Group under a deterministic scenario

- ❑ The *footprint approach* is complementary to a probabilistic-based view

- ❑ Taking into account SCOR's current exposures and all risk mitigation instruments, footprint scenarios provide the impact on:
  - ▪ the Group's solvency ratio
  - ▪ the Group's liquidity
  - ▪ the Group's own operations

- ❑ For Nat Cat, key historical events have been selected

SCOR regularly produces and evaluates footprint scenarios, providing comfort that the impact of such events on the Group's current solvency would be limited

Class	Footprint scenario	Group's loss net of all risk mitigation mechanisms in € millions (before tax)	Impact on the Group's solvency ratio
US Earthquake	1906 San Francisco earthquake	386	-10 points
Japanese Earthquake	1923 Great Kantō earthquake	465	-12 points
North Atlantic Hurricane	1926 Great Miami Hurricane	247	-7 points
	1928 Okeechobee Hurricane	344	-9 points
	1938 Long Island Express Hurricane	365	-10 points
	1965 Hurricane Betsy	156	-4 points
European Windstorm	1990 Daria extra tropical cyclone	229	-6 points
	1999 Lothar – Martin extra tropical cyclones	347	-9 points
Japanese Typhoon	1959 Typhoon Vera	206	-6 points
	1961 Typhoon Nancy	158	-4 points

*Track of Great Miami Hurricane in 1926*

6. DMS – Daily Global Roll-up
Nat Cat Operating Model & Group ERM Framework

SCOR has benefited from exclusive access to the Dynamic Portfolio Management component of RMS(one) since Q4 2011

Capacity consumption projection through 2015 renewal campaigns (€/ USD '000)

EUWS
NAHU
EUWS Capacity
NAHU Capacity

January Renewal   April Renewal   June/July Renewal
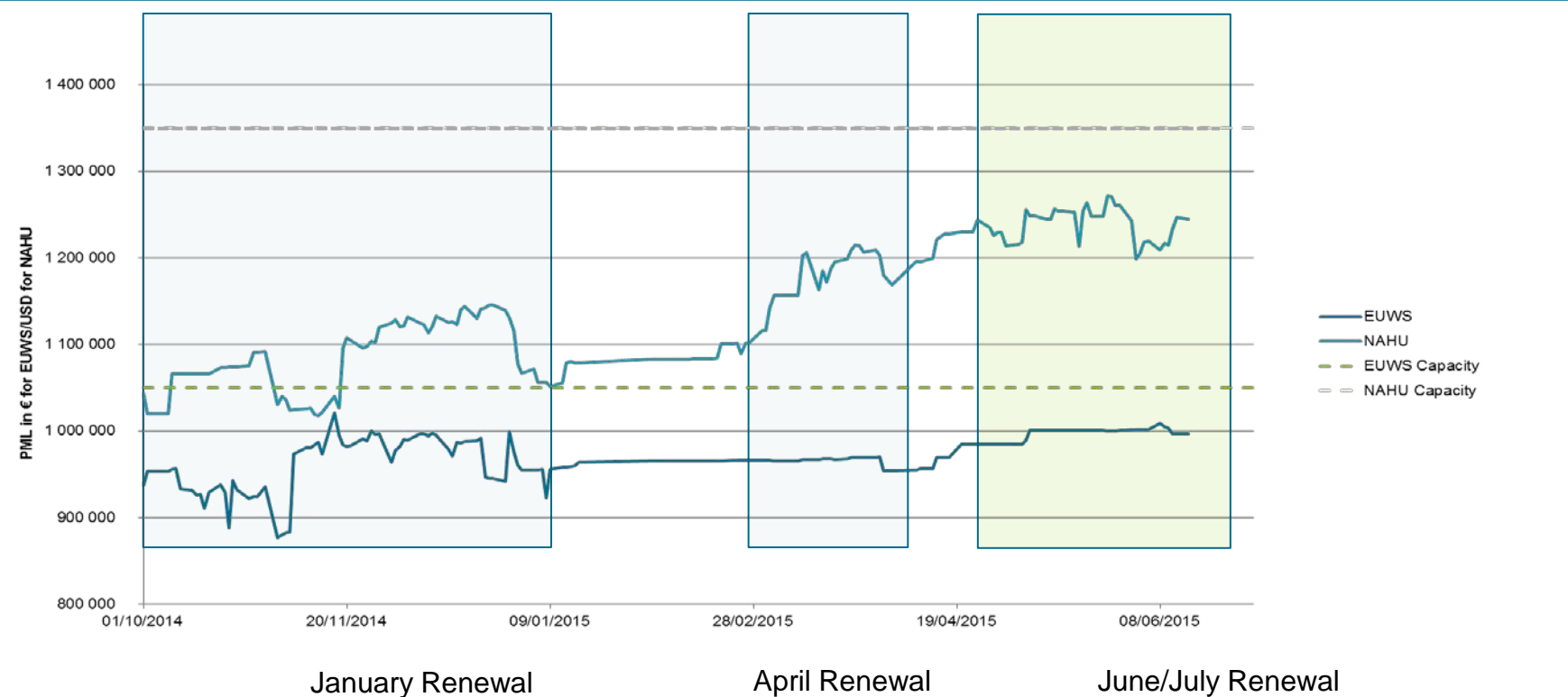
❑ SCOR is able to closely monitor the effect of thousands of underwriting decisions made during every renewal campaign throughout the year on a daily basis

