Disaster Risk Assessment and Stratification Using the Hybrid Loss Exceedance Curve

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ERN-AL

RISK MANAGEMENT

Disaster risk management involves four different components or policies:

a) *Risk identification (comprises risk understanding, acknowledgement, perception and assessment);*

b) *Risk reduction (encompasses the prevention and mitigation themselves);*

c) *Risk financing (that is related to loss retention and transfer for financial protection); and*

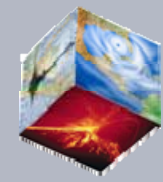
d) *Disaster management (that includes preparedness, emergency response, recovery and reconstruction).*

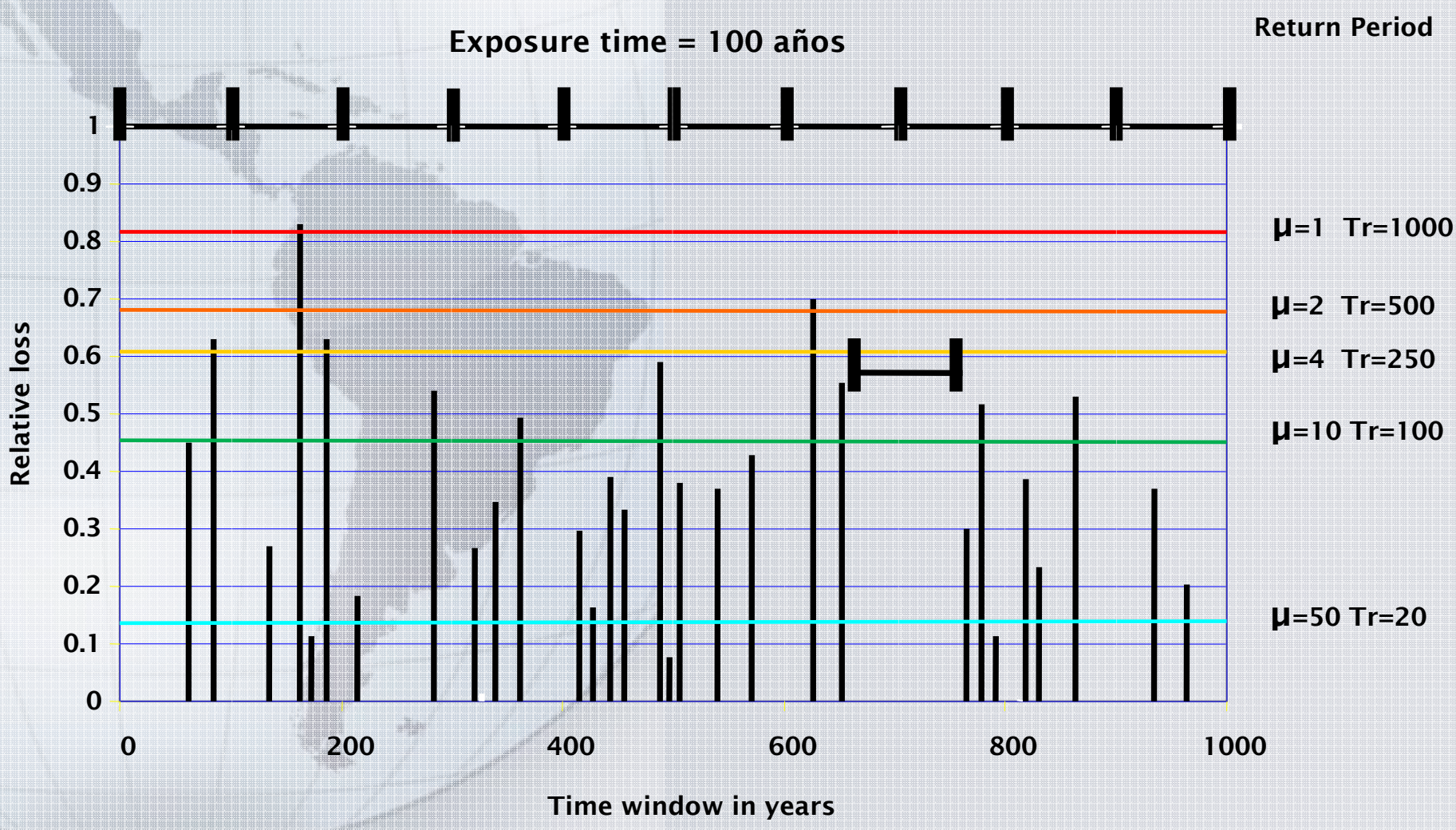
RISK MANAGEMENT

- *Needs risk assessment, and risk sizing signifies to evaluate the expected physical damage -victims and economic equivalent loss- as well as social, environmental and governance drivers.*
- *The causes and factors of risk must be identified in order to be able to assess the effectiveness of both corrective and prospective vulnerability / risk reduction measures.*
- *The follow-up of risk is an unavoidable step to evaluate the performance of disaster risk management and climate change adaptation.*

Probabilistic Risk Assessment

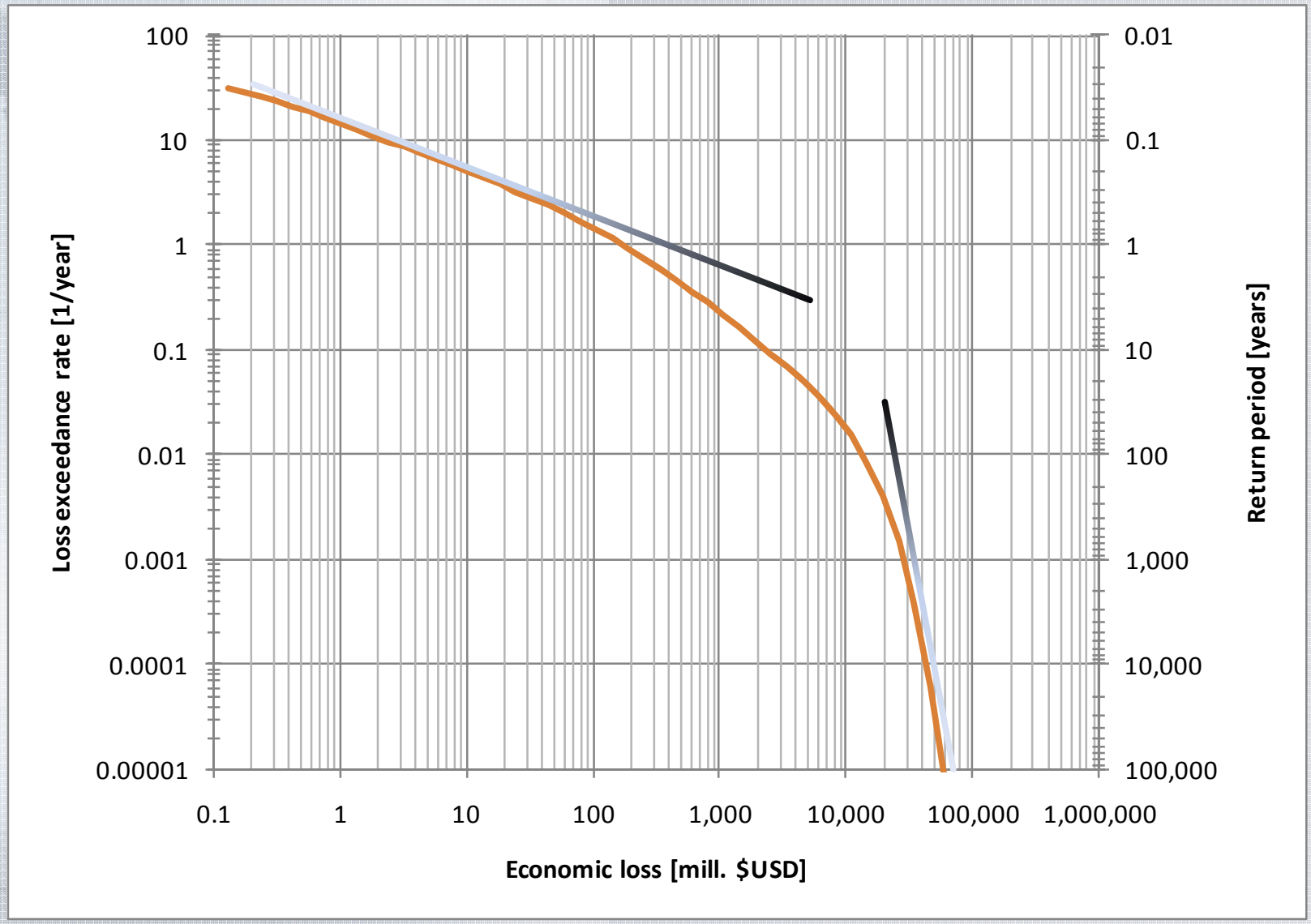
Concept of return period or exceedance annual rate





Loss Exceedance Curve

- *Correlates event frequency with expected economic loss*



Small disasters are local and frequent events with notable accumulated social effects

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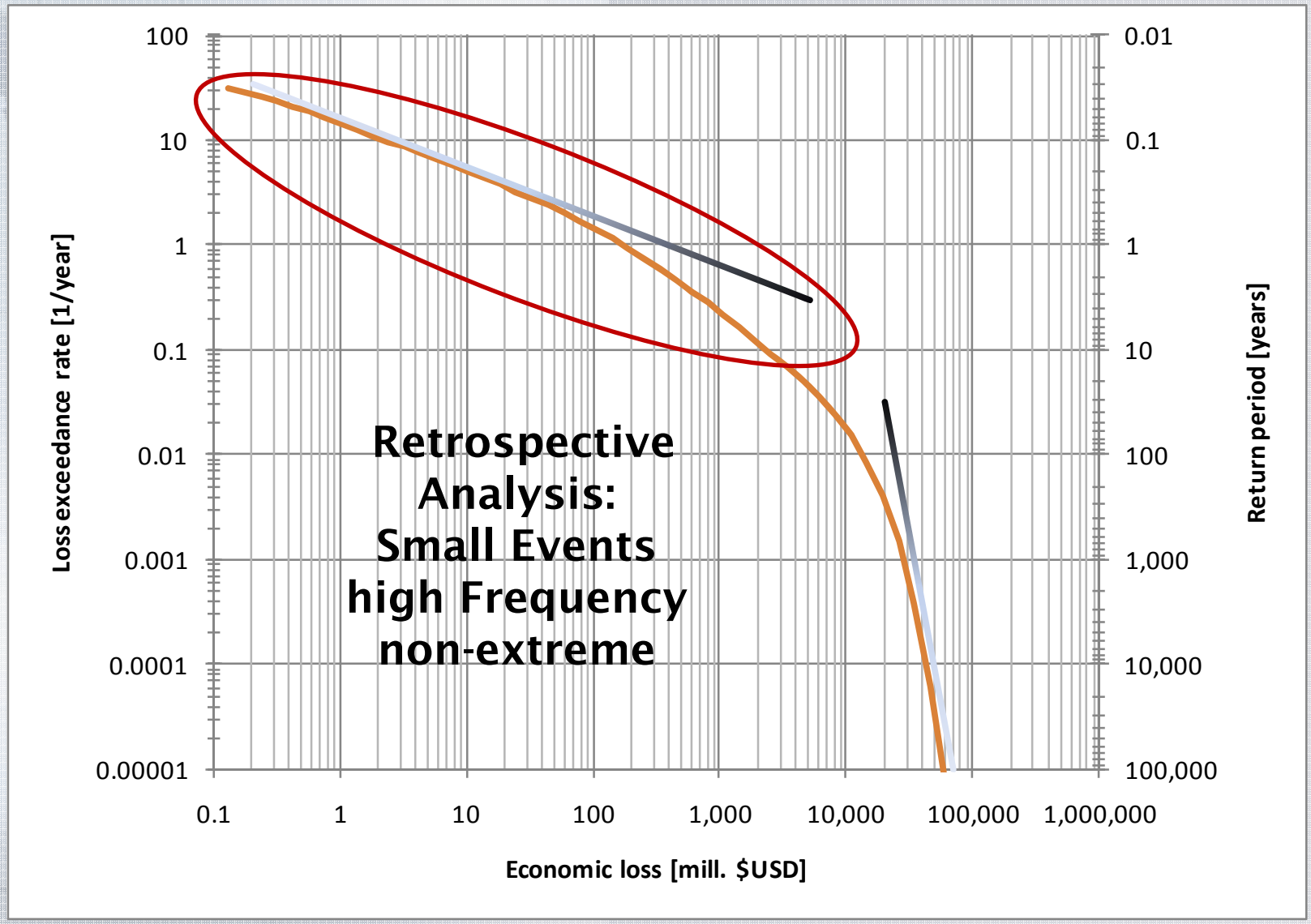
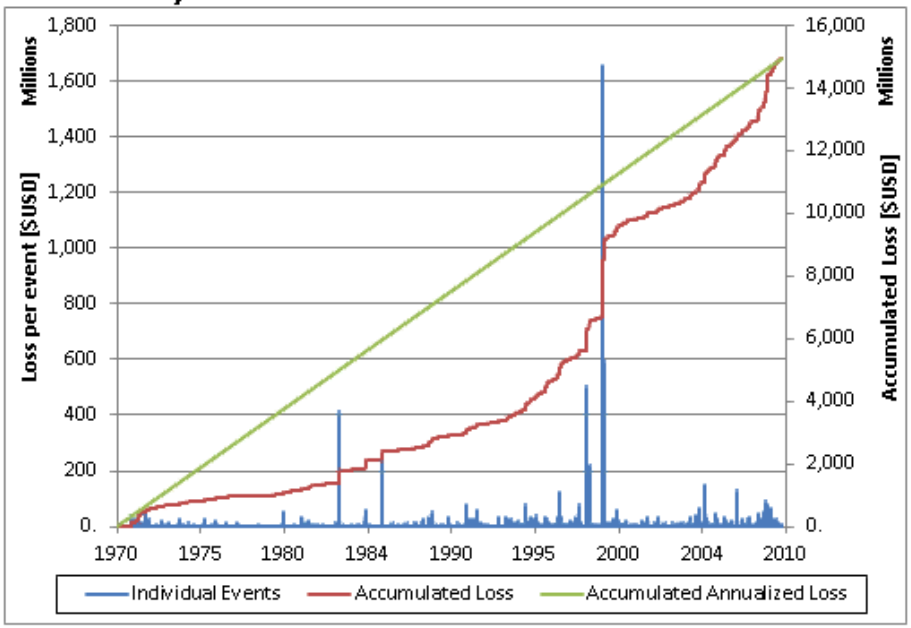


