Disaster Risk Assessment Tools and Applications

UNFCCC expert meeting on loss and damage
9-11 November, 2012
Barbados

pcrafi.sopac.org
Main Outputs

Pacific disaster risk assessment
- Probabilistic assessment of major perils
- Pacific Risk Information System
- Risk based framework to direct resources of countries and development partners

Pacific disaster risk financing solutions
- Fiscal risk exposure
- Financial disaster risk management
- Regional risk pooling
Perils Modeled

**Tropical Cyclone**

- Wind
- Flood from Precipitation
- Flood from Storm Surge

**Earthquake**

- Ground Shaking
- Tsunami Wave
Risk Assessment

Event Generation

Intensity Calculation

Exposure Information

Damage Estimation

Mitigation / Policy Conditions

Limit
Deductible

Loss Calculation
Historical Tropical Cyclones (≈1950-2008)

Raw data collected from the International Best Tracks Archive for Climate Stewardship (IBTrACS) project

<table>
<thead>
<tr>
<th>SS Storm Category</th>
<th>1-min Wind Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>74-95</td>
</tr>
<tr>
<td>2</td>
<td>96-110</td>
</tr>
<tr>
<td>3</td>
<td>111-130</td>
</tr>
<tr>
<td>4</td>
<td>131-155</td>
</tr>
<tr>
<td>5</td>
<td>&gt;155</td>
</tr>
</tbody>
</table>
Historical Earthquakes (Mw≥5.0 from ≈1900-2009)
Hazard Maps: Applications for Planners

100 yr mean return period: wind speed, ground acceleration with ~40% chances to be exceeded in 50 years
Buildings

Collected in the field using template
People

2010 projections based on national census information and PopGIS
Major Infrastructure

Papua New Guinea
Land Cover/Land Use Map $\rightarrow$ Crop Exposure

Major crop location extracted from Land Use/Land Cover (LULC) Maps
Country risk profiles
Illustration with Solomon Islands

**TABLE 2: Estimated Losses and Casualties Caused by Natural Perils**

<table>
<thead>
<tr>
<th>Mean Return Period (years)</th>
<th>AAL</th>
<th>50</th>
<th>100</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Losses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Million USD)</td>
<td>5.8</td>
<td>44.5</td>
<td>63.9</td>
<td>101.5</td>
</tr>
<tr>
<td>(% GDP)</td>
<td>0.9%</td>
<td>6.6%</td>
<td>9.4%</td>
<td>15.0%</td>
</tr>
<tr>
<td><strong>Emergency Losses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Million USD)</td>
<td>1.3</td>
<td>10.2</td>
<td>14.7</td>
<td>23.4</td>
</tr>
<tr>
<td>(% of total government expenditures)</td>
<td>0.5%</td>
<td>3.6%</td>
<td>5.2%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Casualties</td>
<td>63</td>
<td>489</td>
<td>691</td>
<td>1,019</td>
</tr>
</tbody>
</table>

**Risk Profile: Tropical Cyclone**

| **Direct Losses**          |     |    |     |     |
| (Million USD)              | 14.7 | 175.3 | 268.7 | 400.8 |
| (% GDP)                    | 2.2% | 25.8% | 39.6% | 59.1% |
| **Emergency Losses**       |     |    |     |     |
| (Million USD)              | 0.0 | 28.2 | 43.7 | 65.3 |
| (% of total government expenditures) | 0.0% | 10.0% | 15.4% | 23.1% |
| Casualties                 | 96  | 1,043 | 1,780 | 3,106 |

**Risk Profile: Earthquake and Tsunami**

| **Direct Losses**          |     |    |     |     |
| (Million USD)              | 20.5 | 189.6 | 280.6 | 426.2 |
| (% GDP)                    | 3.0% | 27.9% | 41.4% | 62.8% |
| **Emergency Losses**       |     |    |     |     |
| (Million USD)              | 3.8 | 32.8 | 46.6 | 68.6 |
| (% of total government expenditures) | 1.3% | 11.6% | 16.4% | 24.2% |
| Casualties                 | 159 | 1,234 | 1,914 | 3,246 |

**Risk Profile: Tropical Cyclone, Earthquake, and Tsunami**
Explore Maps

Explore pre-made maps, and those made by website users, on such things as earthquake intensity, flood hazards, topography, road networks, buildings, bridges, and much more.