7. Embedded Frameworks
Nat Cat Operating Model & Group ERM Framework

Documentation Framework
Nat Cat Operating Model & Group ERM Framework

SII Documentation Structure

Level 1	Nat Cat Summary Document *(static)*	
Level 2	Nat Cat Governance Framework *(static)*	
	Model Justification Documents *(semi-static)*	
Level 3	Calibration Results *(dynamic)*	Primary & Independent Validation *(dynamic)*
Level 4	External vendor reference documentation *(static)*	

Governance Framework
Nat Cat Operating Model & Group ERM Framework

Model Change	Pricing	Expert Judgement
Processes and Controls	External Models	Data Quality

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Validation Framework
Nat Cat Operating Model & Group ERM Framework

Test Topics	Test Structure	Test Tools
Data	Test description – risk / scope / objective and limitations	Top-down justification / bottom-up model component analysis
Model Design		
Results	Quantitative / Qualitative	Analysis of change
	Pass / fail criteria (what is the hypothesis / expectation?)	Back-testing
Governance		Sensitivity testing
		Scenario testing
Key drivers: Expert judgement, key assumptions, key switches/options, key distribution choices	Test result and rationale	Stress testing
		Benchmarking
	Recommendation (including escalation procedure where tests fail)	Functional testing
		Reconciliation testing
		Stability testing
		Risk attribution testing (variant of P&L attribution)

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Agenda

SCOR's Nat Cat Operating Model

Anchoring

The Scope of your RST

RST value add

Positive Reinforcement
Anchoring

- ✓ Internal (and External) Model approval

- ✓ Robust validation

- ✓ +200% Solvency Ratio

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The Pre-mortem Approach
Anchoring

- Developed by psychologist Gary Klein as a tool to overcome planning fallacy, positive groupthink and overconfidence

- In a re/insurance context we start with the assumption: *"the business is no longer viable – how did we get here?"*

- Consider Reverse Stress Testing as a pre-mortem approach – that is, a genuine attempt to find an alternative hypothesis

- Not just a validation tool to show that insolvency is implausible.

This plan failed

Why?

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Agenda

SCOR's Nat Cat Operating Model

Anchoring

The Scope of your RST

RST value add

Scope of RST

1. Cat Models provide a quick, easy and reasonable way to quantify extreme scenarios, however caution is needed

2. Estimating related direct losses:
   - Property Cat: adjust for non-modelled components, reinstatement premiums
   - Non-Property Cat : Auto, Marine, Engineering, Aviation, Agriculture
   - Life
   - Assets – ILS portfolio
   - P&C Investments with UW risk – business underwritten at Lloyd's

3. Indirect losses:
   - Supply chain interruption,
   - Environmental pollution
   - Others: crime, looting, claims fraud
   - State intervention - deductibles

4. Nat Cats and Emerging risks: cyber, autonomous vehicles (?), etc.

5. Cascading effects / Super cats: 1906 SFEQ and 1907 Banker's crisis

Agenda

SCOR's Nat Cat Operating Model

Anchoring

The Scope of your RST

RST value add

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RST Value Add

- Employ Delphi method

- Consider cluster scenarios: e.g., repeat of the 2005 US Hurricane Season + 1990/99 Eurowind losses

- Perturb historical events and near-misses (JPEQ case-study)

- Analyse largest individual contracts: MGAs, Cat Pools, etc.

