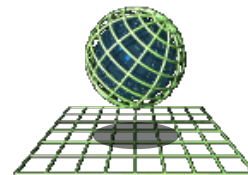


# UNISDR Global Risk Assessment: Towards an Enhanced Vision of Global Disaster Risk

*From Global to Local:  
The need of a good-enough probabilistic and  
holistic risk assessment for DRM stakeholders'  
involvement and action*

Omar-Darío Cardona



**CIMNE**<sup>®</sup>

International Centre for Numerical Methods in Engineering  
Centro Internacional de Métodos Numéricos en Ingeniería

&

INGENIAR LTDA



**INGENIAR**





UNDERSTANDING  
RISK

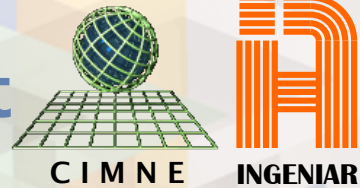
Innovation in Disaster Risk Assessment



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

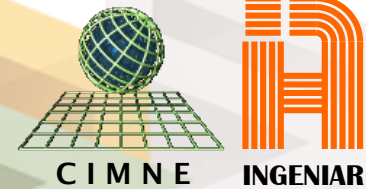
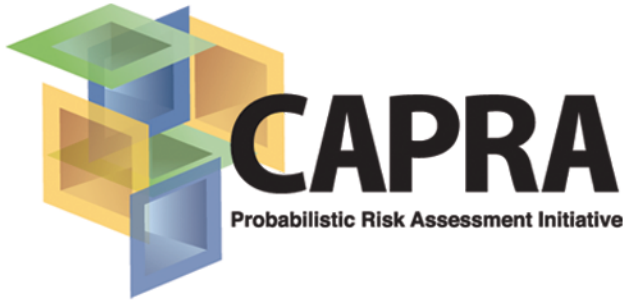


# Some Reflections Regarding Risk Assessment



- ✓ *Measuring is essential to decide; what is not dimensioned cannot be administrated*
- ✓ *Risk assessment is key to aware but also to concern decisionmakers of their responsibility*
- ✓ *Disaster risk is a contingent liability and, thus, is a sovereign risk for the society*
- ✓ *Risk reduction and prevention as a duty for risk governance and for the nations' accountability*
- ✓ *Understand the current reality means identify drivers of vulnerability and lack of resilience*
- ✓ *It means, also, considering the implicit and unavoidable trade-offs regarding transformation*



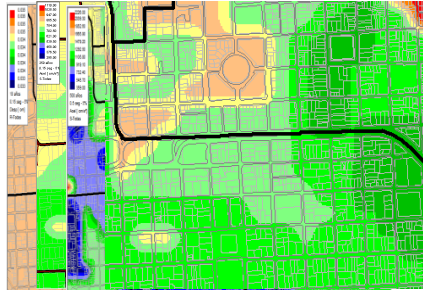


*COMPREHENSIVE  
APPROACH TO  
PROBABILISTIC RISK  
ASSESSMENT*



# Risk Modelling: Loss Assessment

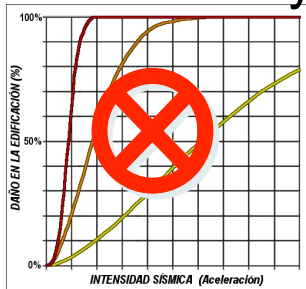
Hazard



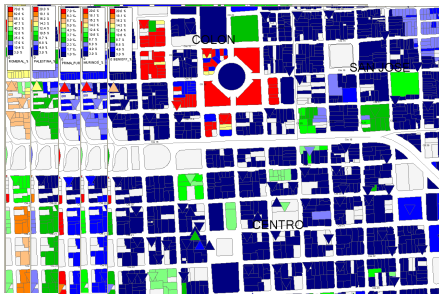
Exposed Assets



Vulnerability



Loss



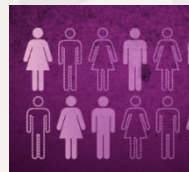
PDF of Risk



Losses

Economic

Human



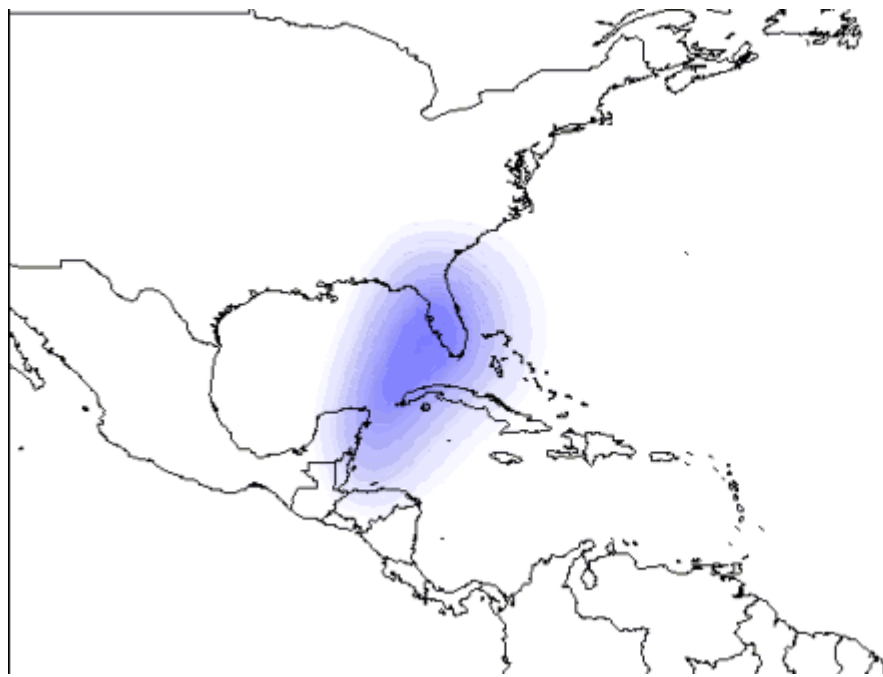
**LOSS EXCEEDANCE CURVE**  
**PROBABLE MAXIMUM LOSS**  
**AVERAGE ANNUAL LOSS**



# Cyclonic Wind and Seismic Hazard

## Set of stochastic scenarios

- ✓ *Mutually exclusive*
- ✓ *Collectively exhaustive*
- ✓ *Admit probabilistic representation*