Extensive and Intensive Risk Assessment

Proposal of a "Hybrid" Loss Exceedance Curve (Cardona 2010)

Hystorical Events Losses and Accumulated Loss



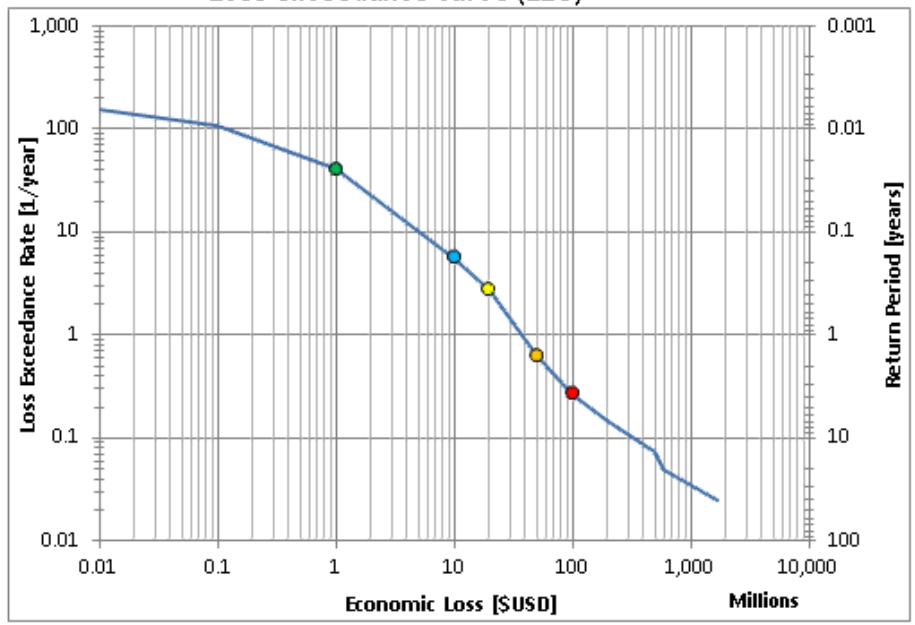
New Event	10/5/2009
Category	Hidrometereologicos
Affectation	
Physical	
Damaged houses	779
Destroyed houses	0
Human	
Injured	0
Killed	0
Economical loss	6,232,400

Time frame	
	years
	41
Accumulated loss	
	million USD
	14,956
Anual Average Loss	
	million USD
	367

Loss exceedance frequency

Economic loss [USD]	Events Number	frequency [times/year]	Period [years]
≥ 10,000	6346	155.612	0.006
≥ 100,000	4487	110.027	0.009
≥ 1,000,000	1673	41.024	0.024
≥ 10,000,000	231	5.664	0.177
≥ 20,000,000	111	2.722	0.367
≥ 50,000,000	26	0.638	2
≥ 100,000,000	11	0.270	4
≥ 200,000,000	6	0.147	7
≥ 500,000,000	3	0.074	14
≥ 590,000,000	2	0.049	20
≥ 1,657,650,000	1	0.025	41

Loss exceedance curve (LEC)



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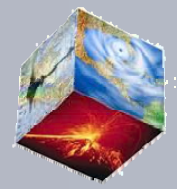

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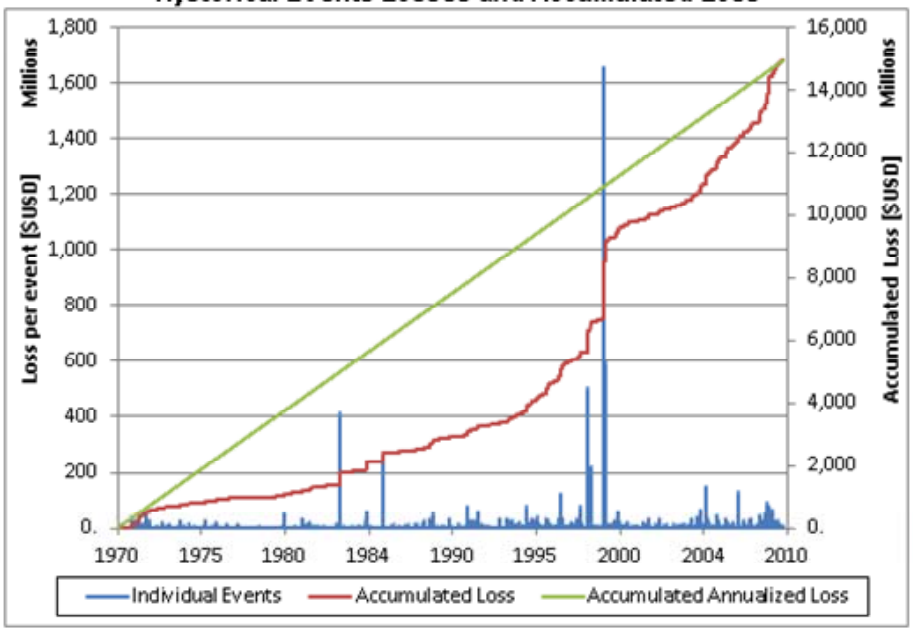

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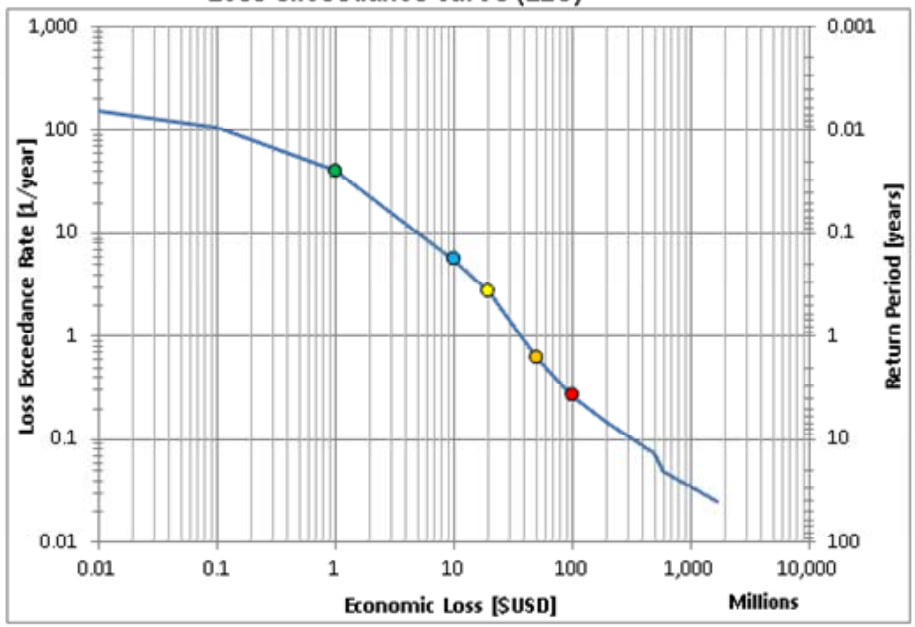
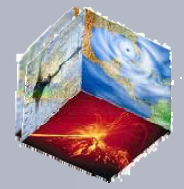
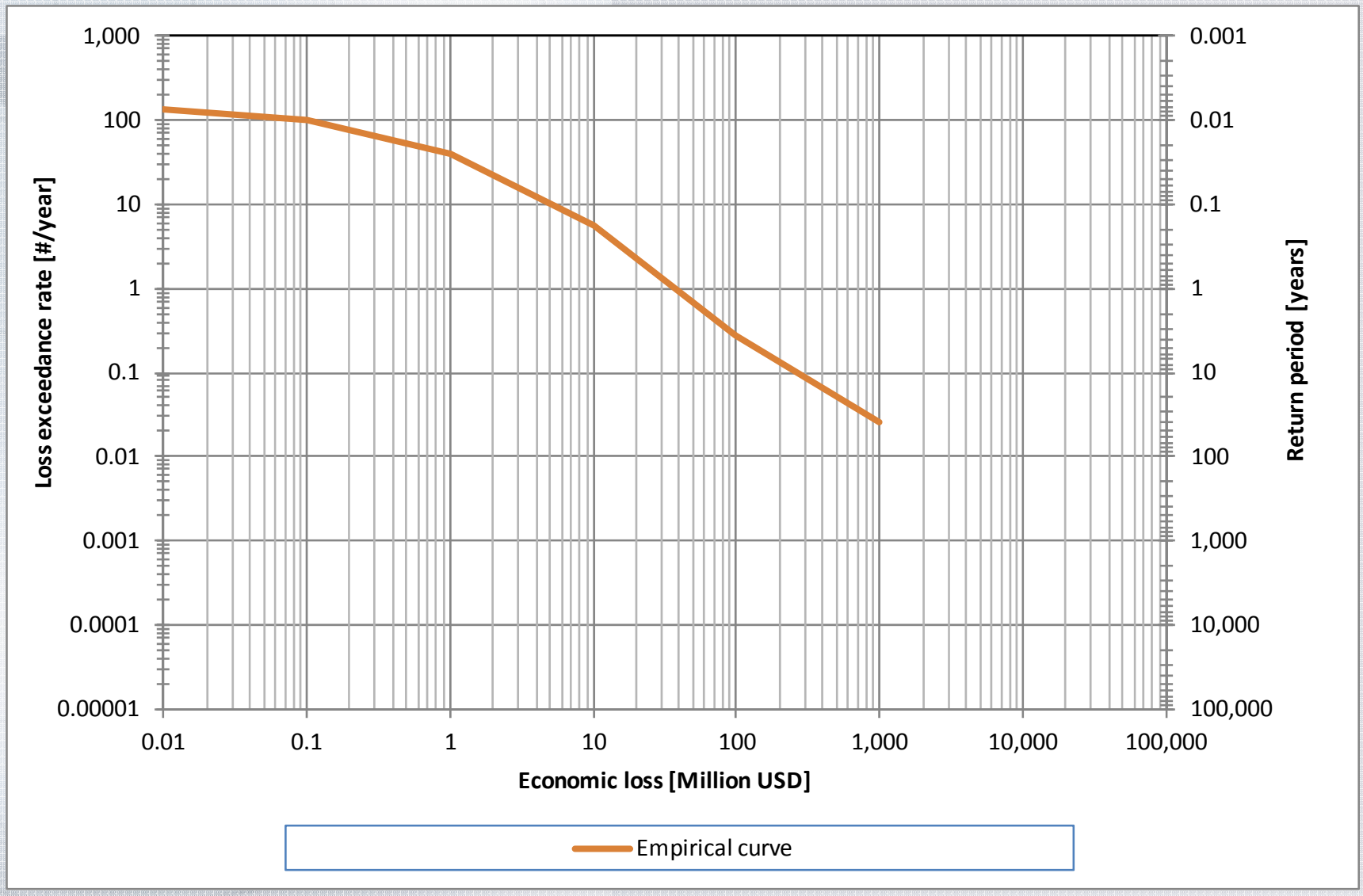


