

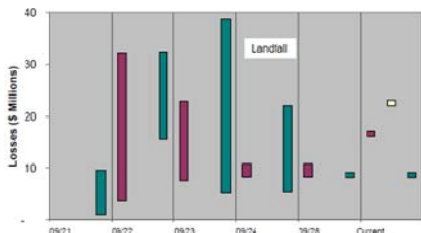
Finding the missing million\$

Modelled v Actual losses using
Visual Business Intelligence

Dr. Beverley J. Adams

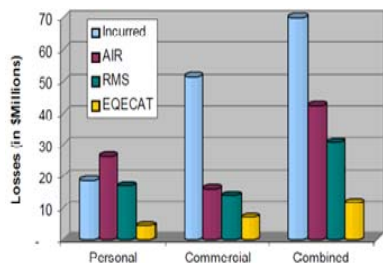


The difference between modelled and actual losses after Katrina ran to \$\$ Millions for this company



Source: Towers Perrin (2006)

Initial modelled losses have wide margins of uncertainty, which translate to inaccurate initial loss estimates for re/insurers relying on cat model outputs.



If the financial impact of recent catastrophes such as Katrina and Gustav is calling you to question the reliability of modelled results for guiding initial loss estimates, enhancing your existing catastrophe response activities with a ‘real-world’ view of post-disaster P&C losses may be the solution that you are looking for.

This paper’s objective is to introduce a new genre of ‘visual business intelligence’ for disaster response, which uses Google-Earth-style technology to produce independent damage state observations that can help re/insurers and hedge funds to better quantify portfolio and industry losses.

The Missing Million\$

During the hours and days after major disasters strike, re/insurance and financial services companies deploy catastrophe models for post-event analysis, to develop initial loss estimates for their portfolios or their market share of the industry as a whole.

However, a fundamental problem that came out of the record 2005 hurricane season and surfaced again during the events of 2008 was that actual losses differed from the AIR, RMS and EQECAT modelled estimates by as much as 100 times. In the case of industry losses, the margin stretched to tens of billions.

An independent re/insurance market review conducted by Towers Perrin (2006) pointed out that in general, when it comes to disaster response for hurricane, the catastrophe models are falling short of the mark. According to Vinay Mistry from the Lloyd’s exposure management team ‘...the degree to which companies got their fingers burned [after Ike] was a function of their relative degree of reliance on cat models...’

This is in large part because by nature, cat models are a mathematical representation of reality. In the words of rating agency A.M. Best (2006), ‘like any model, the validity of

No amount of refinement will produce a representative loss estimate if the basic cat model and event sets are an inaccurate representation of reality.

The degree to which companies got their fingers burned [after Ike] was a function of their relative degree of reliance on cat models.

Vinay Mistry, Lloyd's Exposure Management Team

[catmodel] output is contingent upon the quality of the data and underlying assumptions.

As such, the accuracy of modelled estimates is a function of:

- a) **Model methodology:** a reflection of the success with which the model's loss estimation methodology represents the real world
- b) **Event parameterisation:** the extent to which the best fit stochastic event parameters capture the inherent natural complexities of any given event

In the case of US hurricane, for modelling losses to Katrina, limitations of the loss estimation methodologies include: (a) AIR and RMS models do not include loss due to flooding or demand surge; (b) the EQECAT model does not factor in flooding or storm surge (Towers Perrin, 2006).

In the case of post-disaster event sets, an initial best guess is published in the immediate aftermath, which is subject to considerable uncertainty as the full extent of the impact is often unclear. As days and weeks pass, intelligence is gathered using in-field reconnaissance and the modelling companies update their event set(s) to issue a best fit that is the closest approximation to the event's actual hazard characteristics. However, in practise, there is not always a good fit; for example, in the case of hurricane Ike, one reason cited for underestimation of losses was that wind damage through the Ohio Valley was not fully contemplated by industry estimates (Global Reinsurance, 2008).

Although the modellers have since made well publicised revisions to address some of their shortcomings, in a Global Reinsurance (2008) survey of user satisfaction, 47% of respondents still lack confidence in model performance. In the days after an event hits, companies relying on them as their main source of post-disaster information are still faced with wide margins of uncertainty and potentially large errors.

As a number of re/insurers have discovered in recent years, this is a risky position to be in, because when the basic model and event sets fail to accurately capture post-disaster damage and associated costs, no amount of refinement will produce an indicative loss.

Inaccurate loss estimates may lead to problems including poor capital management decisions, reduced confidence in company performance and downgrading.

Danger! CreditWatch. Downgrading.

It will take some time for the insurance industry to forget the pain caused by discrepancies between actual losses and initial modelled estimates after Katrina and Gustav/Ike. This is because for events such as these, the 'missing \$\$ millions' created a number of serious problems, including:

Dramatic fall in share price. Recently, inaccurate initial post-disaster loss reporting has resulted in major upward revisions of 20-120%. This has culminated in dramatic share price falls of up to 20%.