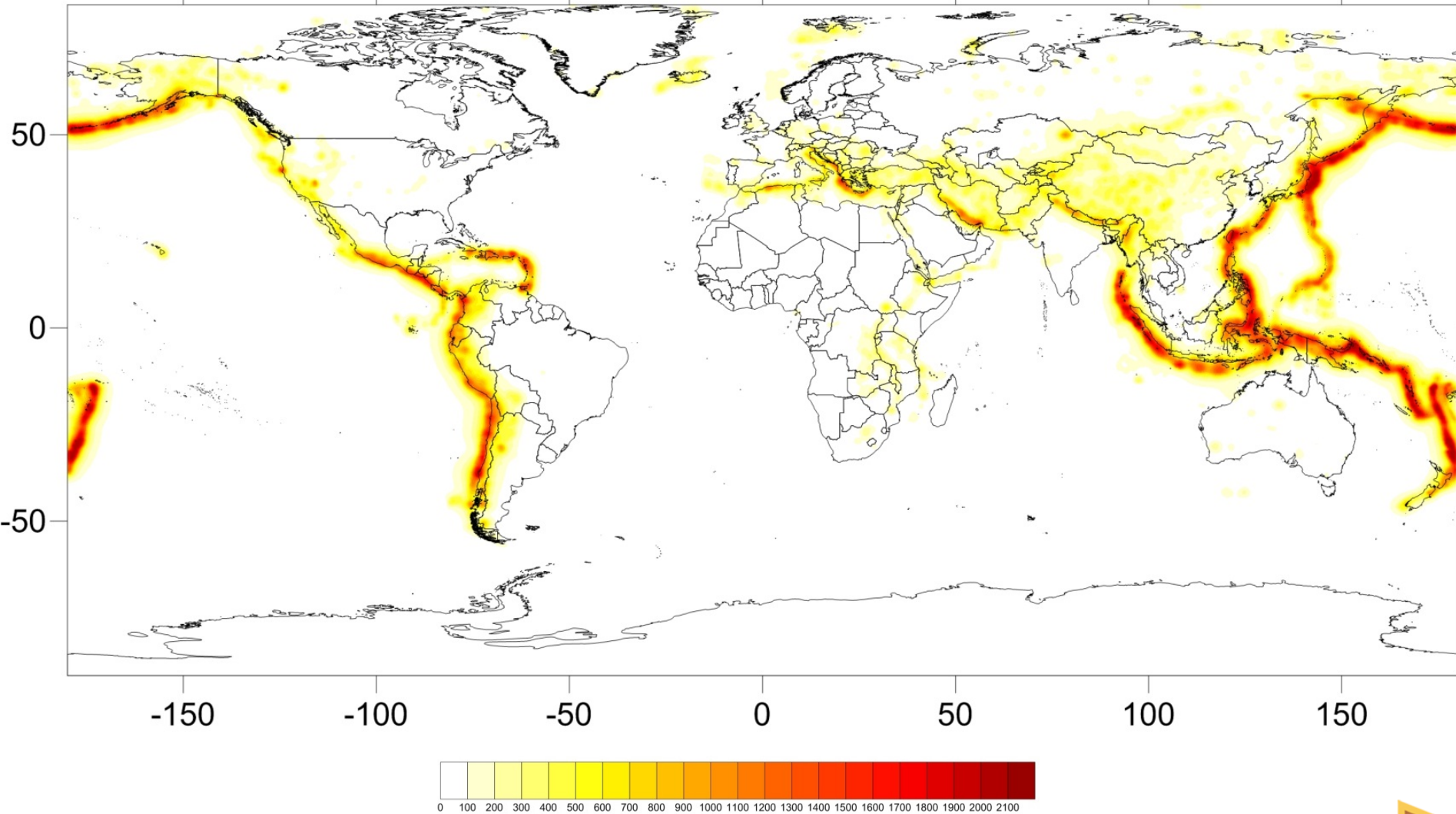
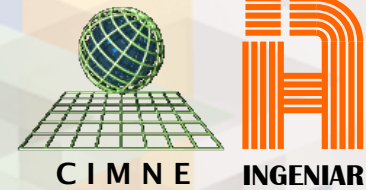