- Conduct root cause analyses (e.g., NZEQ and liquefaction risk => Singapore EQ)

- Consider PML creep (proportional programmes with increasing event limits…)

- Emerging urban centres

- Claims resilience

- Emerging Risks

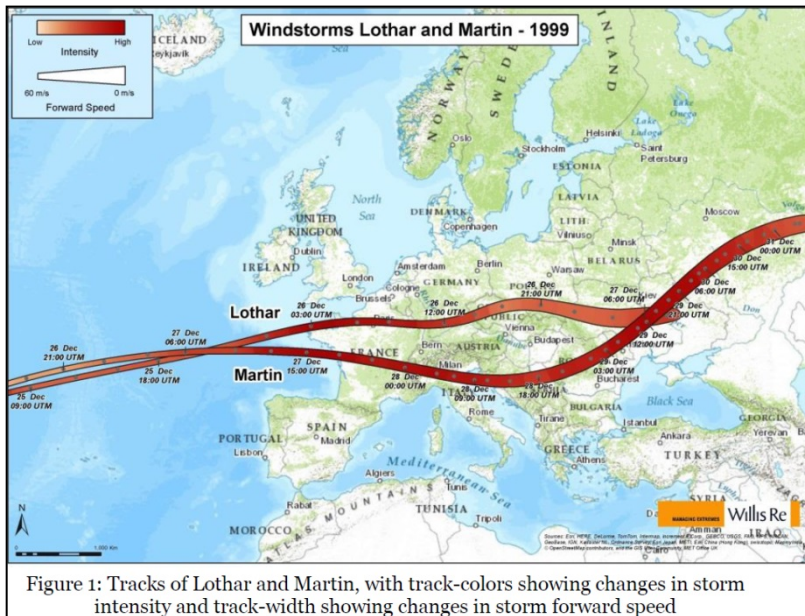- Less calibration, more challenging of fundamental assumptions

