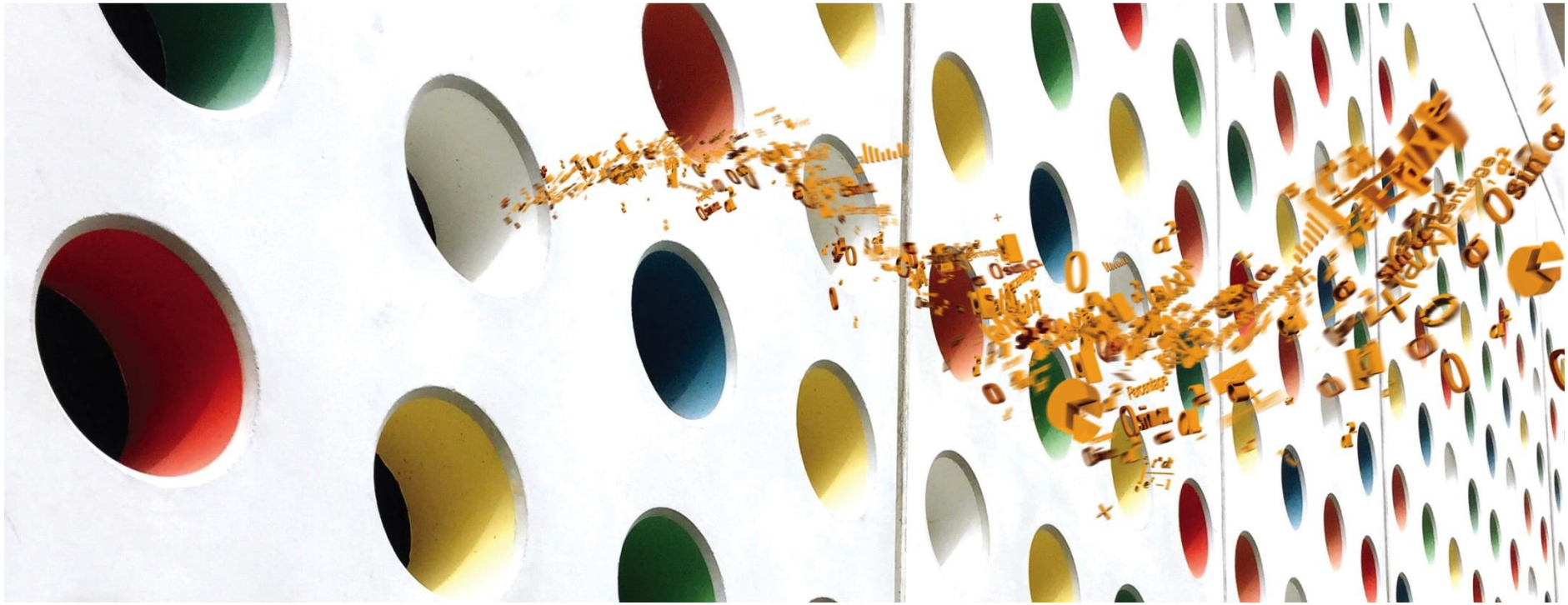


Catastrophe Model Workflow and its Applications

Catastrophe Insights 2018

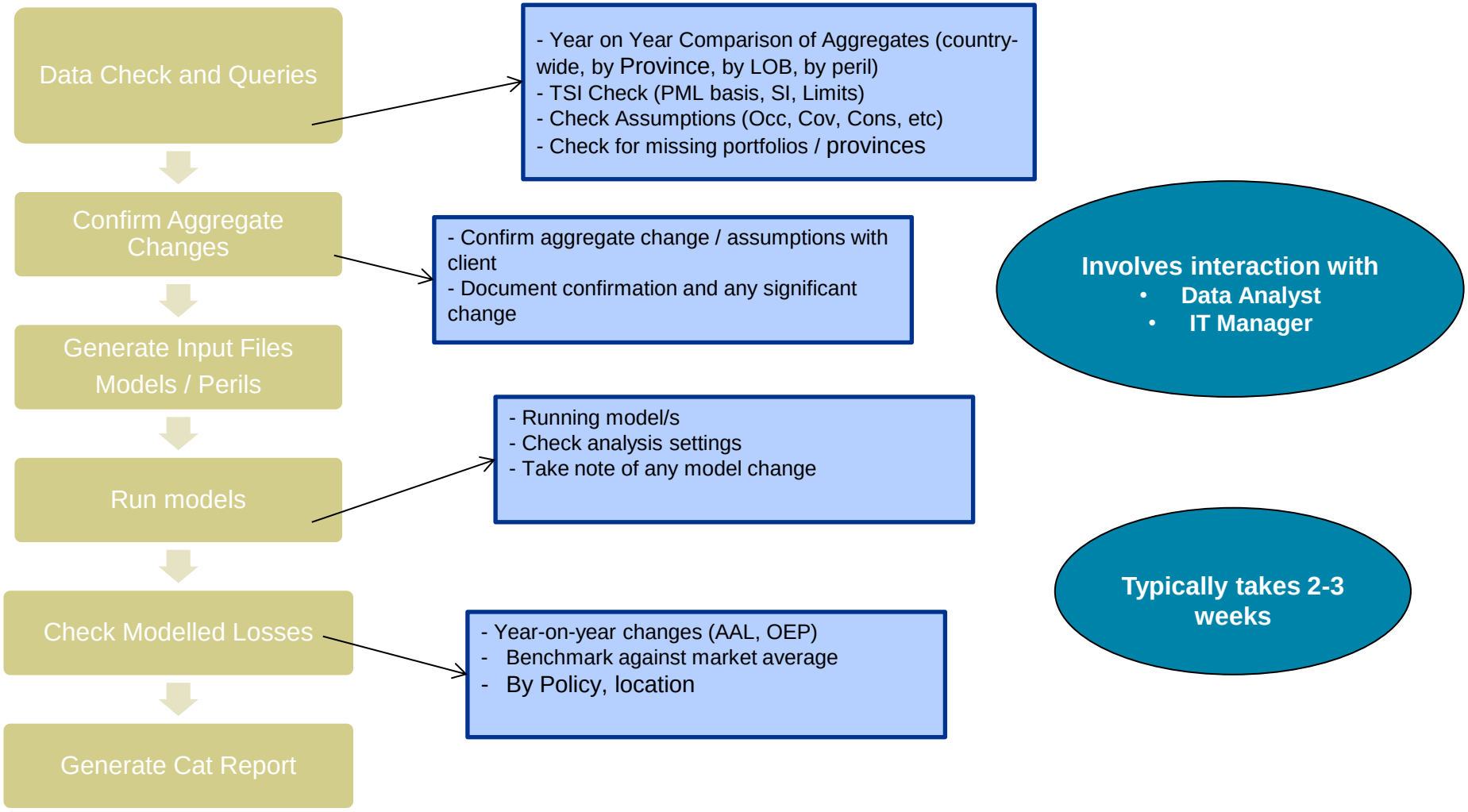
Empower Results®

Agenda

Section 1	Overview of Process/Workflow
Section 2	Inputs Required for Catastrophe Modelling
Section 3	Catastrophe Model Outputs
Section 4	Using Model Outputs for Reinsurance

Section 1: Overview of Process/Workflow

Process/Workflow



Section 2: Inputs Required for Catastrophe Modelling

Data Requirements for a Catastrophe Modelling Analysis

		Required	Recommended
1. Location Information			
Country	ex. Thailand	X	
Location Resolution	ex. Street Address, District, Province	X	
2. Building Information			
Occupancy	ex. Residential, Commercial, Industrial, Engineering	X	
Construction	ex. Masonry, Reinforced Concrete, Wood Frame		X
Building Height	ex. Number of Storeys		X
Year Built	ex. 1995, 2010		X
Secondary Modifiers	ex. Year upgrade, soft storey, etc		X
3. Policy Information			
Coverage Value	ex. Building, contents, business interruption	X	
Sublimit	ex. Site limit, policy limit, peril specific limit		X
Deductible	ex. Site, policy, coverage (% TSI, % loss, BI waiting period)		X