**.AME FORMAT**



# Seismic Hazard Assessment

## Seismic Hazard Maps

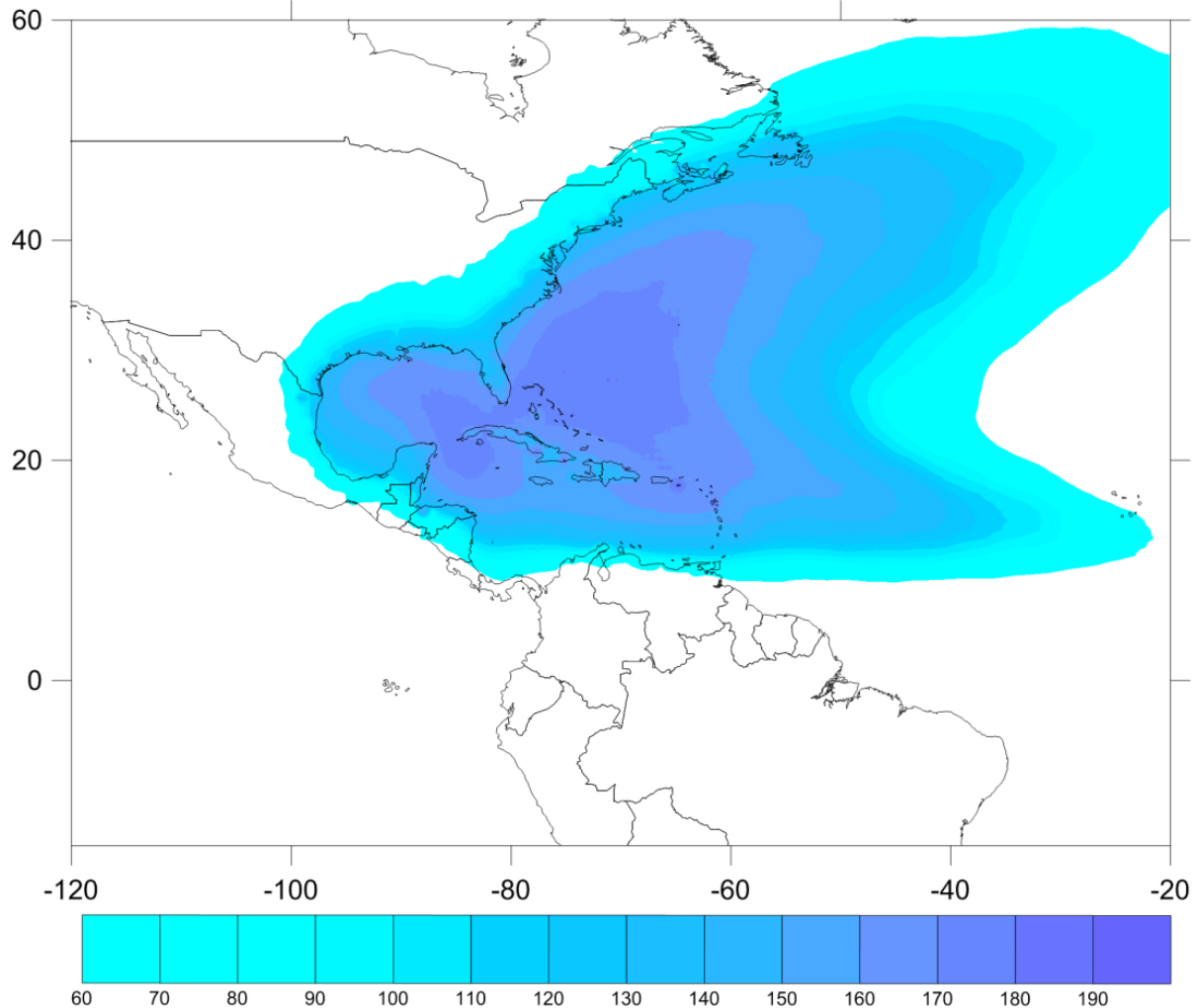


0.2sec, 1,000 años



# Cyclonic Wind Hazard

## Cyclonic Wind Hazard Maps



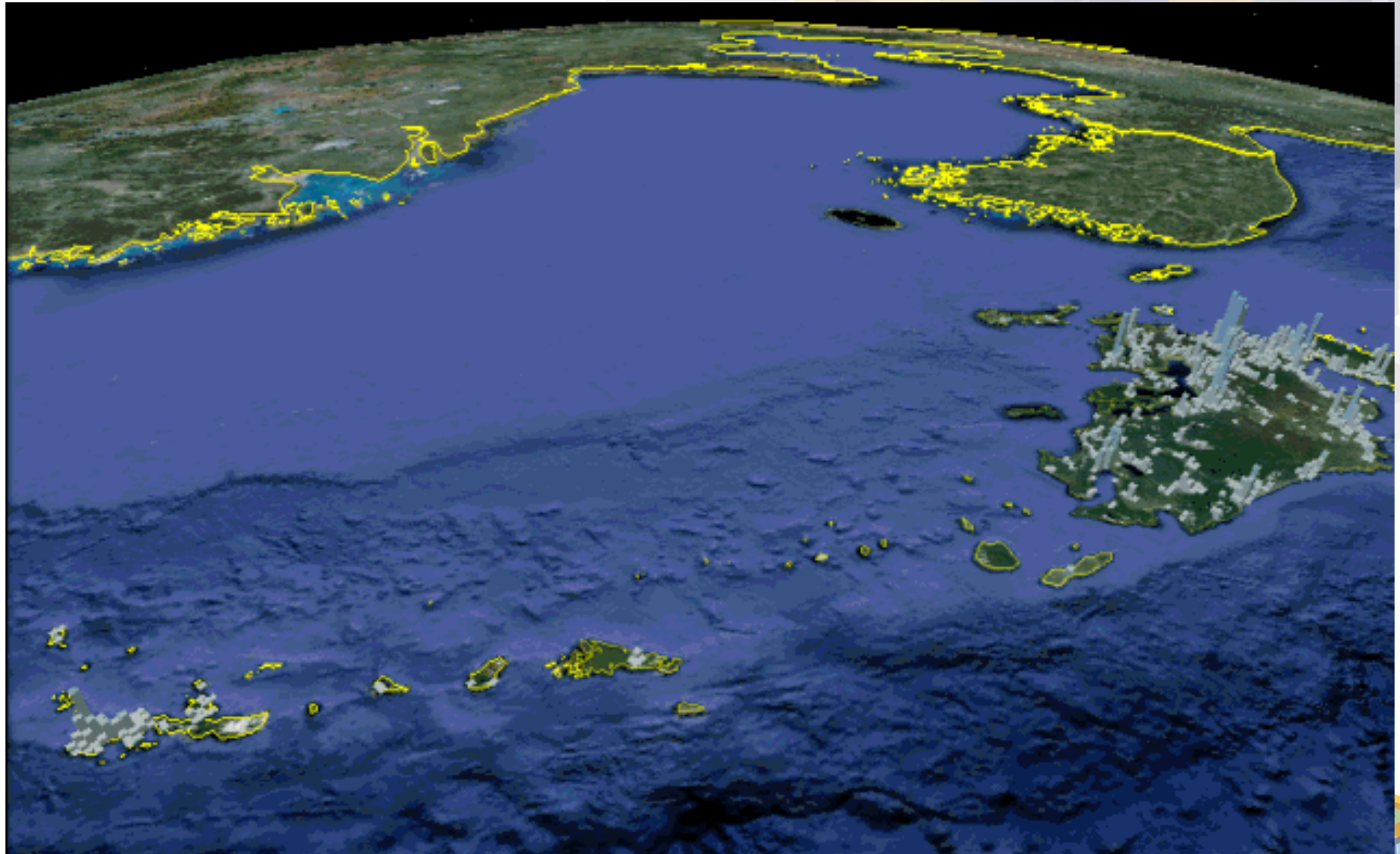
*TR=50 years*





# Global Exposure Database

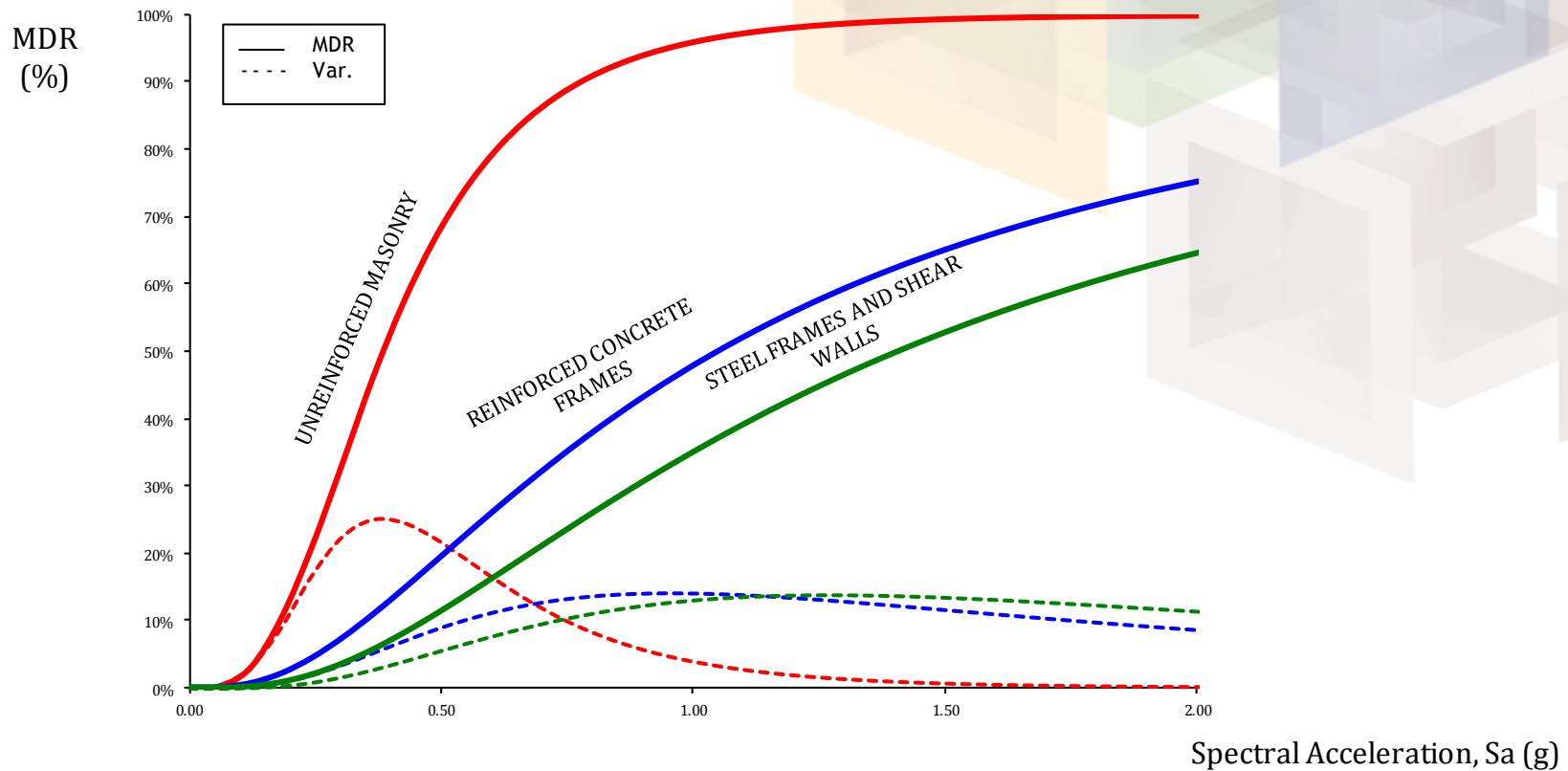
5x5 km grids & 1x1 km in the coast



# Vulnerability

## Vulnerability functions for earthquakes

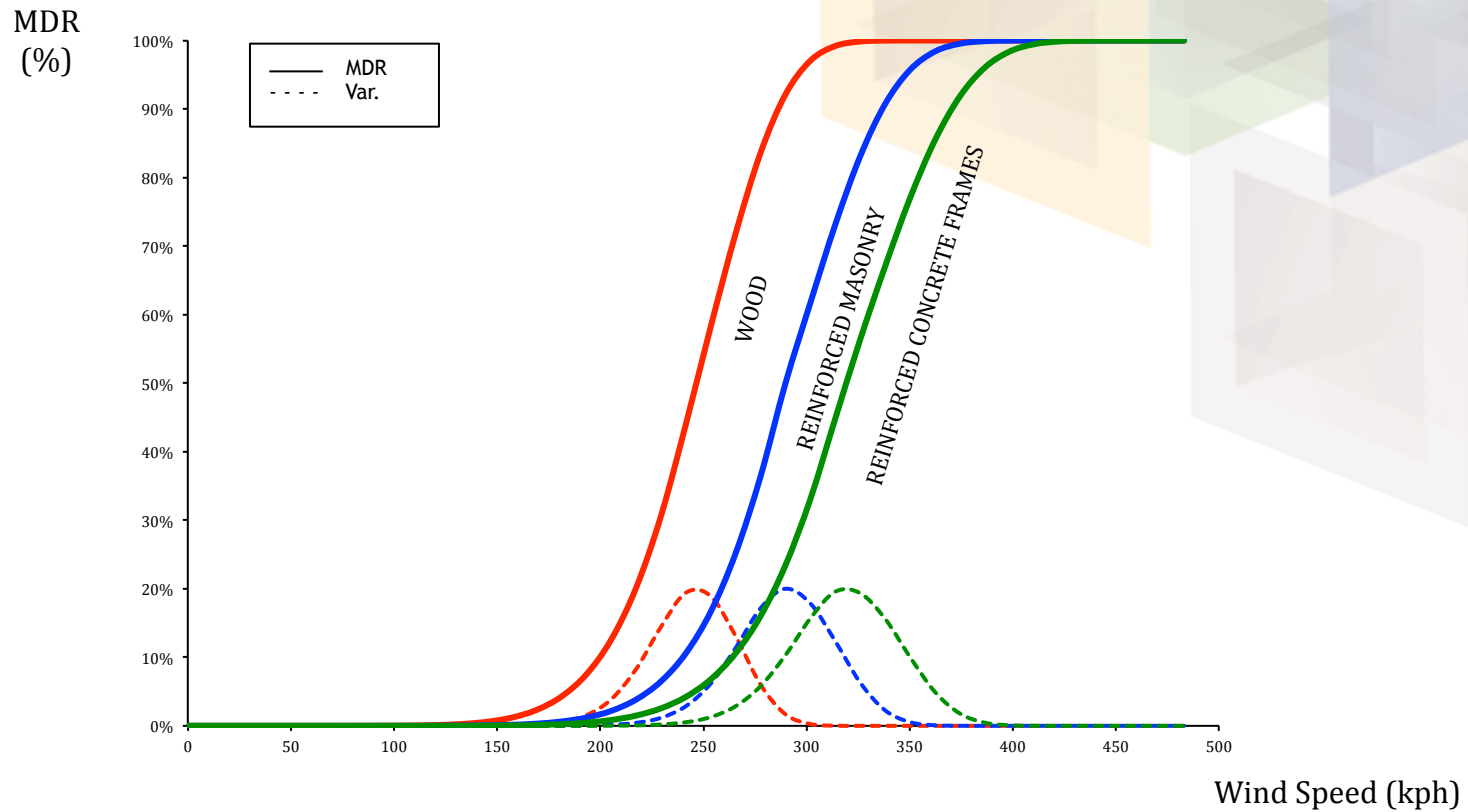
SEISMIC DESIGN  
LEVEL: M



