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Open Source v Proprietary Catastrophe Models

Robert Muir-Wood

Chief Research Officer,

Risk Management Solutions

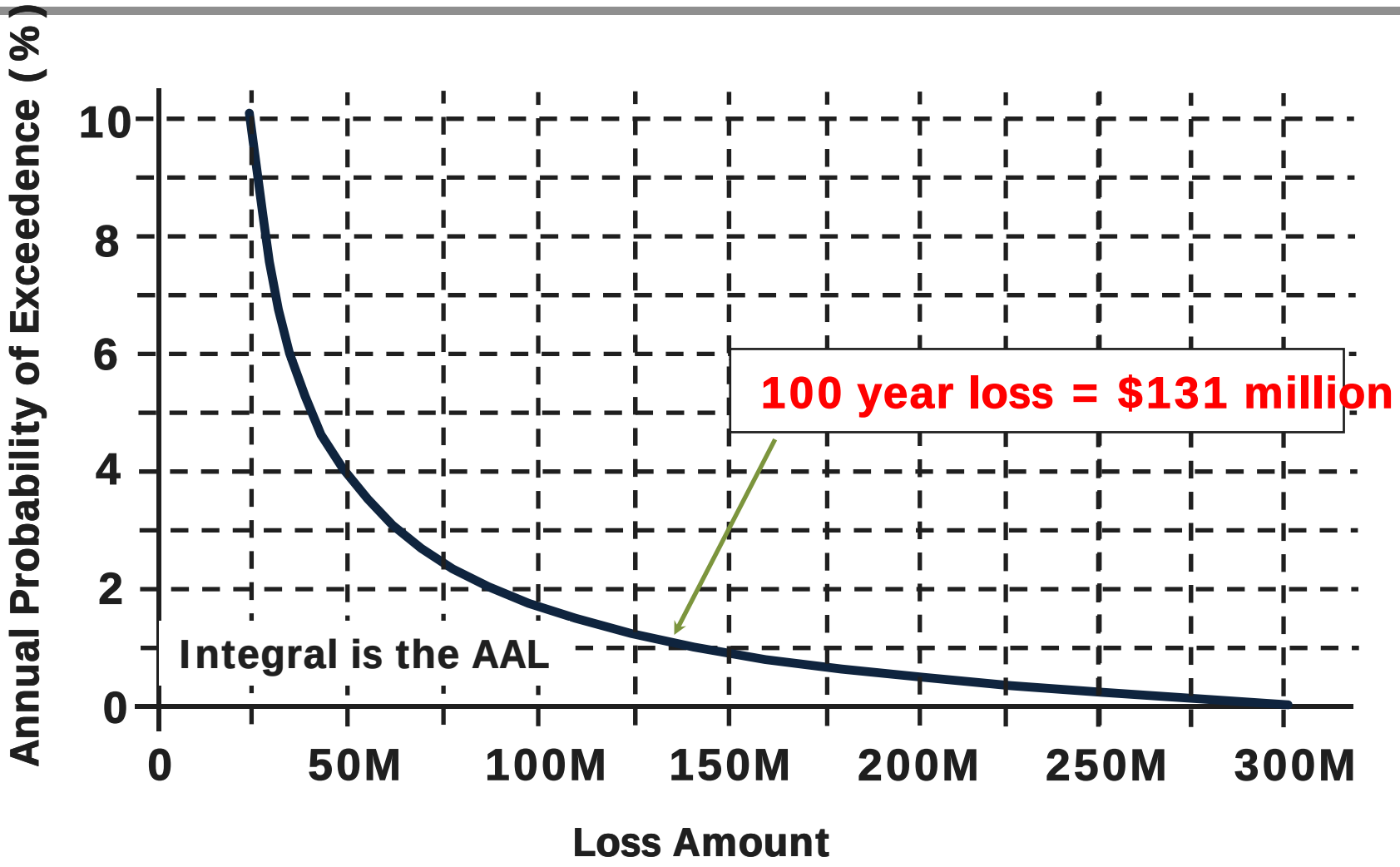
The insurance problem

The universal grammar of Catastrophe Modeling

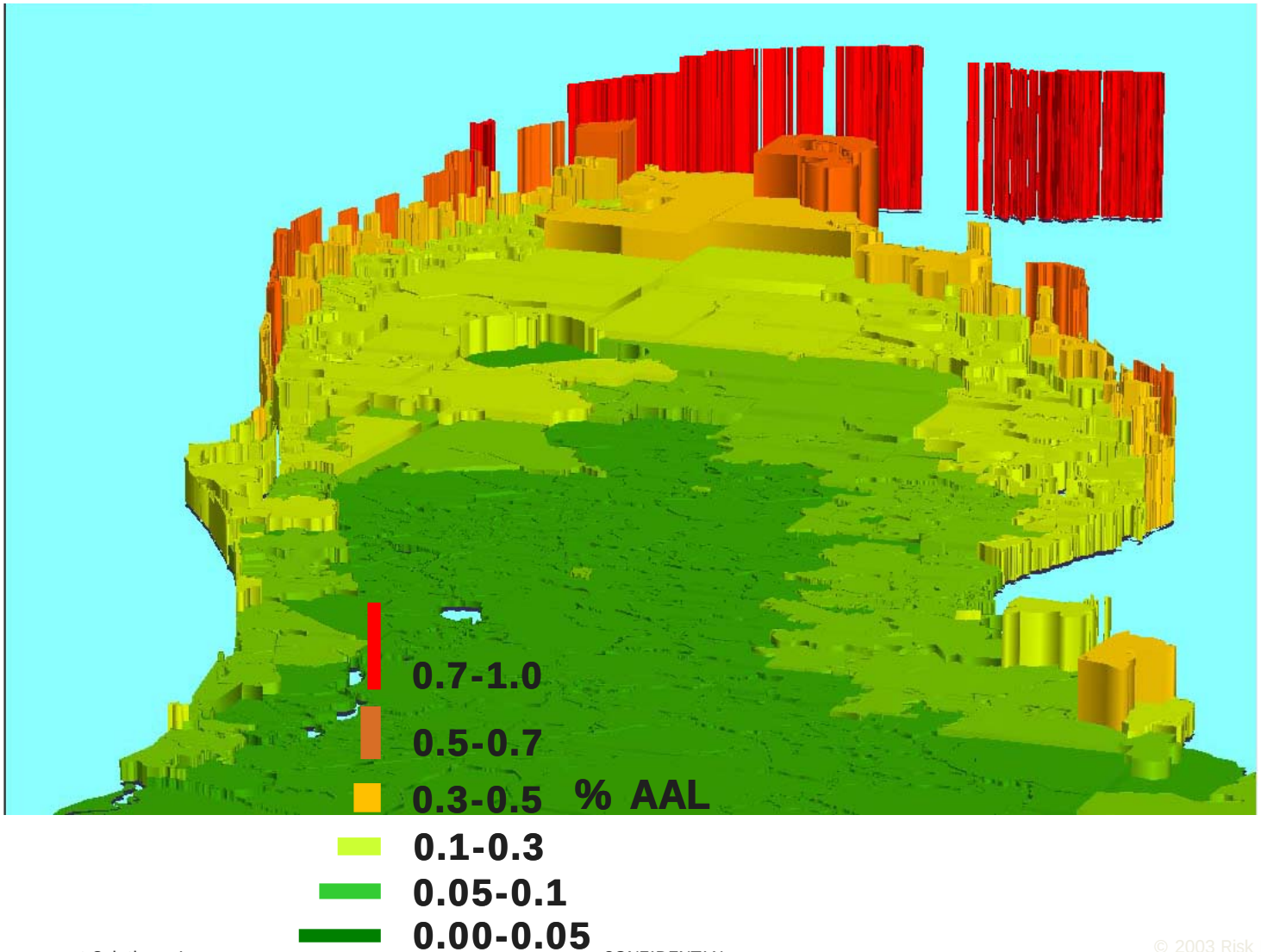
Adjective	Noun	Verb	Adverb / Adjective	Object

The strong earthquake seriously damaged the unreinforced hotel

Exceedance Probability (EP) Output



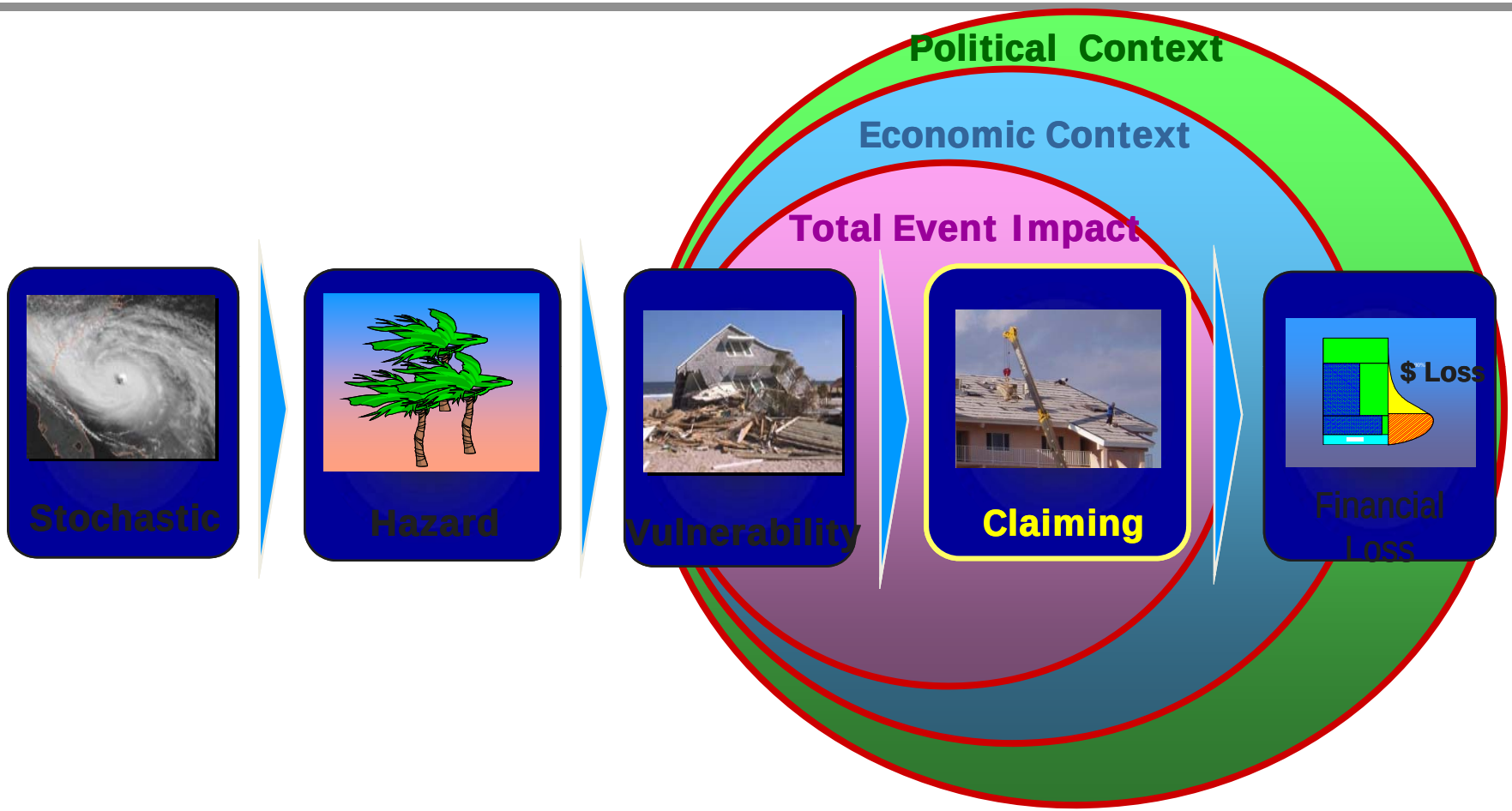
The 'reality' of Risk - Residential Woodframe Loss Cost – Florida



Some other risk 'realities'

- Related 'topographies':
  - The risk cost for each relevant property/insured type
  - The risk cost including all secondary perils and consequences
  - The loss tail at each location (for each risk category)
- Correlation structure (web linking every point with every other point)
  - Probability for level of loss affecting two locations in the same event
  - Becomes highly multi-dimensional when considering multiple locations

Post-event loss amplification - In major Catastrophes loss does not occur in isolation

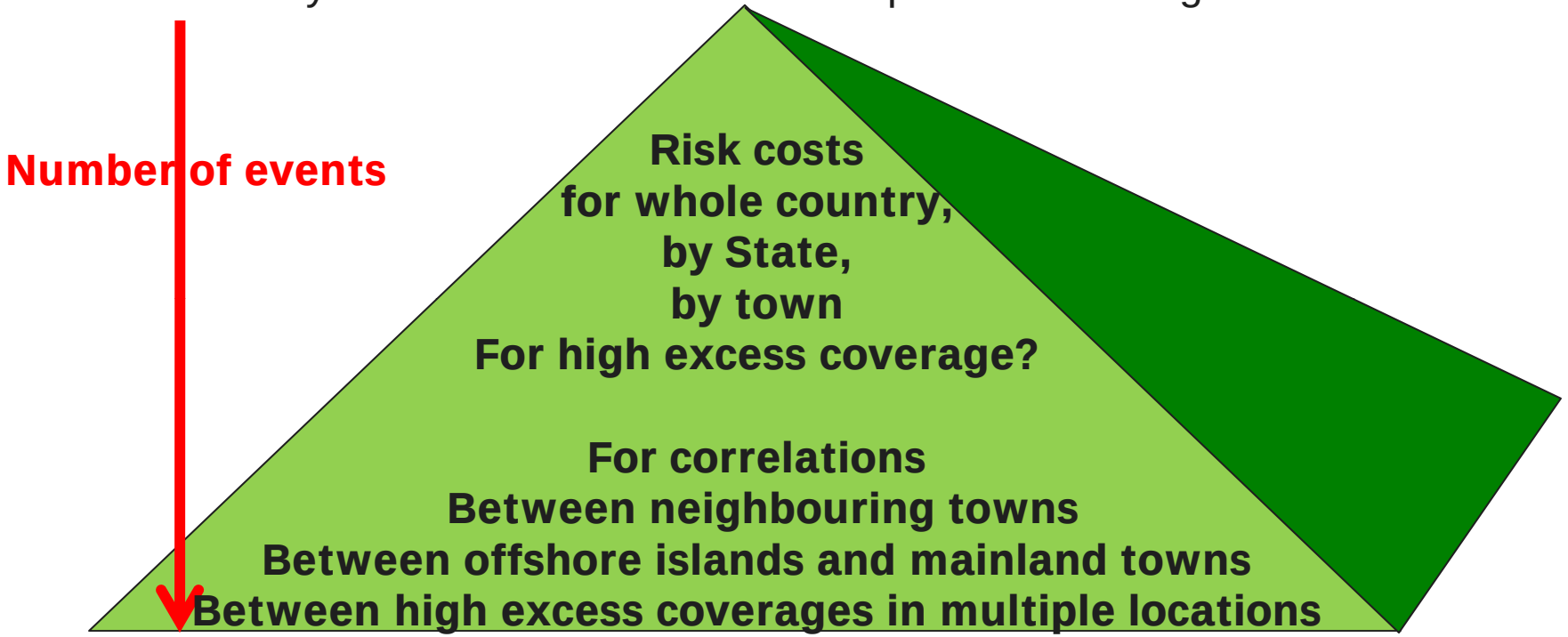


Aleatoric Exposure Uncertainty

Bolivar Peninsular, Texas after 2008 Hurricane Ike

How much convergence is required to get the absolute measure of risk?

- How many hurricanes of all sizes are required to converge on:



- We can never hope to accomplish all the different convergence challenges,
- However in each model upgrade we hope to push the frontier of convergence deeper

Why don't Universities teach Cat Modelling?*

* **Only course is at NTU Singapore run by RMS modelers**

What are the obstacles to the broader University education in catastrophe modeling?

- Requires:
  - Working across University departments
  - Challenging scientists to behave like engineers
  - Challenging engineers to think like scientists
  - Science-literate data-sceptical statisticians
- Historical data sets are generally incomplete and incoherent
- High quality claims data are hard to obtain for developing vulnerabilities (outside working inside insurance companies)
- Requires a clear end-user of the model and its outputs

What do proprietary Cat modelers do that is difficult?

- Manage teams of top ex-academic expert (egos), from a diverse range of fields, into a single coherent team
- Ensure consistency among all model elements
- Model compression and convergence
- Capture and output uncertainty
- High performance business computing environments
- Model ownership, upgrades, bug fixes, servicing, 24/7 technical and software support
- Real time catastrophe response

RMS has c 80 scientist/engineer modelers and 120 software developers, with a delivery platform containing c 2 million lines of code

The key to industrial strength Cat modeling

- Calibration! Calibration! Calibration!
  - Surface roughness model
  - Filling model
  - Locational windspeed hazard RPs
  - Vulnerability (each coverage)
  - Historical event reconstructions
  - Historical loss return periods
  - Correlation
  - Clustering

Building a Cat model is easy – it is building a model in which every component is calibrated that is the challenge

Open Source

- Open source procedures work well for widely-used software applications
  - Requires many developers in the field
  - A shared and consistent understanding of user needs
- Can ‘open source’ work where this requires the integration of different disciplines of scientific knowledge and statistics?
- GEM will be an interesting test case
  - Develop single perspective or show knowledge uncertainty?
  - Building models with teams scattered around the world is very inefficient

RMS has sponsored Open Source Cat modeling meetings to inspire a broader-based community of Cat modelers

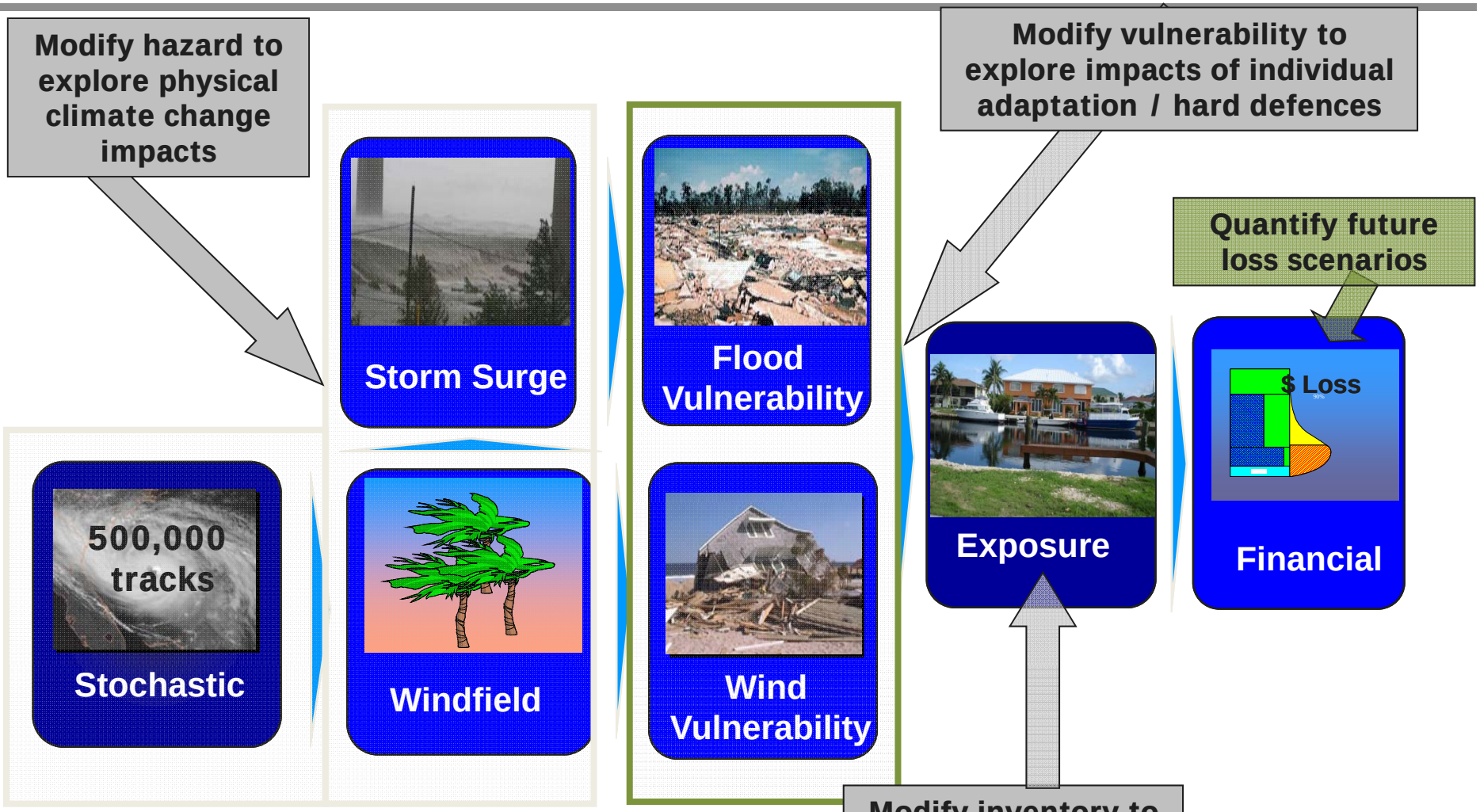
Industrial-strength Cat models

- Insurers, their investors, insurance regulators, rely on cat models to determine capital adequacy (and hence solvency) of insurance companies
- This is a regulatory function – important that the model has been tested and assured for this capability
- There is also an enormous diversity of complex financial structures in risk transfer
- And model users are increasingly interested in seeing uncertainty revealed and even priced
- However Cat modelers build models where they perceive there is a pre-existing, or nascent, insurance market
- And there remain significant gaps in coverage

The 'Black Box' accusation

- RMS does considerable research on how to develop better Catastrophe models
- We publish scientific papers on many aspects of our research
- We work on global initiatives – such as IPCC authorship
- Our models have a very open architecture so that model users can access the underlying databases of hazard and vulnerability
- And we are completely open with clients about what is in the models and how they have been calibrated
- However we remain in a commercially competitive marketplace

A window into future impacts: cat models as a tool to explore impacts and benefits of adaptation



e.g. future coastal flood risk

Simple v Proprietary Cat models

- Simple cat models provide an environment for exploring risk
- However full risk quantification, and the development of critical risk metrics, require an integrated team under a coherent management
- Could be either in the private or public sector (but may be harder to sustain long term in the public sector)
- The Open Source community should focus on developing standard entry-level Cat models
- And deliver full models for countries where no high quality Catastrophe risk models are yet available – eg.
  - Flood/wind typhoon Vietnam
  - Flood Jakarta and Bangkok
  - Volcano - Java