Create Maps

Using the same raw data used to create other maps on the site, PaRIS lets you compose and share your own maps. Create a map with our cartography tool to develop new insights and track changes over time. Save, print and share these maps if you wish!

Search for Data

PaRIS lets you access and browse geospatial data. Search for data that is valuable to you in a number of geospatial formats.

About

Pacific Risk Information Systems (PaRIS) is one of the largest collections of geospatial information for the Pacific island region. It contains information and data layers on:

- **Base maps**
  - administrative boundaries, topography, bathymetry, land use cover, surface soil, geology
- **Hazard maps**
  - tropical cyclone, earthquakes
- **Field Survey Results**
  - building, infrastructure - partial coverage
- **Risk exposure**
  - population, buildings, infrastructure, crops
- **Risk and loss maps**
- **Historic event and disaster impact catalogues**

PaRIS was assembled to provide detailed probabilistic risk information for 15 Pacific Island countries for a range of decision makers including disaster risk management agencies. The perils covered are tropical cyclones (wind, storm surge and rain) and earthquake (ground shaking, tsunami). The countries covered are Cook Islands, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru...
Applications – PCRAFI Phase 3

- Rapid Disaster Impact Estimation
- Macroeconomic Planning & Disaster Risk Financing
- Integration of Climate Change projections
- Urban Planning and Infrastructure Design
- Professional and Institutional Capacity Development
Post-Disaster Loss Calculation
Post-Disaster Real Time Loss Assessment - Tropical Cyclones and Earthquakes

• CAT models do not typically use any direct field observation of damage, loss, or disaster intensity

• The accuracy of the loss estimates improves if field observations are taken into account
Pre-disaster Loss Assessment

• Feasibility study for the development of a system that, **in real time**, forecasts the impact of tropical cyclones as they build on any of the 15 PICs

• AIR has extensive experience in such systems in the Atlantic Ocean in the North Pacific Ocean for certain countries

• Such systems are feasible but their application to the region of the PICs needs to be studied further
## Pacific Disaster Risk Financing and Insurance Solutions

### Increasing financial resilience against natural disasters

<table>
<thead>
<tr>
<th>Institutional Capacity Building</th>
<th>Pacific disaster risk insurance market development</th>
<th>Pacific disaster risk insurance pilot</th>
</tr>
</thead>
<tbody>
<tr>
<td>• TA to MoF to develop integrated disaster risk financing strategy</td>
<td>• Refine cat risk models for market-based transactions</td>
<td>• Test the credibility of Pacific cat risk models on reinsurance markets</td>
</tr>
<tr>
<td>• TA to MoF to develop risk-based financial planning</td>
<td>• Build capacity of private market players (e.g., insurers)</td>
<td>• Assess the risk appetite of reinsurers for Pacific disaster risk</td>
</tr>
<tr>
<td></td>
<td>• Develop prototype parametric insurance products</td>
<td>• Test the viability of Pacific disaster risk insurance</td>
</tr>
</tbody>
</table>

![Flags of the Pacific Island Countries](image)
Integrating PACCSAP TC projections with PCRAFI risk modeling

**Objective:** a regional assessment of potential future tropical cyclone risk to critical assets in Pacific island countries with climate change.

**Outcome:**
1. understand the changing nature of tropical cyclone risk to infrastructure assets
2. consider the future implications in terms of loss and damage
3. assess the effectiveness of current planning and design standards against future needs

Pacific-Australia Climate Change Science and Adaptation Planning Program
PACIFIC RISK INFORMATION SYSTEM

- Rapid Disaster Impact Estimation
- Urban Planning and Infrastructure Design
- Macroeconomic Planning & Disaster Risk Financing
- Integration of Climate Change projections
- Professional and Institutional Capacity Development