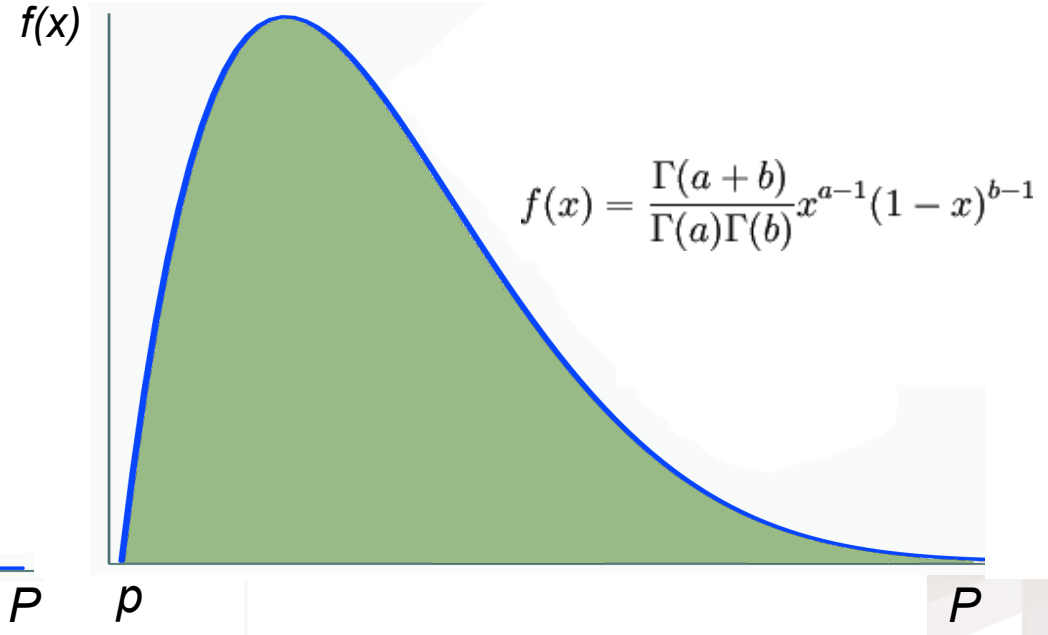
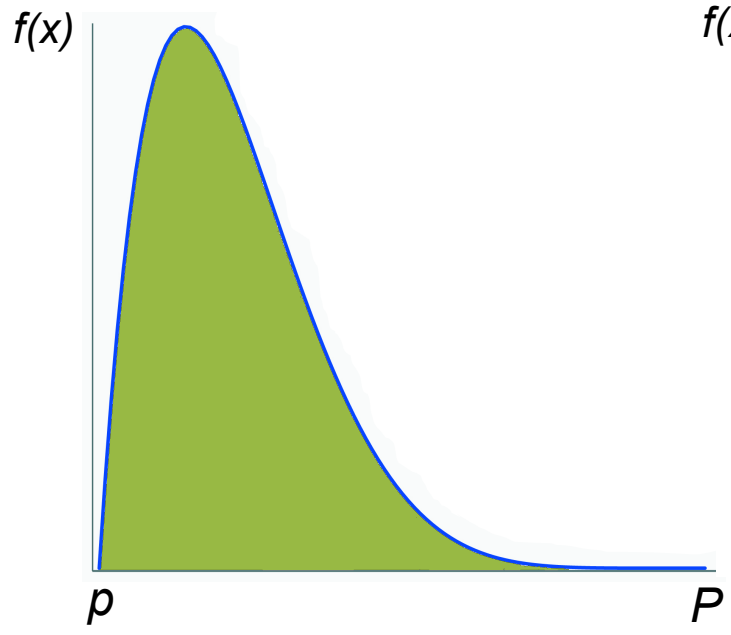
# Vulnerability

## Vulnerability functions for wind

QUALITY  
LEVEL: M



$$f(l | Event i) = \int_0^{\infty} \underbrace{f(l | Sa)}_{\text{Vulnerability}} \underbrace{f(Sa | Event i)}_{\text{Hazard}} dSa$$



$$v(p) = \sum_{i=1}^{Events} \Pr(l \geq L | Event i) \cdot F_A(Event i)$$

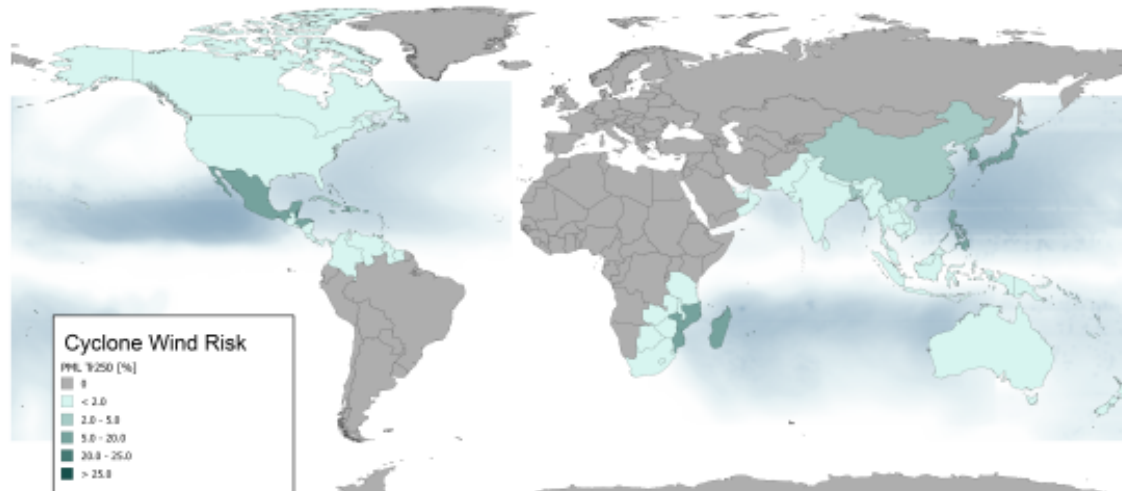
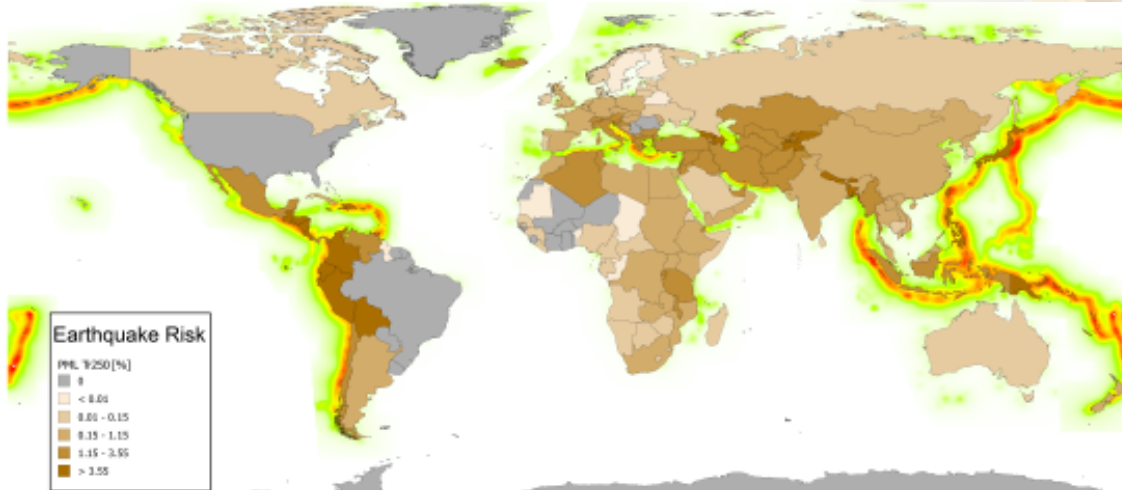
Loss exceedance rate (#/ year)