Poorly informed Capital Management decisions. Costly mistakes resulting from liquidating assets to cover inaccurate estimates of expected claims, or based on inaccurate information that an event has tipped the company into a layer where they incur loss.

Reduced confidence in company performance. Initial estimates proved inaccurate and in many cases losses increased significantly. Reduced confidence of rating agencies, shareholders, investors and reinsurers.

Downgrading. Being placed under CreditWatch or Downgraded due to poor reporting or unexpected losses. A.M. Best downgraded 15 rating after Katrina and held 10 companies under review.

And of course, its important to bear in mind that these problems are not just limited to US hurricane models. The same concerns surrounding the efficacy of post-disaster loss estimates are equally relevant for international windstorm events such as Japanese cyclone, together with other types of peril including earthquake and flood. In many cases, cat models may exist, but their performance for post-event loss reporting is far from proven.

Visual business intelligence enables insurers and reinsurers to independently compute the worst case loss scenario, and gives a sanity check on modelled results.

EXAMPLE A: Visual business intelligence showing damage caused by Ike to onshore oil refineries. Used to compute % damage and estimate repair cost:



EXAMPLE B: Wildfire damage to residential neighborhoods in San Diego after the 2007 California fire siege. Used to compute IED loss.



Visual business intelligence describes a class of post-disaster response data, which using high-resolution aerial and satellite reconnaissance images captured in near-real time after the event, provides companies with an objective visual assessment of the real world situation.

You are most likely already familiar with concept of visual business intelligence if you use Google Earth and Microsoft Bing. These public sites provide a useful snapshot of the non-disaster situation, which when compared with photographs captured in the immediate aftermath of an event, offer an honest and objective record of the scene.

Important technical features include:

- **Actual damage:** Visual business intelligence records the *actual* damage visible to insured properties, high-value facilities, commercial, industrial and offshore structures. It is used to assess the % damage and estimate the ground-up loss.
- **Accurate:** Visual business intelligence can be compared with Google Earth or Microsoft Bing 'before' imagery to accurately assess damage.
- **Clear-cut:** Visual business intelligence records the extent and severity of the impact zone, swiftly showing whether exposures are 'in or out'.
- **GIS compatible:** Visual business intelligence is captured in a geographic framework so portfolio addresses and coordinates are easily located.
- **Rapid:** Visual business intelligence (for example, Aerial data) is collected within a day, or at most days. The time window for satellite collection is typically 1-4 days, and is constantly coming down as the global constellation of high resolution systems expands.

Visual business intelligence provides companies with an independent real world view of actual damage and loss, within hours or days of the event.

Visual business intelligence also includes information such as flood boundaries and storm surge impact zones that have been extracted from aerial and satellite reconnaissance images and converted to GIS format for immediate analysis.

Examples of derived datasets vary with the type of event, but may include:

Event	Example of a Derived Dataset	How to use it
Flood	Flood extent boundary	Overlay in GIS with portfolios of addresses to compute ground-up loss.
Surge	Surge impact area	
Wind	% destroyed buildings % damage class (destruction, moderate/severe, minor, none)	
Quake	% collapsed buildings	Apply % replacement or repair cost for building and contents.
Wildfire	% damaged and destroyed buildings	

How might Visual Business Intelligence help my company?

Visual business intelligence may be used to support a range of post-disaster loss estimation activities, including:

- ✓ Estimating losses based on the performance of individual high-value facilities
- ✓ Quantifying the impact of an event on your portfolios for different LOB
- ✓ Quantifying losses to the IED/GED, useful to assess demand surge or as a comparison to the market
- ✓ Independently verifying modelled loss estimates

Visual business intelligence can give you a jump on the market, by better informing capital management and investment decisions.

In the case of extreme events, accurate loss estimates make our job easier... and can help re/insurers avoid being placed under review.

Richard Attanasio,
VP P/C Ratings
A.M. Best

CASE STUDY: Hurricane Ike.
Observation oriented and derived intelligence data used to estimate the % damage caused by wind and flood.



For **executives and board members**, inserting visual business intelligence into initial phase of data gathering for internal response planning and board level discussions prior to going public offers a number of benefits including:

- **Increased accuracy of initial loss estimates:** Ground-up loss computed using visual business intelligence provides an independent check on modelled estimates and initial claims intelligence. This reduces the risk of widely fluctuating payment expectations.
- **Avoiding scrutiny:** Rating agencies and investors are satisfied because best practise has been followed in issuing public loss estimates.
- **Better informed capital management decisions:** Increased confidence in expected loss and capital adequacy from an early stage, may secure a 'jump on the market.'