Extensive and Intensive Risk Assessment

Proposal of a “Hybrid” Loss Exceedance





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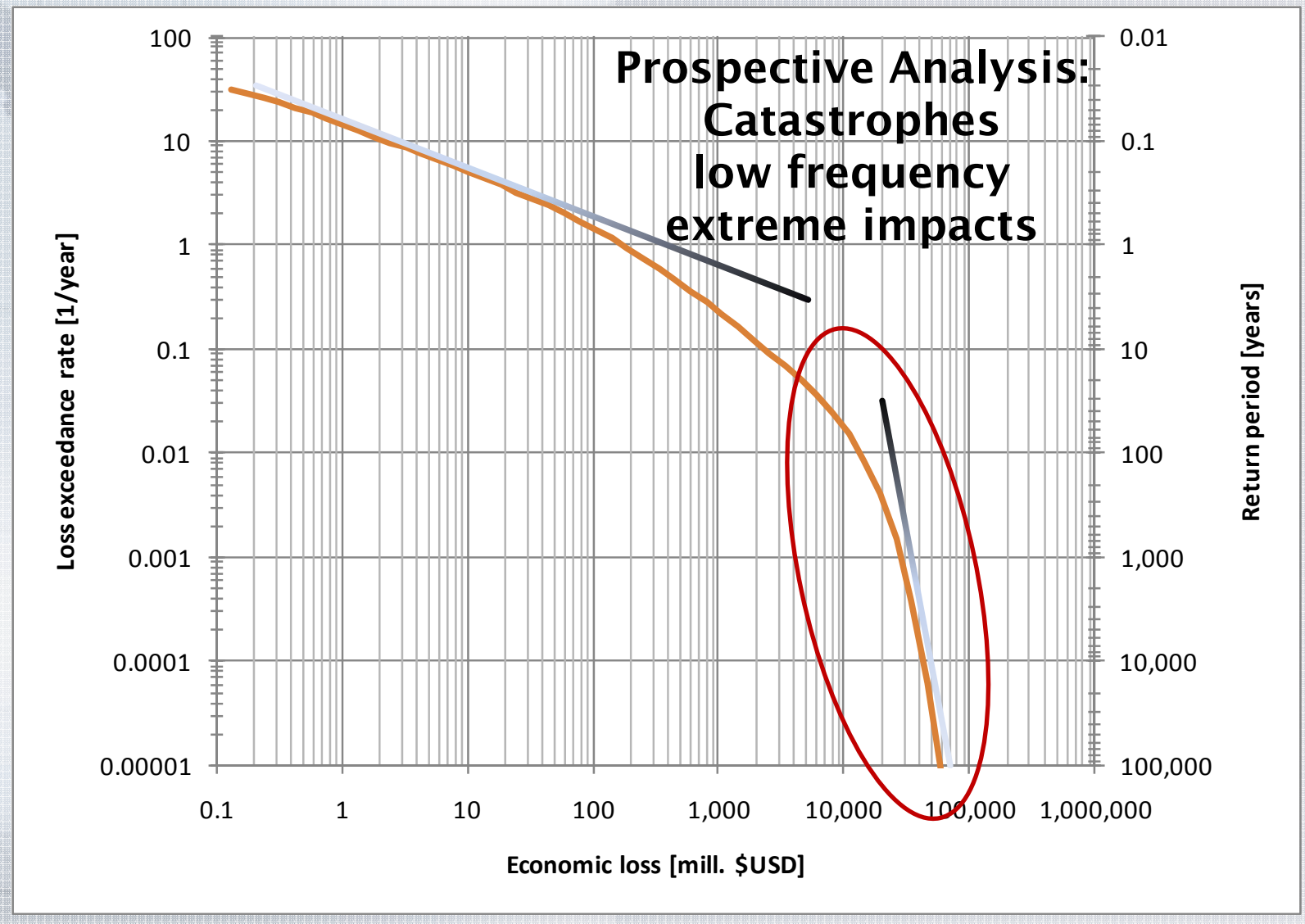
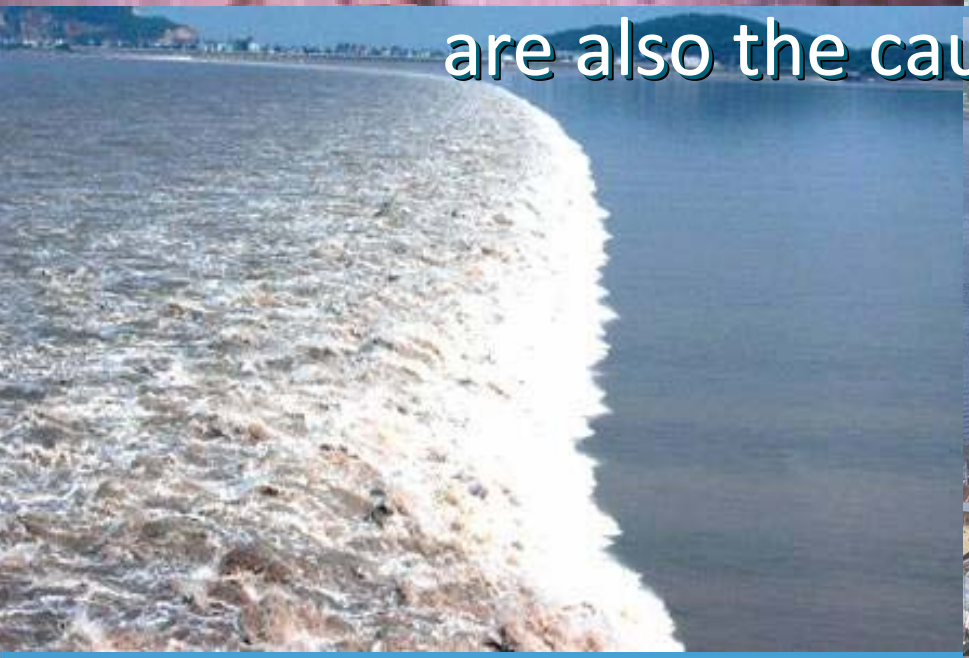
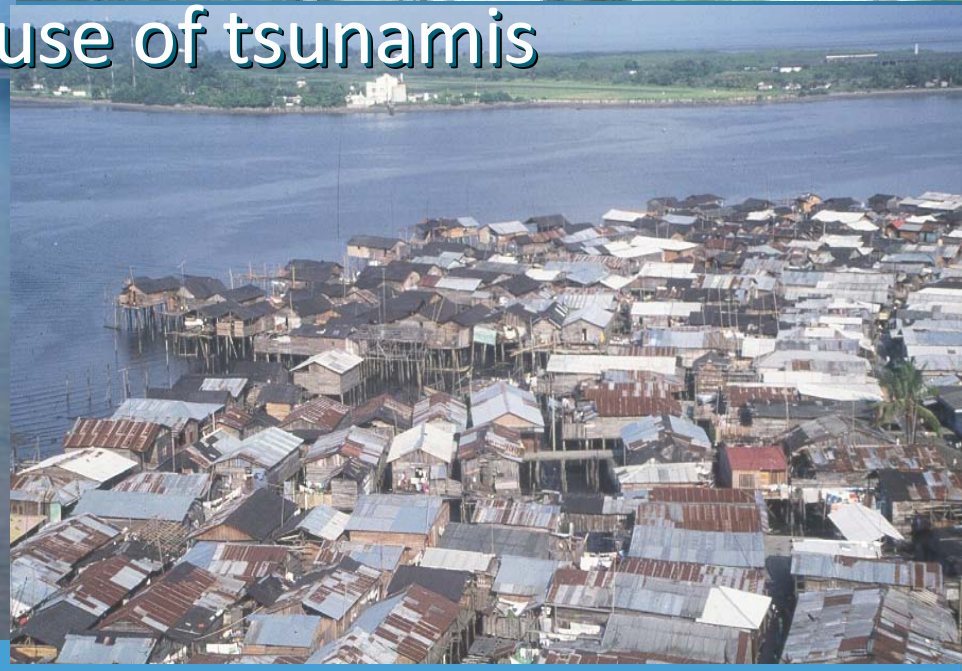



Hurricanes are considered extreme events that can generate extreme impacts

Floods as result of excessive rainfall may produce extreme disasters as well in urban and rural areas

In addition to direct effects the intensive earthquakes are also the cause of tsunamis