Losses

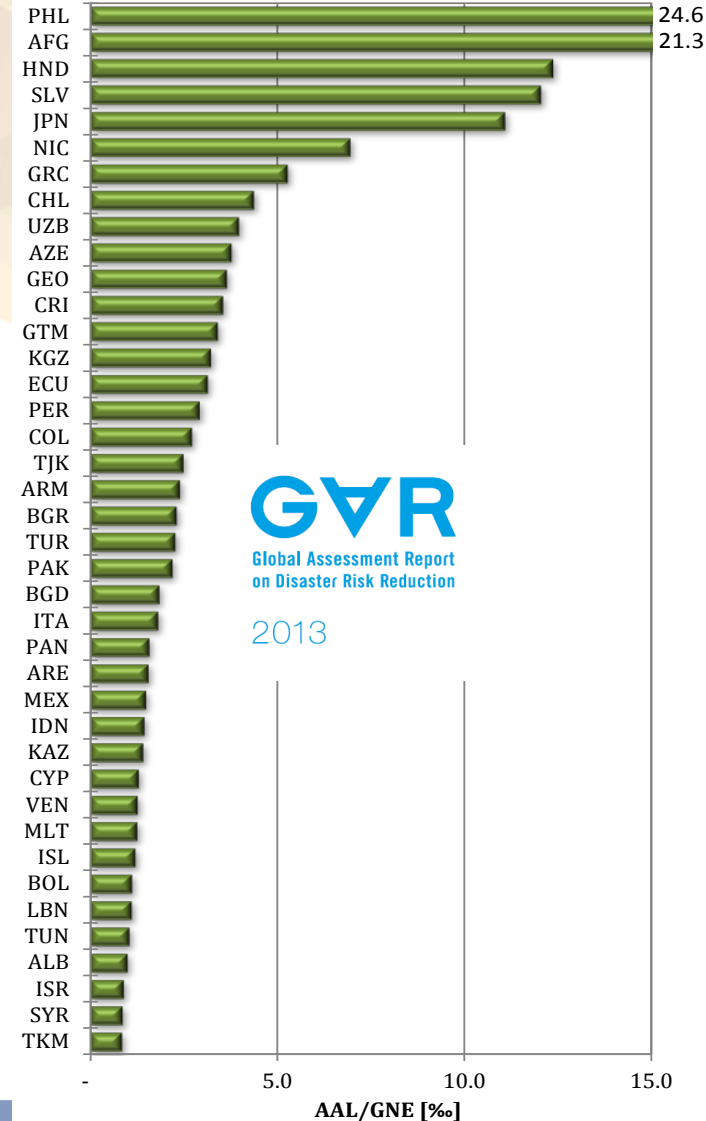


# Risk Maps and Rankings

Using AAL and PML results



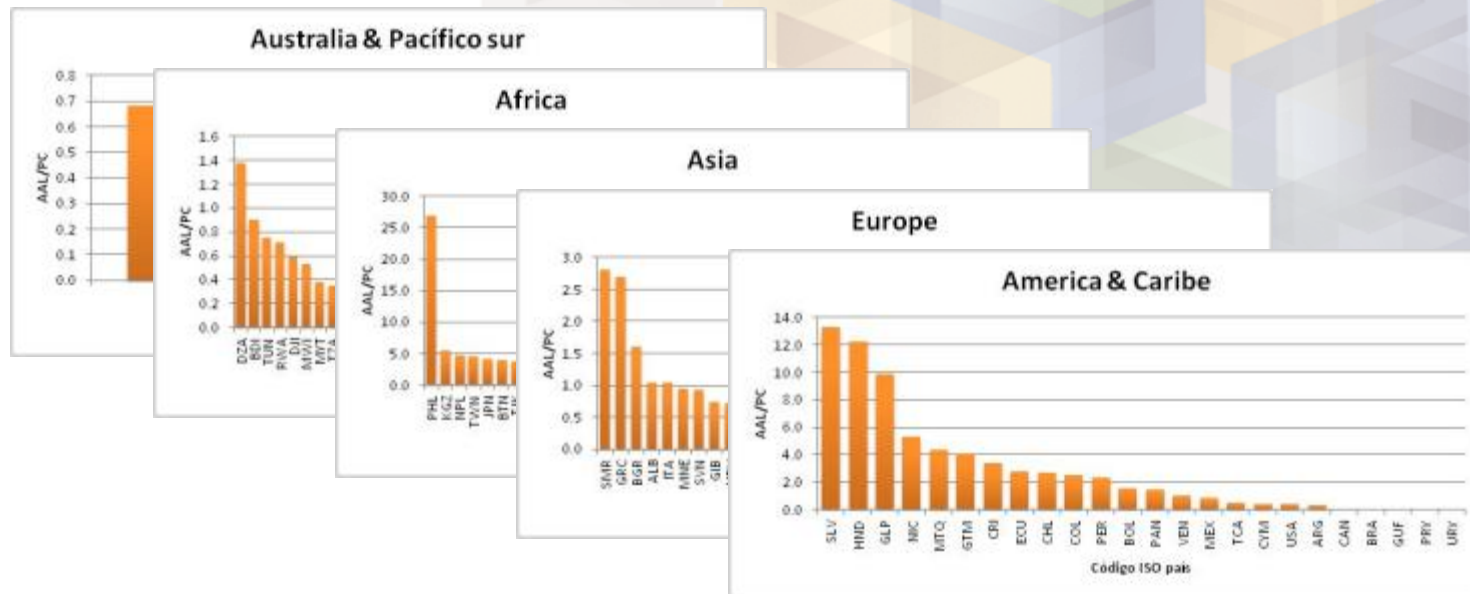
Global level (National)