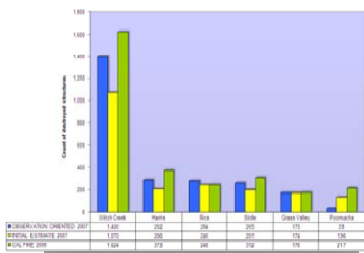
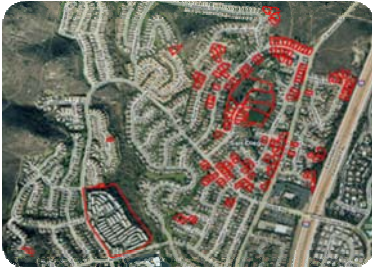
Case Studies

The following three case studies illustrate some of the ways in which visual business intelligence is currently being incorporated into disaster response strategies. They feature events from both within the USA and Europe, emphasising the point that observation oriented data can be used for events around the World. The case studies also span three different types of peril – hurricane, wildfire and flood, illustrating the utility of visual business intelligence for different classes of damage.

Case Study 1: Calculating Business Interruption (BI) to high-value facilities for Hurricane Ike

Hurricane Ike struck the Texas coast in the early hours of September 13th 2008. Visual business intelligence consisting of high-definition aerial reconnaissance images were collected the following day on September 14th and again on September 15th, for onshore oil facilities in Texas and Louisiana.

CASE STUDY: Calculating the number and location of destroyed/damaged buildings during the 2007 California wildfires for estimating industry loss



The reconnaissance images were used directly to assess the levels of physical wind damage sustained by these facilities. Flood inundation zones were also developed. Together, these datasets were used to estimate BI due to combined wind and flood effects.

Case Study 2: Estimating industry losses for the 2007 California wildfires

The southern California wildfires of 2007 resulted in region wide destruction to over 3,000 buildings and burnt more than 520,000 acres of land. Visual business intelligence consisting of several thousand high-definition aerial reconnaissance images were captured as events were contained, during a period spanning 25th October and 8th November (RMS, 2008).

These were used to estimate industry losses. From visually inspecting the data, neighbourhood and per building damage interpretations were integrated with tax assessor data to estimate % damage within impacted areas. These aerial reconnaissance data were used to develop an industry loss estimate of \$1.8 billion (RMS, 2008). The results from this observation oriented damage assessment were rapidly issued. Although they were markedly higher than other estimates being issued at the time, they compared closely with official figures issued several months later in 2008 by CalFIRE (CALFIRE, 2008).

Case Study 3: Computing portfolio losses after the 2007 UK floods and Hurricane Katrina.

After the 2007 UK Gloucester and Yorkshire floods, flood boundaries were extracted from visual business intelligence comprising of satellite and aerial data, and used for listing and counting exposure that was 'in and out' of the flood zone.

CASE STUDY: Derived flood intelligence for the 2007 UK floods, used in Guy Carpenter's i-aXs system to compute portfolio losses.



Visual business intelligence can be obtained from several different sources. Commercial providers offer affordable data, tailored for event-wide or facility-specific loss estimates.

The data was captured within 48 hours of the flood peak in July 2007, and made available to re/insurers for integration with portfolio data through Guy Carpenter's i-aXs RealCat event tracking tool (www.iaxs.info).

Visual business intelligence on flood has similarly been used to compute ground-up losses after other events including hurricane Katrina, hurricane Gustav, hurricane Ike and the 2008 Mid-west floods.

How to obtain Visual Business Intelligence

Visual business intelligence may be obtained from several sources:

- **Commercial providers:** Companies who specialize in collecting and sourcing data at event-wide or facility levels, and provide an expert service for rapid data delivery and analysis. They may also offer consultancy services such as in-house training and GIS support to guide the integration of observation oriented data into the disaster response processes of re/insurance and financial services companies.
- **Modelling companies and brokers:** Cat modelling companies and brokers who as part of their service package provide clients with post-disaster information. Data is often obtained from unverified public sources, although depending on the scale of the event, it may be sourced from commercial providers (see above).
- **Public sources:** Mostly applicable to major hurricanes and floods within the US. Data is collected and distributed by Government departments including FEMA and NOAA. The Media are increasingly publishing geographically referenced images of the disaster scene, often featuring the most 'media worthy' situations.

Be aware that there are pros and cons associated with the different sources.

