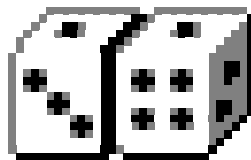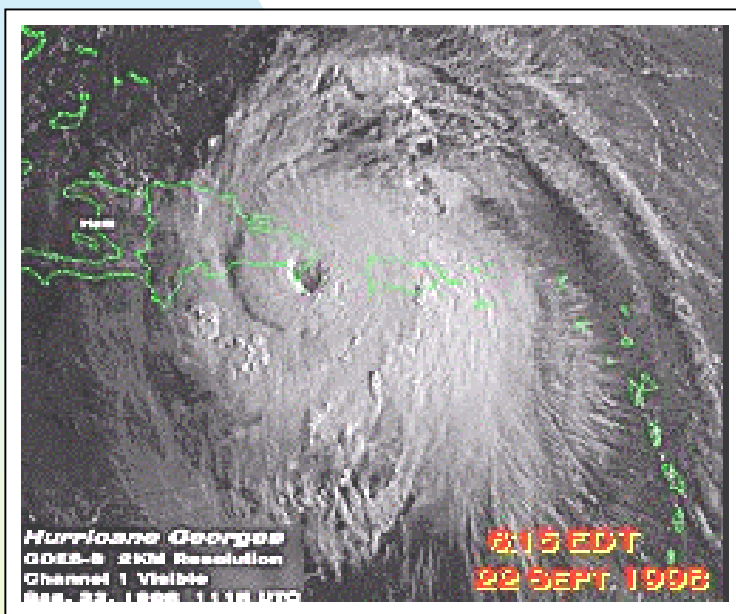# Cat Models in Practice: "A Reinsurer's Perspective"

Robert Porter, Senior Vice President
ICA Cancun, Mexico
March 2002

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Catastrophe Models

- Number of different commercially available catastrophe models including EQECAT, RMS, AIR, etc.

- All aimed at providing solutions to modeling, pricing and understanding catastrophe risk

- As a reinsurer what are we looking to achieve…

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Cat Model Objectives

- Analyze catastrophe risk exposure by account

- Price catastrophe risk appropriately

- Attempt to price on a consistent basis

- Evaluate marginal impact on existing portfolio

- Control and manage catastrophe aggregates

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General Catastrophe Modeling Approach

- 1. Probability of different cat events occurring (historical record, scientific research, etc.)

- 2. Expected property loss from different cat events (damageability curves)

- 3. Adjustments for (re)insurance terms (deductibles, event limits, co/ins, etc.)

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Catastrophe Model Issues

- Quality of underlying data assumptions in models

- Quality and accuracy of data input into model

- Consideration of (re)insurance conditions

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Quality of Underlying Data

- Wind
  - ◆ Government sources (e.g. NOAA in US); other historical records
  - ◆ Old events based on observations, crude measuring devises
  - ◆ 150 years data total for Caribbean / US Atlantic Coast and only 50 w/ reliable data
  - ◆ Long-Term vs. Short-Term (25-40 year oscillations in sea temperature of N. Atlantic; El Niño, etc.)
  - ◆ Adjust for population, wealth, inflation

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Quality of Underlying Data (cont.)

- Earthquake

  - ♦ Government sources (e.g. U.S. Geological Survey); other historical records

  - ♦ Different measuring systems over time (MMI, Richter, Surface / Body Wave, etc.)

  - ♦ Short-term Patterns: Increasing EQ stress along known fault lines (Turkey)

  - ♦ "X" factor: Modeling for unknown fault lines

  - ♦ Adjust for population, wealth, inflation

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Catastrophe Models:
Quality of Data Input

- Location – Zip Code vs. Cresta
  - Soil composition
  - Topography
  - Proximity to beachfront
- Construction Input
  - Poured Concrete, Concrete Block, Steel, Brick Masonry; Reinforced vs. Unreinforced
  - Construction code; adherence to code; age of buildings and code at that time
  - Housing stock vs. Insured Stock

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Catastrophe Models:
Quality of Data Input (cont.)