Inputs needed

- Catastrophe models require three basic types of data:
  - Exposure location (the more accurate = the less uncertain simulation)
    - Street address converted to latitude & longitude coordinates (same as GPS is using)
    - Higher units (Tambons, Ampohes, Postal codes, Changwats,…)
  - Exposure Value
    - Sums insured (Total insured values)
    - Other policy conditions (limits, deductibles, reinsurance levels,…)
  - Policy characteristics:
    - Coverage: Building | Content | Business interruption
    - Lines of business: Residential, Commercial, Industrial, Agriculture
    - Other modifiers: Basements, construction class, no. of stories, …

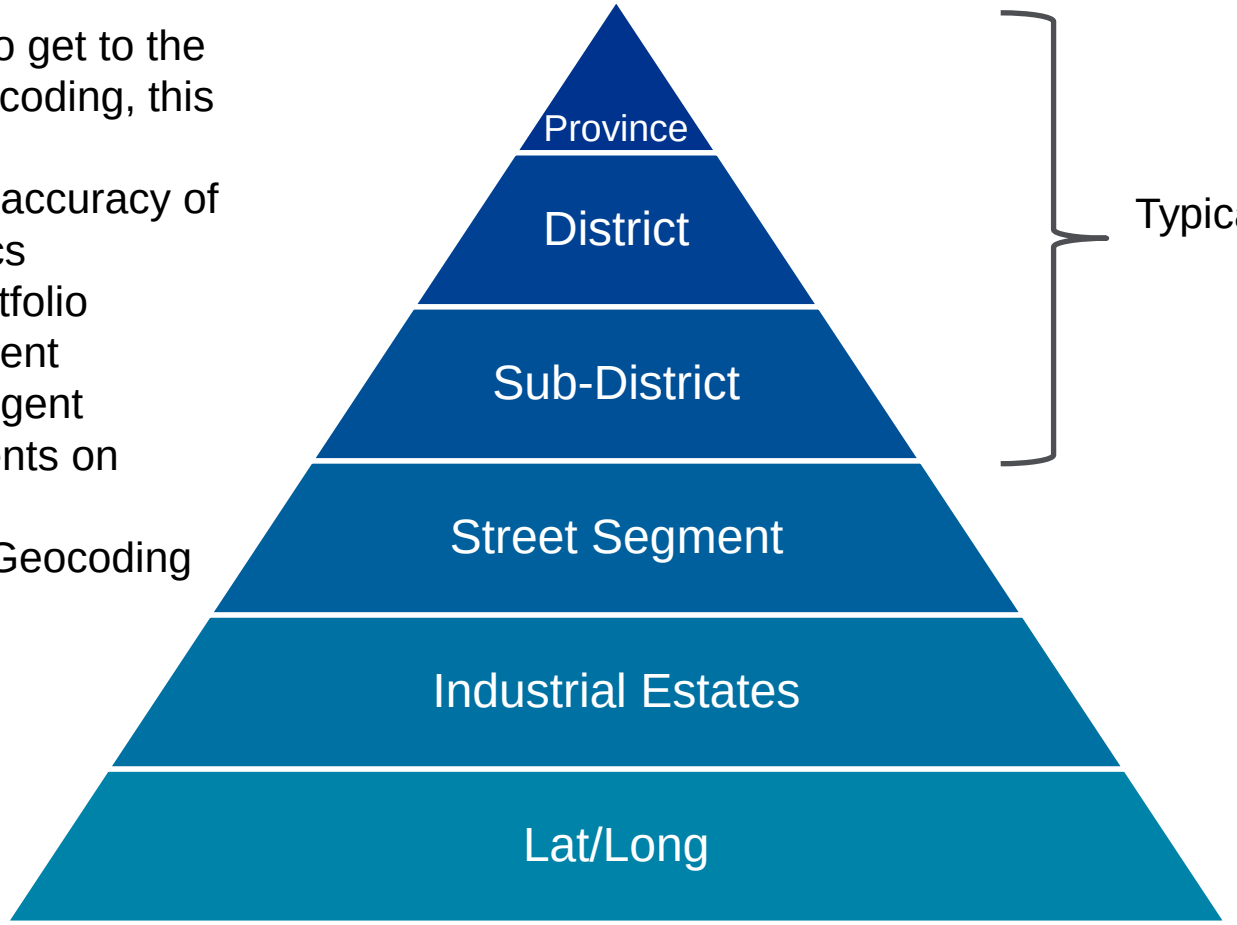
- **Aggregated** – values summarized per larger unit (loss of information)
- **Per policy data** – each (sub)policy described individually

Highly preferred approach!!!

