Disaster Risk Modeling

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- Risk Model & its Components
- Scenario vs. Probabilistic Modeling
- Risk Modeling Applications
- Disaster Risk Modeling in the Caribbean
Risk Model is a Tool Box

- There are various applications
- Some complex outputs and applications
- But choosing the appropriate tool will extensively facilitate the desired operation
Risk Models provide a representation of a complex physical phenomena

\[
\text{Hazard} \times \frac{\text{Exposure/Vulnerability}}{} = \text{Risk}
\]
Multi-hazard Models

- **EARTHQUAKE**
  - Tsunami
  - Ground Shaking / Liquefaction

- **HURRICANE**
  - Strong winds
  - Storm surge
  - Hurricane rainfall

- **INTENSE RAIN**
  - Other rainfall

- **VOLCANO**
  - Ash falls
  - Ballistic Ejections
  - Pyroclastic Flows
  - Lava flows

- **LANDSLIDES**
  - Ground shaking
  - Hurricane rainfall
  - Other rainfall

- **FLOODS**
  - Hurricane rainfall
  - Other rainfall
Powerful reliable models need extensive amount of DATA
Scenario Risk Modeling

San Juan del Sur
Nicaragua

Risk:
Physical Damage, Loss $
Probabilistic Hazard Modeling

Stochastic Event Set = All events that could impact a region

Frequency:
How likely is this event?
Annual probability of occurrence (i.e. 1/100)

Severity:
How strong is the event?
Hurricane Cat 4
What does the event look like?
Track, Point of landfall, wind field, etc
Risk Assessment

Visualization of hazard and risk
Infrastructure design
Climate Change Adaptation
Analysis of financial exposure

Tools to Assist Decision Making

Cost Benefit analysis for mitigation and prevention investments
Territorial planning
Scenario analysis for emergency preparedness
Immediate damage assessment
Risk Assessment

- Visualization of hazard and risk
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- Climate Change Adaptation
- Analysis of financial exposure
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- Territorial planning
- Scenario analysis for emergency preparedness
- Tools to Assist Decision Making
Scenario Analysis - # of injured

DAY

NIGHT

CONVENCIONES
Número de Heridos/Manzana
0
1
2 - 3
4 - 5
6 - 10
11 - 20
21 - 25
26 - 30
31 - 50
> 50
Risk Assessment

Visualization of hazard and risk

Infrastructure design

Climate Change Adaptation

Analysis of financial exposure

Immediate damage assessment

Cost Benefit analysis for mitigation and prevention investments

Territorial planning

Scenario analysis for emergency preparedness

Tools to Assist Decision Making
Flood Risk: Explore climate change scenarios

Base Model

Model A: Higher Intensity

Model B: Lower Intensity
Land Use Planning
Land Use Planning and Zoning

*Identification of main hazards*

- Seismic hazard map
- Landslide hazard map
- Flood hazard map
Design Specifications For Infrastructure Design
Cost Benefit Analysis
Retrofitting of Critical Infrastructure

Bogota Disaster Vulnerability Reduction program
Schools Retrofitted 2004-2008: 201
Total Budget: $80 Million

Schools and Administration
Immediate Damage Estimation

Surface Response Spatial Distribution

Damage Distribution Calculation

Bogotá Accelerograph Network (RAB)

Physical damage

Human losses
Financial Analysis of Risk

Insurance Premium Calculation

- Underwriting
- Reinsurance
- Reserve Calculations
What are the Potential Applications of Risk Modeling in the Caribbean region?
What is the Road Map to make risk modeling application part of DRM practice in the Caribbean?
All Hands at Work