Historical Event Perturbation
RST Value Add
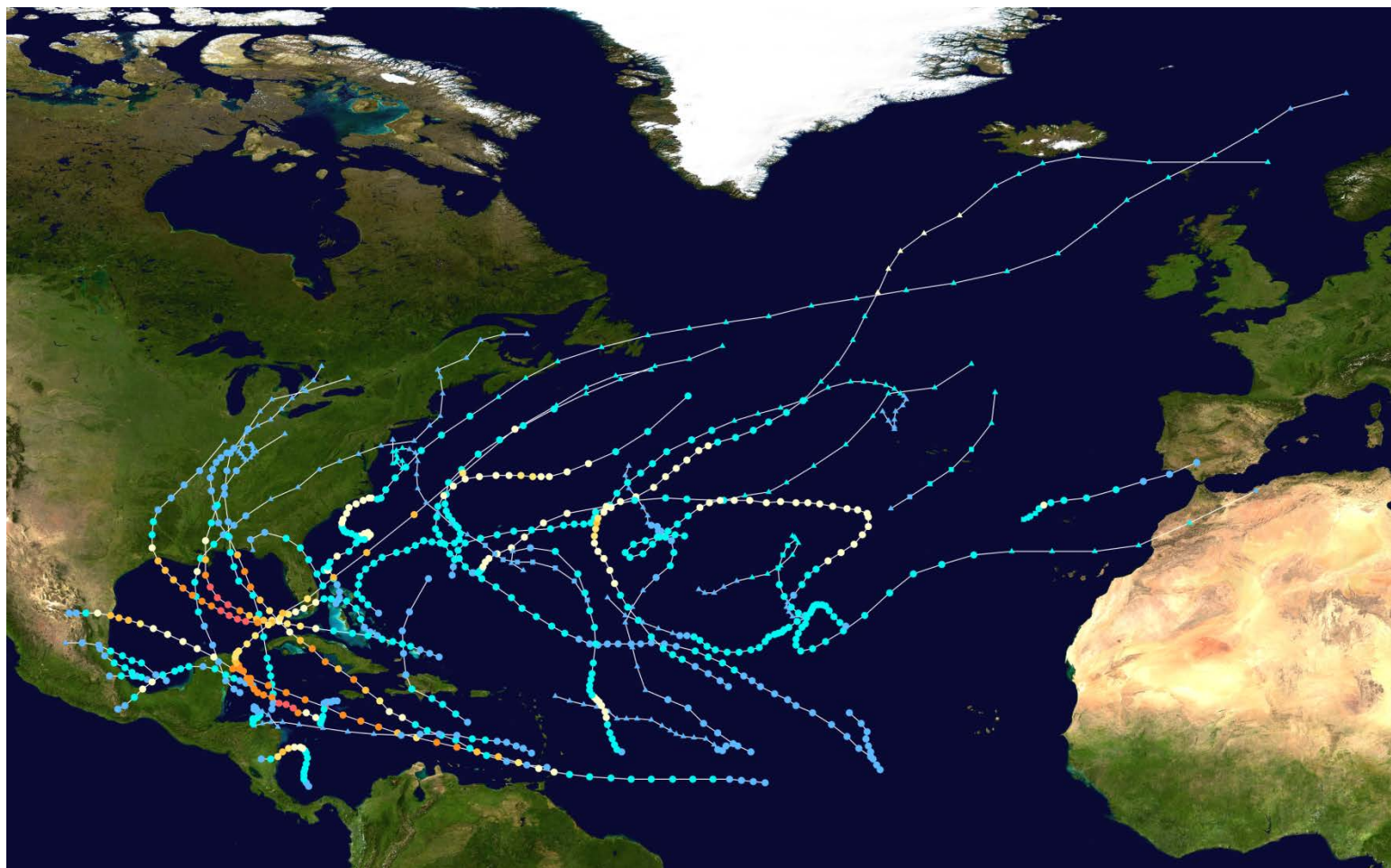
Figure 1: Tracks of Lothar and Martin, with track-colors showing changes in storm intensity and track-width showing changes in storm forward speed
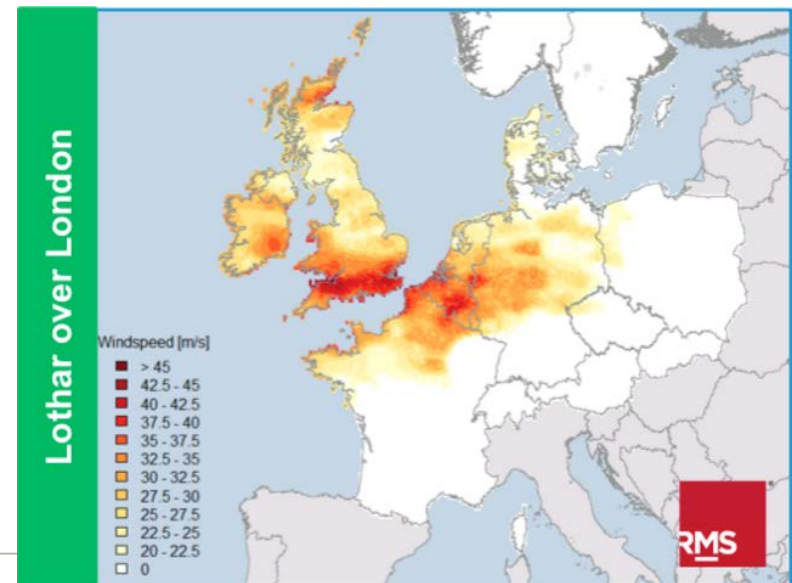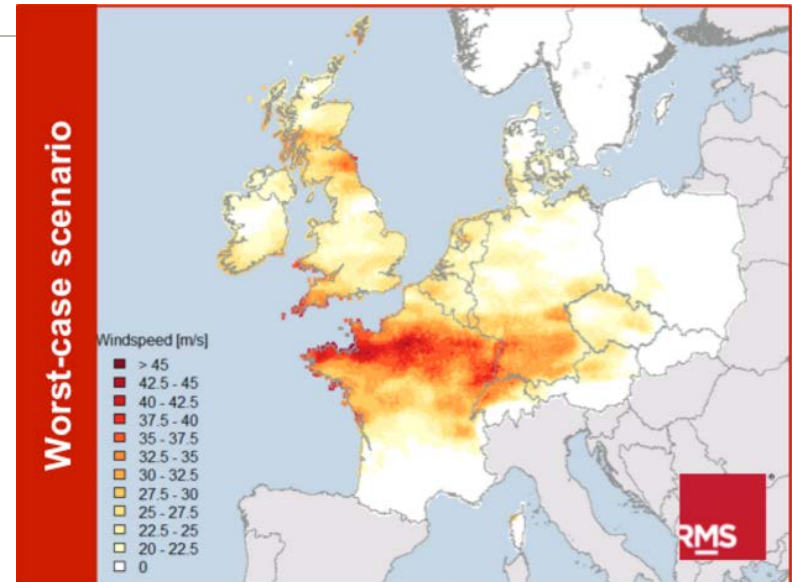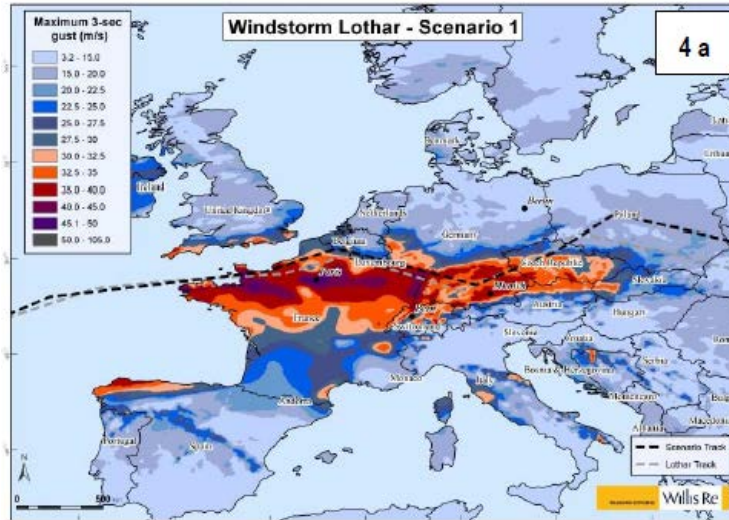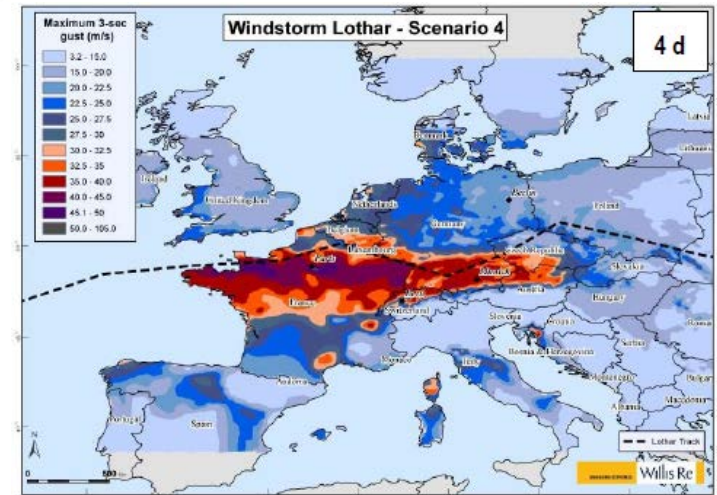
Historical Event Perturbation
RST Value Add