Importance of Location Information

The ideal is to get to the risk level geocoding, this will lead to:

- Improved accuracy of risk metrics
- Better portfolio management
- More stringent requirements on systems
- Need for Geocoding



A balance or stepped approach is needed to ensure outcomes can be achieved

Sample Data: Inputs needed

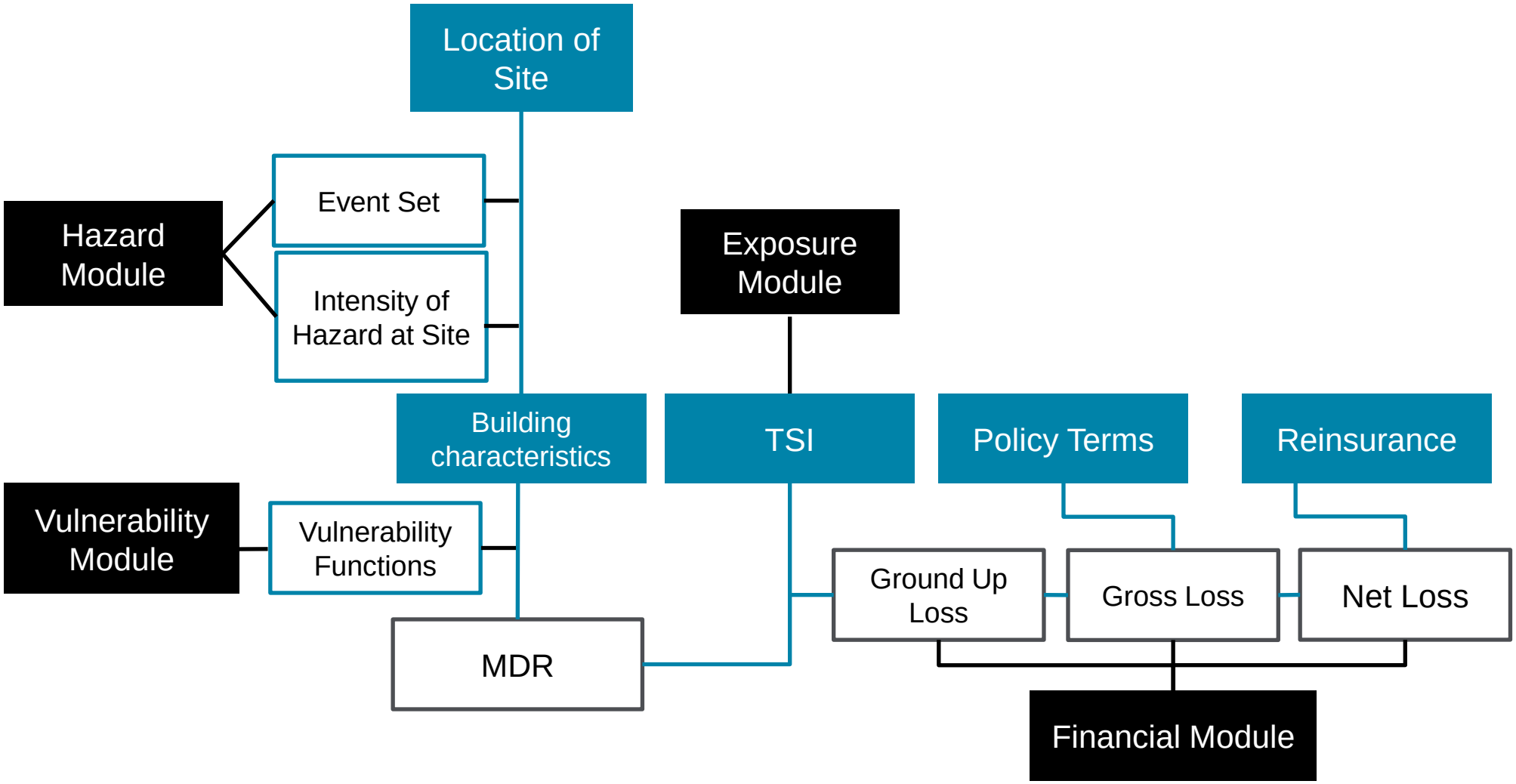
Example of catastrophe model input file

(format would depend on size of file)

