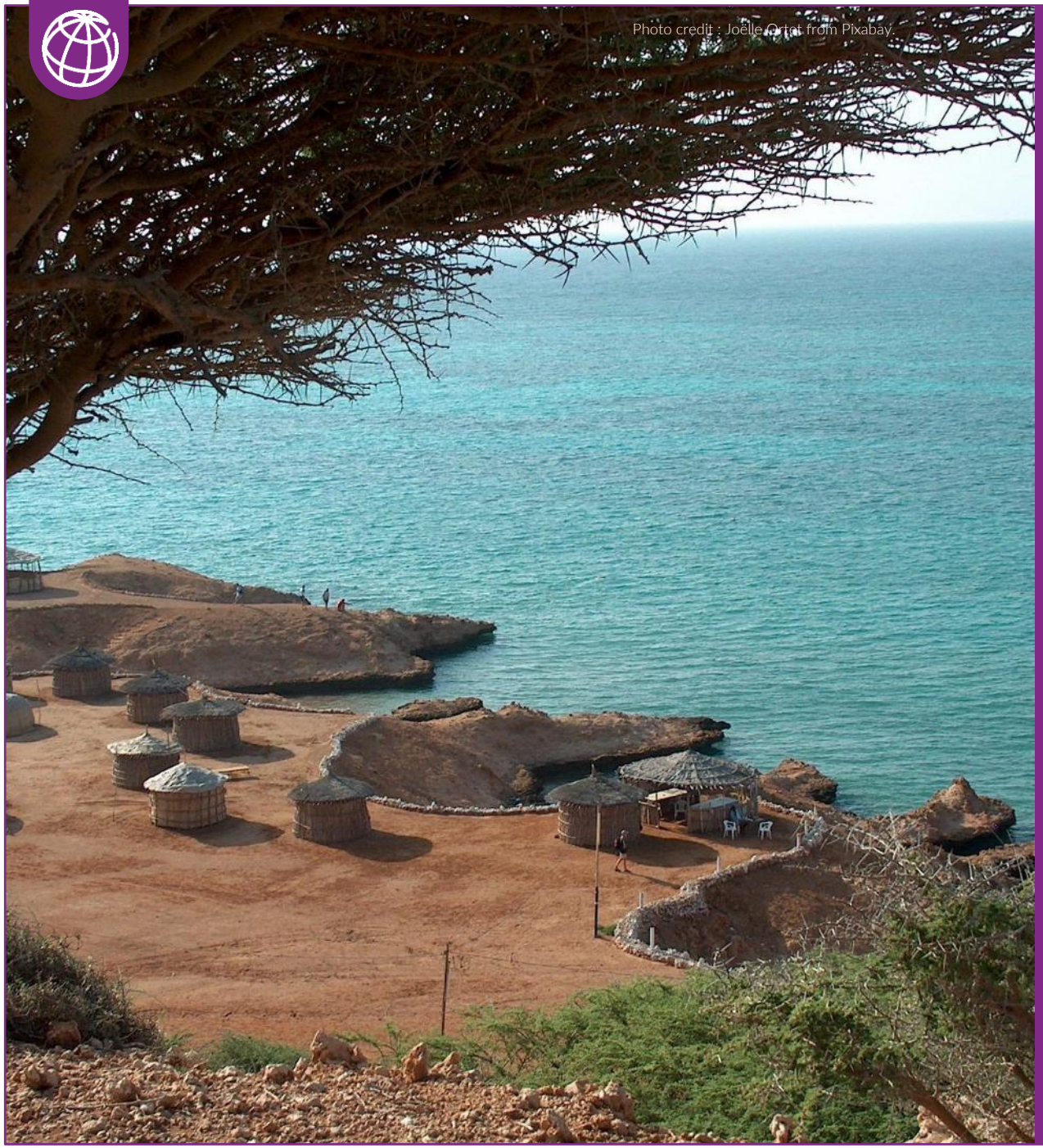


# Building a Disaster Risk Insurance Programme and the role of Public Private Partnerships

## Table-Top 1 – Risk Modelling and Analysis – John Luke Plevin and Atilla Zorkirişci

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# 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**.