Max winds over Paris and Munich

+5% windspeeds for the whole footprint
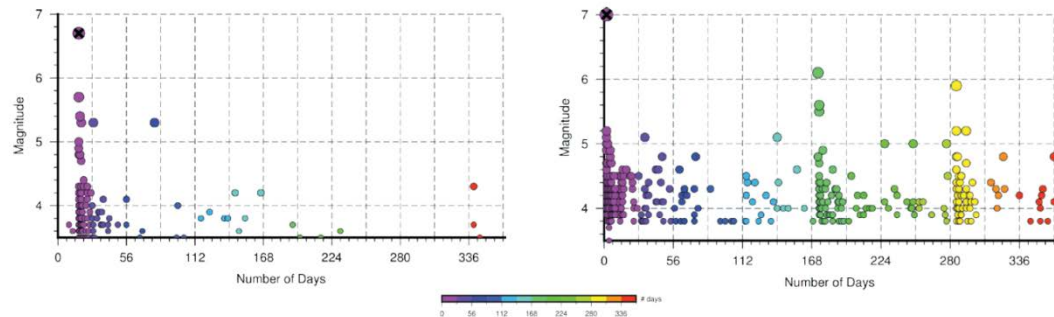
"Non-peak" perils: Emerging Urban Centres
RST Value Add