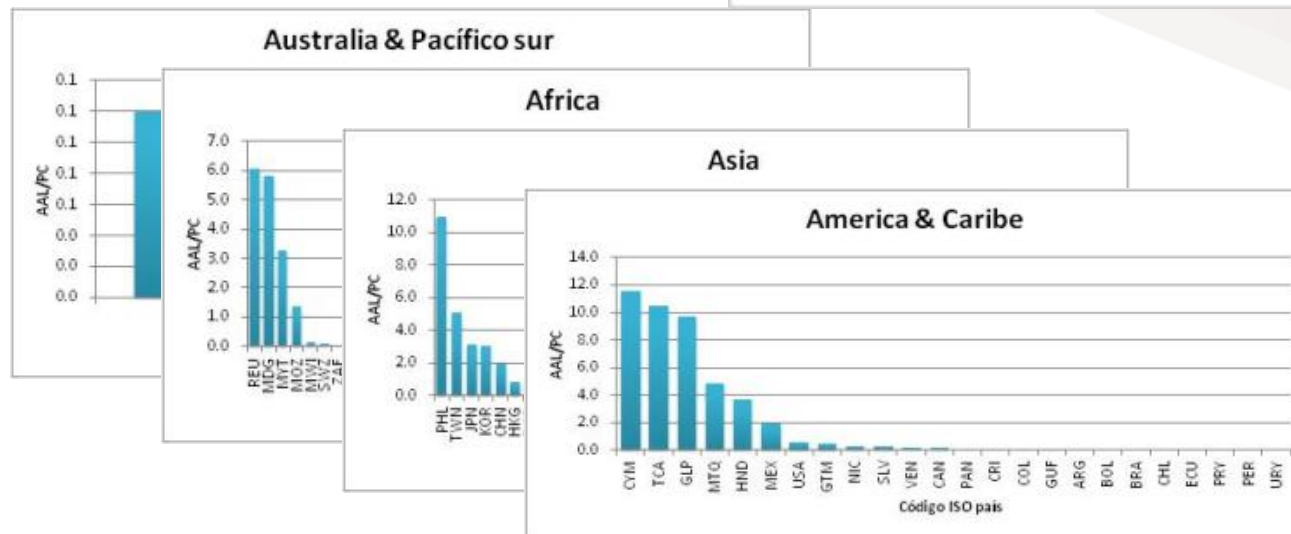
# Risk Indicators

## AAL/PC (EQ & W) by region

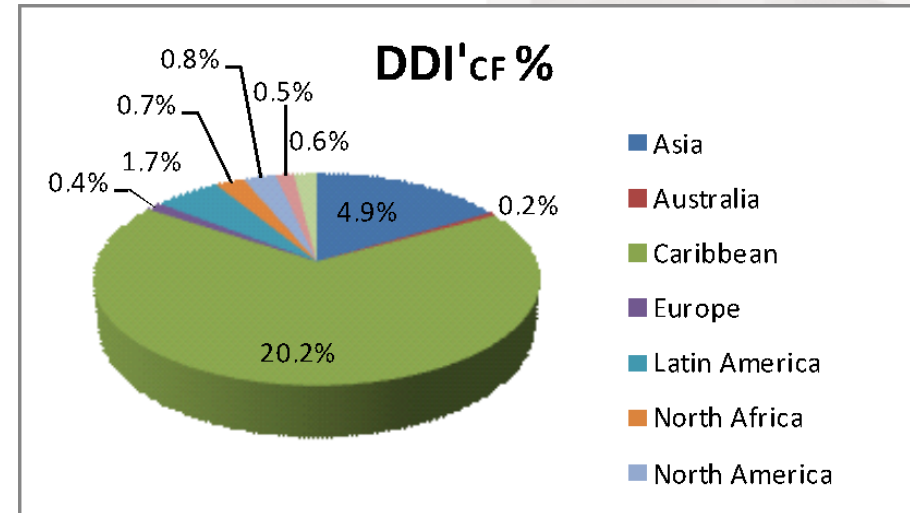
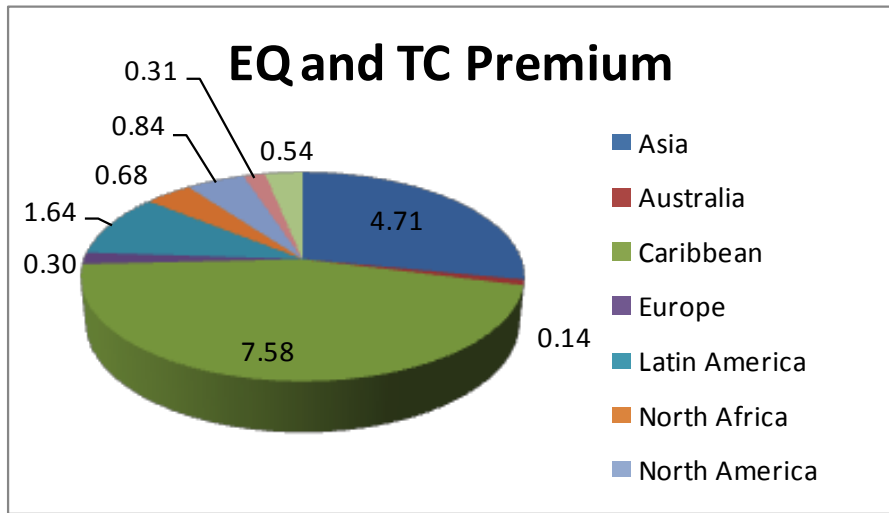
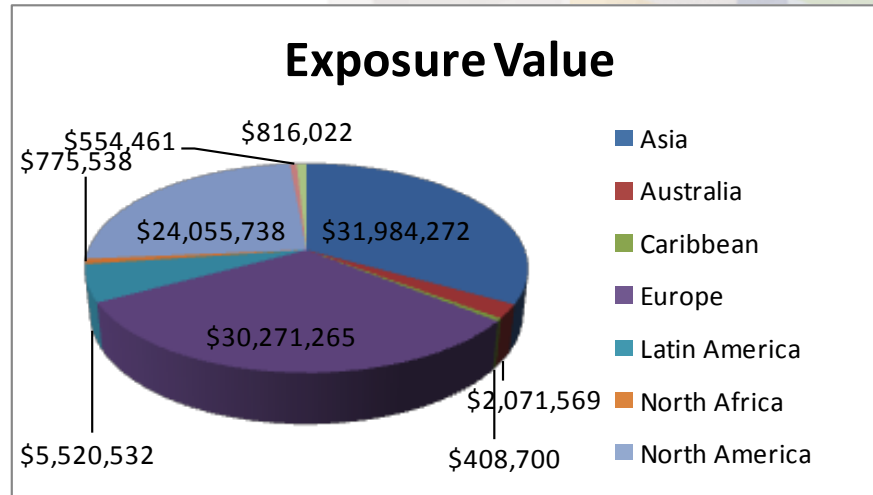
### Earthquake



