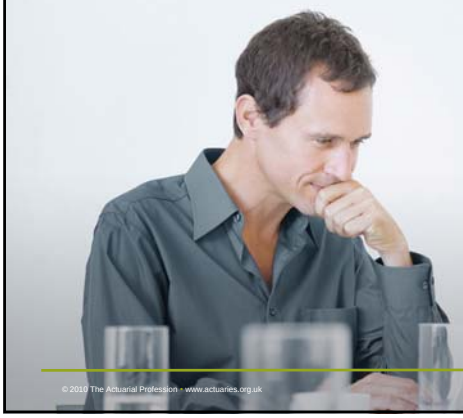
The Actuarial Profession
making financial sense of the future

The latest issues surrounding catastrophe modelling
Trevor Maynard



Lloyd's Catastrophe Modelling

29 March 2011

Agenda

- RDS a critical part of catastrophe modelling
- Lloyd's Catastrophe Model
- Emerging risks

RDS

A critical aspect of catastrophe modelling

The role of exposure management

- Exposure Management is responsible for managing the aggregation, or potential accumulation of risks and reinsurance within individual syndicates and across the Lloyd's market, and alerting the market to emerging risks
- Principal activities include:
  - Assessing managing agent exposure management competencies
  - Operating the Realistic Disaster Scenario framework
  - Monitoring reinsurance performance and trends
  - Researching and raising awareness of emerging risk issues
  - Quantifying cat risk contribution in capital model

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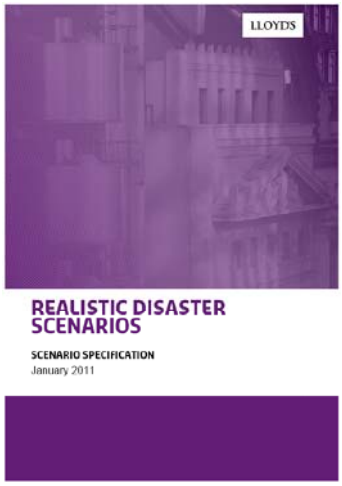
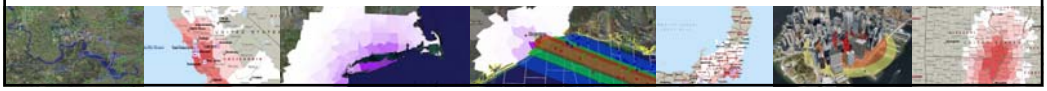
The RDS process

- 17 structured scenario-based questions
- Mixture of Natural & Man-made catastrophes
- Tests syndicate and market resilience to *thematic* major disasters
- *Deterministic* framework
- Reported January and July



The scenarios

Generic Scenarios		Compulsory Scenarios		Industry loss
1	Marine Event	8	Two Event (Northeast US windstorm followed by Carolinas windstorm)	$78bn + $36bn
2	Loss of Major Complex	9	Florida Windstorm	$125bn
3	Aviation Collision	10	Gulf of Mexico Windstorm	$111.5bn*
4	Satellite Risks	11	European Windstorm	€23bn
5	Liability Risks	12	Japanese Typhoon	¥1.5trn
6	Political Risks	13	California Earthquake	$78bn
7	Alternative RDS: A/B	14	New Madrid Earthquake	$47bn
		15	Japanese Earthquake	¥5trn
		16	UK Flood	£6.2bn
		17	Terrorism	N/A



Benefits of RDS

- A standardised framework for assessing syndicate and market cat risk over time
  - Open and transparent, very easy to explain to non-specialists
- Encourages a disciplined approach to monitoring and managing risk
  - Company specified Alternatives drives good behaviours
- Business planning tool for future exposure levels
- Understanding reinsurance counterparty concentration risk
- Standard stress tests for Capital setting
- Useful to assess losses in actual catastrophes
- Widely used beyond Lloyd's, both in London and globally
- Publicly available: www.lloyds.com/rds

