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Building a Disaster Risk Insurance Programme and the role of Public Private Partnerships

**Table-Top 1 –
Risk Modelling and Analysis –
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Academy

The lifecycle of a Disaster Risk Insurance Programme



Risk Modelling and Analysis - Key Discussion Topics

Key Table-Top Discussion Questions

1

Do you believe you have the necessary data available in your country to design and implement a Public Private Insurance Partnership?

2

Who should be collecting the necessary data in your country and which Agencies and stakeholders can support you ?

3

What type of data do you think is critical for Risk and Resilience decision making, Product Development and Public Private Insurance Partnership operations?

4

If data is not available, would you consider investing in developing a data collection and risk modelling capability?

Risk Modelling Techniques

Risk Modelling consists of 3 key elements:

1. **Hazard:** annual probability of hazard at specific location
2. **Exposure:** scale and exposure of exposed locations
3. **Vulnerability:** fragility of exposed assets to the level of hazard

Catastrophe Models:

Calculate the probability of the hazard using historical data & climate change models. These provide a large number of scenarios e.g. 10,000 from which various metrics can be calculated such as the **Average Annual Loss** and various **return periods**.

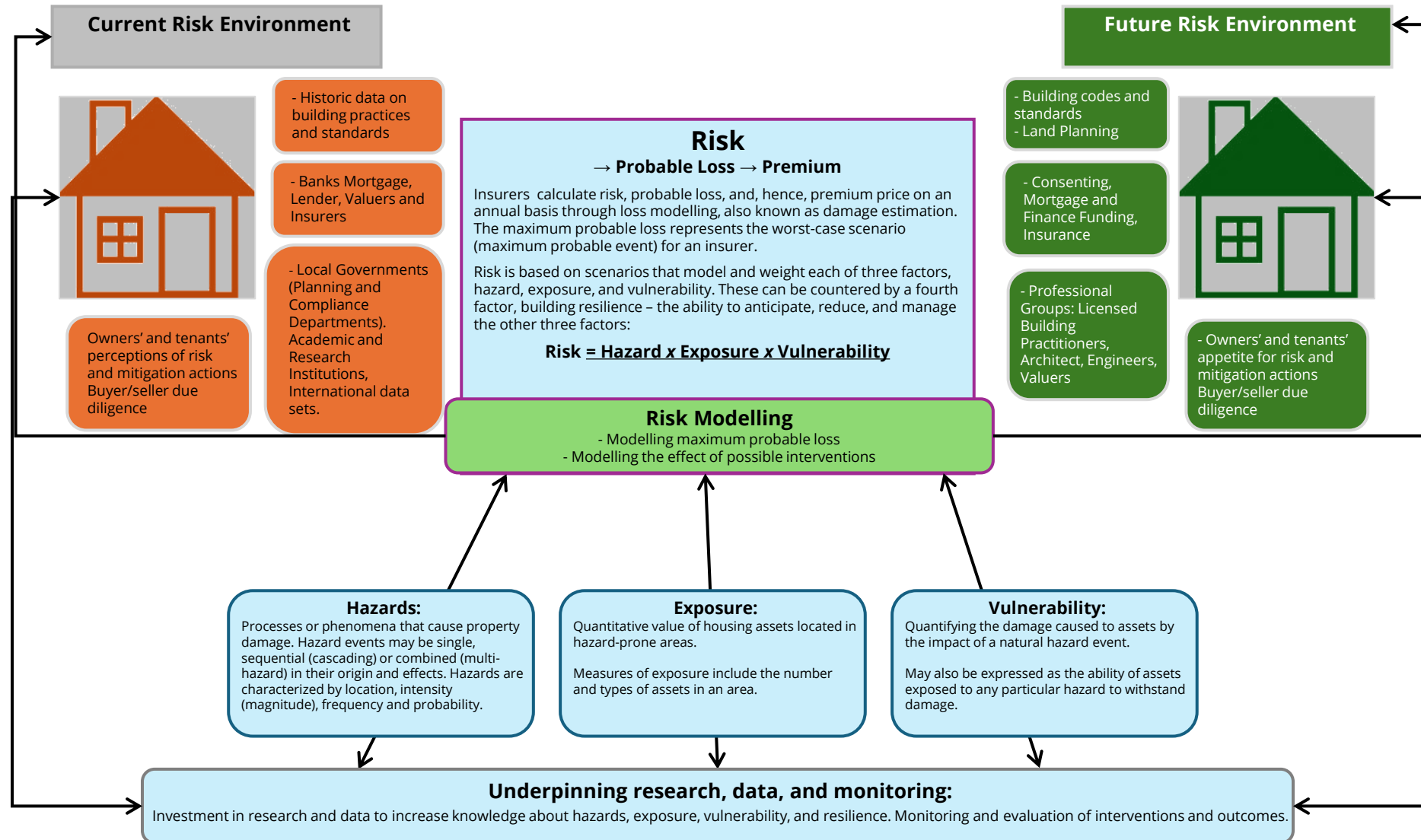
Data can come from many sources and be aggregated to develop a Risk Profile:

- Satellite remote sensing.
- Weather data – automatic weather stations and synthetic weather data sets
- Drones (Operator, Beyond Visual Line of Sight (BVLOS), Autonomous)
- Geographic Information Systems (GIS) software with analytical capabilities (risk location, risk accumulation, risk analysis and portfolio monitoring).

Existing Data sets such as:

- Tropical Cyclone: International Best Track Archive for Climate Stewardship (IBTrACS) – NOAA
 - National Centers for Environmental Information
 - Academic and research institutions
 - Earthquake: United States Geological Survey (USGS) ShakeMap
 - Population data: Gridded Population of the World v4 – various sources inc. Pacific Environment Data Portal, NASA
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Risk Modelling is key to understanding current and future risk



Risk Modelling and Analysis



Exposure
Information



Event Set



Hazard Module



Vulnerability
Module



Financial Module

Catastrophe models typically produce two types of loss results



Historic Scenario Results

- The model runs a single event against a given portfolio
- A single result is produced rather than a probabilistic result
- Useful for benchmarking against actual events where insurers have loss data



Exceedance Probability Results

- Models produce losses which have a corresponding exceedance probability
- This is the probability that in any one year a loss of a specific size will be equalled or exceeded
- Produced on an annual occurrence or annual aggregate basis in the form of a return period
- Annual occurrence – probability of a single event producing a loss of a certain size
- Annual aggregate – probability of having an aggregate loss of a certain size over the course of a year (multiple events)

Exposure Information

High resolution location-specific data



Site information

- Sums insured
- Geographic location
- Geospatial coverage



Coverage type

- Buildings / Contents / Business Interruption



Primary modifiers

- Detailed occupancy
- Detailed construction
- Year built
- Number of stories



Secondary modifiers and Financial information (site and policy deductibles)

Event Set

Event size / frequency



Historical event catalogues on their own can be insufficient for modelling

- Very low numbers of events
- Incomplete records
- Short period of instrument recording