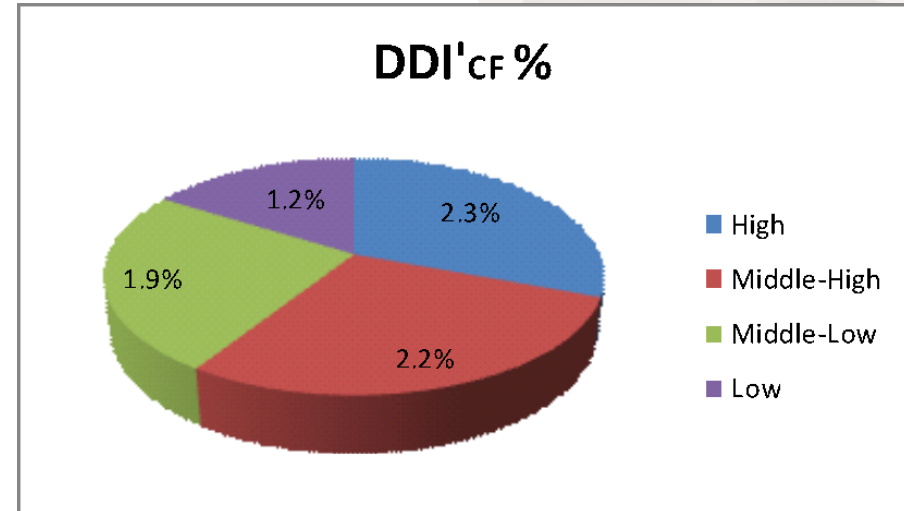
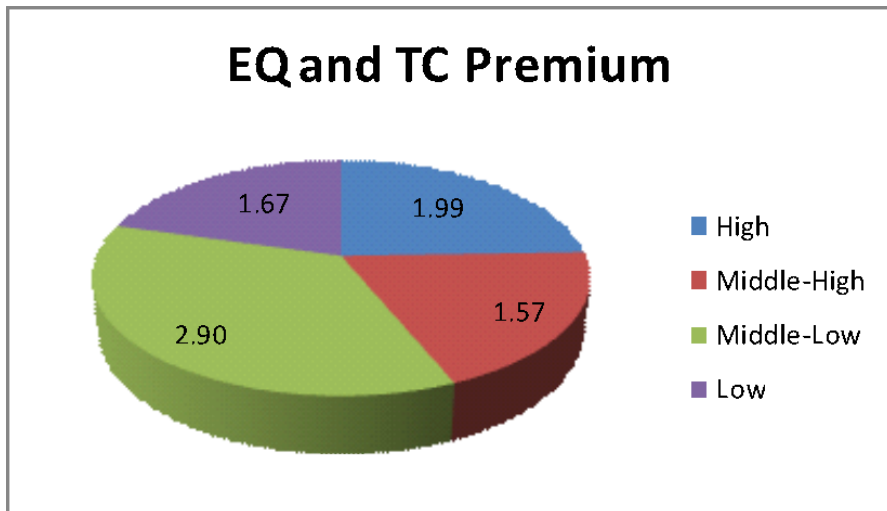
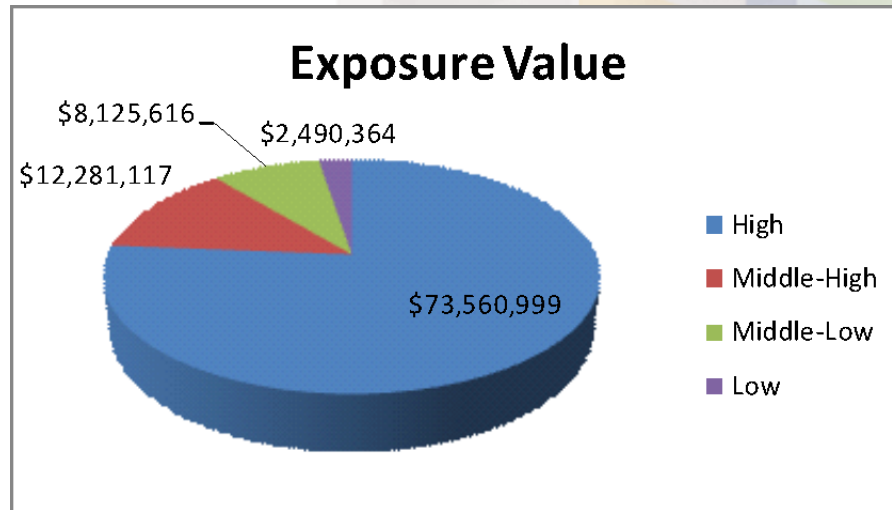
### Cyclone Wind



# Some Global Figures by Region

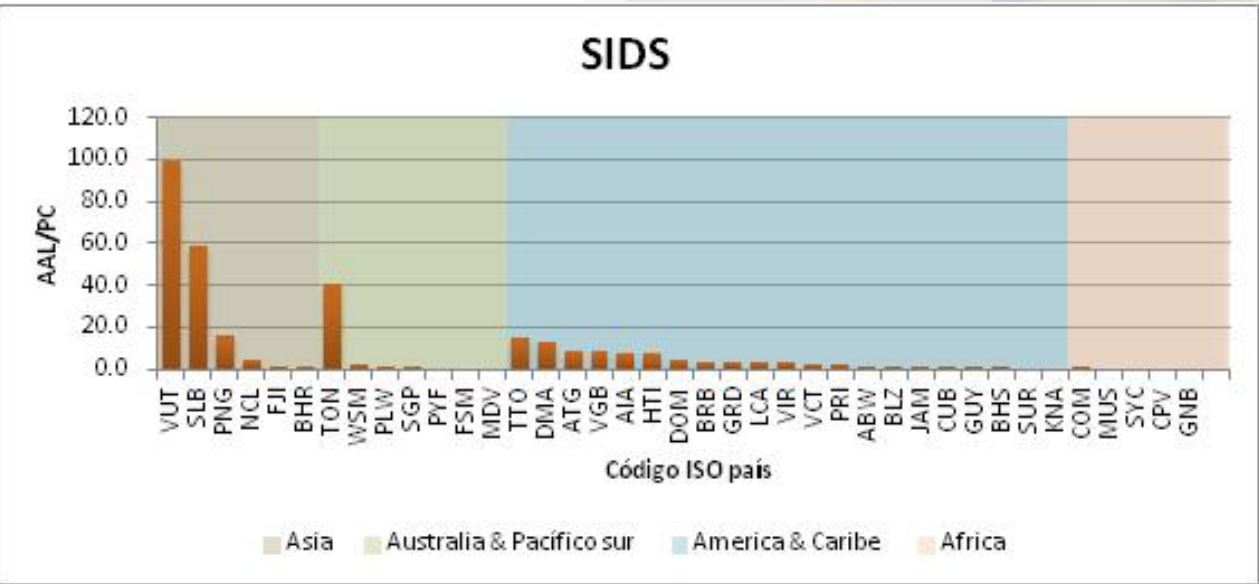
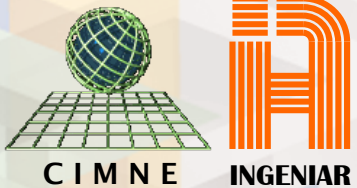