How RDSs are used at Lloyd's

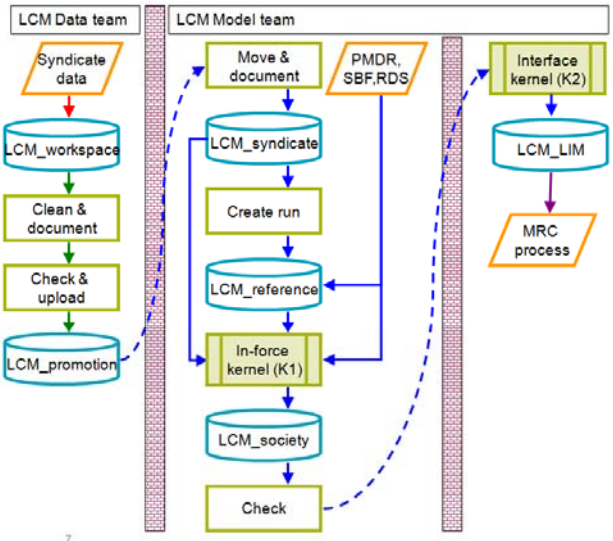
- Syndicate cat and large loss potential
- Lloyd's market risk => NCF adequacy
- Benchmark exposure management process
- Supports Rating process
- Stress & scenario testing of capital setting
- US Trust Fund implications
- Understand Reinsurer concentration\credit risk

Lloyd's Catastrophe Model

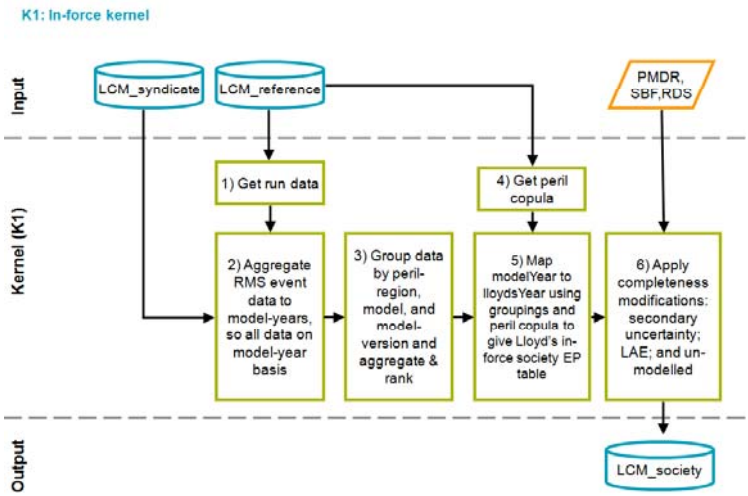
Overview

- Scenarios miss things and have probability zero
- Lloyd's has some unique challenges
- Following reflects current thinking; may change

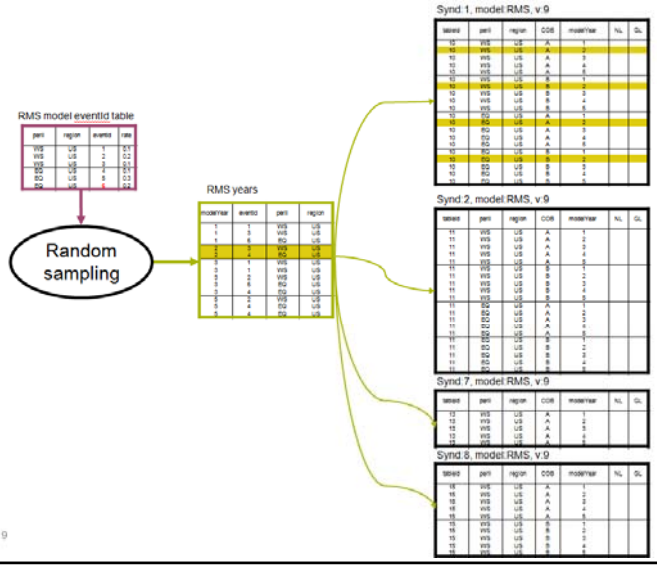
Model flow diagram



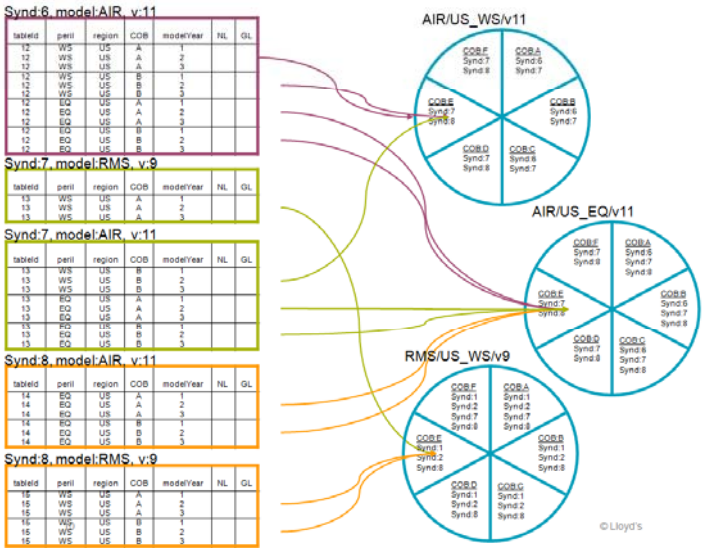
In-force view



Creating RMS years



Create peril/model/version groups



Peril copula

- Captures dependency between offshore and onshore energy
- Allows for teleconnection modelling in future (if any)