Address	Subdistrict	District	Lat.	Long.	Stories	Basement	LoB	Type of Item	Actual S/I	SI Ret	SI TT	SI FAC	SI QS	Flood Sublimit	SL Ret
เลขที่ 35/151 หม	BANG LEN,	A.BANGYAI,	13.86072	100.43733	2	0	R	Building	590,000	531,000	47,200	-	11,800	20,000	19,600
เลขที่ 3 ลาดพร้	CHOMPOL,	CHATUCHAK,	13.80848	100.56574	2	1	R	Building	4,000,000	3,600,000	320,000	-	80,000	20,000	19,600
เลขที่ 9/615 หมู่	KHOK FAET,	NONGJOK,	13.83515	100.82802	2	1	R	Building	218,000	196,200	17,440	-	4,360	20,000	19,600
เลขที่ 717/4 สี่	SIPRAYA,	BANGRAK,	13.729408	100.523206	0	0	C	Furniture	720,000	648,000	57,600	-	14,400	20,000	19,600
เลขที่ 62/55 9	BANGPLEE-YAI,	BANGPHLI,	13.616282	100.69886	0	0	I	Building	700,000	630,000	56,000	-	14,000	20,000	19,600
เลขที่ 19/6 (ฉ.48	SIPRAYA,	BANGRAK,	13.77354	100.34224	2	0	R	Building	1,170,000	1,053,000	93,600	-	23,400	20,000	19,600
	DINDAENG,	DINDANG,	-	-	0	0	C	Building	362,033,352	241,355,569	-	120,677,783	-	15,000,000	10,000,000
เลขที่ 35/10 หมู่	LADSAWAI,	A.LAMLUKKA,	13.95399	100.68677	2	0	I	Building	1,110,000	999,000	88,800	-	22,200	20,000	19,600

Section 3: Catastrophe Model Outputs

The Catastrophe Modelling Process (Recap)



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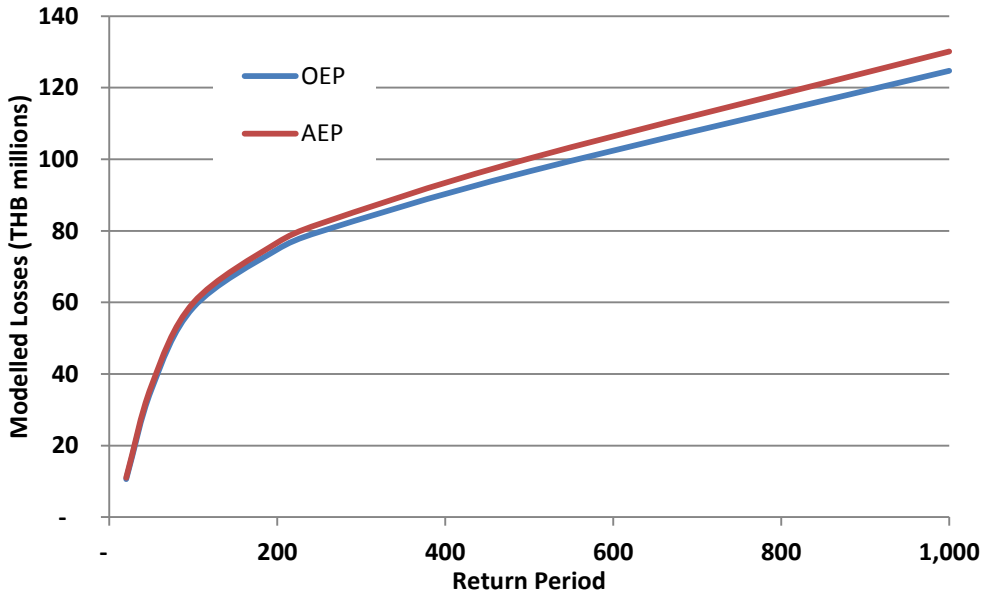
Model Outputs: Exceedance Probability (EP)