- Exposure: Building vs. Contents vs. Business Interruption

- Occupancy
  - ◆ Commercial – Offices, Retail, Hotel, Restaurant, Warehouse, etc.
  - ◆ Industrial – Petroleum, Water Plant, Factory, etc.
  - ◆ Residential and Government (schools, offices)

- Number of Stories

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Quality of Data

Best results obtained by detailed input: aggregates by region, by construction, by exposure, by occupancy & by # stories

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Analyzing Catastrophe Risk: (Re)Insurance Conditions

- Deductibles – must account for variation in proportion of properties affected

- First-Loss Policies (only top location aggregates provided, how to model?)

- Co-Insurance

- Reinstatement provisions; event limits; drop-down layers; second event covers, etc.

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Catastrophe Models:
Ease of Use

- Works in progress – unexpected errors do occur. Reinsurers working as Beta testers.

- Clear labeling of assumptions needed
  - "Black Box": Full disclosure vs. proprietary rights

- Concise output reports with annual avg cost, key exceedance points and program pricing

- Time – need to balance level of analysis / data input vs. time required and quality / significance of improved answer

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Catastophe Models: Factors Not Captured

- **Catastrophic Perils**
  - ◆ Flood (Venezuela 1999, Texas 2001)
  - ◆ Terrorism (NYC 2001)
  - ◆ Hail / Ice Storms (Canada, Australia)

- **Post-Loss Demand Surge (just now being introduced in some models)**

- **Short-term Hazard Trends**

- **Non-Building Property exposures**
  - ◆ Auto / Inland Marine / Engineering

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Portfolio Management

- Companies often use different models (RMS, EQECAT, AIR, etc.) in different regions, yet how does (re)insurer analyze overall portfolio?

- Determining 100-250 year worst-case loss

  - Should each account stand alone or should marginal impact on specified return period loss be considered?

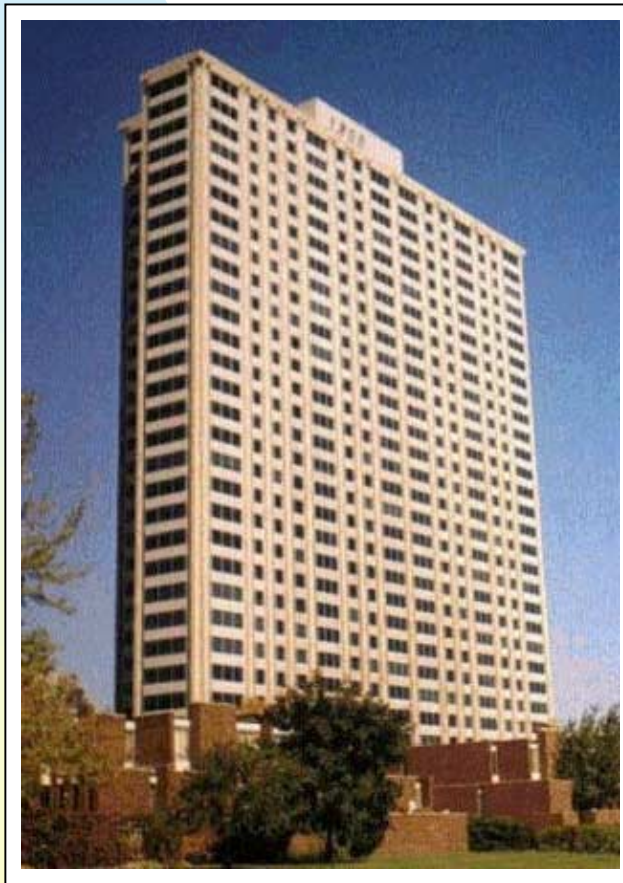 - How does (re)insurer adjust capital charge for low/high exposure areas?