Random rank alignment

lloydsYear	GM_WS	US_WS	US_EQ	EU_WS
1	4	4	2	5
2	5	5	1	3
3	1	2	3	4
4	3	3	4	2
5	2	1	5	1

Rank dependency based on AIR model

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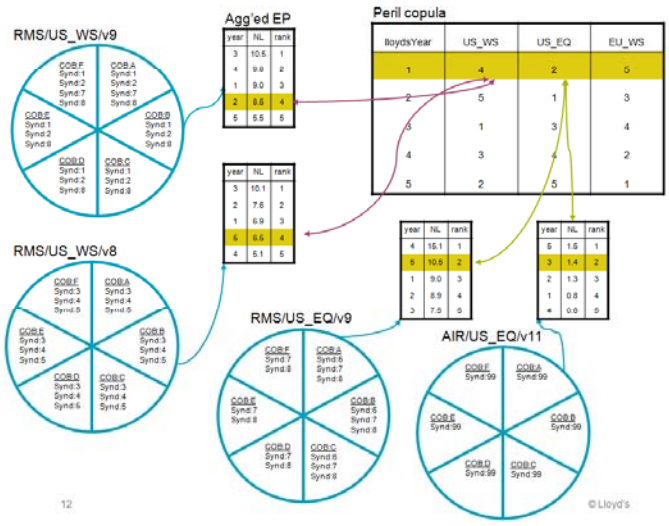
Rank matching



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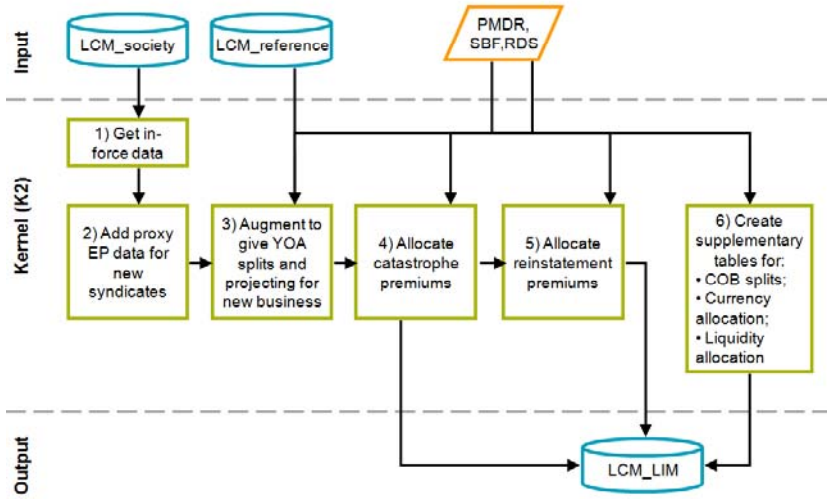
Allocating to year of account etc



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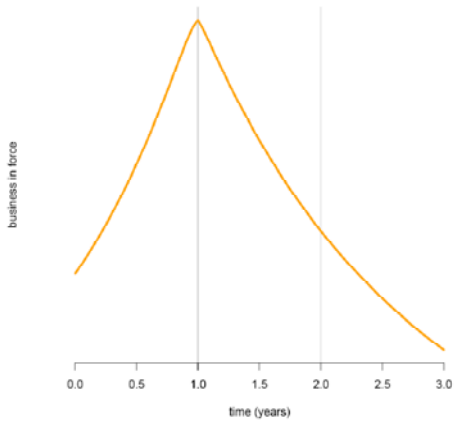
Business profiles



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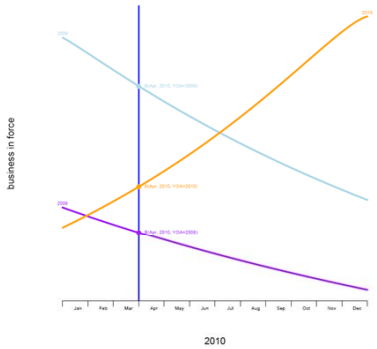
Multiple years of account and calendar years

Each line in the graphic above can be expressed as a function, B:

B(month, calendar year, YOA)

Creating a volume index

$$I(\text{month}, \text{calYear}, \text{YOA}) = \frac{B(\text{month}, \text{calYear}, \text{YOA})}{\sum_{\text{YOA}} B(\text{In - Force date}, \text{calYear}, \text{YOA})}$$