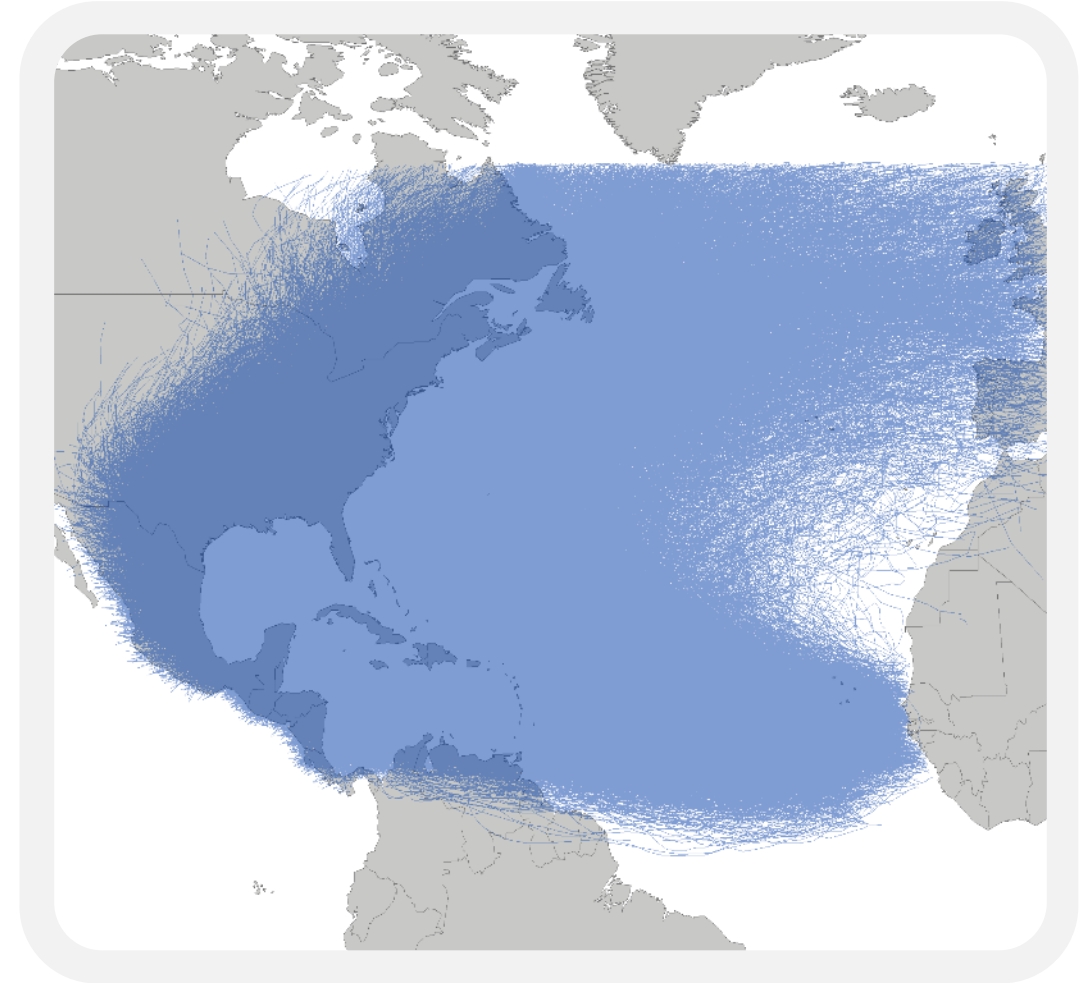


Statistical methods are used to create simulated event sets

- Use historical events
- Take initial conditions and alter parameters to simulate many unique events
- 1000's of stochastic events created and simulated randomly



Simulated event sets represent a more complete view of hazard, including extreme events which may not yet have been recorded

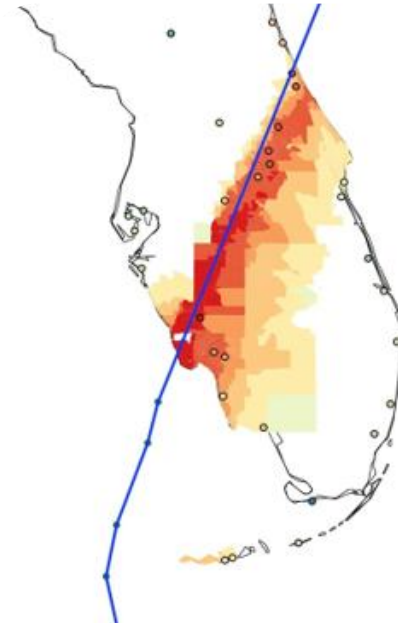
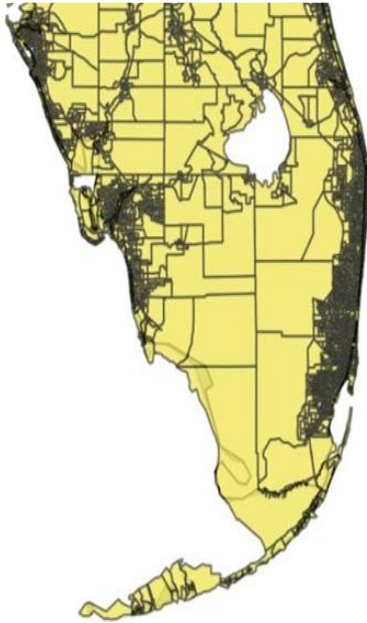