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"Reality Check"

- Different models have different assumptions

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"Reality Check"

- Different models have different assumptions
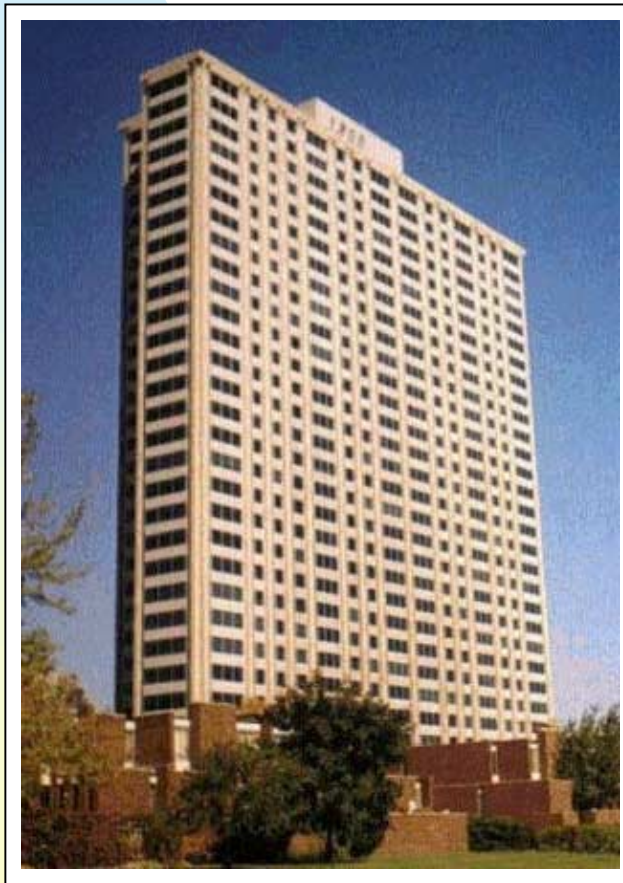
- Different output for same risks. For example…
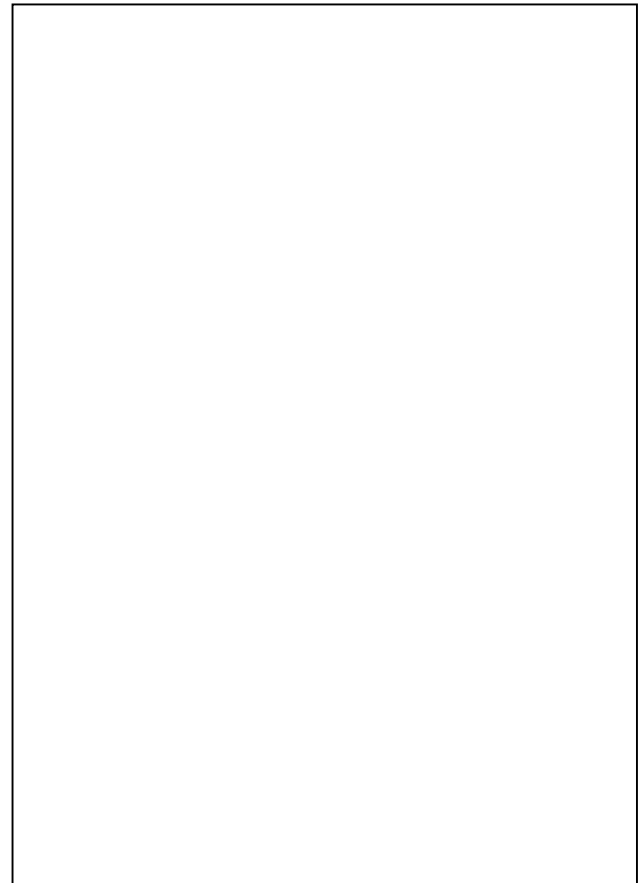
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"Reality Check"

Apartment Bldg after EQ
(**Model "X"**)

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"Reality Check"