Extensive and Intensive Risk Assessment

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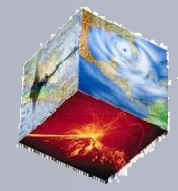
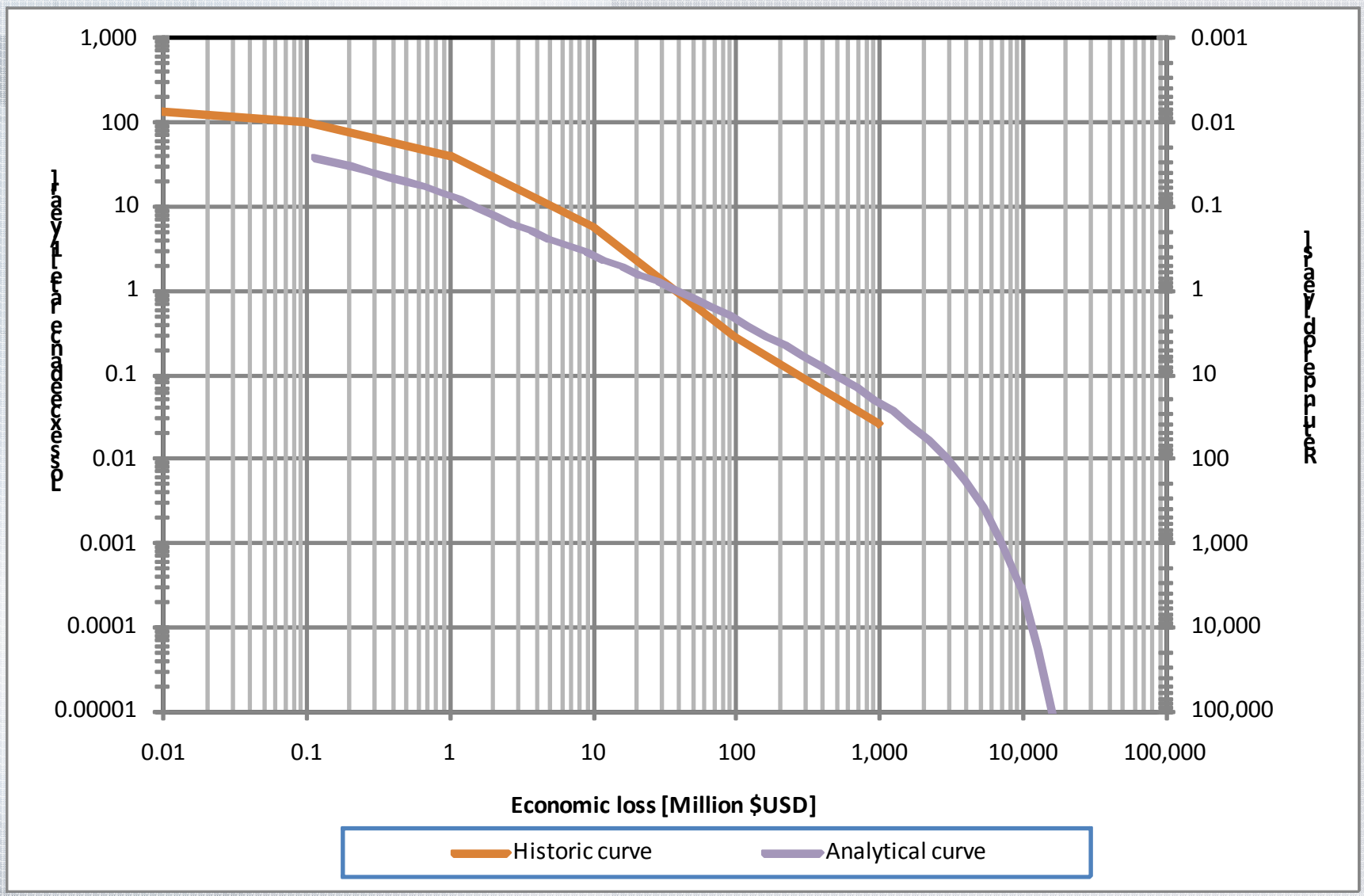
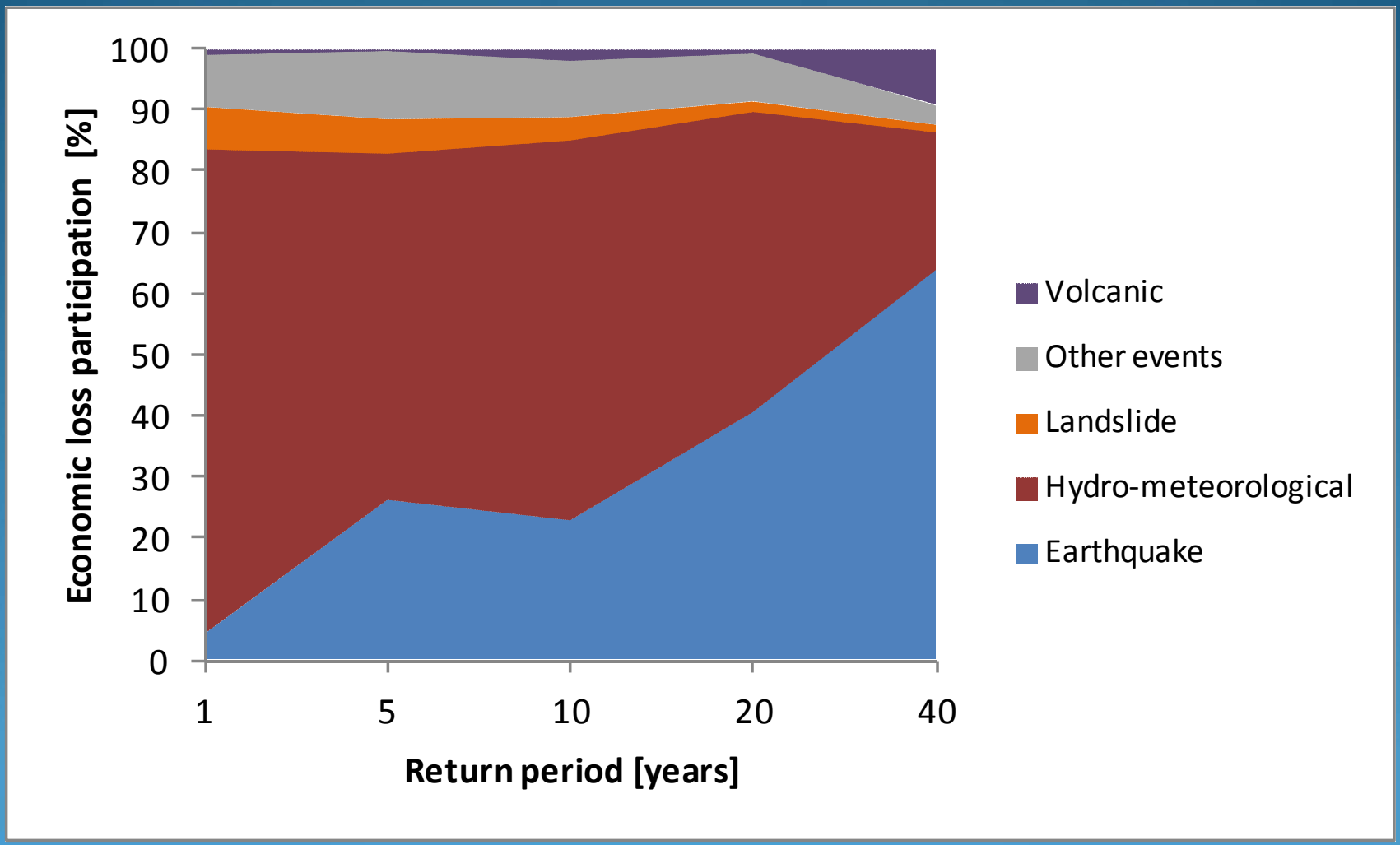
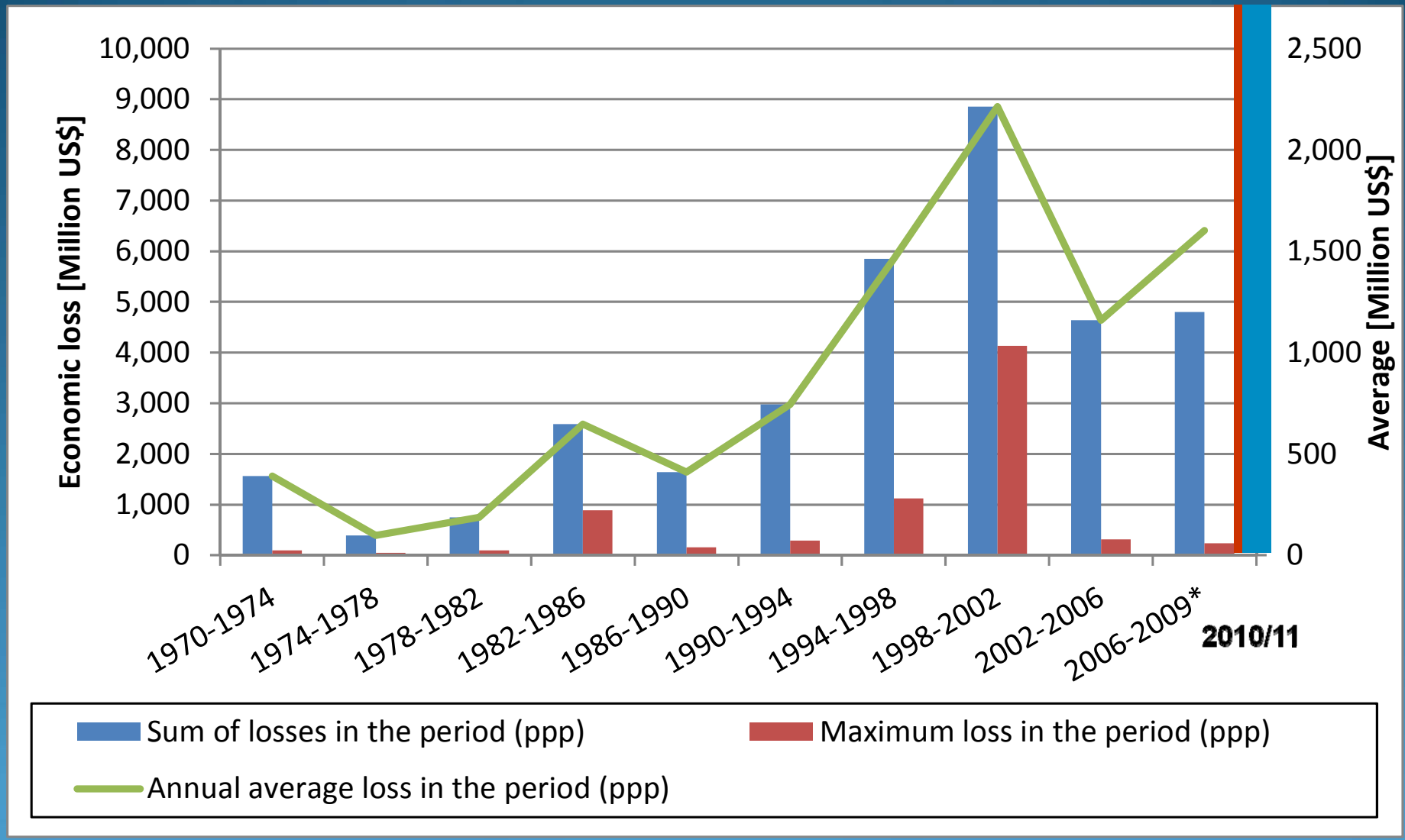




Participation in losses of each type of event for Colombia using hystoric records



Economic losses for presidential periods in Colombia



Extensive and Intensive Risk Assessment

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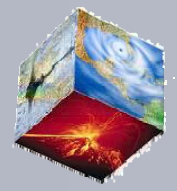
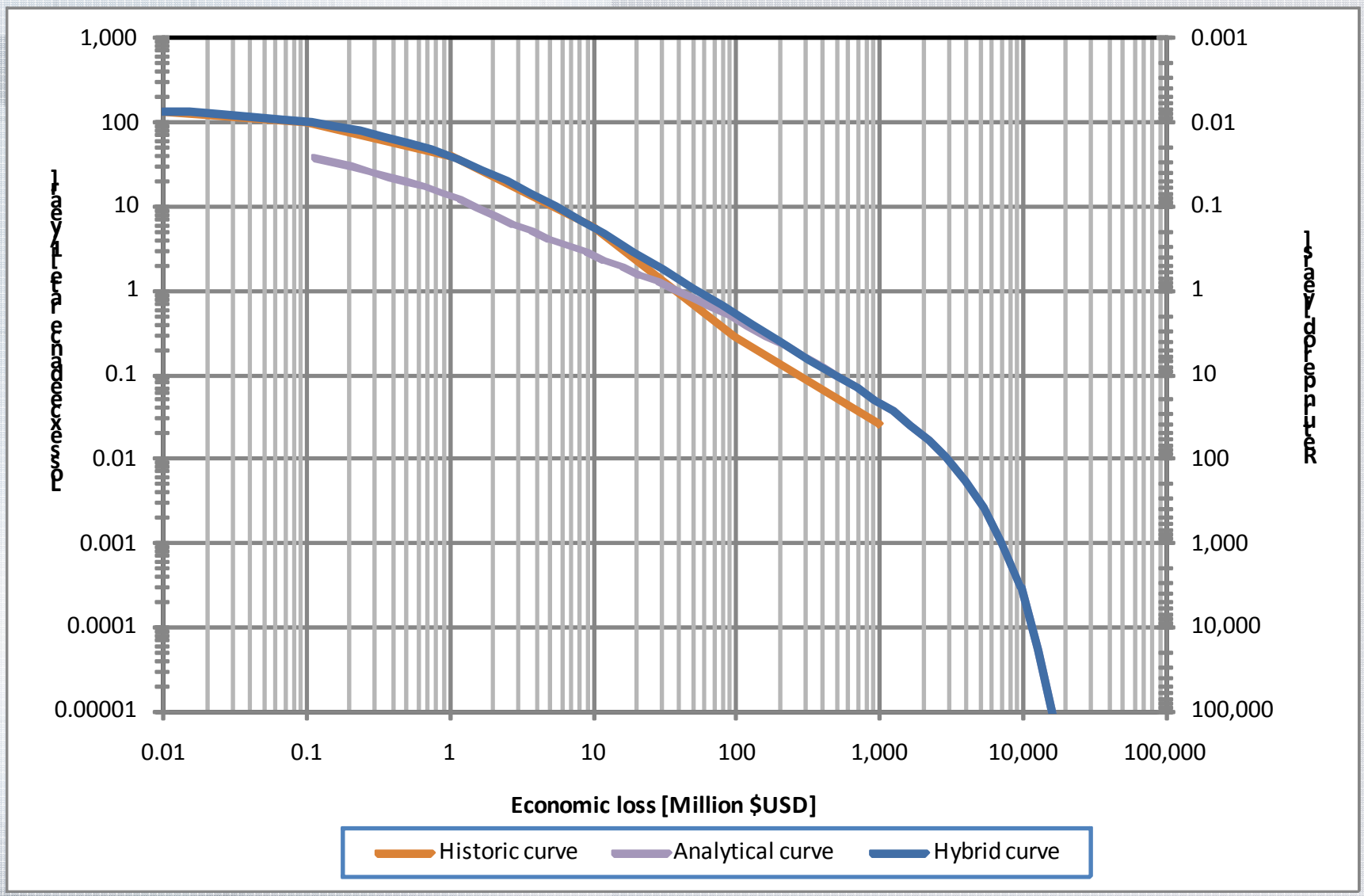
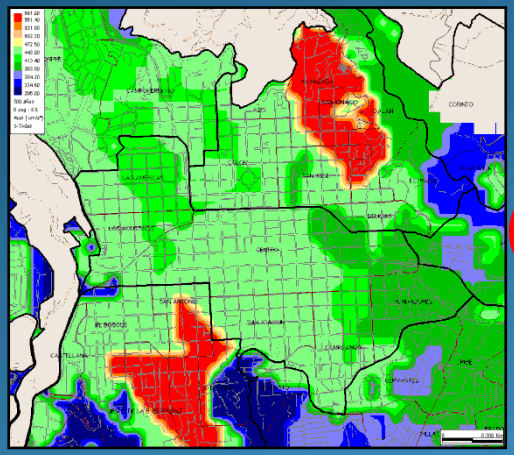


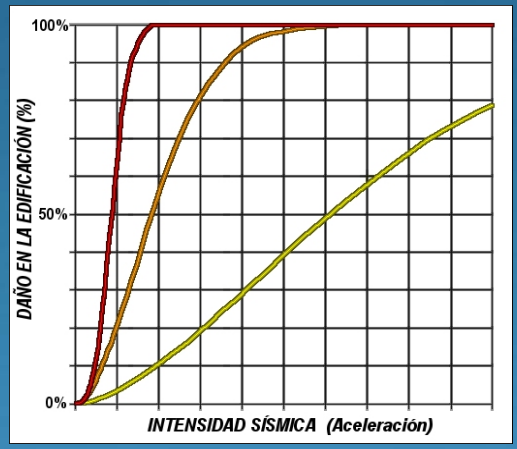


EVALUATION OF RISK: ESTIMATING LOSSES

Hazard



Vulnerability

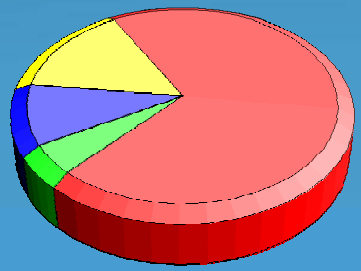


Risk - Damage

Estimating losses

ESCENARIO	TOTAL EXPUESTO Pèrdida (Mill. USD)	PML (%)
Falla Cauca	$ 60.5	12.3
Falla Subducción	$ 54.2	11.0
Falla Benioff	$ 50.1	10.2
Falla Romeral	$ 48.1	9.8

Risk management




GFDRR
GLOBAL FACILITY FOR DISASTER
REDUCTION AND RECOVERY
ISDR
IDB

Developing Tools to support Climate Resilient Decision Making

CAPRA
Probabilistic Risk Assessment Initiative

Message: WB is building tools to enable informed decision-making about complex dynamic systems in a changing climate.