THB Million

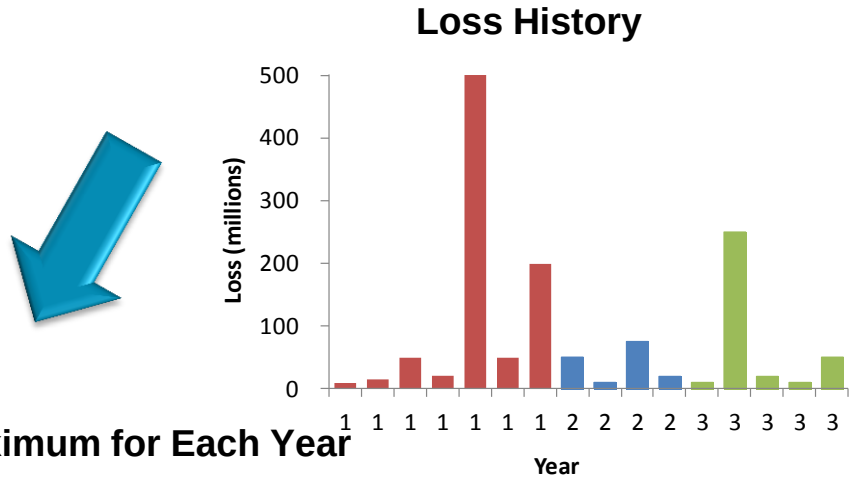
Return Period	Net Loss OEP	Net Loss AEP
1,000	124.7	130.1
500	96.6	100.2
250	**79.7**	**81.9**
200	74.8	76.7
100	58.6	59.9
50	35.6	36.6
20	10.6	11.0
AAL	2.4	2.4
Std Dev	11.3	11.3

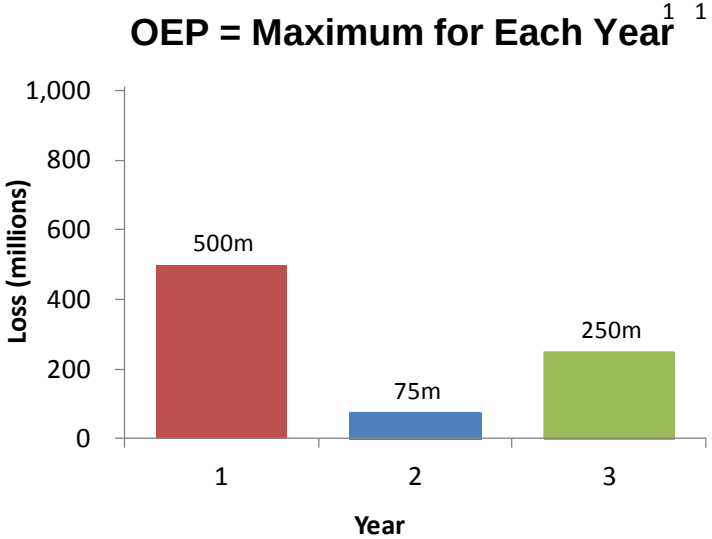


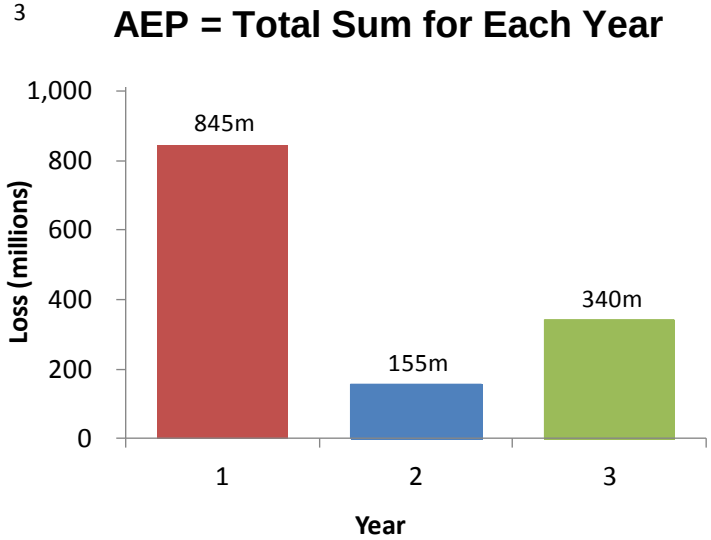
An **Exceedance Probability (EP)** curve is a cumulative probability distribution, showing the likelihood of various return period loss amounts being equalled or exceeded