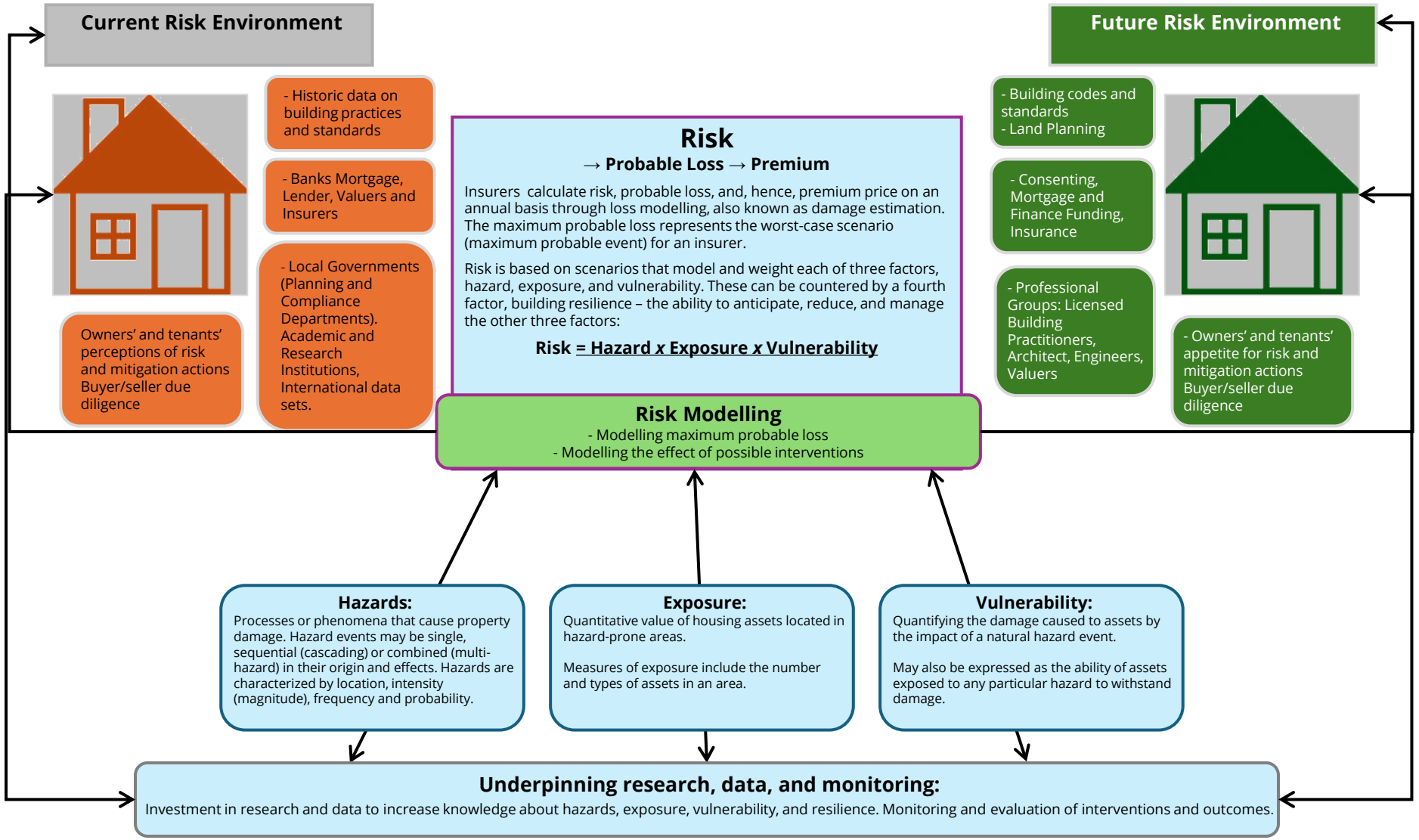
## Data can come from many sources and be aggregated to develop a Risk Profile:

- 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

# 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

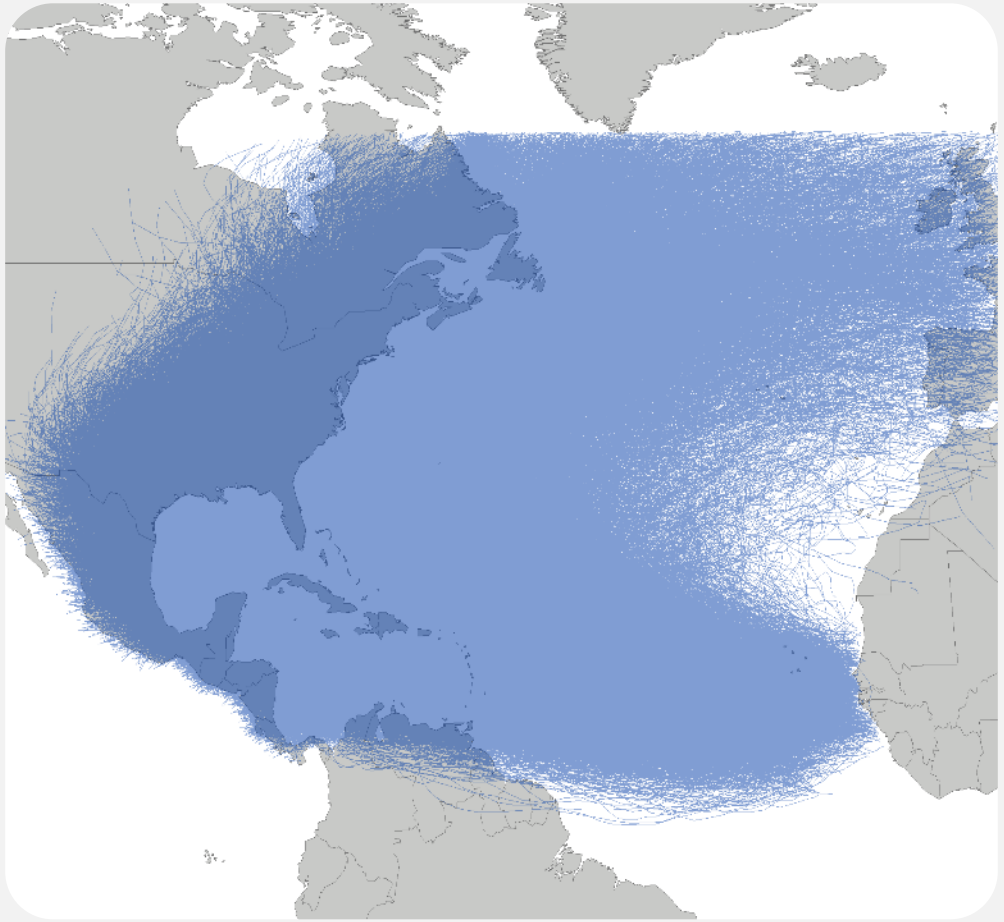
**Historical event catalogues on their own can be insufficient for modelling**