	Pros and Cons
Commercial providers	<ul style="list-style-type: none"> ✓ Guaranteed rapid data collection and delivery at event-wide or facility levels ✓ Tailored to meet specific response data needs, using custom acquisition or tasking ✓ International, multi-event coverage
Modelling companies & brokers	<ul style="list-style-type: none"> ✓ Data collection usually occurs rapidly ✓ Data may cover event-wide impacts ✗ You have to be a client ✗ Does not support detailed damage assessment for individual facilities or specific areas of interest ✗ No guarantee that data collection will occur
Public sources	<ul style="list-style-type: none"> ✓ Data collection usually occurs rapidly ✓ Data often free ✗ No guarantee that data collection will occur or that relevant areas will be covered. US focused ✗ Media provides incomplete 'snapshots' ✗ Uncertainty surrounds quality and completeness of derived intelligence

Where to go from here

This paper serves as an introduction to the uses of visual business intelligence for bridging the gap between modelled and actual losses in the days after disaster strikes. If you want someone to offer guidance on how visual business intelligence might help your business, or need help sourcing data or derived disaster intelligence, consider eCityRisk. We offer the following services to help you:

- **Internet links:** A comprehensive listing of public internet sources for observation oriented data, covering the US, Europe, and other major insurance markets. Includes key information sources, and the latest sites that you probably won't have visited. It can be found here: www.ecityrisk.com/observational_data/



- **Visual Business Intelligence and Data Acquisition Service:** We handle all aspects of data collection for independent post-disaster damage assessment and ground-up loss calculations. We cover a range of perils including flood, earthquake, hurricane wind, storm surge and tsunami, tornado and wildfire. For further information, please download our brochure at: http://ecityrisk.com/pdf/ecityrisk_brochure.pdf
- **Consulting and In-house support:** Bring a visual business intelligence expert to your organization to provide training or on-the-ground support during response activities by calling 01372 278777 (UK) or 562 628 1675 x228 (US).

How to reach us: If you want to contact Beverley Adams directly, she can be reached via e-mail at bj@ecityrisk.com

The Last Word

Thank you for your interest in this free paper. We welcome our comments, feedback and suggestions. Please consider sending us a note about how this paper has helped you.

References

A.M. Best (2006) Record hurricanes lead to modelling queries, Special Report – Property and Casualty Review/Preview.

CALFIRE (2008) *2007 Fire Siege Timeline*, http://www.fire.ca.gov/communications/downloads/communique/2008_spring/Timeline.pdf

Global Reinsurance (2008) GR Survey: CAT modelling, <http://www.globalreinsurance.com/story.asp?sectioncode=6&storycode=372983>

Global Reinsurance (2008) Gustav/Ike losses ‘significantly underestimated’, <http://www.globalreinsurance.com/story.asp?sectioncode=5&storycode=374580>

Global Reinsurance (2009) S&P downgrades Advent, <http://www.globalreinsurance.com/story.asp?sectioncode=13&storycode=376340>

RMS (2008) *The 2007 U.S. Wildfire Season: Lessons from Southern California*, http://www.rms.com/Publications/2007_US_Wildfire_Season.pdf

Towers Perrin (2006) *Actual versus Modeled Loss: A Review of the 2004-2005 Hurricane Seasons*, Presentation given by John De Martini and David Langdon, May 3rd 2006, http://www.towersperrin.com/tp/getwebcachedoc?webc=REIN/USA/2006/200602/2006_RAA_DeMartini_2_13_az.pdf

About the Author:

Dr. Adams is the UK MD of eCityRisk, the newly formed subsidiary of ImageCat, of which she is one of the founding directors. Dr. Adams holds a PhD from London University and is a respected authority in re/insurance risk management through the use of spatial technology. Dr. Adams has also served as an advisor to the UK Government, and provided briefings to the US White House and NASA on post-disaster damage and loss estimation.



WHO WE ARE:

eCityRisk is a trusted provider of Geospatial Data Services to the insurance and financial services industries.

We specialize in providing rapid and reliable information to guide critical business decisions before, during and after disasters.

WHAT WE DO:

We provide disaster and inventory data services, mapping solutions and expertise to help you:

- rapidly produce accurate post-disaster loss estimates, by assessing damage and business interruption to property portfolios and individual accounts
- conduct reconnaissance missions in the immediate aftermath of a disaster to assess the condition of key facilities
- calibrate probabilistic hazard models (event sets?) using real disaster impact area and building damage data
- improve the quality of exposure data and confidence in portfolio management
- manage your accumulation of risks and increase competitive strength using webGIS to visualize and analyze portfolios at the time of underwriting
- boost the confidence of rating agencies, investors and analysts through implementing best practice.



eCityRisk USA

400 Oceangate
Suite 1050
Long Beach
CA 90802, USA

Tel: +1 (562) 628-1675
Fax: +1 (562) 628-1676

info@ecityrisk.com

eCityRisk UK

Suite G,
Communications House
63 Woodfield Lane
Ashted
Surrey, KT21 2BT
United Kingdom

Tel: +44 (0)1372 278777
Fax: +44 (0)1372 278800

info@ecityrisk.com