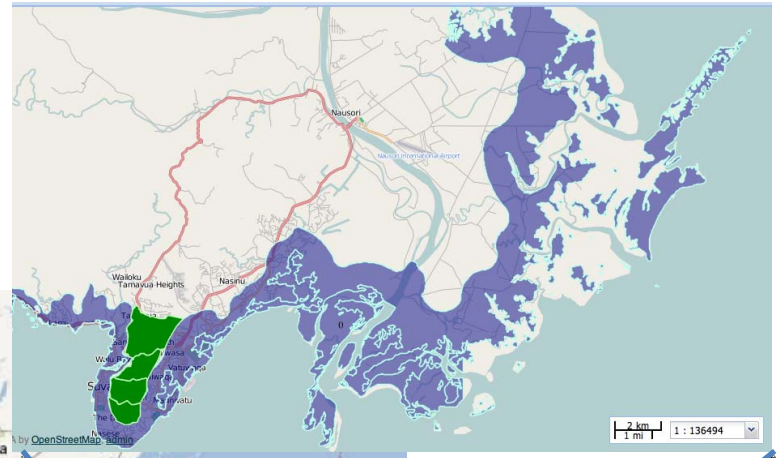
Risk-in-a-Box

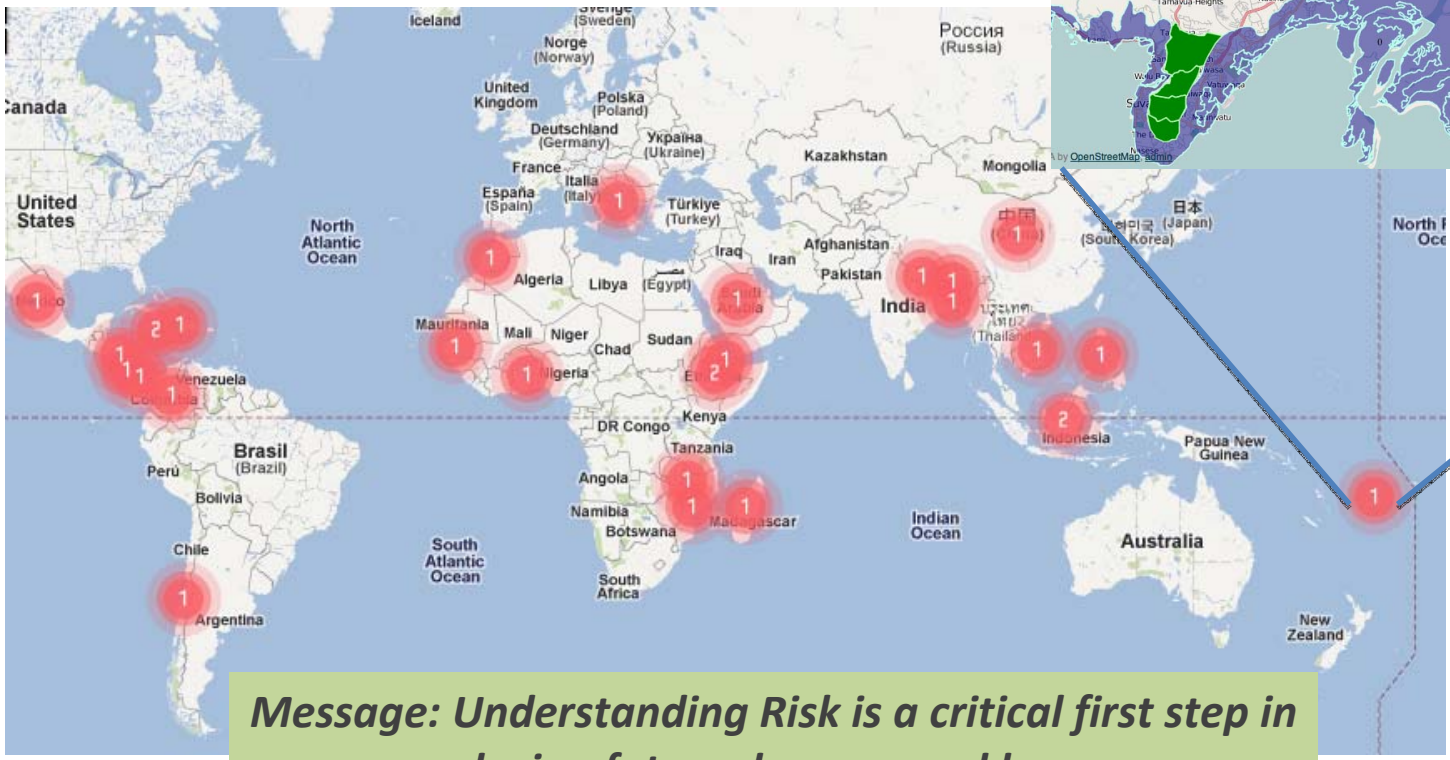
WCDIS Weather and Climate Information and Decision-Support Systems

Understanding Risk

http://vimeo.com/30057201

WB/GFDRR financed over 40 Regional, National and city level **Risk Assessment** to help countries Understand their Risk



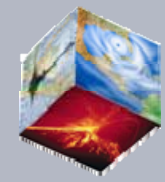


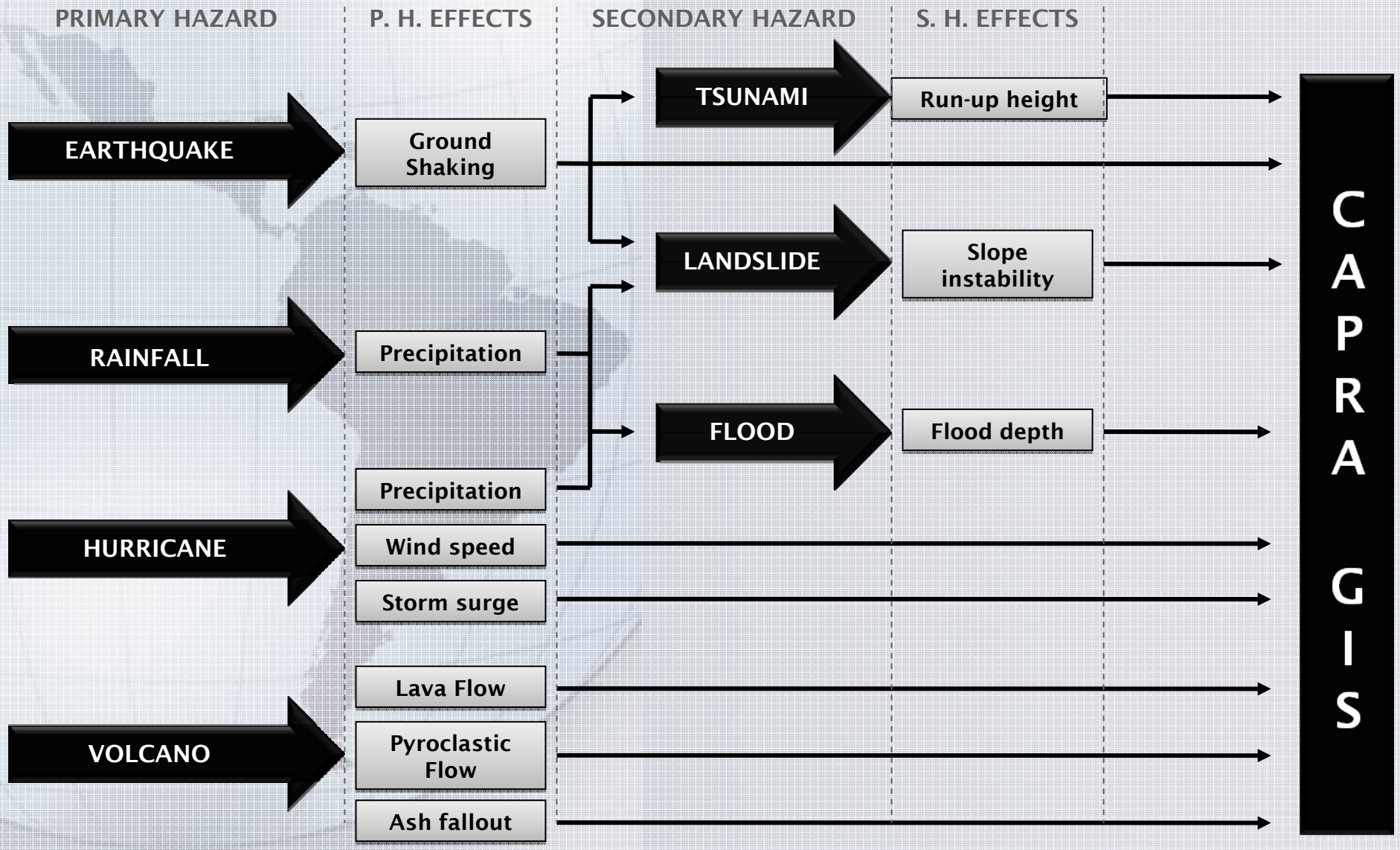
Message: Understanding Risk is a critical first step in reducing future damage and losses.

PCRAFI

Most extensive study of Disaster and Climate risk in the Pacific to support government decision making