Hazard Module

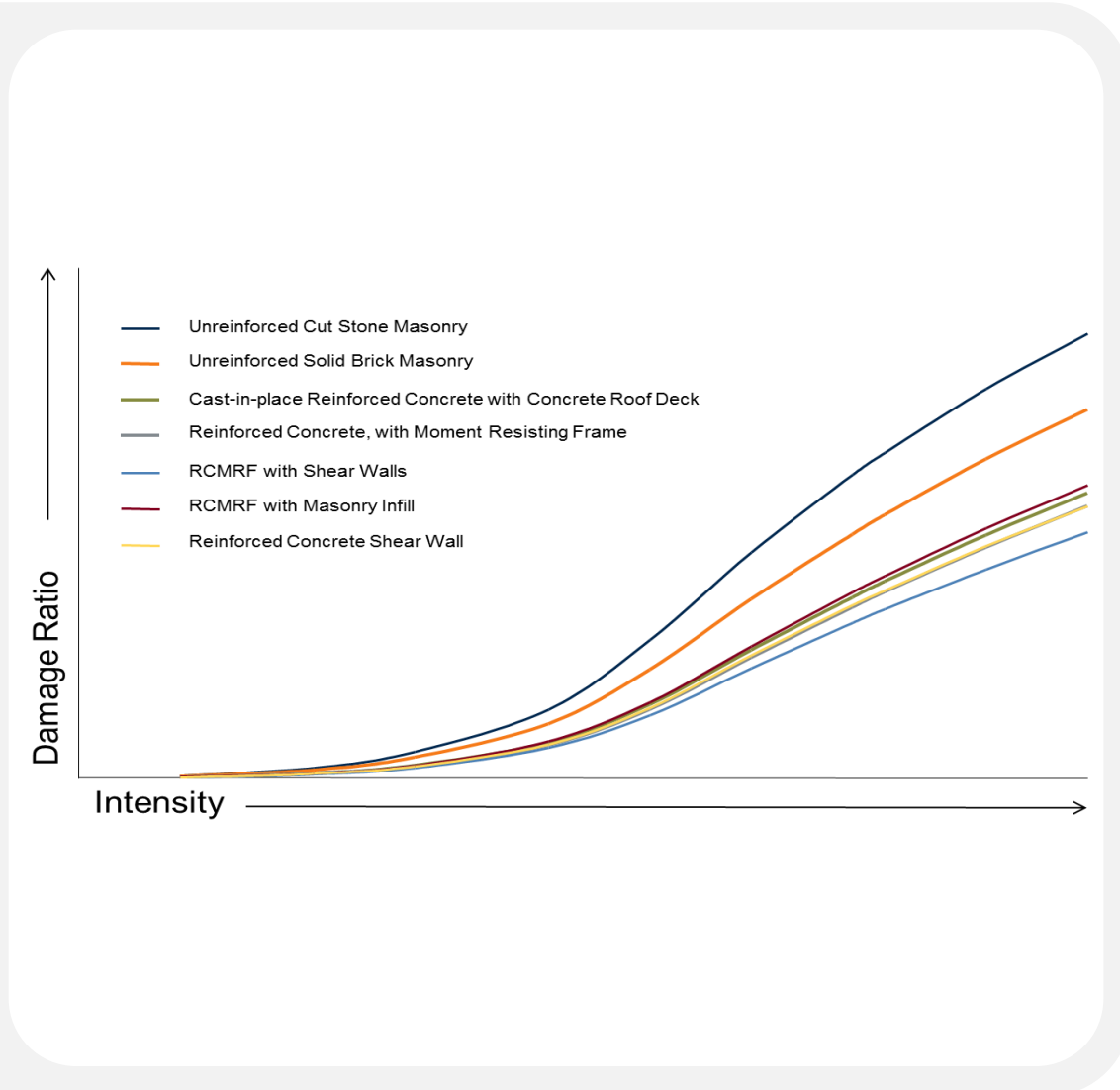


Information of the physical hazard in a specific geographical area.

For hurricanes, a model calculates the strength of the winds around a storm, considering the surface roughness or terrain and the built environment (see right)





Vulnerability Module




The amount of loss depends on the characteristics of the risk:

 Construction type

 Occupancy type

 Roof type

 Number of stories

Vulnerability assesses how much damage will occur to the exposed property

Vulnerability assessment largely uses engineering studies to inform how a building will behave following an event, including the use of past observations

Financial Module



Exceedance Probability (EP) Results

- Losses can be viewed in an EP curve (below) or in a Return Period (RP) format
- The RP format is another way of expressing probability and should not be taken literally

Average Annual Loss (AAL)

- The expected value of the aggregate loss distribution
- Premium needs to cover loss from a peril over time
- Losses from any given year will be higher/lower than AAL



Standard Deviation (uncertainty)

- Measurement of uncertainty around the mean loss