Apartment Bldg after EQ
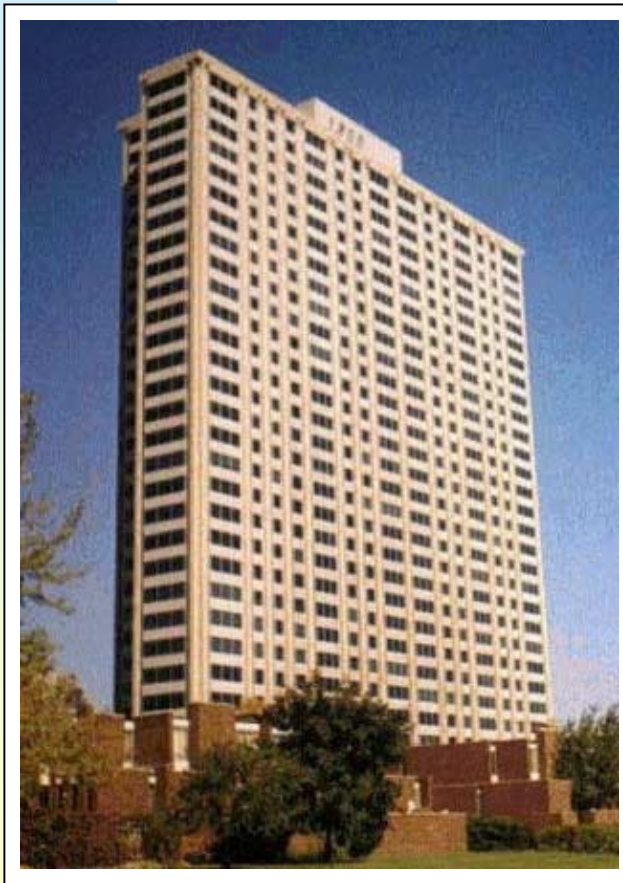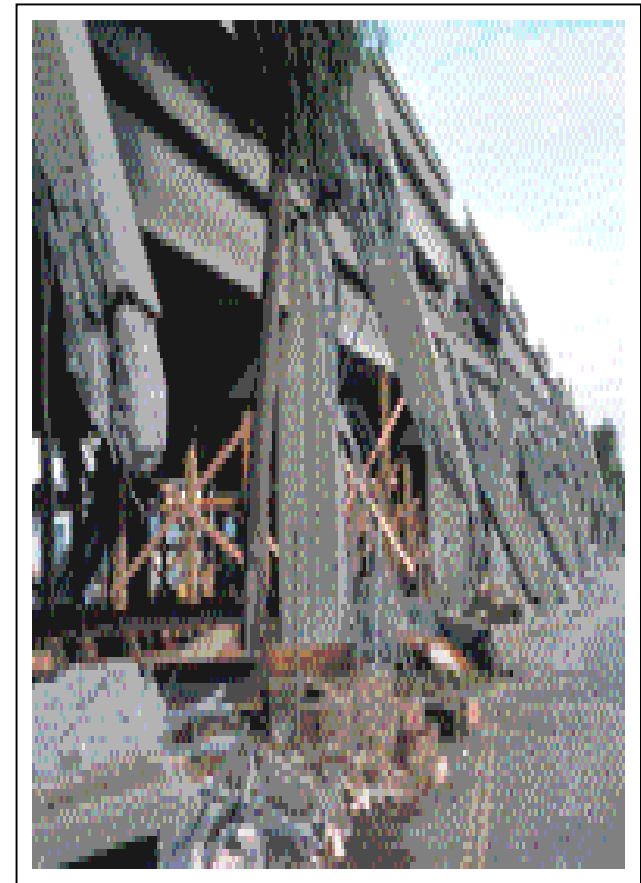   (Model "X")

VS.

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"Reality Check"

Apartment Bldg after EQ
(Model "X")

Apartment Bldg after EQ
(Model "Y")

VS.

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"Reality Check"

- Different models have different assumptions

- Different output for same risks

- Need to Reality check outputs and review assumptions

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"Reality Check"

- What is the annual average pure premium vs. original market rates over last ten years?

- Is 100-250 year PML in range of Cat XL limits?

- Look at simulated events to ensure that location, size of loss and return period make sense

- Identify historical events and compare against actual company loss data.

- How do alternative models stack up for a given peril in a given region?

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Catastrophe Models: Conclusions

- Models provide for enhanced management, pricing of catastrophe risk

- Need to understand the methodology applied in cat models

- Need to "stress test" output

- Need to recognize limitations

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