- 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 simulated many unique events
- 1000's of stochastic events created and simulated randomly

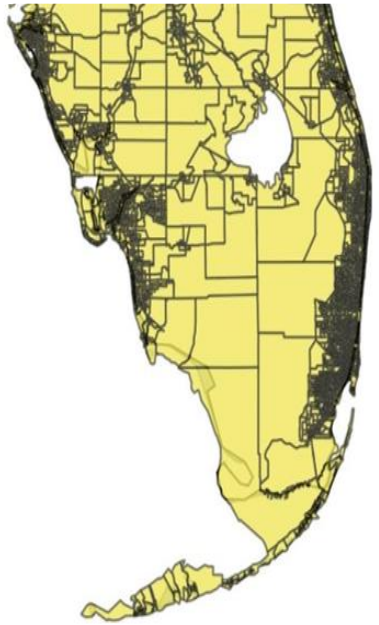
**Simulated event sets represent a more complete view of hazard, including extreme events which may not yet have been recorded**

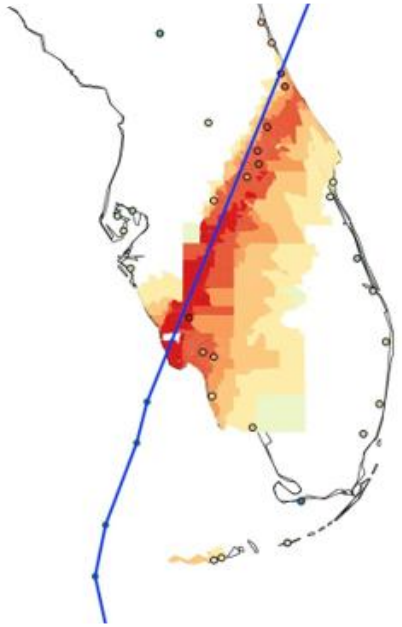


# Hazard Module

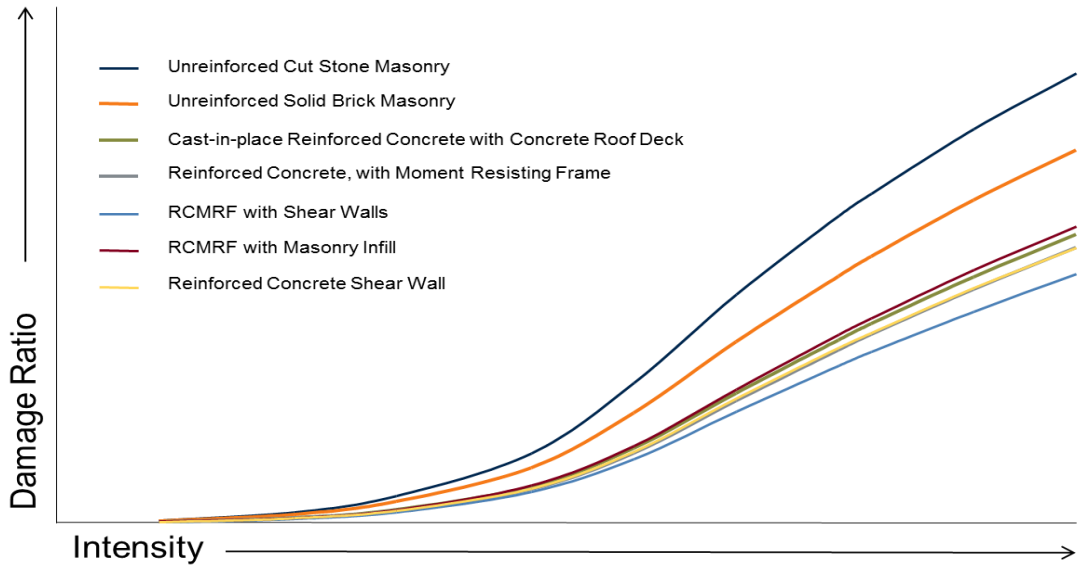
**Information of the physical hazard in a specific geographical area.**

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