UNEP FI North American Taskforce Event –
Managing Climate Change Risks: The Case of
Cat Bonds

New York, October 23, 2006
2005: +0.47°C above the 1961-1990 annual mean.

Source: CRU, UK (2006), compilation acc. to WMO
Changing Risks

- Greenhouse gases
- Air and sea temperature
- Humidity
- Sea level

More extreme weather events
- Wind, hail, rain
- Drought

Important:
- More frequent events
- Stronger events
Great Weather Disasters 1950 – 2005

© 2006 NatCatSERVICE, Geo Risk Research, Munich Re, as per March 28, 2006
2005: 650 natural catastrophes

- Major natural catastrophe
- Great natural catastrophe
- Earthquake, tsunami, volcanic eruption
- Windstorm
- Flood
- Temperature extremes (i.e. heat wave, forest fire), Mass movements (i.e. avalanche, landslide)

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How to Prepare for Increasing Cat Risks?

- Development of new risk models considering climate change
- Adequate pricing
- Substantial deductibles, based on the respective exposure
- Loss prevention
- Exclusion of certain hazards
- Exclusion of particularly exposed areas
- Private-public partnership
- Cat Bonds
Transaction Structure

- **TRS Provider**
  - Inv. Income
  - L – TRS Spread + Inv. Income

- **Collateral Account**
  - Cover

- **SPV**
  - Spread
  - Repayment L + Spread
  - Proceeds

- **Sponsor**

- **Capital Markets Investors**
Outstanding Volume and Issuance per Year

* And prior; ** To date; Source: Goldman Sachs

Year | Outstanding | Issued
--- | --- | ---
1997* | 1.3 | 1.3
1998 | 1.8 | 1.1
1999 | 2.0 | 1.2
2000 | 2.3 | 1.1
2001 | 2.7 | 1.0
2002 | 3.3 | 1.3
2003 | 5.1 | 2.4
2004 | 5.3 | 1.3
2005 | 8.4 | 2.4
2006** | 11.9 | 3.3

*And prior; **To date; Source: Goldman Sachs
Nat Cat Risks Transferred to Capital Markets

- Cal. EQ: 18
- Japan EQ: 17
- Centr. U.S. EQ: 16
- U.S. EQ: 16
- Pac N/W EQ: 16
- Mexico EQ: 16
- Australia EQ: 16
- US Hurricane: 27
- Europe Wind: 27
- France Wind: 27
- Japan Wind: 27
- Australia Wind: 27
Never before since the beginning of records (1850) have so many named tropical storms occurred in the North Atlantic basin in one season: 27, of which 15 with hurricane strength.*

* Old absolute record 21 in 1933, resp. 12 in 1969.
Changes in the Sea Surface Temperature

NATL: North Atlantic
WPAC: West Pacific
SPAC: South Pacific
EPAC: East Pacific
NIO: Northern Indic
SIO: Southern Indic

Source: Webster et al. (2005), Science Vol. 309.
### Industry Exposure – Region / Coverage Type

<table>
<thead>
<tr>
<th></th>
<th>Resi</th>
<th>Comm</th>
<th>Mobile</th>
<th>Auto</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Florida</strong></td>
<td>1,222</td>
<td>1,343</td>
<td>43</td>
<td>124</td>
<td>2,732</td>
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<tr>
<td><strong>N.E.</strong></td>
<td>3,406</td>
<td>4,314</td>
<td>19</td>
<td>241</td>
<td>7,980</td>
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<tr>
<td><strong>Texas</strong></td>
<td>1,356</td>
<td>1,668</td>
<td>37</td>
<td>176</td>
<td>3,236</td>
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<tr>
<td><strong>Gulf</strong></td>
<td>722</td>
<td>836</td>
<td>36</td>
<td>91</td>
<td>1,685</td>
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<tr>
<td><strong>S.E.</strong></td>
<td>1,602</td>
<td>1,569</td>
<td>63</td>
<td>177</td>
<td>3,411</td>
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<tr>
<td><strong>Mid-Atlantic</strong></td>
<td>1,329</td>
<td>1,181</td>
<td>13</td>
<td>106</td>
<td>2,628</td>
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<tr>
<td><strong>Inland State</strong></td>
<td>3,271</td>
<td>3,225</td>
<td>69</td>
<td>313</td>
<td>6,878</td>
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<tr>
<td><strong>Total</strong></td>
<td>12,907</td>
<td>14,137</td>
<td>279</td>
<td>1,227</td>
<td>28,549</td>
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</table>

Source: AIR Worldwide; Insured Industry Portfolio; in USD bn
## Hurricane Frequency Sensitivity Analysis I

<table>
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<th>Class Notes</th>
<th>Base Case</th>
<th>Sensitivity Case</th>
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<tbody>
<tr>
<td></td>
<td>P(A)</td>
<td>E(L)</td>
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<tr>
<td>A</td>
<td>1.97</td>
<td>1.79</td>
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<tr>
<td>B</td>
<td>2.59</td>
<td>2.28</td>
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<td>C</td>
<td>3.34</td>
<td>3.02</td>
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<tr>
<td>D</td>
<td>4.65</td>
<td>3.97</td>
</tr>
</tbody>
</table>

All numbers in %
Hurricane Frequency Sensitivity Analysis II

Estimated Insurance Industry Losses (USD Billions)

- Class A Exhaust (USD 72.5 bln)
- Class A Attach / Class B Exhaust (USD 62.5 bln)
- Class B Attach / Class C Exhaust (USD 52.5 bln)
- Class C Attach / Class D Exhaust (USD 42.5 bln)
- Class D Attach (USD 32.5 bln)

Exceedance Probability

- Near-Term Frequency
- Long-Run Frequency
Hurricane Cat Bond Pricing

![Graph showing the relationship between Expected Loss and Spread über LIBOR (Bps) for Pre-Katrina 2005, 2006 Bonds, 2005 Post-Katrina, and Pre-Katrina lines.](image)

- **Pre-Katrina 2005**
- **2005 Post-Katrina**
- **2006 Bonds**

The graph illustrates the pricing trends post-Katrina compared to pre-Katrina, with a clear increase in spread über LIBOR (Bps) for higher expected losses.
Contacts

Munich American Capital Markets, Inc.
540 Madison Avenue, 5th Floor
New York, NY 10022-3213
Phone:  +1 212 610-5900
Fax:  +1 212 610-5979
E-mail:  info@macm.com

Beat Holliger
Phone:  +1 212 610-5909
E-mail:  bholliger@macm.com