- **Occurrence Exceedance Probability (OEP) Curve** - shows the annual probability that the losses for at least one occurrence will exceed a certain amount
- **Aggregate Exceedance Probability (AEP) Curve** - shows the probability that aggregate losses in a year (i.e. the sum of all losses from all occurrences in a year) will be greater than a certain amount

Exceedance Probability (EP)







- Probability of activating and exhausting occurrence based contracts
- Assessing single event covers

- Aggregate limits
- Stop loss treaties
- Reinstatements

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Model Output: Annual Average Loss (AAL)

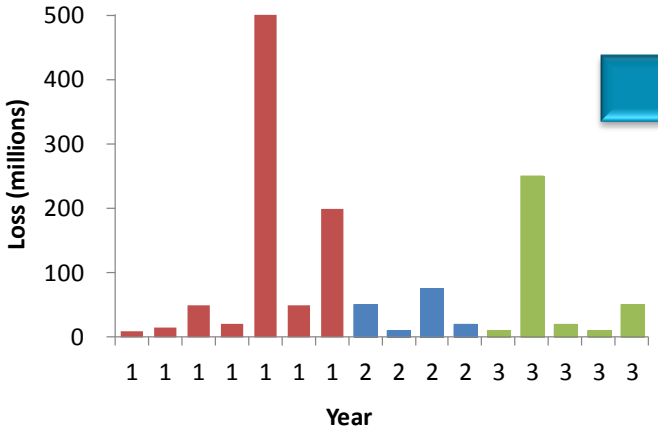
THB millions

Return Period	Net Loss
1,000	9.9
500	7.5
250	**4.2**
200	3.4
100	1.8
50	0.8
20	0.2
AAL	0.1
Std Dev	0.6

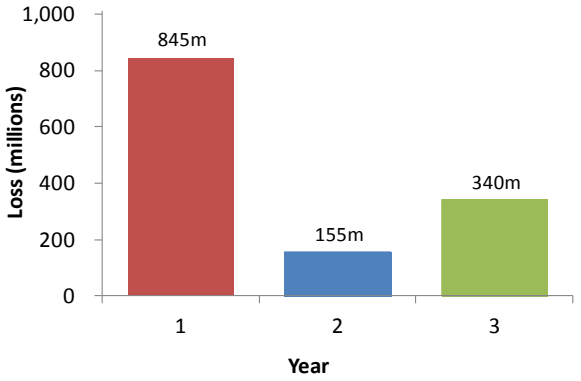
The **Annual Average Loss (AAL),** also referred to as the Pure Premium or Burning Cost, is an estimate of the annual premium needed to cover losses from a modelled peril

- Fundamental for pricing decisions and rating determinations

Loss History



AEP = Total Sum for Each Year



AAL = 447m

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Section 4: Using Model outputs for Reinsurance