# Some Global Figures by Economic Level

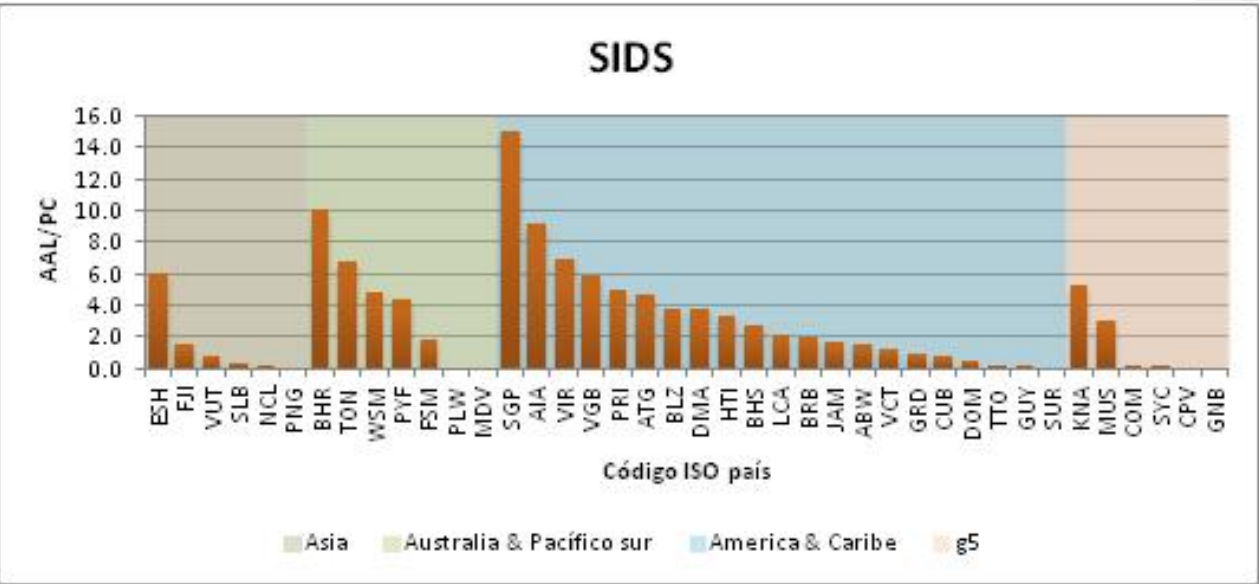




# Small Island Developing States



Earthquake

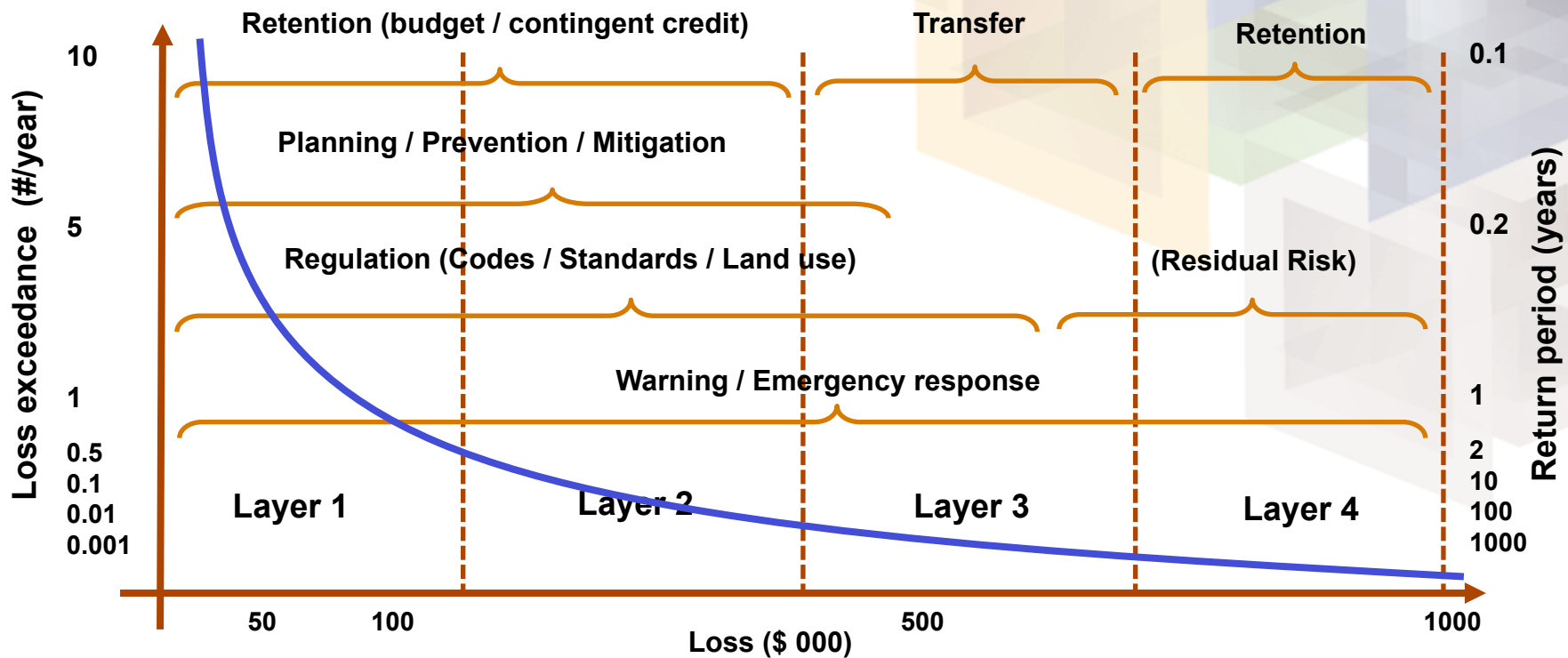


Cyclone Wind



# Loss Exceedance Curve

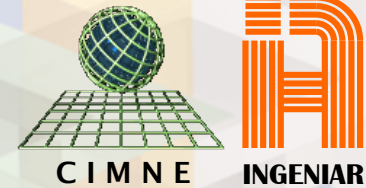
Governments need to define a risk reduction/financing strategy



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



# Some Reflections Regarding GRM for GAR

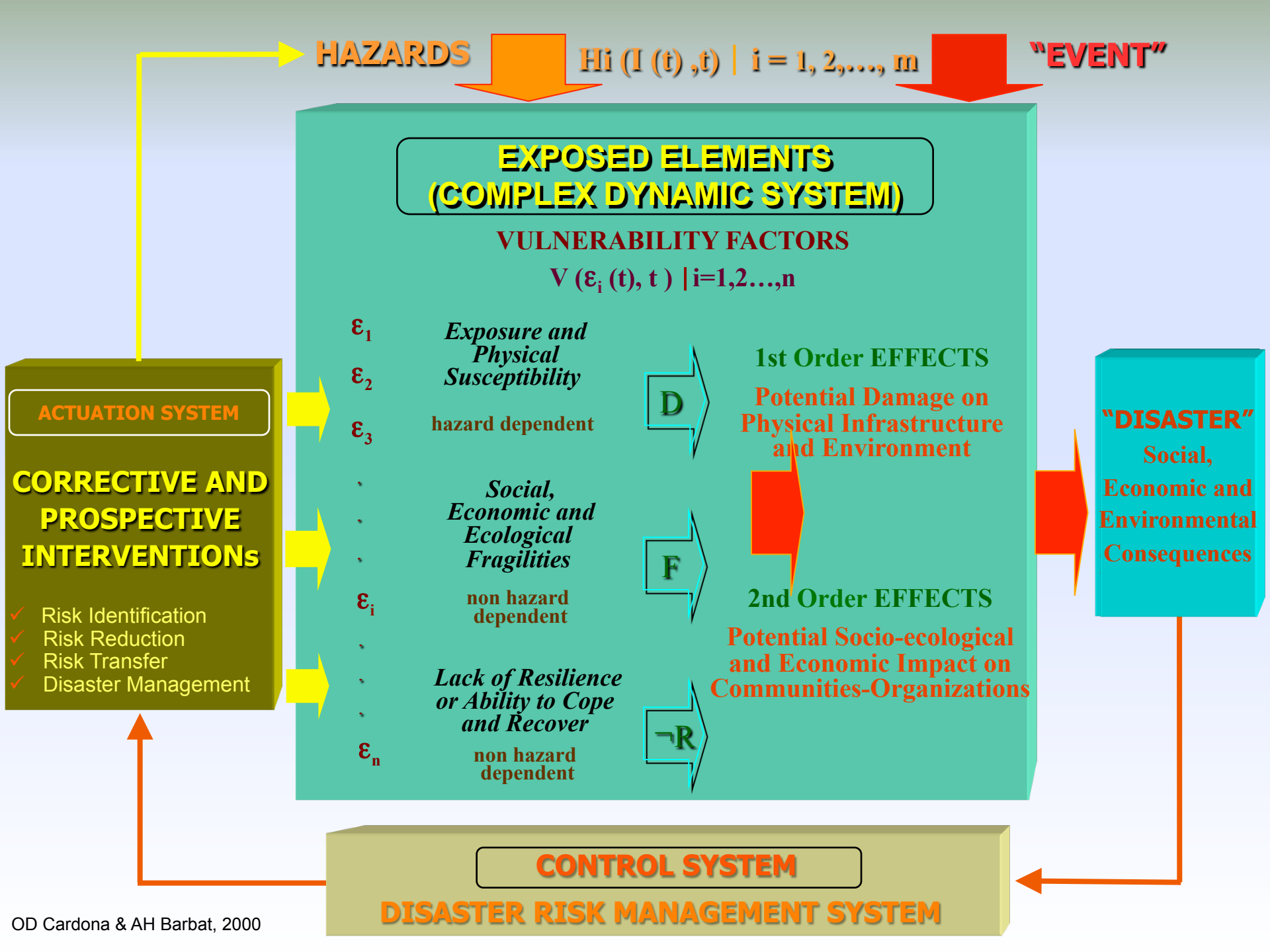


- ✓ *A worldwide methodology consistent for all hazards evaluated has been conducted at global level. Results are then useful for comparisons and rankings among them.*
- ✓ *Disaster risk had been estimated only based on historical records. The GRM is the first of its kind that takes into account events that have not yet occurred.*
- ✓ *This study has highlighted the need for countries to carry out risk analysis with higher resolution levels at sub-national or local level when the required information is available.*
- ✓ *The same “arithmetic” can be used for any resolution level.*



*Understanding probable losses due to hazard events creates powerful incentives for countries to develop planning options and tools to cope with risk, including allocating the sustained budgetary resources necessary to reduce the potential damage and safeguard the transformation of development.*







*“Far better an approximate answer to the right question, which is often vague, than an exact answer to the wrong question, which can always be made precise”*

John W. Tukey





*It is necessary to explore how probabilistic risk models and holistic models can be integrated in an effort to develop a methodology that can provide the true benefits of aggregation and disaggregation of hard and soft risk drivers to identify the corrective and prospective interventions to be done.*