Estimated ground motions from a repeat of the 1679 Sanhe-Pinggu Earthquake, as modeled by the RMS® China Earthquake Model
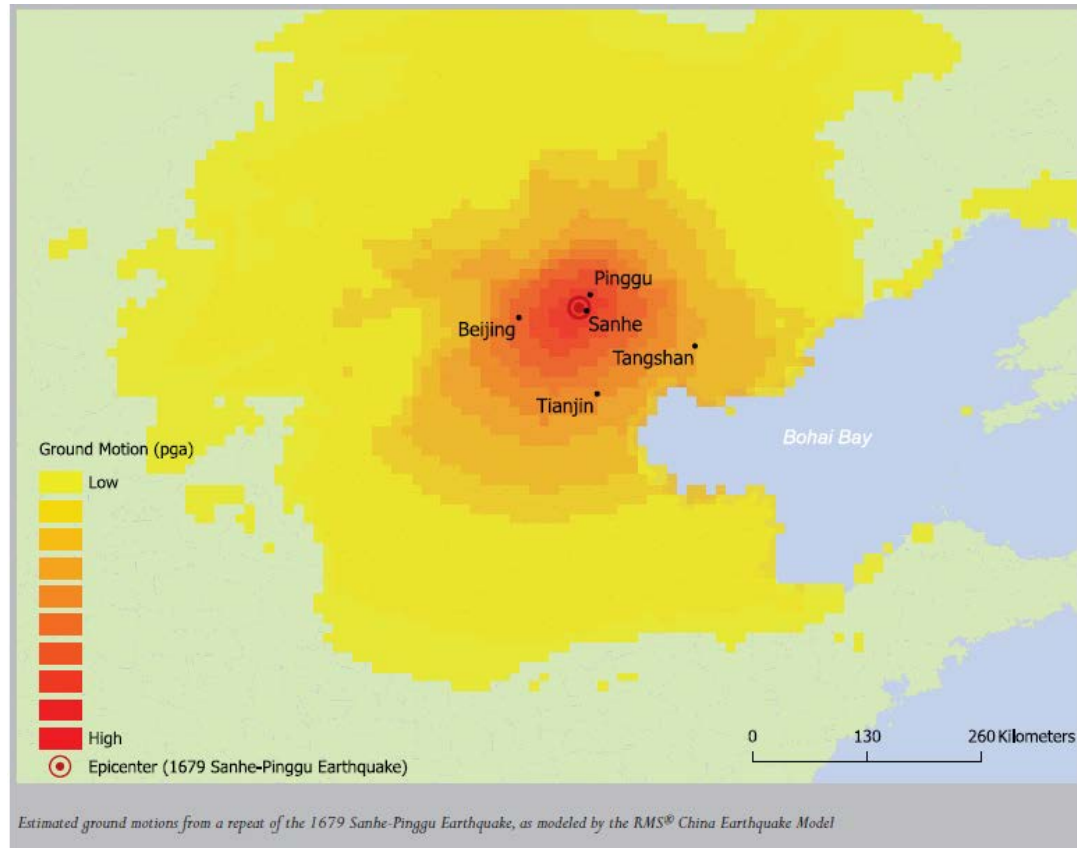
Fundamental Assumptions
RST Value Add

1. A and B are independent

2. B follows A

3. A and B need to happen together

4. A is capped

5. A is implausible

6. A = f(x)

Aftershock sequence: Northridge (1994, left) and Canterbury (2010, right)
Source: Swiss Re

Key messages

1. The Operating Model is key to embedding Solvency II

2. Post Internal Model Approval, Reverse Stress testing is arguably the most important validation tool.

3. Use Cat Models, but ensure your assessment captures all material sources of loss

4. Through a robust elicitation process, we can extract more creative threats to the viability of our business model

SCOR

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