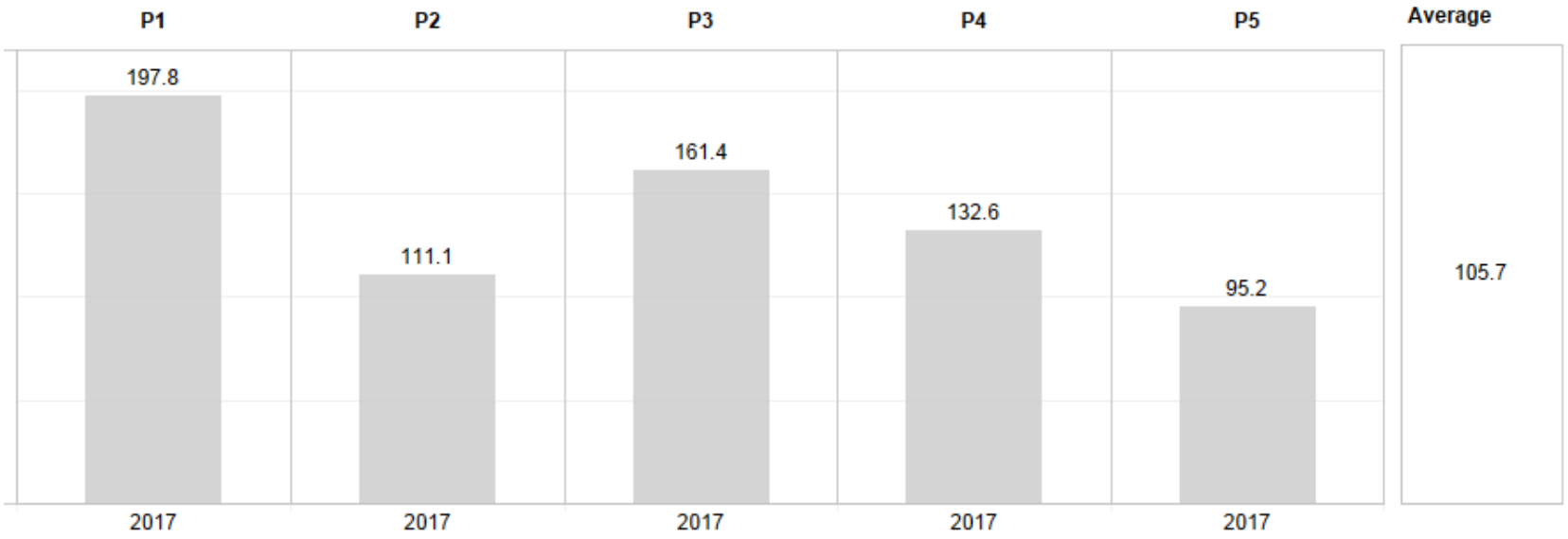
Reinsurance Catastrophe Considerations

Capital Model	Return Period / Peril	Basis
Australia	Greater of: Natural Perils Vertical Requirement (NP VR) # Natural Perils Horizontal Requirement (NP HR) # Other Accumulations Vertical Requirement (OA VR)	NP VR & OA VR - Occurrence NP HR - Aggregate
Bermuda	1:100 TVaR - All Perils	Aggregate
Canada	1:370 - Earthquake	Occurrence
Indonesia	Retention for a 1/250 year cat event	
Japan	Greater of: Return of Kanto equivalent earthquake* Return of equivalent typhoon as Isewan Typhoon*	Occurrence
Lloyd's	RDS an 1-in-200 year all risk estimate within the ICA	Aggregate
New Zealand	Greater of: 1:1000 – Earthquake 1:250 – Non earthquake	Occurrence
Philippines	Min Cat XOL Reins: equivalent to 5% of aggregate net retained insured values against Earthquake, Typhoon and Flood under Zone A or Zone B whichever is higher	
Solvency I	None	N/A
Solvency II	1:200 - All Perils	Aggregate
Taiwan	Greater of: 1:250 – Earthquake 1:100 – Wind	
U.K.	None for ECR; However ICA includes a 1-in-200 year all risk estimate	Aggregate
U.S.	100yr HU & 100yr EQ	Aggregate
A.M. Best BCAR	Greater of: 1:250 – Earthquake 1:100 - Wind	Occurrence
S&P CAR	1:250 - All Perils	Aggregate

NP VR: 1 in 200 year return period loss after allowing for all classes of business, non-modelled perils and potential growth in the insurer's portfolio
NP HR: Three '1 in 10 year' losses or four '1 in 6 year' losses less an allowance for the net premium liability provision which relates to catastrophic losses
* In practice usually modelled as 1:200 earthquake and 1:70 typhoon respectively

From Ground Up Cover – Exhaustion Return Period

The graph below shows the return period of exhaustion of 5 companies in a territory and the average.



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