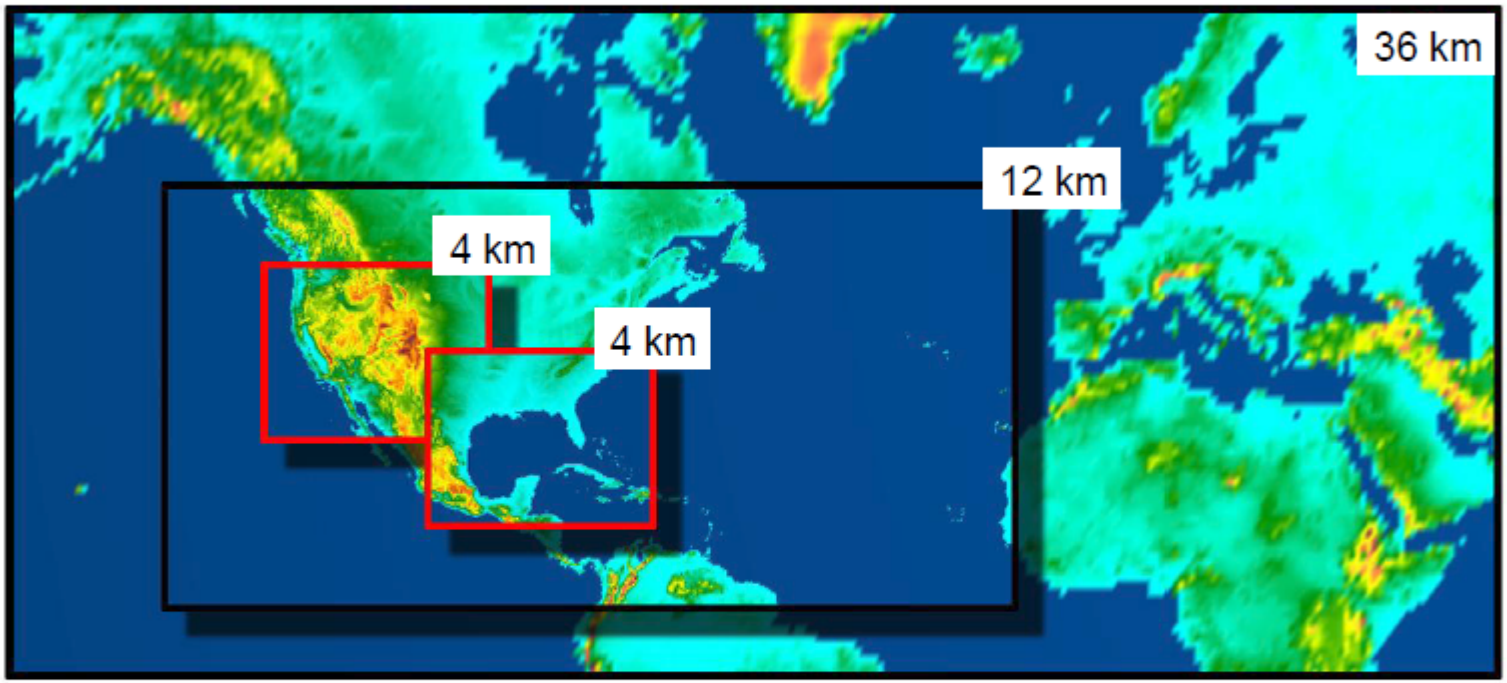
MULTI-HAZARD APPROACH





Nested Regional Climate Model

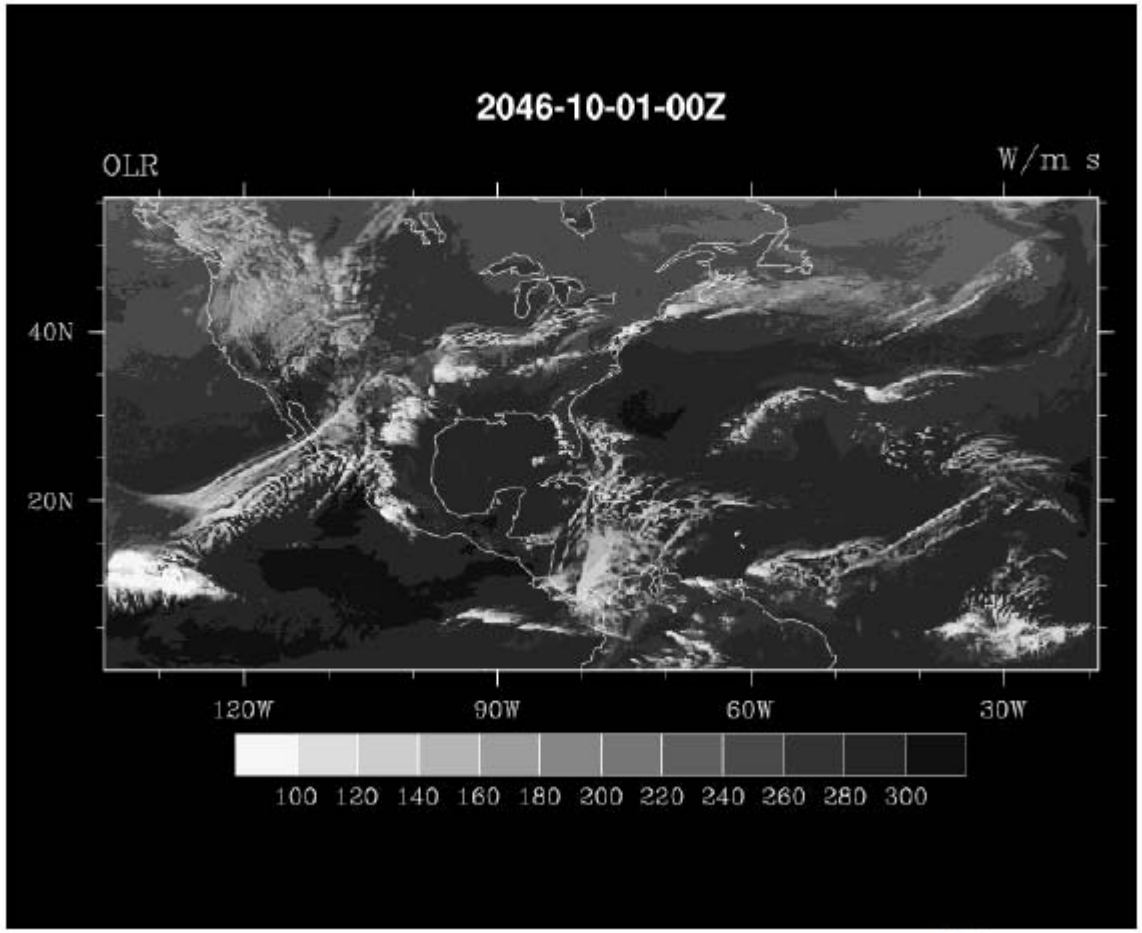
Multi-decadal Regional Climate Predictions of High-Impact Weather Over North America & the Caribbean



- Global Model: 3 Ensembles from 1950-2060
- NRCM: 1995-2005 Obs, 1995-2005, 2020-2030, 2045-2055,
- 3 ensembles at 36km, 1 at 12 km, specific cases at 4 km.
- Use of statistical downscaling to fill in intermediate periods
- ~300 Tb of data (to date); 450 Tb total (including earlier runs)

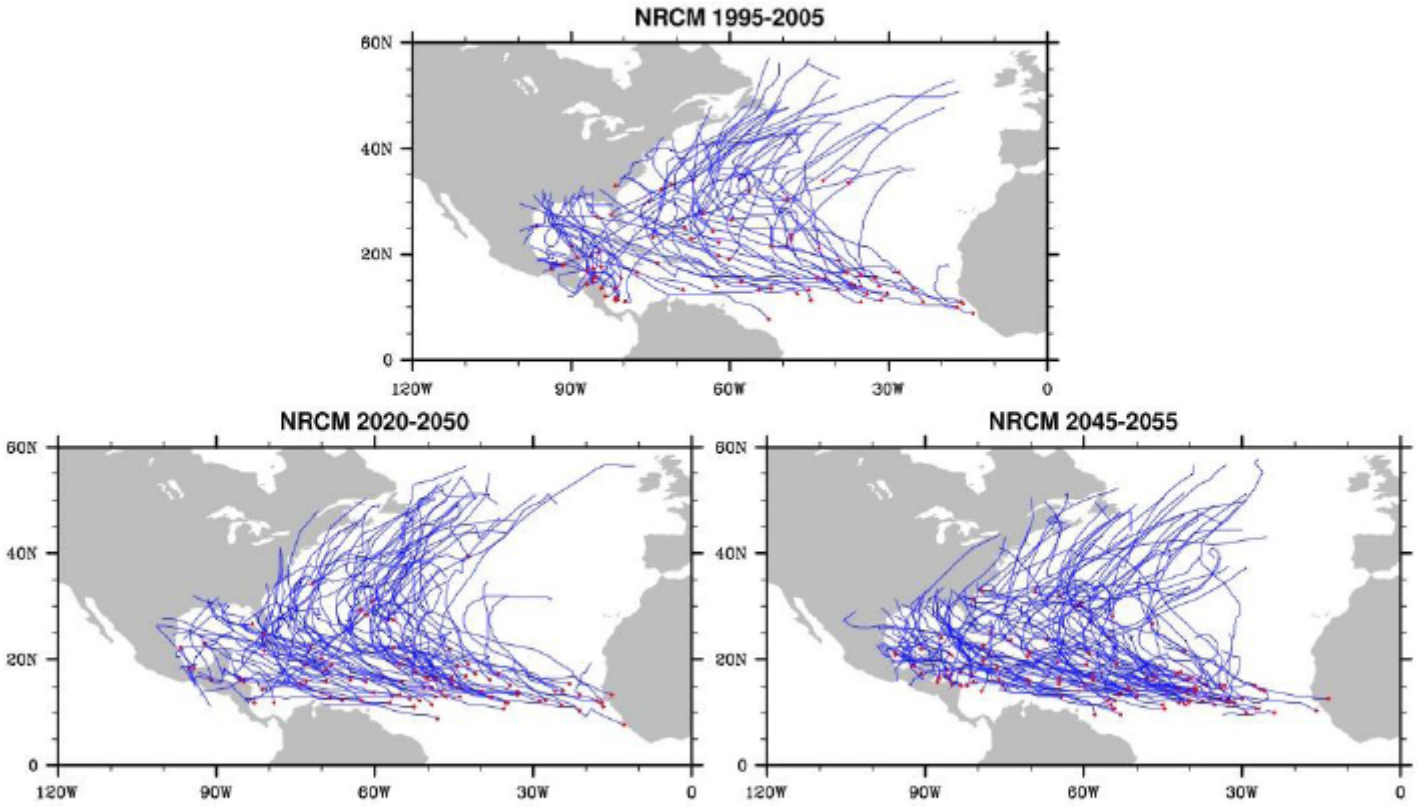
Nested Regional Climate Model

Regional Climate Simulation for 2046



Nested Regional Climate Model

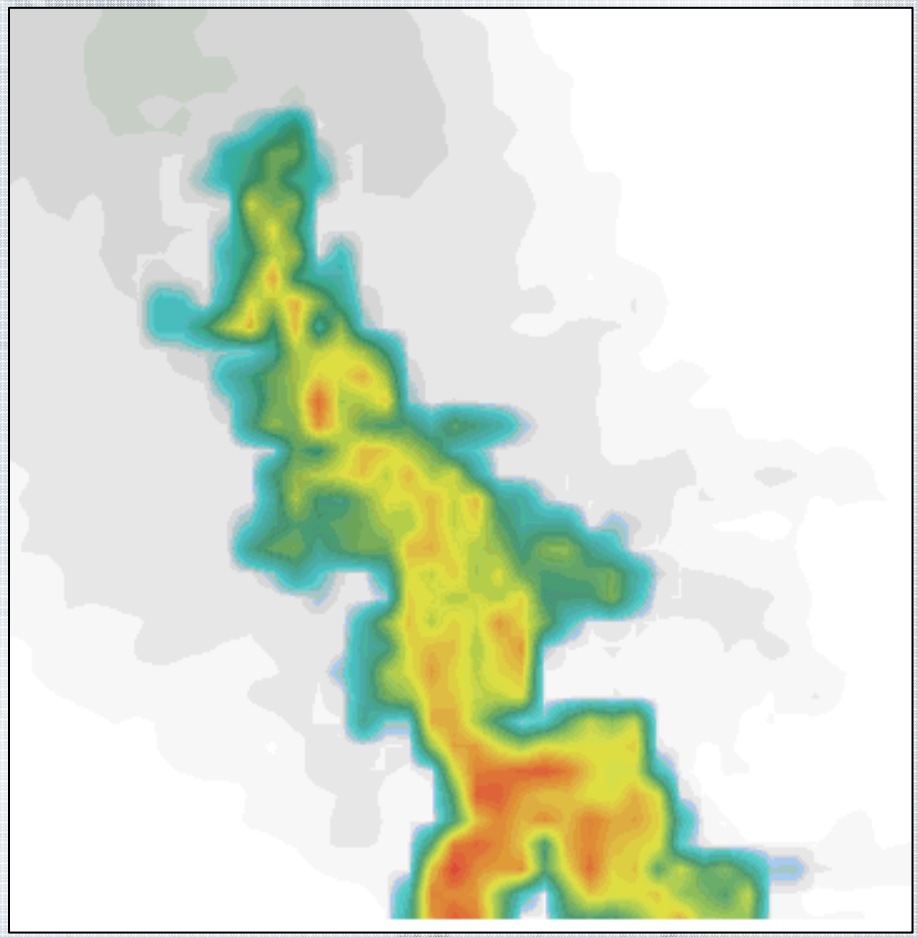
NRCM Example: Atlantic Hurricanes

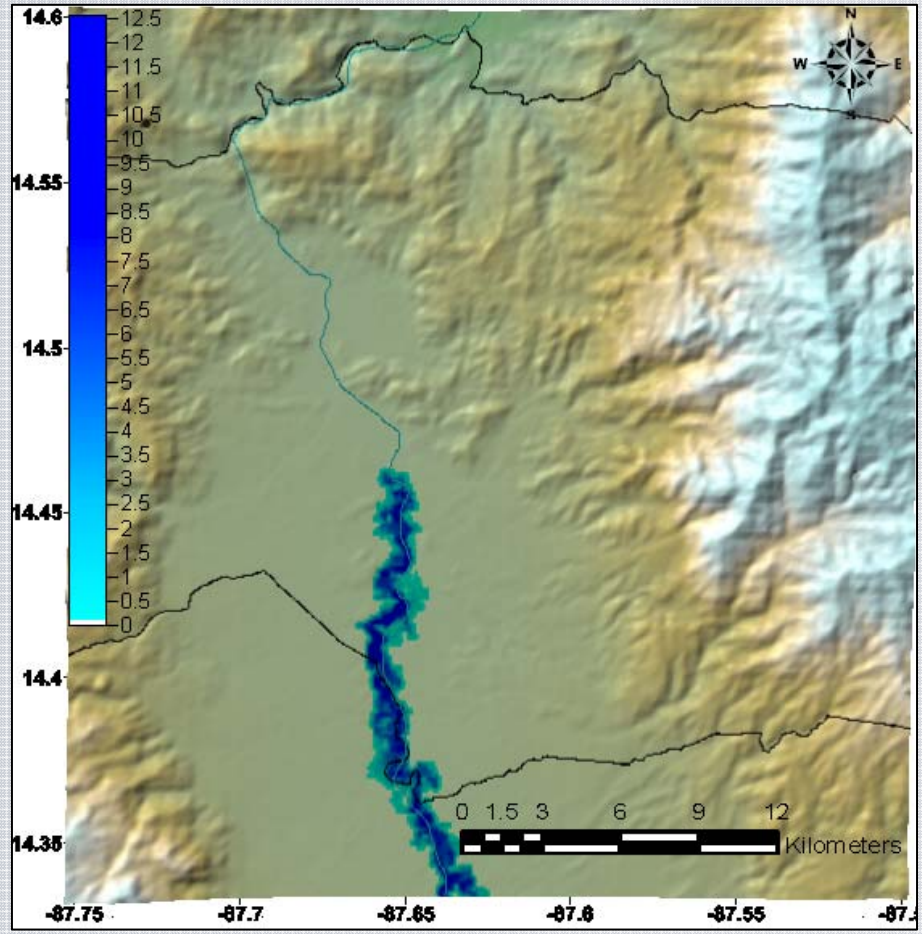


(Suzuki 2010)