- Splitting in-force into YOA
- Allowing for growth

$$\sum_{\text{YOA}} I(\text{In - force date}, \text{calYear}, \text{YOA}) = 1$$

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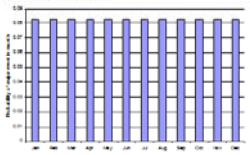
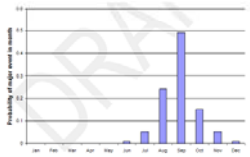
Peril profiles

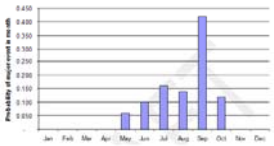
US and JP EQ



US_WS



JP_WS



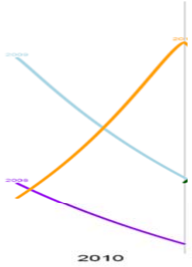
EU_WS

$$\sum_{month} P(month, peril, region) = 1$$

Creating a combined index

$$combinedIndex = \sum_{month} P(region, peril, month) \times I(month, calYear, YOA, region, peril, COB, synd)$$

X



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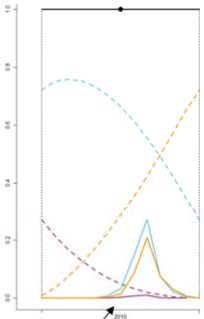
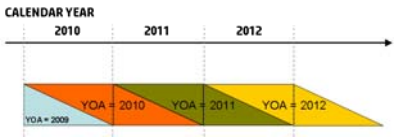


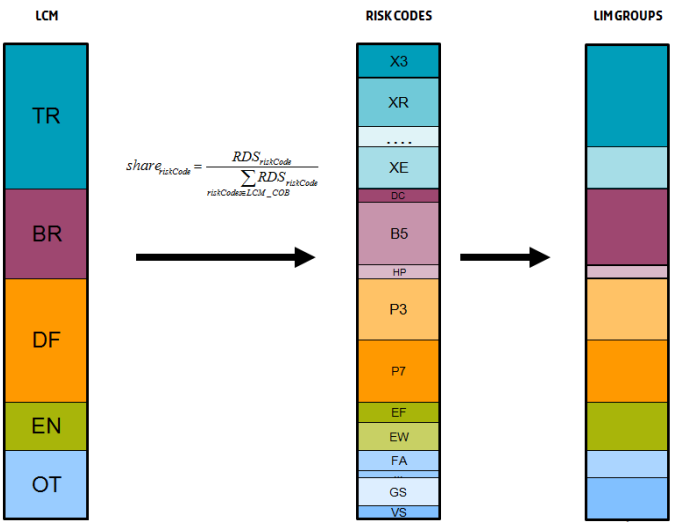
Combined index = area

Augmented in-force data – YoA and Cal Year

GL(year, synd,region, peril, COB, **YOA, CalYear**) = **GL**(year, synd, region, peril, COB) **x** combinedIndex(…, YOA, CalYear)

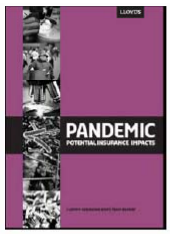


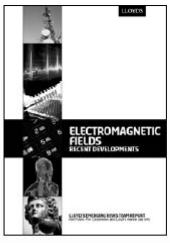
Augment classes of business

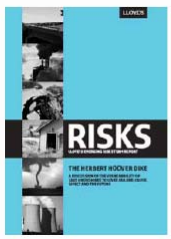


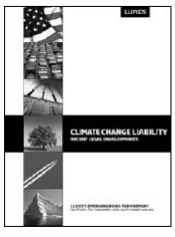
Emerging risks

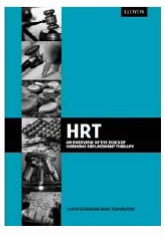
Don’t forget…











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Don’t forget…

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Don’t forget…

Help is available!

- Emerging risks team
- LRN and KTN
  - Links to research councils
  - Universities
- Lloyd's special interests group
- Lobbying
  - Responsible innovation
  - Avoiding liability catastrophes

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In summary…

- Scenario tests augment models – they'll always have a role
- But scenarios miss things, stochastic modelling is valuable if suitably interpreted
- Lloyd's catastrophe modelling takes high quality syndicate modelling and augments it to form a Lloyd's view
- Models always leave things out….
  ….keep thinking about emerging risks too.

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Questions or comments?

Expressions of individual views by members of The Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenter.