Cat Events of 2010 and 2011

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Managing Director
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AIR History

• Founded 1987
• First cat modelling company
• Pioneered probabilistic cat loss estimation methodology
• Covers natural hazards in 90+ countries & terrorism in US
• Leading application for use by hedge funds and cat bond investors
• Extensive use in re/insurance industry and capital markets solutions
  – >90% worldwide reinsurers
  – > 400 primary insurers benefit
  – All major intermediaries
  – Research-oriented clients
• Subsidiary of Verisk Insurance Solutions
• Offices in Boston, London, Munich, San Francisco, Hyderabad, Beijing and Tokyo
AIR Offices

AIR Staff

Around 320 professionals
Over 45 hold PhDs
AIR Catastrophe Models: Global Coverage

ALERT™ (AIR Loss Estimates in Real Time)

- Provides real-time loss estimates
- Industry losses estimated for the most likely scenarios
- Posted on ALERT website as detailed hazard and loss maps
- Files containing all scenarios can be downloaded and input directly into AIR software for further analysis of company-specific losses
Cat Events of 2010 and 2011

Timeline of Cat Events 2010 – 2011 (I)

- Maule, Chile, earthquake (27th Feb 2010)
- European Winterstorm Xynthia (27th Feb 2010)
- Christchurch, New Zealand, earthquake (4th Sep 2010)
- Queensland, Australia, floods (Dec 2010 – Jan 2011)
- Cyclone Yasi, Australia (2nd Feb 2011)
Timeline of Cat Events 2010 – 2011 (II)

- Christchurch, New Zealand, earthquake (22nd Feb 2011)
- Tohoku, Japan, earthquake (11th Mar 2011)
- Severe Thunderstorms in the US (20 – 27th May 2011)
- Christchurch, New Zealand, earthquake (13th June 2011)

Maule, Chile, earthquake (27th Feb 2010)
The Pacific Ring of Fire Represents The Most Seismically Active Area in the World

Chile Is a Mega-Thrust Convergence Zone
February 27, 2010 Mw 8.8 Maule Earthquake Affected a Very Extensive Area

Variations in Reported Earthquake Parameters Reflect Uncertainties in Rupture Length

USGS

UCSB

EIC

L=450 km

L=490 km

L=490 km
ALERT Provides a Set of Scenarios that Reflect the Uncertainty in Source Parameters

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AIR Participated in the EERI Field Damage Survey
Damage in Modern Buildings Due to Flexo-Compression

Overturning Moment

Tension/Compression

The Impact of the Tsunami Was Restricted to the Chilean Coast

ESTIMATED TSUNAMI ARRIVAL TIMES
Hours after the initial earthquake.

ESTIMATED TSUNAMI WAVE HEIGHT
0 1 foot

Easter Island
Juan Fernandez Islands
Bio-Bio and Maule Coasts
Summary of ALERT Loss Estimates for the Chile Earthquake

**M 8.8 MAULE Region of Chile (February 27, 2010)**

- **AIR Loss Estimate from Chile EQ (Feb. 28, 2010)**: $2B – $6B (USD)
- **AIR Updated Loss Estimate from Chile EQ (March 25, 2010)**: $5.5B – $8.5B (USD)
- **Swiss Re Estimate (March 26, 2010)**: $4B – $7B (USD)
- **Munich Re Estimate June 8, 2010**: ~8BUSD

*AIR industry insured loss estimate for property lines excluding infrastructure

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**Xynthia (Extratropical Cyclone)**
European Windstorm Xynthia – February 27th, 2010

- Gusts up to 140 km/h in areas of lower elevation across Spain, France, Germany, Belgium, and Denmark
- Torrential rains
- Caused significant travel disruption and property damage across parts of Spain, France, Belgium, and Germany
- Post-disaster survey

Insured Loss was Estimated at Around €2 Billion
Christchurch, New Zealand Earthquakes (Sep 2010, Feb 2011)

New Zealand is Located in a Very Seismically Active Region

Australia
Stable Continent

EURASIA PLATE
New Guinea Trench
PACIFIC PLATE
Java Trench

New Zealand
44 mm/yr
Seismicity of New Zealand is Dominated by the Tectonic Interaction between the Pacific and Australian Plates

Historical Summary of the Epicentral Distribution of M > 4 Earthquakes: 1840 - 2002
Large Historical Earthquakes (M > 6.5) Correspond to Active Crustal Faults

Institute of Geological and Nuclear Sciences compiled slip rate data for more than 300 faults based on paleoseismic and geodetic (GPS) data.

Summary of the Mw 7.1 (4 September 2010) and Mw 6.3 (22 February 2011) Christchurch Earthquakes
The Event Occurred on an Unknown Fault, Yet AIR’s Stochastic Catalogue Contained Similar Events

Event # 115067

Event # 117749

Event # 60823

AIR Participated in the EERI Field Survey of Damage from the Christchurch Earthquake

EERI Reconnaissance Team at Port of Lyttelton

EERI Team Leader and Tao Interview EQC Associates
How Easy It Is to Estimate New Zealand AAL from Historical Events?

Historical AALs:

- 1900 – August 2010: 409m NZD
- 1900 – October 2010: 454m NZD
- 1900 – March 2011: 545m NZD

Queensland, Australia, floods (Dec 2010)
ALERT Posting for Queensland Floods

Insured Losses: 2.6 – 3 billion AUD

Cyclone Yasi, Australia (2nd Feb 2011)
**Damage Survey: Tropical Cyclone Yasi (Feb 3, 2011)**

- Made landfall in Northern Queensland (between Cairns and Townsville)
- Damage survey
  - AIR crew sent within days
  - Large cities spared from strongest winds, minimal damage
  - Newer residences (built post-1980) highlight strength of building code
  - Damage to older homes primarily to roof coverings and structures
  - Damage to roller doors of garages and light metal buildings/sheds
  - Significant damage to area crops

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**ALERT Loss Estimates for Yasi**

**Insured Losses:** 350 to 1,500 million AUD
Tohoku, Japan, Earthquake (11th March 2011)

Japan Seismicity Is Dominated by the Subduction of the Pacific and Philippine Sea Plates
HERP Hazard Work Did Not Include This Level of Seismicity in the Region

- HERP (Headquarters for Research Promotion) was established after the 1995 Kobe earthquake
- The 2005 regional seismicity model has gone through incremental updates in 2006 and 2007
- HERP report includes information on
  - 98 well studied faults
  - 178 other faults
  - about 26 subduction zone segments

ALERT Posting of 12 March 2011 Was Based on Event Parameters and Fault Slip Distribution
**Reported JMA Macroseismic Intensity for Different Prefectures and Distribution of TIV**

<table>
<thead>
<tr>
<th>JMA Seismic Intensity</th>
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<th>Total Insured Replacement Values, All Lines [JPY trillion]</th>
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**Overview of Tsunami Footprint Modelling**

- **SRTM Elevation**
- **POM Results**
- **Satellite Imagery**
- **JMA Data**
- **Modelled Tsunami Footprint**
**AIR’s Modelled Inland Tsunami Penetration in Natori and Sendai**

![Maps showing inland tsunami penetration in Natori and Sendai](image)

**ALERT Coverage and Loss Estimates for Tohoku Earthquake**

- **Main Shock – M9.0 Tohoku Region (Mar. 11, 2011)**
  - **Early Observations (March 11th and 12th)**
  - **K-NET Ground Motion Data Becomes Available (Mar 12-24)**
  - **Using Updated Ground Motion Data and Accounting for Tsunami Losses**

- **15B to 35B USD Insured Loss**
  - (March 12)

- **20B to 30B USD Insured Loss**
  - (March 24)

*The loss estimates do not reflect:*
- Losses to uninsured properties
- Losses to infrastructure
- Indirect business interruption losses
- Loss adjustment expenses
- Losses from non-modelled perils, including tsunami and fire-following
AIR's Loss Estimate with Tsunami is $20 Billion - $30 Billion (1.5-2.5 Trillion JPY) (~40 year to ~80 year loss)

Timeline of Cat Events 2010 – 2011 (I)

- Maule, Chile, earthquake (27th Feb 2010) - $8bn
- European Winterstorm Xynthia (27th Feb 2010) - $2bn
- Christchurch, New Zealand, quake (4th Sep 2010) - $5bn
- Queensland, Australia, floods (Dec 2010) - $3bn
- Cyclone Yasi, Australia (2nd Feb 2011) - $1bn
### Timeline of Cat Events 2010 – 2011 (II)

- **Christchurch, New Zealand, quake (22\textsuperscript{nd} Feb 2011)** - $10bn
- **Tohoku, Japan, earthquake (11\textsuperscript{th} Mar 2011)** - $30bn
- **Severe US Thunderstorms (20 – 27\textsuperscript{th} May 2011)** - $7bn

### Summary

- Major cat events of 2010 and 2011 so far have caused insurance losses in excess of $60 billion
- Of this, nearly $50 billion were recorded in just three countries - Japan, New Zealand and Australia
- The largest single insured cat event of 2010 and 2011 so far was the Tohoku earthquake
- AIR aims to produce ALERT postings for all major cat events
- ALERT postings can be interpreted as live stress-tests of the underlying models and industry exposures
- ALERT postings have proved invaluable for many companies