Example of flood hazard evaluation using CAPRA

Scenario: Hurricane

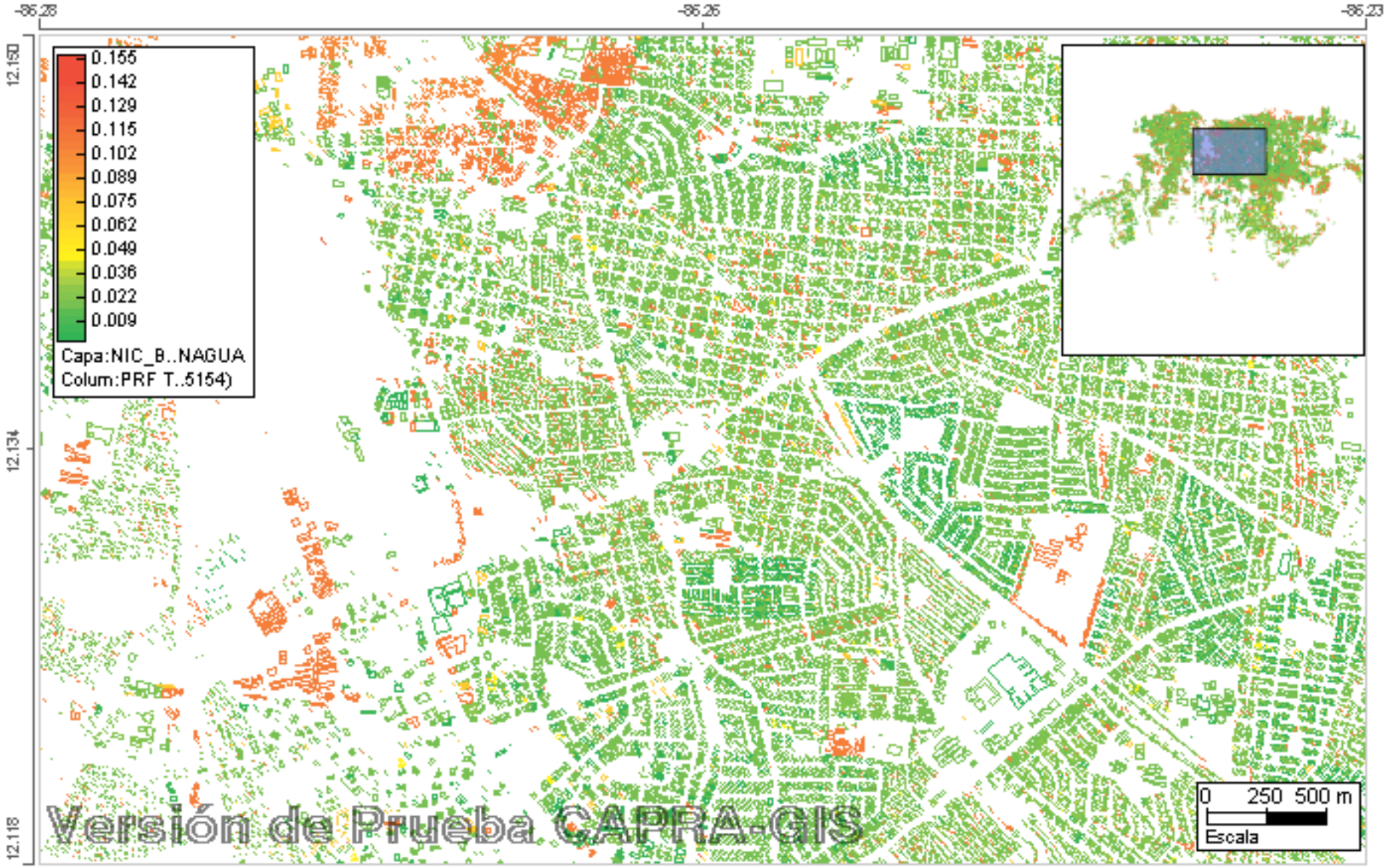




Process

Results

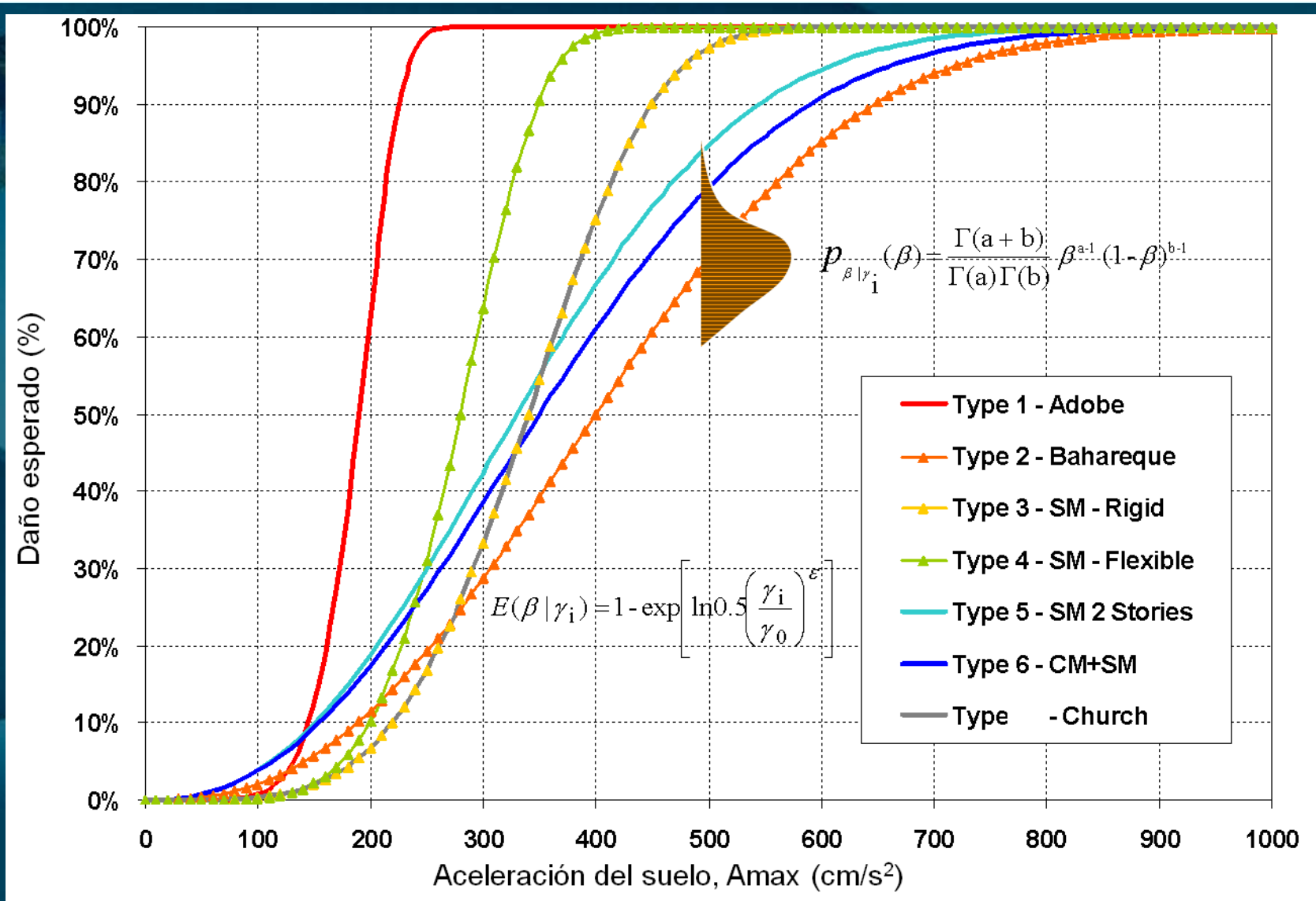
EXPOSURE MODELLING USING CADASTRAL INFORMATION



CAPRA Evaluación Probabilista de Riesgo para América Central

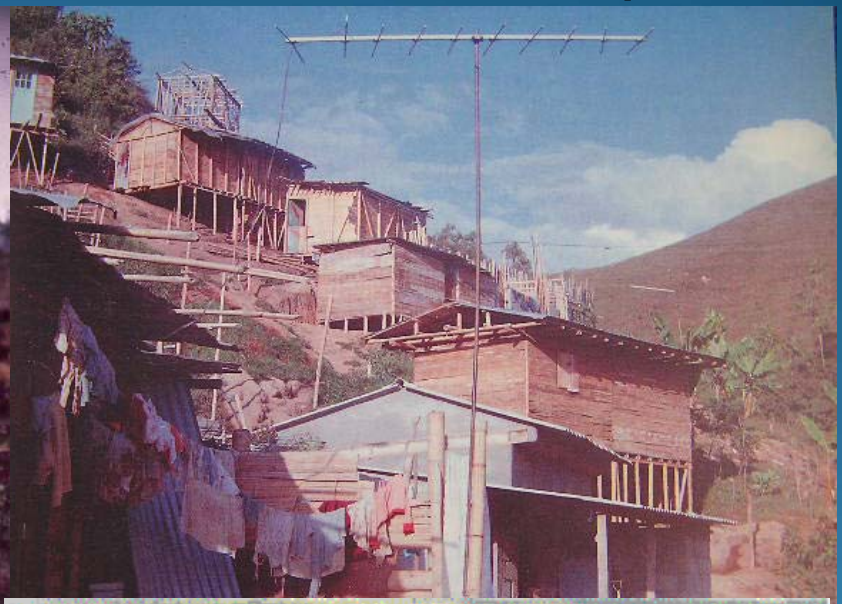
Visor de mapas

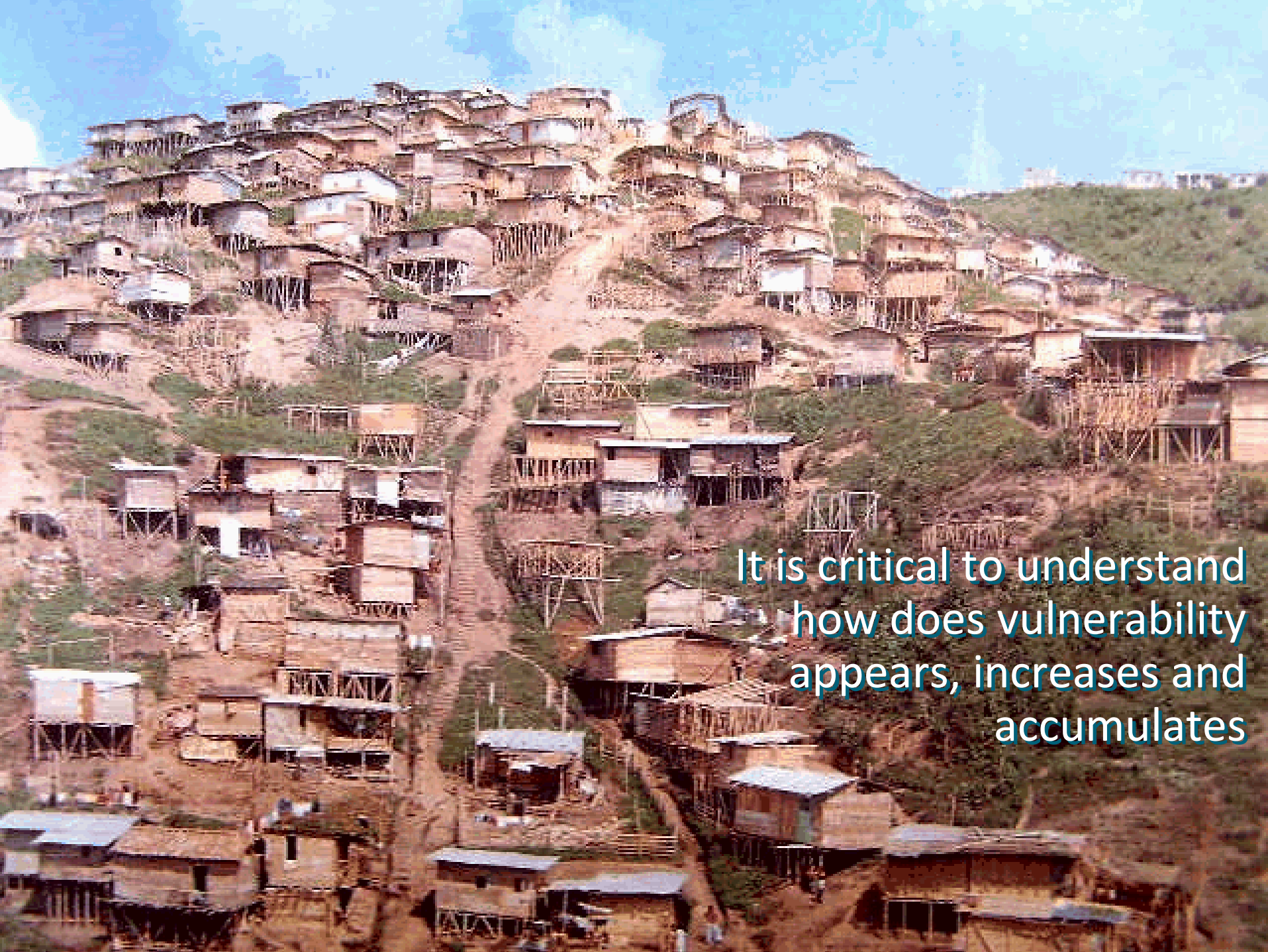
EXAMPLES OF VULNERABILITY FUNCTIONS



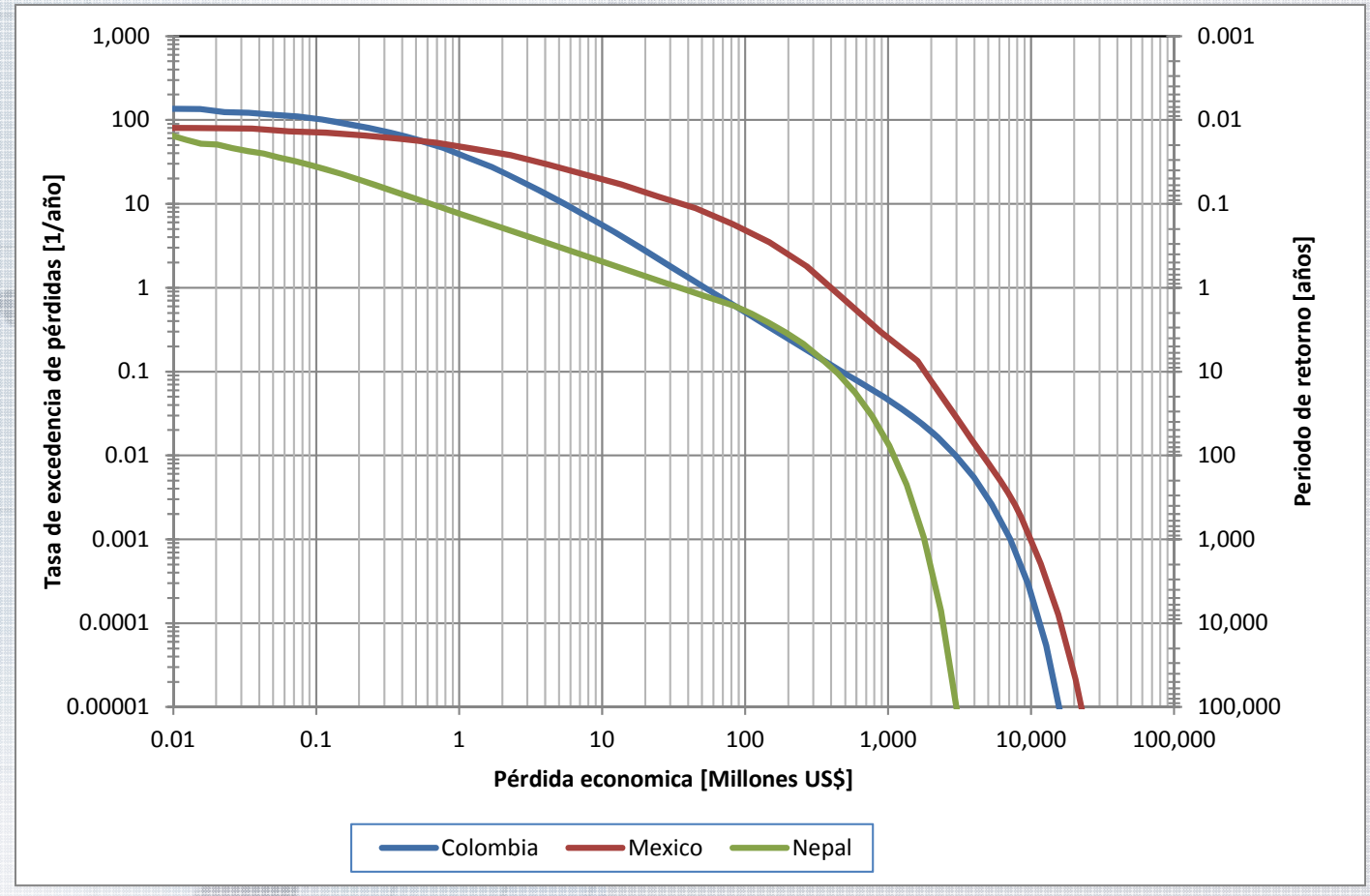
Absence of standards and their compliance controls and governance lead to chaotic conditions of vulnerability

Poverty and social segregation are factors that aggravate the conditions of vulnerability




It is critical to understand how does vulnerability appears, increases and accumulates

“Hybrid” Loss exceedance curves



AAL comparison

	DesInventar All events [US$ millions]	DesInventar Without other events [US$ millions]	Catastrophic analysis Fiscal sector [US$ millions]	Hybrid curve [US$ millions]
Colombia	380	360	316	490
Mexico	2,760	2,540	810	2,424
Nepal	54	52	207	235

RISK INDICATORS

Expected annual loss (per thousand of exposed value)

Catastrophic Risk Profile: Guatemala

Risk concentration

Geographic distribution of Premium (‰) by municipality - Hurricanes

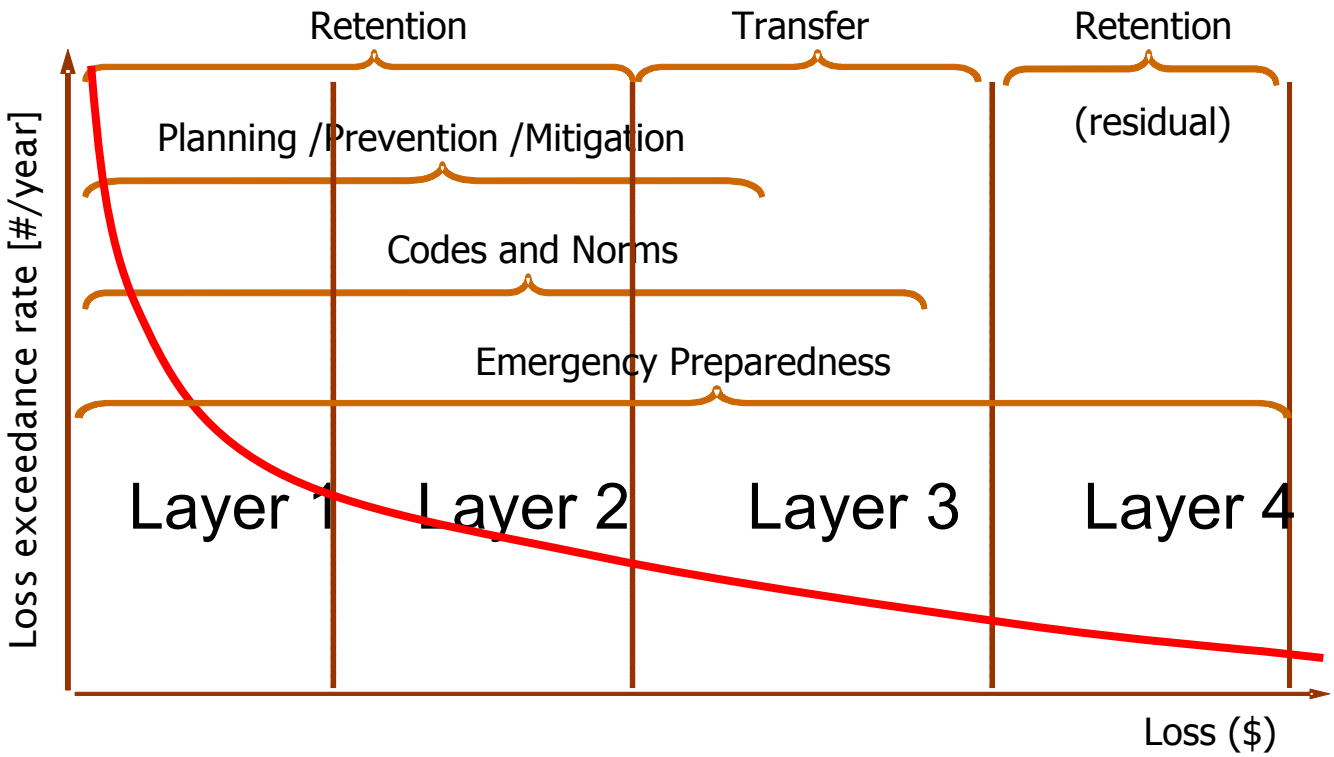
Catastrophic Risk Profile: Guatemala

Risk concentration

Geographic distribution of Premium (‰) by municipality - Earthquakes

Risk Stratification

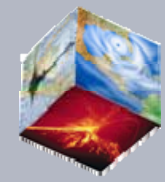
Governments need to define a risk reduction/financing strategy



1 = High probability & low/moderate losses
2 = Medium probability & moderate/high losses
3 = Low probability & high losses
4 = Very low probability & very high losses

Risk Financing

Financial protection options



¿How can the government cover the costs of the attention of emergencies and reconstruction?

Post-disaster(ex-post)

- *Reassignment of budget categories and loans*
- *New Taxes*
- *New-additional (international) credits*
- *Assistance from donors*

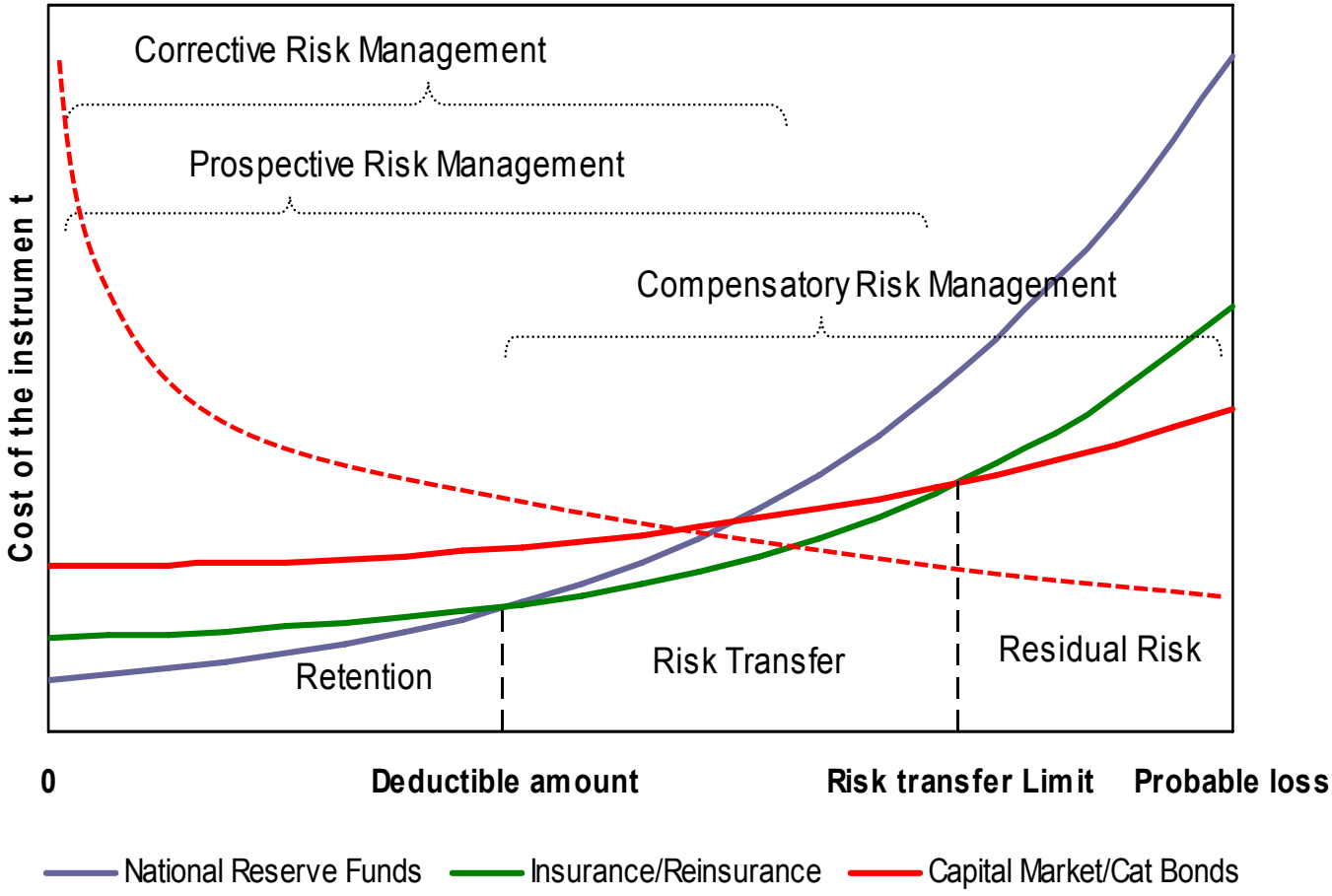
Pre-disaster (ex-ante)

- *Disaster reserve funds*
- *Insurance/Reinsurance*
- *Catastrophe bonds*
- *Contingent loans*
- *Capital markets*

Risk Financing

Financial protection options

- INSURANCE / REINSURANCE
- CAT BONDS
- CONTINGENT SURPLUS NOTES
- SECURITIES
- HEDGES
- CAT SWAPS
- CLIMATE DERIVATIVES
- CONTINGENT LOAN



Climate change already increasing the intensity and frequency of hydrometeorological hazards

Wind

Storm surge

Tropical cyclones

Rainfall → Floods

Heat waves

Frequency

Intensity

Hazards

Exposure + increase of vulnerability

Increase of risk

When ...the facts are uncertain,
...the values are in dispute,
...the stakes are high,
and ...the decisions are urgent.